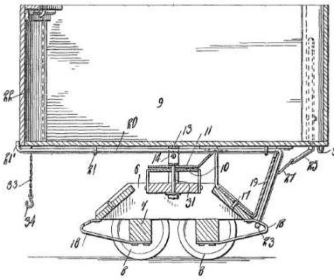
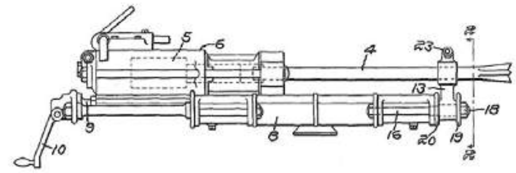
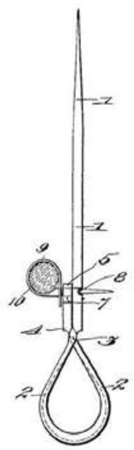
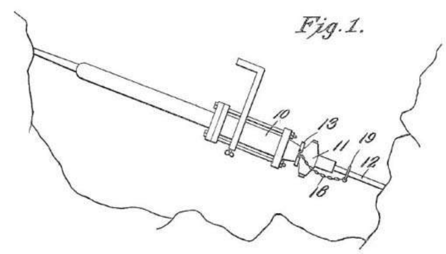


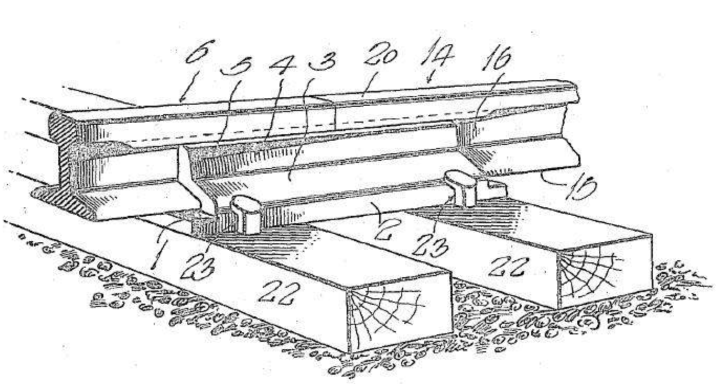


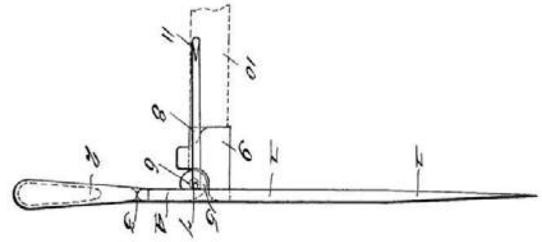
Mining Related Patents from Bisbee, Arizona and Vicinity





Compiled by Richard W. Graeme IV





Richard W. Graeme IV

February 27, 2010

INTRODUCTION

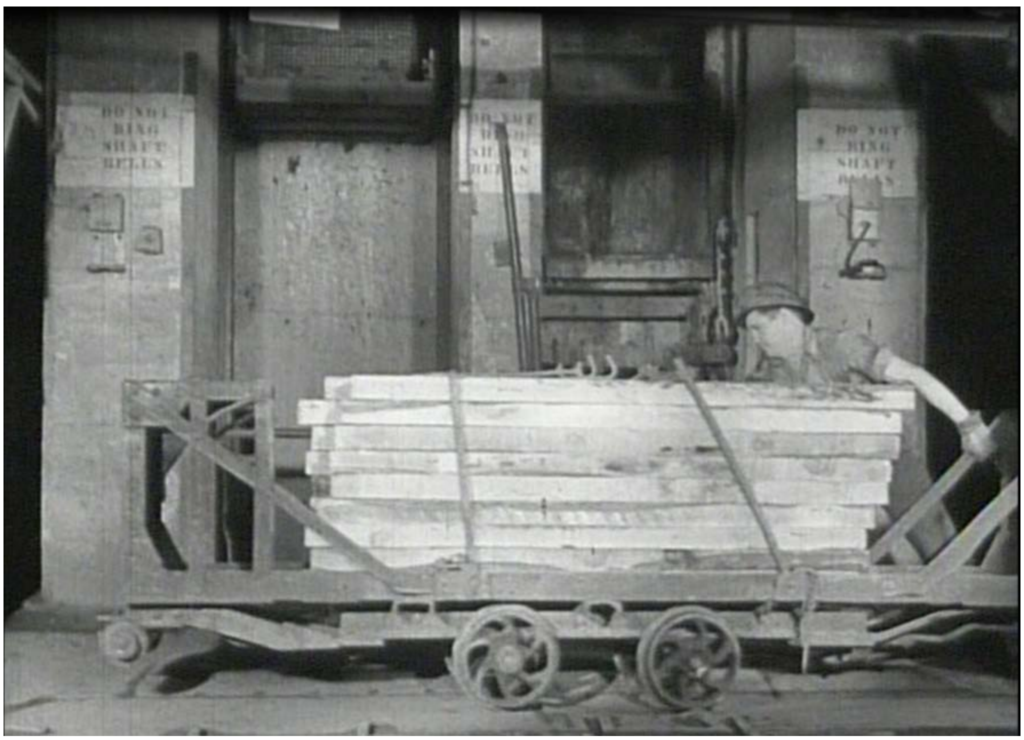
As one of the largest mining camps in the United States, Bisbee provided a home for imaginative designers of mining equipment. Around 65 mining related patents were applied for, and of these a handful were implemented and widely used in mining. Generally, these inventions were like the Material Car and Blasting Fuse Spitter and saw adoption largely inside the Warren Mining District. The rock drill designs by Charles Hulquist appear to be the most successful and developed into the Cochise Rock Drill of the Cochise Rock Drill Manufacturing Company which later became part of the Thor Rock Drill line. The following patents achieved, at least, some level of success in the Bisbee area:

- Patent # 1,380,255 Rock Drill Column
- Patent # 1,651, 479 Blasting Fuse Spitter
- Patent # 1,697,824 Clutch for Material Carrier
- Patent # 1,785,982 Material Carrier

Blasting Fuse Spitters, more commonly, called spitter boards were used until the mines in Bisbee closed in 1975. After the blast holes were loaded, the fuses were gathered and placed into the slot in the board. Then the fuses were lit and the boards were broken to allow the fuses to hang freely. Although, the use of spitter boards was not mandatory, these boards helped organize the fuses and prevented the miners from forgetting to light one of the fuses. Spitter boards were made in carpenter shop at the Junction mine. Early on, they were made from scrap wood taken from dynamite boxes. Later, thin boards were purchased specifically to manufacture them.

Miners in Bisbee using "Blasting Fuse Spitters" made from wooden powder boxes
C. 1934

The Material Carrier and the Clutch for the Material Carrier were used in conjunction with each other until the early 1950s. In the mines these material cars were called Scott trucks after their inventor, John William Scott. These inventions assisted miners in lowering timber and were a significant improvement over the early method of loading shaft cages, one timber at a time. The heavily timbered stopes in Bisbee used vast quantities of timber which needed to be lowered underground. With a Scott truck, the timber would be loaded onto the truck at the Junction framing shop and secured. Then the entire load of timber, including the Scott truck was lowered underground on the cage. Once underground, the Scott truck was removed from and delivered to a timber station and unloaded.



A Material Carrier after being unloaded from a cage at the Junction Mine
C. 1930

Ray P. Saffold’s Drill Column was known locally as the Saffold Bar. Drill columns were originally used to support large rock drills called drifters. These unique columns could be set up much quicker than a normal column and took an average of only 30 minutes to erect. The dual threaded extension is distinctive of his invention and they can be readily identified. Although, the use of column-mounted drifters declined, these columns continue to be used to support small underground diamond drills. Columns built on his design were used until the end of Bisbee’s large scale mining in 1975. Three of the drifters on display at the Queen Mine Tour in Bisbee are mounted on Saffold columns.

Left: Ray P. Saffold’s style drill column with mounted drill.
Bisbee, Az. C. 1920

Right: Dual thread extension on a column in the Queen Mine Tour.

Charles Hultquist’s rock drill designs were developed into a successful Cochise Rock Drill line. These drills found widespread use in both mining and construction. His designs were used to develop drifters, jackhammers and stopers. They were popular due to the efficient valve design used in the drills. These valves reduced air consumption by as much as 30%. By 1913, Charles Hultquist had moved to Los Angeles where he continued to develop designs and patents on rock drills. In June 1930, Cochise Rock Drill Mfg Company was sold to Independent Pneumatic Tool Company. The model 40 jackhammer continued to be built under the Thor-Cochise brand until the 1940’s.

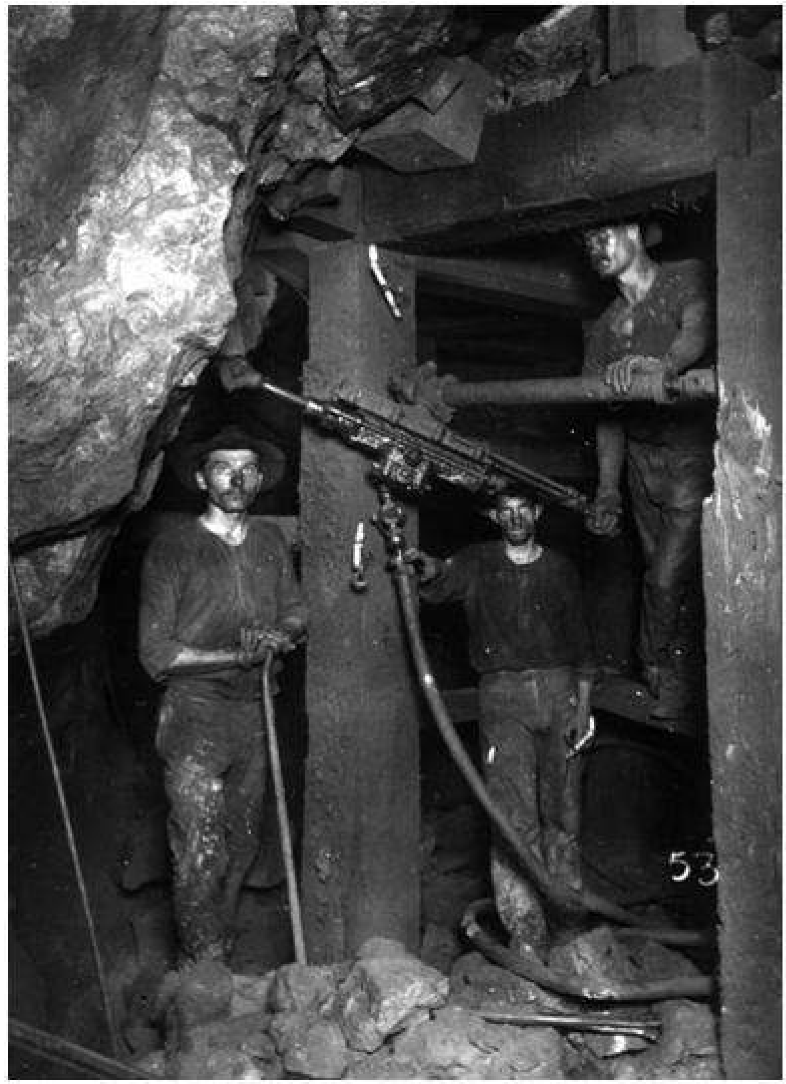
Charles Hultquist’s patents developed in the Bisbee area:

Patent # 856,877 Rock-Drill Chuck

Patent # 964,970 Valve (rock drill)

Patent # 978,568   Rock-Drill

Patent # 1,059,539 Rock-Drill

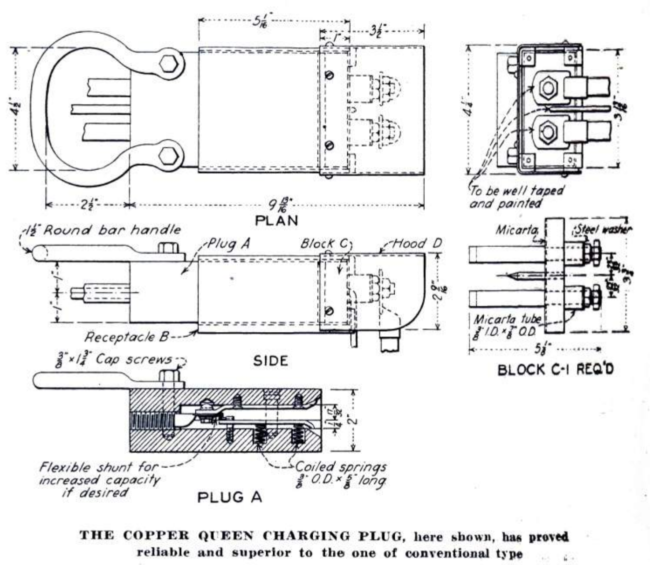


Right: A “Cochise” drifter in a square set stope. Bisbee Az. C. 1914

Advertisement, E&MJ 1914

Other inventions that were patented saw limited use as they were originally designed, but evolved and were adopted in different forms. Patent # 1,317,600 an improvement for a jackhammer designed by inventor, Sameul Slack along with W.M. Mclean. This was used for a limited time to suspend plugger-style drills so they could easily drill horizontally. Over time, it was developed into a simple method where the drill was hung from a chain called the “Mexican” setup.

Copper Queen Charging plug was an important invention that was never patented. Developed in the 1930s, these plugs allowed locomotives to be easily charged and connected to the battery power supply. Effective and simple, they remained in use until the end of mining. Then, after the mines shutdown, the locomotives from Bisbee were sold to small mining companies. Some of these locomotives continued to be used with the Copper Queen plug. Unlike, the other mining related inventions, these plugs continue to be used in their original function. Today, all of the locomotives and chargers at the Queen Mine Tour are equipped with them.



Above Left: Schematics for a Copper Queen Charging Plug.

Above Right: Copper Queen Charging Plug on a locomotive at the Queen Mine Tour.

With the cessation of large scale mining in 1975 and the last of underground mining in 1981, the need for creating new devices and methods for mining disappeared. Also, the individuals with the skills and knowledge had moved. It is probable that other patented inventions, such as, patent # 1,217,707 for the Pull-Switch for Electric Mine Signals were actually adopted and used. Unfortunately, no examples or information was uncovered to support the actual employment of the other devices.

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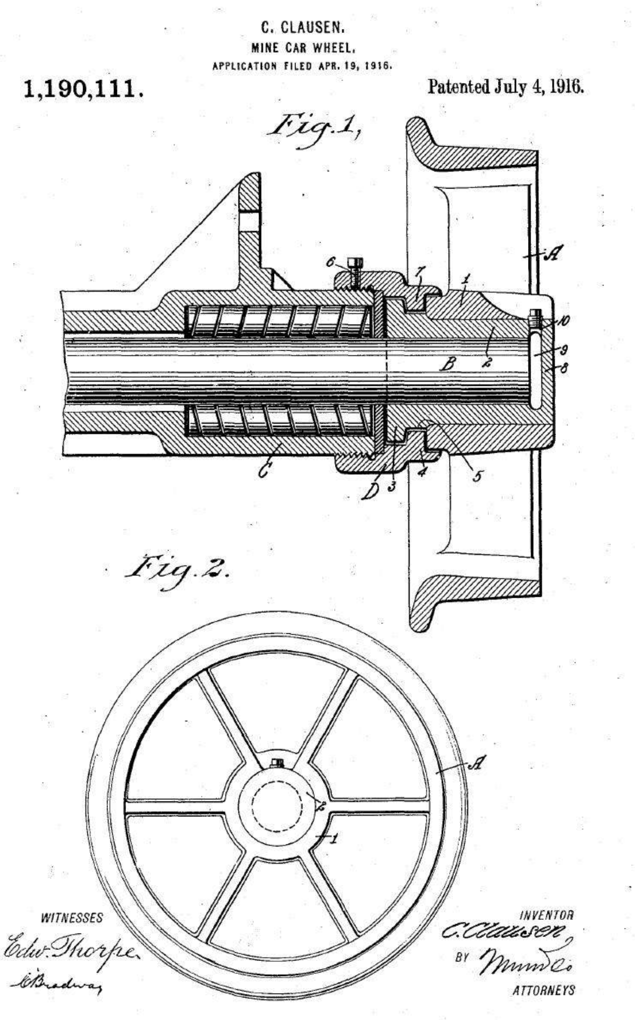
Haulage


C. CLAUSEN.
MINE CAR WHEEL.
APPLICATION FILED APR. 19, 1916.
1,190,111.
Patented July 4, 1916.
Fig. 1,
Fig. 2.
WITNESSES
Edw. Thorpe
INVENTOR
C. Clausen,
BY Munn & Co
ATTORNEYS

No. 631,692. Patented Aug. 22, 1899.

J. W. BREEDING.

CAR WHEEL.

(Application filed June 20, 1899.)

(No Model.)

Fig. 1.

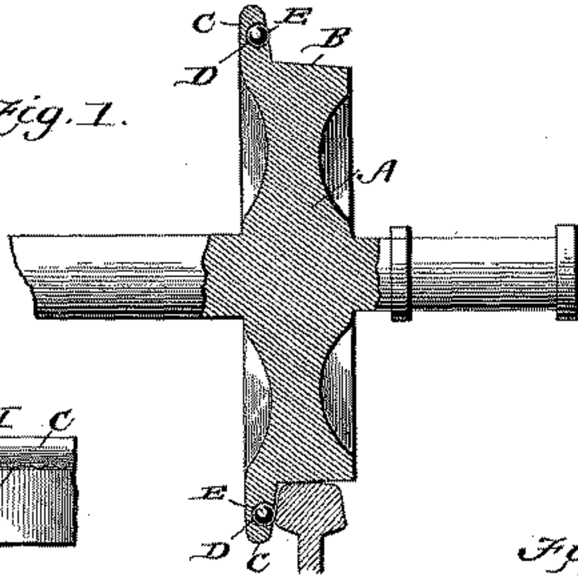


Fig. 6.

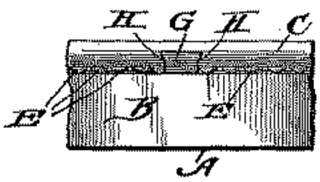


Fig. 3.

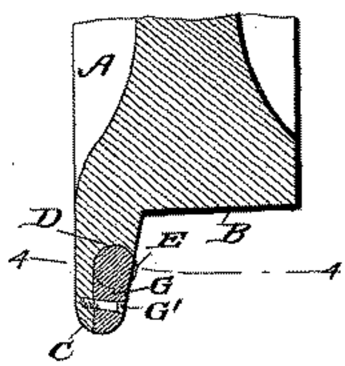


Fig. 2.

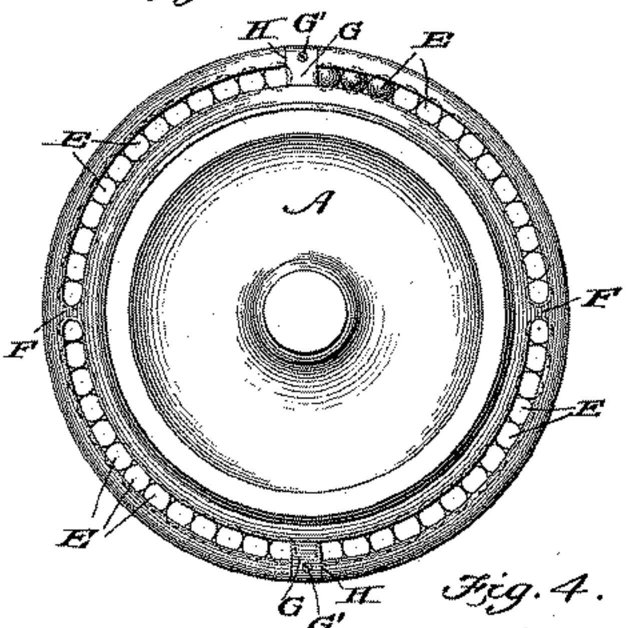


Fig. 5.

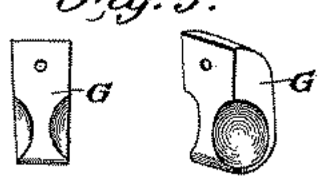
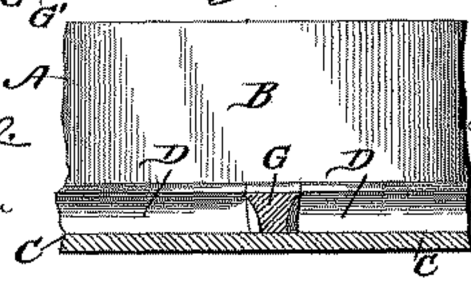


Fig. 4.



WITNESSES:

M. D. Blondel

Perry B. Turpin

INVENTOR

John W. Breeding

BY Munn & Co.

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN W. BREEDING, OF BISBEE, ARIZONA TERRITORY, ASSIGNOR OF ONE-THIRD TO EMIL MARKS AND RICHARD P. BROWN, OF SAME PLACE.

CAR-WHEEL.

SPECIFICATION forming part of Letters Patent No. 631,692, dated August 22, 1899.

Application filed June 20, 1899. Serial No. 721,243. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BREEDING, a citizen of the United States, residing at Bisbee, in the county of Cochise and Territory of Arizona, have invented a new and useful Improvement in Car-Wheels, of which the following is a specification.

My invention is an improvement in car-wheels, having for an object to provide an improved construction by which to prevent the wheel from climbing the track-rail; and the invention consists in certain novel constructions and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the drawings, Figure 1 is a vertical sectional view of a car-wheel provided with my improvements in place on a rail. Fig. 2 is a face view of the wheel. Fig. 3 is a detail enlarged section of the rim portion of the wheel. Fig. 4 is a detail section on about line 4 4 of Fig. 3. Fig. 5 illustrates in detail one of the removable blocks for closing the loading-opening, and Fig. 6 is a partial detail edge view.

The car-wheel A is formed with the tread B and the flange C, and may in general respects be of any suitable construction.

As is well known, car-wheels, especially when somewhat worn, have a tendency to climb the rail, which results in many accidents. By my invention I provide the flange C with balls, which protrude from its inner face and are adapted to turn freely in all directions, whereby they will offer no friction or resistance to the movement of the wheel upon the rail and may also turn freely in a direction radial to the wheel, so in case the wheel starts to climb the rail the balls will turn in a direction radial to such wheel, thus causing it to slip back to its proper position upon the rail. By this means I avoid any lifting movement of the wheel-flange alongside the track-rail, and thus avoid all accidents resulting from the climbing of the wheel upon the rail.

In the construction shown I provide the flange C in its inner face with a circumferentially-extended undercut raceway D for the balls E. This raceway is arranged about midway between the tread B and the outer edge of the flange C and is so formed relatively to the balls E as to permit the latter to protrude from the inner face of the flange C sufficiently far to operate upon the rail, as before described. It is desired to prevent the balls from moving bodily circumferentially of the wheel, and for such reason I prefer to divide the raceway D by cross-partitions F F and G G into a series of segmental sections. The partitions G are arranged alternately with the partitions F and are removable to facilitate loading the balls into the raceway. To this end I provide the wheel-flange with undercut slots H, intersecting the raceway D, and form the partitions G to fit the slots H, as will be understood from Figs. 2, 3, and 5. When inserted, as shown in Fig. 2, the partition-blocks are suitably held, it may be, by means of screws G′, as shown in Fig. 3. The blocks G, it will be noticed, operate both to form a partition for abutment by the balls in the raceway and to close the loading-opening, which leads through the undercut raceway for the balls.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A car-wheel having a tread and a flange and provided with balls supported in its flange and protruding from the inner face thereof and adapted to turn in a direction radial to the wheel whereby to avoid any lifting movement of the wheel-flange alongside the track-rail, substantially as set forth.

2. A car-wheel provided with a tread and a flange and provided in the inner face of its flange with a circumferentially-extending undercut raceway and with balls held in said raceway and protruding from the inner face of the flange substantially as set forth.

3. A car-wheel provided with a tread and a flange and having in the inner face of its flange a circumferentially-extended raceway divided by cross-partitions into segmental

sections, and balls held in said raceway and protruding from the inner face of the wheel-flange, substantially as set forth.

4. A car-wheel having its flange provided in its inner face with a circumferentially-extended undercut raceway for balls and with a loading-opening leading to said raceway, and the removable block fitting said loading-opening and extending across the raceway whereby to form a partition for abutment by the balls in the raceway, substantially as set forth.

JOHN W. BREEDING.

Witnesses:
SOLON C. KEMON,
PERRY B. TURPIN.

O. B. THOMAS.
RAIL JOINT.
APPLICATION FILED JAN. 17, 1916.

1,180,678.

Patented Apr. 25, 1916.
2 SHEETS—SHEET 1.

Fig. 1

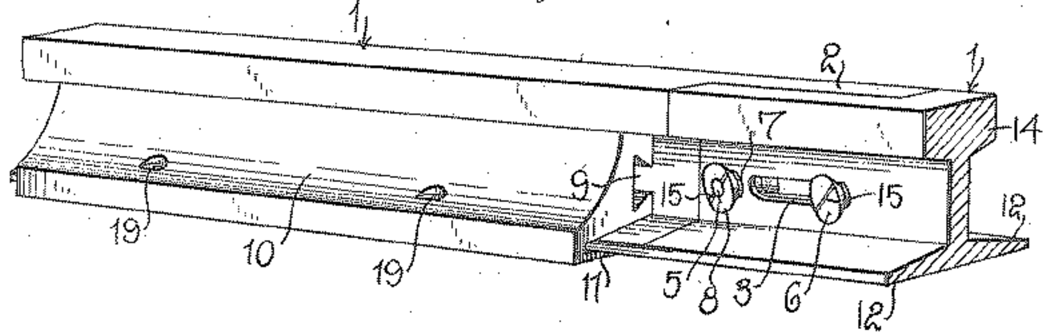


Fig. 3

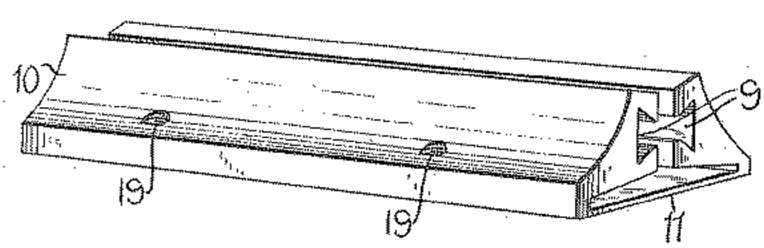
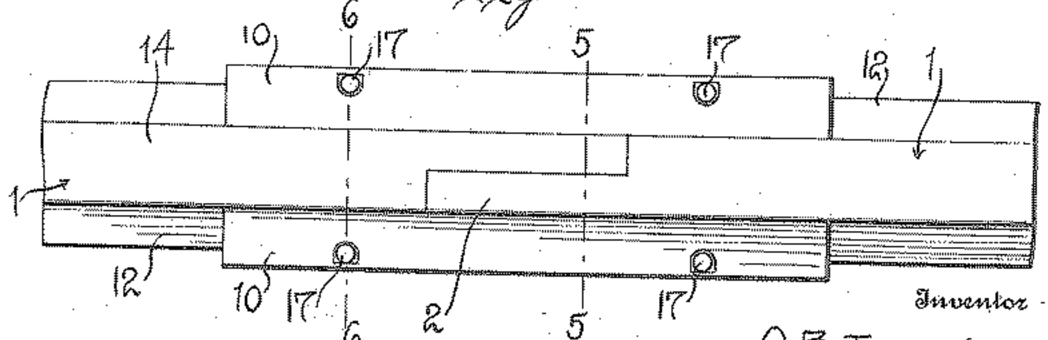


Fig. 2



Inventor

O. B. THOMAS

By Watson E. Coleman

Attorney

O. B. THOMAS.

RAIL JOINT.

APPLICATION FILED JAN. 17, 1916.

1,180,678.

Patented Apr. 25, 1916.

2 SHEETS—SHEET 2.

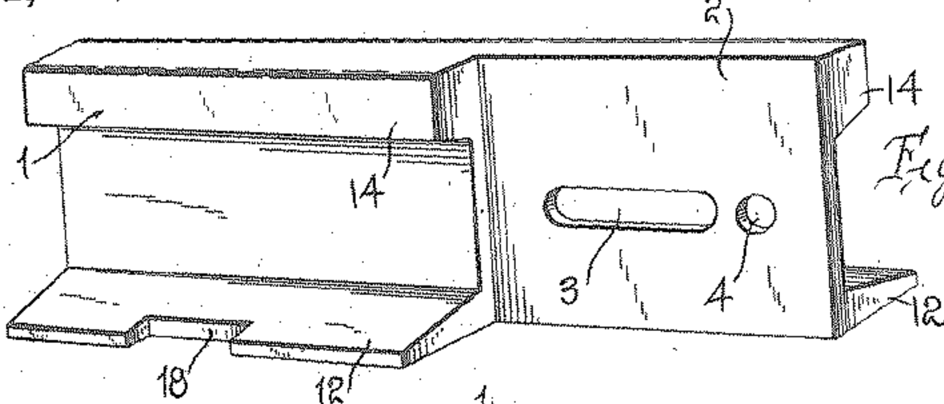


Fig 4

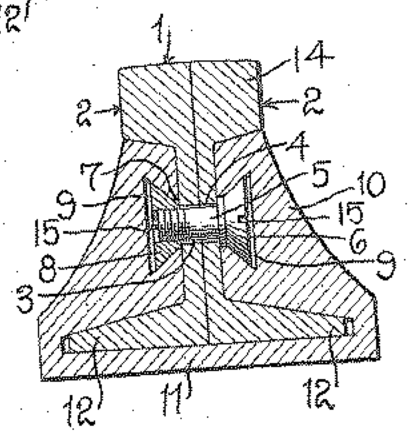


Fig 5

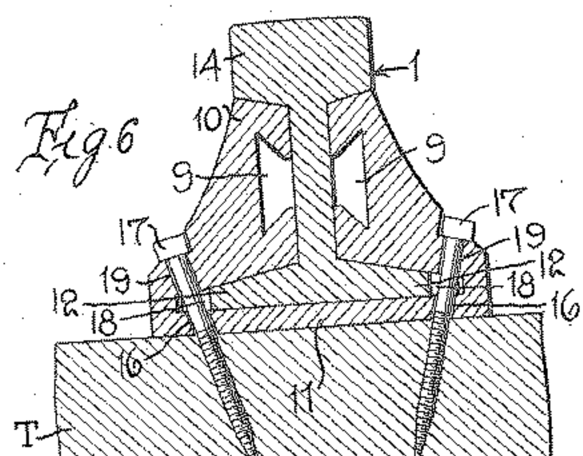


Fig 6

Inventor

O. B. THOMAS

By Watson E. Coleman

Attorney

UNITED STATES PATENT OFFICE.

OTIS B. THOMAS, OF LOWELL, ARIZONA.

RAIL-JOINT.

1,180,678. Specification of Letters Patent. Patented Apr. 25, 1916.

Application filed January 17, 1916. Serial No. 72,552.

To all whom it may concern:

Be it known that I, OTIS B. THOMAS, a citizen of the United States, residing at Lowell, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Rail-Joints, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to certain improvements in rail joints, and it is an object of the invention to provide a device of this general character having novel and improved means whereby no interference is offered to the expansion or contraction of the rails.

Furthermore, it is an object of the invention to provide a rail joint having novel and improved means whereby an effective connection is afforded and whereby "pounding" as the rolling stock passes over the joint is substantially entirely eliminated.

The invention consists in the details of construction and in the combination and arrangement of the several parts of my improved rail joint whereby certain important advantages are attained and the device is rendered simpler, less expensive and otherwise more convenient and advantageous for use, all as will be hereinafter more fully set forth.

The novel features of the invention will hereinafter be definitely claimed.

In order that my invention may be the better understood, I will now proceed to describe the same with reference to the accompanying drawings, wherein—

Figure 1 is a view in perspective of a rail joint constructed in accordance with an embodiment of my invention, the locking member or sleeve fish plate being shown in inoperative position; Fig. 2 is a view in top plan of my improved rail joint as herein embodied, the locking member or sleeve fish plate being shown in operative position; Fig. 3 is a view in perspective detached of the locking member or sleeve fish plate as herein included; Fig. 4 is a view in perspective of one of the meeting rail ends comprised in my rail joint as herein embodied; Fig. 5 is a sectional view taken substantially on the line 5—5 of Fig. 2; and Fig. 6 is a sectional view taken substantially on the line 6—6 of Fig. 2, with an adjacent portion of a tie shown in fragment.

As disclosed in the accompanying drawings, 1—1 denote the meeting ends of rails and as the formation of said ends is the same, a detailed description of one is thought to be sufficient. As herein embodied, each of the rail ends 1 is provided with a longitudinally disposed extension comprising a lateral half of the rail proper and adapted to overlap the corresponding extension of the second rail end and whereby it will be perceived that "pounding" as the rolling stock passes over the joint is substantially entirely eliminated. Each of the extensions 2 is provided with a longitudinally disposed slot 3 and in longitudinal alinement therewith and arranged in advance thereof is the opening 4. The opening 4 has disposed therethrough the tubular shank 5 of a headed member 6, said tubular shank being also disposed, when the joint is assembled, through the elongated slot 3 of the coacting rail end 1. In threaded engagement with the tubular member 6 is the shank 7 of the headed member 8. By this arrangement, it will be perceived that the slots 3 permit longitudinal movement of the rail ends 1—1 in either direction in order to compensate for the contraction or expansion of the rails.

The heads 6 and 8 are arranged at opposite sides of the extensions 2 when the joint is assembled and are adapted to be received within the dove-tail grooves 9 disposed longitudinally of the side plates 10, said plates being integrally connected with the chair 11 upon which the meeting ends 1—1 are adapted to rest, as is believed to be clearly shown in the accompanying drawings, said side plates 10 and chair 11 affording a sleeve fish plate which is readily slidable longitudinally of the rails 1. The lapped or scarfed joint may be of any size desired but in every instance I desire it to be understood that the sleeve fish plate is of a length not less than three times the length of the lapped or scarfed joint, as in practice I have found that with this arrangement, a maximum of strength is afforded. While I have herein disclosed the slots 9 as extending the entire length of the side plates 10, it will also be understood that they may be of any length which will meet the requirements of practice. It is to be observed that in the present embodiment of my invention, the plates 10 overlie the flanges 12 of the rails 1 and contact therewith and also underlie the heads 14 of the rails in a conventional manner. It is also to be observed that the outer face of the heads 6 and 8 are provided with the grooves or channels 15 so that the same may be engaged by a suitable implement to separate the shanks 5 and 7 so that the meeting ends 1 may be separated. While the headed members 7 and 8 serve to effectively maintain the lapped or scarfed joint firmly together, it will also be readily understood that said headed members also serve to effectively hold and support the sleeve fish plate in operative position.

In order to maintain the plates 10 against creeping, I provide said plates adjacent their lower edges with the openings 19 and in oblique alinement therewith I provide the chair 11 with the openings 16 arranged inwardly of the lower margins of the plates 10 through which the lag screws 17 are disposed and operatively engaged with the supporting tie T. It is to be observed that the screws 17 are disposed on such an angle as to be received within the elongated notches 18 formed in the free longitudinal edges of the flanges 12 of the rails 1 so that said screws will afford no interference to the expansion or contraction of the rails, said notches or recesses being of a minimum length equal to the length of the slots 3, hereinbefore referred to.

From the foregoing description, it is thought to be obvious that a rail joint constructed in accordance with my invention is of an extremely simple and comparatively inexpensive nature and is particularly well adapted for use by reason of the convenience and facility with which it may be assembled, and it will also be obvious that my invention is susceptible of some change and modification without material departure from the principles and spirit thereof and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice.

I claim:

1. A rail joint comprising the meeting ends of rails provided with overlapping extensions, each of said extensions being provided with a longitudinally disposed slot, a headed member carried by one extension and disposed through the slot of the second extension, and a fish plate overlying the meeting ends of the rails and provided with a longitudinally disposed slot to receive the head of the headed member.

2. A rail joint comprising the meeting ends of rails provided with overlapping extensions, each of said extensions being provided with a longitudinally disposed slot, a headed member carried by one extension and disposed through the slot of the second extension, and a fish plate overlying the meeting ends of the rails and provided with a longitudinally disposed slot to receive the head of the headed member, said slot being dove-tail in cross section.

3. A rail joint comprising the meeting ends of rails provided with overlapping extensions, each of said extensions being provided with a longitudinally disposed slot, a headed member carried by one extension and disposed through the slot of the second extension, a fish plate overlying the meeting ends of the rails and provided with a longitudinally disposed slot to receive the head of the headed member, and an anchoring member directed through the fish plate and adapted to engage a tie, the flange of the rail adjacent the anchoring member being provided with an elongated recess through which the anchoring member is directed.

4. A rail joint comprising the meeting ends of rails having overlapping extensions, each of the extensions being provided with a longitudinally disposed slot, a member disposed through each of the extensions in advance of the slot thereof and having its opposite ends headed, and connected fish plates overlying the opposite sides of the meeting ends of the rails and provided with longitudinally disposed grooves to receive the heads of the members.

5. A rail joint comprising the meeting ends of rails having overlapping extensions, each of the extensions being provided with a longitudinally disposed slot, a member disposed through each of the extensions in advance of the slot thereof and having its opposite ends headed, connected fish plates overlying the opposite sides of the meeting ends of the rails and provided with longitudinally disposed grooves to receive the heads of the members, and means for holding the plates against movement longitudinally of the rails.

6. A rail joint comprising the meeting ends of rails provided with overlapping extensions, each of said extensions being provided with a longitudinally disposed slot, a headed member carried by each extension and disposed through the slot of the second extension, a sleeve fish plate slidably mounted upon the rails and adapted to bridge the lapped joint afforded by the extensions, the inner faces of said sleeve being provided with grooves to receive the heads of the headed members whereby said sleeve is firmly held in applied position.

7. A rail joint comprising the meeting ends of rails provided with overlapping extensions, each of said extensions being provided with a longitudinally disposed slot, a headed member carried by each extension and disposed through the slot of the second extension, a sleeve fish plate slidably mounted upon the rails and adapted to bridge the lapped joint afforded by the extensions, the

inner faces of said sleeve being provided with grooves to receive the heads of the headed members whereby said sleeve is firmly held in applied position, said sleeve being of a length not less than three times the length of the lapped joint afforded by the extensions.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

OTIS B. THOMAS.

Witnesses:
JACK FRAME,
KIRK E. JACOBS.

C. CLAUSEN.

MINE CAR WHEEL.

APPLICATION FILED APR. 19, 1916.

1,190,111. **Patented July 4, 1916.**

Fig. 1,

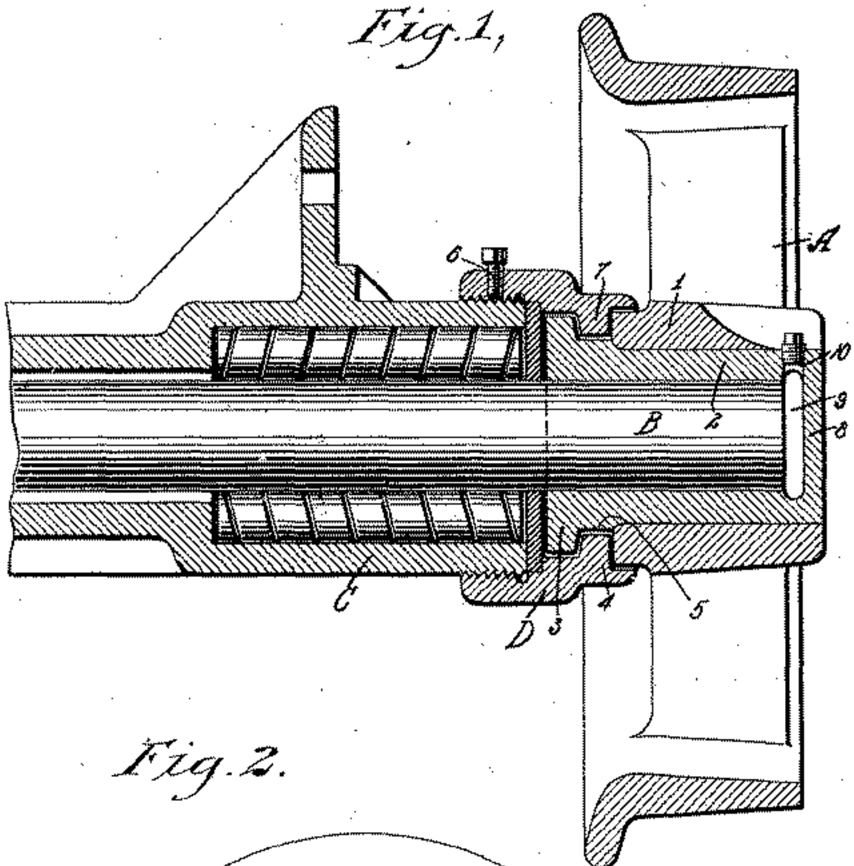
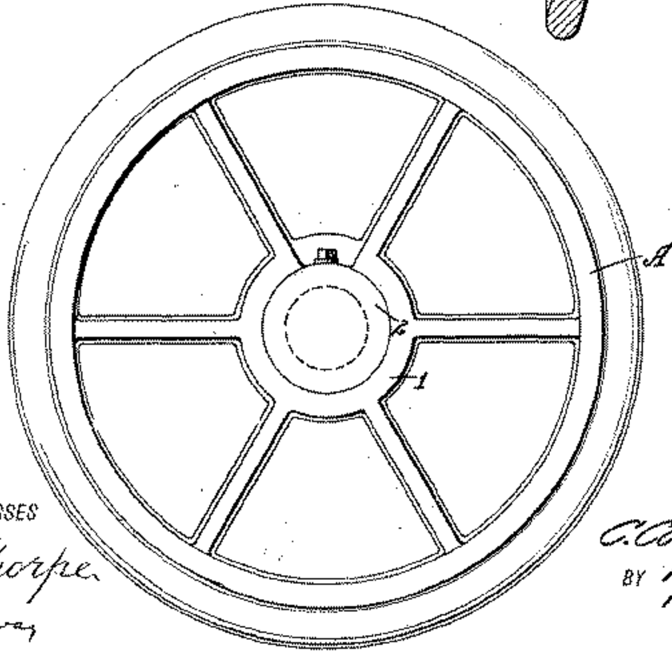


Fig. 2.



WITNESSES

Edw. Thorpe

C. Broadway

INVENTOR

C. Clausen

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

CARL CLAUSEN, OF BISBEE, ARIZONA.

MINE-CAR WHEEL.

1,190,111. Specification of Letters Patent. Patented July 4, 1916.

Application filed April 19, 1916. Serial No. 92,172.

To all whom it may concern:

Be it known that I, Carl Clausen, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and State of Arizona, have invented a new and Improved Mine-Car Wheel, of which the following is a full, clear, and exact description.

This invention relates to mine cars, and more particularly to wheels therefor.

The invention has for its general objects to improve the construction of wheels, whereby one wheel on an axle will be loose for permitting the two wheels to have differential movement for freely passing around a curve in the track, the wheel being preferably cast of manganese steel and provided with a bushing which is forced or driven into the hub portion of the wheel and which freely rotates on the axle, there being a special formation whereby the bushing is engaged with a retaining ring or collar fastened to the axle bearing, whereby the wheel can be removably applied to the axle.

With such objects in view, and others which will appear as the description proceeds, the invention comprises various novel features of construction and arrangement of parts which will be set forth with particularity in the following description and claims appended hereto.

In the accompanying drawing, which illustrates one embodiment of the invention and wherein similar characters of reference indicate corresponding parts in both the views, Figure 1 is a sectional view of the wheel and associated parts; and Fig. 2 is a side view of the wheel.

Referring to the drawing, A designates the car wheel, B the axle, C the bearing therefor, and D the wheel-retaining ring.

The wheel A in the present instance is supposed to be cast of manganese steel, which metal is too hard to admit of the bore of the hub being finished in such a manner as to have a rotating contact with the axle B, and therefore, in the hub 1 of the wheel is disposed a brass, bronze or other bushing 2 of such shape and size as to have a forced fit in the hub, making the bushing and wheel a permanently united unitary structure. This bushing has its bore carefully machined so as to fit the axle on which the wheel rotates. The inner end of the bushing is slightly larger in diameter than the bore of the hub so as to form a shoulder against which the hub engages when the bushing is driven into the hub, and beyond this enlarged portion is an annular flange 3 which coöperates with the end 4 of the hub to form an annular groove 5. The retaining ring D is screwed on and encircles the bearing C and is held in position by a set screw or equivalent means 6. The retaining ring projects over the inner end of the bushing and has an internal annular flange or the equivalent 7 which engages in the annular groove 5, whereby the wheel A and the bushing are retained on the axle. The retaining ring if made in one piece is applied to the bushing before the same is driven into the wheel, and the wheel is fastened in place by screwing the retaining ring on the bearing with the end of the axle projecting into the bushing 2. The outer end 8 of the bushing is closed and a chamber 9 is formed between the closed end of the bushing and the axle to contain lubricant, which is supplied through a normally plugged opening 10 in the bushing.

From the foregoing description taken in connection with the accompanying drawing, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative and that such changes may be made when desired as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. The combination of an axle, a bearing therefor, a retaining ring removably fastened to the bearing and having an internal flange, a wheel, and a bushing fastened in the hub of the wheel and having an annular groove on its inner end with which the flange of the retaining ring engages to rotatably hold the wheel and bushing on the axle.

2. The combination of a wheel, a bushing fastened in the hub thereof and having an end extending from one end thereof, said extending end being formed with a circumferential groove, an axle extending into the bushing, a bearing for the axle, and a ring

screwed on the outside of the bearing and embracing the projecting end of the bushing and formed with an internal annular flange engaging in the groove of the bushing to rotatably retain the latter and wheel on the axle.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CARL CLAUSEN.

Witnesses:
L. C. SHALLUTH,
ERNEST J. BEYER.

A. KRANJEC.
RAIL JOINT.
APPLICATION FILED JULY 12, 1917.

1,248,342. Patented Nov. 27, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

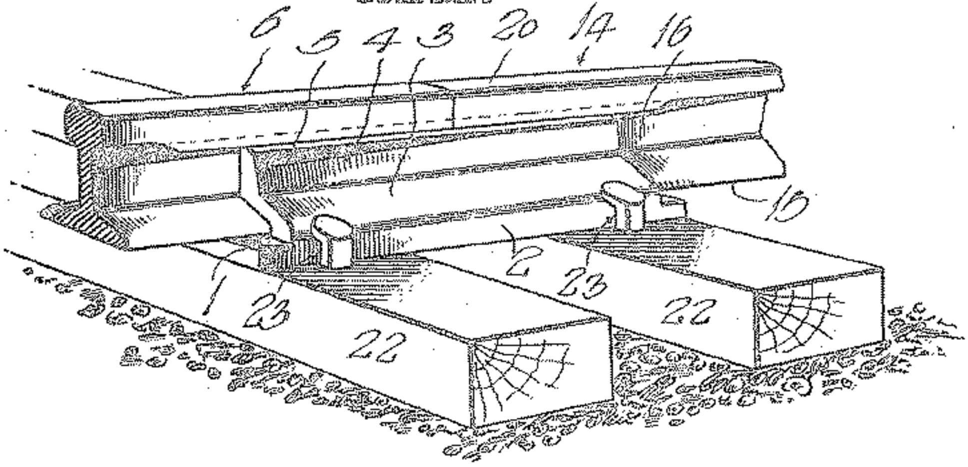


Fig. 2.

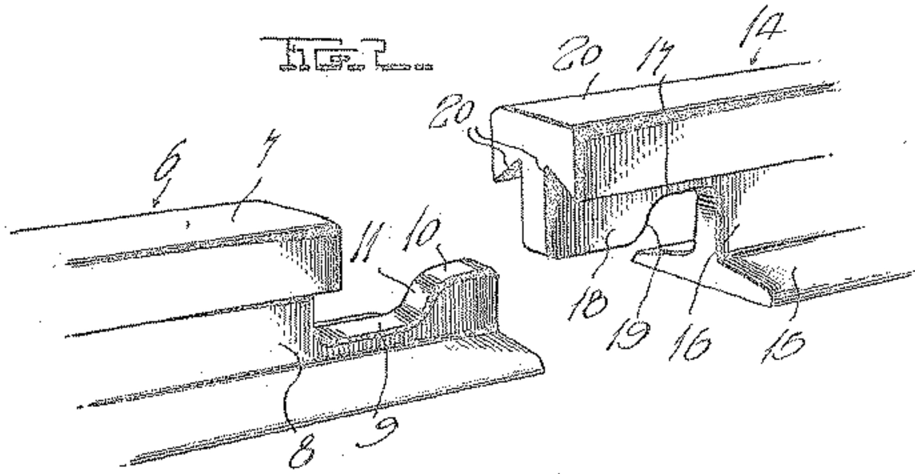
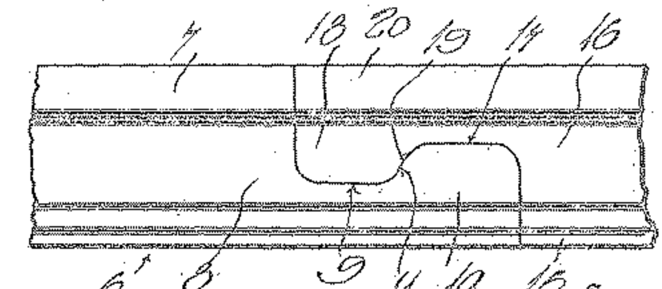


Fig. 3.



Inventor

Witness
H. Woodard

Andrew Kranjec

By H. B. Willson & Co.

Attorneys

A. KRANJEC.
RAIL JOINT.
APPLICATION FILED JULY 12, 1917.

1,248,342. Patented Nov. 27, 1917.

2 SHEETS—SHEET 2.

FIG. 4.

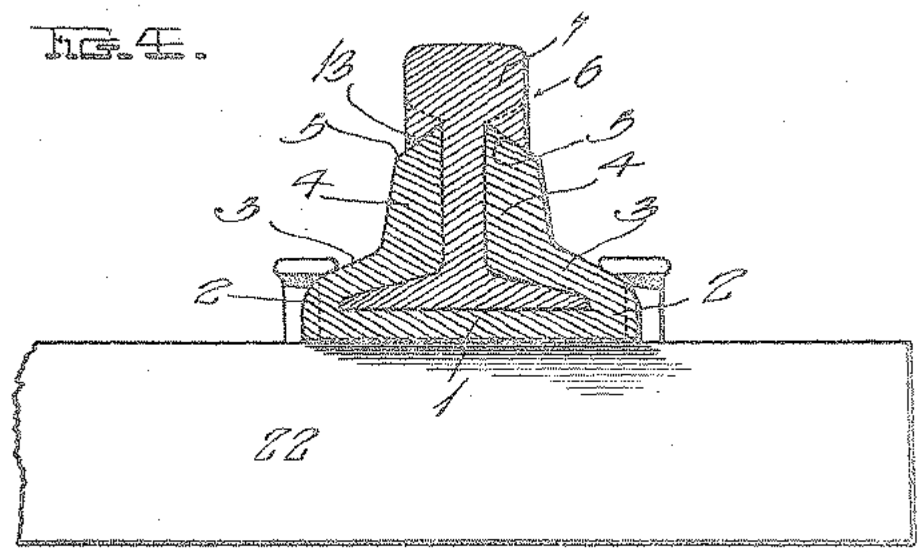
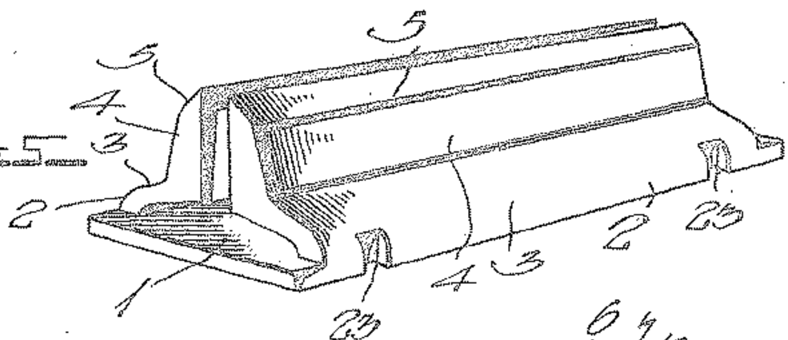


FIG. 5.



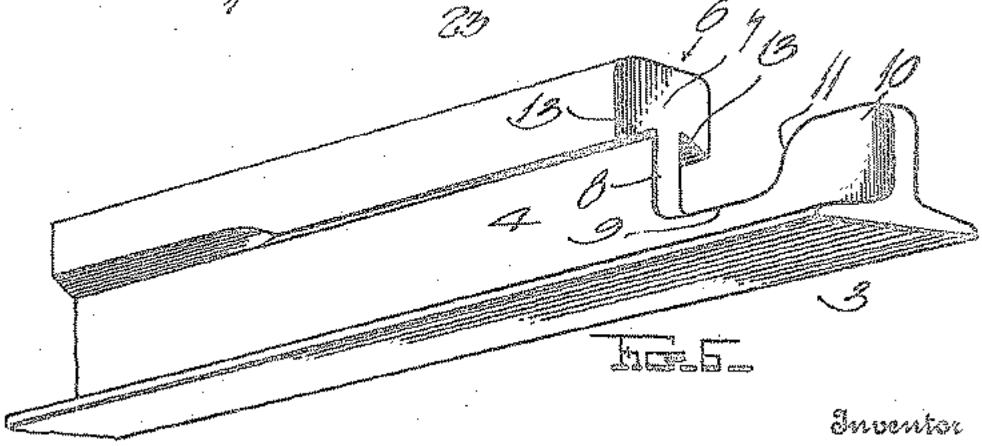


FIG. 6.

Inventor

Witness

H. Woodard

Andrew Kranjec

By D. H. Robinson & Co.

Attorneys

UNITED STATES PATENT OFFICE.

ANDREW KRANJEC, OF LOWELL, ARIZONA.

RAIL-JOINT.

1,248,342. Specification of Letters Patent. Patented Nov. 27, 1917.

Application filed July 12, 1917. Serial No. 180,174.

To all whom it may concern:

Be it known that I, ANDREW KRANJEC, a subject of the Emperor of Austria-Hungary, residing at Lowell, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Rail-Joints; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in rail joints and has for its primary object the provision of a reliable and simple means for connecting the ends of rails.

Another object is to provide a device of this character which will be highly efficient in performing its functions and at the same time will be inexpensively manufactured.

With these and numerous other objects in view my invention resides in the novel features of construction and in the combination and arrangement of the several parts as described in the specification and claim and clearly illustrated in the accompanying drawings forming a part of this application and in which:

Figure 1 is a perspective view of my improved rail joint assembled.

Fig. 2 is a perspective view of the adjacent ends of two rails prior to connecting them.

Fig. 3 is a side elevation of the ends of two rails connected.

Fig. 4 is a vertical transverse sectional view of the joint.

Fig. 5 is a perspective view of the chair and

Fig. 6 is a perspective view of an end of one of the rails showing the undercut grooves.

Similar numerals of reference are employed to indicate corresponding parts throughout the several views. The preferred embodiment of my invention as illustrated in the accompanying drawings includes broadly a rail chair adapted to receive the adjacent ends of two rail sections, one section having an upstanding lug at one end to be received in a socket in the other section.

In detail the rail chair comprises an elongated, preferably rectangular base 1 of suitable dimensions, and formed from iron, steel or the like, side walls formed integral with the base, each comprising a longitudinal upstanding flange 2 on the edge of the base 1, an inwardly upwardly inclined portion 3 formed on the upper edge of the upstanding flange 2 and a vertically upwardly extending flange 4 on the inner edge of the inclined portion 3, said upwardly extending flange 4 having its upper edge inclined upwardly and inwardly to form a shoulder 5 whose purpose will be hereinafter set forth. The upwardly extending flanges 4 of the side walls are spaced apart for a purpose to be seen as the description progresses.

In order that the rail chair may be secured to the ties 22 by spikes or the like fasteners, the opposite longitudinal edges are provided with notches 23 so that the spikes may be held in positive engagement with said chair.

One of the rail sections 6 has a portion of its head cut away to expose the upper edge of the web 8 which is provided with a notch 9 extending from the end of the head 7 to a point substantially midway the length of the web extension whereby an upstanding lug 10 is formed and whose functions will be set forth. The outer end wall 11 of the notch 9 is inclined upwardly and outwardly into the upper edge of the upstanding lug 10 for a purpose to be hereinafter set forth. The head adjacent the lug 10 extends downwardly on each side of the web 8 and has in the opposite lower edges undercut longitudinal grooves 13 whose purpose will be hereinafter set forth.

The other rail section 14 has a portion of its base flange 15 and web 16 cut away and has a notch 17 cut into the lower edge of the web 16, said notch extending from the adjacent end of the base flange 15 to a point substantially midway the length of the web 16 thereby providing at the outer end of said web a depending lug 18 for reception in the notch 9 of the other rail section 6 when the two are joined. The outer wall 19 of the notch 17 in the rail section 14 is inclined downwardly and outwardly longitudinally so that when the sections are being connected the two inclined walls of the notches will contact each other and tend to make a tight joint by moving the rail sections toward each other. The head 20 of the rail section 14 is provided with downwardly extending flanges providing undercut grooves 21 which, when the rails are joined, are longitudinally alined with the undercut grooves 13 in the other section, said grooves being so shaped as to tightly engage the shoulders 5 on the rail chair side walls.

The rail joint is assembled by placing the integral rail chair on one of rails adjacent the end. The other rail is then placed in the notch of the first mentioned rail, and the rails are then connected by sliding the integral chair over joint.

From the foregoing description the construction and operation of my improved rail joint the operation thereof will be readily understood and it is also to be understood that numerous changes in the minor details of construction may be made without sacrificing the principal advantages.

I claim:

A rail joint including a pair of rail sections, one section having a portion of its head cut away at one end to expose a portion of the upper edge of its web and having a notch in said upper edge, said notch having its outer end wall inclined longitudinally outward and upwardly forming an upstanding lug on the end of the web, the other section having a portion of its base flange cut away at one end to expose the lower edge of the web and having a notch in the lower edge, said notch having its outer end wall inclined longitudinally outward and downwardly forming a depending lug to be received in the notch in the other section, the heads having longitudinally alined parallel undercut grooves in their opposite lower faces, a chair comprising a base, a pair of substantially L-shaped side walls to engage the webs and base flanges of the rail sections and ribs formed on the upper edges of the side walls to be received in said undercut grooves.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ANDREW KRANJEC.

Witnesses:

ALEXANDER MURRY,

C. M. GREGOVICH.

M. S. RUNSVOLD.

MINE CAR.

APPLICATION FILED SEPT. 7, 1917.

1,276,418. Patented Aug. 20, 1918.

2 SHEETS—SHEET 1.

FIG. 1.

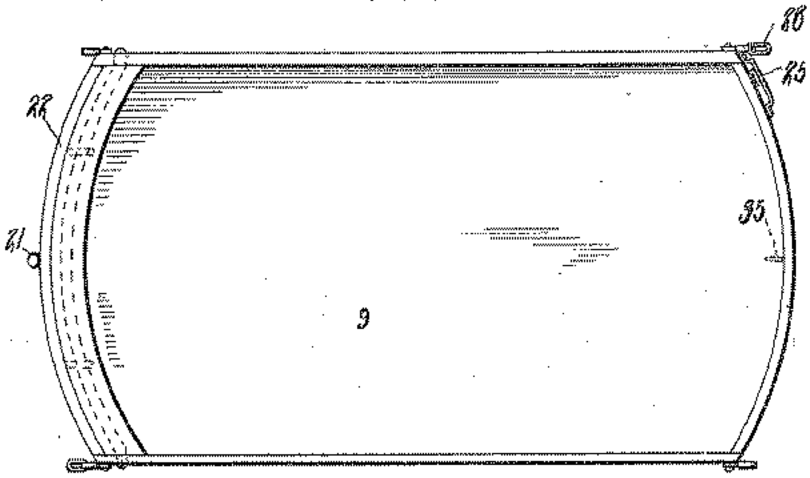
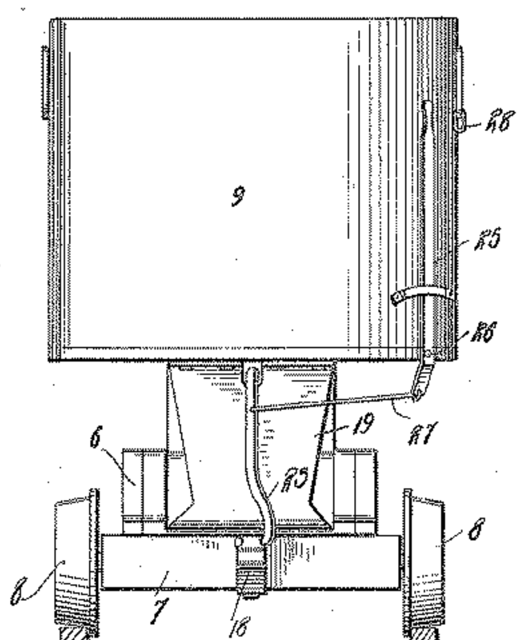


FIG. 2.



INVENTOR

Martin S. Runsvold

WITNESSES

W. C. Fielding

Dwight B. Galt

BY Richard B. Owen.

ATTORNEY

M. S. RUNSVOLD.

MINE CAR.

APPLICATION FILED SEPT. 7, 1917.

1,276,418. Patented Aug. 20, 1918.

2 SHEETS—SHEET 2.

FIG. 3.

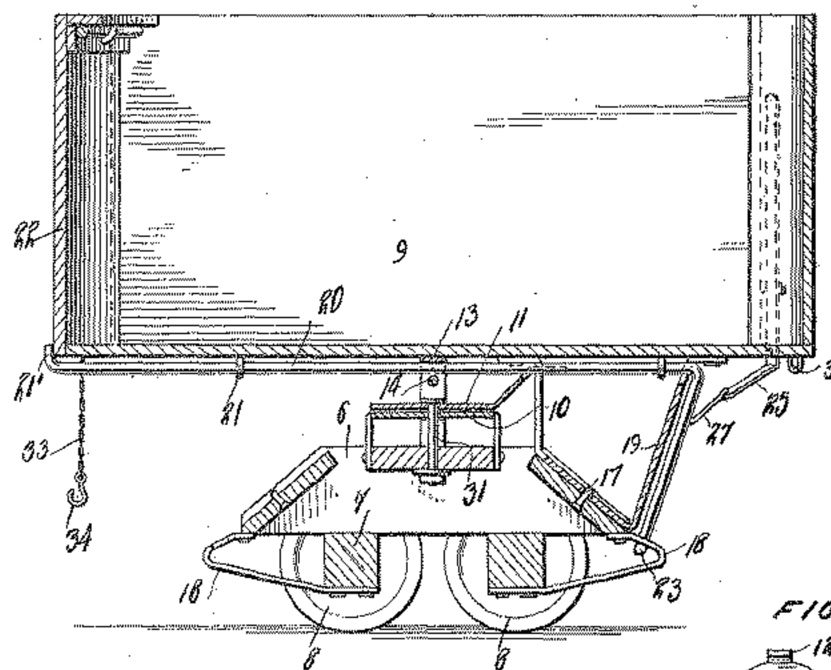


FIG. 5.

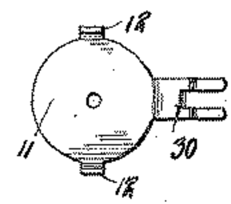
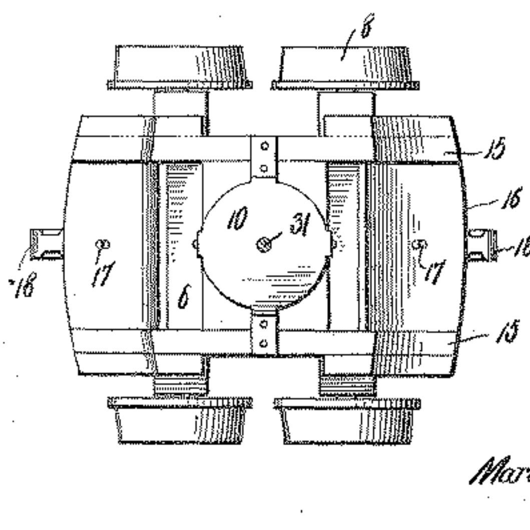


FIG. 4.



INVENTOR

Martin S. Runsvold

WITNESSES

W. C. Fielding.

Dwight B. Galt.

BY Richard B. Owen.

ATTORNEY

UNITED STATES PATENT OFFICE.

MARTIN S. RUNSVOLD, OF BISBEE, ARIZONA.

MINE-CAR.

1,276,418. Specification of Letters Patent. Patented Aug. 20, 1918.

Application filed September 7, 1917. Serial No. 190,211.

To all whom it may concern:

Be it known that I, MARTIN S. RUNSVOLD, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Mine-Cars, of which the following is a specification.

This invention relates generally to cars, and particularly to cars for use in mining and excavating operations.

The primary object of the invention is to provide a car of this character which is capable of being quickly and easily dumped and reset, and which has its body so arranged as to be capable of being dumped in a number of different directions.

A further object of the invention is to provide a dump car of the character set forth which can be dumped without in any way disturbing the truck, and which involves an improved means for locking the body against rotary or dumping movement.

A still further object of the invention is to provide a dump car which has its body constructed in such manner as to enable a number of such cars to be coupled together to form a train, and the cars are connected in such manner as to obviate the opportunity of the same to become derailed when the train is rounding sharp curves.

With these objects in view, together with others which will appear as the description proceeds, the invention resides in the novel formation, combination, and arrangement of parts, all as will be described more fully hereinafter, illustrated in the drawings, and particularly pointed out in the claims.

In the drawings:—

Figure 1 is a top plan view of a dump car constructed in accordance with this invention,

Fig. 2 is a front elevation of the said car,

Fig. 3 is a longitudinal sectional view taken through the car body and the truck therefor,

Fig. 4 is a sectional plan view of the truck structure, and

Fig. 5 is a plan view of the fifth wheel for supporting the car body.

Referring now particularly to the drawings, 6 represents the truck upon which the body of the dump car is mounted, and this truck includes the supporting axles or bolsters 7, upon which the wheels 8 are mounted. The car body indicated generally at 9, is rotatably mounted upon the truck at the center thereof, and is also capable of rocking vertically.

The truck 6 is provided with an upstanding centrally arranged fifth wheel plate 10 upon which is rotatably mounted a second fifth wheel plate indicated at 11, the latter plate being adapted to support the body of the vehicle. The plate 11 is provided with a pair of diametrically opposite upstanding ears 12, which are adapted to coöperate with the depending ears formed at the extremities of a laterally disposed strap member 13 on the bottom of the car body; a pin 14 being employed to hold the ears 12 and 13 in proper assembled relation. This construction permits of the body being readily rocked vertically so as to dump.

The forward and rear laterally disposed plates at the ends of the truck 6 are inclined upwardly and inwardly and each is provided adjacent its ends with upstanding stop members 15, the said stops between them forming a channel 16. Each of the said end plates is provided with a centrally arranged upstanding pin 17, and the said plates are held rigidly in the truck frame by strap members or braces 18 connected at their inner ends to the bolsters or axles 7.

The car body 9 has depending from one end thereof a foot 19, the lower end of which is inclined upwardly and inwardly corresponding with the inclination of the end plate of the truck. This foot is of a width equal to the distance between the upstanding portions 15 upon the truck plate, so as to snugly fit between the same. The foot is also provided with a central aperture as shown particularly in Fig. 3 of the drawings, the said aperture being adapted to receive the pin 17 in one of the opposing truck plates. The foot is so arranged that when it is within the recess or channel 16, the car will be held in proper horizontal position, and when it is desired to rotate the car body, one end thereof may be depressed, whereupon the foot 19 will be raised from engagement with the pin 17 and out of the channel 16. As soon as the sides of the foot have cleared the stop 16, the said body may be rotated.

Associated with a car body and truck of this character is an improved locking means, the same in the present instance comprising an elongated bar or rod 20 rotatably mounted in suitable keepers 21 upon the bottom of the car body, and extends longitudinally and centrally thereof. One end of the rod projects beyond the corresponding edge of the car body 9, and is bent upwardly to provide a catch portion 21′ adapted to engage with the lower edge of the end gate 22 of the car body to hold the same against being opened. The opposite end of the bar or rod 20 extends downwardly and inwardly to provide a latch portion 23 for engagement within the loops formed by the strap members 18 at each end of the truck. When the bar is in the position shown in Fig. 3, the door 22 will be held against being opened, and the portion 23 will be engaged within the loop 18 to prevent the body from being rocked vertically. When it is desired to rotate or dump the car, the rod 20 may be rotated in such direction as will cause the portion 22 to be retracted from engagement within the loop 18, whereupon the body 9 is free to be rocked vertically. It will also be obvious that this rocking movement of the bar 20 will cause the catch portion 21′ to be disengaged from the end gate 22.

The means for controlling the rocking movement of the rod 20 comprises a lever 25, pivoted as at 26 to one end of the car, and a link 27 connects the lower end of the lever with the depending member 23 of the bar 20. A link 28 is arranged on the car body to engage over the end of the lever 25 to hold the latter against rocking movement. It is preferred that the lever 25 be located so as to be capable of being operated without entering between the cars.

As a brace and additional support for the car body, a projection 30 extends outwardly and upwardly from one end of the fifth wheel plate 11, and this projection straddles the bar 20 and is adapted at its extremity to engage the bottom of the car 9. A king-bolt 31 connects the fifth wheel plates.

In order that several of the cars thus constructed when hooked together to form a train may freely move laterally relative to each other, as is necessary in rounding sharp curves, the ends of each car are rounded as shown. It will be observed that the chains, hooks and eyes are arranged upon the car bodies intermediate the longitudinal edges thereof, so that pull will be exerted upon the bodies at the center thereof. This manner of coupling the cars obviates the possibility of overturning of the same when rounding sharp curves. It is also obvious by rounding the ends of the cars the hands of the operator may be inserted between the cars to effect the coupling of the same. By arranging the ends of the cars so as to be convex, the said ends of the adjoining cars will be incapable of engaging each other, either when the train is rounding a sharp curve, or when the car bodies are being rocked upon their pivots to dumping position. Chains 33 and hooks 34 may be used in coupling the cars, and each car may be provided at one end with an eye 35 to receive the hooks of the next adjacent car.

From the foregoing it is obvious that I have provided a mine car which is of extremely simple construction and which is capable of being readily operated. Any of the cars of a train may be dumped, one at a time or all together without abutting the next adjacent car and without danger of derailing the trucks. It is also apparent that the car body may be quickly reversed, and may be locked firmly against oscillating or rotary movement.

While the present is a disclosure of what is believed to be the preferred embodiment of the invention, it is to be understood that the invention is not limited thereto, but that various changes in the minor details of construction, proportion, and arrangement of parts may be resorted to if desired without departing from the spirit of the invention as defined by the appended claims.

I claim:—

1. In a dump car, a truck, a body pivotally and rotatably mounted on said truck, a foot on one end of said body adapted to rest upon said truck, guard members on the sides of said truck for holding said foot against lateral movement, and a latch for holding said foot engaged with said truck.

2. In a dump car, a truck, a body pivotally and rotatably mounted on said truck, a foot on one end of said body adapted to rest on said truck, strap members on the sides of said truck for holding said foot against lateral movement, a pin projecting upwardly from said truck at each end thereof, and between said stops, and the said foot being provided with an aperture to receive one of said pins.

3. In a dump car, a truck, a body rotatably mounted on said truck intermediate the ends thereof, the said truck being provided at each end with a recess, a foot on said body adapted to fit in either of said recesses, a pin on each end of said truck, projecting upwardly within each of said recesses, the said foot having an opening to receive one of said pins, the said body being capable of rocking vertically, and means for holding said body against rocking movement.

4. In a dump car, a truck, a body rockably mounted on said truck and capable of rotating thereon, a rotatable rod extending longitudinally of said body, a latch at one end

of said rod adapted to engage the door of said body to hold the said door against movement, the opposite end of said rod constituting a latch to hold the said body against rocking movement, and a lever for rotating said rod.

In testimony whereof I affix my signature in presence of two witnesses.

MARTIN S. RUNSVOLD.

Witnesses:
JOHN A. ERICKSON,
HARRY G. E. COOK.

J. W. KIMMERLY.
SWITCH.
APPLICATION FILED MAR. 25, 1920.

1,358,160. **Patented Nov. 9, 1920.**

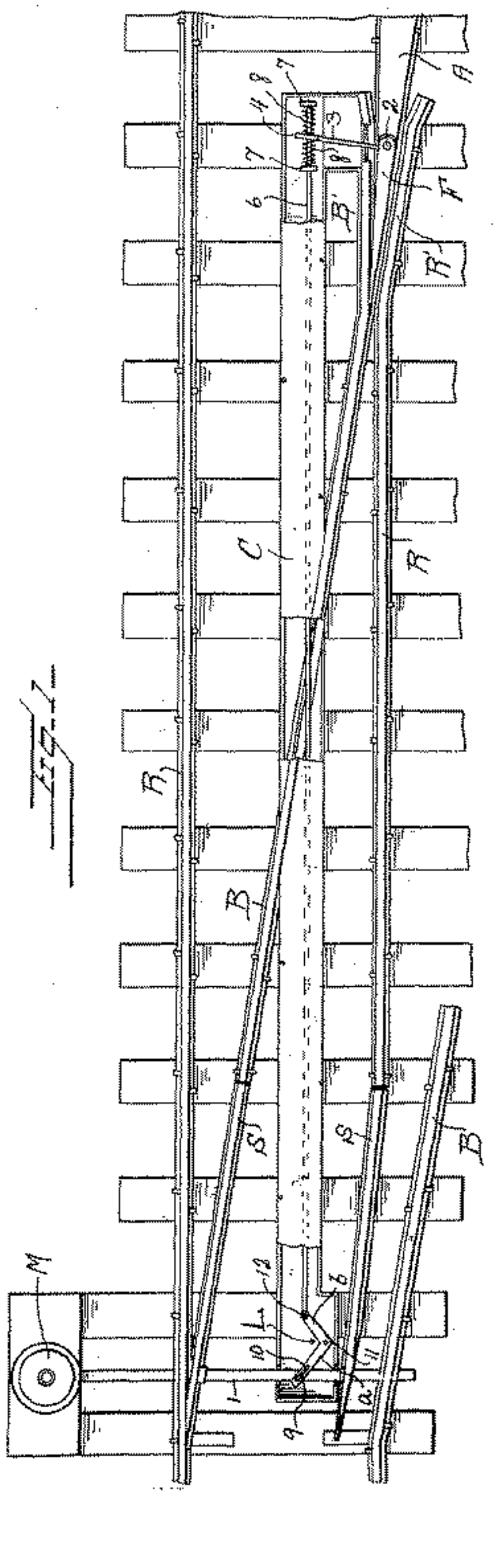
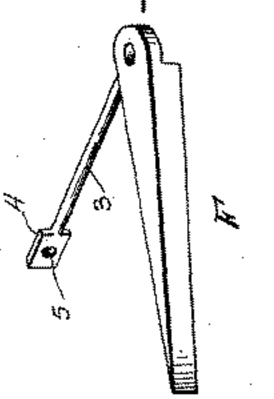


Fig. 1

Fig. 2



Inventors
J. W. Kimmerly
By Watson E. Coleman
Attorney

UNITED STATES PATENT OFFICE.

JOSEPH W. KIMMERLY, OF WARREN, ARIZONA.

SWITCH.

1,358,160. Specification of Letters Patent. Patented Nov. 9, 1920.

Application filed March 25, 1920. Serial No. 368,538.

To all whom it may concern:

Be it known that I, JOSEPH W. KIMMERLY, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Switches, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to certain improvements in switches, and it is an object of the invention to provide a novel and improved device of this general character embodying a movable frog point which is operatively connected with the switch points so that the position of the frog point is governed by the switch points and in a manner to produce a closed frog, thereby giving the wheels of the rolling stock a continuous rail on which to run during a switching operation.

The invention consists in the details of construction and in the combination and arrangement of the several parts of my improved switch whereby certain important advantages are attained and the device rendered simpler, less expensive and otherwise more convenient and advantageous for use, as will be hereinafter more fully set forth.

The novel features of my invention will hereinafter be definitely claimed.

In order that my invention may be the better understood, I will now proceed to describe the same with reference to the accompanying drawings, wherein:

Figure 1 is a fragmentary view in top plan and partly in section illustrating a switch constructed in accordance with an embodiment of my invention, the mechanism for throwing the switch points being diagrammatically indicated; and

Fig. 2 is a view in perspective of the frog point detached.

As disclosed in the accompanying drawings, R denotes the rails of the main line, and B the rails of the branch line, and with which coact the switch points S. The points S are tied by the cross rod 1 whereby said points S move in unison and in the same general direction. M indicates diagrammatically any desired mechanism whereby the requisite endwise movement may be imparted to the rod 1 for throwing the points S as desired.

F denotes a frog point coacting with the adjacent guard rails B′ and R′, and which frog point is mounted for swinging movement relative to said guard rails, and for which reason the point F is pivotally engaged at one end, as indicated at 2, with the frog A.

The pivoted end portion of the frog point F is provided with an inwardly directed arm 3 terminating in a vertically disposed plate 4 having disposed therethrough an opening 5.

Loosely directed through the opening 5 is an end portion of a rod 6 disposed between the rails R and movable in a direction longitudinally thereof. The rod 6 at opposite sides of the plate 4 is provided with the stops or enlargements 7 and interposed between each of said enlargements 7 and the plate 4 is an expansible member 8. As herein disclosed each of the members 8 comprises a coil spring encircling the rod 6.

The rod 1 at a point between the switch points S is provided with an upstanding pin 9 which extends within a longitudinally disposed slot 10 produced in an arm *a* of a bell crank lever L. The heel of the bell crank lever L is pivotally mounted as at 11 for swinging movement and the rod 6 is pivotally engaged as indicated at 12 with the outer end portion of the second arm *b* of the bell crank lever L.

When the switch points S are thrown through the medium of the mechanism M the bell crank lever imposes the desired strain or stress upon the rod 6 to throw the frog point F substantially in unison with and in the same general direction as the switch points S so that a continuous rail is provided with the rolling stock when traveling over the main line or on to the branch or side line. It will be self-evident that the tension of the member 7 is sufficient to impart the desired swinging movement to the point F through the medium of the arm 3 and at the same time compensates for any inequality of the relative movements of the points S and the point F.

C denotes a casing or housing in which the rod 6, the bell crank lever L and the major portion of the arm 3 are contained so that the same are effectively protected against the elements or the like, so that the desired operation of my improved switch is assured.

From the foregoing description, it is thought to be obvious that a switch constructed in accordance with an embodiment of my invention is particularly well adapted for use by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification without departing from the principles and spirit thereof, and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice except as hereinafter claimed.

I claim:

In combination with the rails of a main line and a branch line, switch points coacting therewith, means connecting the points whereby the same move in unison and in the same general direction, a movable frog point, a laterally directed arm carried by the frog point, a rod disposed longitudinally of the main rails, an operative connection between the first named rod and the second named rod whereby endwise movement is imparted to the second named rod upon the throwing of the switch points, said second named rod being loosely disposed through the arm of the frog point, and yieldable members carried by the second named rod at opposite sides of the arm of the frog point and contacting with said arm whereby the frog point is moved in unison with and in the same general direction as the switch points.

In testimony whereof I hereunto affix my signature.

JOS. W. KIMMERLY.

Hoisting

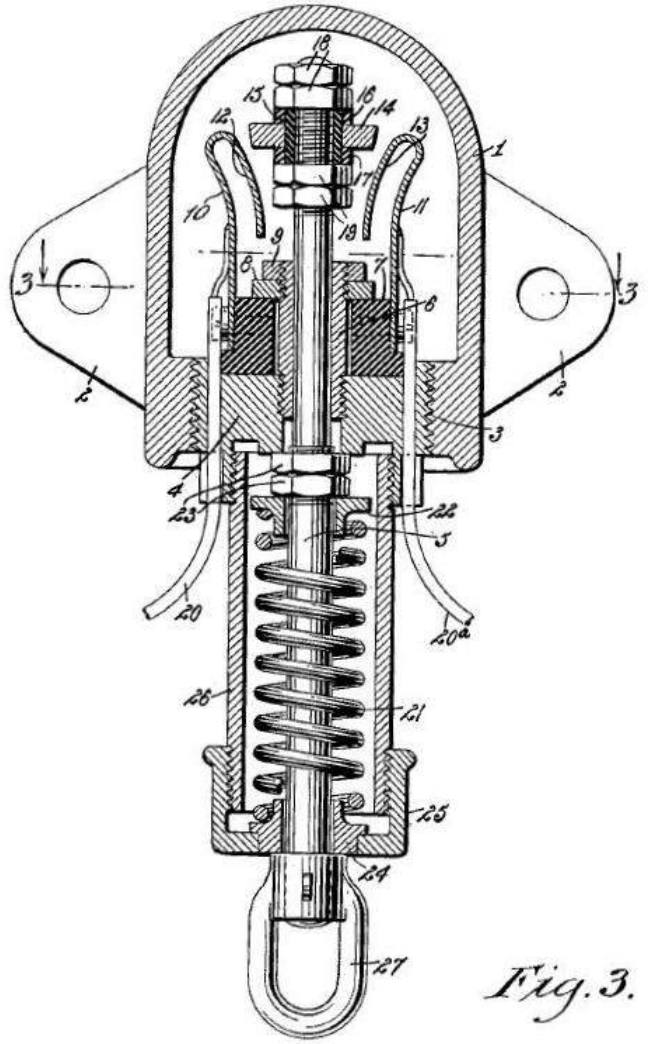


Fig. 3.

No. 733,907. PATENTED JULY 14, 1903.

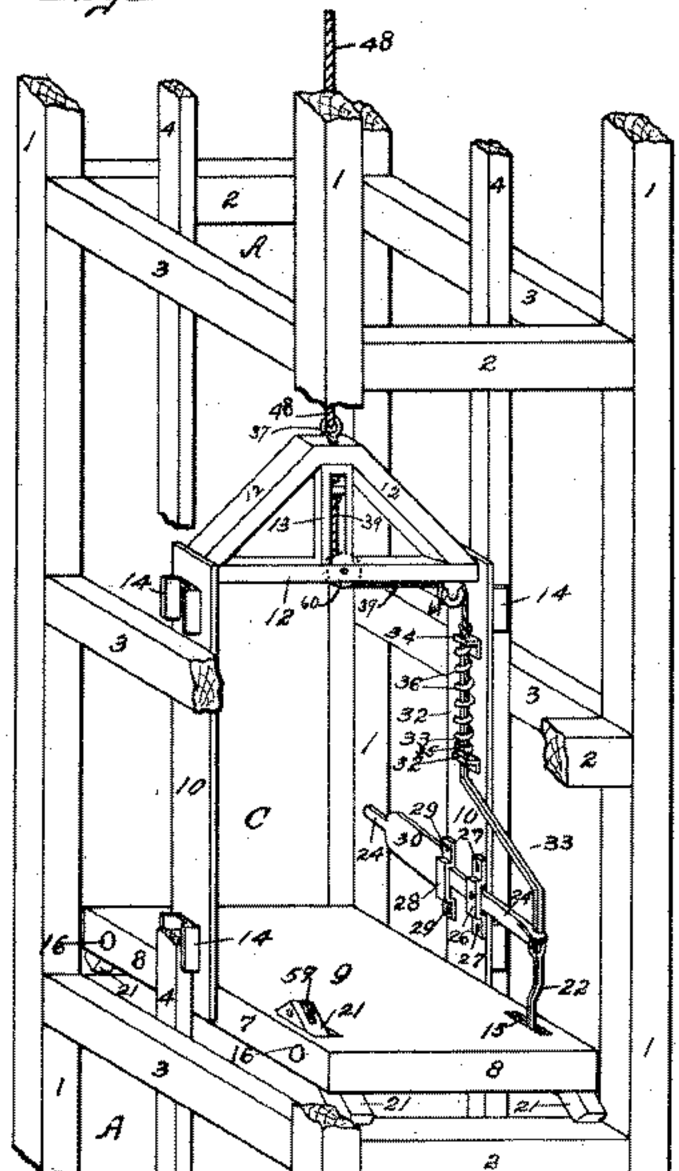
H. HANSON & F. L. DWIGHT.

SAFETY CHAIR FOR MINING CAGES.

APPLICATION FILED OCT. 21, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig 1



Witnesses

Wm G. Cutts

Chas. F. Fiege

Inventors

Harry Hanson

Frederick L. Dwight

By James R. Rogers

Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 733,907. PATENTED JULY 14, 1903.

H. HANSON & F. L. DWIGHT.

SAFETY CHAIR FOR MINING CAGES.

APPLICATION FILED OCT. 21, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2

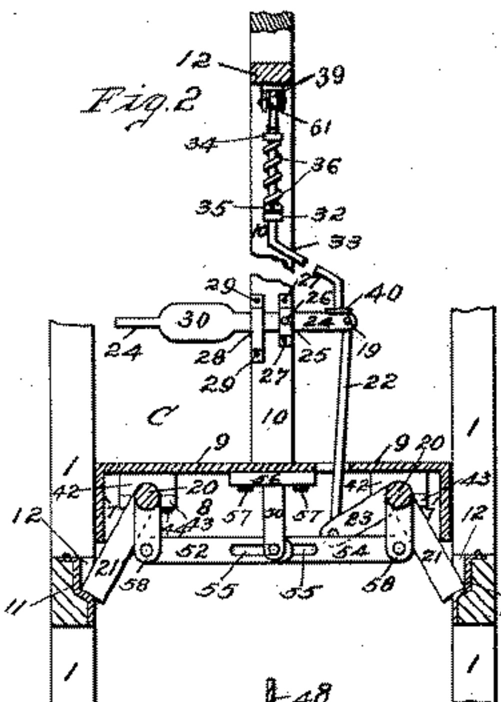


Fig. 3

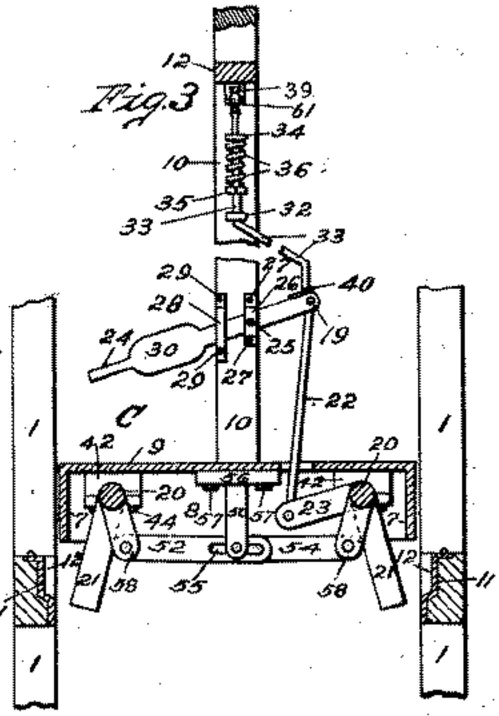


Fig. 4

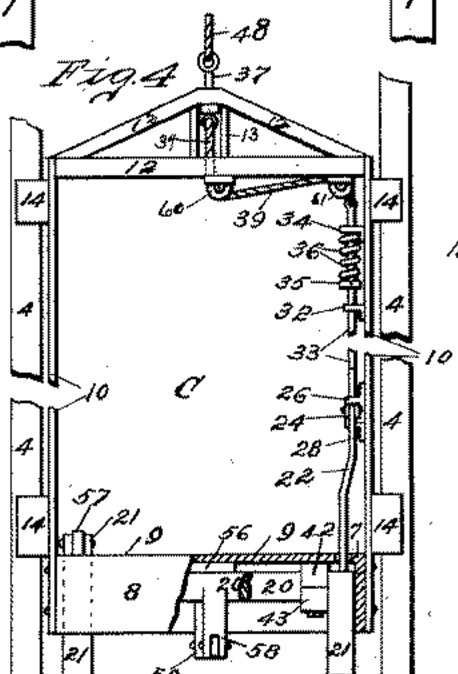
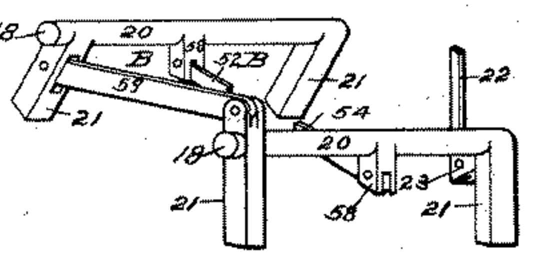


Fig. 5



Witnesses
Mary G. Cates.
Chas. F. Fiege

Inventors
Harry Hanson
Frederick L. Dwight
by James R. Rogers
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 733,907. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

HARRY HANSON, OF LOS ANGELES, CALIFORNIA, AND FREDERICK L. DWIGHT, OF BISBEE, ARIZONA TERRITORY.

SAFETY-CHAIR FOR MINING-CAGES.

SPECIFICATION forming part of Letters Patent No. 733,907, dated July 14, 1903.

Application filed October 21, 1902. Serial No. 128,160. (No model.)

To all whom it may concern:

Be it known that we, HARRY HANSON, a resident of Los Angeles, county of Los Angeles, and State of California, and FREDERICK L. DWIGHT, a resident of Bisbee, county of Cochise, and Territory of Arizona, citizens of the United States, have invented and discovered a new and useful Improvement in Safety-Chairs for Mining-Cages; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in safety-chairs for mining-cages and the like; and the objects of our improvement are, first, to provide means whereby mining-cages and cages for elevators may be stopped with certainty at predetermined stations within the frame of shafts of mines and of buildings; second, to afford facilities secured to the cage for readily controlling the movement of the cage within the frame of the shaft; third, to construct movable legs connected to the cage and stationary supports upon the frame of the shaft by means of which the cage securely rests at predetermined points within the frame of the shaft, and, fourth, to devise an automatic locking device whereby should the cable or the safety-chain of the cage break at any point of elevation thereof the cage automatically rests and is securely held upon portions of the frame of the shaft. We attain these objects by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of portions of the frame of the shaft before it is inserted into the mine with parts thereof broken away, a view in perspective of the cage within the frame of the shaft, the cable and safety-chain attached to the cage, the automatic locking devices holding the legs of the cage upon the front and rear timbers of the frame of the shaft, and the cable and safety-chain slackened. Fig. 2 is a longitudinal sectional view through the cage near one edge thereof, showing the platform of the cage in section, portions of the frame broken away, illustrating the cage resting upon supports made into two of the front and rear timbers of the frame of the shaft at predetermined stations of elevation of the frame, the safety-chain cut and slackened below the point of separation. Fig. 3 is a view similar to that shown in Fig. 2 except that the removable chair-legs of the cage are shown removed from the front and rear timbers of the frame of the shaft, the locking devices in reverse positions from the locking devices illustrated in Fig. 2, the safety-chain severed but drawn tightly below the point of separation. Fig. 4 is a view partly in elevation of portions of the frame, the cage and the locking devices with portions of the frame, cage, and of the locking devices broken away and the platform of the cage partly in section and part thereof in elevation, the cable and safety-chain tightly drawn, and the legs of the cage removed from the supports of the frame; and Fig. 5 is a perspective view of the chair of the cage with the central post removed, toggle-levers, and pitman-rod partly broken away.

Similar reference letters and numerals refer to like parts throughout the several views.

The letter A refers to a section of the frame of the shaft, and numerals 1 1 refer to the four vertical posts thereof to be inserted within the mine. The numerals 2 2 indicate the front and horizontal timbers, which are secured at the ends to the said vertical posts 1 1 of the frame of the shaft. 3 3 indicate the lateral timbers of said frame, which are dovetailed or otherwise connected with the ends of the front and rear timbers 2 2. The ends of the timbers 2 and 3 are secured in recesses in the vertical posts. These posts are preferably made in sections about five feet in length, or longer, if desirable.

Cut into the inner top edges of the front and rear timbers 2 2, as shown in Figs. 2 and 3, at regular distances apart, preferably about one hundred feet apart, near each end thereof, are recesses 11 11, in which are fastened by means of screws, in order to protect the timbers 2 2 from wear, pieces of metal 12 12, upon which the ends of the legs 21 21 of the chair B of the cage abut while the cage C is at rest at the said stations of the frame of the shaft. In case of accident, such as the breaking of the cable 48 or of the safety-chain 39, as shown upon Fig. 2 of the drawings, the legs of the chair of the cage may, however, be made to rest upon the front and rear timbers 2 2 of the frame, as illustrated in Fig. 1.

4 4 refer to the two guide-posts within the frame A of the shaft, secured to the side timbers 3 3 about midway between each of the two pairs of vertical posts 1 1 of the frame A of the shaft, respectively connected to each of said timbers, and these guide-posts 4 4 by means of the guides 14 14, secured to the outer face of the cage-hangers 10 10, serve to keep the cage C within the center of the frame A of the shaft while the cage is being raised and lowered. These said guide-posts 4 4 extend the entire length of the frame A of the shaft, so as to accurately and centrally guide the cage C within the frame A of the shaft from the bottom of the mine to the top thereof—the surface of the earth—and vice versa.

The cage is raised and lowered by winding the cable 48 upon a drum or upon an equivalent device and the drum or said equivalent device revolved by any well-known means.

The reference-letter B refers to the chair of the cage C, which is shown in Fig. 5 of the drawings, and the numeral 9 refers to the platform of the cage C. (Illustrated in perspective in Fig. 1 and in longitudinal sections in Figs. 2 and 3 and partly in cross-section and partly in elevation in Fig. 4 of the drawings.) The platform 9 is preferably made of iron, but may be made of other suitable material, and it consists, preferably, of a rectangular plate, although it may be made of any desired form, having two lateral downward-projecting flanges 7 7 and front and rear flanges 8 8. The said platform, with its flanges, is desirably made of one piece of metal, cast or otherwise, constructed. In each end of the two lateral downward-projecting flanges 7 7, near each end thereof, as shown upon Fig. 1 of the drawings, are two perforations 16 16, in which the ends 18 18 (see Fig. 5) of the oscillating rods 20 20 of the chair B are journaled, and by means of clamping devices, preferably bolts or rivets, the platform 9 is securely held upon the two-part journal-bearings 42 43 and 42 43, secured together by screws 44 44. Near the rear end of the platform 9 of the cage a longitudinal slot 15 is cut therethrough, in which slot the upwardly-projecting pitman-rod 22 reciprocates, which rod 22 connects the hand-lever 24 with the crank-arm 23. (Shown in Figs. 2 and 3.) This crank-arm is connected with and desirably made a part of the rear oscillating rod 20 of the chair. The legs 21 21 of the chair are preferably made a part of the rods 20 20, and one of the front and one of the rear legs are pivotally connected by means of the rod 59, as shown upon Fig. 5 of the drawings. To the oscillating rods 20 20 lugs 58 58 are centrally connected thereto or made integral therewith. These lugs 58 58 are slotted at their free ends, in which slots the toggle-levers 52 54 are pivoted. The inner end of each of said toggle-levers 52 54 is provided with a longitudinal slot 55 55, which slides on a pin in the free end of the central and downwardly-projecting post 50, which has a base 56, which, if desirable, may extend the entire length of the platform 9. The said base 56 of the post 50 is securely held to the platform 9 by means of screws 57 57.

The upper or suspending portion of the cage consists of a double-triangle portion 12 12. The apex of the double triangle is truncated, and through the center of the truncated portion and the vertical brace 13 is provided with a perforation in which the king-bolt 37 reciprocates. In the upper portion of the king-bolt 37 the cable 48 is secured and passes upward to the top of the mine and is reeled upon any well-known device. (Not necessary to be shown upon the drawings.) To the lower end of the king-bolt 48 a perforated nut is secured and below which is an eye made integral with the king-bolt, in which the safety-chain 39 is fastened at its upper end. The lower portion of the safety-chain passes under and over pulleys 60 61, respectively, and is secured to the upper end of the depressing-rod 33 of the locking device.

The pitman-rod 22, hereinbefore referred to, is pivoted at one end to the free end of the crank-arm 23, and at the opposite end thereof is pivotally connected at 19 to the rear end of the hand-lever 24. The said hand-lever is pivoted to the inner face of one of the vertical hangers 10 of the cage by means of the pivot-pin 25, (shown upon Figs. 2 and 3 of the drawings,) which pivot-pin 25 passes through the bracket 26 into the hanger 10 and is attached to the said hanger 10 by means of screws 27 27 or other devices. The free end of the hand-lever 24 is held in close contact with the vertical hanger 10 of the cage by means of a keeper 28, secured at each end thereof to said hanger 10 of the cage C, by means of screws 29 29, and near the free end of the hand-lever 24 and preferably made a part thereof is a counterweight 30. We secure to the upper end of said hanger 10, to which the hand-lever 24 is pivoted, by means of screws or other equivalent devices, the perforated brackets 32 34, and in perforations in said brackets 32 34 the upper portion of the depressing-rod 33 of the locking device reciprocates. When the safety-chain 39 (shown in Fig. 2 of the drawings) and the cable 48 are slackened, as illustrated in Fig. 1 of the drawings, the lower end of the depressing-rod 33, by means of the coil-spring 36, is forced in contact with the rear end of the hand-lever 24, which is held in a horizontal position against the gravity of the counterweight 30, made a part of the lever 24, as illustrated in Figs. 1 and 2 of the drawings. When the cable 48 and the safety-chain 39 are tight, supporting, for example, the cage and its contents in the shaft, the hand-lever 24 is thrown in the position shown in Fig. 3 of the drawings, the depressing-rod 33 elevated in the brackets 32 34, and the coil-spring 36 coiled more closely together, as illustrated in Figs 3 and 4 of the drawings, the rear end of the hand-lever will become elevated and the opposite end thereof lowered by means of the counterweight 30 thereon. In this position of the hand-lever 24 the pitman-rod 22 is carried upward by the hand-lever 24, the end of the crank-arm 23 likewise elevated, and the legs 21 21, through the action of the toggle-levers 52 54 are removed from the supports, as illustrated in Fig. 3 of the drawings.

It will readily appear from the foregoing description, when read in connection with the drawings hereto appended and made a part of the specification and claims, what is the operation of our invention, and further description of the manner of operating our improvement is deemed unnecessary.

It is obvious that many variations and changes in the details of construction and arrangement of our invention would readily suggest themselves to persons skilled in the art and still be within the spirit and scope of our invention.

We do not desire to confine this invention to the specific construction, combination, and arrangement of parts herein shown and described, and the right is reserved to make all changes in and modifications of the same as come within the spirit of this invention; but we do desire to secure as our invention all features of construction and equivalents thereof that come within the scope of our improvement as herein shown and described and illustrated upon the drawings appended hereto.

Having described our invention, what we claim, and desire to secure by Letters Patent, is—

1. A frame for mining-shafts provided with lateral timbers and front and rear timbers, the upper and inner edges of said front and rear timbers having recesses therein, in combination with a cage having a platform and movable chair-legs secured thereto, and means whereby the said legs of the chair are thrown out of contact with said recesses.

2. A frame for mining-shafts having lateral timbers, and front and rear timbers, the upper and inner edges of one or more of said front and rear timbers provided with recesses, pieces of metal inserted in said recesses in said front and rear timbers of the frame, in combination with a cage having suspending devices, a platform and movable chair-legs secured to the under face of said platform and means whereby the legs of the chair are thrown in contact with said recesses.

3. In safety devices for operation within mine-shafts, a cage having a slotted platform, laterally and downwardly projecting flanges provided with perforations near each end thereof, oscillating rods or shafts carrying legs, integrally made therewith, a connecting-rod pivotally secured to the upper end of one of said legs above the upper surface of said platform and the opposite end of said connecting-rod pivotally secured near the lower end of one of the front legs; and means for throwing the said legs in contact with supports upon the frame of the shaft, whereby the cage may be temporarily brought to rest at one or more stations within the frame of the shaft.

4. In safety devices for operation within mine-shafts and within building-elevator shafts, a cage provided with hangers secured thereto and one or more guides fastened upon the outer faces of the hangers, guide-posts secured to the frame, the said cage having a slotted platform provided with downwardly-projecting lateral flanges with perforations therein, oscillating rods having legs secured thereto, a crank-arm upon one of said oscillating rods at about right angles to one of said legs, a pitman-rod pivotally secured at one end to said crank-arm and the opposite end pivotally connected to a counterweighted lever, and automatic locking devices for operating said lever whereby the cage is caused to temporarily rest within the frame of the shaft.

5. In safety devices for operation within mine-shafts, a cage having a platform provided with lateral downwardly-projecting flanges, the oscillating rods carrying movable legs made integral with said rods, journal-bearings for said oscillating rods secured to the platform, and means for simultaneously and automatically operating said legs, whereby the cage is securely held at any predetermined station within the frame of the shaft, or released from said stations of the frame.

6. In safety devices for operating within mine-shafts, a cage having a platform provided with hangers rigidly secured thereto, said platform having downwardly-projecting lateral flanges and downwardly-projecting front and rear flanges, said lateral flanges provided with perforations therein near the front and rear ends thereof, oscillating rods having legs rigidly fixed thereon, and devices for oscillating said rods for throwing the said legs in and out of contact with the frame of the shaft.

7. In safety devices for operation within mine-shafts and shafts for buildings, a cage having suspending devices therefor, devices for guiding the cage centrally within the frame of the shaft, the platform of the cage provided with front and rear flanges and having lateral flanges, the lateral flanges having perforations therein near the front and rear ends thereof, oscillating rods journaled in the platform, one of said oscillating rods provided with a crank-arm, a pitman-rod pivoted in the end of said arm, the upper end of said pitman-rod pivotally connected with a hand-lever counterweighted at one end, and locking devices whereby the cage is securely held from descent at any station of the frame of the shaft.

8. In safety devices for operation within shafts, a cage, a cable for suspending the

same, said cage provided with hangers having guides upon the outer faces thereof, the frame of the shaft having guide-posts on which the said guides are adapted to move, said cage provided with a slotted platform, the oscillating rods, the movable chair-legs fixed to said rods, journal-boxes secured to the platform and means for automatically operating the chair-legs.

9. In safety devices for operating within shafts of mines and buildings, a cage provided with hangers having guides upon the outer faces thereof, guide-posts, a cable for suspending the cage, a hand-lever pivoted to one of the hangers, a pitman-rod pivoted to one end of the hand-lever and the opposite end thereof to a crank-arm, a crank-arm, the cage provided with a platform having slots in the rear end thereof, oscillating rods journaled within downward perforated lateral flanges of the platform, said oscillating rods carrying legs securely fastened thereto, one of said legs projecting upward through one of said slots in the platform, a connecting-rod pivotally connected at one end thereof to said upwardly-projecting end of said leg, the opposite end of said connecting-rod pivotally connected near the lower end of one of the front legs, whereby all the legs are simultaneously thrown in contact with the frame and the cage caused to rest temporarily at any predetermined station therein.

10. In safety devices for operating within shafts of mines and buildings, a cage provided with hangers having guides upon the outer faces thereof, guide-posts secured to a frame, said guides adapted to slide upon said guide-posts, a hand-lever pivoted to one of the hangers, a pitman-rod pivoted to one end of the hand-lever and the opposite end thereof to a crank-arm, a crank-arm secured to one of the legs and to one of the oscillating rods, a cable for suspending the cage, a king-bolt, a safety-chain and a spring-operating depressing-rod connected to the cable, the cage having a platform with slots in the end thereof, oscillating rods journaled within flanges depending from the platform, the oscillating rods carrying legs fastened thereon, one of said legs projecting upward through one of said slots in the platform, a connecting-rod connected at one end to the top of one of the legs, the opposite end of said connecting-rod connected near the lower end of one of the legs, whereby all the legs are thrown in contact with the frame.

In testimony whereof we have signed our names to this specification in the presence of subscribing witnesses.

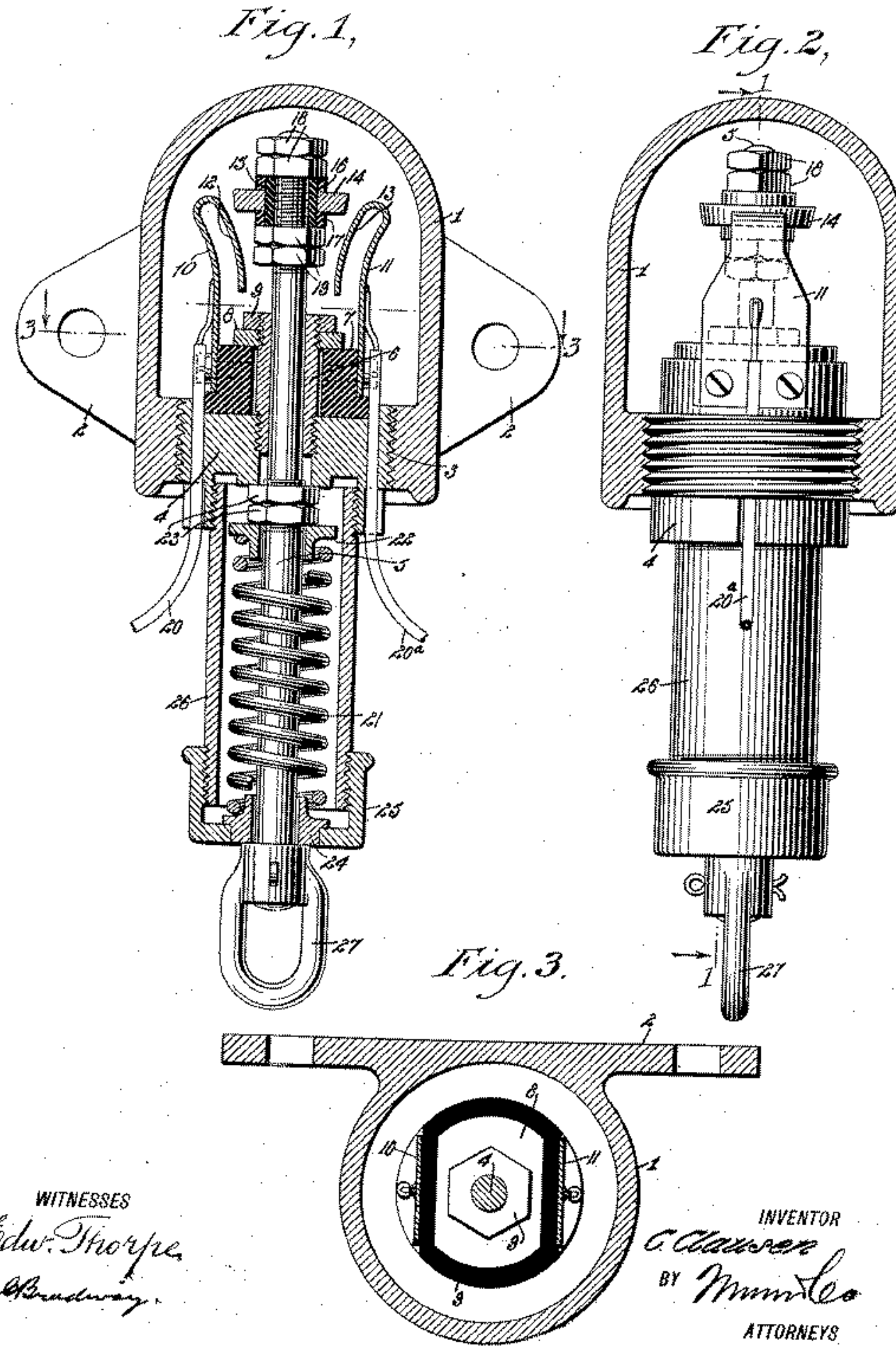
HARRY HANSON.
FREDERICK L. DWIGHT.

Witnesses as to signature of Harry Hanson:
AMELIA GUEST,
INEZ MARLIN.

Witnesses as to signature of Frederick L. Dwight:
C. H. HOLZ,
R. T. GRAHAM.

C. CLAUSEN.
PULL SWITCH FOR ELECTRIC MINE SIGNALS.
APPLICATION FILED APR. 19, 1916.

1,217,707. Patented Feb. 27, 1917.



WITNESSES

Edw. Thorpe.

C. Bradway.

INVENTOR

C. Clausen

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

CARL CLAUSEN, OF BISBEE, ARIZONA.

PULL-SWITCH FOR ELECTRIC MINE-SIGNALS.

1,217,707. Specification of Letters Patent. Patented Feb. 27, 1917.

Application filed April 19, 1916. Serial No. 92,171.

To all whom it may concern:

Be it known that I, Carl Clausen, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and State of Arizona, have invented a new and Improved Pull-Switch for Electric Mine-Signals, of which the following is a full, clear, and exact description.

This invention relates to electric switches, and more particularly to a pull switch for use in mine signals whereby a signal from a lower level can be transmitted to the engineer's station, although the invention is not necessarily limited to this particular use.

The invention has for its general objects to improve and simplify the construction and operation of pull switches so as to be reliable and efficient in use, comparatively inexpensive to manufacture, and so designed that it will positively automatically open when the pull for closing the switch is released.

A more specific object of the invention is the provision of a normally open switch having a novel arrangement of contacts and actuating means for the movable contact, whereby the reliability of the switch is secured.

With such objects in view and others which will appear as the description proceeds, the invention comprises various novel features of construction and arrangement of parts which will be set forth with particularity in the following description and claims appended hereto.

In the accompanying drawing which illustrates one embodiment of the invention and wherein similar characters of reference indicate corresponding parts in all the views,

Figure 1 is a vertical longitudinal section of the switch on the line 1—1, Fig. 2;

Fig. 2 is a side view with the casing or housing in section; and

Fig. 3 is a horizontal section on the line 3—3, Fig. 1.

Referring to the drawing, 1 designates a suitably shaped housing provided with apertured ears 2, whereby the housing can be fastened to a support. The housing is closed at all points, except the bottom, which is provided with a threaded opening 3 into which is screwed a plug 4. Extending through the plug is a vertically movable rod 5 slidable in a guide 6 which is a pipe nipple. This nipple is screwed into the plug 4 and is disposed in the housing 1. Surrounding the nipple is a ring 7 of insulation clamped in place against the plug 4 by a locking plate 8 and a nut 9. Fastened to opposite sides of this block 7 of insulation are upwardly extending metallic springs 10 and 11, and the upper ends of these springs are bent inwardly and downwardly to form yielding contacts 12 and 13 which are spaced apart at opposite sides of the upper end of the rod 5. This rod 5 carries an annular bridging contact 14 which is adapted to engage the contacts 12 and 13. The contact 14 in insulated from its carrying rod 5 by a sleeve of insulation 15 and is clamped in place between rings of insulation 16 and 17 which are in turn held in place by nuts 18 and 19 threaded on the rod 5. The relatively stationary contacts are connected respectively with circuit wires 20 and 20ᵃ which pass in through openings in the plug and are connected respectively with the contacts 10 and 11. The switch is normally open, with the bridging contact 14 disengaged from the contact springs. A spring 21 encircles the lower end of the rod 5 and operates upwardly on the same to hold the switch open. The spring has its upper end bearing on an abutment in the form of a ring 22 which surrounds the rod 5 and is adjustably held in place by nuts 23 screwed on the rod. These nuts form a shoulder engageable with the plug 4 to limit the upward movement of the rod, and by adjusting the nuts the tension of the spring 21 can be varied. The lower end of the spring bears against an abutment 24 which is carried by a cap 25 screwed on the lower end of a pipe nipple 26 that is in turn screwed into the plug 4. On the lower end of the rod 5 is a loop or equivalent device 27 for enabling a chain, cable or its equivalent to be fastened to the movable element of the switch, whereby the latter can be controlled from a remote point. By pulling downwardly on the rod 5 the switch contacts can be engaged for closing the signal circuit and by a pre-arranged code signals may be transmitted by the frequency or duration of the closings and openings of the circuit through the engagements and disengagements of the contacts 12, 13 and 14. It will be observed that the various parts of the switch, together with its operating means, are effectively housed so that the switch can be kept indefinitely in operative condition.

From the foregoing description, taken in connection with the accompanying drawing, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative and that such changes may be made when desired as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A switch comprising a housing having an opening, a plug inserted in the opening, a rod extending through the plug, a tubular member fastened to the plug and disposed within the housing, a ring of insulation surrounding the tubular member, a nut screwed on the tubular member for clamping the insulation to the plug, contacts fastened to and insulated from each other by the insulation ring, a bridging contact fastened to and insulated from the rod and adapted to engage the first-mentioned contacts, a spring on the rod normally operating to hold the bridging contact separated from the first-mentioned contacts, a housing disposed outside the first housing inclosing the spring and rod, and means connected with the rod for moving the same against the tension of the spring to close the circuit through the switch.

2. A switch of the class described comprising a housing, a longitudinally movable rod extending into the housing, a contact carried by and insulated from the inner end of the rod, spring contacts mounted in the housing and insulated from it and from each other and arranged to be engaged by the first-mentioned contact, a spring encircling the rod and disposed on a portion outside the housing, a housing having a threaded connection with the first-mentioned housing to inclose the spring, means within the second-mentioned housing for adjusting the tension of the spring and limiting the movement of the rod, and a device fastened to the rod after the second housing is fastened in place and adapted to connect the rod with an actuating element.

3. A switch of the class described comprising a housing having a threaded opening, a plug screwed into the opening, a tubular member screwed into the plug, an insulation ring surrounding the tubular member, means on the tubular member for clamping the ring in place, contacts fastened to the ring and insulated from each other, a rod extending through the plug and tubular member, a contact carried by and insulated from the rod and arranged to engage the first-mentioned contacts, a tubular element having a threaded connection with the plug and disposed outside the housing and surrounding the portion of the rod disposed exterior to the housing, a spring surrounding the rod and disposed within the tubular element, a cap screwed on the tubular element and having an abutment for one end of the spring, an abutment on the rod for the opposite end of the spring, a nut on the rod for adjusting the position of the last-mentioned abutment to vary the tension of the spring and also forming a stop for limiting the movement of the rod in one direction, and means for permitting an actuator to be attached to the rod.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CARL CLAUSEN.

Witnesses:
L. C. SHATTUCK,
ERNEST J. BEYER.

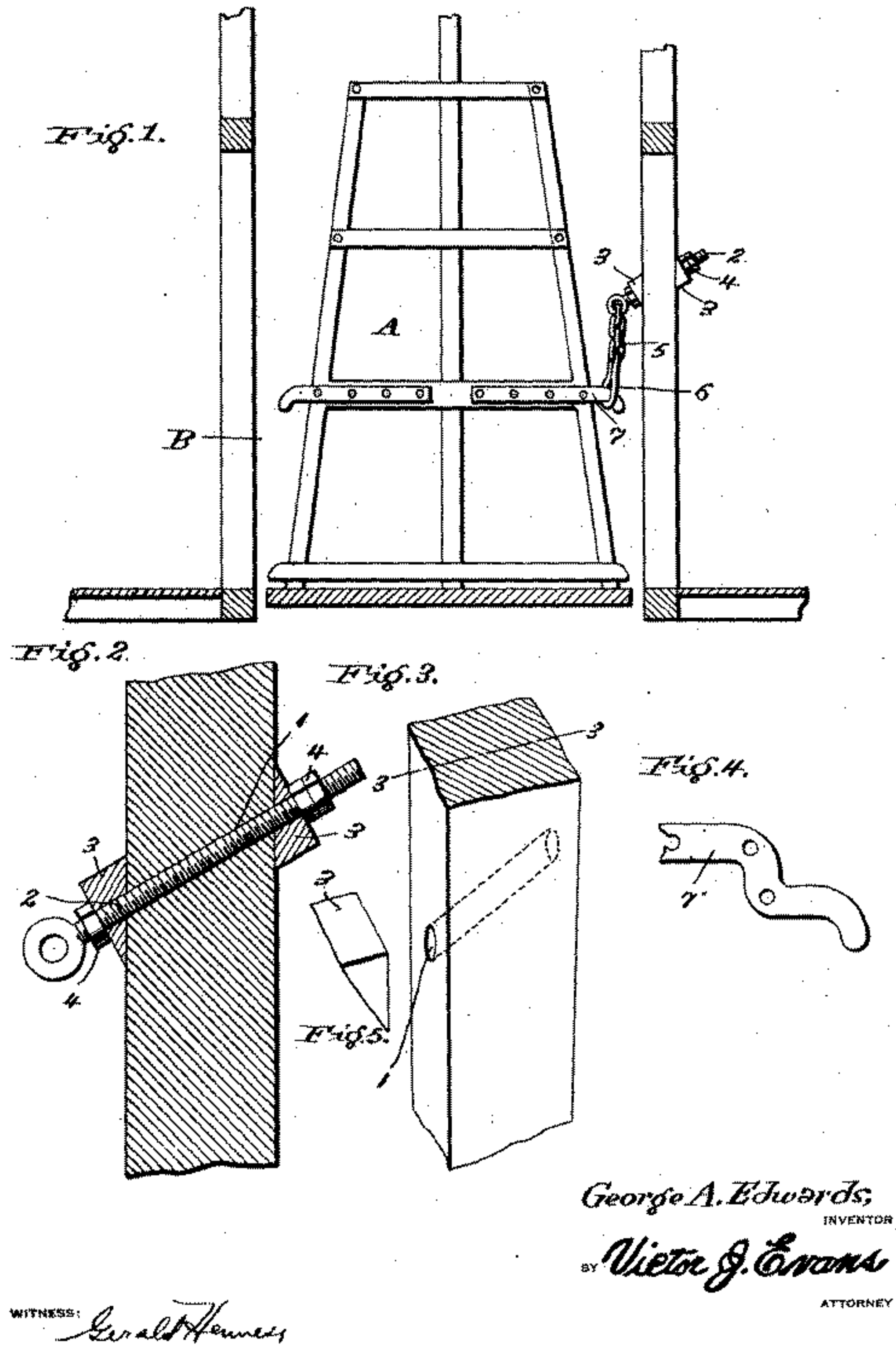
34

March 29, 1927. 1,622,943

G. A. EDWARDS

ELEVATOR SUPPORT

Original Filed June 13, 1924



Patented Mar. 29, 1927. **1,622,943**

UNITED STATES PATENT OFFICE.

GEORGE A. EDWARDS, OF BISBEE, ARIZONA, ASSIGNOR OF ONE-HALF TO FRED HENDERSON, OF BISBEE, ARIZONA, AND ONE-HALF TO NELLIE V. EDWARDS.

ELEVATOR SUPPORT.

Application filed June 13, 1924, Serial No. 719,863. Renewed January 28, 1927.

This invention relates to an attachment for a cage or elevator, the general object of the invention being to provide means for holding the cage at a floor level while it is being loaded or unloaded.

Another object of the invention is to so form the holding means that the cage will be automatically released as it starts its upward movement.

This invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings and specifically pointed out in the appended claims.

In describing my invention in detail, reference will be had to the accompanying drawings wherein like characters denote like or corresponding parts throughout the several views, and in which:—

Figure 1 is a sectional view showing how the invention is used.

Figure 2 is a sectional view through one of the posts and showing how the holding bolt is arranged in said post.

Figure 3 is a view of the post with the hole therein for the bolt.

Figure 4 is a view of a modified form of hook.

Figure 5 is a view of one of the wedge members.

In these views, A indicates the cage or elevator and B the shaft in which the elevator moves. In carrying out my invention I form an inclined hole 1 in one of the timbers of the shaft and place therein the threaded shank of an eye bolt 2. The wedge plates 3 are placed on opposite faces of the post and the bolt passes through these plates. These plates form bearing surfaces for the nuts 4 which hold the bolt in place and which provide means for permitting the bolt to be adjusted in the post. A chain 5 has its upper link engaging the eye of the bolt and the lower link 6 of said chain is enlarged to engage a hook member 7 which is bolted to the cage. Figure 4 shows a different type of hook member at 7′ which is used on standard cages, the hook shown in Figure 1 being used on small cages.

From the foregoing it will be seen that when the cage reaches a floor level it is simply necessary to swing the chain outwardly and place the link 6 in engagement with the hook 7. This will hold the cage at the floor level so that is can be unloaded or loaded without danger of movement of the cage. When the cage starts upward the link 6 will automatically drop from the hook so that it is not necessary to remove the link from the hook.

By placing the bolt on an incline in the post the device has greater strength and there is less tendency for the bolt to break on a hard pull. The wedge plates act as washers as well as bearing surfaces for the nuts. By making the link 6 of considerable length it can be placed in engagement with the hook without danger of the operator getting his hand pinched. The nuts also permit the bolt to be lengthened or shortened to adjust the chain so that the cage can be held on a level with the floor. By having a hook on each side of the cage the cage can be held at different stations, the chain at one station being arranged at one side of the shaft and the chain at the other station being arranged on the opposite side. This device takes the load off the cable and holds the cage level with the floor and when it is not in use the chain hangs down alongside of the shaft entirely out of the way of the cage.

It is thought from the foregoing description that the advantages and novel features of my invention will be readily apparent.

I desire it to be understood that I may make changes in the construction and in the combination and arrangement of the several parts, provided that such changes fall within the scope of the appended claims.

What I claim is:—

1. In combination with a cage and its shaft, a bolt inclinedly arranged in one of the timbers of the shaft, wedge-shaped plates at opposite sides of the timber through which the bolt passes, nuts on the bolt engaging the plates, said bolt having an eye at its lower inner end, a chain having its upper link engaging the eye and its lower link enlarged and a hook on the cage for engaging the enlarged link.

2. An elevator support including in com-

bination with a support having an inclined opening therethrough, of a bolt in said opening, wedge-shaped plates mounted upon each end of the bolt and having their tapered portions extending in opposite directions upon opposite sides of the support, nuts on the bolts engaging the plates, said bolt having an eye at its lowermost end, a chain having its upper link engaging the eye and its lower link enlarged as and for the purpose specified.

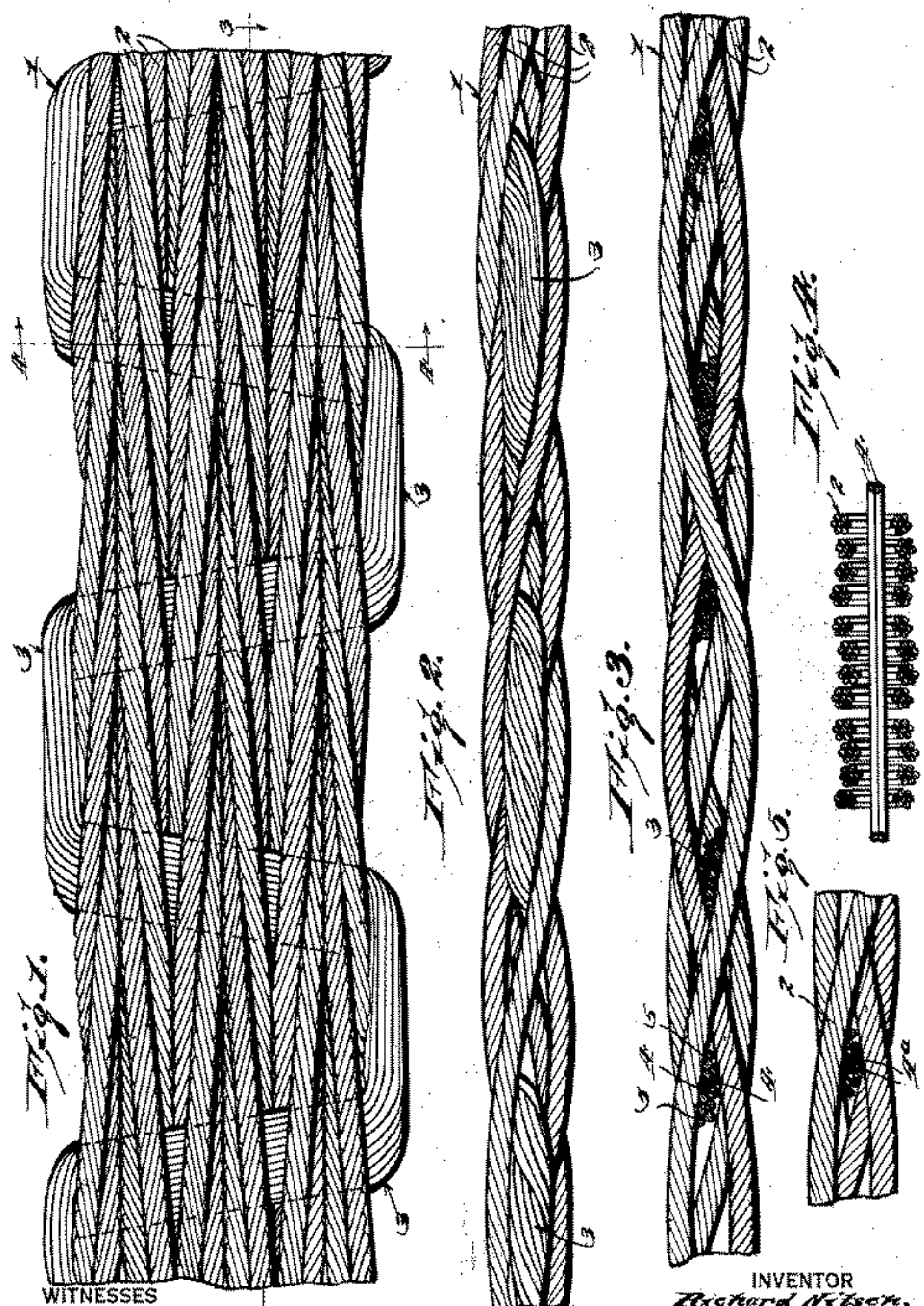
In testimony whereof I affix my signature.

GEORGE A. EDWARDS.

April 15, 1930. R. NITSCH 1,755,018

SEWING WIRE FOR FLAT ROPE

Filed May 31, 1929



WITNESSES

INVENTOR
Richard Nitsch,
BY Munn & Co
ATTORNEY

Patented Apr. 15, 1930 1,755,018

UNITED STATES PATENT OFFICE

RICHARD NITSCH, OF WARREN, ARIZONA

SEWING WIRE FOR FLAT ROPE

Application filed May 31, 1929. Serial No. 367,456.

This invention relates to wire ropes or cables of the flat type and more particularly to the sewing wires used in constructing such cables.

It is well known that with flat metal ropes or cables composed of numbers of wire strands secured together by stitching or lacing that the weakest point in such rope is the sewing wire. This sewing wire, usually employed, is soft Swedish or Norway iron wire which is known in the art as "sewing wire" and which is a low grade open hearth single or double annealed steel wire.

The number and size of sewing wire used depends upon the size of the flat rope to be made and it varies in size from #20 to #16 and in number of wires from 10 to 16.

The strand wires of the rope being of higher grade metal, such as steel, nick the sewing wires and cause them, under the strain produced by the load, to rapidly break and result in splitting the rope necessitating frequent resewing of the rope. Bad sheaves and hoist reel conditions also cause the same effect.

A primary object of this invention is to overcome these objections and defects and provide a rope or cable in which danger of sudden breakage is eliminated and in which the necessity of resewing is reduced to a minimum and the life of the rope greatly prolonged.

Another object is to so produce sewing wires for use in the manufacture of flat wire cables or ropes that a soft wire bed will be formed between the hard strand wires of the rope and the hard cores of the sewing wires, even after the soft sewing wires are nicked and broken since the stubs of such soft wires remain inside of the strands and the rope remains compact allowing the strands to be used for resewing without damage from internal nicking.

Another object of the invention provides a composite sewing wire for use in manufacturing flat metal ropes or cables constructed with a hard metal core incased in soft wires thereby avoiding internal nicking of the wires and prolonging the life of the cable.

In carrying out these objects, the invention is susceptible of a wide range of modification without departing from the spirit or sacrificing any of the advantages of the claimed invention; there being shown in the drawings for illustrative purposes a preferred and practical form, in which:

Figure 1 represents a side elevation of a piece of flat rope manufactured with the sewing wires constituting this invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is a longitudinal section taken on the line 3—3 of Fig. 1;

Fig. 4 is a transverse section taken on the line 4—4 of Fig. 1;

Fig. 5 is a detail longitudinal section showing a slightly different form of sewing wire.

In the embodiment illustrated a flat metal rope is shown at 1 composed of a plurality of longitudinally extending strand wires 2 which may be composed of any desired number of wires depending upon the flexibility of the cable to be manufactured. These strands 2 are laid right and left lay alternately, the number of strands depending upon the required width and strength of the cable.

The strands 2 are sewed or laced with a strand of sewing wire 3 which constitutes the present invention. This sewing wire 3 is a composite wire being constructed of a combination of soft and hard wires the number of which may vary in respective strands provided that the hard wires shown at 4, two being here illustrated, do not exceed one-half the number of wires used in making up the sewing strand. These hard wires 4 are preferably made of high grade cast steel and have formed around them a bed of soft wires 5 which protect the hard wires 4 which constitute practically a core for the strand 3, against nicking or by the hard wires which form the strand 2 of the cable. The hard wires 4 constituting the sewing wire core are of a diameter not to exceed that of the soft wires 5 as shown in Fig. 3 and are preferably made of less diameter as shown at 4^a in Fig. 5. It is of course understood that owing to the different sizes of finished rope required the numbers and the diameters of the sewing or lacing wires will also necessarily vary according to the type of the finished rope.

From the above description it will be seen that the soft wire strands 5 of the sewing wires 3 form a bed between the wires used in the manufacture of the strands of the rope and the cast steel core wires 4 of the sewing wire even after the soft sewing wires 5 have been nicked and broken. The stubs remain inside the rope strands whereby the rope strands remain compact and in this way eliminate any danger of sudden rope breakage due to internal nicking of the wires in the strand. The strands may also be used for resewing without damage from internal nicking.

The use of these composite sewing wires will at least double the amount of tonnage hoisted by the cable before resewing is required. Ropes sewed by these composite wires will also provide at least double service over those sewn with wires as now made even although the sheave wheels are badly grooved or if the hoist reels of sheave shafts are out of line.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will, of course, be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention or its scope as claimed.

I claim:

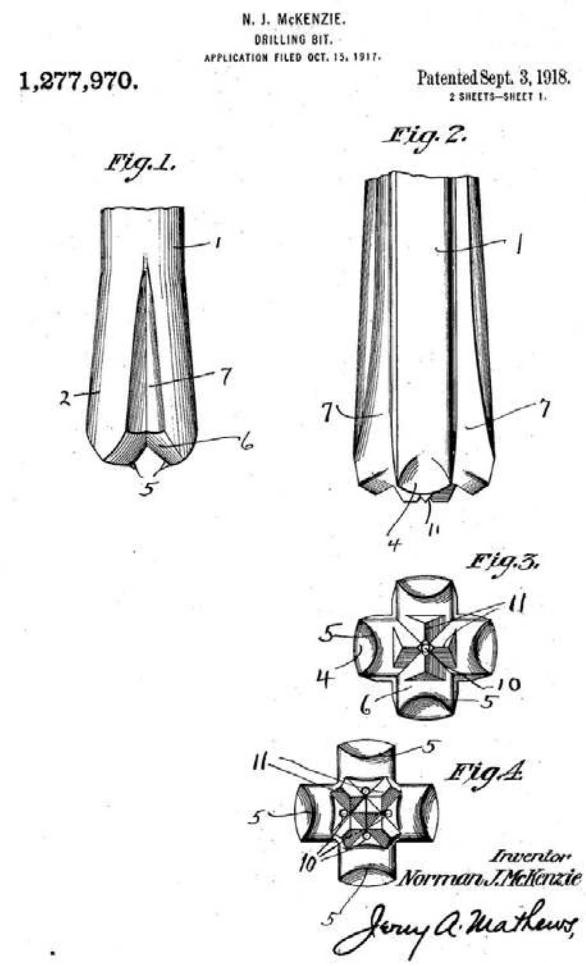
1. A composite sewing strand or lacing for metal rope composed of hard and soft wires one embedded in the other.

2. A composite sewing strand or lacing for metal rope composed of hard and soft wires, the soft wires being positioned outside the hard wires and arranged to form a bedding for the hard wires to protect them from cutting contact with the strands of the rope when in use.

3. A composite sewing strand or lacing for metal rope composed of hard and soft wires, the soft wires being arranged to form a bedding for the hard wires to protect them from cutting contact with the strands of the rope when in use, the hard wires being of less diameter than the soft wires whereby the hard wires are protected against cutting contact with the hard wires of the rope strand.

RICHARD NITSCH.

Drilling

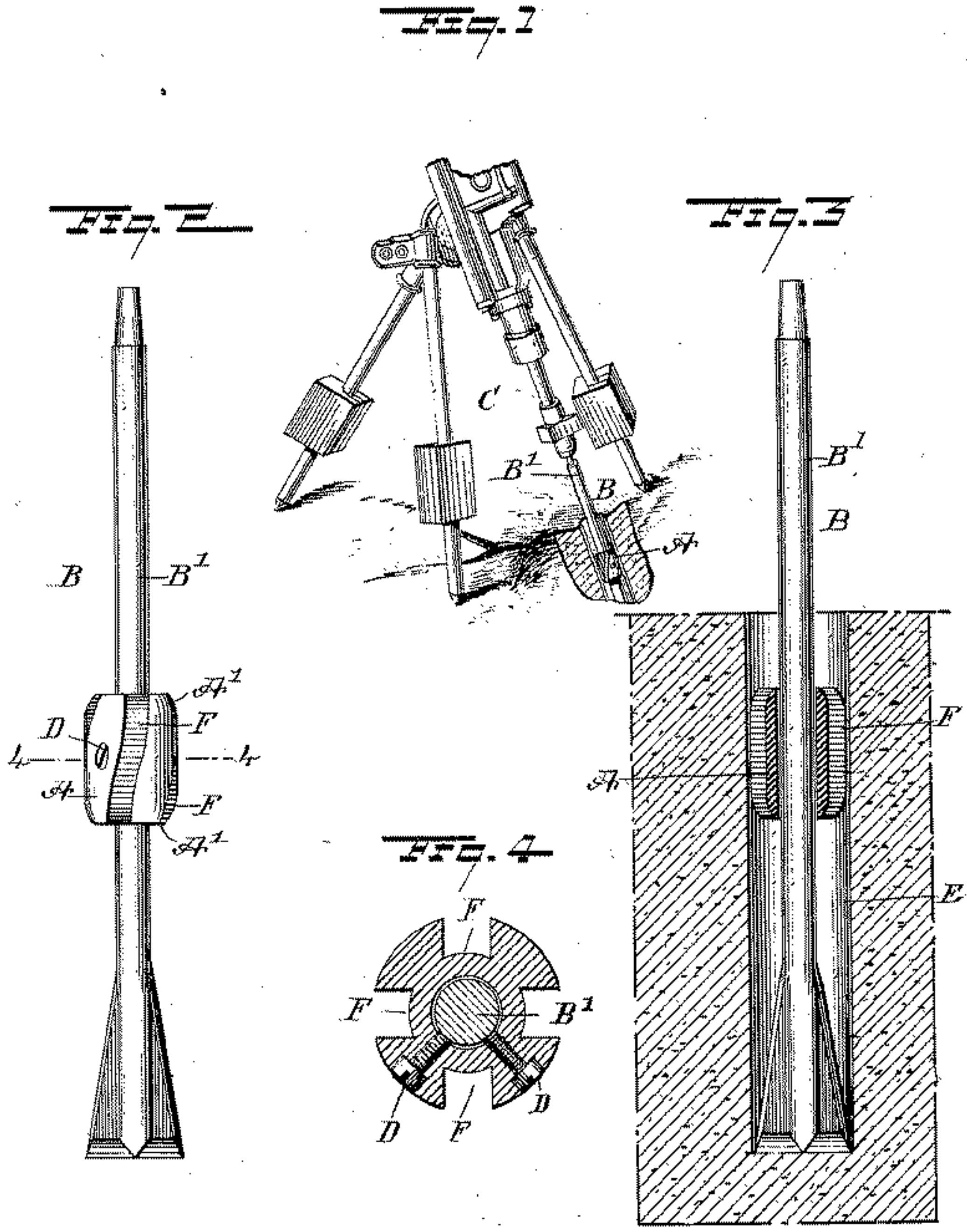

N. J. McKENZIE.
DRILLING BIT.
APPLICATION FILED OCT. 15, 1917.
1,277,970.
Patented Sept. 3, 1918.
2 SHEETS—SHEET 1.
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Inventor
Norman J. McKenzie
Jerry A. Mathews,

No. 838,339. PATENTED DEC. 11, 1906.

E. M. KINSELLA.

GUIDING APPLIANCE FOR DRILLING MACHINES.

APPLICATION FILED AUG. 24, 1905.



WITNESSES:

John a Bergstrom

INVENTOR

Edward M. Kinsella

BY

Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWARD MAURICE KINSELLA, OF BISBEE, ARIZONA TERRITORY.

GUIDING APPLIANCE FOR DRILLING-MACHINES.

No. 838,339. Specification of Letters Patent. Patented Dec. 11, 1906.

Application filed August 24, 1906. Serial No. 275,605.

To all whom it may concern:

Be it known that I, EDWARD MAURICE KINSELLA, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and Territory of Arizona, have invented a new and Improved Guiding Appliance for Drilling-Machines, of which the following is a full, clear, and exact description.

The invention relates to hand and power drilling-machines; and its object is to provide a new and improved guiding appliance for guiding the drill-bit of the machine in the drill-hole to allow easy working of the drill-bit in seamy or fitchety ground and to permit ready escape of the sand, dirt, or other borings from the drill-hole.

The invention consists of novel features and parts and combinations of the same, which will be more fully described hereinafter and then pointed out in the claim.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a perspective view of the improvement as applied to a power drilling-machine. Fig. 2 is an enlarged side elevation of the improvement in position on the drill-bit. Fig. 3 is a like view of the same in position in the drill-hole, and Fig. 4 is an enlarged sectional plan view of the same on the line 4 4 of Fig. 2.

The guiding appliance is in the form of a tubular guiding-block A, removably and adjustably secured on the shank B′ of the drill-bit B of a hand or power drilling-machine C, by the use of one or more countersunk set-screws D or other fastening devices disposed in any suitable relation to said shank B′. The guiding-block A has its ends A′ rounded off to allow easy up-and-down movement of the block A in the drill-hole E on reciprocating the drill-bit B in the usual manner.

The peripheral face of the block A is provided with grooves F, extending from one end of the block to the other and preferably in a slightly curved or spiral form, as plainly shown in Fig. 2, the said grooves permitting ready passage or escape of the sand, dirt, or other borings in the drill-hole and without requiring the removal of the drill-bit from the drill-hole. The spiral arrangement of the grooves in the block also prevents the formation of flutes or ridges in the drill-hole, which flutes or ridges would interfere with the free turning of the said block, and thereby of the drill; but by means of the spiral grooves all liability of the block sticking in the drill-hole is avoided.

When the device is in use, the guiding-block A readily guides the drill in the drill-hole, and thus prevents the drill from sticking, especially when boring in seamy or fitchety ground, it being understood that the diameter of the guiding-block A is somewhat less than the diameter of the drill-hole E. It will further be seen that on loosening the set-screw D the guiding-block A may be readily moved up or down on the shank B′ of the drill-bit, so as to bring the guiding-block in proper position for the purpose above mentioned.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

A guiding appliance for drilling-machines, comprising an elongated block having a central opening and rounded ends and provided on its periphery with a plurality of spiral grooves extending from end to end of the block, and with means for rigidly and adjustably securing it to a drill-rod.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD MAURICE KINSELLA.

Witnesses:

LELAND S. GAMBLE,

A. C. DOWNS.

No. 856,877.

PATENTED JUNE 11, 1907.

C. A. HULTQUIST.

ROCK DRILL CHUCK.

APPLICATION FILED SEPT. 20, 1906.

Fig. 2.

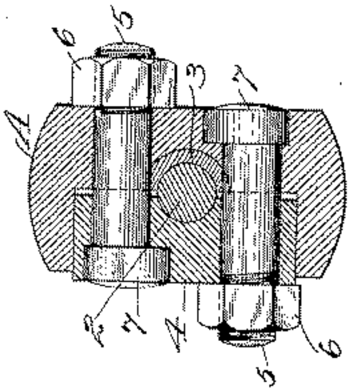


Fig. 1.

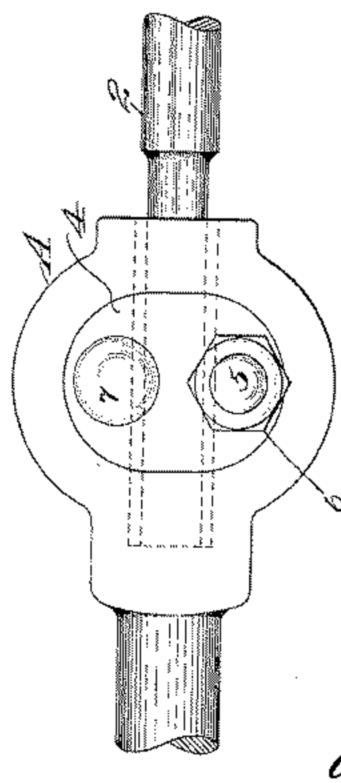
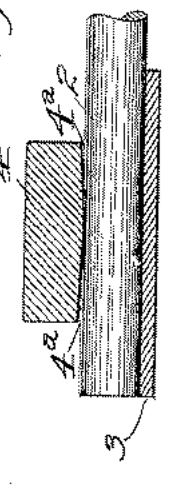


Fig. 3.



WITNESSES:

Frederick E. Maynard.

J. H. Nourse

INVENTOR

Charles A. Hultquist

BY

Geo. H. Strong.

ATTORNEY

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES A. HULTQUIST, OF LOWELL, ARIZONA TERRITORY.

ROCK-DRILL CHUCK.

No. 856,877. Specification of Letters Patent. Patented June 11, 1907.

Application filed September 20, 1906. Serial No. 335,405.

To all whom it may concern:

Be it known that I, CHARLES A. HULTQUIST, a citizen of the United States, residing at Lowell, in the county of Cochise and Territory of Arizona, have invented new and useful Improvements in Rock-Drill Chucks, of which the following is a specification.

My invention relates to an improved rock drill holding chuck; and it consists in the combination and arrangement of parts, and in details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a side elevation. Fig. 2 is a transverse section. Fig. 3 is a longitudinal section of the key and bushing, showing the drill-shank in elevation.

In rock drills it is customary to secure the drill shank to the piston rod or other part by which the drill is actuated, by means of a chuck having an opening to receive the end of the drill shank, and by means of a key and bolts the drill is clamped into the chuck.

It is the object of my invention to provide improvements in such chucks, and means by which the drill can be more securely locked in place, and easily removed from the chuck when required.

A is the chuck having a bore made into one end to receive the drill shank 2.

3 is a bushing such as is commonly used in rock drills. Opposed to this bushing is the key 4 which fits into a chamber upon the opposite side of the chuck from the bushing 3, and the key has a segmental channel on its inner face corresponding with and opposed to the bushing so that when the drill shank has been inserted between the two, the key may be drawn firmly against the shank by bolts, thus clamping the drill shank firmly in place. This key is preferably made oval in transverse section, as shown in Fig. 1, but it might be made round or of other forms.

The segmental channel which fits the drill shank is made a little larger or slack at the ends as indicated at 4ᵃ Fig. 3 so that it acts as an equalizer, making the strain always the same on both bolt-holes, and holding the drill very securely, while at the same time saving the holes.

Holes are bored through the key and the chuck to receive the holding bolts 5, and by means of nuts 6 screwed upon the ends of the bolts, the parts are clamped together to bind upon the drill.

In my invention I countersink one hole in the key which receives the bolt-head, and the hole upon the opposite side of the chuck which receives the other bolt-head, so that these bolt-heads lie substantially flush upon opposite sides and the nuts 6 correspondingly project upon the opposite ends of the bolts which extend through the chuck and the key.

By this construction it is possible to apply a wrench and remove the nuts without interfering with the head of the other bolts; and it also makes it easy to get at both ends without turning the chucks which it is necessary to do with the ordinary construction of chucks and which is difficult if the drill sticks in the hole.

With this chuck the miner can get at both nuts without turning the chuck since they are on opposite sides.

In order to prevent the bolts from turning when setting up the nuts, the bolt-heads 7 are made eccentric to the shank of the bolt, and the key 4 and chuck A are bored to receive these eccentric heads as shown, so that when they are in place, the nuts can easily be turned on or off without any danger of turning the bolts.

It will be understood that the heads might be made polygonal and the correspondingly shaped socket made to receive them, but the form here shown enables the sockets to be bored out, and of inexpensive construction.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A drill chuck having a socket to receive the drill shank, a key fitting a chamber upon one side of the shank, and adapted to be compressed upon the drill shank, bolts extending through the key and the chuck upon opposite sides of the drill shank, said bolts having cylindrical heads eccentric to the body portion, correspondingly shaped sunken chambers in the key and the chuck upon opposite sides adapted to receive the heads of the bolts and nuts turnable upon the opposite ends of the bolts to lock the drill shank in the chuck, said chambers and bolt holes not intersecting the segmental drill-holding channels.

2. A drill chuck having a socket and a drill shank fitting therein, a key fitting a countersunk chamber upon one side of the chuck, and bolts by which said key is caused to clamp the drill shank within the chuck, said key having the ends constructed to make a slack fit whereby the key acts as an equalizer for the strain upon the bolts.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES A. HULTQUIST.

Witnesses:
JAS. BERGMAN,
F. J. HOGAN.

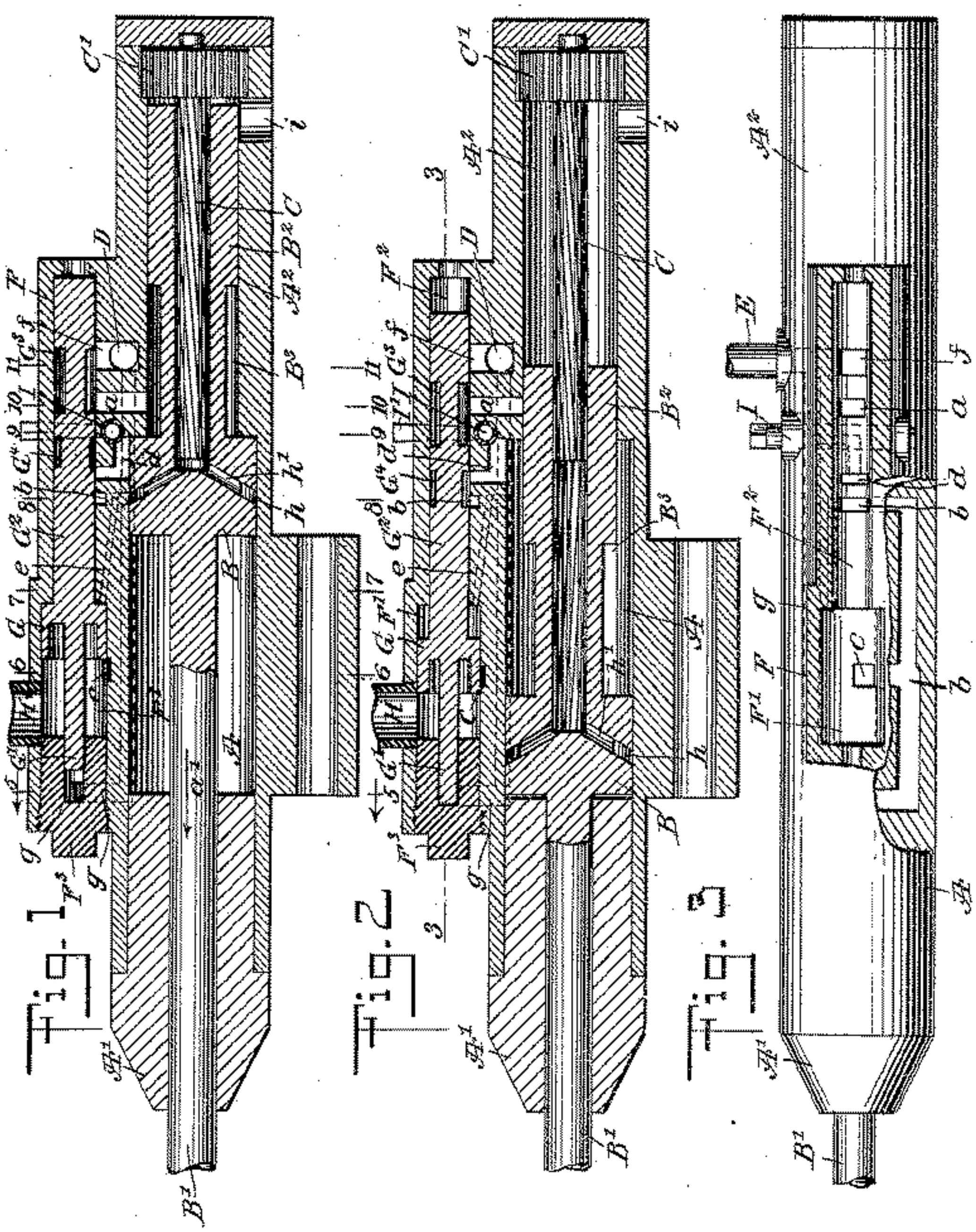
W. E. PORTER.

ROCK DRILL.

APPLICATION FILED MAY 25, 1908.

931,479. Patented Aug. 17, 1909.

2 SHEETS—SHEET 1.



WITNESSES

John Bergstrand

Theo. G. Hoster

INVENTOR

William E. Porter

BY Munn & Co.

ATTORNEYS

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

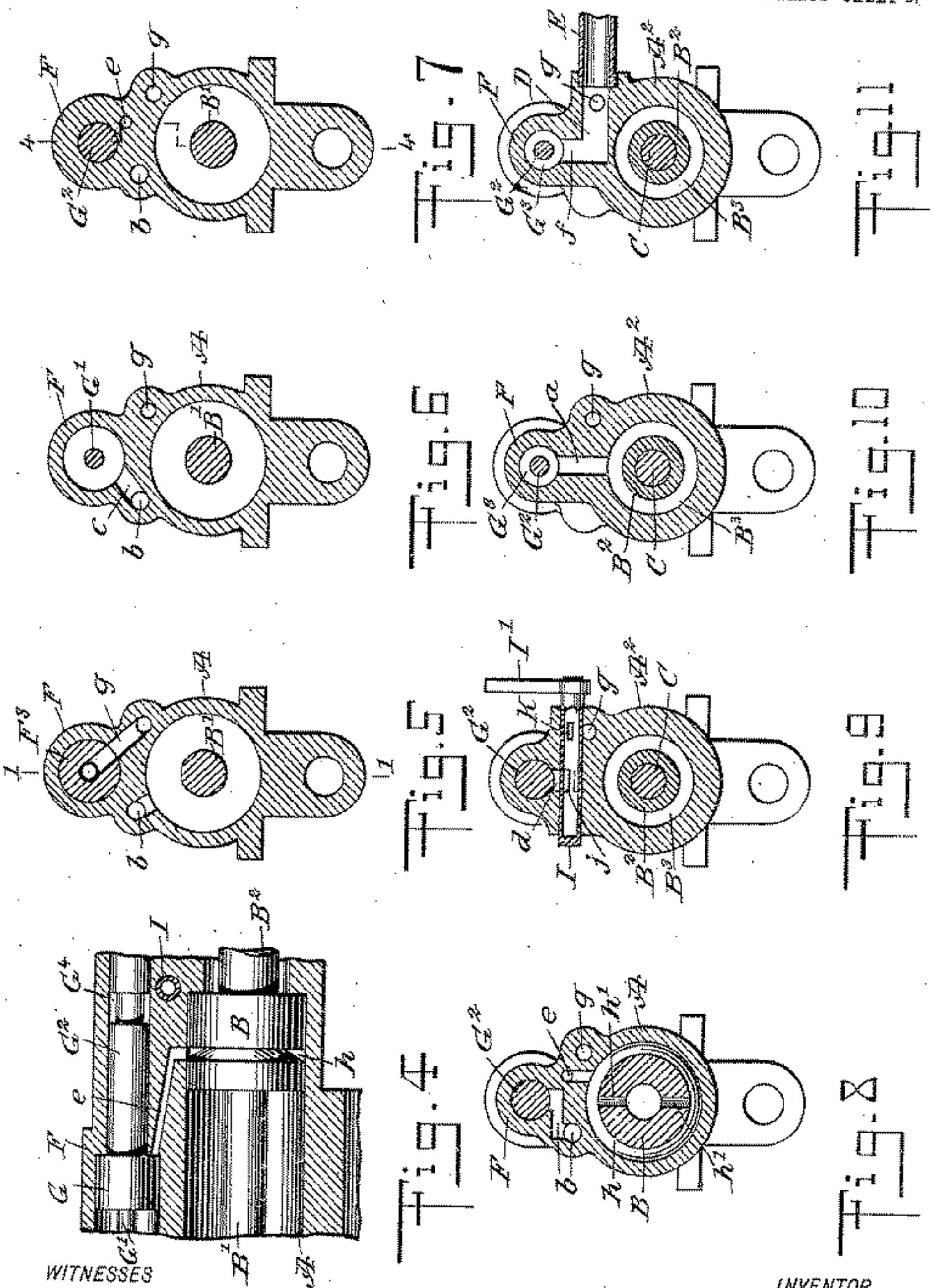
W. E. PORTER.

ROCK DRILL.

APPLICATION FILED MAY 25, 1908.

931,479. Patented Aug. 17, 1909.

2 SHEETS—SHEET 2.



WITNESSES

John a Bergstrom

Theo G. Hoster

INVENTOR

William E. Porter

BY Munn & Co.

ATTORNEYS

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM E. PORTER, OF BISBEE, ARIZONA TERRITORY.

ROCK-DRILL.

No. 931,479. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed May 25, 1908. Serial No. 434,785.

To all whom it may concern:

Be it known that I, WILLIAM E. PORTER, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and Territory of Arizona, have invented a new and Improved Rock-Drill, of which the following is a full, clear, and exact description.

The invention relates to fluid pressure rock drills having a reciprocating hammer piston.

The object of the invention is to provide a new and improved rock drill, which is simple, durable and compact in construction, and in which the compressed air or other fluid pressure is utilized to drive the piston ahead, both under initial and expansion pressure, to cushion the driven piston and to return the piston by the exhaust pressure, thus rendering the rock drill very effective and exceedingly economical in the use of the motive agent.

The invention consists of novel features and parts and combinations of the same, which will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a longitudinal section of the improvement on the line 1—1 of Fig. 5; Fig. 2 is a similar view of the same and showing the working parts in a different position; Fig. 3 is a sectional plan view of the same on the line 3—3 of Fig. 2, the piston valve being removed and parts being broken away to show the passage leading to the forward end of the cylinder, Fig. 4 is a sectional side elevation of part of the improvement, on the line 4—4 of Fig. 7; Fig. 5 is a cross section of the same on the line 5—5 of Fig. 1; Fig. 6 is a similar view of the same on the line 6—6 of Fig. 1; Fig. 7 is a like view of the same on the line 7—7 of Fig. 1; Fig. 8 is a cross section of the same on the line 8—8 of Fig. 1; Fig. 9 is a like view of the same on the line 9—9 of Fig. 1; Fig. 10 is a similar view of the same, on the line 10—10 of Fig. 1; and Fig. 11 is a like view of the same on the line 11—11 of Fig. 1.

In the cylinder A is mounted to reciprocate the piston B having its piston rod B′ extending through the head A′ at one end of the cylinder A, to connect with the drill employed for drilling into the rock. From the piston B extends the feed sleeve B^2 in an opposite direction from the piston rod B′, and this feed sleeve B^2 is provided adjacent to the piston B with an annular groove B^3, and the feed sleeve B^2 slides in a bore A^2 connected with the cylinder A and of less diameter than the latter. The sleeve B^2 is engaged by the feed screw C having a ratchet wheel C′ for turning the sleeve B^2 and the piston B in the usual manner.

The live motive agent passes into a chamber D adjacent to the bore A^2, and this chamber D is connected by a pipe E with a suitable source of motive agent supply such as compressed air or the like. In the chest F arranged lengthwise on the cylinder A is formed a cylindrical bore F′ in which reciprocates a piston valve G having a reduced portion G′ at its left-hand side, and a reduced portion G^2 at its right-hand side, and which reduced portion G^2 has annular grooves G^3 and G^4 intermediate of its ends, as plainly indicated in the drawings. The reduced portion G^2 of the piston valve G is mounted to slide in the bore F^2 of the chest F, and the said bore F^2 is open at the right-hand end to the atmosphere, and is connected at the other end with the larger bore F′, provided with an exhaust pipe H leading to the atmosphere. The reduced portion G′ at the left-hand end of the piston valve G slides in a bearing formed in the cap F^3, closing the left-hand end of the chest F.

An admission port *a* opens into the bore A^2 adjacent to the right-hand end of the cylinder A, and into the left-hand end of the cylinder A opens a port *b*, the said ports *a* and *b* opening into the bore F^2 of the chest F. The port *b* is provided with a branch port *c* leading to the bore F′ of the chest F, directly opposite the exhaust pipe H, for carrying the exhaust motive agent to a suitable place of discharge. A port *d* intermediate the ports *a* and *b* connects the cylinder A with the bore F^2 of the chest F and a longitudinal port *e* connects the cylinder A with the enlarged bore F′ of the chest F, at the junction of the bore F′ with the bore F^2, as plainly indicated in Fig. 2. The chamber D connects by a port *f* with the bore F^2, adjacent to the port *a*, and the said chamber D is also connected by a port *g* with the bearing in the cap F^3 and in which the reduced portion G′ of the piston valve G is mounted to slide. In the piston B is formed an annular groove *h* adapted to register with the port *e* at the time the piston B is in the right-hand end of the cylinder A, and from the said annular groove h lead ports h' to the fluted bore in the feed sleeve B^2, so that air can exhaust from the right-hand end of the bore F′ by way of the port e, annular groove h, ports h' and the feed sleeve bore into the bore A^2, from which leads a port i to the atmosphere. A plug valve I is arranged transversely and is provided with ports j and k, adapted to register with the ports g and d, to allow live motive agent to pass from the chamber D by way of the port g, plug valve I, port d, recess G^4 and port b (see Fig. 2) to the left-hand end of the cylinder A, to start the machine in case the piston B is at rest at the forward end of its stroke. Use is also made of this valve I for admitting live motive agent to the left-hand end of the cylinder A, in case a drill sticks in the bore hole, especially when the drill passes through cross seams. Normally the valve I is in the inactive position shown in Figs. 1 and 2, and when it is desired to make use of the valve I for the purposes above mentioned, then a quarter turn is given to the valve I by the operator turning the handle I′ of the valve from a vertical to a horizontal position.

Now when the several parts are in the position illustrated in Fig. 1, then the reduced portion G^3 of the piston valve G connects the ports f and a with each other, so that the live motive agent can pass from the chamber D into the right-hand end of the bore A^2 and by way of the reduced portion B^3 the pressure is exerted against the piston B, to force the same from the right to the left into the position shown in Fig. 2. As the piston B advances from the right to the left it passes over the port d and the intermediate port e and finally uncovers the same, so that the motive agent in the right-hand end of the cylinder A can pass through this port e into the bore F′, to act on the right-hand end of the piston valve G, to force the latter from the right to the left or to the position shown in Fig. 2, thus disconnecting the ports j and a, and thereby shutting off the motive agent from the right-hand end of the cylinder A. The motive agent now acts expansively in the cylinder A. When the piston valve G is shifted from the right to the left, as above described, then the ports d and b are connected with each other by the reduced portion G^2, so that a portion of the motive agent in the right-hand end of the cylinder A can pass to the left-hand end thereof, to act on the left-hand face of the piston B with a view to return the latter to its previous position, it being understood that the area of the piston B at the left-hand face is in excess of the area at the right-hand face thereof. When the piston valve G is in the left-hand position shown in Fig. 2, it closes the port z, to confine the pressure in both ends of the cylinder A.

When the piston valve G is shifted as above described, from the right to the left, then the port c is closed and the left-hand end of the cylinder A is cut off from the exhaust pipe H and consequently the motive agent remaining in this left-hand end of the cylinder A forms a cushion to prevent the piston B from striking the cylinder head A′. Immediately after the piston B is cushioned, the motive agent previously used to drive the piston B from the right to the left is exhausted from the right-hand end of the cylinder to the left-hand end thereof by way of ports b and d and groove G^4, the port c being closed to the exhaust pipe H by the shifting of the piston valve G from the right to the left. Now the pressure entering the left-hand end of the cylinder A causes the piston B to return to its previous position shown in Fig. 1. When the piston B returns, the port e connects with the annular piston groove h, to allow the pressure in the right-hand end of the bore F′ to escape to the atmosphere by way of the said port e, grooves h, ports h', bore of the feed sleeve B^2, the bore A^2 and exhaust port i. The live motive agent passing by way of the port g into the bearing of the cap F^3 acts on the reduced portion G′ to shift the valve G back to its position shown in Fig. 1. It is understood that the port g allows the motive agent from the chamber D to act at all times against the end of the reduced portion G′ of the piston valve G, so that the latter is shifted from the left to the right, back to the position shown in Fig. 1, to again connect the ports j and a with each other, and the above-described operation is then repeated.

By the arrangement described the compressed air or other fluid pressure is utilized, to drive the piston B ahead, both under initial and expansive pressure, and the piston B is cushioned by a portion of the exhaust motive agent remaining in the left-hand end of the cylinder A, thus preventing injury to the cylinder head A′ by the piston B. It will also be noticed that the return stroke of the piston B is produced by a portion of the motive agent directed from the right-hand end of the cylinder A to the left-hand end thereof, to act on the larger area at the left-hand face of the piston B.

The port e is sufficiently small, so that the piston B nearly completes its outward stroke before the piston valve G is shifted from the right to the left after the port e is uncovered, and the motive agent from the cylinder A can pass by way of the narrow port e into the bore F′ of the chest F, to force the piston valve G from the right to the left.

By making the annular groove B^3 of more or less length, the motive agent is cut off later or sooner, as the feed sleeve then closes the admission port later or sooner, and hence the motive agent in the rear end of the cylinder A acts expansively for a predetermined period, that is, after the port *a* is closed.

By the arrangement described, the live air in the cylinder A can be expanded to any desired degree, so that the total excess pressure on the piston only slightly exceeds the weight of the piston and drill, and the incidental friction, so that all the motive agent is utilized to the fullest advantage and with the greatest economy. It will also be noticed that but little back pressure is had on the working blow, owing to the direct and short travel of the exhaust, and also on account of the expansion of air to a comparatively low pressure previous to exhausting the motive agent, thus causing greater efficiency and economy of the compressed air.

The machine is very simple and durable in construction, and composed of comparatively few parts, not liable easily to get out of order.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A rock drill, comprising a cylinder provided with an outlet port leading to the atmosphere, a piston mounted to reciprocate in the said cylinder and having a feed sleeve extending therefrom, the bore of the feed sleeve communicating with said outlet, the said piston being provided with passages leading from its periphery to the bore of the feed sleeve, a chest, a pressure supply chamber, a piston valve in the said chest, and means controlled by the said piston and the said piston valve to admit live motive agent to the rear end of the cylinder for forcing the piston on the outward stroke, to partly exhaust the motive agent from the forward end of the cylinder, to cushion the piston on the last portion of its outward stroke, to cut off the live motive agent at a given point and to admit the motive agent to the forward end of the cylinder to return the piston, to admit live motive agent to the said chest for shifting the said piston valve by live motive agent, and to exhaust the motive agent for the said chest by way of the piston and its feed sleeve.

2. A rock drill, comprising a cylinder having an admission port, an exhaust port, the said ports connecting with the ends of the said cylinder, a port intermediate the said end ports, a chest into which open the said end ports and the said intermediate port, one end of the chest having an exhaust pipe, a piston valve reciprocating in the said chest and having one end reduced to connect the said cylinder exhaust port with the exhaust pipe, the said reduced end sliding in a bearing in the said chest, the piston valve having its body provided with annular grooves, of which one serves to connect the intermediate port with the exhaust, and a pressure supply chamber connected by a port with the said chest for the other of the annular grooves to connect this port with the said admission port, the said pressure supply chamber being connected with the end of the bearing for the said reduced end of the piston valve, to shift the valve into an admission position, the said piston controlling the said intermediate cylinder port to allow part of the motive agent to shift the valve in a reverse direction.

3. A rock drill comprising a cylinder having an admission port leading to the rear end of the cylinder, a port leading to the forward end of the cylinder, and an intermediate port, a chest into which opens the said cylinder ports, a pressure supply chamber having a port opening into the chest, a piston reciprocating in the said cylinder, and a piston valve reciprocating in the said chest, the said piston valve having its body provided with annular grooves, one of which serves to connect the port of the pressure supply chamber with the admission port and the other serves to connect the said intermediate port with the port leading to the forward end of the cylinder.

4. A rock drill comprising a cylinder having an admission port connecting with the rear end of the cylinder, a port leading to the forward end of the cylinder, an intermediate port, a chest into which opens the said cylinder ports, a pressure supply chamber connected by a port with said chest, an exhaust pipe at the forward end of said chest, the port leading to the forward end of the cylinder having a branch port opening into the chest opposite the exhaust pipe, a piston reciprocating in the said cylinder, a piston valve reciprocating in the said chest and having its body provided with annular grooves, one of said grooves serving to connect the intermediate port with the port leading to the forward end of the cylinder, and the other groove serving to connect the port of the pressure supply chamber with the admission port, the cylinder being provided with a port leading from its rear end to the chest for the passage of the motive agent to act on the piston valve to move said valve to cut-off position, the said port being controlled by the piston, and means whereby the live motive agent from the pressure supply chamber acts on the said piston valve to return the same to the admission position.

5. A rock drill comprising a cylinder having an outlet port in its rear end leading to the atmosphere, a piston mounted to reciprocate in said cylinder and having a feed sleeve extending therefrom, the said piston having an annular groove connected by ports with the bore of the feed sleeve, a chest, a piston valve reciprocating in the said chest and actuated by the motive agent, the said valve controlling the entrance of live motive agent to the cylinder, and arranged to cut off the motive agent and connect the cylinder

ends with each other for the motive agent to return the piston, the said valve also controlling the exhaust of the motive agent from the cylinder, the said chest being connected by a port with the cylinder for the admission of the motive agent to the chest and for the exhaust of the motive agent from the chest, the annular groove of the piston being adapted to register with said port to permit the exhaust motive agent from the chest to pass by way of the piston and its feed sleeve to the said outlet port in the rear end of the cylinder.

6. A rock drill comprising a cylinder, a piston mounted to reciprocate in said cylinder, a chest, a pressure supply chamber, a piston valve in the said chest and having one end reduced, a bearing in the said chest in which the reduced end of the piston valve slides, the said cylinder being provided with ports controlled by the piston valve for admitting live motive agent from the pressure supply chamber to the rear end of the cylinder for forcing the piston on the outward stroke, the said cylinder having ports controlled by the piston valve to permit the motive agent to pass from the rear end of the cylinder to the forward end thereof to return the piston, means controlled by the piston for admitting the motive agent from the rear end of the cylinder to the chest to move the piston valve to cut-off position, the said pressure supply chamber being connected by a port with the bearing for the reduced end of the piston valve to admit the motive agent to said bearing to shift the piston valve to the admission position, and a manually controlled valve provided with ports adapted to register with the port leading to said bearing, and the ports leading to the forward end of the cylinder to allow live motive agent to pass from the pressure supply chamber to the forward end of the cylinder.

7. In a rock drill, a cylinder having an outlet port in its rear end leading to the atmosphere, a piston mounted to reciprocate in said cylinder and having its piston rod extending through the forward head of the cylinder, the said piston being provided with a feed sleeve extending rearwardly and having its bore communicating with said outlet port, the said piston having a peripheral groove communicating with the bore of the feed sleeve, a chest, a valve adapted to reciprocate in said chest, the said valve controlling the passage of the motive agent to and from the cylinder, the said chest being connected by a port with the cylinder for the admission of the motive agent to the chest and the exhaust of the motive agent from the chest, the groove of said piston being adapted to register with said port.

8. In a rock drill, a cylinder, a piston mounted to reciprocate in said cylinder, a chest having an exhaust pipe at one end, the said cylinder having an exhaust port opening into the chest opposite the said exhaust pipe, a piston valve adapted to reciprocate in the said chest, and having a reduced end, a closure for one end of the chest having a bearing formed therein in which the reduced end of the piston valve slides, the said valve controlling the entrance of the live motive agent to the cylinder, and arranged to cut off the motive agent and connect the cylinder ends with each other for the motive agent to return the piston, the said valve also controlling the exhaust of the motive agent from the cylinder, means controlled by the piston for admitting the motive agent to the chest to move the piston valve to cut off position, and means for admitting live motive agent to the bearing for the reduced end of the piston valve to return said valve to the admission position.

9. A rock drill comprising a cylinder, having an admission port leading to the rear end of the cylinder, a port leading to the forward end of the cylinder, and a port intermediate the said end ports, a chest into which opens the said cylinder ports, a pressure supply chamber having a port opening into the chest, a piston reciprocating in the said cylinder and having its piston rod extending through the head at one end of the cylinder for connection with a drill, a piston valve reciprocating in the chest, the piston valve being provided with means for connecting the port of the pressure supply chamber with the admission port and for connecting the said intermediate port with the port leading to the forward end of the cylinder, the said chest being connected by a port with the cylinder for the admission of the motive agent to the chest to move the piston valve to cut-off position, and for the exhaust of the motive agent from the chest, the said port being controlled by the piston, and means whereby the live motive agent from the pressure supply chamber acts on the said piston valve to return the same to the admission position.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM E. PORTER.

Witnesses:

FRANK REYES,

PARKER L. WOODMAN.

C. A. HULTQUIST.
VALVE.
APPLICATION FILED NOV. 22, 1909.

964,970. Patented July 19, 1910.

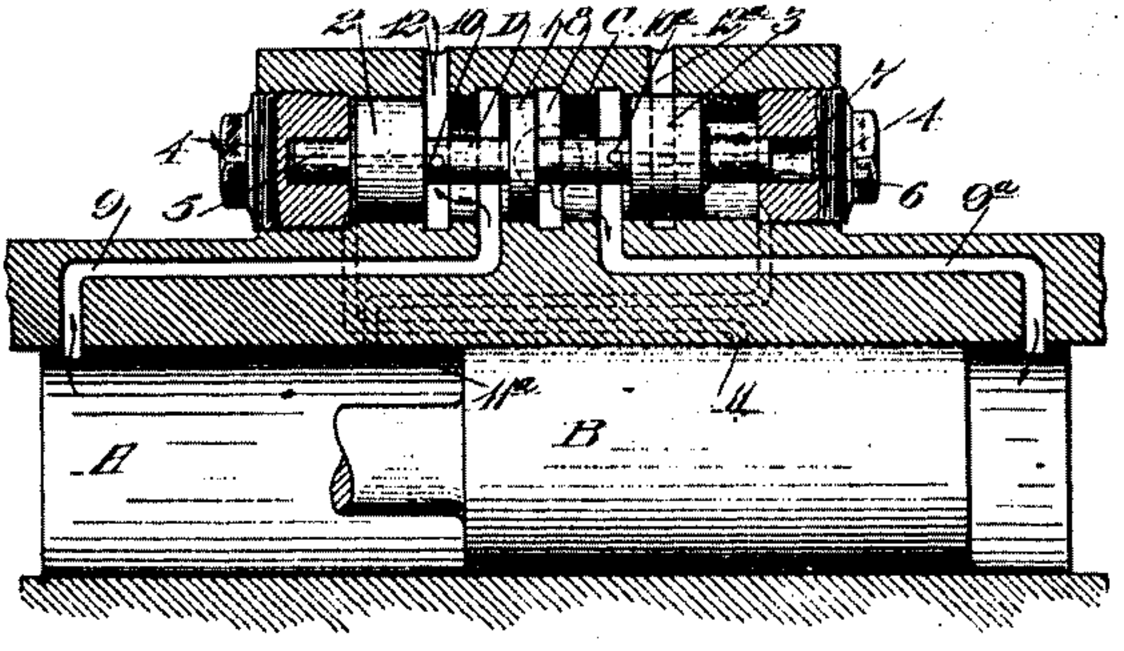


Fig. 1.

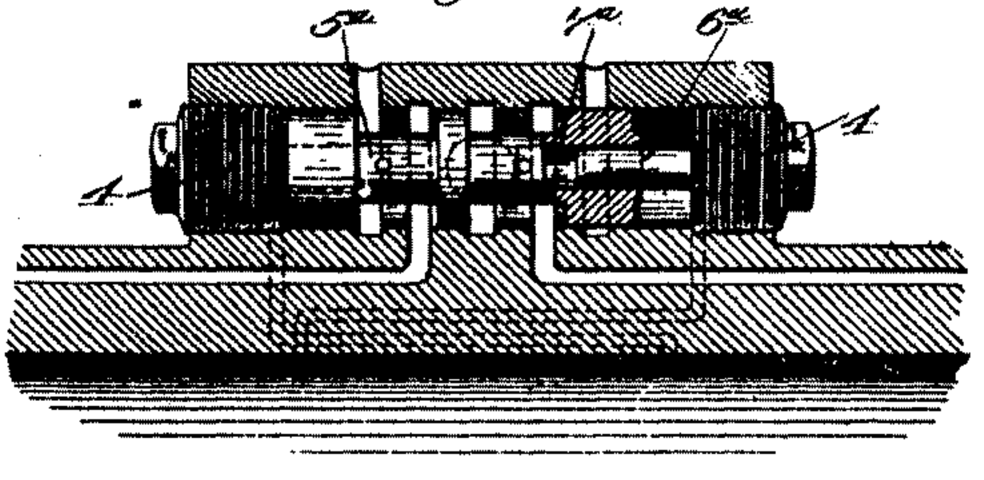


Fig. 2.

Inventor.

U TED STATES PATENT OFFICE.

CHARLES A. HULTQUIST, OF LOWELL, ARIZONA TERRITORY.

VALVE.

964,970. Specification of Letters Patent. Patented July 19, 1910.

Application filed November 22, 1909. Serial No. 529,242.

To all whom it may concern:

Be it known that I, CHARLES A. HULTQUIST, a citizen of the United States, residing at Lowell, in the county of Cochise and Territory of Arizona, have invented new and useful Improvements in Valves, of which the following is a specification.

My invention relates to an improved valve motion, which is especially designed for the operation of hammers, rock-drills, &c., driven by an elastic fluid under pressure.

It consists in a means for holding the valve in position after it has been moved or tripped by the action of air in the cylinder.

It also comprises details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation of the cylinder and valve chamber. Fig. 2 is a modification of the device.

A is the cylinder in which the piston B is adapted to reciprocate. This piston may act as a hammer to operate a rock-drill, or a riveting hammer, or for other equivalent purposes where reciprocating motion is required.

C is the valve chamber, in which the valve is adapted to reciprocate. The valve consists of a stem D, and the pistons 1—2—3, which fit and reciprocate within the valve chamber C.

4 are the heads of the valve chamber, and either of these may be removed, and the valve removed; the pistons 1—2—3 being of uniform diameter so that the valve may be moved from either end of the valve chest by removing either of the plugs 4.

The ends or smaller diameters 5 and 6 of the valve are adapted to reciprocate in chambers 7 in which these ends fit.

8 is the inlet passage for the fluid under pressure, and the head 1 moves so as to open communication with either one side or the other of this head, and between it, and either of the heads 2 or 3. 9 and 9ᵃ are ports connecting this intermediate space with opposite ends of the cylinder A; and 10—10ᵃ are ports connecting the central portion of the valve chest with the chambers 7 in the heads 4.

In Fig. 2 I have shown stems 5ᵃ and 6ᵃ projecting inwardly from the heads 4 of the valve chest, and the chambers 7ᵃ are formed in the ends of the valve heads 2 and 3 so that instead of these small plungers being operated with the valve, the valve moves with relation to the fixed plungers, the operation however is essentially the same in both cases.

11—11ᵃ are ports opening from the cylinder into the valve chest exterior to the heads 2 and 3, and 12—12ᵃ are the ports opening through the side of the valve chest, and which are exposed by the movements of the heads 2 and 3 so as to alternately exhaust the actuating fluid from the ends of the cylinder.

The operation of the device will then be as follows: The valve having the position shown in Fig. 1, the head 3 has been moved to the right so as to open communication between the inlet port 8 and the port 9ᵃ which leads to the right end of the cylinder A, while the head 1 will be in position to cut off the impelling fluid from the ports 9 and 10. The port 10ᵃ being opened simultaneously with the port 9ᵃ, the impelling fluid will pass through this port into the chamber 7 at the right, and behind the plunger 6, at the same time while the fluid is entering the right end of the cylinder A, the pressure in both being the same. The pressure within the cylinder will force the piston B toward the left end of the cylinder, and as the port 9 is in open communication with the port 12, the fluid at the left end of the cylinder will be exhausted through these ports, and when the piston has moved far enough to uncover the port 11, the fluid which has impelled it to the left, will pass through this port and behind the head 2 of the valve. The area of this head being so much larger than the area of the plunger 6, the pressure will overcome that in the right hand chamber 7, and the valve will be immediately forced to the right end of its stroke; thus causing the head 2 to cover and inclose the exhaust port 12, the head 3 to uncover the exhaust port 12ᵃ, and the head 1 to be moved to the right so as to open communication between the inlet port 8, the port 9, and the port 10, which supplies the left chamber 7 behind the plunger 5. In this manner the valve is perfectly balanced and cushioned, and the alternate changing of pressure at opposite ends will automatically operate it in unison with the movements of the piston within the main cylinder.

The action of the plungers 5 and 6 to hold and steady the valve may be explained as follows: The piston or hammer B will always travel past the ports 11 and 11ᵃ in its reciprocations, as the valve requires a tle time to trip or change its position, and er it has changed, the piston will still conue its movement in the same direction unthe opposing fluid pressure has cushioned and the return stroke is commenced.

'n the position shown, the pressure behind head 3 has been exhausted together with exhaust from the left end of the cylinder, ore the piston B has returned far enough cover the port 11ᵃ, therefore there would nothing to hold the valve in its place if rere not for the pressure behind the plun6.

Iaving thus described my invention, what laim and desire to secure by Letters Patis—

'he combination with the cylinder, of a procating engine, having inlet ports conting with opposite ends and secondary ts connecting with the central portion he cylinder, of a valve chamber, with the tral portion of which the cylinder inlet ts communicate, and with the outer ends which the secondary ports communicate, said valve chamber having end-heads and having a centrally disposed supply port and exhaust ports between said central port and the cylinder ends, a valve consisting of a stem with heads between which the main ports are exposed, a central head adapted to open the supply port to either side by the reciprocations of the valve, said reciprocations alternately closing the exhaust ports of the valve chambers, plunger extensions of less diameter than the said heads, the end heads of the cylinder having chambers within which the said extensions are movable and guided, and ports through which pressure is admitted behind said extensions, simultaneously with the admission to the corresponding cylinder end.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES A. HULTQUIST.

Witnesses:
GEO. J. TYRK,
WALKER MILAN.

C. A. HULTQUIST.

ROCK DRILL.

APPLICATION FILED FEB. 28, 1910.

978,586. Patented Dec. 13, 1910.

3 SHEETS—SHEET 1.

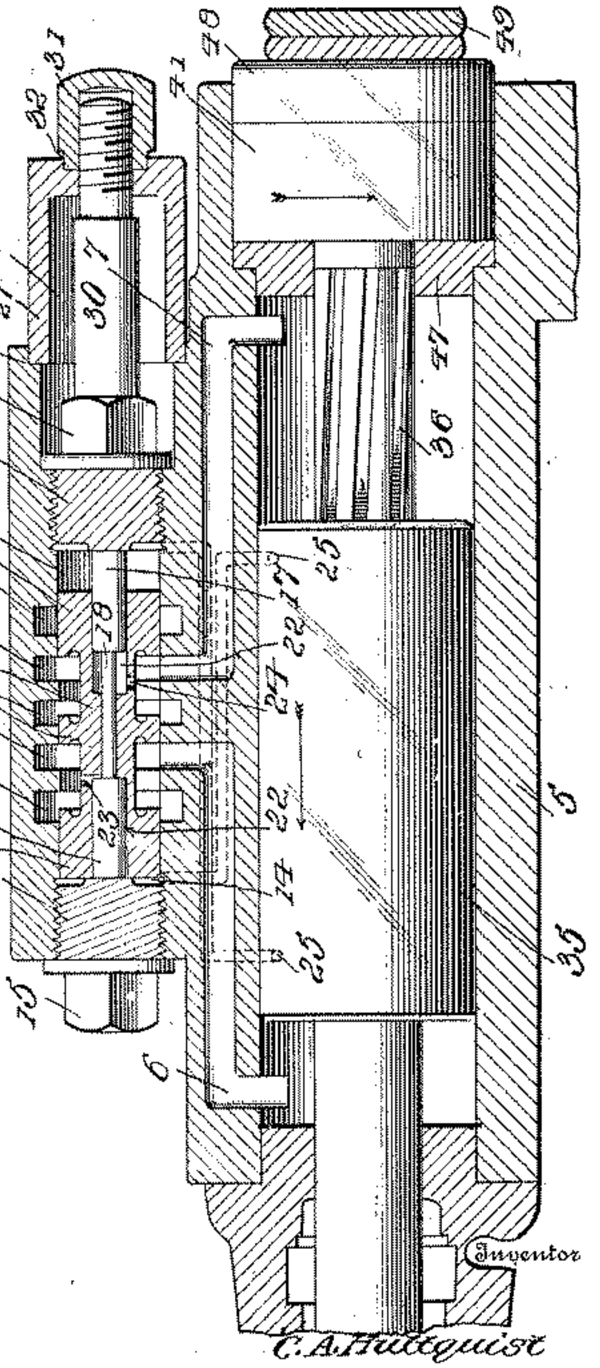


Fig. 1

Inventor

Witnesses

W. T. Woodson

Juana M. Fallin

C. A. Hultquist

By

. . . . . Atty. Attorneys

C. A. HULTQUIST.

ROCK DRILL.

APPLICATION FILED FEB. 28, 1910.

978,586. Patented Dec. 13, 1910.

3 SHEETS—SHEET 2.

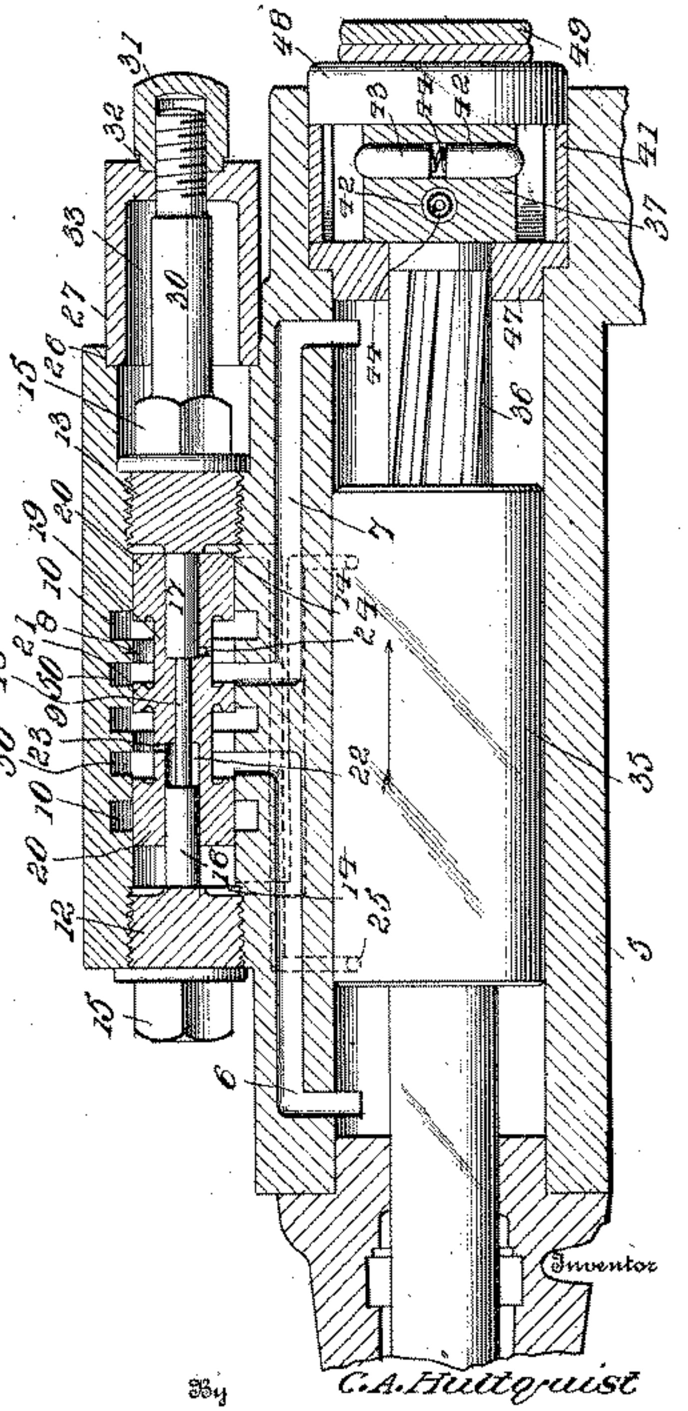


Fig. 2.

Witnesses

W. H. Woodson

Juana M. Fallin

Inventor

C. A. Hultquist

By

Attorneys

C. A. HULTQUIST.

ROCK DRILL.

APPLICATION FILED FEB. 28, 1910.

978,586. **Patented Dec. 13, 1910.**

3 SHEETS—SHEET 3.

Fig. 4.

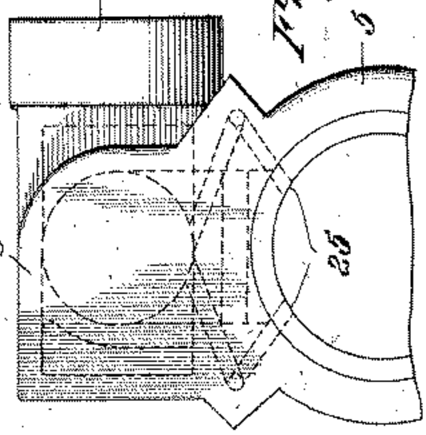


Fig. 5.

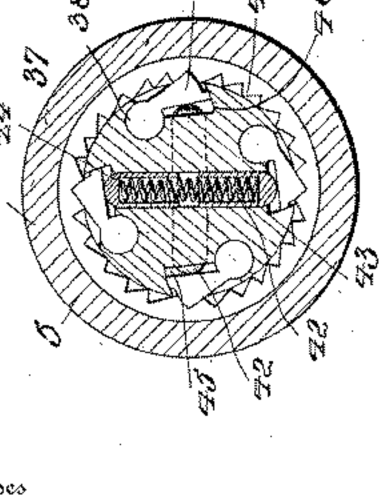
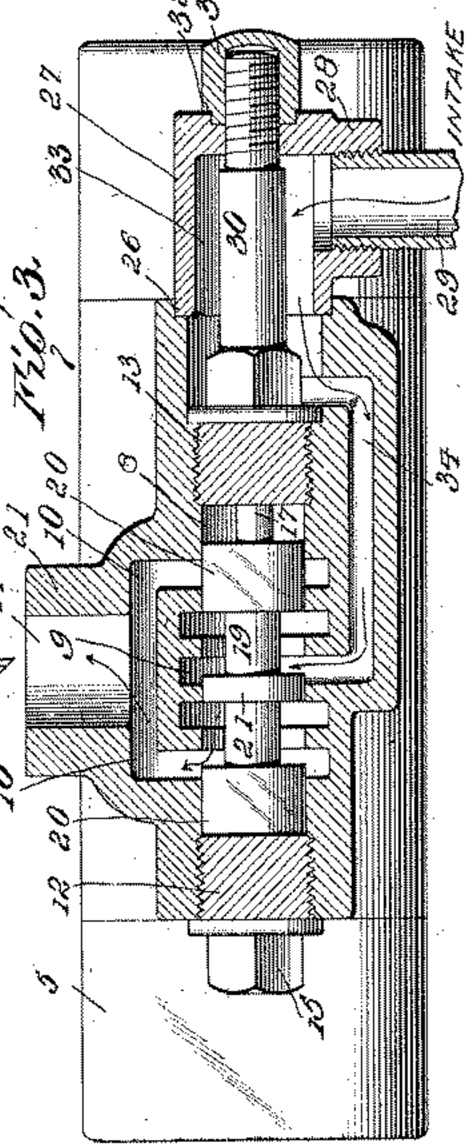


Fig. 3.



Inventor
C. A. Hultquist

Witnesses
W. A. Woodson
Juana M. Fallin,

By H. A. Lacey, Attorney

UNITED STATES PATENT OFFICE.

CHARLES A. HULTQUIST, OF BISBEE, ARIZONA TERRITORY.

ROCK-DRILL.

978,586. Specification of Letters Patent. Patented Dec. 13, 1910.

Application filed February 28, 1910. Serial No. 546,466.

To all whom it may concern:

Be it known that I, CHARLES A. HULTQUIST, citizen of the United States, residing at Bisbee, in the county of Cochise and Territory of Arizona, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

This invention relates to rock drills and has for its object the provision of a drill of simple and compact construction in which wear on the several parts incident to the operation thereof is reduced to a minimum.

A further object is to provide a novel form of valve for controlling the admission of air or other fluid to the cylinder.

A further object is to provide means for reciprocating the valve to alternately open and close the inlet ports, and fluid pressure means for preventing rearward movement of said valve at the end of each stroke.

A further object is to provide means for rotating the piston, and means for balancing the rifle bar of said piston, thus to prevent the latter from binding or wedging in the cylinder.

A further object is to provide means whereby the fluid supply pipe may be positioned on either side of the drill without the necessity of detaching said fluid supply pipe.

A still further object of the invention is generally to improve this class of devices so as to increase their utility, durability and efficiency.

Further objects and advantages will appear in the following description, it being understood that various changes in form, proportions and minor details of construction may be resorted to within the scope of the appended claims.

For a full understanding of the invention and the merits thereof and also to acquire a knowledge of the details of construction and the means for effecting the result, reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a vertical sectional view of a rock drill constructed in accordance with my invention, showing the piston or hammer near the completion of its working stroke; Fig. 2 is a similar view showing the piston or hammer near the end of its return stroke; Fig. 3 is a horizontal sectional view of the valve; Fig. 4 is an end view; Fig. 5 is a vertical sectional view showing the construction of the pawl and ratchet mechanism for revolving the piston.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The rock drill forming the subject matter of the present invention comprises a cylinder 5 having fluid passages or ports 6 and 7 formed in the opposite ends thereof and communicating with a valve chamber 8. The valve chamber 8 is provided with a circumferential inlet port or chamber 9 and oppositely disposed exhaust chambers or ports 10, which latter communicate with a common exhaust nipple or pipe 11 extending laterally from one side of the drill, as shown. The opposite ends of the valve chamber 8 are closed by removable plugs 12 and 13 having their inner ends reduced to form circumferential ports 14 and their outer ends provided with angular portions 15 so that the same may be conveniently grasped with a wrench or other suitable tool to permit the removal of said plugs.

Interposed between the plugs 12 and 13 is a stationary plunger comprising oppositely disposed heads 16 and 17 connected by an intermediate stem or rod 18, said stationary plunger extending through the valve 19. The valve 19 is formed with a plurality of spaced disks 20 and 21 the outer disks 20 being movable alternately over the exhaust ports or chambers 10 and the central disk 21 being movable over the inlet port 9 to control the admission of fluid to the opposite ends of the cylinder.

The valve 19 is provided with a central bore to receive the connecting stem 18 and is also provided with oppositely disposed chambers or pockets 22 for the reception of the heads 16 and 17 of the stationary plunger, there being ports 23 and 24 formed in the walls of the valve and communicating with the chambers 22, as shown.

A duct 25 is disposed on each side of the cylinder and forms a source of communication between the interior of said cylinder and the ports 14 so that the fluid in the cylinder may be utilized for shifting the valve.

One end of the valve chamber 8 is cutaway to form a seat 26 for the reception of a T-coupling or casing 27 to the nipple 28 of which is attached in any suitable manner, a fluid supply pipe 29.

The plug 13 is provided with a stem 30 which projects through an opening in the end of the T-coupling or casing 27 and is provided with terminal threads for engagement with a clamping nut 31, there being a seat 32 formed in the end of the casing 27 and similar in construction to the seat 26 to prevent the entrance of dirt and other foreign matter to the interior of the casing. The interior walls of the casing 27 are spaced from the stem 30 to form a circumferential chamber 33 which communicates by a passage 34 with the inlet-port or chamber 9 to permit the air from the supply pipe 29 to enter said chamber 9. Thus it will be seen that by releasing the nut 31 and rotating or partially rotating the T-coupling or casing 27, the fluid supply pipe 29 may be positioned on either side of the drill without the necessity of detaching the supply pipe from the casing.

It will here be noted that the seats 26 and 32 form in effect bearings for the casing 27 when the latter is rotated, the casing being locked in adjusted position by tightening the nut 31.

It will also be noted that the plugs 12 and 13 are approximately of the same diameter as the valve 19 so that by unscrewing the plugs, said valve 19 may be readily removed from its seat for the purpose of effecting any necessary repairs thereto. The plugs 12 and 13 not only form abutments for the heads of the stationary plunger, but also permit the valve 19 to reciprocate within the chamber 8 without binding or wedging action between the parts.

Mounted for reciprocation within the cylinder 5, is a piston 35, the central portion of which is rifled to receive a correspondingly rifled bar 36, the latter being provided with an integral head 37, seated in the rear end of the cylinder 5, as best shown in Figs. 2 and 5 of the drawings. The head 37 is provided with a series of substantially spherical sockets 38 in which are pivotally mounted locking pawls 39 adapted to engage corresponding ratchet teeth 40 formed in the inner face of a retaining ring 41. The head 37 is also provided with intersecting openings 42 in which are mounted sliding plungers 43, the ends of said plungers being adapted to bear against the adjacent edges of the pawls 39 for the purpose of forcing said pawls in contact with the teeth 40. The plungers 43 are each preferably formed in two sections having sockets or chambers formed therein for the reception of coil springs 44 so that the pawls will normally and yieldably bear against the ratchet teeth 40.

Communicating with each socket 38 is a recess 45 adapted to receive the adjacent pawl 39, the end wall of each recess being provided with a curved bearing surface 46 for engagement with the adjacent end of the pawl, thus to assist in preventing accidental displacement of the pawls and also to prevent undue wear on the same.

It will here be noted that two of the pawls are in engagement with the adjacent teeth on the ring 41, while the mating pawls are at the half notch, thus insuring a perfectly balanced rifle bar 36 and effectually preventing binding or wedging action of the piston within the cylinder.

On the rearward stroke of the piston 35, the pawls 39, by engagement with the ratchet teeth 40, will hold the rifle bar 36 rigid, so that as the piston travels over the rifle bar, a slight rotary movement will be imparted thereto for the purpose of turning the drill or other cutting tool. On the working stroke of the piston, the pawls 39 will move the distance of a half tooth and rotate the rifle bar slightly so as to allow the piston 35 to travel in a straight path.

The member 37 is retained within the cylinder 5 by means of a washer 47 and a head 48, the former being provided with a stop-shoulder and the latter being provided with suitable cushioning springs 49 extending across the outer surface of the head, as best shown in Figs. 1 and 2 of the drawings.

Auxiliary ports or chambers 50 are disposed on opposite sides of the inlet port 9 so as to permit the entrance of fluid through the ports 23 and 24 to the chambers 22 of the valve.

Thus it will be seen that on the rearward or return stroke of the piston 35, the air or other fluid in the front end of the cylinder 5 will flow through the adjacent duct 25 to the port 14 at the rear end of the valve 19, so as to shift said valve and permit the air from the inlet port 9 to flow through the port 7 to the rear end of the piston. When the valve 19 is moved to the position shown in Fig. 1 of the drawings, a portion of the air from the main supply pipe will enter the rear chamber 22 through the ports 50 and 24 so as to hold the valve to its seat and prevent rearward movement thereof during the working stroke of the piston. When the valve is in the position above referred to, the air from the port 14 at the rear of the valve will pass through the duct 25 to the front end of the cylinder and the air in the front end of said cylinder will be exhausted through the passage 6 and chambers 50 and 10 to the common exhaust pipe or nipple 11. As soon as the duct leading to the port 14 at the front of the cylinder is uncovered, the fluid at the rear end of said cylinder will flow through said duct and shift the valve 19 in the opposite direction so as to open up communication between the inlet port 9 and the front end of the cylinder and permit the discharge of fluid from the rear end of the cylinder through the ports 7, 50 and 10 to the exhaust 11, a portion of the fluid from the inlet port at the same time entering the chamber 22 at the front end of the valve through the port 23 and holding said valve against the plug 13.

As the piston 35 reciprocates within the cylinder 5, the rifle bar 36 will impart a slight rotary movement to the piston, as before stated.

Having thus described the invention, what is claimed as new is:

1. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, removable plugs forming closures for the opposite ends of said chamber, a stationary plunger arranged within the valve chamber and having its opposite ends bearing against the inner faces of the plugs, a valve mounted for reciprocation on the plunger for controlling the admission of fluid to the opposite ends of the cylinder, a duct leading from each end of the valve to the cylinder to permit the passage of fluid for reciprocating said valve, and fluid pressure means for preventing rearward movement of the valve during a part of each stroke.

2. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, removable plugs forming closures for the opposite ends of the valve chamber, one of which is provided with a stem, a casing spaced from the stem to form a chamber communicating with the inlet port and provided with means for attachment to a source of fluid supply, a plunger interposed between and bearing against the plugs, a valve mounted for reciprocation on the plunger for controlling the admission of fluid to the opposite ends of the cylinder, and a duct leading from each end of the valve to the cylinder to permit the passage of fluid for reciprocating said valve.

3. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, solid plugs forming closures for the opposite ends of the valve chamber, one of said plugs being provided with a threaded rod, a rotary casing surrounding the rod and spaced from the latter to form a chamber communicating with the inlet port and a source of fluid supply, a plunger interposed between and bearing against the plugs, a valve mounted for reciprocation on the plunger for controlling the admission of fluid to the opposite ends of the cylinder, and a nut engaging the threaded end of the rod and bearing against the casing for securing the latter in adjusted position.

4. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, removable plugs forming closures for the opposite ends of the valve chamber, one of said plugs being provided with a stem, a casing spaced from and surrounding the stem to form a chamber communicating with the inlet port and a source of fluid supply, means carried by the stem and engaging the casing for holding the latter in adjusted position, a plunger interposed between and bearing against the plugs, a valve mounted for reciprocation on the plunger for controlling the admission of fluid to the opposite ends of the cylinder, a duct extending from each end of the valve to the cylinder to permit the passage of fluid for reciprocating the valve, and pockets formed in the valve around the plunger and communicating with the fluid supply, for preventing rearward movement of the valve during a part of each stroke.

5. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, removable plugs forming closures for the opposite ends of the valve chamber, a stationary rod arranged within the valve chamber and having its opposite ends provided with enlarged heads bearing against the inner faces of the plugs, a valve mounted for reciprocation on the plunger for controlling the admission of fluid to the opposite ends of the cylinder, said valve being provided with a central bore for the reception of the rod and oppositely disposed chambers adapted to receive the heads of said rod, there being ports formed in the walls of said chambers and adapted to communicate alternately with the fluid supply, and a duct extending from each end of the valve to the interior of the cylinder.

6. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, removable plugs forming closures for the opposite ends of the valve chamber and provided with inner flat bearing faces, a stationary plunger arranged within the valve chamber and having its opposite ends bearing against the flat faces of the plugs, a valve mounted for reciprocation on the stationary plunger for controlling the admission of fluid to the opposite ends of the cylinder, a duct extending from each end of the valve to the interior of the cylinder for reciprocating the valve, and fluid pressure means for preventing rearward movement of the valve during a part of each stroke.

7. A rock drill including a cylinder having inlet and exhaust ports and provided with a valve chamber, a piston operating within the cylinder, removable plugs forming closures for the opposite ends of the valve chamber and provided with circum-

ferential ports and flat bearing faces, a plunger interposed between the plugs and provided with a reduced stem and oppositely disposed heads bearing against the flat faces of the plugs, a valve mounted for reciprocation on the plunger for controlling the admission of fluid to the opposite ends of the cylinder, and a duct extending from each end of the valve to the interior of said cylinder to permit the passage of fluid for reciprocating the valve, there being pockets formed in the valve to receive the heads of the plunger and provided with ports to permit the admission of fluid to said chambers for the purpose of preventing rearward movement of the valve during a part of each stroke.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES A. HULTQUIST. [L. S.]

Witnesses:
J. E. MALDONODO,
M. C. HIGH.

W. E. THRASHER.

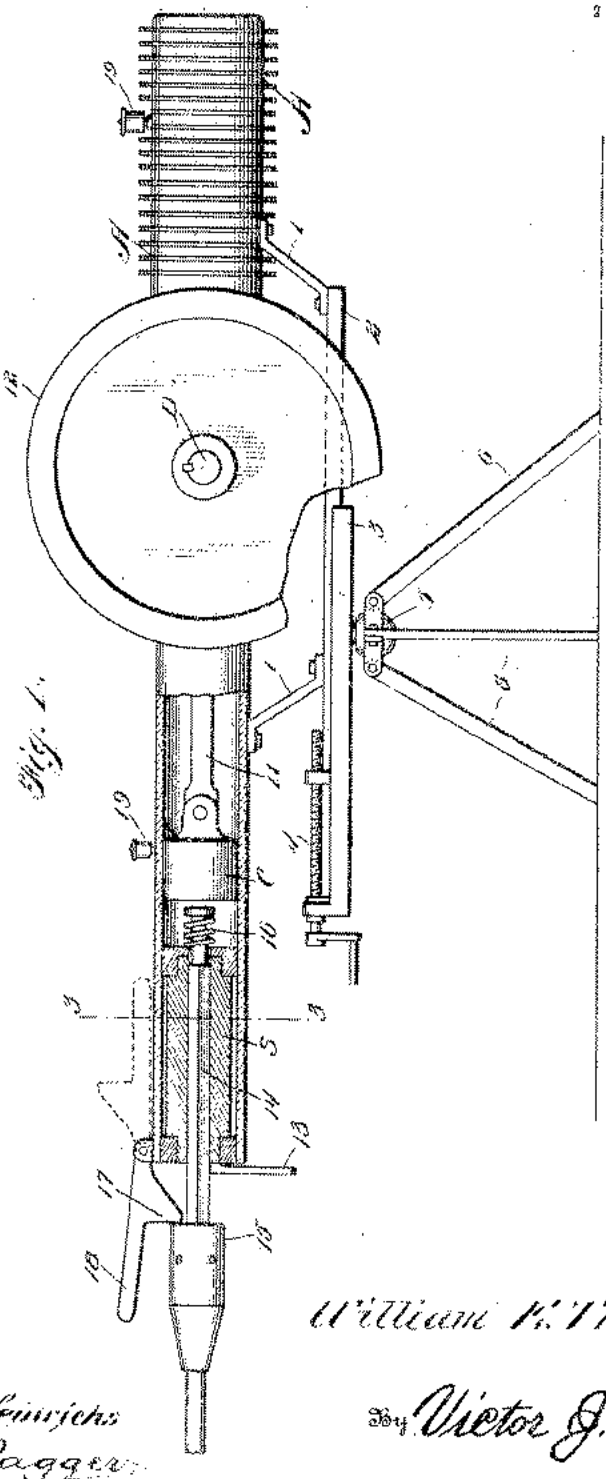
DRILL.

APPLICATION FILED DEC. 2, 1911.

1,037,082.

Patented Aug. 27, 1912.

2 SHEETS—SHEET 1.



Witnesses

Louis R. Heinrichs

Wm Bagger

William E. Thrasher

By Victor J. Evans

W. E. THRASHER.

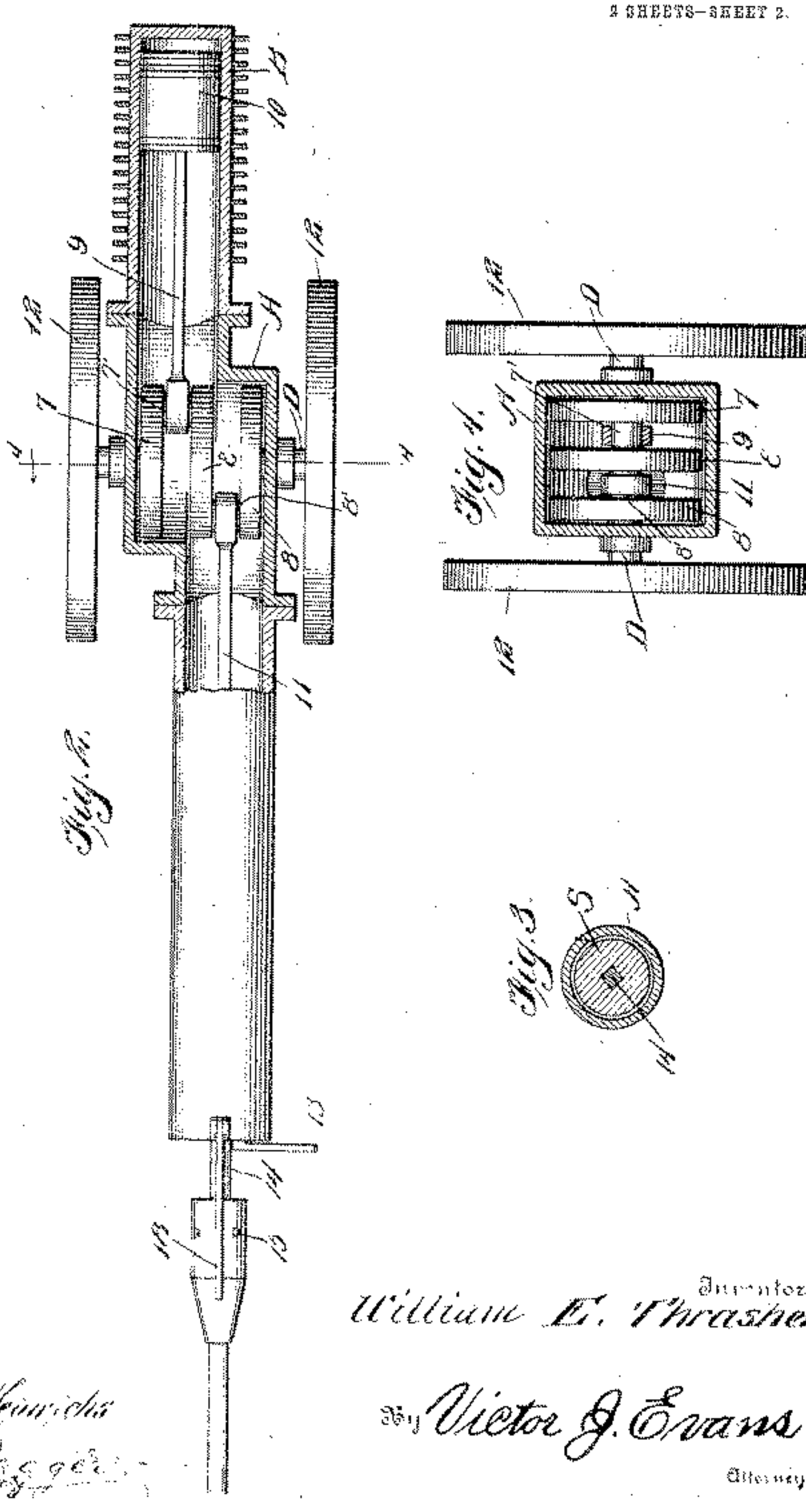
DRILL.

APPLICATION FILED DEC. 2, 1911.

1,037,082.

Patented Aug. 27, 1912.

2 SHEETS—SHEET 2.



Witnesses

Louis R. Heinrichs

[illegible]

Inventor

William E. Thrasher

By Victor J. Evans

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM E. THRASHER, OF BISBEE, ARIZONA.

DRILL.

1,037,082. Specification of Letters Patent. Patented Aug. 27, 1912.

Application filed December 2, 1911. Serial No. 663,557.

To all whom it may concern:

Be it known that I, WILLIAM E. THRASHER, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented new and useful Improvements in Drills, of which the following is a specification.

This invention relates to drills, riveting machines and the like, and it has for its object to produce a machine of this class which shall be operated directly by a gasolene or other internal combustion engine to take the place of pneumatic drills and riveters such as are now ordinarily employed.

A further object of the invention is to produce a drilling and riveting machine which may be manufactured and operated at a comparatively moderate expense and which may be efficiently utilized above ground and under ground in places where the supply and circulation of air is sufficient to warrant its use.

A still further object of the invention is to produce a drilling and riveting machine which shall be complete in itself and which may be operated without the installation of air compressors and allied machinery.

With these and other ends in view which will readily appear as the nature of the invention is better understood, the same consists in the improved construction and novel arrangement and combination of parts which will be hereinafter fully described and particularly pointed out in the claim.

In the accompanying drawings has been illustrated a simple and preferred form of the invention, it being, however, understood that no limitation is necessarily made to the precise structural features therein exhibited, but that changes, alterations and modifications within the scope of the claim may be resorted to when desired.

In the drawings—Figure 1 is a side elevation, partly in section, of a machine constructed in accordance with the invention. Fig. 2 is a top plan view of the same with parts broken away to expose the interior construction. Fig. 3 is a transverse sectional detail view taken on the line 3—3 in Fig. 1. Fig. 4 is a transverse sectional view taken on the line 4—4 in Fig. 2.

Corresponding parts in the several figures are denoted by like characters of reference.

A suitably constructed frame A is provided with downwardly extending braces 1 supporting a guide 2 which slidably engages a base member 3 carrying a feed screw 4 whereby the frame may be adjusted longitudinally of the base member. The latter is mounted by a ball and socket joint or other suitable universal joint 5 upon a foldable support which may be provided with three or four legs 6 to enable the device to be suitably adjusted and leveled.

The frame A carries at one end thereof a suitably constructed motor, conventionally indicated at B, said motor being an air-cooled gasolene engine or other internal combustion engine of any suitable and approved construction. The opposite end of the frame carries a slide C constituting a hammer. The frame A is provided intermediate the engine B and the slide C with a transverse shaft D having crank disks 7 and 8 with oppositely disposed wrist pins or cranks 7′ and 8′, the former of which is connected by a pitman 9 with the engine piston 10, while the wrist pin or crank 8′ is connected by a pitman 11 with the slide C that constitutes the hammer. The shaft D may also be provided with fly wheels 12 of suitable size and weight, said fly wheels being, however, made as compactly as possible to occupy as little space as possible. By making the crank disks 7 and 8 sufficiently heavy and using a center disk E, the fly wheels may probably be entirely dispensed with.

The end of the frame adjacent to the slide constituting the hammer C carries a cylindrical sleeve S which is suitably supported for rotation and which is equipped with a handle 13 whereby it may be oscillated about its axis. The sleeve S carries a longitudinally movable stem 14 provided at its outer end with a tool holding chuck 15. The stem 14 is forced inwardly in the direction of the hammer C by the action of a suitably arranged spring 16. A cam member 17 is pivoted upon the frame or casing A, said cam member being provided with a handle 18, whereby it may be manipulated to place said cam member in engagement with the chuck 15 for the purpose of holding the stem 14 projected against the tension of the spring 15, thereby retaining the stem out of range or engagement with the hammer when it shall be desired to temporarily suspend the operation of the drill or other tool carried by the chuck associated with the stem. The portion of the stem engaging the sleeve S is non-circular; thus, when the sleeve is rocked or oscillated by the handle 13, the tool carried by the stem will be correspondingly turned or rocked in the bore formed thereby. It is obvious that when the cam member 17 is moved out of the path of the handle 13, as shown in dotted lines in Fig. 1, the sleeve with the tool carrying stem may be completely rotated.

Lubricating devices 19 are to be provided wherever needed for the purpose of lubricating the parts of the device which are subject to friction. The carbureter and the sparking device of the engine are to be arranged in such a manner as to permit the engine to be tilted to various positions during the operation, but the detailed construction and arrangement of these parts is not herein shown or claimed.

It will be seen from the foregoing description that I have provided an organized machine including a motor and a tool, such as a drill or a riveting tool associated therewith the whole being supported in such a manner as to enable the tool to be utilized under conditions and substantially in the same manner as drills and riveters operated pneumatically, as is now customary.

Having thus described the invention, what is claimed as new, is:—

In a device of the character described, a frame, an internal combustion motor at one end of the frame, a movably supported hammer adjacent to the other end of the frame, a sleeve supported for rotation about its axis at the end of the frame adjacent to the hammer, a spring actuated tool carrying stem associated with the sleeve and lying in the path of the hammer, a cam member associated with the frame to engage the stem to retain the latter in projected position, and means for transmitting motion from the motor to the hammer.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM E. THRASHER.

Witnesses:

P. V. Coldwill,

Joseph Waters.

C. A. HULTQUIST.

ROCK DRILL.

APPLICATION FILED JULY 26, 1910.

1,059,539. Patented Apr. 22, 1913.

3 SHEETS—SHEET 1.

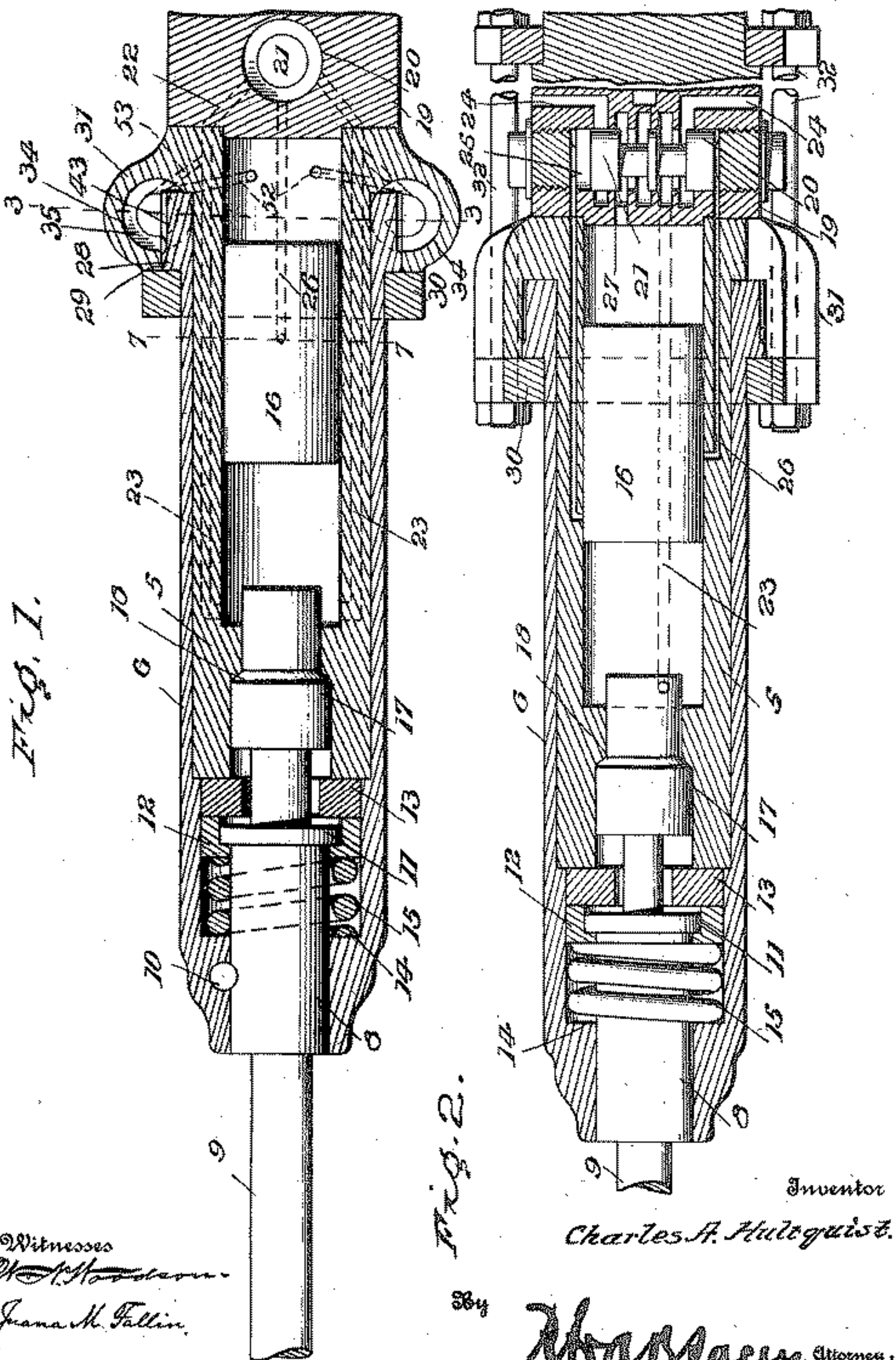


Fig. 1.

Fig. 2.

Witnesses

W. H. Woodson.

Juana M. Fallin.

Inventor

Charles A. Hultquist.

By H. B. Willson & Co., Attorneys.

C. A. HULTQUIST.

ROCK DRILL.

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1,059,539. Patented Apr. 22, 1913.

3 SHEETS—SHEET 2.

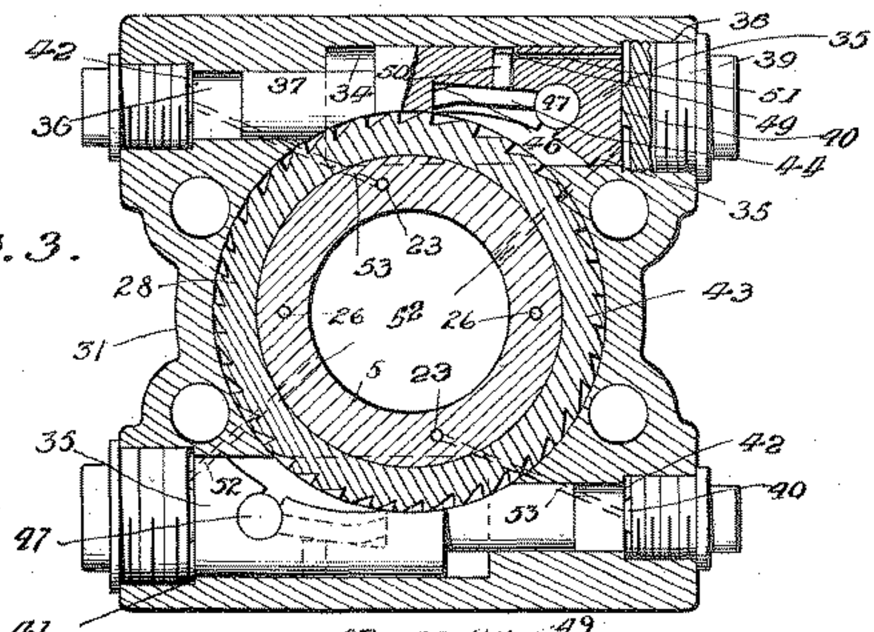


Fig. 3.

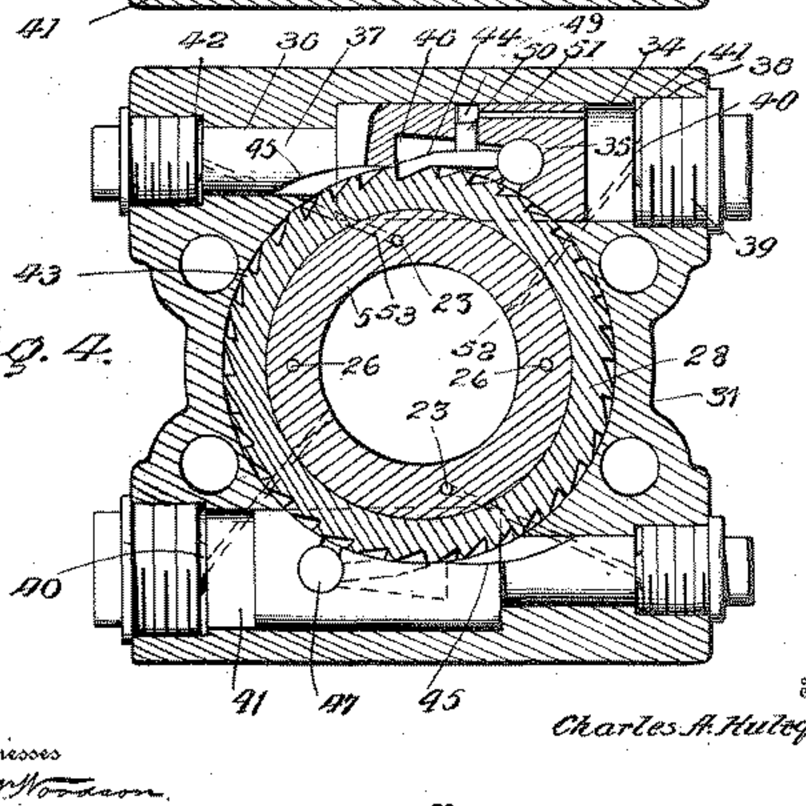


Fig. 4.

Inventor

Charles A. Hultquist.

Witnesses

W. T. Woodson

Juana M. Fallin,

By

D. B. Wacey, Attorneys.

C. A. HULTQUIST.
ROCK DRILL.
APPLICATION FILED JULY 26, 1910.

1,059,539. **Patented Apr. 22, 1913.**

3 SHEETS—SHEET 3.

Fig. 5.

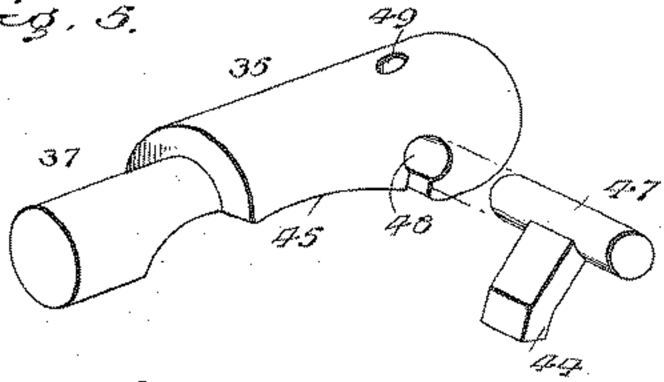


Fig. 6.

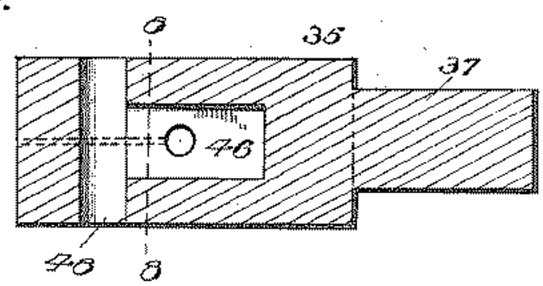


Fig. 8.

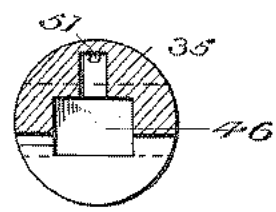
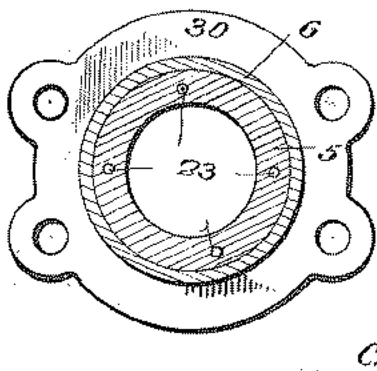


Fig. 7.



Inventor
Charles A. Hultquist

Witnesses
W. N. Woodson,
Juana M. Fallin,

By H. B. Willson & Co., Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES A. HULTQUIST, OF BISBEE, ARIZONA.

ROCK-DRILL.

1,059,539. Specification of Letters Patent. Patented Apr. 22, 1913.

Application filed July 26, 1910. Serial No. 573,995.

To all whom it may concern:

Be it known that I, Charles A. Hultquist, citizen of the United States, residing at Lowell Station, Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

This invention relates to rock drills and more particularly to means for automatically rotating the cutting tool or bit during the drilling operation.

The object of the invention is to provide a rock drill in which the piston or hammer actuating fluid is utilized for operating the drill rotating mechanism.

A further object is to provide a rock drill including relatively stationary and movable members, one of which supports the drill bit and is provided with ratchet teeth for engagement with co-acting pawls pivotally mounted in suitable fluid actuated pistons carried by the other member.

A further object is to provide a rock drill, the bit rotating mechanism of which is so arranged that when fluid is admitted to the hammer to actuate the latter, a portion of said fluid will be conducted to the pistons, thereby to cause the pawls to engage the ratchet teeth and rotate the bit with a step by step movement during the drilling operation.

A further object is to provide a rock drill, the construction of which is such as to balance the twisting thrust on the movable cylinder, thus to reduce friction between the parts and consequently increase the efficiency of the machine.

Further objects and advantages will appear in the following description, it being understood that various changes in form, proportions and minor details of construction may be resorted to within the scope of the appended claims.

For a full understanding of the invention and the merits thereof, reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a rock drill constructed in accordance with the present invention; Fig. 2 is a similar plan view taken at right angles to Fig. 1; Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1, showing the pistons at the beginning of their working stroke; Fig. 4 is a similar view, showing the pistons at the end of their working stroke; Fig. 5 is a perspective view of one of the pistons detached, the pawl of said piston being shown in position to enter a seating recess; Fig. 6 is a longitudinal sectional view of one of the pistons; Fig. 7 is a transverse sectional view taken on the line 7—7 of Fig. 1; Fig. 8 is a transverse sectional view taken on the line 8—8 of Fig. 6 of one of the pawl carrying pistons.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The improved rock drill forming the subject matter of the present invention comprises a relatively stationary main cylinder 5 and a movable cylinder or casing 6, the latter being provided with a bushing 8, preferably angular in cross section for the reception of a correspondingly shaped bit or tool 9. The bushing 8 is retained in position on the movable member or cylinder 6 by a transverse locking key 10, the inner end of said bushing being provided with a flange 11 which engages an inwardly extending flange on a collar 12. Interposed between the collar 12 and the adjacent end of the main cylinder 5, is a second collar 13, and interposed between said collar 12 and a shoulder 14 formed in the movable member 6, is a coil spring 15 which serves to receive and absorb the impact of the blow of the hammer 16 when drilling in soft ground or when the bit enters a depression or hole in a rock, thus to prevent undue strain on the working parts of the drill.

The outer end of the cylinder 5 is provided with a seating recess for the reception of a tappet 17, said tappet being provided with an enlarged head which engages the adjacent end of the bit 9 and is provided with an inclined stop shoulder 18 for engagement with a correspondingly inclined stop shoulder formed in the main cylinder, as best shown in Fig. 1 of the drawings.

Bearing against the inner end of the main cylinder 5, is a valve chest 19 having a seat 20 formed therein for the reception of a valve 21. The valve chest 19 is provided with oppositely disposed inlet ports 22 which communicate with longitudinal passages 23 opening into the main cylinder at the front of the hammer 16, there being angularly disposed exhaust ports 24 also formed in the valve chest 19 and communicating with the atmosphere at the opposite ends of said valve chest. The valve 21 is provided with oppositely disposed chambers 25, there being a passage or conduit 26 forming a source of communication between one of said chambers and the front end of the cylinder, and a similar passage or conduit connecting the other chamber and rear end of the main cylinder so as to allow a portion of the fluid from the cylinder to enter said chambers and shift the position of the valve.

An inlet port 27 opens into the main cylinder at the rear of the hammer and through which fluid is admitted to said hammer for starting the latter on its working stroke.

The inner end of the movable member or cylinder 6 is provided with an annular collar 28 defining oppositely disposed shoulders 29, one of which bears against a retaining ring 30, while the other is seated within a casting or enlargement 31, preferably formed integral with the inner cylinder 5, as shown. The shoulders 29, by engagement with the retaining ring and enlargement 31, serve to prevent longitudinal movement of the movable cylinder 6, while at the same time permitting said cylinder to revolve on the main cylinder without undue friction between the parts. The ring 30 is retained in position by means of tie rods or bolts 32, which latter extend through perforations formed in said ring and enlargement 31, and also through perforations formed in lugs 33 formed on the valve chest. The enlargement or casting 31 is cored or hollowed out to produce oppositely disposed chambers 34 in which are slidably mounted fluid actuated pistons 35, one end of each chamber being reduced at 36 to accommodate a correspondingly shaped extension 37 formed on one end of the adjacent piston 35. The interior walls of the chambers 34 are threaded at 38 for engagement with removable plugs 39, the inner faces of said plugs being provided with lugs 40 defining circumferential chambers 41 and 42.

The outer face of the collar 28 is serrated to form ratchet teeth 43, which latter are engaged by suitable pawls 44 carried by the pistons 35. One face of each piston and its extension 37 is cut-away, as indicated at 45 to accommodate the collar 28, there being seating recesses 46 formed in the pistons at the cut-away portions thereof to receive the pawls 44. The pawls 44 are each provided with a cylindrical body portion 47 which fits within a correspondingly shaped recess 48 formed in the adjacent piston 35 so as to allow free pivotal movement of the pawl within the seating recess 46, while at the same time preventing accidental displacement of said pawl.

Intersecting the seating recess 46 of each piston 35, is an opening 49 in which is seated a plunger 50, there being a passage or conduit 51 forming a source of communication between the chamber 41 and the adjacent opening 49, and through which air or other fluid is admitted to the plunger 50 for the purpose of forcing the free end of the pawl 44 into engagement with the ratchet teeth 43. The pistons 35 are made of differential diameters as more power is required for the working stroke than for the return stroke.

A passage or conductor 52 forms a source of communication between each chamber 41 and the interior of the main cylinder 5 at the rear of the hammer 16 so that when fluid is admitted to said hammer to start the latter on its working stroke, a portion of the fluid will pass through the passages 52 to the chambers 41 and thus cause the pawls 44 to engage the ratchet teeth 43 and partially rotate the movable cylinder 6 carrying the bit or working tool, some of the fluid being conducted through the passage 51 to the plunger 50 and serving to hold the active end of the pawl in engagement with the ratchet teeth during the rotation of the movable cylinder. A passage 53 also forms a source of communication between each chamber 42 and the adjacent passage 23 so that when fluid is admitted through the passages 23 to the front of the hammer 16 to start the latter on its return stroke, a portion of the fluid in the main cylinder at the front of said hammer 16 will be conducted through the passages 53 to the chambers 42 and return the pistons 35 to normal position, the pawls 44 riding loosely over the ratchet teeth 43 during the retraction of said pistons. As the pistons 35 are retracted, the fluid in the chambers 41 will exhaust through the passages 52 into the main cylinder 5 at the rear of the hammer 16, and thence pass through the inlet port 27, valve 21 and exhaust ports 24 to the atmosphere. On the forward movement of each piston 35, the air in the chambers 42 will pass through the passages or conduits 53 into the passages 23 to the front of the hammer 16 where it exhausts together with the cylinder exhaust. Thus it will be seen that on the working stroke of the hammer 16, a portion of the actuating fluid at the rear of the piston will enter the cylinders 34 to operate the pistons 35 and rotate the movable cylinder and bit with a step by step movement, thus obviating the necessity of manually rotating the bit during the drilling operation.

While it is preferred to rotate the movable cylinder 6 and bit on the working stroke of the hammer, it will of course be understood that the bit may be rotated on the return stroke of the hammer with equally good results.

It will here be noted that by having the pistons 35 disposed on opposite sides of the casting or enlargement 31, the twisting thrust on the movable member or casing 6 is preferably balanced, thus reducing friction between the parts and consequently increasing the efficiency of the machine.

Having thus described the invention, what is claimed as new is:

1. A fluid pressure actuated rock drill including an inner cylinder, an outer cylinder rotatably mounted on the inner cylinder and provided with means for supporting a bit, a hammer mounted to reciprocate within the inner cylinder, a circumferential row of ratchet teeth on the outer cylinder, fluid pressure actuated means operating simultaneously on diametrically opposite portions of the row of ratchet teeth to rotate the outer cylinder with a step by step movement during the reciprocation of the hammer, and a single valve arranged transversely to the axes of the cylinders to admit pressure fluid simultaneously to the hammer and said fluid-pressure actuated means.

2. A fluid pressure actuated rock drill including an inner cylinder, an outer cylinder rotatably mounted thereon and formed with a circumferential row of ratchet teeth at its rear end and provided at its front end with means for supporting a bit, a hammer mounted for reciprocation within the inner cylinder, a casting on the rear end of the inner cylinder having oppositely disposed chambers formed therein opening through its opposite sides, pistons mounted to reciprocate in opposite directions in said chambers, pawls carried by the pistons and adapted to simultaneously engage the ratchet teeth at diametrically opposite portions of the outer cylinder for rotating the same with a step by step movement, and a single valve arranged at the rear end of the casting to simultaneously admit fluid to both chambers and to said hammer whereby the bit-supporting member will be continuously rotated in one direction during the reciprocation of the hammer.

3. A fluid pressure actuated rock drill including an inner cylinder, an outer cylinder rotatably mounted thereon and having ratchet teeth at its rear end and provided at its front end with means for supporting a bit, a casting carried at the rear end of the inner cylinder and provided with oppositely disposed chambers opening through its opposite sides, removable closures for the opposite ends of said chambers, a hammer mounted to reciprocate within the inner cylinder, pistons mounted to reciprocate in opposite directions within the chambers of the casting, pawls pivotally mounted in the pistons to engage the ratchet teeth on opposite sides of the outer cylinder, fluid pressure operated means acting on the pawls for normally holding said pawls in engagement with the ratchet teeth, and a single valve at the rear of the casting for simultaneously controlling the flow of fluid to the pistons, the pawls and the hammer.

4. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, means carried by one end of the rotatable cylinder for supporting a bit, a collar formed on the opposite end of said cylinder and provided with ratchet teeth, said collar defining oppositely disposed annular shoulders, a hammer mounted to reciprocate within the stationary cylinder, a casting carried by the stationary cylinder against one of said annular shoulders and provided with chambers at opposite sides of its longitudinal axis, said chambers opening through opposite sides of the casting, removable closures for the ends of said chambers, a retaining ring bearing against the opposite annular shoulder, pistons mounted to reciprocate in opposite directions within the chambers, pawls carried by the pistons and adapted to simultaneously engage the opposite sides of the ratchet teeth for rotating the bit-supporting member with a step by step movement, and a single valve for simultaneously controlling the flow of fluid to said chambers and the hammer.

5. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, the rotatable cylinder being provided at one end with means for supporting a bit, ratchet teeth formed on the opposite end of said cylinder, a hammer mounted for reciprocation within the stationary cylinder, a casting around the rear ends of the cylinders having oppositely disposed parallel chambers formed therein opening through its opposite sides, each chamber being larger at one end than at the other end, removable plugs of different diameters forming closures for the opposite ends of the cylinders, pistons mounted to reciprocate in opposite directions within the enlarged portions of the chambers and provided with reduced extensions operating within the smaller portions of said chambers, pawls pivotally mounted on the larger portions of the pistons and adapted to simultaneously engage the ratchet teeth at diametrically opposite points, and a single valve at the rear of the casting to simultaneously admit fluid to said chambers and hammer.

6. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, one of which is provided with means for supporting a bit and the other with longitudinally disposed fluid passages, a hammer mounted to reciprocate within the stationary cylinder, ratchet teeth formed on the rotatable cylinder, a casting around the rear ends of the cylinders having spaced chambers formed therein and opening through its opposite sides, removable closures for the ends of the chambers, pistons

mounted for reciprocation in opposite directions within said chambers, pawls pivotally mounted on the pistons, there being passages forming a source of communication between one end of each chamber and the interior of the stationary cylinder at the front of the chamber and similar passages forming a source of communication between the opposite end of each chamber and the fluid passages formed in said stationary cylinder, and a single valve at the rear end of the casting controlling the admission of fluid to the chambers and the hammer.

7. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, one of which is provided with means for supporting a bit, ratchet teeth formed on the rear end of the rotatable cylinder, a hammer mounted to reciprocate within the stationary cylinder, a casting around the rear ends of the cylinders having chambers formed therein above and below and transversely to the cylinders and opening through the opposite sides of the casting, the interior walls of said chambers being threaded at their ends, correspondingly threaded plugs forming removable closures for the opposite ends of the chambers and provided at their inner ends with inwardly extending lugs defining fluid receiving compartments at the ends of the chambers, pistons mounted to reciprocate in opposite directions within the chambers, pawls pivotally mounted in the pistons and adapted to simultaneously engage the ratchet teeth at diametrically opposite points, and a valve for simultaneously controlling the admission of fluid to the chambers and hammer, there being fluid passages extending from the chambers at said plugs through the casting and stationary cylinder for conducting a portion of the fluid to the pistons.

8. A fluid pressure actuated rock drill including relatively stationary and movable members, one of which is provided with means for engagement with a bit, a hammer mounted for reciprocation within the stationary member, a casting having oppositely disposed chambers formed therein, ratchet teeth formed on the movable member, pistons mounted for reciprocation in opposite directions within said chambers and provided with seating recesses having openings communicating therewith, pawls pivotally mounted in said recesses, plungers slidably mounted in the openings in the pistons, and means for simultaneously controlling the admission of fluid to the chambers and hammer, respectively, there being passages formed in the pistons for admitting fluid to the plungers, thereby, to simultaneously force the pawls in engagement with the ratchet teeth at diametrically opposite points to effect the continuous rotation of said bit supporting member during the reciprocation of the hammer.

9. A fluid pressure actuated rock drill including relatively stationary and movable cylinders, one of which is provided with means for supporting a bit, a collar carried by the movable cylinder and provided with ratchet teeth, a hammer mounted for reciprocation within the stationary cylinder, a casting provided with oppositely disposed chambers, pistons mounted for reciprocation in opposite directions within said chambers and each having one side thereof cut-away to accommodate the collar and provided with a seating recess having an opening communicating therewith, said pistons being provided with cylindrical openings communicating with the adjacent seating recesses, pawls having cylindrical portions seated in the cylindrical openings and adapted to simultaneously engage the ratchet teeth at diametrically opposite points on the collar for rotating the bit supporting member with a step by step movement, plungers mounted in the openings and bearing against the pawls, means for admitting fluid to the opposite ends of the pistons, and means for conducting a portion of the fluid to the plungers, thereby to force the pawls into engagement with the ratchet teeth.

In testimony whereof, I affix my signature in presence of two witnesses.

CHARLES A. HULTQUIST. [L. S.]

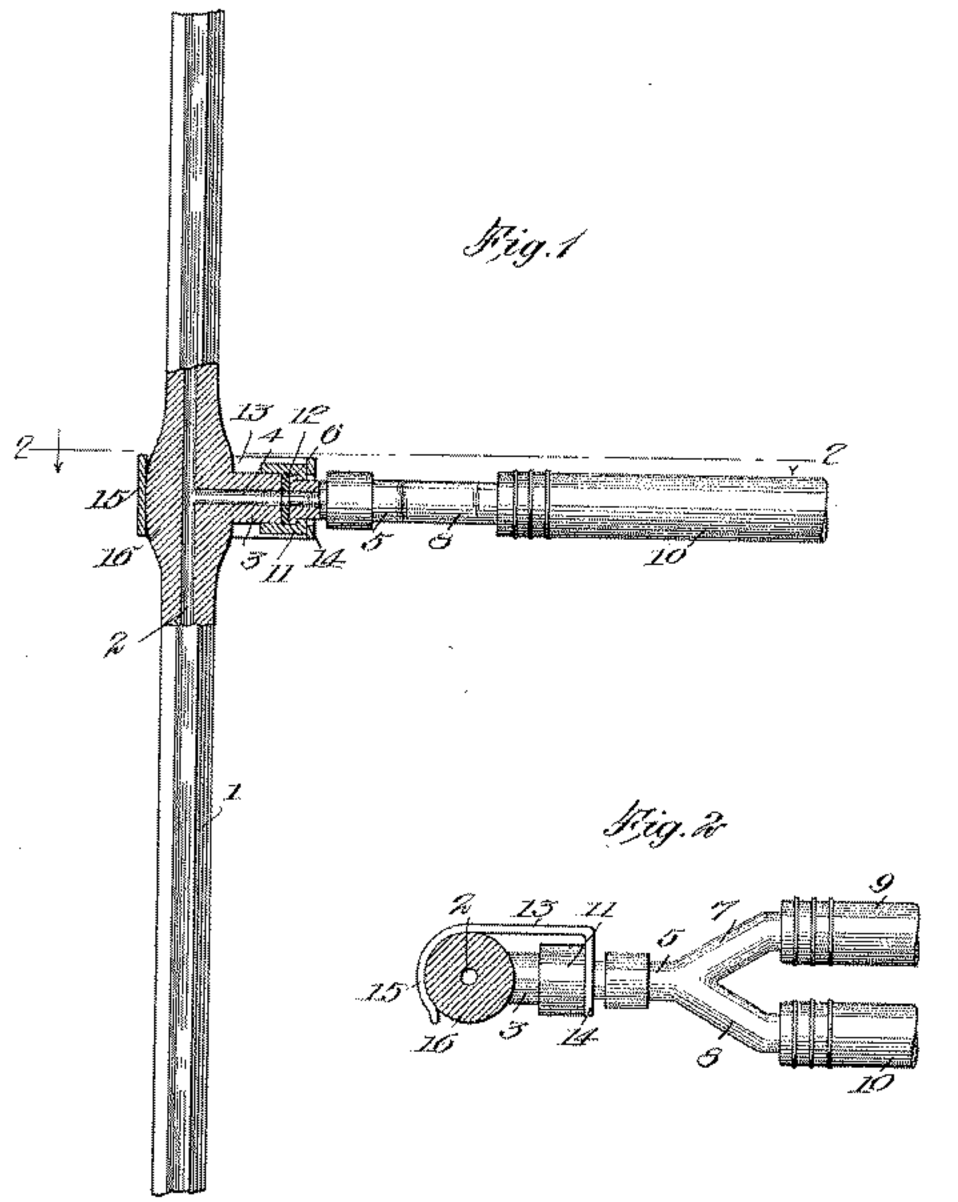
Witnesses:

D. E. TWOMEY,

P. T. MCRAE.

M. SMITH.
ROCK DRILL.
APPLICATION FILED MAY 1, 1913.

1,116,146. Patented Nov. 3, 1914.



WITNESSES
F. D. Sweet.
Myron G. Clear

INVENTOR
Michael Smith
BY Munn & Co
ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MICHAEL SMITH, OF BISBEE, ARIZONA.

ROCK-DRILL.

1,116,146. Specification of Letters Patent. Patented Nov. 3, 1914.

Application filed May 1, 1913. Serial No. 764,766.

To all whom it may concern:

Be it known that I, MICHAEL SMITH, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and State of Arizona, United States of America, have made a new and useful Improvement in Rock-Drills, of which the following is a specification.

My invention relates to rock drills and more particularly to the drill bits used in rock drilling and of that type provided with a side inlet through which either air or water, or both, may be introduced under atmospheric or forced pressure.

The object of my invention is to provide a structure in which the side fitting or inlet nozzle may be quickly and readily attached or detached by a single movement, a spring clip of peculiar structure being employed for this purpose, and the further object of my invention is to provide a side fitting or inlet nozzle of particular structure whereby air or water, or both, may be introduced either under atmospheric or forced pressure as the needs of a particular situation demand.

In the accompanying drawing illustrating my invention, Figure 1 is a side elevation of the intermediate portion of a rock drill bit provided with my improvements, the bit being broken away and in section around the connection of the side fitting or inlet nozzle thereto. Fig. 2 is a transverse section therethrough, taken substantially on line 2—2 of Fig. 1.

Referring now to these figures, 1, indicates a rock drill bit having a longitudinal bore or aperture 2, and provided with an intermediate laterally projecting nipple 3, having a smooth outer surface and a square outer end, and provided with a bore or aperture 4, the inner end of which communicates with the aperture 2 of the bit.

For reasons mainly dependent upon economy, I preferably form the longitudinal bore or opening 2 throughout the entire length of the drill bit, after which, this bore or aperture may be plugged up at the head end of the bit by any suitable means not shown.

The side fitting or inlet nozzle comprises a cylindrical body 5, having an annular shoulder 6 around one end and bifurcated at its opposite end in order to form branches 7 and 8 respectively, adapted for connection with air and water pipes 9 and 10. This fitting is also provided with a collar 11 surrounding its first mentioned end and having an inturned annular shoulder for engagement with the shoulder 6 of the body 5 in order to prevent displacement of the collar, this collar 11, being adapted to slip over the outer end of the nipple 3. An apertured gasket 12 is preferably provided, being disposed within the collar 11 so as to engage between the contiguous ends of the body 5 and the nipple 3 when the side fitting or inlet nozzle is coupled in operative position as shown in Fig. 1.

The means whereby the above mentioned parts are coupled in the manner desired consist of a spring clip formed from a strip of metal and the body 13 of which is provided with an angularly bent end 14 having an aperture through which the body 5 of the side fitting extends and provided with an angularly bent and curved portion 15 extending in substantially the same direction with the angularly bent end 14 and adapted to clasp the bit 1, this engagement, as shown in both of the figures, being such that it may be released by one hand and with but a single movement, the disengagement of the clip leaving the side fitting or inlet nozzle entirely free for removal.

It will be noted by particular reference to Fig. 1 that the bit 1 is provided with an enlargement 16 located at the point where the nipple 3 is united to the bit and serving the double purpose of strengthening this part of the bit, the normal strength of which is slightly impaired by the connecting bores or apertures 2 and 4, and providing for the ready attachment and detachment of the clip above described, it being seen that the aperture of the angular end 14 of the clip is substantially larger in diameter than that of the body 5 of the side fitting, thus permitting of angular movement of the clip in a direction longitudinally of the drill bit in order that it may be more readily and quickly slipped on or off of the bit enlargement 16 which it clasps in the coupled position of the parts, the sides of the enlargement 16 sloping gradually in order that the engaging end 15 of the clip may be more readily moved in an angular direction when disengagement is desired.

In its practical use the quick detachable coupling, requiring but a single movement in order to attach and detach the side fitting, will be found to be of considerable advantage in many instances wherein a quick change of drill bits is required, and the specific structure by which I accomplish this advantage is particularly important in that it preserves the natural normal strength of each and all of the parts.

I claim:—

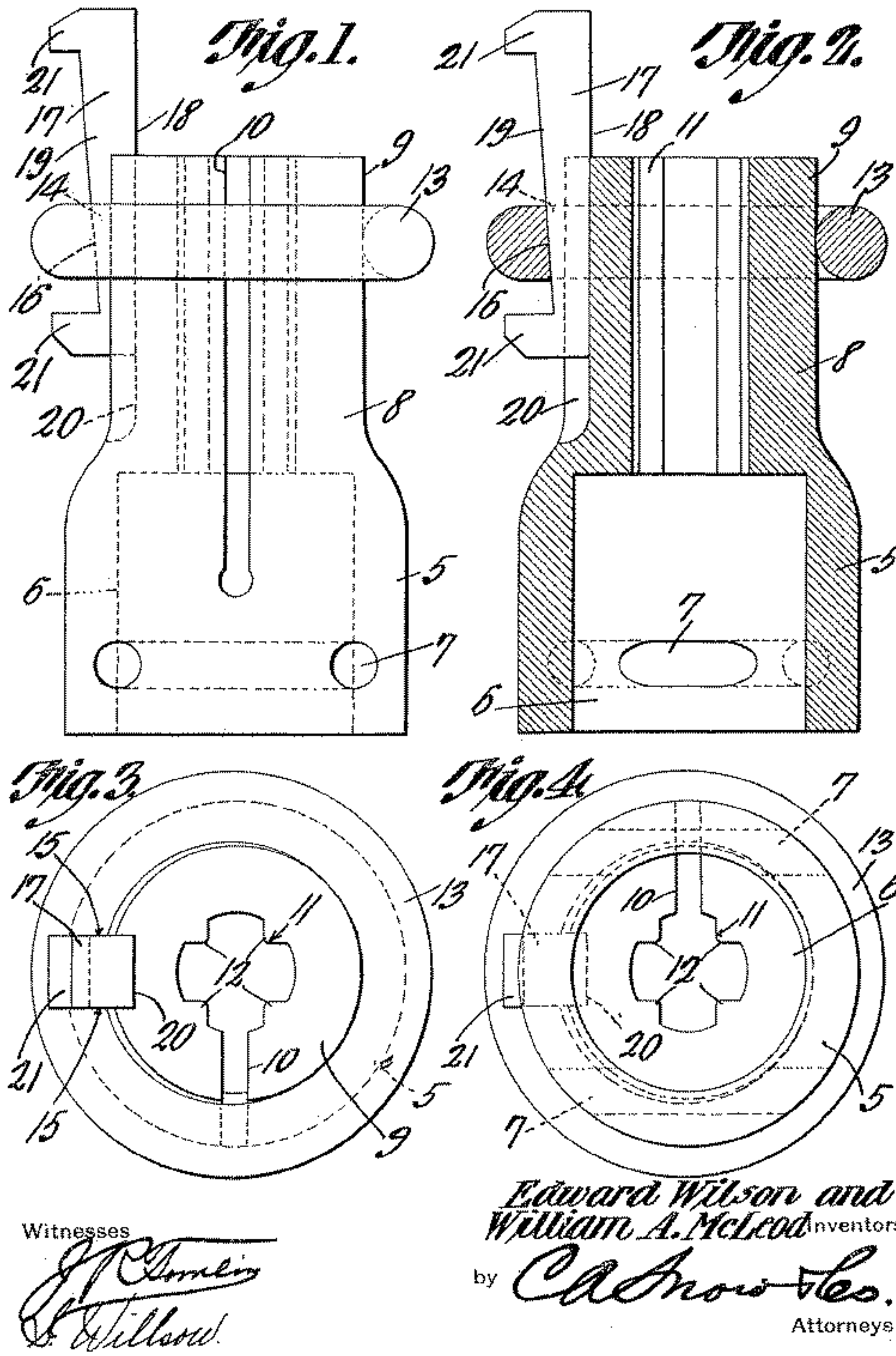
A rock drilling bit provided with a longitudinal fluid passage and having an intermediate enlargement, the sides of which slope gradually, and a laterally projecting nipple extending from the enlargement and provided with a fluid passage communicating with the passage of the bit, an inlet nozzle having a flanged end adapted to abut the end of the nipple, a collar having an internal flange adapted to engage the flange of the nozzle and arranged on the nozzle to receive the end of the nipple, and a spring clip having one angular end provided with an aperture through which the nozzle projects, the said aperture being of sufficiently greater diameter than that of the nozzle whereby to permit of angular movement of the clip, the opposite end of said clip being bent angularly and curved to clasp the enlargement of the drill bit and to slide upon the sloping sides and away from the center of the enlargement when it is desired to detach the clip.

MICHAEL SMITH.

Witnesses:
DAN B. LEED,
FRANK THOMPSON.

E. WILSON & W. A. McLEOD.
DRILL EXTRACTOR.
APPLICATION FILED MAR. 24, 1914.

1,117,468. Patented Nov. 17, 1914.



UNITED STATES PATENT OFFICE.

EDWARD WILSON AND WILLIAM A. McLEOD, OF BISBEE, ARIZONA.

DRILL-EXTRACTOR.

1,117,468. Specification of Letters Patent. Patented Nov. 17, 1914.

Application filed March 24, 1914. Serial No. 827,000.

To all whom it may concern:

Be it known that we, EDWARD WILSON and WILLIAM A. MCLEOD, citizens of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented a new and useful Drill-Extractor, of which the following is a specification.

This invention relates to improvements in a drill extractor.

An object of the present invention is to provide an attachment which may be secured to a drill so that it may be extracted from damp or wet holes, and also can be used to extract a drill from flat holes drilled by a stopping machine.

A further object is to provide a device which will attain the aforementioned ends in an expeditious manner, will be serviceable and efficient in use, and will be effective for the purposes desired.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed, can be made within the scope of what is claimed, without departing from the spirit of the invention.

In the drawings accompanying this specification and forming a part thereof, the preferred form of our invention has been shown, wherein:—

Figure 1 is a view in side elevation of our improved drill extractor. Fig. 2 is a similar view taken in longitudinal section. Fig. 3 is a front end view of the device. Fig. 4 is a rear end view thereof.

Referring to the drawings in which similar reference numerals designate corresponding parts throughout the several views, 5 indicates the body portion of the device and is provided with the bore 6 extending therein, communicating with which bore are the transverse apertures 7, through which a suitable holding or cotter pin may be driven, thus securing the device to a cylindrical shaft or similar member to aid in the extraction of the drill which is wedgedly secured to the opposite extremity of the body portion as will be hereinafter explained.

Extending forwardly from the body portion 5 are the gripping jaws 8, said jaws being formed by providing the cylindrical sleeve 9 with the longitudinally extending slot 10. The said slot divides the sleeve into two gripping jaws which are wedgedly forced together in order to engage the shank of a drill. The sleeve is provided with a substantially cruciform bore 11 extending therethrough, the inwardly projecting and oppositely disposed ridges 12 being especially adapted to grip the shank of a drill and allow the device to exert such forces thereon as are necessary to extract the drill from a hole.

In order to wedge the jaws into forced engagement with a drill shank, the ring 13 is provided surrounding the sleeve 9 and which ring is provided with the radially extending groove or slot 14 which is provided with the straight parallel walls 15 and the inclined bottom 16. The inclination of the bottom wall 16 is such that it slopes centrally and rearwardly, as clearly illustrated in Fig. 2. The key 17 is provided with the angularly disposed faces 18 and 19, the outer face 19 being complementary to the inclination of the bottom wall 16 and is adapted to continuously contact therewith. The sleeve is provided with the groove or key slot 20 extending longitudinally therealong in which the key 17 extends. Thus the key is limited or constrained to longitudinal movement with respect to the sleeve and when driven inwardly will draw the opposite portion of the ring into forced engagement with the sleeve, thus compressing the two jaws together at diametric points quadrantially removed from the slot 10. The key is provided with the outstanding end 21 so that there will be no danger of the key being driven from beneath the ring which would result in its detachment from the device. Mention is also made of the fact that the ring and key as well as the sleeve, are so proportioned that with the key extended to its farthest point, there will be little likelihood of the key and ring becoming detached from the sleeve, this being provided for by so designing the sleeve as to at all times resiliently engage the key and frictionally hold the key and ring against longitudinal movement with respect to the sleeve. The jaws of the sleeve will rigidly engage the drill shank without mutilating the same and thus provide for the ready and quick extraction of the drill.

Having thus fully described our invention, what we claim is:—

A drill extractor comprising a body portion provided with a bore extending therein, transversely alined apertures extending through the side walls of said body portion, a sleeve projecting from the said body portion, said sleeve provided with a longitudinal groove extending entirely through the side wall thereof, dividing the said sleeve into gripping jaws, one of said jaws provided with a longitudinal groove quadrantially removed from the said slot, a ring extending around and contacting with said gripping jaws, said ring provided with a groove adapted to aline with the groove of the said gripping jaw, said groove provided with an inclined bottom wall, and a tapering pin slidably positioned in the sleeve groove and engaging the ring groove, contacting with the inclined wall thereof and adapted to draw the said ring into wedged engagement with the said gripping jaws.

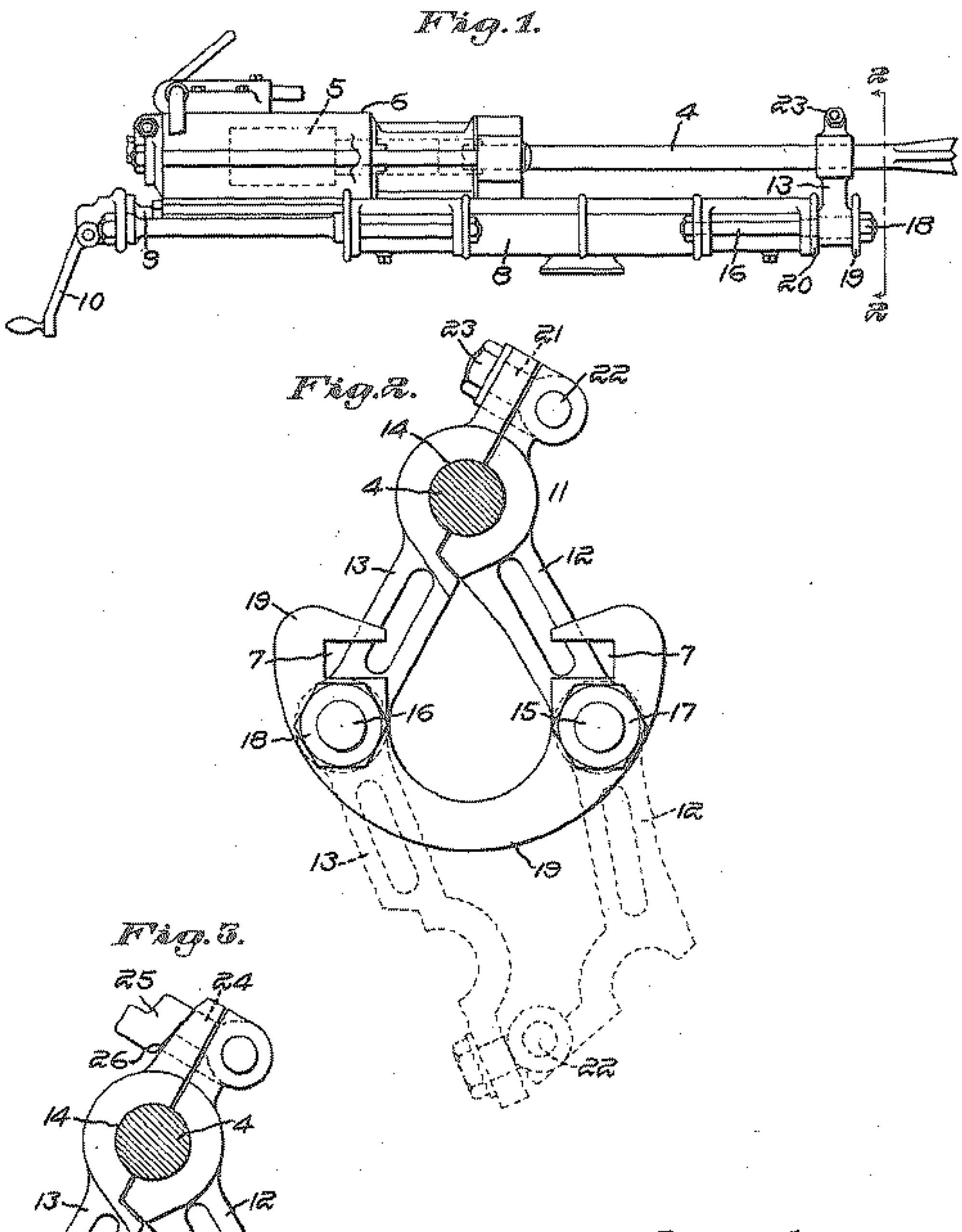
In testimony that we claim the foregoing as our own, we have hereto affixed our signatures in the presence of two witnesses.

EDWARD WILSON.
WILLIAM A. McLEOD.

Witnesses:
HARRY H. MYERS,
FRANK HOUSTON.

A. L. ENGELS & J. WALKER.
ROCK DRILL.
APPLICATION FILED JULY 21, 1914.

1,190,387. Patented July 11, 1916.



Witnesses:
Carl L. Choate.
Horace A. Crossman.

Inventors:
Andrew L. Engels,
Joseph Walker,
by Emery Booth Janney & Varney
Attys.

UNITED STATES PATENT OFFICE.

ANDREW L. ENGELS AND JOSEPH WALKER, OF BISBEE, ARIZONA.

ROCK-DRILL.

1,190,387. Specification of Letters Patent. Patented July 11, 1916.

Application filed July 21, 1914. Serial No. 852,300.

To all whom it may concern:

Be it known that we, Andrew L. Engels and Joseph Walker, both citizens of the United States, and residents of Bisbee, county of Cochise, and State of Arizona, (the post-office address of each being Bisbee, Arizona,) have invented an Improvement in Rock-Drills, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to rock drills and is more especially concerned with means for guiding the drill bit and permitting holes to be started at an angle.

Our invention will be best understood by reference to the following specification when taken in connection with the accompanying drawings of one illustrative embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings: Figure 1 is a side elevation of a rock drill embodying our invention; Fig. 2 is a detailed sectional view of the same on an enlarged scale on lines 2—2 of Fig. 1; and Fig. 3 is a detailed view of a modified form of fastening means for the separable guide.

Referring to the drawings and to the embodiment of our invention which we have selected for illustration, we have there shown a rock drill comprising a drill bit 4 which may be operated by any appropriate means, herein a common form of pressure fluid engine having a piston 5 working in a cylinder 6, the latter being mounted in the guideways 7 in a shell 8, upon which it may be fed longitudinally by any usual or desired means, as, for example, a feed screw 9 having a crank 10, and operating in a familiar manner which it will be unnecessary here to describe, as it forms no essential part of our present invention. The shell 8 is herein shown as reversible whereby the rock drill may be employed to drill holes in any position of the machine, whether in an upward or a downward direction or in a generally horizontal direction at the will of the operator.

In operating rock drills of this type there is often a lateral stress on the drill bit, particularly in starting holes at an angle. Under such circumstances, it is desirable to provide a guide which shall guide the outer end of the drill bit adjacent the work, apart from the guidance afforded by the drill chuck or cylinder head. To this end, we have herein provided a drill bit guide designated generally by the numeral 11, preferably mounted in fixed position with respect to the length of the drill bit, and the lengthwise motion of the cylinder as the latter is fed toward or withdrawn from the work.

This drill bit guide is preferably separable,—that is to say,—it is capable of being opened to permit the drill bit to be removed laterally therefrom. It is, of course, well known that drill bits are provided with enlargements at the front end and sometimes at the rear end as well, the front end enlargements being for the purpose of providing the necessary cutting edges with their clearances, whereas the rear end enlargement is often in the form of a shank held in a drill chuck in some appropriate manner. In order to permit a drill bit of the described character to be removed from the guide, the latter is herein composed of a pair of members 12 and 13, forming together an aperture 14 in which the drill bit has a sliding fit. These members may be movably mounted in any appropriate manner whereby they may be separated to permit the removal of the drill bit, but in the present embodiment of our invention are mounted respectively on pivots 15 and 16, whose axes are parallel to the axis of the drill bit. These pivots are herein in the form of shouldered studs appropriately secured to the shell 8 and provided at their outer ends with nuts 17 and 18, by means of which a plate 19 is secured in spaced relation to a similar plate 20 at the outer end of the shell, whereby the members 12 and 13 are permitted to turn freely on their pivots while held against axial movement thereon. It will here be observed that the plates 19 and 20 are both notched to provide continuations of the grooves 7 in the shell 8.

The members 12 and 13 may be held in drill bit guiding relation by any appropriate means such, for example, as a swinging bolt 21 pivoted at 22 to the member 12 and engaging the member 13 in any suitable manner. Herein both members are bifurcated. The bolt is hinged or pivoted in the bifurcation of one member and engages in the bifurcation of the other member, and in the form shown in Figs. 1 and 2 is provided with a nut 23 by means of which the two members may be fixedly secured in drill bit guiding relation, but may be instantly disconnected and swung laterally from the position shown in full lines in Fig. 2 to the position shown in dotted lines therein. In the latter position the two members may be secured to each other by the bolt and thus locked underneath the shell out of the way during the changing of the drill bit.

If desired, the nut may be dispensed with, and there may be substituted for the bolt an L-shaped member 24 provided with a head 25 having an inclined or wedge-like surface or surfaces 26, whereby the two members of the guide may be drawn toward each other by simply swinging the L-shaped member into place, and giving it a light tap with a hammer, thus locking the parts in drill bit holding relation.

It will now be apparent that when the rock drill is in operation and a hole is being started, the described supplemental guide will effectively guide the forward end of the drill bit and prevent the latter from becoming displaced laterally, yet the drill bit may be quickly and conveniently removed and replaced by another. It will also be evident that the unlocking and opening of the drill bit guide may be accomplished without the necessity of stopping the machine and immediately locked underneath out of the way during the changing of the drill steels.

While we have herein shown and described one specific embodiment of our invention for illustrative purposes, and have disclosed and discussed in detail the construction and arrangement incidental to one specific application thereof, it is to be understood that the invention is limited neither to the mere details nor relative arrangement of parts, nor to its specific embodiment herein shown, but that extensive deviations from the illustrated form or embodiment of the invention may be made, without departing from the principles thereof.

Having thus described our invention, what we claim and desire by Letters Patent to procure is:—

1. A rock drill comprising, in combination, a drill bit, means for reciprocating said drill bit, a mounting upon which said means is mounted to slide lengthwise of the drill bit, and separable drill bit guiding means comprising a purality of members pivoted to the mounting in a plane transverse to said drill bit in such manner that they may severally be swung clear of said drill bit and into proximity in reversed position and means to clamp said members together in similar manner either in drill bit guiding relation or in said reversed position.

2. A rock drill, comprising, in combination, a drill bit, means for reciprocating said drill bit, a mounting upon which said means is mounted to slide lengthwise of the drill bit, and separable drill bit guiding means comprising a plurality of members pivoted to the mounting in a plane transverse to said drill bit in such manner that they may severally be swung clear of said drill bit into proximity in reversed position and means to clamp said members together in similar manner either in drill bit guiding relation or in said reversed position, the members in such first mentioned relation together froming an opening to receive and guide the drill bit.

3. A rock drill comprising, in combination, a drill bit, means for reciprocating said drill bit, a mounting provided with longitudinal grooves in which said means may slide, and separable drill bit guiding members pivoted to the mounting coöperatively forming an opening to receive and guide said drill bit and means to secure said members together in drill bit guiding relation, said members being arranged to be swung clear of said grooves when not in guiding relation.

4. A rock drill comprising, in combination, a drill bit, means for reciprocating said drill bit, a mounting on which said means may slide lengthwise of the drill bit, and separable drill bit guiding members pivoted on the end face of said mounting to swing in a plane transverse to the bit, said members coöperatively forming an opening to receive and guide the drill bit and means for clamping said members together in drill bit guiding relation.

5. A rock drill comprising, in combination, a drill bit, means for reciprocating said drill bit, a mounting provided with longitudinal grooves in which said means may slide, pivots projecting from the end face of said mounting, drill bit guiding members on said pivots to swing in a plane transverse to the drill bit and coöperatively forming an opening to receive and guide the same, a plate having a surface conforming to and alining with the guiding surface of said mounting, maintained outwardly of said members and means to secure said members in drill bit guiding relation said members adapted to be swung clear of said guiding surface when not so secured.

6. A rock drill comprising, in combination, a drill bit, means for reciprocating said drill bit, a mounting provided with longitudinal grooves in which said means may slide, pivots projecting from the end face of said mounting, drill bit guiding members on said pivots to swing in a plane transverse to the drill bit coöperatively forming an opening to receive and guide the same, a plate having a surface conforming

to and alining with the guiding surface of said mounting, maintained on said pivots outwardly of said members and means to secure said members in drill bit guiding relation said members adapted to be swung clear of said guiding surface when not so secured.

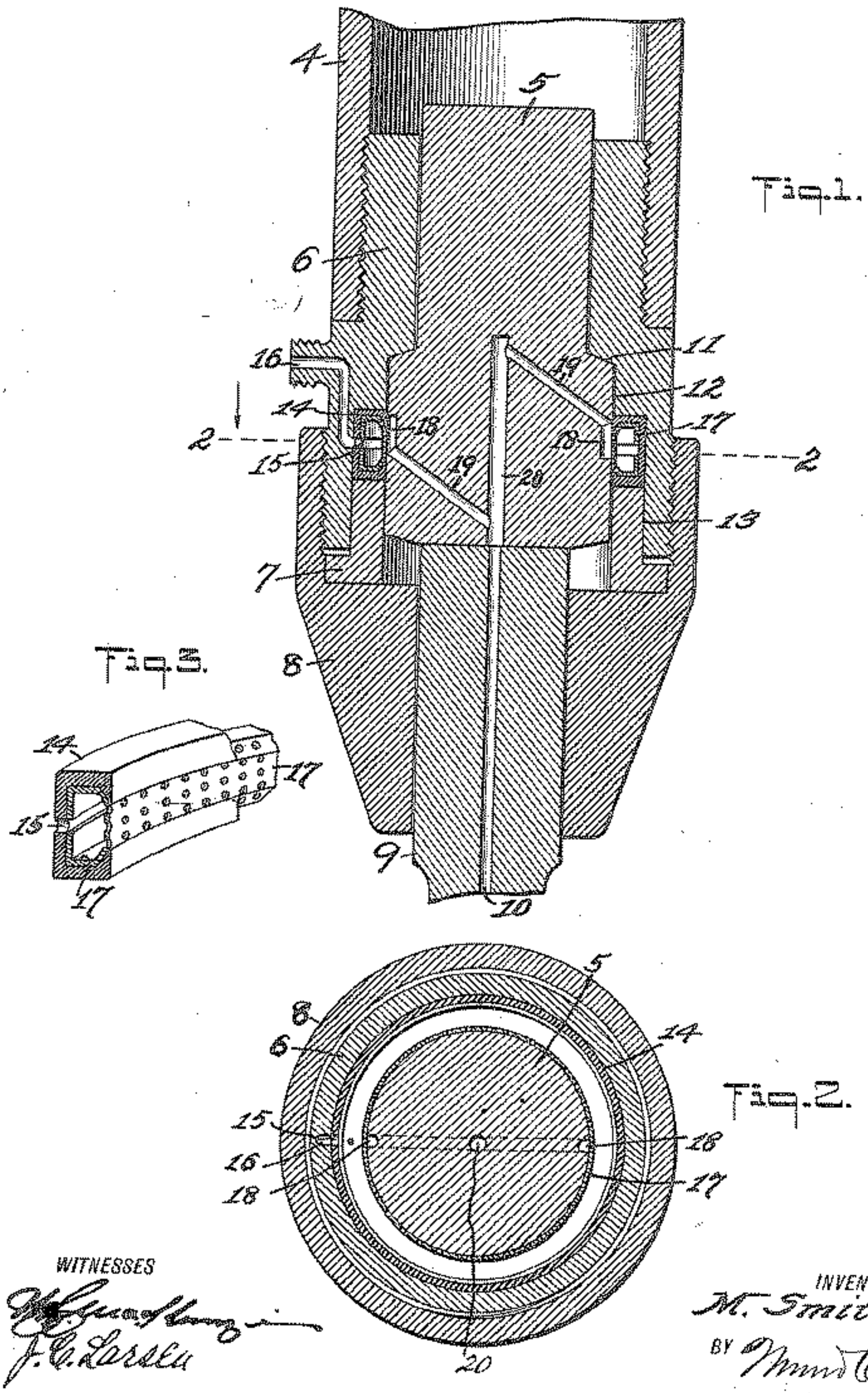
In testimony whereof, we have signed our names to this specification, in the presence of two subscribing witnesses.

ANDREW L. ENGELS.
JOSEPH WALKER.

Witnesses:
S. H. Doll,
S. A. Goff.

M. SMITH.
ROCK DRILL.
APPLICATION FILED SEPT. 28, 1916.

1,232,111. Patented July 3, 1917.



WITNESSES

INVENTOR
M. Smith
BY Munn & Co.
ATTORNEYS

UNITED STATES PATENT OFFICE.

MICHAEL SMITH, OF BISBEE, ARIZONA.

ROCK-DRILL.

1,232,111. Specification of Letters Patent. Patented July 3, 1917.

Application filed September 28, 1916. Serial No. 122,613.

To all whom it may concern:

Be it known that I, MICHAEL SMITH, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

My invention relates to rock drills of the type in which water is fed through the drill iron to the cutting end, and one of the main objects of the invention is to provide a constant supply of water to the reciprocating tappet and thence to the drill iron in a non-leakable manner and with a minimum of friction between the operative parts.

My invention includes a packing formed of a ring of flexible material of channel shape held in position by means of a metallic perforated ring, said packing being held in its operative position by means of separable members of the housing of the tappet and the member of which likely to become worn by rock cuttings is relatively small and inexpensive and readily replaced when worn.

My invention is fully described in the following specification, of which the accompanying drawings form a part, in which like characters refer to like parts in each of the views, and in which:—

Figure 1 is a fragmentary longitudinal central section taken through a rock drill and showing my invention applied thereto; Fig. 2 is a section taken on the line 2—2 of Fig. 1; and Fig. 3 is an enlarged, detached, fragmentary, view of my improved packing.

Referring to the drawings, 4 represents the cylinder wherein a piston is reciprocated to strike a tappet 5 slidably arranged within a bushing formed of two members 6 and 7 held in operative relationship by means of a head 8 screw-threaded upon the member 6 and which member 6 is in turn screw-threaded into the cylinder 4, said tappet impinging upon the inner end of a drill iron 9 having a bore 10 therethrough, the piston not being shown as it forms no part of this invention.

The tappet 5 is shouldered at 11 to limit inward movement thereof and its outward movement is limited by the head 8, and the bushing member 6 is of an increased diameter (interiorly) to receive the enlarged or shouldered portion of the tappet, as shown at 12, and is of greater diameter interiorly at 13 than at the portion 12 to receive the bushing member 7 in a slidable manner, the internal diameter of the member 7 equaling that of the portion 12 of the member 6 to serve as a bearing for the tappet in its reciprocation.

Arranged in the inner end of the enlarged internal portion 13 of the bushing member 6, and held therein by the member 7, is a packing ring 14 of flexible material formed into channel shape with the open side inward toward the tappet against which it bears, said flexible ring 14 having an inlet 15 in register with a water feed passage 16 in the bushing member 6 and to which water is led from any source of supply, either at atmospheric or forced pressure.

The flexible ring 14 is held in its operative position or shape by means of a perforated metallic ring 17 also of substantially channeled formation with the open side outwardly allowing the water to enter thereinto from the inlet 15 and with its perforated side inwardly and extended through the open side of the flexible ring whereby the water in the metallic ring may pass to one or more longitudinally arranged channels 18 in the outer surface of the tappet.

The tappet channels 18 are of such length as to insure communication thereof with the perforations in the metallic ring 17 in any axial position of the tappet and, in view of the fact that the metallic ring is filled with water entirely around the tappet, a supply of water is assured to the tappet channels 18.

These channels 18 are connected with bores 19 leading to an axial bore 20 in the tappet and which last named bore connects with the bore 10 of the drill iron 9, and it will thus be seen that a constant supply of water, or of air under pressure if desired, is assured in the drill iron and therefore at its cutting end.

The metallic ring 17 will preferably not touch the tappet but will force the leather or other material of the flexible ring against the tappet, thus reducing the friction between packing and tappet to a minimum and, if the bushing member 7 should become worn by rock cuttings entering the head 8 a new one may be expeditiously substituted therefor and at low cost because of the relatively small size of said member.

I may, if desired, make structural changes over the details shown and described, provided such changes do not depart from the spirit of the invention and come within the scope of the appended claims.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. The combination in a rock drill adapted to a drill iron having an axial bore therethrough, a tappet having an axial and a lateral passage, and a bushing having a passage connecting the exterior with the interior thereof; of a packing consisting of a channeled ring of perforated flexible material having its open side toward said tappet lateral passage and its perforations toward said bushing passage, and a channeled ring therein of perforated metal having its open side toward said bushing passage and its perforations toward said tappet lateral passage.

2. As an article of manufacture, for use in a rock drill, a packing consisting of a channeled ring of perforated flexible material, and a channeled ring of perforated metal having its open side adjacent the perforations in said flexible ring and having its perforations adjacent the open side of said flexible ring.

MICHAEL SMITH.

Witnesses:
G. W. Prickett,
George Etz, Jr.

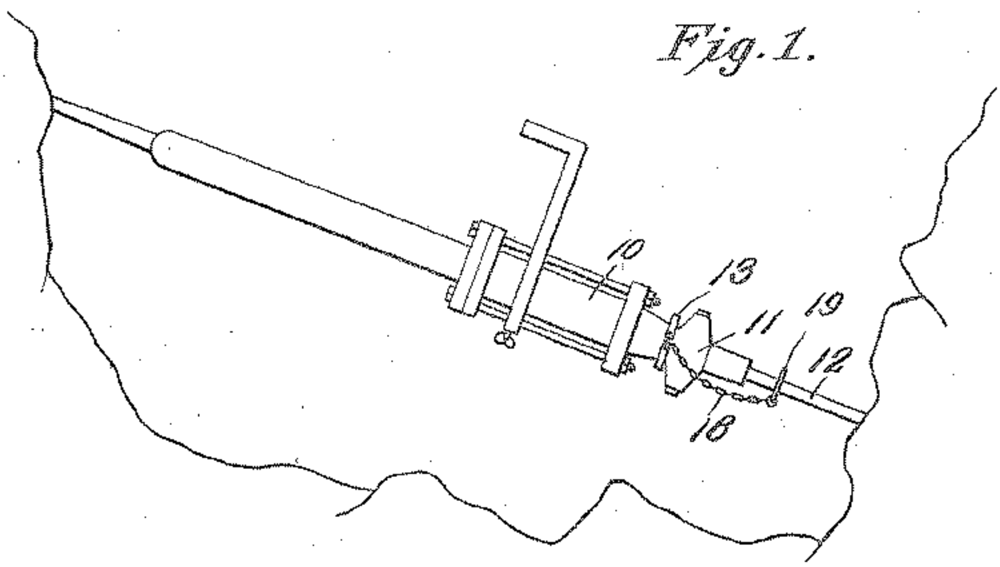
A. V. LEA.

DRILL BIT PULLER.

APPLICATION FILED JAN. 4, 1917.

1,262,960. Patented Apr. 16, 1918.

Fig. 1.



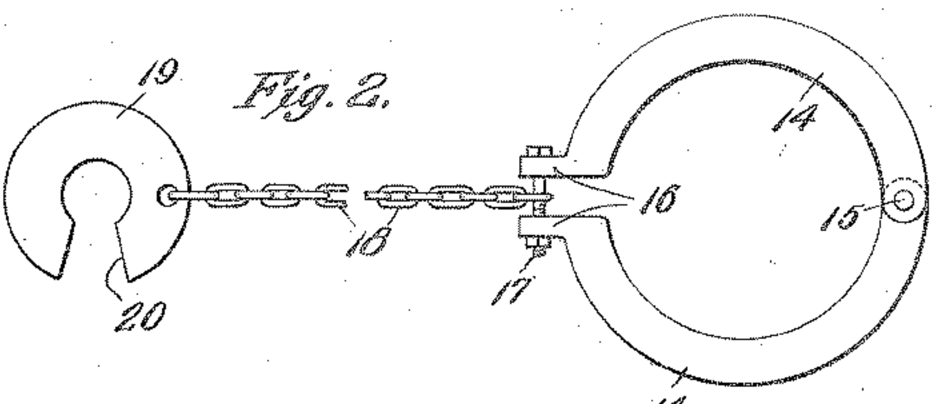


Fig. 2.

INVENTOR

Aaron V. Lea,

NESSES

James F. Crown,

Ross J. Woodward

BY Richard B. Owen,

ATTORNEY

UNITED STATES PATENT OFFICE.

AARON V. LEA, OF BISBEE, ARIZONA.

DRILL-BIT PULLER.

1,262,960. Specification of Letters Patent. Patented Apr. 16, 1918.

Application filed January 4, 1917. Serial No. 140,616.

To all whom it may concern:

Be it known that I, AARON V. LEA, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Drill-Bit Pullers, of which the following is a specification.

This invention relates to an improved drill bit puller and the principal object of the invention is to provide a puller which can be connected with the drill socket and with the bit or steel and which will be so constructed that when it is desired to extract the bit, this may be easily done through the medium of the puller.

Another object of the invention is to so construct this puller that it may be connected with the bit or steel and while it will not interfere with the bit when drilling, will obtain a firm grip thereon when extracting the bit.

This invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a view in elevation showing a drill in use with the puller connected with the bit and drill socket or brace.

Fig. 2 is a view of the puller before being put in place.

The drill brace indicated in general by the numeral 10 indicates a conventional type of brace such as is commonly used for rock drilling and includes a socket 11 into which fits the bit or drilling steel 12 which will also be of a conventional construction. The puller is provided with a collar indicated in general by the numeral 13 in Fig. 1 and shown in detail in Fig. 2. This collar is formed of two sections 14 which are pivotally connected as shown at 15 and have their free end portions provided with outstanding ears or fingers 16 connected by a bolt 17 so that the collar may be secured in place as shown in Fig. 1. A chain 18 which may be termed a cable or flexible connection is carried by the bolt 17 and carries a gripping ring 19 which is split as shown at 20 so that the ring may be put in place upon the drill steel 12.

When in use, this puller is put in place as shown in Fig. 1 with the collar engaging the socket and the gripping ring mounted upon the bit or drilling steel. The drill will be driven in the usual manner until the bit has drilled a hole in the rock, the desired depth, water being of course poured into the hole to soften the rock and make the drilling easier. During the drilling process, the powdered rock mixes with the water and forms a paste which collects about the drill steel within the hole and as this cakes about the drill steel, it often makes it exceedingly difficult to extract the bit after the drilling is completed. With this device in use, the socket or brace can be disconnected from the bit and the bit can then be easily pulled out of the hole by means of the puller. When the puller is drawn toward the outer end of the bit, the ring 19 will be turned so that it will have a friction grip upon the bit or drill steel and there will therefore be no danger of the puller slipping off of the steel when in use while at the same time, this construction permits the puller to be easily put in place and not interfere with the proper action of the drill steel while drilling the hole. It will thus be seen that there has been provided a very efficient puller so constructed that it can be easily put in place and further so constructed that it may be connected with the stock or socket thus preventing danger of its becoming lost.

Having thus described the invention, what is claimed is:—

A puller comprising a collar for fitting upon a bit stock, the collar having side sections with their free end portions terminating in spaced relation, a fastener connecting the free end portions of the sections, a split ring for fitting loose upon a drilling steel, and a flexible connection having one end portion connected with said split ring and its opposite end portion engaged by the fastener.

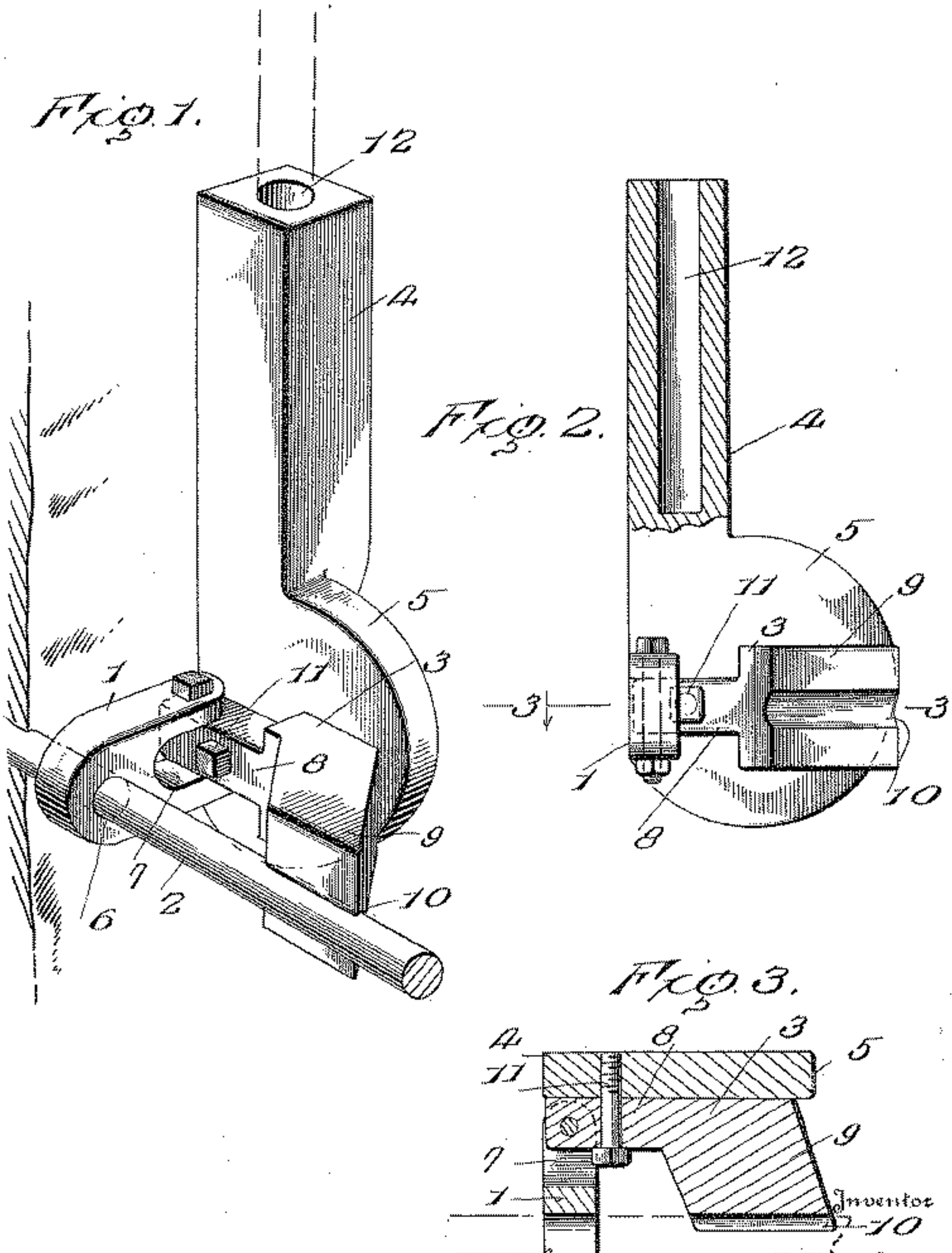
In testimony whereof I affix my signature in presence of two witnesses.

AARON V. LEA.

Witnesses:
DANIEL J. KENNEDY,
NELS KOLGAARD.

C. L. WILSON.
DRILL EXTRACTOR.
APPLICATION FILED OCT. 23, 1917.

1,272,749. Patented July 16, 1918.



C. L. Wilson.

By [signature], Attorneys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CORTEZ L. WILSON, OF BISBEE, ARIZONA.

DRILL-EXTRACTOR.

1,272,749. Specification of Letters Patent. Patented July 16, 1918.

Application filed October 23, 1917. Serial No. 198,173.

To all whom it may concern:

Be it known that I, CORTEZ L. WILSON, citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Drill-Extractors, of which the following is a specification.

This invention relates to devices for extracting drills from rock and has for its object the provision of a device for the stated purpose which will be composed of few parts and will be, therefore, free of complicated constructions and arrangements. The invention also seeks to provide a device for the stated purpose which may be easily manipulated and which will be positive and rapid in its operation.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of an apparatus embodying my improvements;

Fig. 2 is a view partly in side elevation and partly in section;

Fig. 3 is a section taken on the line 3—3 of Fig. 2.

In carrying out my invention, I employ a gripping member 1 which is adapted to engage around the drill 2, a fulcrum member 3 which is pivoted to the gripping member and is adapted to bear against the side of the drill, and an operating lever 4 which is pivotally mounted upon the bearing member 3 and is constructed with a cam or eccentric 5 which is adapted, when the lever is swung about its pivot, to bear against the side of the rock and thereby force the gripping and fulcrum members away from the rock, a pulling force being exerted thereby against the drill which will withdraw it from the hole. The gripping member 1 is essentially an elongated block having an opening 6 at one end through which the drill 2 may pass and provided at its opposite end with a notch or recess 7 in which the stem 8 of the fulcrum or bearing block 3 is pivoted. The head 9 of the fulcrum block extends laterally from the stem 8 and is provided with a groove 10 in its outer face which is adapted to fit against the drill 2, as clearly shown in Fig. 1. The operating lever 4 is pivoted at one end upon the fulcrum block by a pin or bolt 11 inserted through the stem 8 of the fulcrum block between the pivot thereof and the head 9, as shown most clearly in Fig. 3, and the eccentric or cam 5 is formed on the side of the lever with its flat face bearing against the outer surface of the fulcrum block.

To withdraw a drill from the rock by the use of my extractor, the gripping member is engaged upon the projecting portion of the drill by slipping the end of the same through the opening 6 in said member and then pushing the member as close as possible against the face of the rock as shown in Fig. 1. The fulcrum member will then project outwardly from the rock and the groove 10 in the head of said member will engage the drill so that the fulcrum block will be prevented from dropping. The operating lever will stand upright and against the face of the rock as shown in Fig. 1, and it will preferably be provided with a longitudinal bore or socket 12 in which may be engaged the end of a long bar or rod so as to increase the leverage and the force which may be applied. The lever is then swung downwardly so that the peripheral face of the cam or eccentric 5 will ride against the rock thereby forcing the pivot bolt or pin 11 outwardly and consequently causing the fulcrum block and the gripping member to bind firmly against the drill so that it will be caused to follow the outward movement of the fulcrum member and the gripping member and will be thereby withdrawn from the hole in the rock. Should a single movement of the lever be insufficient to fully extract the drill, the lever may be returned to its upright position and the device slid along the drill until it bears against the face of the rock after which the lever may be again swung downwardly and this operation may be repeated until the drill is fully withdrawn.

My device is obviously simple in the construction and arrangement of its parts and may be produced at a very low cost. It will be found highly efficient in operation for the purpose for which it is designed, and is not apt to get out of order and become inoperative.

Having thus described the invention, what is claimed as new is:

1. A device for the purpose set forth comprising a gripping member, a fulcrum member pivoted thereto, said gripping member and said fulcrum member being adapted to engage a drill, and means mounted upon the fulcrum member for imparting a longitudinal movement to the gripping member and the fulcrum member.

2. A device for the purpose set forth comprising a gripping member adapted to engage around a drill, a fulcrum member extending from the gripping member and adapted to bear against the side of the drill, and an operating member carried by the fulcrum member.

3. A device for the purpose set forth comprising a gripping member provided at one end with an opening to receive a drill and provided with a notch at its opposite end, a fulcrum member pivoted within the said notch and adapted to bear against the side of the drill, and an operating member mounted upon the fulcrum member.

4. A device for the purpose set forth comprising a gripping member provided at one end with an opening to receive a drill and having a notch at its opposite end, a fulcrum member having a stem pivoted within said notch and a head extending laterally from the stem to bear against the side of the drill, and an operating member mounted upon said fulcrum member.

5. A device for the purpose set forth comprising a gripping member, a fulcrum member pivoted to the gripping member, and an eccentric pivotally mounted upon the fulcrum member and having its plane face opposed to the side of the fulcrum member.

6. A drill extractor comprising a gripping member to extend at an angle to the drill and provided at one end with an opening whereby to receive and fit around the drill, a fulcrum block pivoted at one end to the end of the gripping member more remote from the drill and provided at its free end with an offset to bear against the drill, said offset having a groove in its face to engage the drill, and a cam fulcrumed upon said block at the side opposite the offset and the gripping member, said cam having its plane face arranged parallel with the fulcrum block and its peripheral edge presented to the body in which the drill is set.

In testimony whereof I affix my signature.

CORTEZ L. WILSON. [L. S.]

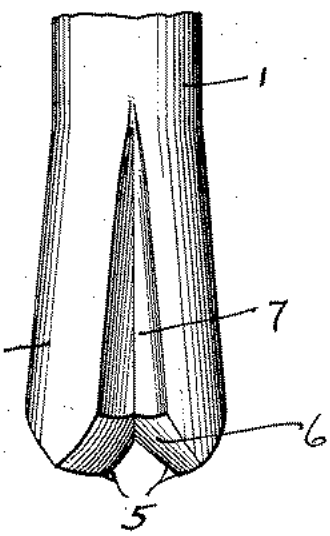
N. J. McKENZIE.
DRILLING BIT.
APPLICATION FILED OCT. 15, 1917.

1,277,970. Patented Sept. 3, 1918.

2 SHEETS—SHEET 1.

Fig. 2.

Fig. 1.



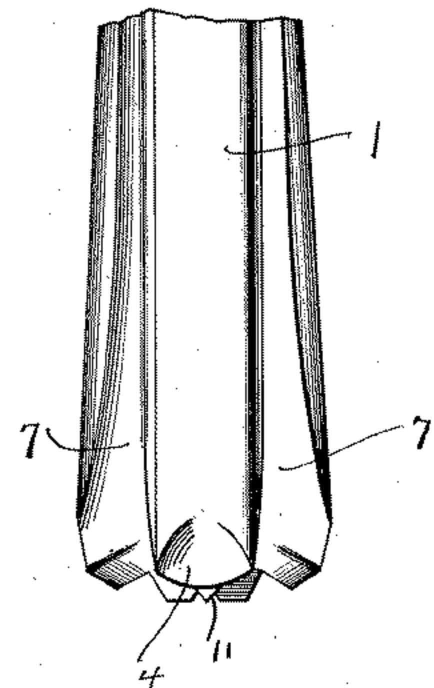


Fig. 3.

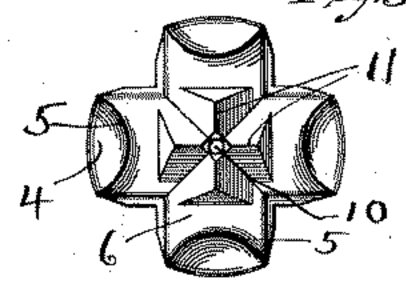
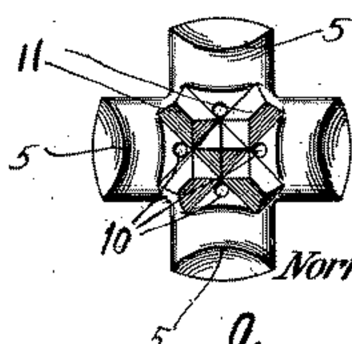


Fig. 4.



Inventor
Norman J. McKenzie
Jerry A. Mathews,

N. J. McKENZIE.
DRILLING BIT.
APPLICATION FILED OCT. 15, 1917.

1,277,970. Patented Sept. 3, 1918.

2 SHEETS—SHEET 2.

Fig. 5.

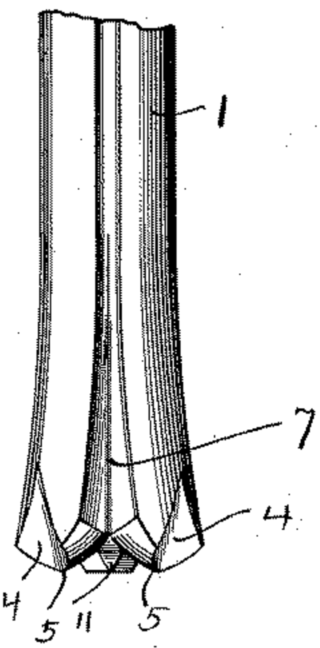


Fig. 8.

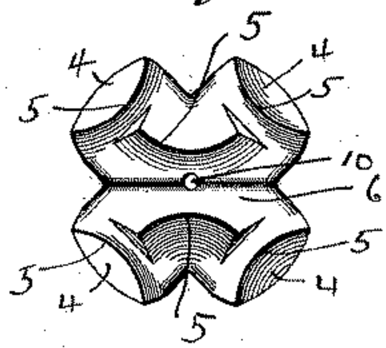


Fig. 9.

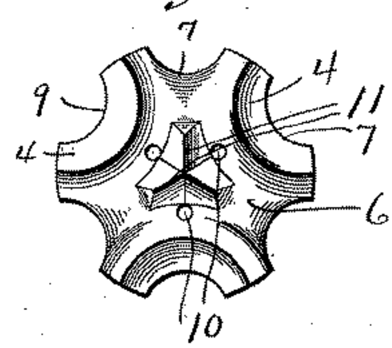


Fig. 6.

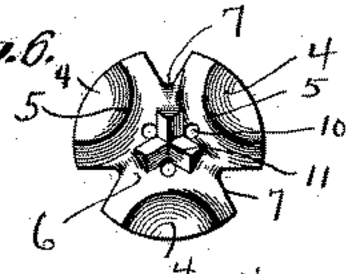


Fig. 7.

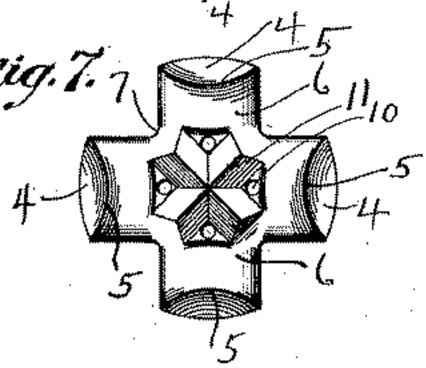
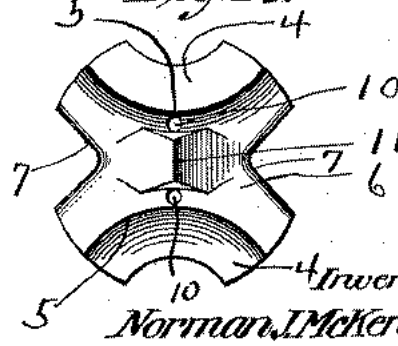


Fig. 10.



Inventor
Norman J. McKenzie
Jorey A. Mathews.

UNITED STATES PATENT OFFICE.

NORMAN J. McKENZIE, OF BISBEE, ARIZONA.

DRILLING-BIT.

1,277,970. Specification of Letters Patent. Patented Sept. 3, 1918.

Application filed October 15, 1917. Serial No. 196,668.

To all whom it may concern:

Be it known that I, NORMAN J. MCKENZIE, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented new and useful Drilling-Bits, of which the following is a specification.

The object of my invention is to provide certain improvements in bits which will enable them to perform the required work with a minimum expenditure of power and a minimum degree of resistance to the cutting teeth.

In the accompanying drawings, Figure 1 is a side elevation of one form of bit; Fig. 2 is a side elevation of a furtber modified form; Fig. 3 is an end view of same; Fig. 4 is an end view of a modified form; Fig. 5 is a side elevation of a further modification; Fig. 6 is an end view of same; and Figs. 7, 8, 9 and 10 are end views of other modified patterns of my invention involving like particulars of construction and operation.

Like characters of reference designate corresponding parts throughout the several views.

Referring to the accompanying drawings, 1 indicates the shank of the drill, which may be of any suitable sbape or size; suitable ribs 2 are provided at the working end or face of the drill, preferably diverging outwardly as illustrated in Figs. 1, 2, 5.

The face of the drill is provided with a plurality of novel inversely curved cutting teeth 5, which are separated by grooves 6. Tbese grooves provide a channel opening into the flutings 7 wbich extend upwardly and longitudinally from the face of the drill and provide a passage for chips and dust produced by the drilling. Each rib is provided with a clearance groove or cavity 4 opening into the longitudinal flutings 9 which are similar in shape and function to flutings 6 and 7. I may provide one or more center teeth 11 in the face of the drill. These center teeth are relatively small and may be of any suitable form, sucb as illustrated in the drawings. Their usefulness consists in their coöperation witb the inversely curved teeth in fracturing rock that is especially hard. I preferably provide the drills with one or more suitable channels 10, so that water may be supplied through the drill to lessen the danger of the bore becoming choked.

While several patterns of my invention are illustrated, yet it will be observed that in each instance I require inversely curved teeth for cutting; grooves and cavities opening out of the face of the drill, and longitudinal flutings into which these grooves open to allow for the escape of chips and dust; while I may provide center teeth, the principal work of fracturing the rock is performed by the inversely curved outer teeth, which perform a more effective cutting operation than is accomplished with the ordinary drill bit.

It is by this novel positioning and shape of teeth that I am enabled to relieve the resistance in the center of the drill bit, and to increase the drill efficiency toward the outer edge of the bore, wbich relieves the corners of the bit while in operation. The outer portions of the inversely curved teeth strike approximately at right angles to their center portions, in the instance of the forms having relatively large inversely curved teeth; and, similarly the outer portions of these inversely curved teeth operate at approximately right angles to the relatively small center teeth, sbown in the modified forms.

My drill bits are intended for general use in mining drilling and boring, and it is my object to uniformly increase the fracturing efficiency from the center to the periphery of the face of the drill. This peculiar form of cutting teeth bas proven more efficient than any radially arranged cutting teeth, and overcomes the defect which many drills have of providing a disproportionate amount of cutting surface at the center, as compared with the outer portions of the face of the drill.

This is particularly important in view of tbe necessity for effectually ejecting cuttings from under the central portion of tbe drill, and the grooves and flutings intervening between the inversely curved cutting teeth provide an efficient passage for chips.

What I claim is:

In drill bits, the combination of teeth positioned near the center of the drill, a plurality of inversely curved outer teeth spaced from the first mentioned teeth and having clearance grooves therebetween, longitudinal flutings extending up the sides of the drill and communicating with the clearance grooves in the face of the drill, the inversely curved teeth having concave outer faces for the ejection of chips and dust, substantially as and for the purposes described.

NORMAN J. McKENZIE.

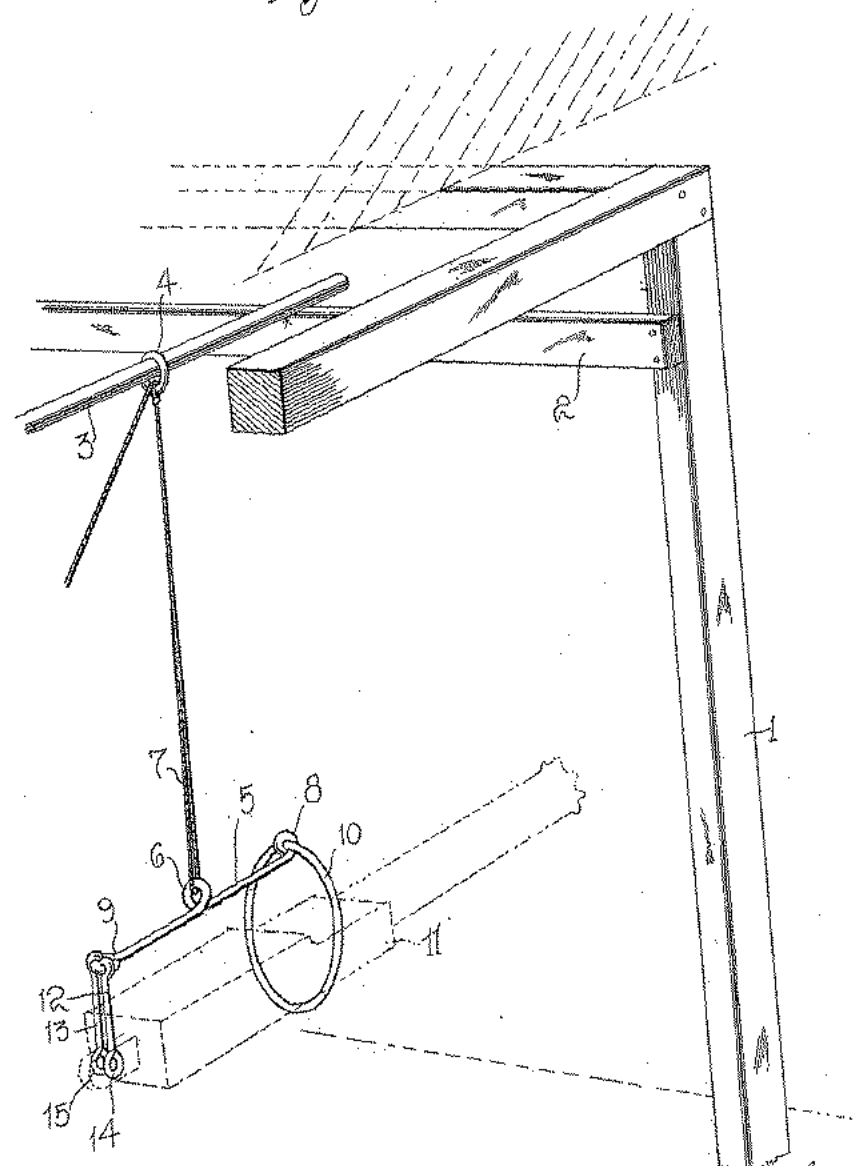
BEST AVAILABLE COPY

S. SLACK.
JACK HAMMER.
APPLICATION FILED JUNE 23, 1919.

1,317,600.

Patented Sept. 30, 1919.

Fig.1



Inventor:
Samuel Slack
By Franklin H. Hough
Attorney.

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

SAMEUL SLACK, OF BISBEE, ARIZONA.

JACK-HAMMER.

1,317,600. Specification of Letters Patent. Patented Sept. 30, 1919.

Application filed June 23, 1919. Serial No. 305,995.

To all whom it may concern:

Be it known that I, SAMEUL SLACK, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Jack-Hammers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to new and useful improvements in slings for hammers, and consists of a simple and efficient device of this nature so arranged that the jack hammer may be supported for convenient use through the medium of a mechanism, which will be hereinafter fully described and specifically defined in the appended claim.

My invention is illustrated in the accompanying drawing which, with the numerals of reference marked thereon, form a part of this application, and in which:

Figure 1 is a perspective view showing the device suspended.

Reference now being had to the details of the drawings by numerals:

1 designates the vertical posts or timbers of a mine and upon the cross pieces 2 secured thereto is supported a shaft upon which a ring 4 is placed. The spring consists of a rod 5 bent to form an eye 6, through which a rope 7 passes and which rope is secured to the ring 4. The rope passes up and through the ring 4 through which it slides freely, and whereby, as the rope is pulled upon, the member 5 may be raised. Each end of the rod 5 is bent to form eyes 8 and 9 respectively, and 10 is a ring which is fastened in the eye 8 and passes about the jack hammer or drill 11. Two links designated respectively by numerals 12 and 13 have eyes at their upper ends connected to the eyes 9 and their lower ends are provided with eyes 14 which are fastened to the projecting lug 15 upon the jack hammer or drill.

By the means of my improved sling, it will be noted that the jack hammer may be held at different elevations, thereby relieving the operator of the weight of the same, the device being easily and quickly adjusted to any location within the mine.

What I claim to be new is:

A sling for jack hammers comprising a rod with eyes at its ends and an intermediate wire, the latter being adapted to be attached to a supporting cable, a ring secured to the eyes at one end, links having eyes at their opposite ends and which are connected each to an eye at the end of the rod opposite that to which the ring is connected.

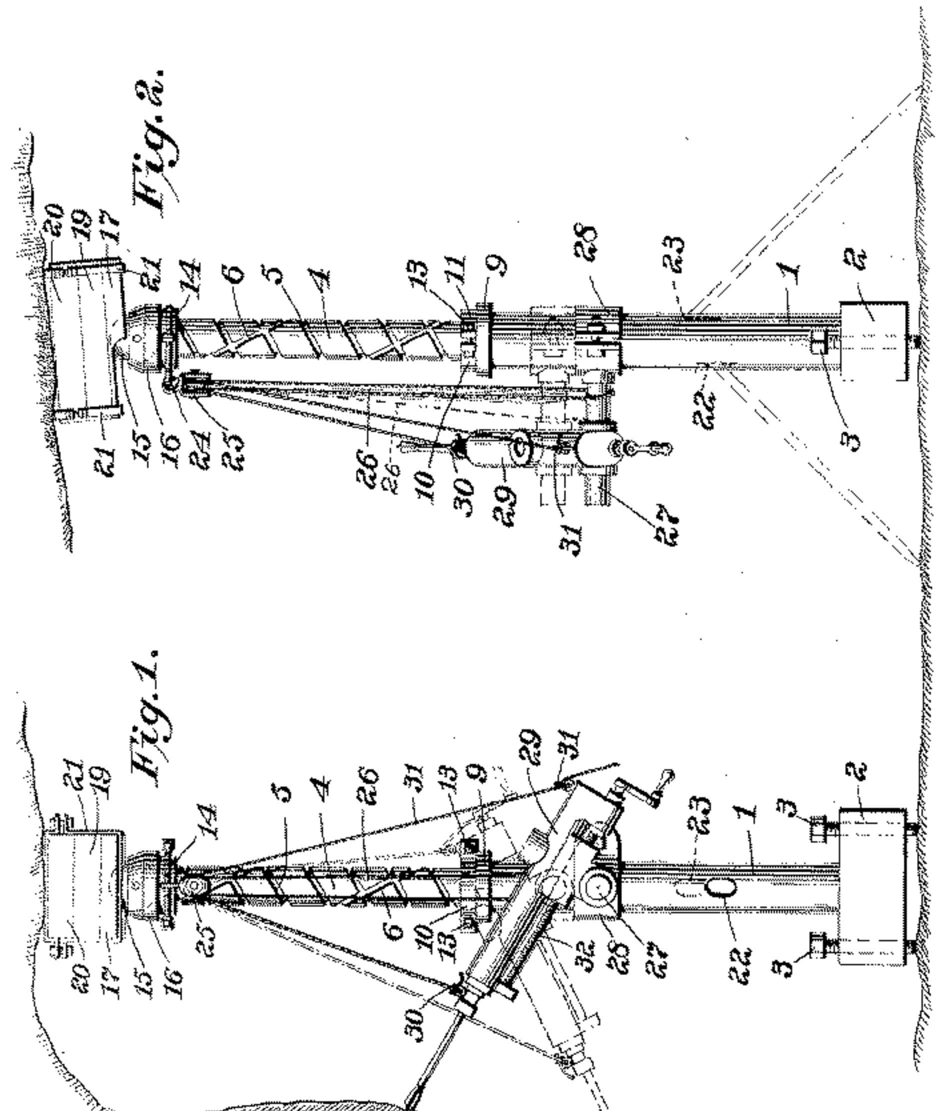
In testimony whereof I hereunto affix my signature.

SAMEUL SLACK.

R. P. SAFFOLD.
DRILL COLUMN.
APPLICATION FILED MAR. 29, 1919.

1,380,255. Patented May 31, 1921.

2 SHEETS—SHEET 1.

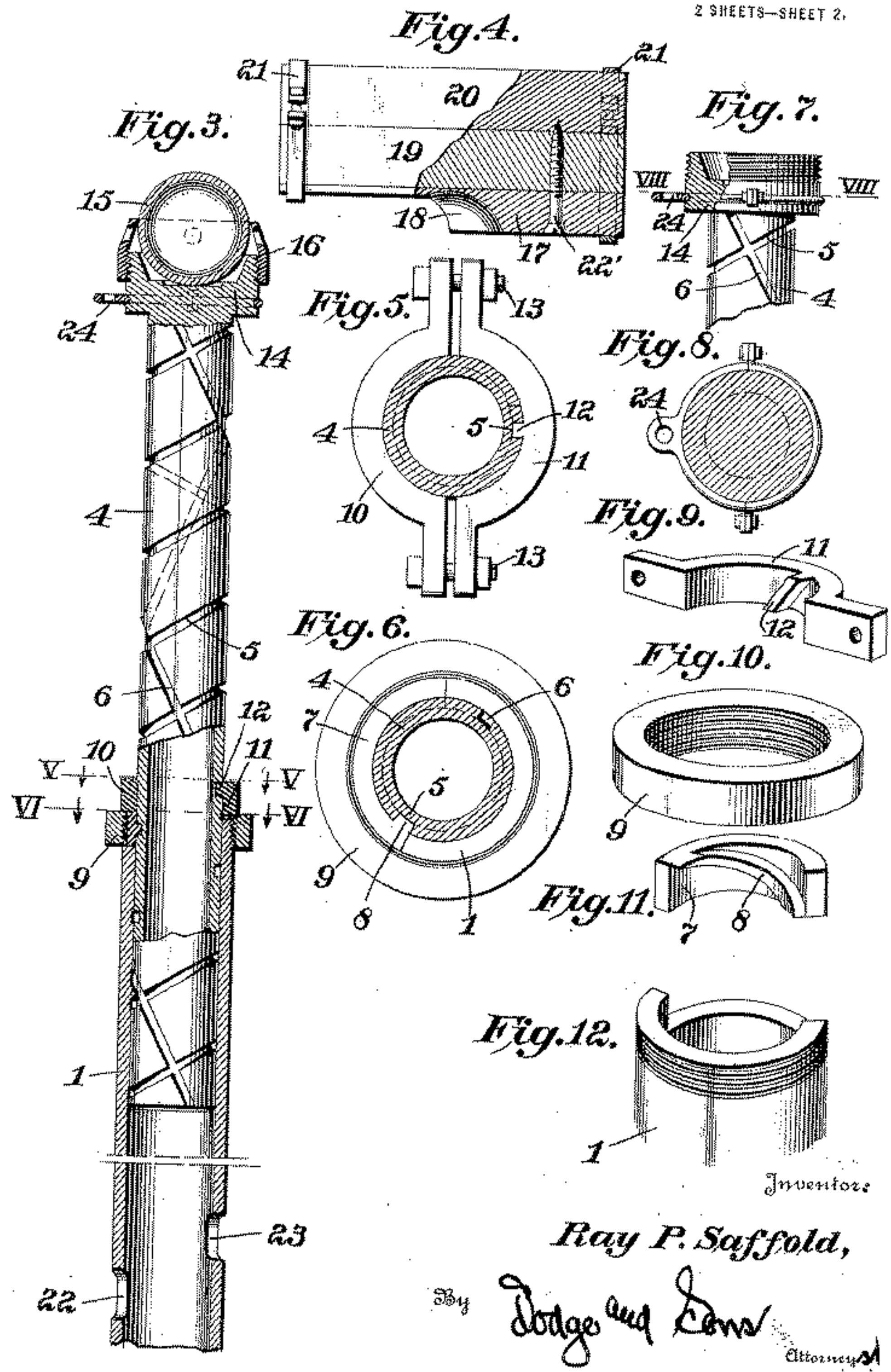


Inventor:
Ray P. Saffold,
By Dodge and Sons
Attorneys

R. P. SAFFOLD.
DRILL COLUMN.
APPLICATION FILED MAR. 29, 1919.

1,380,255.

Patented May 31, 1921.
2 SHEETS—SHEET 2.



UNITED STATES PATENT OFFICE.

RAY P. SAFFOLD, OF WARREN, ARIZONA.

DRILL-COLUMN.

1,380,255. Specification of Letters Patent. Patented May 31, 1921.

Application filed March 29, 1919. Serial No. 286,075.

To all whom it may concern:

Be it known that I, RAY P. SAFFOLD, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Drill-Columns, of which the following is a specification.

This invention pertains to an improved drill column. It has for its main object the production of a column which may be readily extended and secured in place. A further object resides in the provision of a head block of peculiar formation in which the top of the column will readily find its seat or bearing, the block being so constructed that the parts subject to wear may be readily renewed.

A still further object resides in the provision of means whereby the drill proper may be readily raised upon the column.

With these and other objects in view, and which will appear in the following description, reference is had to the annexed drawings, wherein,—

Figure 1 is a side elevation of the column with a drill in position thereon;

Fig. 2 a similar view looking from the rear;

Fig. 3 a vertical sectional view of the column, the lower or base portion being broken away;

Fig. 4 a sectional elevation of the head block;

Fig. 5 a horizontal sectional view taken on the line V—V of Fig. 3;

Fig. 6 a similar view taken on the line VI—VI of Fig. 3;

Fig. 7 a detailed sectional elevation of the upper portion of the column;

Fig. 8 a transverse sectional view on the line VIII—VIII of Fig. 7;

Fig. 9 a perspective view of one of the clamping collar elements;

Fig. 10 a perspective view of the ring employed in conjunction with the extension sustaining member;

Fig. 11 a similar view of the extension sustaining member; and

Fig. 12 a perspective view of the upper portion of the base of the column.

In the drawings, 1 denotes the base of the column, which, as will be seen, is tubular in form and is provided at its lower end with a block 2 having set screws 3 mounted therein, said screws and block forming a jack for the column. The column is made in two sections and the upper or extensible portion is denoted by 4. It is preferably made hollow and is provided upon its outer face with a screw thread 5 of a slow pitch and with a second screw thread 6 of steep pitch and running in a direction reverse to the other. The upper end of the base 1 (see Fig. 12) is cut away and a block 7, having a spline or feather 8 formed thereon and entering the thread 5, is placed in the seat or recess formed by the cut away portion and held in such position by a ring or collar 9 (Fig. 10). There is thus formed between the extension 4 a thread connection which permits the extension to be rotated and to be raised or lowered as may be desired and necessary. To hold the extension in its proper position with reference to the base I employ a clamp, preferably composed of two yoke-shaped members 10 and 11 (see Figs. 5 and 9), the member 11 being provided with a lug or spline 12 which enters the quick-pitch thread 6. Bolts 13 pass through the oppositely disposed ends of members 10 and 11 and serve to lock the clamp in place. As will be readily appreciated, the extension may be turned upwardly by rotating the same counter-clockwise and then held in its adjusted or elevated position by releasing the clamping elements 10 and 11 and bringing them to the position shown in Figs. 1, 2 and 3, and tightening up the bolts 13. The feather 8 and spline 12 standing in opposite directions, of course, prevent any downward movement of the extension into the base. It is conceivable that instead of making the spline or feather 8 upon a separate member as 7, and holding it in place by the ring 9, any other construction which will provide a threaded engagement between the upper end of the column and the telescoping extension 4 may be employed, but the present arrangement forms a simple and cheap construction and one which admits of a ready replacement of the feathered element should the same become worn or perhaps broken.

The upper end of the extension 4 carries a head 14 which is recessed to receive a ball 15, said ball being held upon its seat by a collar 16 which has a threaded engagement with the head 14. The ball while thus being held in place is free to rotate to accommodate itself to its bearing against a head block which is interposed between the ball and the upper wall of the drift. Said block would preferably be formed as best shown in Fig. 4. It comprises a bearing member 17 having a rounded seat 18 which receives the ball and overlying block 19 and an upper bearing block 20. Said members 17, 19 and 20 will be held together in any suitable manner, as, for instance, by clamps 21 which pass about the end of the various elements. Screws 22 will be employed to hold the members 17 and 19 permanently together. Member 20 which takes against the wall will, of course, in time become worn, and it is for the purpose of replacing this block that the members are made separable. This does not necessitate re-forming a seat or socket as 18 each time a new face block 20 is substituted or positioned. The employment of the ball 15 working in the socket 18 and forming the member 17, as shown in Fig. 4, enables the bearing block to be brought to most any position with reference to the head of the column and thereby facilitating the positioning of the column. To assist in such positioning I preferably provide the base 1 with a plurality of openings as 22, 23, (Figs. 1 and 3) into which are projected drills or rods, as indicated in dotted lines in Fig. 2. These rods tend to maintain the column in position while the extension and block are being adjusted to the upper face or wall of the drift. After the extension 4 is turned up as far as possible, the screws 3 are turned down and the column is thus locked in place. The rods or drill steels may then be removed as there is no further necessity of their presence, the column being firmly held in place by the adjustments above noted.

The employment of the ball 15 and the socket 18 to receive the same will be found advantageous over the usual pointed end commonly employed in conjunction with a head block, for the present construction does not wear out the socket or recess as does the construction just referred to.

To raise and lower the drilling machine upon the column, I employ a rope rigged to the column and the drill in the manner best shown in Figs. 1, 2, 7 and 8. Secured to the upper end of the column, and preferably to the head 14, is a hook or eye 24 to which is attached a pulley 25. A rope is passed through the pulley, the bight of the rope, indicated by 26, passing beneath the supporting arm 27 which extends outwardly from the clamp 28 which surrounds the base 1. The arm 27 carries the drilling machine, denoted generally by 29. One end of the rope, as 30, is secured to the chuck end of the machine, while the opposite end of the rope or that denoted by 31 is secured to the rear of the machine or secured to arm 27, as indicated in dotted lines, Fig. 2. The machine may be swung about the arm 27 as a fulcrum. When the parts are in the position shown in full lines in Fig. 1, and the clamp 28 is free, the miner may raise the clamp upwardly along the column by depressing the chuck end of the machine or bringing it to the position shown in dotted lines in Fig. 1. The chuck end being further removed from the fulcrum 27 than the rear end of the machine, there is a tendency upon the depression of the forward or chuck end of the machine to raise the clamp 28 and thus carry the machine from the position shown in full lines to the elevated position indicated in dotted lines. After the parts have been brought to the position shown in dotted lines in Fig. 1 the operator will by reversing the feed screw 32 of the drill cause the rear end of the machine to extend beyond the fulcrum farther than the chuck end of the machine and upon depressing the rear end of the machine the clamp 28 will be again raised and this operation may be repeated as many times as is found necessary to bring the drill to its proper elevation. Instead of manipulating the drilling machine in the manner just specified to cause its elevation, the operator may by turning on the power of the drill cause the drill to be rotated and thus wind the end 30 about the rotatable member of the drill thereby effecting raising of the drilling machine. Ordinarily it takes two men, at least, to raise the drilling machine upwardly along the column, but with the arrangements just described the machine may be raised by one man with the expenditure of but little energy.

What is claimed is:

1. A drill column comprising two telescoping members, one of said members having a threaded connection with the other, the externally threaded member having a second reverse thread; and a stop collar having a spline adapted to enter said reversely formed thread and to bear against the adjacent end of the other member.

2. A drill column comprising a hollow base; an upper member telescoping said base, said member being provided with reversely formed threads thereon; a spline on the base taking into one of the threads; and a stop collar taking into the other thread, said collar resting on the upper end of the base when the parts are brought to their final adjustment.

3. A drill column comprising a hollow base; an upper member telescoping said base, said member being provided with reversely formed threads thereon; a spline on the base taking into one of the threads; a stop collar taking into the other thread, said collar resting on the upper end of the

base when the parts are brought to their final adjustment; and a jack located at the lower end of the base.

4. A drill column comprising a hollow base; an upper member telescoping said base, said member being provided with reversely formed threads of different pitch; a feathered member secured to the column and coöperating with the thread of least pitch; and a stop collar having a spline entering the quick pitch thread, said collar surrounding the threaded member and adapted when the parts are brought to their adjusted position to bear upon the upper end of the base.

5. A drill column comprising a hollow base having a recess formed in the upper end thereof; a member seated in said recess; a feather extending inwardly therefrom; means for securing said member in place; a threaded extension telescoping said base, the feather aforesaid entering the thread; and means for holding said base and extension against relative movement when they are brought to their desired adjusted relation.

6. In a drill column, the combination of a base, an extension member carried thereby; a ball rotatably mounted on the upper end of said member; and a separate bearing block having a socket in which the ball seats.

7. In a drill column, the combination of a base; an extension member carried thereby; a ball rotatably mounted on the upper end of said member; a bearing block having a socket in which said ball seats, said block being unattached to the ball; and a removable bearing plate carried by said block.

8. In combination with a drill column; a freely revoluble ball carried by the upper end thereof; and a bearing plate having a socket formed therein for the reception of the ball, the plate being disconnected from the ball being cut away to one side of the socket so that the block may be tipped and adjusted with reference to the column.

9. In combination with a drill column; a ball carried by the upper end thereof and free to rotate with reference thereto; a bearing block adapted to receive the ball, said block being formed of a series of separable elements; and clamping means adapted to hold said elements together.

10. In combination with a drill column; a drilling machine; a supporting bar for said machine, said bar being slidably supported upon the column; a pulley block attached to the upper portion of the column; and a repe or cable having its ends secured to the opposite ends of the drilling machine, said rope passing through the block and having a bight or loop passing downwardly and embracing the supporting bar.

11. In combination with a drill column; a drilling machine; a supporting bar therefor slidingly supported on said column; means for shifting said machine longitudinally with reference to the axis of the bar; a pulley block attached to the upper end of the column; and a rope or cable having its ends connected to the opposite ends of the drilling machine and likewise having a bight which passes downwardly and embraces the supporting bar.

12. In combination with a drill column; a ball rotatably mounted on one end thereof; an independent removable bearing block having a socket in which the ball seats; and means for holding the column in position and with the ball seated in the socket, whereby the block will be forced against the wall of the drift in which the column is located.

In testimony whereof I have signed my name to this specification.

RAY P. SAFFOLD.

R. P. SAFFOLD.

SHELL FOR ROCK DRILLING MACHINES.

APPLICATION FILED MAR. 25, 1920.

1,412,712.

Patented Apr. 11, 1922.

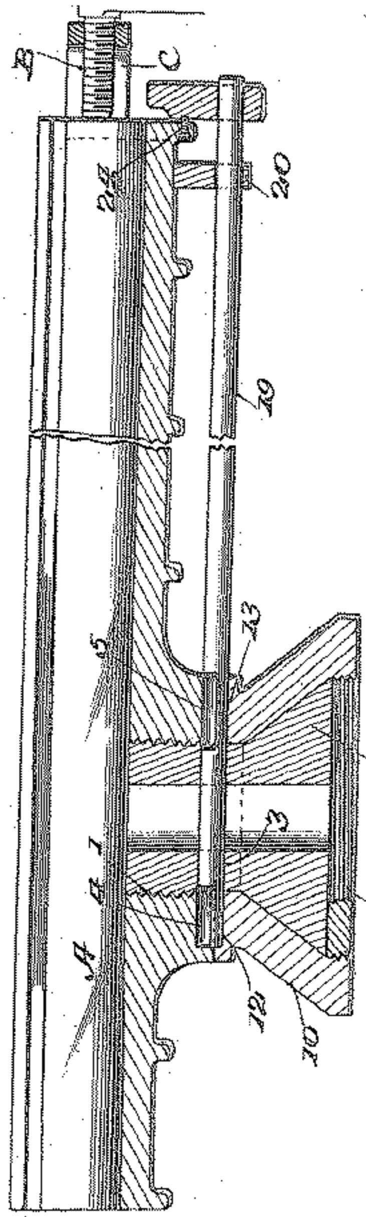


Fig. 1.

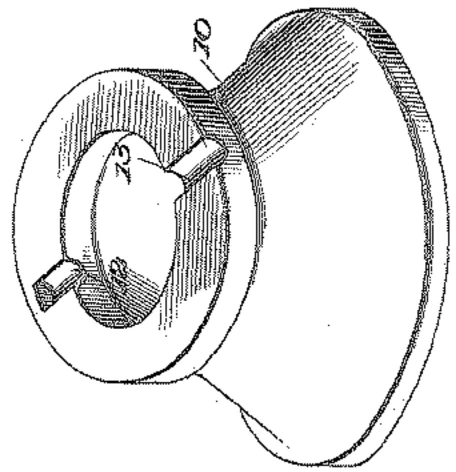


Fig. 3.

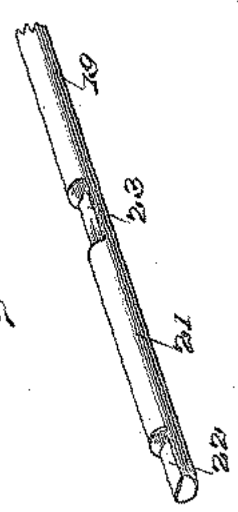


Fig. 2.

Ray P. Saffold INVENTOR.

BY

McGee and Higgins ATTORNEYS

UNITED STATES PATENT OFFICE.

RAY P. SAFFOLD, OF BISBEE, ARIZONA.

SHELL FOR ROCK-DRILLING MACHINES.

1,412,712. Specification of Letters Patent. Patented Apr. 11, 1922.

Application filed March 25, 1920. Serial No. 368,541.

To all whom it may concern:

Be it known that I, RAY P. SAFFOLD, of Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Shells for Rock-Drilling Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to shells for rock drills. The object is to provide a shell which is so formed that it may be turned for the purpose of changing a drill without necessity of first applying a wrench or other tool for loosening the clamp which connects the shell with the supporting arm of the frame, simple and efficient means being provided for rigidly connecting the shell with the supporting frame in normal position of the drilling machine and which means is effective for quick manipulation to allow the shell to be turned to change the drill, the improvements in the construction of the shell being such as to avoid loss of time in the present common practice of first loosening the clamping means to turn the shell and also in finding the original position of the machine with regard to the line of the hole.

Referring to the drawings, Figure 1 is a longitudinal sectional view of a shell equipped with my improvements. Figure 2 is a perspective view of one end of the locking rod. Figure 3 is a perspective view of the outer shell.

The shell is indicated at A and is equipped with the usual feed screw B supported at one end of the shell by a hanger C.

The shell has a vertical opening 1 which, in the form illustrated herein, is screw threaded to receive the upper cylindrical screw threaded end of what I term an inner cone 2, this cone forming a connection between the shell and a base to be later described. It is manifest that this cone may be secured to the shell in other ways. The cylindrical portion of the inner cone is transversely bored, as at 3, and this bore is adapted to aline with recesses 4, 5 of the shell.

An outer cone 10 is fitted over the inner cone 2, and constitutes the base of the shell. The cones are adapted for relative rotary movement, the outer cone being, in its coupled relation with the shell, the means to which a clamp is secured to fasten the shell to the frame of the machine. The top of the outer cone has recesses 12, 13, corresponding to the recesses 4 and 5 of the shell. At 14 I have shown a screw threaded washer for holding the inner and outer cones in position.

It is necessary in the normal operation of the drilling machine that the inner and outer cones and the shell proper be securely locked so that there can be no movement of any of these parts relative to another. This locking is effected by means of a rod 19 disposed longitudinally of the shell with its outer end supported in a bracket 20 formed on the shell. This rod has a cylindrical portion 21 and two semi-cylindrical portions 22 and 23, the cylindrical portion lying wholly within the bore of the inner cone, and the portions 22 and 23 taking in the recesses 4, 12, and 5, 13, respectively, of the shell and the outer cone. When the semi-cylindrical portions 22 and 23 of the rod are turned so that they occupy the recesses 12 and 13 of the outer cone, the shell, the inner cone and the outer cone are locked as against any relative movement. On the other hand, with the rod turned so that the semi-cylindrical portions 22 and 23 are within the recesses 4 and 5 of the shell, the latter with the inner cone may be turned relatively to the outer cone which is held fast to the supporting arm, the flat faces of the semi-cylindrical portions 22 and 23 riding over the top of the outer cone. The rod 19 is equipped at its outer end with a handle by which it may be turned, appropriate means, such as a stop 24, being arranged for limiting and indicating the turning movement of the rod.

In the use of my improved shell, it will be manifest that the shell may be secured to the supporting arm by any preferred clamping means, such clamp gripping the outer cone or base 10 in a manner well known in the art. With the locking rod 19 turned so that its semi-cylindrical portions 22 and 23 are within the recesses 4 and 5 of the shell, the shell and the two cones are integrally locked. When it is required to change the drill it is only necessary to turn the locking rod 19 to remove the semi-cylindrical portions of the rod from the recesses of the outer cone. The shell and the inner cone may then be turned relatively to the outer cone, the position of the latter on the supporting arm being unaffected. The advantages of this construction will be apparent to those skilled in the art.

While I have shown and described a shell

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including a base which has in part the configuration of known shell bases, it is manifest that in lieu of the outer cone to which the ordinary clamp is secured this part of the shell base might be made integral with the clamp or other part supporting the shell on the frame, the inner cone or its equivalent being secured to such outer member by means similar to the washer shown in the drawings, the locking arrangement between the two parts being effective to rigidly secure the shell to the supporting frame and yet capable of such manipulation as to permit relative movement between the shell and the inner cone or member on the one hand and the outer cone on the other.

I claim as my invention:

1. A shell for rock drilling machines including a base comprising a cone-like member fixedly secured to said shell and having a transverse bore and a second cone-like member fitted over said first mentioned member and which members are adapted for relative movement, a rod extending through the transverse bore of said first cone-like member and adapted in one position to lock said members against movement and in a reverse position to permit relative movement.

2. A shell for rock drilling machines including a base comprising a cone-like member fixedly secured to said shell and having a transverse bore and a second member fitted over said first mentioned member and which members are adapted for relative movement, said second member having recesses adapted to aline with the transverse bore of said cone-like member, a rod extending into said recesses and bore for locking said members against relative movement, said rod having cut-away portions permitting it to be turned out of engagement with the recesses of said second member to allow relative movement of said members.

3. A shell for rock drilling machines including a base comprising an outer member having a flat face adapted to register with a similar face on said shell, the face of the outer member and the face of the shell having complementary recesses, an inner member connecting said outer member with said shell, said inner member having a transverse bore adapted to aline with the complementary recesses of said shell face and the outer member, a rod extending into said recesses and bore, said rod being in part cylindrical and in part semi-cylindrical, the semi-cylindrical portions being adapted to fit in the recesses of said outer member to lock the members as against relative movement, and to be turned therefrom into the recesses of the shell face to permit relative movement between the members, and a handle for turning said rod.

In testimony whereof I have signed this specification.

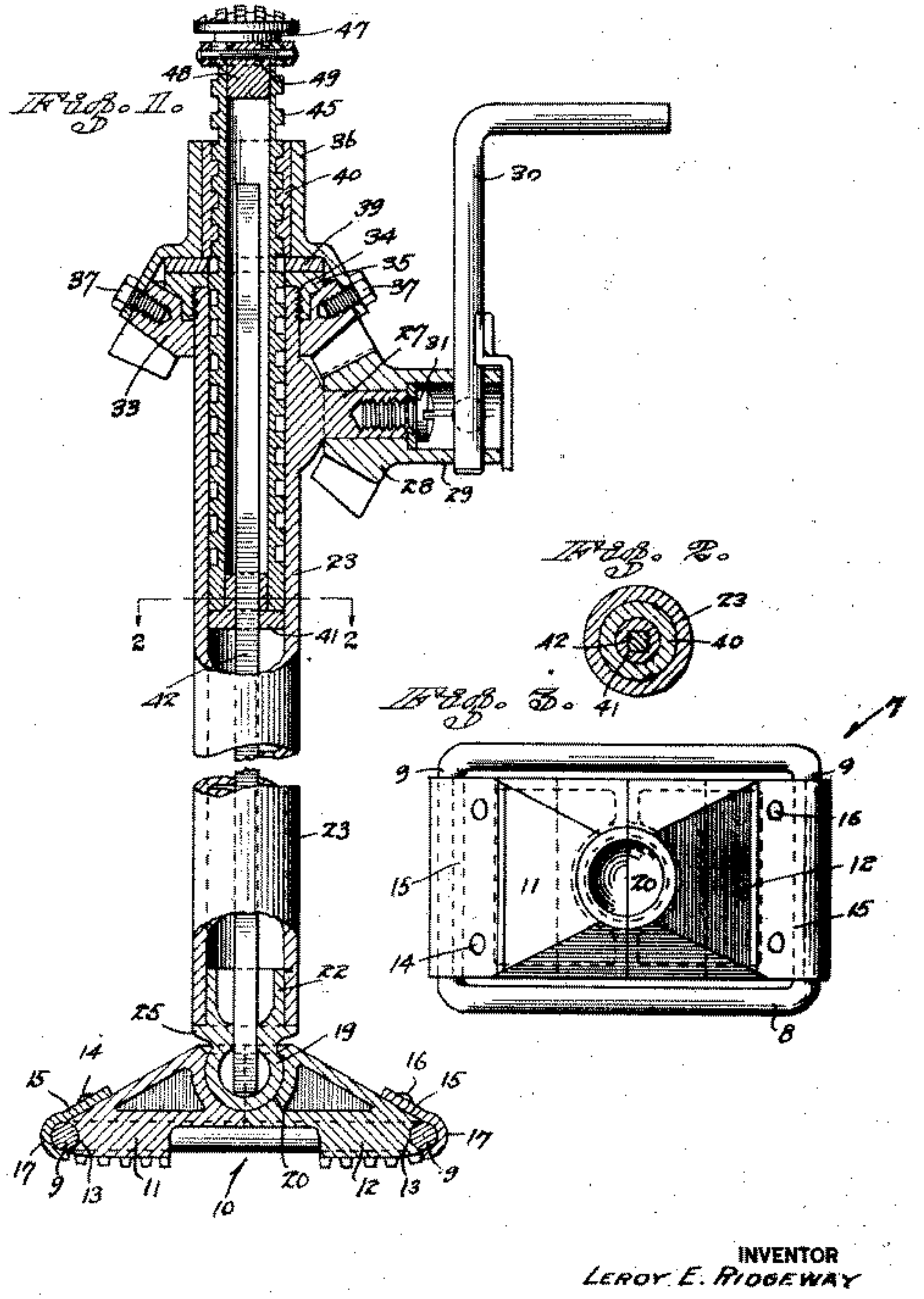
RAY P. SAFFOLD.

Feb. 5, 1929. 1,701,122

L. E. RIDGEWAY

MACHINE BAR

Filed Oct. 4, 1926



INVENTOR

LEROY E. RIDGEWAY

BY

ATTORNEYS.

Patented Feb. 5, 1929. **1,701,122**

UNITED STATES PATENT OFFICE.

LEROY E. RIDGEWAY, OF LOWELL, ARIZONA, ASSIGNOR OF ONE-HALF TO JOHN A. RIDGEWAY, OF LOWELL, ARIZONA.

MACHINE BAR.

Application filed October 4, 1926. Serial No. 139,493.

This invention relates to an extension machine bar and self-acting base clamp which may be employed as a mining column for supporting rock drills.

An object of my invention is the provision of an efficient device of the character described.

With the foregoing object in view, together with such other objects and advantages as may subsequently appear, this invention resides in the construction and arrangement of parts hereinafter described and claimed, and illustrated in the accompanying drawings, in which

Figure 1 is an elevational view partly in section and partly broken away of my device;

Figure 2 is a horizontal section taken on line 2—2 of Figure 1, and

Figure 3 is a plan view of the base clamp shown in Figure 1.

Referring to the drawings for a more detailed description thereof, the base 7 comprises a round bar 8 of rectangular form, the ends of which are designated by the numerals 9. The base also comprises a body portion 10 of two parts or jaws 11 and 12 which are similar to each other and are provided at their sides with arcuate grooves 13 which receive the sides 9 of the rectangle 8. The parts 11 and 12 of the body 10 of the base are not secured together, but co-act with each other and with the bar 8 to function as an integral clamping base for the remainder of the structure hereinafter described. The parts 11 and 12 of the base are provided with members 15 which are secured to them by fastening means 16. The members 15 have arcuate lower portions 17 which fit partly around the outsides of the ends 9 of the bar 8. The parts 11 and 12 of the base are thereby hinged to the ends 9, whereby they may be opened up to receive a ball 19. After the introduction of the ball 19 between the open jaws 11 and 12, these parts may be closed down and then hold the ball in a corresponding socket 20, shown in Figure 3, which socket is formed by both parts 11 and 12. The jaws 11 and 12, however, do not meet when they are in clamping or closed position, whereby their clamping action becomes greater the greater the force exerted upon them. The ball 19 is integral with a member 22 which fits into a hollow column 23, the latter being supported on a shoulder 25 formed adjacent the member 22.

The device is provided with a lateral extension 27, which carries a rotatable beveled gear 28. A hollow extension 29 projects from the beveled gear 28 and carries a crank 30 for rotating the gear 28 which is secured to the extension 27 by means of a screw 31. The beveled gear 28 engages the rotatable gear 33 which encloses the standard 23 and which is held in position by a member 34 screwed to the standard as indicated at 35. The gear 33 encircles an upwardly extending sleeve 36 secured thereto by means of bolts 37. A thrust washer 39 is placed on top of the member 34 and contacts with the sleeve 36. The sleeve 36 is secured to an inner hollow threaded member 40 which threadedly engages a hollow screw 45. The hollow screw 45 is plugged at its lower end by a member 41 having a square aperture therein, through which passes a square elongated key 42; this bar extends downwardly and passes through a square aperture in the member 25 and down into the hollow ball 19. The hollow screw 45 is provided at its top with a thrust point cap 47 having a shank 48 which fits into the hollow screw 45 and is secured thereto by means of a fastener 49.

In the operation of the device the rotation of the crank 30 turns the beveled gear 28 which is effective to turn the beveled gear 33 and therefore to turn also the sleeve 36 secured to the gear 33. The rotation of the sleeve 36 and the member 40 which is integral therewith, raises or lowers the hollow screw according to the direction of turning of the crank 30.

It will be seen that the hollow ball 19 fits into a socket so that the device is swivelly connected to the base, whereby it may accommodate itself to any required position. It will also be appreciated that the key 42 functions to hold the hollow screw 45 from rotating, so that the screw will be raised or lowered.

While I have described one embodiment of my invention, modifications thereof may be readily devised without departing from the spirit of my invention, and it is to be understood that such modifications come within the scope of the appended claims.

I claim:

1. In a device of the character described,

an element terminating in a ball and a socket member adapted to receive the ball, the socket member being split to provide co-operating sections, and the latter being hinged to be closed by the insertion of the ball, and to be opened by the withdrawal of the ball.

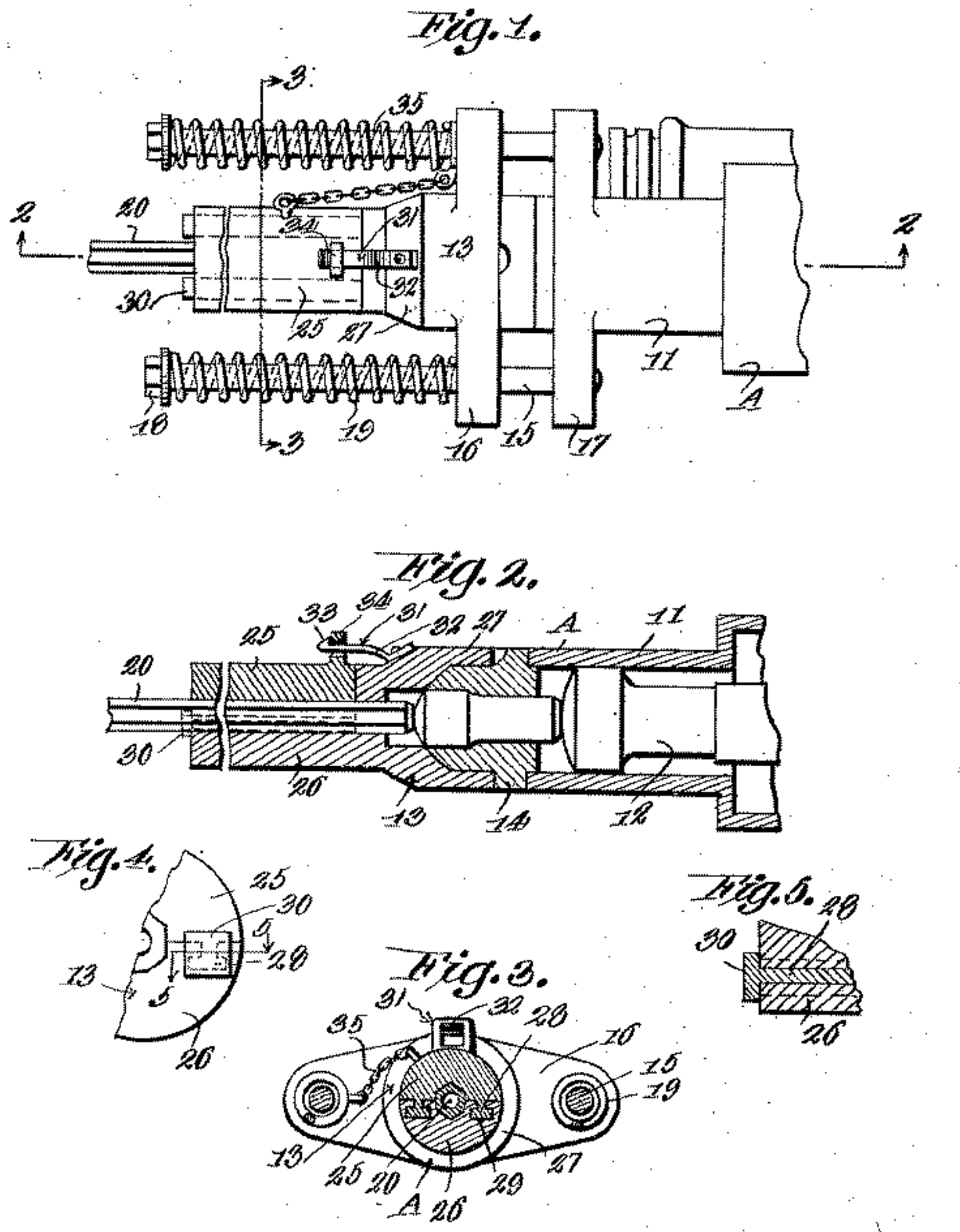
2. In a device of the character described, a hollow column terminating in a ball, a threaded member movable in the column, means engaging the threaded member for imparting motion to the same, and a bar held in the ball against rotation and slidably engaging the threaded member for preventing rotation thereof.

LEROY E. RIDGEWAY.

June 24, 1930. P. L. SAVAGE ET AL 1,768,216

HAMMER DRILL

Original Filed Jan. 16, 1928



WITNESSES
[signature]

INVENTOR.
PARIS L. SAVAGE
WILLIAM RHODES
BY
Irving L. McCathran
ATTORNEY.

Patented June 24, 1930 **1,768,216**

UNITED STATES PATENT OFFICE

PARIS L. SAVAGE, OF BISBEE, ARIZONA, AND WILLIAM RHODES, OF LONG BEACH, CALIFORNIA; SAID RHODES ASSIGNOR TO JOHN VALDIN, OF BISBEE, ARIZONA

HAMMER DRILL

Original application filed January 16, 1928, Serial No. 247,124. Divided and this application filed December 22, 1928. Serial No. 328,022.

This invention appertains to hammer drills and is a division of our application filed January 16, 1928, Serial No. 247,124.

The primary object of the present invention is to provide an improved means for constructing the front head of hammer drills, whereby the head can be quickly dismantled for facilitating the removing and placing of drill bits in position.

Another important object of the invention is the provision of a sectional front head for hammer drills with novel means for detachably connecting said sections together the construction of the head permitting the use of and the quick changing of relatively long steels or bits.

With these and other objects in view, the invention consists in the novel construction, arrangement and formation of parts, as will be hereinafter more specifically described, claimed and illustrated in the accompanying drawing, in which drawing:—

Figure 1 is a fragmentary top plan view of the front head of a hammer drill, showing the novel construction of said head,

Figure 2 is a longitudinal section through the same taken on the line 2—2 of Figure 1, looking in the direction of the arrows,

Figure 3 is a transverse section taken on the line 3—3 of Figure 1, looking in the direction of the arrows,

Figure 4 is a fragmentary front end elevation of the hammer drill showing one of the dust lugs carried by the removable section of said head for covering the tongue and groove connection between the sections of the head, and

Figure 5 is a fragmentary detail section through the front of the head showing one of the dust lugs.

Referring to the drawing in detail, wherein similar reference characters designate corresponding parts throughout the several views, the letter A generally indicates a portion of a pneumatic hammer drill, which includes the forwardly extending cylinder 11 having reciprocally mounted therein a piston 12. Forwardly of the cylinder 11 is arranged a front head 13 and confined between the front head 13 and the cylinder 11 is the cylinder bushing 14. These parts are held in place by the front head bolts 15 which are extended through suitable ears 16 and 17 formed respectively on the head and cylinder. The forward ends of the front head bolts 15 receive nuts 18 and expansion springs 19 are confined between the nuts and the ears 16.

The front head construction forms the important feature of the present invention and will now be described. This head 13 supports the drill steel or bit 20 and the head is so constructed as to permit the operator of the machine to change a drill steel six inches longer than the old style front head, which is very important and which saves time and labor in the changing of bits or drill steels.

This head 13 includes a removable semi-cylindrical portion 25 at the extreme front end thereof and forms a companion portion for the rigid semi-cylindrical portion 26, which is an integral part of the body portion 27 of said front head. In order to hold the removable portion 25 in place, we provide a T-shaped tongue and groove connection 28 and 29 between the companion portions 25 and 26 as clearly shown in Figure 3 of the drawing. The tongue and the walls of the groove can be provided with a slight taper, if so preferred, which will eliminate lateral movement of the detachable section.

In order to prevent the entrance of foreign matter into the front head between the tongues and grooves, lugs 30 are moulded on the removable semi-cylindrical section 25 of the front head, which extends over the grooves of the rigid semi-cylindrical section 26. When the removable section is in assembled position, the inner end thereof abuts against the body portion 27 of the front head, while the lugs 30 abut against the semi-cylindrical rigid section 26 and cover the ends of the grooves 29.

A latch 31 is provided, as shown in Figure 2 of the drawings, for preventing the accidental displacement of the removable section 25. This latch, as shown, includes a resilient latch bar or dog 32 which is riveted or otherwise secured to the body portion 27 of the front head. This resilient latch bar or dog 32 projects forwardly from said body portion and is provided with a tooth 33 at its extreme forward end. The detachable section 25 is provided with a keeper 34 and when said section is slid into operative position, the latch or dog 32 will slide into the keeper and the tooth 33 thereof will engage the keeper and hold the section in position. The latch bar or dog 32 can be readily actuated by the thumb of the operator, as it is merely necessary to press this latch or dog until the tooth thereof rides out of engagement with the front of the keeper after which the removable section can be pulled forwardly.

A short piece of chain 35 is attached to the removable section 25 and to one of the front head bolts 15, so as to prevent loss of the removable section.

It is obvious from the foregoing that a front head has been provided which will permit the use of longer drill steels with the apparatus and which will permit the convenient changing of said drill steels.

Changes in details may be made without departing from the spirit or the scope of this invention.

What we claim as new is:

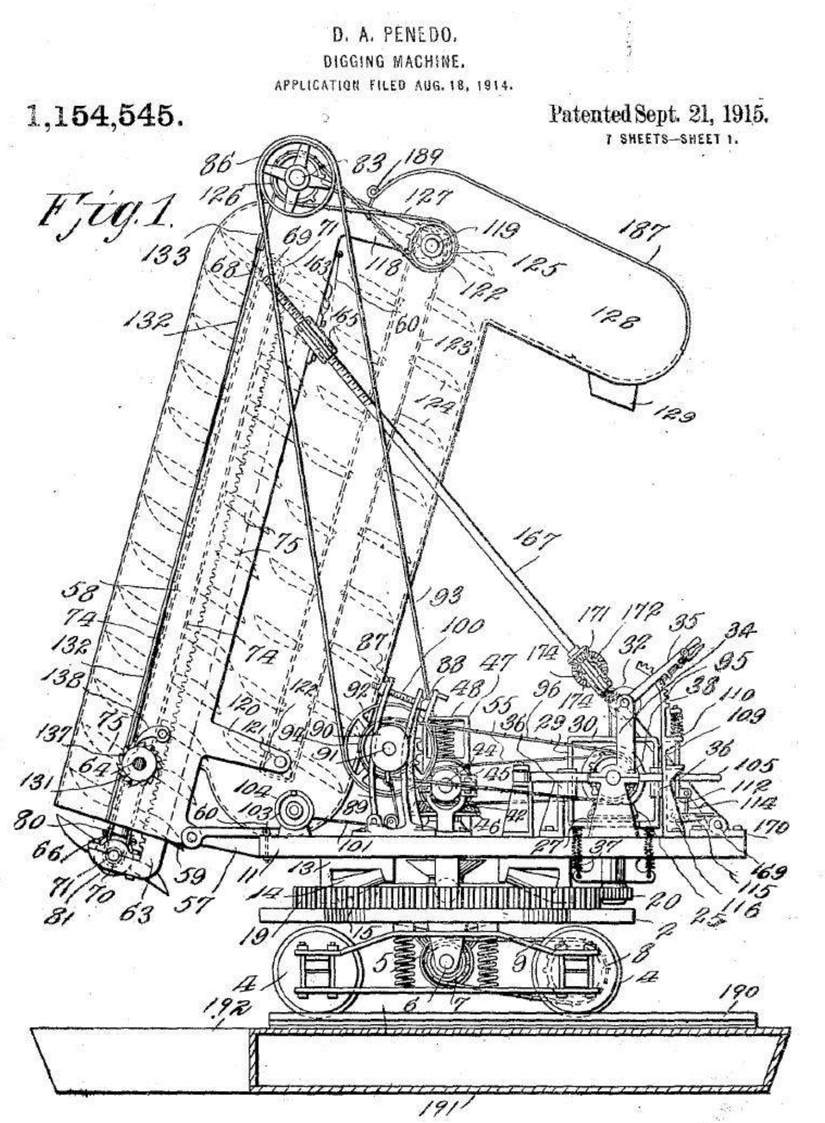
1. A front head for hammer drills comprising a body, a semi-cylindrical extension on said body, a companion semi-cylindrical extension each having a portion of a guide-way therein for a drill bit, a tongue and groove connection between said extensions, latch plates for normally covering the tongue and groove connection at the outer end of the head, and a latch for engaging the removable section carried by said body.

2. A front head for hammer drills for receiving a drill bit, comprising a body having an opening therein, for said drill bit, a semi-cylindrical extension on said body having a portion of a guide-way therein for the drill bit, a companion semi-cylindrical extension removably associated with the rigid extension having a companion guide-way portion for the drill bit, said removable extension being adapted to abut the body when in operative position, means for preventing lateral shifting movement of the removable extension relative to the rigid extension, and means for normally preventing forward shifting movement of the removable extension relative to the rigid extension.

In testimony whereof we affix our signatures.

PARIS L. SAVAGE.
WILLIAM RHODES.

Mining Machines



E. F. KELLUM.

MINING APPARATUS.

APPLICATION FILED AUG. 24, 1911.

1,020,649. Patented Mar. 19, 1912.

5 SHEETS—SHEET 1.

FIG. 2

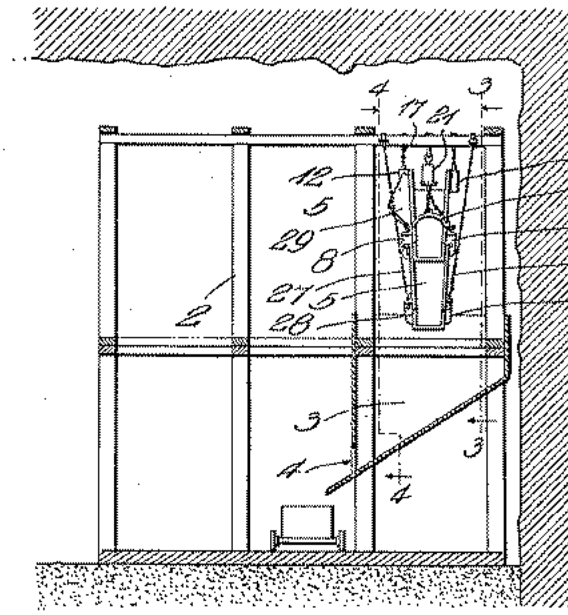
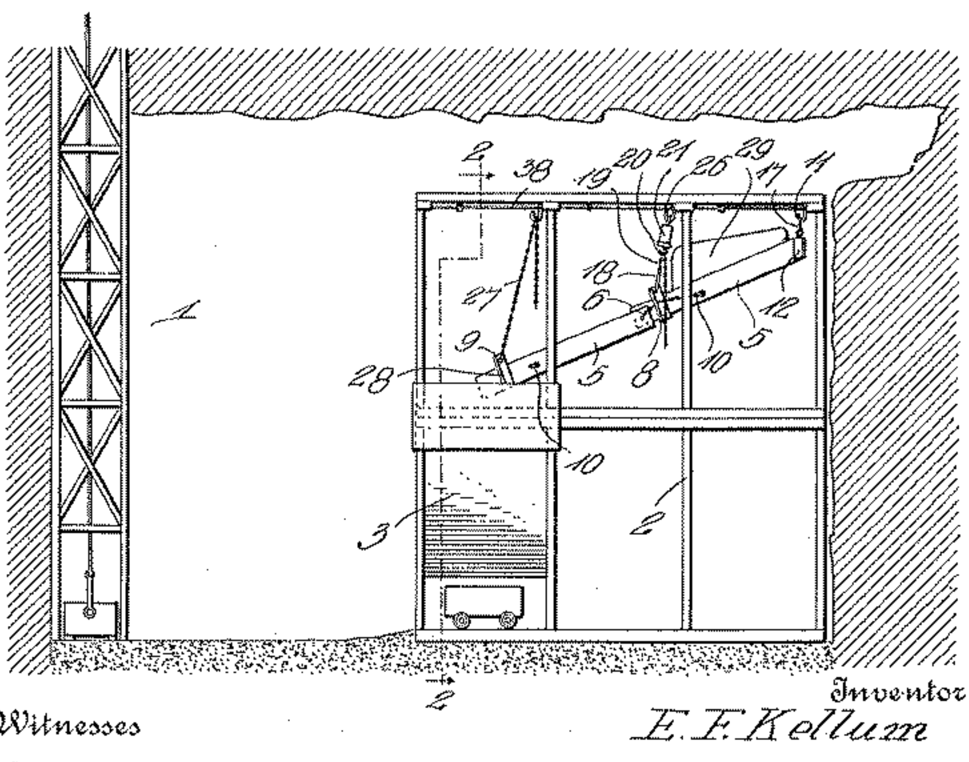


FIG. 1



Witnesses

C. [illegible]

C. E. Hunt

Inventor

E. F. Kellum

by A. B. Willson & Co.

Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

E. F. KELLUM.

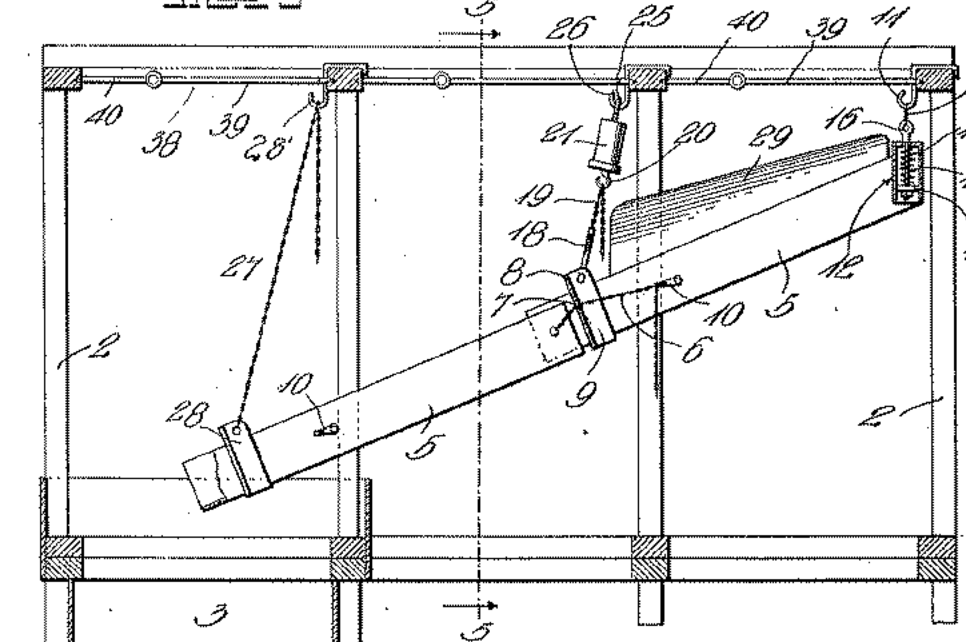
MINING APPARATUS.

APPLICATION FILED AUG. 24, 1911.

1,020,649. Patented Mar. 19, 1912.

5 SHEETS—SHEET 2.

Fig. 3



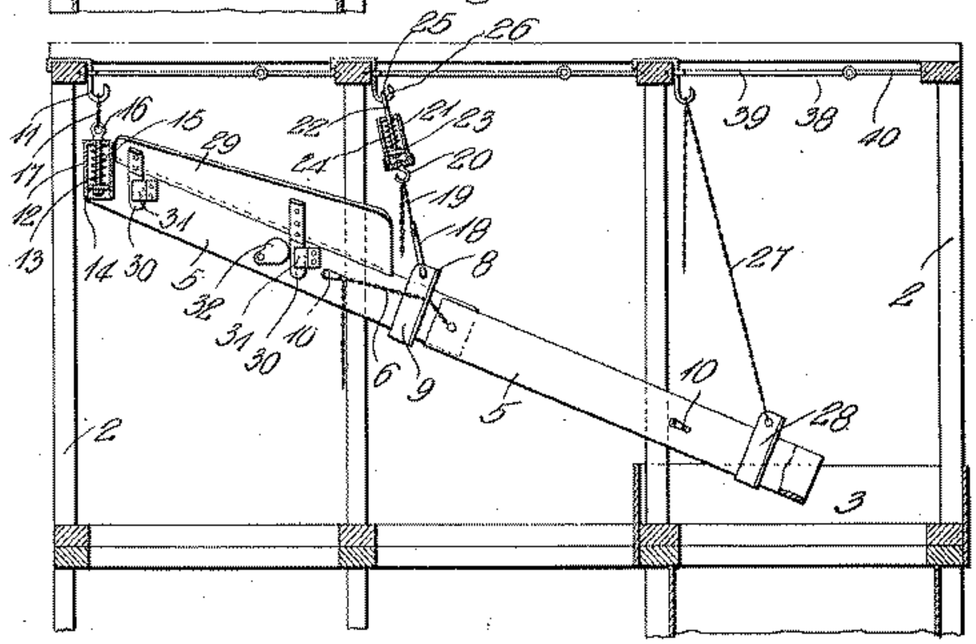


Fig. 4

Witnesses

C. Resentier

C. E. Hunt.

Inventor

E. F. Kellum

by H. B. Willson & Co

Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

E. F. KELLUM.
MINING APPARATUS.
APPLICATION FILED AUG. 24, 1911.

1,020,649.

Patented Mar. 19, 1912.

5 SHEETS—SHEET 3.

Fig. 5

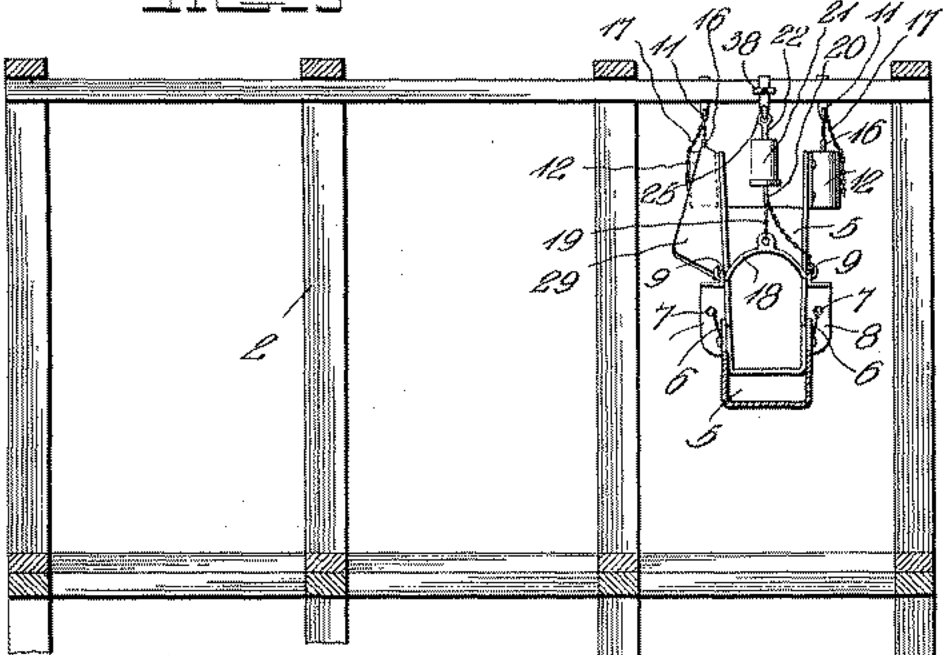


Fig. 7

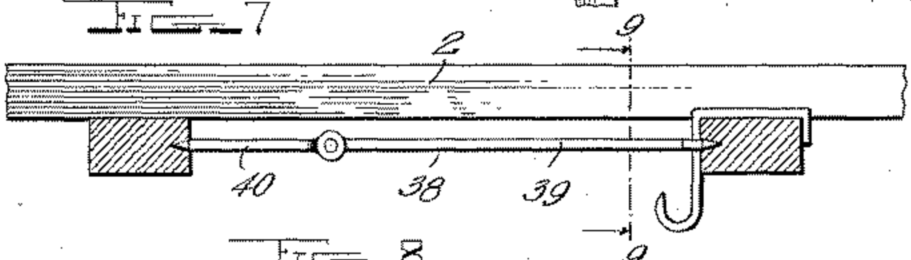


Fig. 8

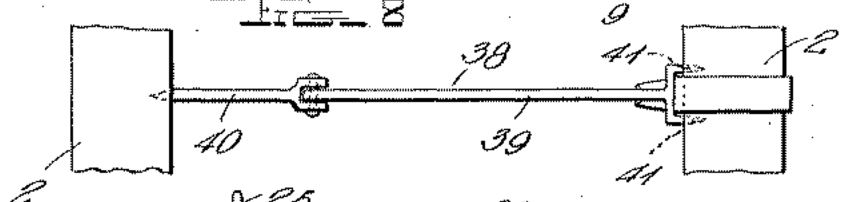
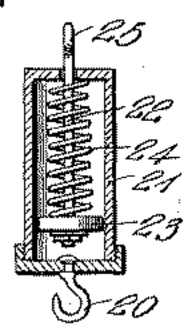


Fig. 6



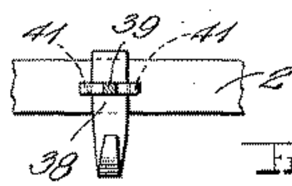


Fig. 9

Inventor

Witnesses

E. F. Kellum

by A. B. Willson & Co.

Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

E. F. KELLUM.
MINING APPARATUS.
APPLICATION FILED AUG. 24, 1911.

1,020,649. Patented Mar. 19, 1912.

6 SHEETS—SHEET 4.

Fig. 10

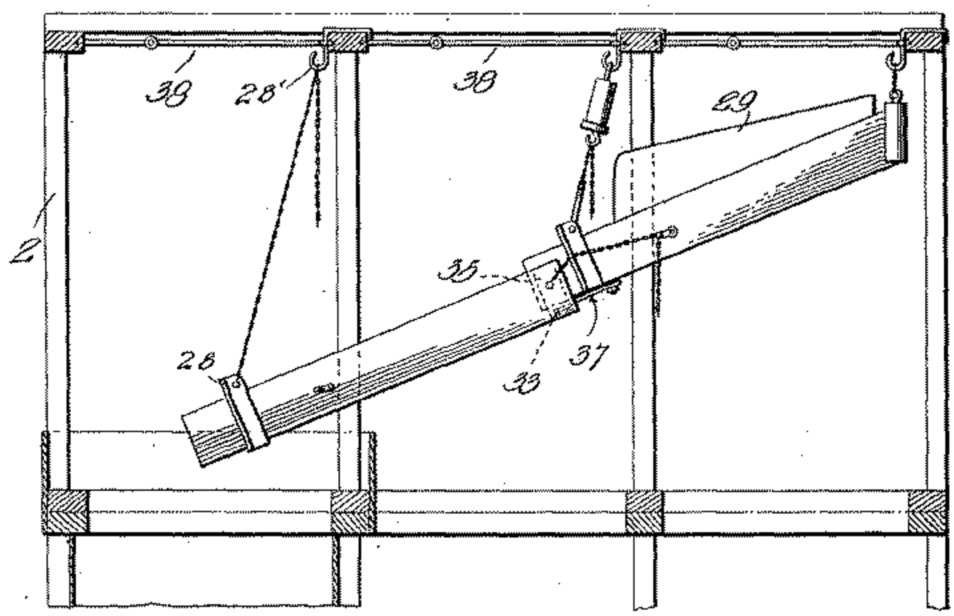


Fig. 11

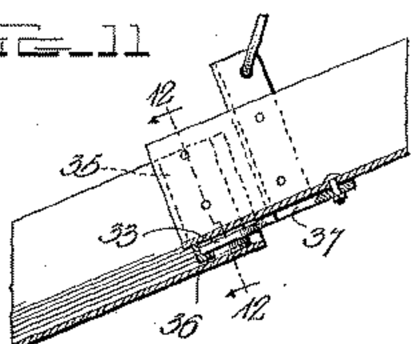
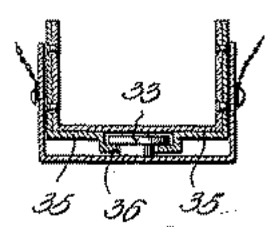


Fig. 12



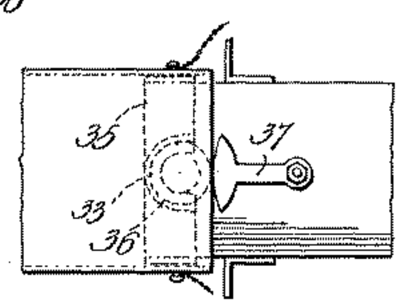


Fig. 13

Inventor

Witnesses

E. F. Kellum

C. Clendler

by A. B. Willson & Co.

Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

E. F. KELLUM.
MINING APPARATUS.
APPLICATION FILED AUG. 24, 1911.

1,020,649. Patented Mar. 19, 1912.

5 SHEETS—SHEET 5.

FIG. 14

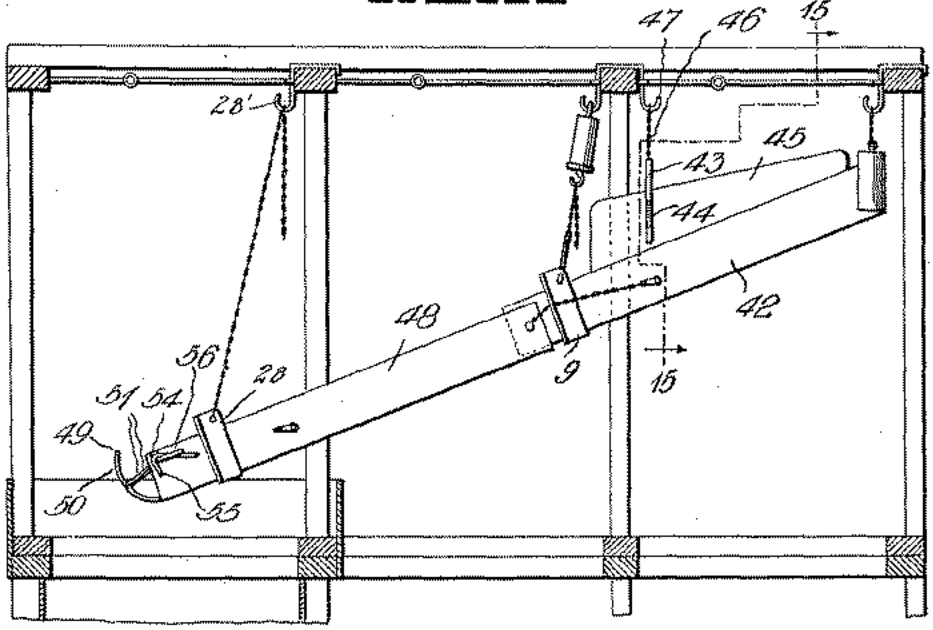


FIG. 15

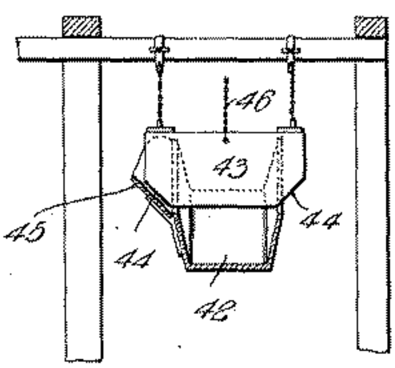


FIG. 16

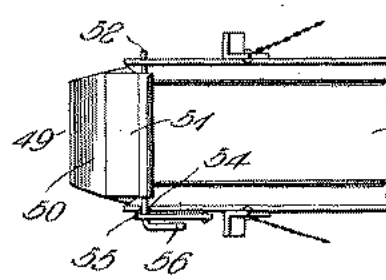


FIG. 19

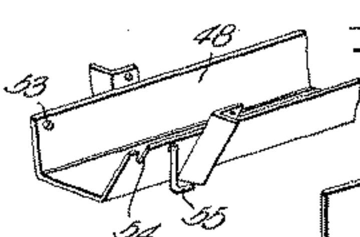


FIG. 18

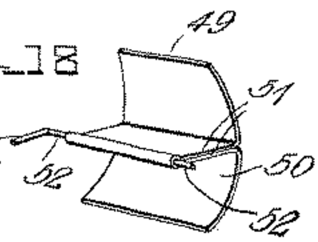


FIG. 17

Inventor

Witnesses

E. F. Kellum

C. C. Hunt.

by H. B. Willson & Co.

Attorneys

UNITED STATES PATENT OFFICE.

ELMO FINLEY KELLUM, OF DON LUIS, ARIZONA.

MINING APPARATUS.

1,020,649. Specification of Letters Patent. Patented Mar. 19, 1912.

Application filed August 24, 1911. Serial No. 645,696.

To all whom it may concern:

Be it known that I, ELMO F. KELLUM, a citizen of the United States, residing at Don Luis, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Mining Apparatus; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in mining apparatus.

One object of the invention is to provide an apparatus of this character by means of which the handling of ore in mines will be greatly facilitated.

Another object is to provide an improved construction and arrangement of ore conducting slides formed in sections and having means whereby the same are adjusted to the desired inclination and which are adapted to be readily shifted to various parts of the workings, whereby the ore may be carried or directed thereby to the permanent chutes in the mine.

With these and other objects in view, the invention consists of certain novel features of construction, and the combination and arrangement of parts as will be more fully described and claimed.

In the accompanying drawings: Figure 1 is a vertical sectional view through a portion of a mine showing the construction and arrangement of the invention; Fig. 2 is a similar view on the line 2—2 of Fig. 1; Fig. 3 is a vertical sectional view on the line 3—3 of Fig. 2; Fig. 4 is a similar view on the line 4—4 of Fig. 2; Fig. 5 is a vertical transverse sectional view on the line 5—5 of Fig. 3; Fig. 6 is a detail vertical sectional view through one of the yielding supporting devices for the slides; Fig. 7 is a detail sectional view through a portion of the frame showing the manner in which the slide supporting hooks are secured to the frame; Fig. 8 is a plan view of the parts shown in Fig. 7; Fig. 9 is a detail cross sectional view on the line 9—9 of Fig. 7; Fig. 10 is a vertical sectional view through a portion of the frame showing a modified construction of the slides; Fig. 11 is a detail vertical longitudinal sectional view through a portion of the slides shown in Fig. 10 illustrating the manner in which the sections of the slides are secured together; Fig. 12 is a cross sectional view on the line 12—12 of Fig. 11; Fig. 13 is a bottom plan view of the parts shown in Fig. 11; Fig. 14 is a view similar to Fig. 3 showing a modified arrangement of the slides in which they are provided with doors; Fig. 15 is a vertical section taken on the line 15—15 of Fig. 14; Fig. 16 is a plan view of the lower end of the lower section of the modified arrangement of the slide; Fig. 17 is a detail perspective view of the door for the upper slide section of the slide; Fig. 18 is a similar view of the door or closure for the lower section of the slide. Fig. 19 is a detail perspective view of the lower end of the lower section of the slide.

Referring more particularly to the drawings, 1 denotes a drift in a mine in which my improved apparatus is arranged and from which the ore is removed by stoping and which may be one-thousand feet or more under ground.

The invention is to be applied to the usual frame work 2 which is arranged in the drift or stope and which consists of sills arranged on the floor of the stope and having secured thereto a series of uprights, preferably about seven feet high for each floor of the frame, said frame being any desired number of "sets" high, in the present instance the frame is shown as consisting of two floors or "sets." The uprights are connected at their upper ends by oppositely disposed beams or joists arranged to form the "square sets." Arranged at a suitable location in the lower floor of the frame is a permanent or stationary ore discharging chute 3 having its bottom inclined toward one side in which is formed a discharge opening 4 whereby the ore may be delivered from the chute into a car or receptacle. Connected at its lower end with the upper end of the chute 3 and extending upwardly at a suitable angle and in any desired direction into the upper slides of the frame is one or more ore receiving slides 5 whereby the ore from the upper portion of the stope or drift is carried down and discharged into the chute. The slides 5 are each formed of a series of sections of which there may be any number two being herein shown. The lower end of the upper section of the slides is of slightly less width than the upper end and the said lower end of the upper slide section over-laps and fits into the upper end of the adjoining lower section, said engaging ends of the sections being secured together by chains 6, which are secured to the upper end of the lower section and pass through guide apertures 7 arranged in stop flanges 8, formed on reinforcing straps, or U-shaped hanger bars or stirrups 9 secured to the upper section of the slides adjacent to its lower end as shown clearly in Figs. 3 and 4. The chains 6 after passing through the apertures in the flanges 8 of the hanger are engaged with hooks 10 secured to the outer sides of the upper slide section as shown.

The upper sections of the slides are yieldingly and detachably secured to hooks or hangers 11 secured to the upper joists or beams of the frame, said upper ends of the slide sections having secured to their opposite sides spring casings 12 in which are arranged piston rods 13 having on their inner ends pistons 14 between which and the upper ends of the casings are arranged coiled springs 15. The upper ends of the piston rods 13 are slidably engaged with openings of the casings and have formed on their upper ends, eyes 16 to which are connected the lower ends of hanger chains 17, adapted to be engaged with the hooks or hangers 11 on the frame thereby yieldingly supporting the upper ends of the slides.

The lower end of each upper slide section and the upper end of each lower section are yieldingly supported by a bail 18 connected to the upper ends of the hanger bar or stirrup 9 and to which is connected the lower end of a chain 19, the upper portion of which is adapted to be adjustably connected to a hook 20 arranged on the lower end of a cylinder 21. In the cylinder 21 is arranged a piston rod 22, having on its inner end a piston 23 between which and the upper end of the cylinder is arranged a coiled spring 24. The outer end of the piston rod 22 is provided with an eye 25 which is connected with a hook or hanger 26 secured to the adjacent joist or beam of the frame. The lower end of the lower section of the slide is supported by means of chains 27, the lower ends of which are secured to a stirrup 28 on the lower end of the sections while the upper ends of said chains are secured to hangers 28′ secured to the adjacent joist or beam of the frame. By thus constructing and arranging the supporting devices, it will be readily seen that the slides will be yieldingly supported and may be adjusted by lengthening or shortening the hanger chains to change the slides to any desired angle or inclination. By this arrangement of supports the position of the slides may also be readily changed so that said slides may project in any direction from the permanent chute 3 of the frame.

Adapted to be detachably secured to one side of a slide section is an inclined or laterally deflected guide plate 29, to the lower portion of which are secured downwardly extending inclined lugs 30 which are adapted to be engaged with brackets or keepers 31 secured to the adjacent side of the slide section to which the plate is applied whereby said guiding plate is held in position. The lugs 30 are held in engagement with the brackets or keepers 31 by latches 32 which are pivoted to the side of the slide section thus securing the lugs 30 in engagement with the keepers.

In Figs. 10, 11, 12 and 13 of the drawings, is shown modified means for connecting the sections of the slides together, said connection in this instance comprising a flanged head 33 secured to the inner side of the upper end of the lower section of the slide and adapted to be engaged with a recess formed by the lower portion of a U-shaped hanger or stirrup 35 secured to the lower end of the upper section and having arranged therein a segmental seat 36 adapted to receive the head 33 on the lower section of the slide. The head 33 when thus engaged with the stirrup and seat in the upper section of the slide, is held in position by a latch 37 pivoted to the under side of the section as shown. In all other respects the construction and arrangement of the slide just described are the same as the slide described in the first part of the specification and a further description of these parts is not thought to be necessary.

The hangers with which the supporting devices and hanger chains of the slides are engaged are preferably secured to the beams or joists of the frame by means of fastening devices 38, said devices comprising bars 39 and 40 which are hingedly connected together at their inner ends as shown. The bar 39 has its outer end bifurcated or provided with a pair of sharp fastening prongs 41 which are adapted to straddle the hangers or hooks and to be forced into the adjacent portion of the joists or beams on each side of the hangers, as shown. The bar 40 has its outer end sharpened to form a barb or point which is forced into the beam or joist. The combined length of the two bars or sections of the fastening devices is greater than the space between the beams or joists engaged thereby so that when the prongs and point on the outer ends of the bars are engaged with the beams and the bars straightened out, said prongs and sharp end of the bars will be forced into the beams thus firmly holding the fastening devices in position and in operative engagement with the hangers whereby the latter are securely fastened to the beams.

While I have herein shown and described the preferred manner of supporting the slides, it is obvious that if desired the supporting springs may be dispensed with and

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the slides supported at their ends by one or more hangers and supporting chains similar to the arrangement of the chains 27 which support the lower ends of the lower section of the slide thus dispensing with the bail 18. By yieldingly supporting the slides as herein shown and described the same are prevented from being broken by heavy pieces of ore or rock thrown therein or by concussion resulting from blasting operations, the slide will yield to the pressure exerted while if rigidly secured it would be liable to break. By forming the slides in sections the length of the same may be increased or diminished as required.

In the modified arrangement of the slide shown in Figs. 14 and 15 the upper section 42 of the slide has arranged thereon near its lower end a door 43 comprising a metal plate which is adapted to fit on the upper edges of the sides of the slide and which has its lower outer corners beveled or cut off at an angle as shown at 44, whereby the ends of the plate will fit closer against the inclined guiding or deflecting plate 45 arranged on the side of the slide which corresponds to the plate 29 shown in the first form of the invention. The plate or door 43 is supported in position at the end of the slide by a chain 46 adapted to be adjustably connected with a hanger 47 arranged on the adjacent over-head cross bar of the supporting frame. In the outer end of the lower section 48 of the slide is arranged a door or closure 49 comprising a curved plate 50 which tapers from one end toward the other and which has formed on its concaved side adjacent to its wider end a laterally projecting attaching flange 51 in which is secured a shaft 52. The ends of the shaft 52 project beyond the side edges of the flange 51 and form pintles one of which is engaged with a bearing aperture 53 formed in one side of the slide while the other pintle is engaged with a bearing notch 54 formed in the opposite side of the slide. The pintle or end of the shaft is held in operative engagement with the notch 54 by means of a hook 55 which is pivoted to the adjacent side of the slide and is adapted to be hooked over the pintle or end of the shaft as shown. The pintle or end of the shaft which engages the notch 54 is preferably extended and bent at an angle to form a crank handle 56 whereby the shaft may be rocked to swing the narrow end of the plate into and out of engagement with the slide thereby closing and opening the lower or discharge end of the same. These doors 43 and 49 are designed to convert the slide into a chute having discharge regulating means.

While I have herein shown and described the slide sections having the doors or closures as a modified form of the invention it is obvious that the doors or closures shown in the modification may be applied to the preferred form of the slides if desired.

From the foregoing description taken in connection with the accompanying drawings, the construction and operation of the invention will be readily understood without requiring a more extended explanation.

Various changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention as claimed.

Having thus described my invention, what I claim as new is:

1. In a mining apparatus a supporting frame, a chute arranged therein, a slide having its lower end arranged to discharge into said chute, said slide being formed of a plurality of sections, the lower end of one section fitting into the upper end of the adjoining section, stirrups secured to the lower end of one section, and having formed thereon laterally extending flanges provided with guide apertures, means detachably and adjustably connecting the adjacent ends of adjoining sections and passing through the guide apertures in said flanges, and means to yieldingly and adjustably connect the slides with the upper frame.

2. In a mining apparatus a supporting frame, a slide arranged therein, said slide being formed of upper and lower sections, means to secure said sections together, spring casings secured to the upper end of the upper section, spring retracted rods arranged in said casing, hanger chains secured to the upper ends of said rods, hangers secured to the upper beams or joists of the frame and adapted to receive said chains, a stirrup secured to the lower end of the upper section, a bail secured to said stirrup, a hanger secured to the joists above said lower end of the upper slide section, a spring casing, a spring retracted rod arranged in said casing and having its outer end engaged with said hanger, a hook on the lower end of said casing, a chain secured to said bail and adapted to be adjustably engaged with said hook, whereby the lower end of the upper section and the upper end of the lower section of the slide are supported and hanger chains secured to the lower end of the lower section of the slide, whereby said end is adjustably supported.

3. In a mining apparatus a supporting frame comprising sills, a series of uprights secured to said sills, joists to connect the upper ends of said uprights, a series of hangers engaged with said joists, hanger fastening devices, said devices comprising hingedly connected bars, prongs formed on the outer end of one of said bars, a point formed on the outer end of the other bar, said pointed and pronged ends of the bars being adapted to be engaged with the joists

or beams with which said hangers are engaged with the said prongs strengthening the hangers whereby when the bars are straightened out the points and prongs on the outer ends thereof will be forced into the joists thus securing said bars and the hangers in place, a chute arranged in said frame, a slide positioned to discharge into said chute, said slide being formed in a plurality of separable sections, means to detachably connect said sections together and means to yieldingly and adjustably connect the same with said hangers.

4. In a mining apparatus a supporting frame, a chute arranged therein, a slide positioned to discharge into said chute, said slide being formed in a plurality of separable sections, the engaging end of one of which over-laps or fits into the adjoining end of the other section, a flanged head formed in the engaging end of one of said sections, a hanger secured to the end of the adjacent section, a seat arranged in said hanger and adapted to receive the head of the other section, a latch adapted to secure said head in engagement with said seat and means to yieldingly and adjustably secure said sections of the slides into the frame.

5. In a mining apparatus, a supporting frame, a slide arranged therein and formed of a plurality of detachably connected sections, hanger stirrups secured to one end of each of said sections, apertured flanges formed on said hangers, hooks secured to the sides of the sections, connecting chains secured to one section and passing through the apertures in said flanges and engaging with the hooks on the adjacent section, whereby said sections are detachably secured together, means for adjustably securing said sections to said supporting frame, an inclined deflecting plate, and means for detachably securing said plate to one side of a slide section.

6. In an apparatus of the character described, a supporting frame, a chute arranged therein, a slide mounted with its lower end disposed over said chute, said slide comprising a plurality of detachably connected sections, a door plate adapted to be engaged with the upper section of the slide, a hanger, a supporting chain attached to said plate and adapted to be engaged with said hanger whereby the plate is removably supported in operative engagement with the slide section, and a closure pivotally and removably secured in the discharge end of the lower section of the slide.

7. In an apparatus of the character described a supporting frame, a chute arranged therein, a slide mounted with its lower end disposed over said chute, said slide comprising a plurality of detachably connected sections, a plate removably engaged with the lower end of the upper section of the slide, a door or closure arranged in the discharge end of the lower section of the slide, said door or closure comprising a curved plate having its side edges tapered from one end toward the other to fit between the inclined sides of the chute when in an operative engagement therewith, a laterally extending flange formed on the concave side of the plate, a shaft arranged in said flange, said shaft having its ends projected to form pintles adapted to be engaged with open and closed bearings formed in the sides of the slide, a pivoted retaining member adapted to be engaged with the pintle in the open bearing of the slide section whereby the shaft is removably held in operative position, and a crank handle formed on one of said shaft ends or pintles whereby said door or closing plate may be swung into and out of operative engagement with the end of the sliding section.

In testimony whereof I have hereunto set my hand in presence of subscribing witnesses.

ELMO FINLEY KELLUM.

Witnesses:
W. H. Townsend,
M. M. Kehoe.

D. A. PENEDO.

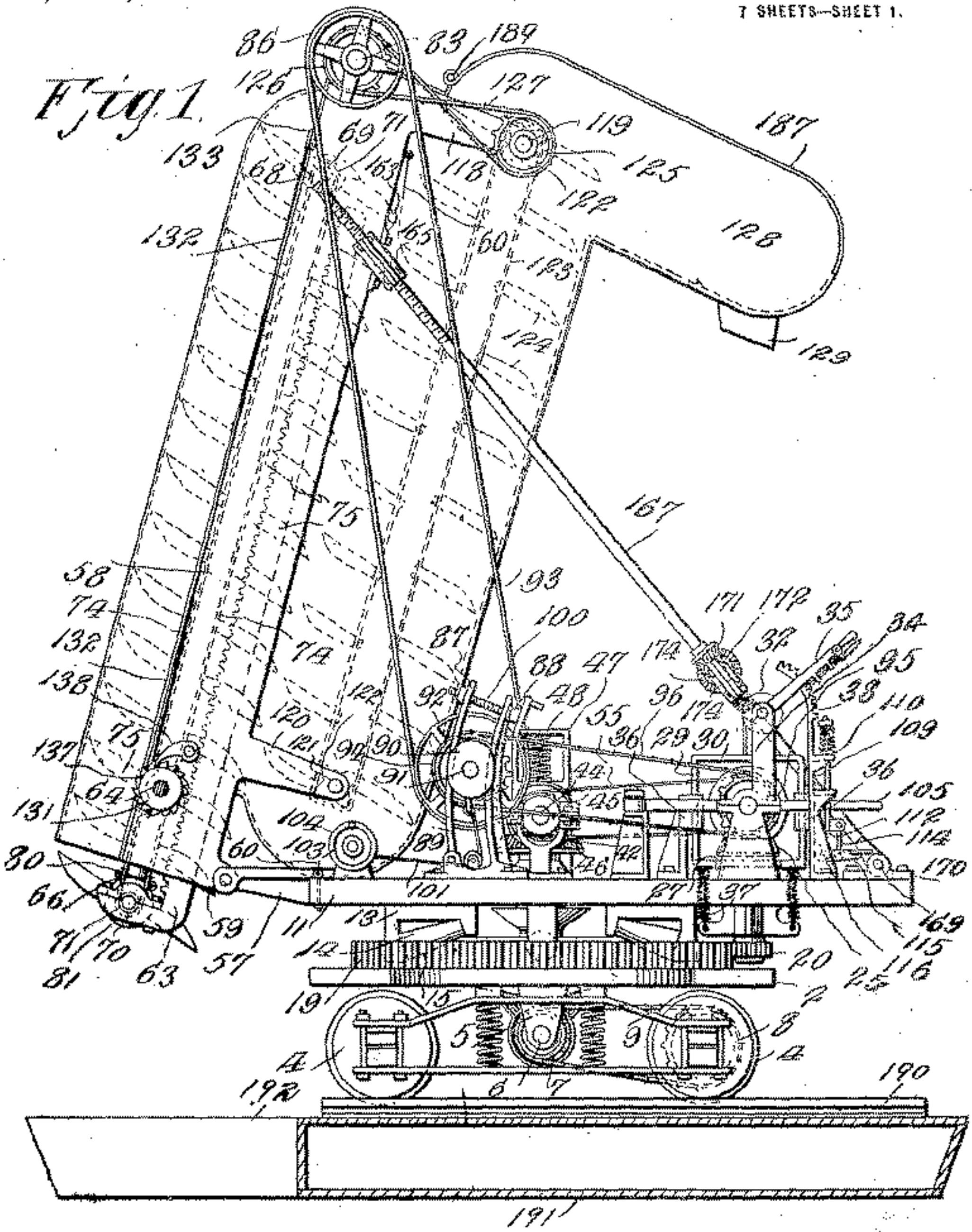
DIGGING MACHINE.

APPLICATION FILED AUG. 18, 1914.

1,154,545. Patented Sept. 21, 1915.

7 SHEETS—SHEET 1.

Fig. 1.



Inventor

Daniel A. Penedo,

Witnesses

Frank J. McCarthy

By Victor J. Evans

Attorney

D. A. PENEDO.
DIGGING MACHINE.
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7 SHEETS—SHEET 2.

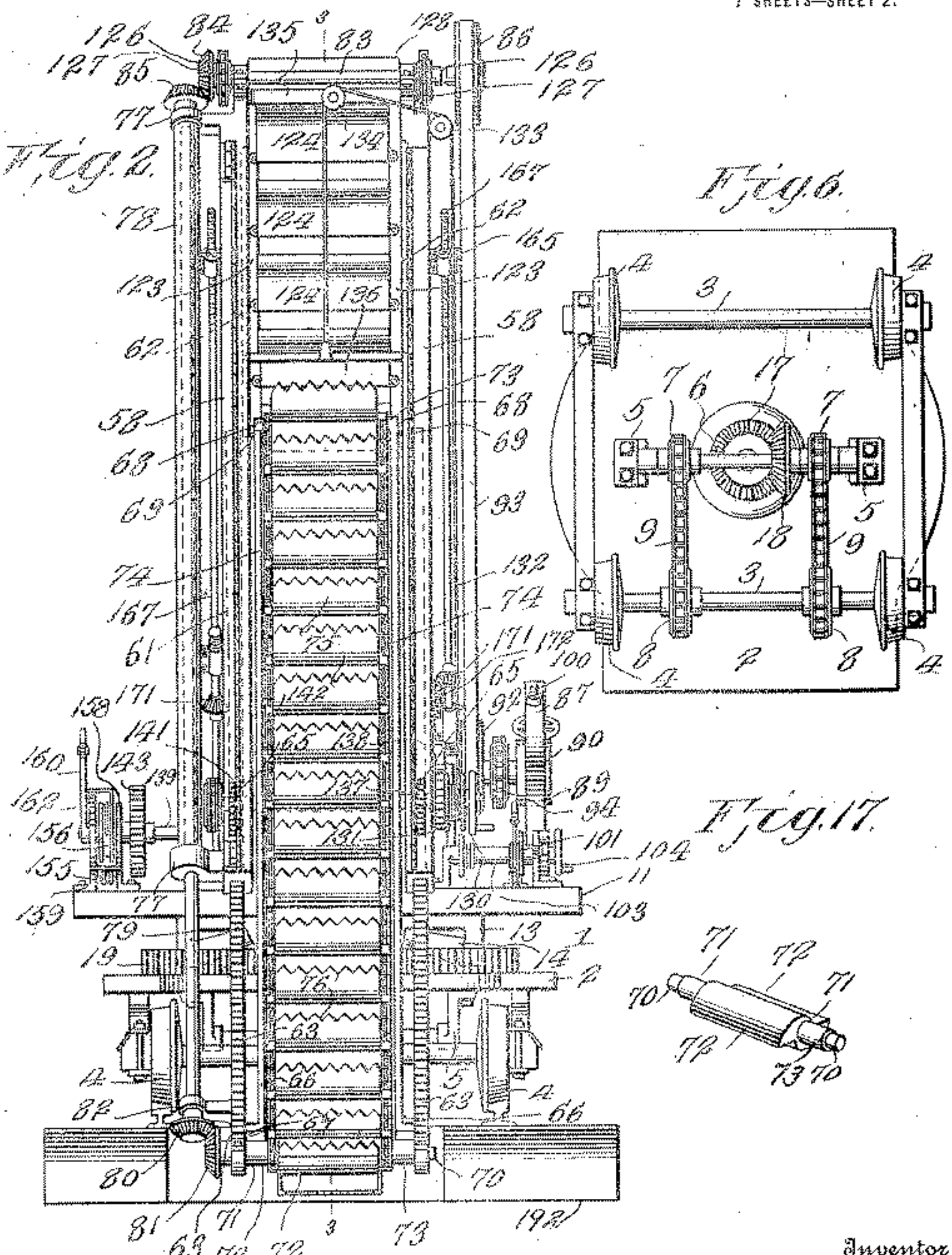

Fig. 2.

Fig. 6.

Fig. 17.

Inventor
Daniel A. Penedo,

Witnesses
Frank Hough
John J. McCarthy

By Victor J. Evans
Attorney

D. A. PENEDO.

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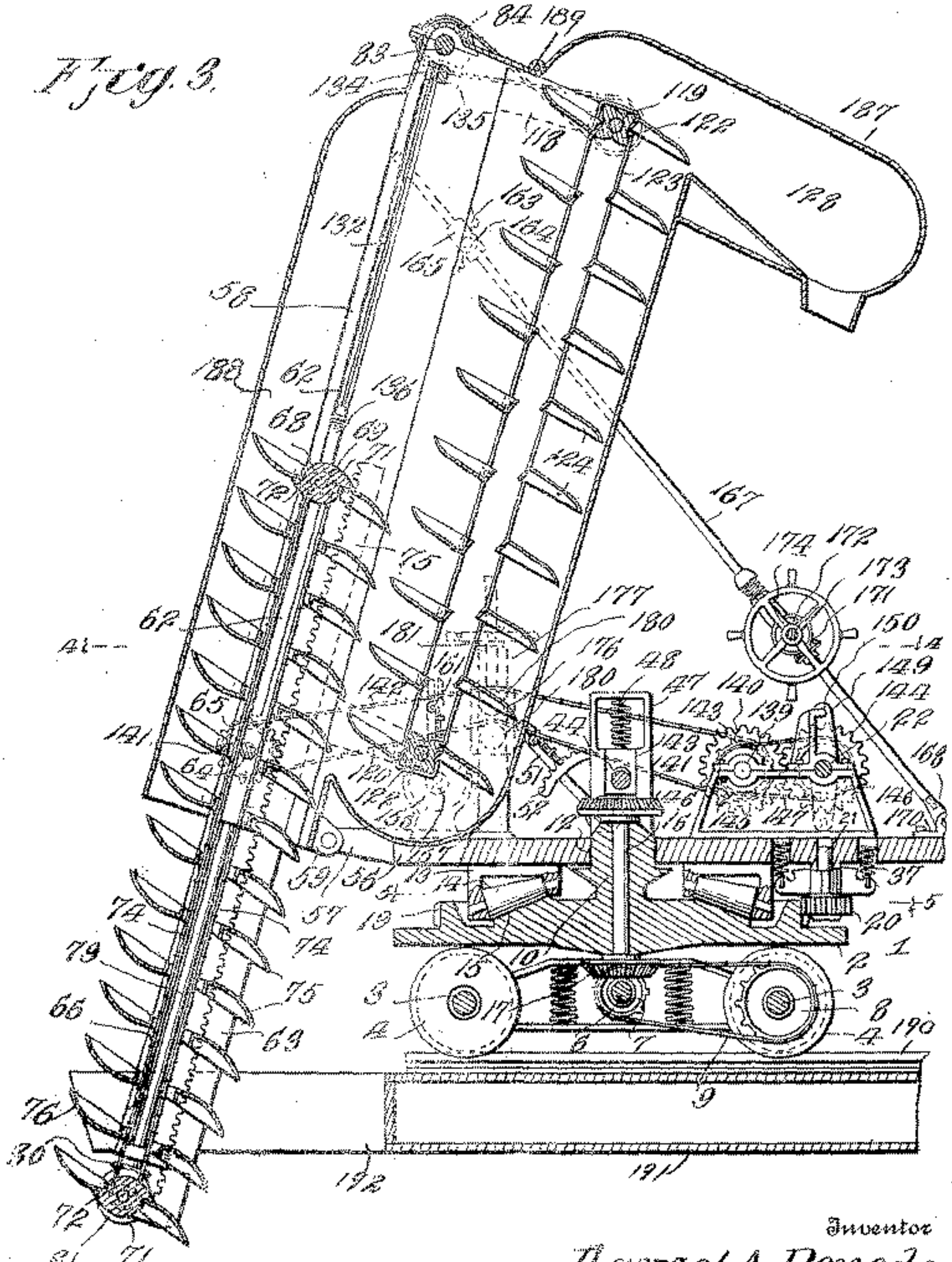
7 SHEETS—SHEET 3.

Fig. 3.



Inventor

Daniel A. Penedo,

By Victor J Evans

Attorney

Witnesses

Frank Hough

John J McCarthy

D. A. PENEDO.

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7 SHEETS—SHEET 4.

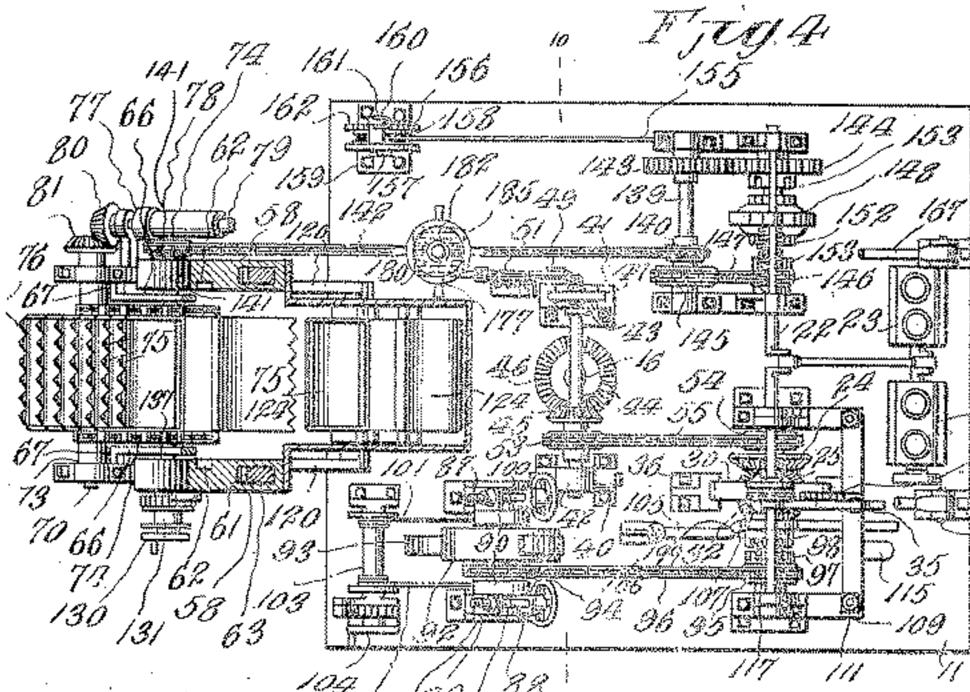


Fig. 4

Fig. 14

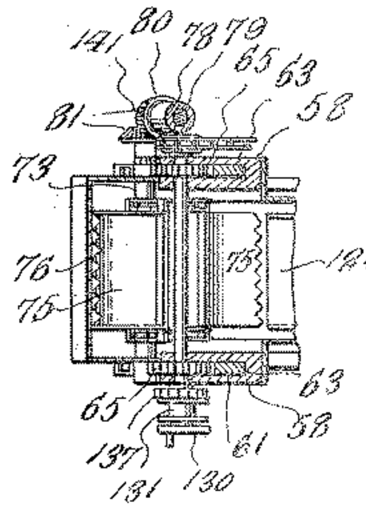
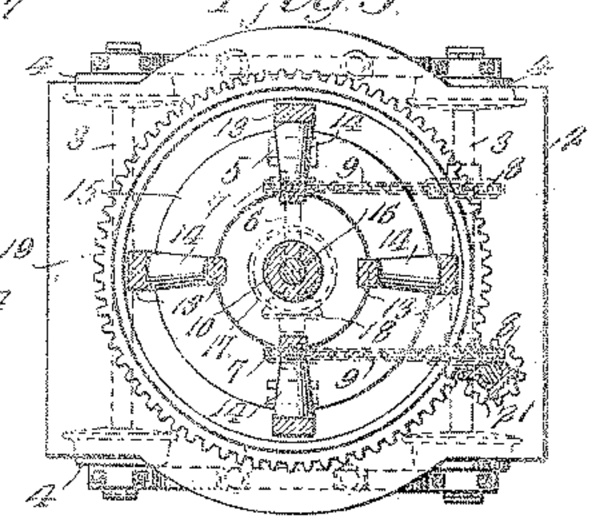


Fig. 5



Inventor

Daniel A. Penedo,

By Victor J. Evans

Attorney

Witnesses

Frank Hough

John J. McCarthy

D. A. PENEDO.
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7 SHEETS—SHEET 5.

Fig. 7.

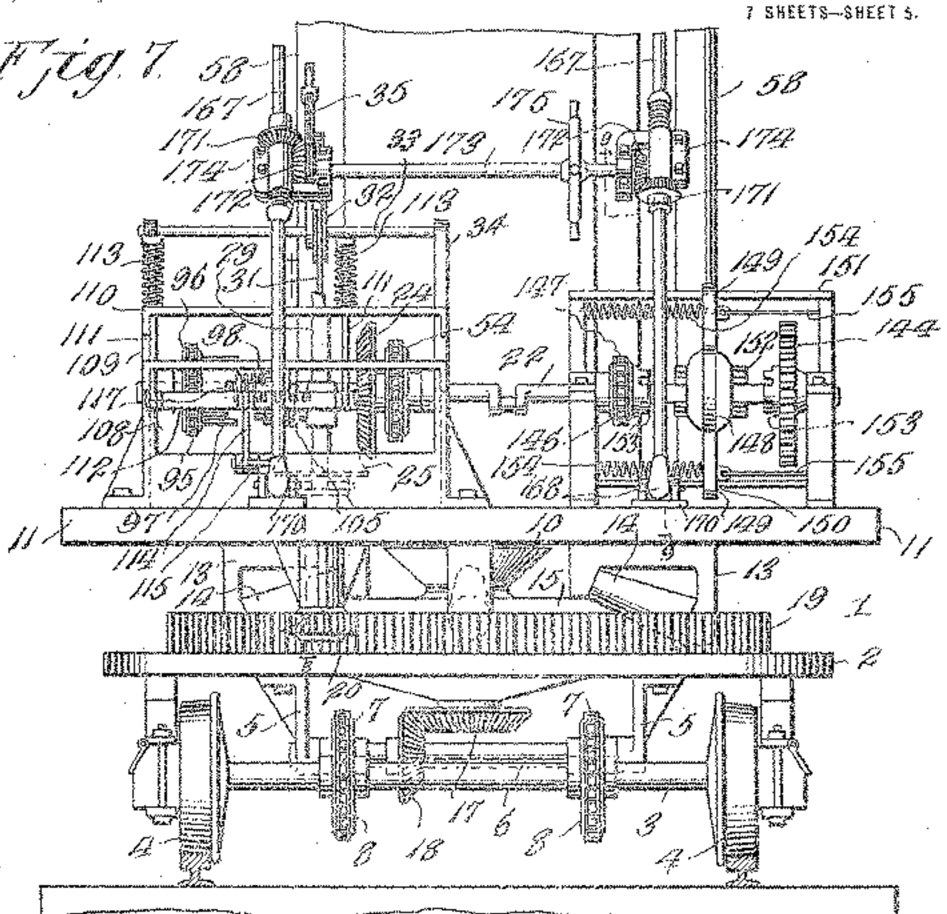


Fig. 8.

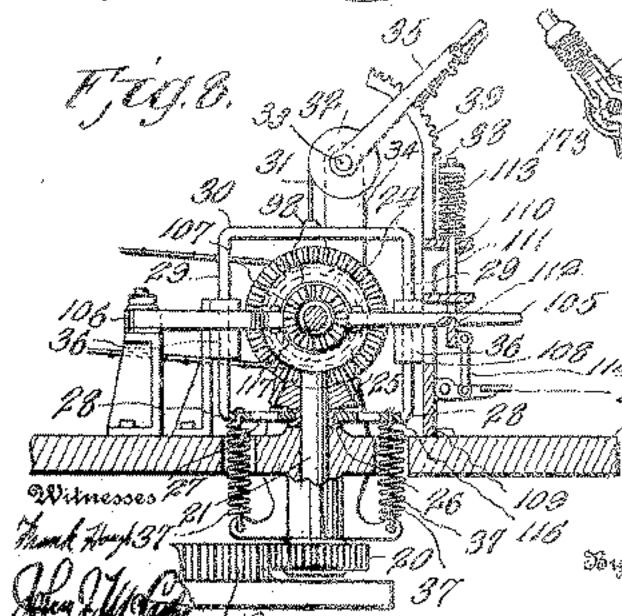
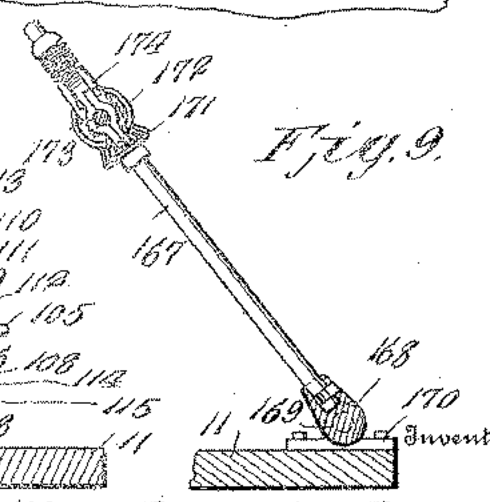


Fig. 9.



Witnesses
Frank Hough
John J. McCarthy

Inventor
Daniel A. Penedo
By Victor J. Evans
Attorney

D. A. PENEDO.
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APPLICATION FILED AUG. 18, 1914.

1,154,545.

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7 SHEETS—SHEET 6.

Fig. 10.

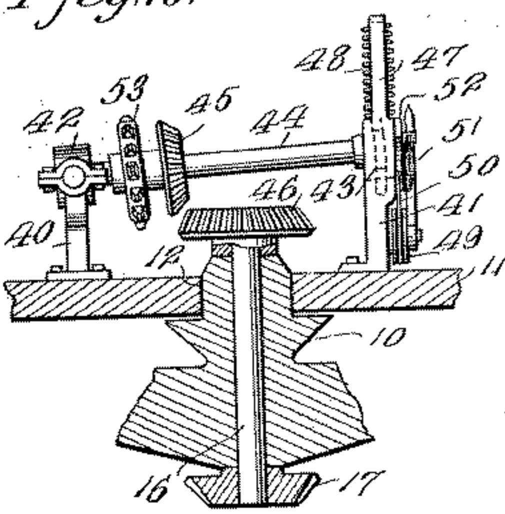


Fig. 11.

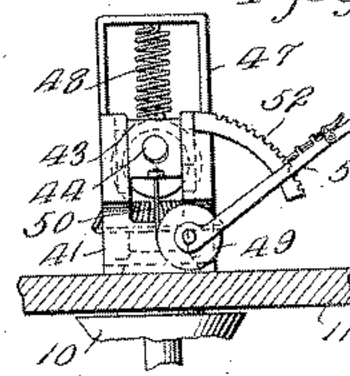
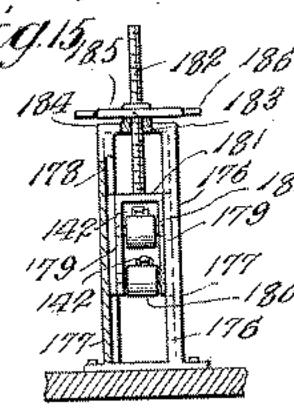


Fig. 15.



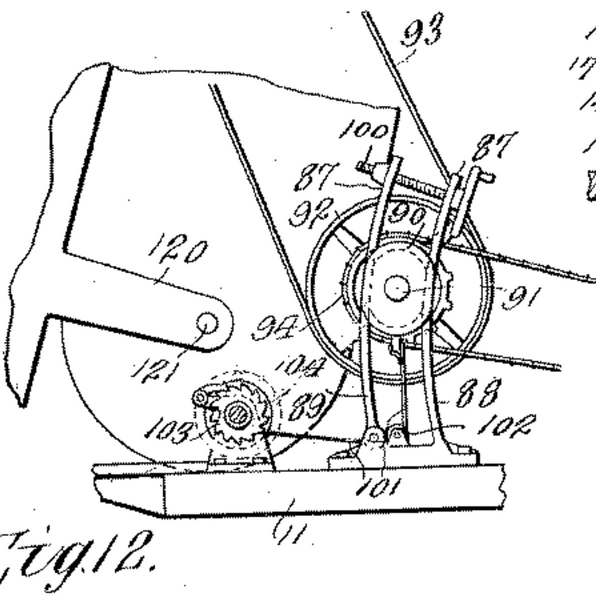


Fig. 12.

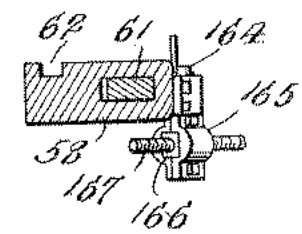


Fig. 16.

Witnesses
Frank Hough
John J. McCarthy

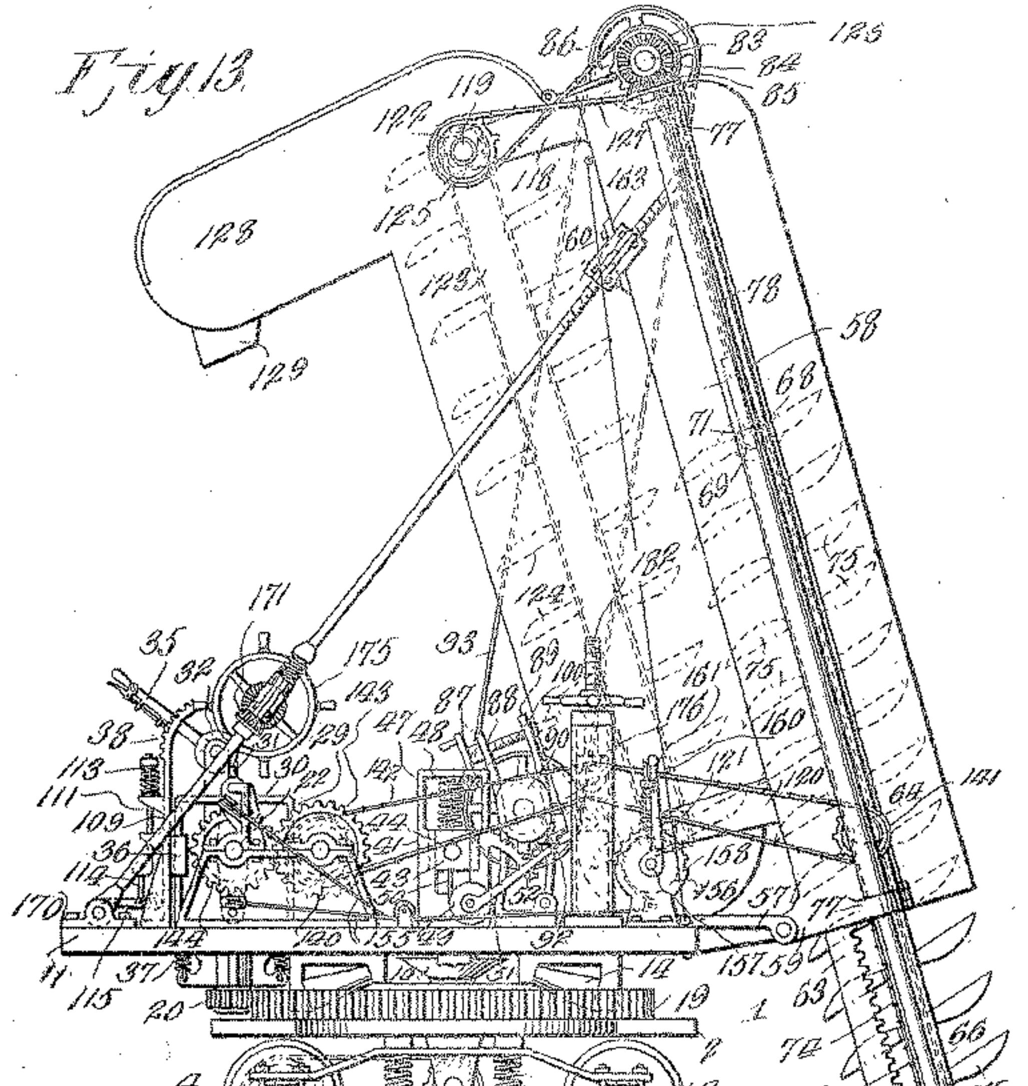
Inventor
Daniel A. Penedo,
By Victor J. Evans
Attorney

D. A. PENEDO.
DIGGING MACHINE.
APPLICATION FILED AUG. 18, 1914.

1,154,545. Patented Sept. 21, 1915

7 SHEETS—SHEET 7.

Fig. 13.



Witnesses
Frank Hough
John J. McCarthy

Inventor
Daniel A. Penedo,
By Victor J. Evans
Attorney

UNITED STATES PATENT OFFICE.

DANIEL A. PENEDO, OF BISBEE, ARIZONA.

DIGGING-MACHINE.

1,154,545. Specification of Letters Patent. Patented Sept. 21, 1915.

Application filed August 18, 1914. Serial No. 857,401.

To all whom it may concern:

Be it known that I, DANIEL A. PENEDO, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented new and useful Improvements in Digging-Machines, of which the following is a specification.

This invention relates to improvements in digging machines and has particular application to a machine which may be used for dredging, excavating, conveying and analogous purposes.

In carrying out the present invention, it is my purpose to provide a machine of the class described which will embody among other features what may be termed a digger capable of vertical adjustment so that the same may be fed downwardly as the digging progresses and an endless conveyer in communication with the digger and adapted to receive the material therefrom in order that such material may be carried away to the desired point, means being provided whereby the digger and excavator may be swung simultaneously so that the digger may be disposed at any desired angle.

It is also my purpose to provide apparatus of the type set forth wherein the digging and conveying mechanism may be swung in an arc of a circle in order that the material may be excavated or conveyed from any desired point.

A further object of my invention is the provision of a digging apparatus which may be readily transported from place to place and which will be self-propelled and wherein the various controlling devices will be under the control of the engineer or operator so that the digger and conveyer may be shifted to any desired position and thrown into and out of operation at will.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of parts hereinafter set forth in and falling within the scope of the claims.

In the accompanying drawings; Figure 1 is a view in side elevation of a digging machine constructed in accordance with the present invention, the same being shown as mounted upon a pontoon for dredging purposes. Fig. 2 is a similar view taken at right angles to Fig. 1 showing the digger in lowered position. Fig. 3 is a vertical central sectional view through the machine. Fig. 4 is a horizontal sectional view therethrough, parts being shown in top plan. Fig. 5 is a similar view taken on a plane below the platform and showing the truck in top plan. Fig. 6 is a bottom plan view of the truck showing the driving mechanism therefor. Fig. 7 is a fragmentary rear elevation of the machine showing the side of the machine opposite from that illustrated in Fig. 2. Fig. 8 is an enlarged fragmentary vertical sectional view through the machine. Fig. 9 is a similar view on the line 9—9 of Fig. 7, illustrating the mechanism controlling the vertical adjustment of the digger. Fig. 10 is a fragmentary cross sectional view through the machine showing the controlling mechanism for the driving means of the truck. Fig. 11 is a fragmentary longitudinal sectional view through the machine showing the mechanism in Fig. 10 in end elevation. Fig. 12 is a fragmentary side elevation of the machine showing the tightening mechanism for the drive belt of the digger and conveyer. Figs. 13, 14, 15 16 and 17 are detail views of various parts of the machine.

Referring now to the drawings in detail, 1 designates a wheeled supporting truck comprising a base 2, axles 3, 3 journaled in suitable alining bearings depending from the base and disposed adjacent to the forward and rear ends of the latter, and flanged track wheels 4 fast upon the outer extremities of the axles. Depending from the under surface of the base 2 between the axles 3, 3 are transversely alining bearings 5, 5 in which is journaled a drive shaft 6 and keyed upon the drive shaft 6 and suitably spaced apart thereon are sprocket wheels 7, while keyed upon one of the axles 3 are sprocket wheels 8 and over the sprocket wheels 7 and 8 are trained endless chains 9 whereby in the rotation of the drive shaft 6 motion is imparted to the particular axle of the truck to propel the latter along the rails of the trackway. Extending upwardly from the base of the truck approximately centrally thereof is a hollow king post 10.

11 designates a substantially rectangular platform equipped centrally with a bearing 12 opening receiving the upper end of the king post 10 so that the platform may be revolved about the king post. Depending from the under surface of the platform and spaced apart equal distances concentrically of the king post are brackets 13 in the lower limbs of which are journaled supporting

rollers 14 resting upon an annular track 15 secured to the upper surface of the base of the truck and adapted to coöperate with the rollers and brackets to prevent vibration of the platform and permit the latter to rotate about the king post.

In the present instance, the track 15 is shaped after the fashion of the bottom of a saucer, while the rollers 14 taper toward the axis of the platform and engage the track adjacent to the highest point thereof.

Rotatably mounted within the king post 10 is a vertical shaft 16 having the lower end thereof equipped with a bevel pinion 17 meshing with a similar pinion 18 fast upon the drive shaft 6 so that when the shaft 16 is revolved motion will be imparted to the drive shaft. Secured to the upper surface of the base of the truck concentrically of the saucer-like bearing is a toothed annulus 19 and meshing with the annulus 19 is a pinion 20 fast upon the lower end of a vertical shaft 21 passed through the platform adjacent to one side edge of the latter and mounted within a suitable bearing. By means of this construction, it will be seen that when motion is imparted to the shaft 21 the pinion meshing with the annulus on the base of the platform will revolve about such annulus planet fashion with the effect to revolve the platform.

Journaled in horizontally alining bearings arranged transversely of the platform is a main drive shaft 22 disposed above the upper end of the shaft 21. This main drive shaft is connected up with an appropriate form of driving motor 23 and keyed thereon is a bevel pinion 24 adapted to mesh with a similar pinion 25 splined upon the upper end of the shaft 21 for sliding movement. Formed on the lower face of the bevel pinion 25 and depending therefrom is a ring 26 formed with a peripheral groove and disposed within the groove in the ring 26 is an annulus 27 equipped at diametrically opposite points with outwardly projecting arms 28 extending beyond the marginal edge of the pinion 25 and connected with the lower extremities of vertical rods 29 depending from a cross bar 30 fastened to the lower end of a cord or cable 31, the other extremity of the cord or cable being connected to and trained about a drum 32 rotatably mounted upon a shaft 33 supported in suitable standards 34 spaced apart. Connected with one side wall of the drum 32 and extending radially therefrom is a hand lever 35 by means of which the drum may be rotated about the shaft 33. The rods 29 are slidably mounted within suitable guides 36 secured to the platform, while connected with the arms 28 and depending therefrom are coiled contractile springs 37 having the lower ends thereof secured to a suitable support, such springs acting to slide the bevel pinion 25 normally downwardly along the shaft 21 out of engagement with the pinion 24.

Extending upwardly from the platform and disposed to one side of the path of movement of the hand lever 35 is a segment 38 having the teeth 39 thereof adapted to be engaged by the hand lever to maintain the latter in the desired position. When it is desired to elevate the pinion 25 so as to engage the latter with the pinion 24, in order that the shaft 21 will be rotated to revolve the platform about the king post, the hand lever 35 is swung downwardly thereby rotating the drum 32 and exerting a pull upon the cord 31 whereby the cross bar 30, and rods 29, annulus 27 and bevel pinion 25 are elevated and the teeth of the latter meshed with the teeth of the pinion 24. When the pinions are brought into engagement, the hand lever 35 is engaged with the adjacent tooth 39 on the segment 38 thereby maintaining the pinion 25 elevated against the action of the springs 37. On the other hand, when the hand lever is disengaged from the adjacent tooth of the segment and released, the springs react and so lower the pinion 25 thereby disengaging the latter from the pinion on the main drive shaft.

Secured to the upper surface of the platform at opposite sides of the upper extremity of the shaft 16 within the king post are forked brackets 40, 41 alining transversely and pivoted within the bracket 40 and movable about a horizontal axis is a bearing 42, while slidably mounted within the bracket 41 is a bearing 43 and journaled in these alining bearings is a shaft 44 disposed above the upper extremity of the shaft 16 and keyed upon the shaft 44 is a bevel pinion 45 adapted to mesh with a similar pinion 46 fast to the upper extremity of the shaft 16. In the present instance, an inverted U-shaped yoke 47 projects upwardly from the bracket 41 and secured to the interconnecting member of such yoke and depending therefrom is a coiled contractile spring 48 having the lower extremity thereof secured to the bearing 43. This spring acts to slide the bearing 43 upwardly within the bracket 41 whereby the shaft 44 will swing, incident to the pivotal mounting of the bearing 42 within the bracket 40, thereby disengaging the bevel pinion 45 from the pinion 46. To swing the shaft downwardly against the action of the spring 48 different means may be employed. In this case, a drum 49 is journaled upon a stub shaft projecting outwardly from the bracket 41 below the bearing 43 and fastened to the periphery of such drum is one end of a cord 50 having the opposite end thereof secured to the bearing 43. Connected to the drum 49 and projecting upwardly therefrom is a hand lever 51 whereby the drum may be rotated to exert a pull upon the cord 50 and so lower the bearing 43 against the action of the spring 48. To hold the lever in the desired position, a toothed segment or rack 52 is disposed adjacent to the path of movement of the lever and adapted to be engaged thereby so that when the lever is swung to lower the shaft and so cause the bevel pinions 45 and 46 to engage, such lever may engage the adjacent tooth of the rack or segment to hold the bearing against upward sliding movement under the action of the spring. Fast upon the shaft 44 is a belt pulley 53, while fast upon the main drive shaft is a belt pulley 54 and trained over these pulleys is an endless drive belt 55 whereby motion is transmitted to the shaft 44 in the rotation of the main drive shaft. Thus, it will be seen that when the lever 51 is swung to slide the bearing 43 downwardly within the bracket 41 and engage the bevel pinion 45 with the pinion 46, motion will be transmitted from the main drive shaft through the pulleys 53 and 54 and the belt 55 to the shaft 44 and from the latter through the medium of the bevel pinions 45 and 46 to the shaft 16, the latter, in turn, operating the drive shaft of the truck to propel the machine along the trackway.

One end edge of the platform is cut out centrally as at 56 and secured to such edge of the platform immediately adjacent to the opposite sides of the cut out portion are pivot knuckles 57. 58 designates standards spaced apart in parallelism and having the lower extremities thereof formed with laterally projecting pivot knuckles 59 connected to the knuckles 57 whereby a pivotal connection between the standards 58 and the platform is formed. Brace rods 60, 60 are secured to the standards adjacent to the upper and lower ends respectively of the latter so as to maintain the standards against relative swinging movement. Formed in the standards 58 are longitudinal bores 61 opening onto the lower ends thereof, while formed in the confronting faces of the standards are guide grooves or ways 62 and slidably mounted within the bores 61 are rack bars 63 capable of vertical sliding movement. Journaled in the standards adjacent to the lower extremities thereof is a horizontal shaft 64 equipped with pinions 65, 65 working in the bores in the standards and meshing with the teeth of the rack bars in such bores so that as the shaft is rotated in one direction the rack bars will be moved upwardly within the standards, while when the direction of rotation of the shaft is reversed the rack bars will descend. Rods 66, 66 lie parallel with the rack bars between the latter, and are spaced apart and the lower ends of such rods are suitably connected as at 67 with the rack bars adjacent to the lower extremities of the latter, while the upper portions of the rods lie between the standards and secured to the upper extremities of such rods are horizontally alining bearings 68 in which is journaled a shaft 69 having the opposite extremities thereof disposed within the ways 62 and adapted for sliding movement therein. Journaled in suitable transversely alining bearings carried by the lower ends of the rack bars 63 is a shaft 70 and fast upon the shafts 69 and 70 are rollers 71, 71 each having longitudinal ribs 72, 72 formed thereon at diametrically opposite points, while loose upon each shaft at the opposite ends of the roller thereon are relatively short rollers 73, 73. Trained over the relatively short rollers on the shafts 69 and 70 are endless chains 74, 74 spaced apart in parallelism. Suitably fastened to the chains 74 and extending outwardly therefrom are buckets 75 adapted to travel with the chains and spaced apart distances equal to the distance between the ribs on the rollers 71, 71 so that in the rotation of the latter under the action of the shaft each rib will move behind the adjacent bucket and engage the rear edge of the latter with the effect to impart movement to the buckets and chains. The buckets and chains constitute, in effect, a chain conveyer, and this conveyer together with the rods 66 supporting the upper shaft of the conveyer, and the rack bars supporting the lower shaft of the conveyer coöperate to form what may be termed a digging mechanism. The outer edges of the buckets 75 are preferably toothed as at 76 to facilitate the digging.

Extending laterally from one of the standards 58 and disposed adjacent to the upper and lower extremities of such standard are alining bearings 77, in which is journaled a hollow shaft section 78 having the bore thereof non-circular in cross section and slidably mounted within the non-circular bore of the hollow shaft section is a solid shaft section 79 of a cross sectional contour conforming to that of the bore of the hollow shaft section. The lower end of the solid shaft section 79 terminates adjacent to the lower extremity of the proximate rack bar and fast upon such extremity of the solid shaft section is a bevel pinion 80 meshing with a similar pinion 81 fast upon the adjacent end of the shaft 70.

82 designates a brace bar connecting the lower extremity of the solid shaft section 79 to the end of the adjacent rack bar, as shown in Fig. 13.

Journaled in horizontally alining bearings carried by the upper extremities of the standards 58 is a drive shaft 83 and keyed upon one end of the drive shaft 83 is a bevel pinion 84 meshing with a similar pinion 85 fast upon the upper end of the telescopic shaft composed of the sections 78 and 79. Keyed upon the opposite end of the drive shaft 83 is a belt pulley 86. Extending upwardly from the platform below the belt pulley 86 are segment shaped standards 87, 87 each formed of a stationary bar 88 and a movable bar 89 parallel with the stationary bar and spaced apart therefrom and having the lower extremity thereof pivotally connected with the platform. Mounted between the bars of the segment shaped standards 87, 87 are bearing blocks 90 capable of sliding movement within the standards and journaled in the bearing blocks 90 is a horizontal shaft 91 upon which is keyed a belt pulley 92 and over the belt pulleys 86 and 92 is trained an endless driving belt 93. Also keyed upon the shaft 91 is a sprocket wheel 94, while loosely mounted upon the adjacent end of the main drive shaft 22 is a sprocket wheel 95 and over the sprocket wheels 94 and 95 is trained a chain 96. One end edge of the hub of the sprocket wheel 95 is formed with teeth 97, while splined upon the shaft 22 for sliding movement thereon adjacent to the teeth 97 on the sprocket wheel 95 is a clutch collar 98 having one end thereof formed with teeth 99 adapted to interlock with the teeth 97 on the sprocket wheel 95, this structure being clearly illustrated in Fig. 4.

In practice, when the clutch collar 98 is shifted along the shaft so that the teeth 99 interlock with the teeth 97 on the sprocket wheel 95, motion is imparted to the latter to drive the sprocket wheel 94 through the medium of the chain 96. In the rotation of the sprocket wheel 94 the shaft 91 and belt pulley 92 revolve thereby actuating the driving belt 93, belt pulley 86 and drive shaft 83 and in the rotation of the shaft 83 motion is transmitted to the telescopic shaft composed of the hollow shaft section 78 and the solid shaft section 79 with the effect to revolve the stub shaft 70 carried by the lower ends of the adjustable rack bars 63, thereby rotating the endless conveyer composed of the rollers 71, 71, chains 74, 74 and buckets 75 so that the material with which the buckets at the lower end of the conveyer engage will be carried upwardly thereby.

The upper extremities of the bars 88 and 89 constituting the standards 87, 87 are formed with alining openings through which are passed clamping bolts 100 whereby the movable bar of each standard may be moved toward the stationary bar to clamp the bearing block sliding therein and hold the latter against movement as shown in Fig. 12. Connected with each bearing block is one extremity of a cord or cable 101 and these cords or cables are trained around sheaves 102 carried in blocks secured to the platform below the shafts 91 and having the outer ends thereof fastened to a windlass 103 mounted upon the platform and operable from a hand wheel 104. By means of this construction, it will be seen that when the clamping bolts 100 are actuated to release the movable bars of the standards, the bearing blocks within such standards will be free to move therein so that the windlass may be operated to draw the blocks downwardly within the standards to tighten the driving belt 93, the clamping bolts being subsequently actuated to move the movable bars of the standards toward the stationary bars to grip the bearing blocks. Thus, the driving belt of the digging mechanism may be at all times held taut to facilitate the operation of such mechanism.

In the present instance, the shifting mechanism for the clutch collar 98, shown in Fig. 4, comprises a lever 105 fulcrumed at one end as at 106 and connected, centrally, with a ring 107 lying within a groove in the periphery of the clutch collar 98. The outer end of the lever 105 extends through and works within a horizontal slot 108 formed in an upright 109 adjacent to the upper end thereof. Below the slot 108 at the opposite ends thereof the outer face of the upright 109 is equipped with vertically alining guides 110 and within the guides 110 are slidably disposed, parallel guide bars 111 carrying, at their upper ends, a horizontal rack 112, while connected with the opposite extremities of the rack bar are coiled contractile springs 113 having the upper ends thereof secured to the upper edge of the upright. Depending from the rack bar 112 is a link 114 and the lower end of the link is pivotally connected to a treadle 115 fulcrumed at one end as at 116 to the upright adjacent to the lower extremity of the latter. A coiled expansion spring 117 surrounds the main drive shaft 22 between the confronting faces of the clutch collar 98 and sprocket wheel 94 and acts to hold the teeth on the clutch collar normally out of engagement with the teeth on the sprocket wheel. When it is desired to shift the clutch collar so that the teeth thereof will engage with the teeth on the sprocket wheel, the treadle 115 is depressed thereby drawing the rack bar 112 downwardly against the action of the springs 113 so as to release the lever 105. The lever is now swung about its fulcrum 106 and the ring connected therewith and disposed within the groove in the clutch collar 98 actuates the latter against the action of the spring 117 so that the teeth on the confronting faces of the clutch collar and sprocket wheel 95 interlock thereby forming a connection between the sprocket wheel and the main drive shaft whereby the digging mechanism is actuated as previously described. Succeeding the clutching of the sprocket wheel to the shaft, the treadle 115 is released and the springs 113 react and draw the rack bar 112 upwardly so that the teeth thereon engage the lever 105 and hold the latter against return to normal position under the action of the spring 117. To disengage the sprocket wheel from the shaft, the treadle 115 is depressed and the spring controlling the clutch reacts and so disengages the teeth 99 from the teeth 97.

Projecting rearwardly from the standards 58 adjacent to the upper ends thereof are supporting arms 118 and journaled in these arms is a horizontal shaft 119, while projecting rearwardly from the standards adjacent to the lower extremities thereof are arms 120 having the outer ends thereof equipped with horizontally alining bearings in which is journaled a shaft 121. Fast upon the shafts 119 and 121 are four pointed star shaped rollers 122 and over these rollers is trained an endless belt 123 constructed of any suitable material. Fastened to the outer surfaces of the rungs of the belt 123 are buckets 124 spaced apart distances equal to the distances between the points of the star shaped rollers so that the latter will act upon the buckets after the fashion of a sprocket wheel and chain thereby rotating the belt and buckets thereon in the movement of the rollers. In this embodiment of my invention, the opposite extremities of the shaft 119 is provided with belt pulleys 125, while the adjacent portions of the drive shaft 83 are equipped with belt pulleys 126 and over the belt pulleys 125 and 126 are trained endless crossed belts 127 whereby in the movement of the drive shaft 83 on the digging mechanism motion is imparted to the shaft 119 to revolve the belt 123 whereby the buckets thereon are carried around in the same direction as the buckets of the conveyer of the digging mechanism. The star shaped wheels or rollers 122, the belt 123 trained about such rollers and the buckets 124 carried by the belt 123 constitute a conveyer and this conveyer traverses a path parallel to the path of the conveyer of the digging mechanism so that the material carried up by the buckets and the digging mechanism will be dumped or thrown into the buckets 124 of the last mentioned conveyer as the buckets of the digging mechanism conveyer turn about the upper roller 71 to travel downwardly. Secured to the standards 58 adjacent to the upper ends thereof and extending rearwardly therefrom and inclosing the upper portion of the second conveyer is a trough 128 into which the second conveyer discharges and depending from the trough is a spout 129 with which suitable conveying pipes may be connected. Thus, the material thrown onto the second conveyer from the conveyer of the digging mechanism will be discharged into the trough 128 and subsequently carried away by way of the spout 129 and conduits or pipes connected thereto, such conduits leading to the desired point of waste.

In order to rotate the shaft 64 so that the rack bars of the digging mechanism may be actuated to elevate or lower such mechanism, according to the movement of the shaft, a hand wheel 130 is fast upon one end of the shaft 64 and when rotated by the operator or engineer imparts movement to the shaft 64 to slide the rack bar in one direction or the other, according to the direction of rotation of the shaft. Fast upon the shaft 64 between the hand wheel 130 and the adjacent standard is a winding drum 131 to which is connected one end of a cable or rope 132. As shown in Fig. 2, the opposite end of the cable or rope is trained over a sheave 133 mounted upon the upper end of the adjacent standard 58 and a sheave 134 carried by an arm 135 extending outwardly from the other standard and holding the sheave 134 at a point approximately centrally of the standard, and connected with a cross bar 136 having the opposite extremities thereof disposed within the guideways or grooves 62 and connected with the adjacent extremities of the rods 66, 66. Thus, when the hand wheel 130 is rotated to actuate the shaft 64 to elevate the digging mechanism the cable or rope 132 is wrapped about the drum 131 and so exerts a pull on the upper end of the conveyer of the digging mechanism thereby assisting in the elevating thereof, while when the shaft 64 is reversed to lower the digging mechanism the drum unwinds and so slackens the rope or cable 132 as the conveyer of the digging mechanism descends. Fast to one side of the drum 131 is a ratchet wheel 137 with which engages a dog 138 pivoted upon the adjacent standard and coacting with the ratchet wheel to prevent retrograde movement of the winding drum succeeding the hoisting of the digging mechanism.

In some instances, particularly where the machine is used for dredging purposes, the load on the conveyer of the digging mechanism will be of such weight as to prohibit the elevating of the digging mechanism by means of the hand wheel on the shaft and when such contingency arrives, the shaft 64 is driven from the main drive shaft of the machine and the connection between the main drive shaft and the shaft 64 is manually controlled so that the latter may be driven from the main shaft at any time. In the embodiment of my invention selected for illustrative purposes, this manually controlled driving mechanism, shown in Fig. 4, comprises a countershaft 139 journaled in horizontally alining bearings carried by the platform and arranged in parallelism with the main drive shaft 22. Fast upon the countershaft 139 is a sprocket wheel 140, while connected with the shaft 64 is a sprocket wheel 141. Over the sprocket wheels 140 and 141 is trained an endless chain 142. Fast upon the countershaft adjacent to one end thereof is a gear wheel 143 meshing with a similar wheel 143 meshing with a similar wheel 144 loose upon the main drive shaft, while fixed to the countershaft adjacent to the opposite end thereof is a sprocket wheel 145 and loosely surrounding the main drive shaft adjacent to the sprocket wheel 145 is a second sprocket wheel 146. An endless chain 147 is trained over the sprocket wheels 145 and 146. Splined upon the main drive shaft between the gear wheel 144 and the sprocket wheel 146 is a clutch collar 148 capable of sliding movement along the shaft and provided, at diametrically opposite points, with arms 149 disposed in a vertical plane and formed with apertures 150 through which are passed guide rods 151 disposed above and below the main drive shaft parallel therewith and fastened to the standards supporting the bearings of the said shaft in proximity to the gear wheel 144 and sprocket wheel 146. The opposite edges of the collar 148 are formed with teeth 152, while the confronting faces of the gear wheel 144 and sprocket wheel 146 are formed with teeth 153. Springs 154 have certain ends fastened to the arms 149 respectively and the opposite extremities secured to the standard supporting the bearing of the main drive shaft adjacent to the sprocket wheel 146 thereon as clearly illustrated in Fig. 7. Connected with the opposite sides of the arms 149, that is, to say, the sides of the arms opposite from the springs 154, are the branches of a cable or cord 155, such branches being trained through appropriate eyes to facilitate the movement of the cable when it is desired to shift the clutch collar against the action of the springs 154. The opposite end of the cable or cord 155 is connected to the periphery of a drum 156 journaled upon an axle 157 carried by vertically disposed disks 158 spaced apart in parallelism and mounted upon a pedestal 159. Connected to the periphery of the drum 156 and projecting radially therefrom is a hand lever 160 by means of which the drum may be rotated in one direction or the other to pull or release the cable. This hand lever is equipped with a latching dog 161 adapted to engage teeth 162 formed upon the upper portion of the periphery of one of the disks 158. When the lever is in the center of the row of teeth 162 the clutch collar is held spaced apart from between the toothed faces of the gear wheel 144 and sprocket wheel 146 so that in the operation of the main drive shaft the countershaft 139 remains idle, while when the lever is swung to one end of the row of teeth the cable is released and the springs 154 react and slide the clutch collar along the shaft so that the particular set of teeth thereon interlock with the adjacent set of teeth 153 on the sprocket wheel 146. On the other hand, when the lever is at the opposite end of the row of teeth 162, the teeth on the opposite side of the clutch collar will interlock with the teeth of the gear wheel 144 whereby the latter is connected with the main drive shaft and the countershaft rotated in a direction reverse to the rotation thereof under the action of the sprocket wheels 145 and 146 and the chain 147 as is readily apparent.

In operation, when it is desired to lower the digging mechanism from the main power shaft, the lever 160 is swung so as to exert a pull upon the cable or cord 155 and slide the clutch collar 148 so that the teeth thereon will interlock with the teeth on the gear wheel 144 thereby connecting the countershaft with the main shaft so that the chain 142 will be operated to revolve the shaft 64 and lower the rack bars and mechanism carried thereby. On the contrary, when it is desired to elevate the digging mechanism the latching dog on the hand lever 160 is disengaged from the adjacent teeth and the hand lever swung to the opposite end of the row of teeth thereby permitting the springs 154 to react and slide the clutch collar 148 so that the teeth thereon will interlock with the teeth of the sprocket wheel 146 thereby connecting the countershaft with the main shaft through the medium of the sprocket wheels 145 and 146 and the chain 147 whereby the countershaft will be rotated in a direction reverse to the movement thereof under the action of the gear wheels 143 and 144. Thus, the shaft 64 will be revolved to elevate the digging mechanism.

In order to swing the standards 58 about their pivotal connections with the platform so that the digging mechanism and the conveyer receiving the material from the digging mechanism may be swung or tilted to any desired angle relatively to the vertical and held in adjusted position any suitable mechanism may be employed. In the present embodiment of my invention this mechanism, illustrated in Figs. 1, 13 and 16, comprises bearings 163 secured to the rear edges of the standards 58 adjacent to the upper extremities thereof and journaled in the bearings and extending outwardly from the outer sides of the standards are trunnions 164. To the outer extremities of the trunnions 164 are secured blocks 165 and disposed within the blocks 165 are nuts 166 through which are threaded rods 167 as shown in Fig. 16. The lower ends of the rods 167 are rotatably mounted within bearing blocks 168 formed at their lower extremities with laterally projecting trunnions 169 journaled in horizontally alining bearings 170 secured to the upper surface of the platform adjacent to the rear edge thereof. Fast upon the rods 167 are oppositely disposed bevel gears 171 arranged in parallel planes and meshing with the gears 171 are similar gears 172 keyed upon a shaft 173 arranged transversely of the rods 167 and journaled in spring held bearings 174 carried by the rods and each acting upon the shaft to hold the adjacent bevel gear thereon in mesh with the bevel gear on the rod. A hand wheel 175 is keyed upon one end of the shaft 173 and when rotated in one direction revolves the last named shaft and the latter rotates the rods 167 in like directions, incident to the arrangement of the bevel gears upon the rods, thereby swinging the standards 58 to dispose the digging mechanism in a substantially vertical plane or incline such mechanism relatively to the vertical according to the direction of rotation of the shaft 173.

By means of the belt tightener formed by the segment shaped standards 87, 87 the bearing blocks 90 within such standards, the cords 101 and the windlass 103, the driving shaft 93 may be at all times tightened so as to take up any slack incident to the movement of the drive shaft 33 and standards 58.

A chain tightener 176 is employed to take up the slack in the chain 142 incident to the movement of the shaft 64 swinging with the standards 58. In the present instance, this chain tightener, shown in detail in Fig. 15, comprises standards 177, 177 uprising from the platform and disposed at opposite sides of the chain 142 approximately centrally thereof. These standards have the confronting faces thereof formed with ways 178 and within the ways are mounted blocks 179 capable of vertical sliding movement and carrying rollers 180 disposed below the runs of the chain 142. Connecting the upper extremities of the blocks 179 is a cross piece 181 to which is secured an upstanding threaded stem 182 projecting through a bearing 183 carried by a cross bar 184 fastened to the upper extremities of the standards 177 and spanning the latter. Threaded onto the upper end of the stem 182 is a nut 185 equipped with outwardly extending handles 186 whereby the nut may be rotated. When the nut is rotated in one direction the stem is elevated thereby drawing the blocks 179 and rollers 180 upwardly with the effect to tighten the chain, while when the direction of rotation of the nut is reversed the stem, blocks and rollers descend whereby the chain is lengthened.

A cover 187 closes the upper end of the trough 128 and is suitably fastened to the upper ends of the standards 58, while secured to the forward edges of the standards 58 is a cover 188 having the upper edge thereof connected with the adjacent end of the cover 187 and coöperating therewith to inclose the adjacent mechanism, the lower end of the cover 188 terminating adjacent to the lower extremities of the standards. In this instance, the rear end of the cover 187 is hinged as at 189, as shown in Figs. 1 and 3, so that access may be had to the interior of the trough when desired.

From the foregoing description taken in connection with the accompanying drawings, the construction, mode of operation and manner of employing my improved digging machine will be readily apparent.

It will be seen that I have provided a digging machine which may be put to a variety of uses, such as dredging channels, excavating and conveying coal, grain and the like from one ship to another and for many other purposes.

In employing the machine as a dredge, as shown in Figs. 1, 2, 3 and 13, the truck 1 is run out on the rails 190 of a pontoon 191 and the digging mechanism projected into the water between arms 192 extending outwardly from one edge of the pontoon and spaced apart a distance to accommodate the digging mechanism, the space between the arms 192 and the cut out portion 56 in the platform 11 permitting the free movement of the buckets of the conveyer of the digging mechanism.

While I have herein shown and described one preferred form of my invention by way of illustration, I wish it to be understood that I do not limit or confine myself to the precise details of construction herein described and delineated, as modification and variation may be made within the scope of the claims without departing from the spirit of the invention. For instance, other mechanism may be employed for driving and controlling the drive shaft of the conveyers, while the mechanism for elevating and lowering the digging apparatus may be changed.

I claim:

1. In a machine of the class described, a platform, standards pivoted at their lower ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, and means for swinging said standards to move the conveyer to any desired angle.

2. In a machine of the class described, a platform, standards pivoted at their lower

ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, and manually operable means for swinging said standards to move the conveyer to any desired angle.

3. In a machine of the class described, a platform, standards pivoted at their lower ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, bearings carried by the rear edges of said standards, trunnions journaled in said bearings and projecting laterally therefrom, blocks fastened to said trunnions, nuts within said blocks, rods threaded through said nuts, means supporting the lower ends of said rods, and means for rotating said rods to swing said standards.

4. In a machine of the class described, a platform, standards pivoted at their lower ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, bearings carried by the rear edges of said standards, trunnions journaled in said bearings and projecting laterally therefrom, blocks fastened to said trunnions, nuts within said blocks, rods threaded through said nuts, means supporting the lower ends of said rods, a hand operated shaft, gear connections between said last shaft and rods whereby the rods will be rotated in like directions in the rotation of the shaft, and means for rotating said shaft.

5. In a machine of the class described, a platform, standards having their lower ends secured to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed within said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, a second conveyer disposed in a plane parallel with said conveyer belt and adapted to receive the material therefrom, and means for rotating said first shaft to raise and lower said bars, rods and conveyer belt.

6. In a machine of the class described, a platform, standards having their lower ends secured to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed within said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, a second conveyer disposed in a plane parallel with said conveyer belt and adapted to receive the material therefrom, and manually operable means for rotating said first shaft to raise and lower said bars, rods and conveyer belt.

7. In a machine of the class described, a platform, standards having their lower ends secured to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars,

vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed within said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, a second conveyer disposed in a plane parallel with said conveyer belt and adapted to receive the material therefrom, manually operable means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, and power operated means for driving said first shaft to raise and lower said bars, rods and conveyer belt.

8. In a machine of the class described, a platform, standards having their lower ends secured to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed within said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, a second conveyer disposed in a plane parallel with said conveyer belt and adapted to receive the material therefrom, manually operable means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, and means common to said conveyer belt and conveyer for driving the same.

9. In a machine of the class described, a platform, standards pivoted at their lower ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, means for swinging said standards to move the conveyer to any desired angle, a truck supporting said platform, and means for driving said truck.

10. In a machine of the class described, a platform, standards pivoted at their lower ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, pinions on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, an endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, means for swinging said standards to move the conveyer to any desired angle, a truck supporting said platform, means for driving said truck, and means whereby said platform may be rotated upon said truck.

11. In a machine of the class described, a platform, standards pivoted at their lower ends to said platform at one edge of the latter and formed with longitudinal bores, and grooves in the confronting faces thereof, rack bars slidably mounted in said bores, a shaft journaled in said standards, fingers on said shaft meshing with said rack bars, vertical rods parallel with said bars and spaced apart, a connection between the lower end of each rod and the adjacent rack bar, a shaft journaled in the upper ends of said rods and having the opposite extremities thereof disposed in said grooves, a shaft journaled in the lower ends of said bars, rollers keyed upon said shafts, and endless conveyer belt trained about said rollers, means for rotating said first shaft to raise and lower said bars, rods and conveyer belt, means for swinging said standards to move the conveyer to any desired angle, a truck supporting said platform, means for driving said truck, and power driven manually controlled means for rotating said platform upon said truck.

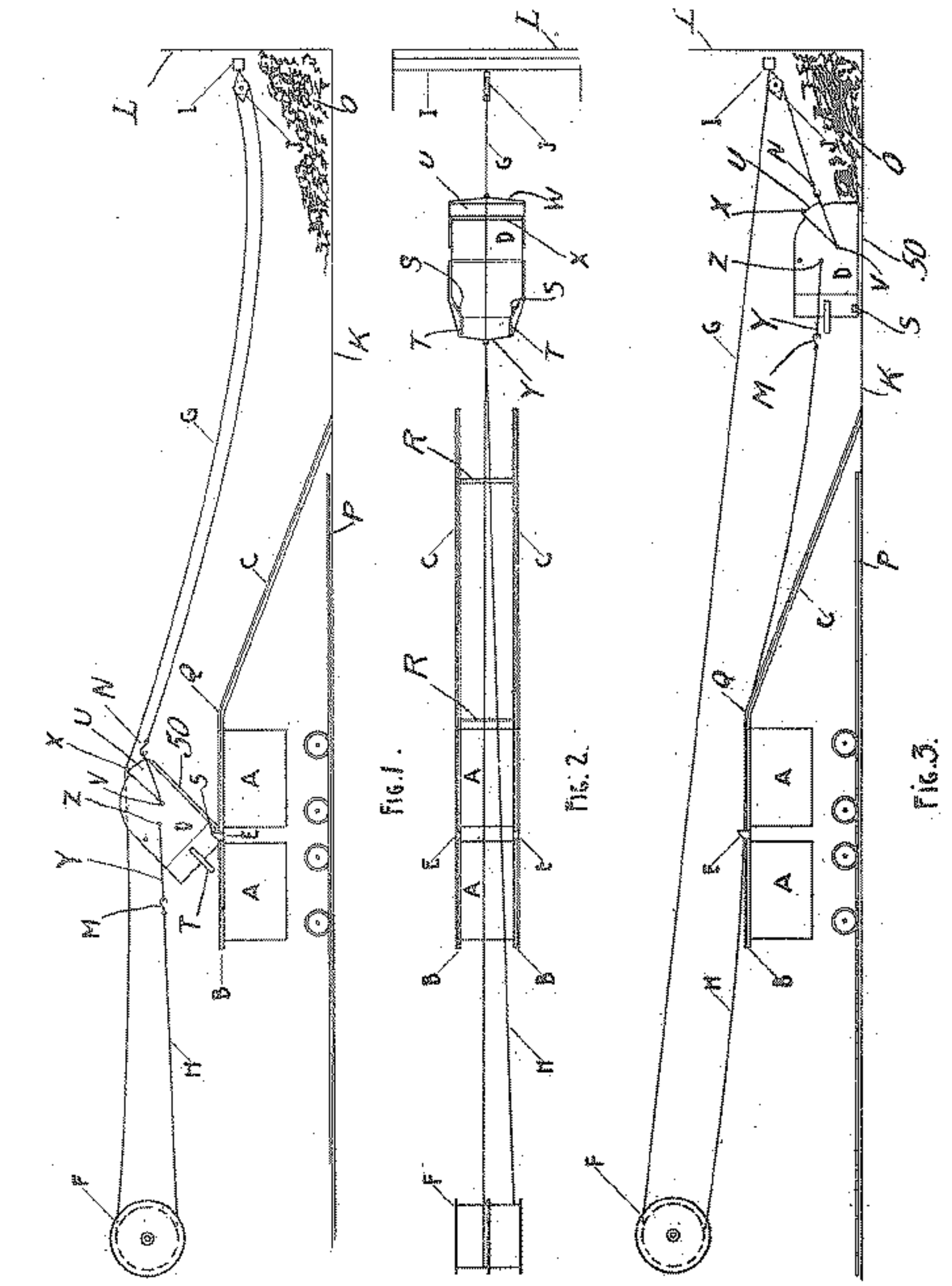
In testimony whereof I affix my signature in presence of two witnesses.

DANIEL A. PENEDO.

Witnesses:
Daniel Armesto,
Benito Quintos.

F. REED & S. L. INGE.
CONVEYER.
APPLICATION FILED AUG. 29, 1917.

1,248,714. Patented Dec. 4, 1917.



Witnesses.
J. R. Tomlin
C. E. Tomlin

Fred Reed and Inventors.
Sam L. Inge
C. A. Snow & Co.
Attorney.

UNITED STATES PATENT OFFICE.

FRED REED AND SAM L. INGE, OF BISBEE, ARIZONA.

CONVEYER.

1,248,714. Specification of Letters Patent. Patented Dec. 4, 1917.

Application filed August 29, 1917. Serial No. 188,803.

To all whom it may concern:

Be it known that we, FRED REED and SAM L. INGE, citizens of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented a new and useful Conveyer, of which the following is a specification.

The device forming the subject matter of this application is adapted to be employed in a mine for loading cars with loose material, and one object of the invention is to provide a device of this kind which will operate in a satisfactory manner in places where the vertical space or headroom is limited.

Another object of the invention is to provide novel means whereby the carrier is operated and dumped.

A further object of the invention is to provide novel means whereby, when the carrier is advanced, a hood at the front of the carrier will be raised, the hood constituting means for preventing the loose material from sliding out of the carrier when the carrier is retracted along an inclined skid.

With the above and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed can be made within the scope of what is claimed, without departing from the spirit of the invention.

In the drawings:—

Figure 1 is a diagrammatic side elevation showing a conveyer constructed in accordance with the present invention;

Fig. 2 is a diagrammatic top plan wherein the track is omitted;

Fig. 3 is a diagrammatic side elevation showing the carrier advanced toward the material, the carrier being in dumping position in Fig. 1.

The letter K designates the floor of a mine and the breast appears at L. The loose material to be removed is shown at O. A track P is mounted on the floor K of the mine and is adapted to be traversed by mine cars A.

The letter Q marks a skid comprising rails, each rail including an inclined part C resting on the floor K of the mine, and a horizontal part B supported on the cars A, constituent rails of the skid may be united by braces R, the horizontal parts B of the rails being provided with stops E.

The letter D designates a carrier which may be in the form of a scoop provided on its bottom with a shoe 50 adapted to traverse the floor K of the mine and to be received between the rails of the skid Q, to hold the carrier D thereon when the carrier is retracted. The bottom of the carrier D is supplied with shoulders S adapted to engage the stops E to effect a dumping of the carrier when the same is retracted. The carrier D may have rearwardly projecting handles T for guiding the carrier into the loose material O when the carrier is advanced. A hood U extends across the front of the carrier and is pivoted to the sides of the carrier as shown at V. A bail W is attached to the lower edge of the hood U. A roller X is journaled on the upper edge of the hood U at the front of the carrier D. A rearwardly extended bail Y is pivoted at Z to the carrier D.

A support I of any desired kind is located near the breast L and carries a sheave J. The numeral F denotes a reversible operating member, which may be a drum. A flexible element G is trained around the sheave J, one end of the flexible element being united by means of a hook N or otherwise with the bail W which forms a part of the hood U. One end of a flexible element H is attached by means of a hook M or in any other suitable way to the bail Y which is pivoted to the carrier D. The flexible elements G and H are wound in opposite directions about the drum F.

Let it be supposed that the flexible element G is under tension, as shown in Fig. 3. Then the carrier B is advanced into the loose material O and the hood U is raised. When the flexible element H is put under tension, as shown in Fig. 1, the flexible element G is slacked away and the hood U is permitted to drop. This prevents the loose material in the carrier from sliding out of the carrier when the carrier is retracted by the flexible element H into the position of Fig. 1. The shoulders S on the carrier D ultimately engage the stops E on the skid Q and, under the pull exerted by the flexible element H, the carrier is tilted and its load is dumped into one of the cars A.

The device herein disclosed embodies a

simple but efficient means whereby a car can be loaded with loose material in mine working, or in any other place where head room is limited.

Having thus described the invention, what is claimed is:—

1. In a device of the class described, an inclined skid having a stop; a carrier adapted to traverse the skid and to engage the stop; a hood extended across the front of the carrier and pivoted to the carrier; a first flexible element extended rearwardly from the carrier and constituting means for retracting the carrier onto the skid into engagement with the stop thereby to effect a dumping of the carrier; a direction-changing idler; a second flexible element trained about the idler, one end of the second flexible element being connected to the hood and constituting means for advancing the carrier and for raising the hood; and means for operating the flexible elements.

2. In a device of the class described, an inclined skid having a stop and comprising spaced rails; a carrier adapted to traverse the skid and to engage the stop, the carrier having a shoe received between the rails of the skid; a hood extended across the front of the carrier and pivoted to the carrier; a first flexible element extended rearwardly from the carrier and constituting means for retracting the carrier onto the skid into engagement with the stop thereby to effect a dumping of the carrier; a direction-changing idler; a second flexible element trained about the idler, one end of the second flexible element being connected to the hood and constituting means for advancing the carrier and for raising the hood; and reversible rotary operating means wherewith the flexible elements are assembled.

In testimony that we claim the foregoing as our own, we have hereto affixed our signatures in the presence of two witnesses.

FRED REED.
SAM L. INGE.

Witnesses to Fred Reed:
MASON B. LAWTON,
MARY E. BONIS.

Witnesses to Sam L. Inge:
J. W. HAMPTON,
J. M. LYONS.

J. GRICAR.

COAL MINING MACHINE.

APPLICATION FILED JAN. 25, 1917.

1,278,333.

Patented Sept. 10, 1918.

2 SHEETS—SHEET 1.

FIG. 1.

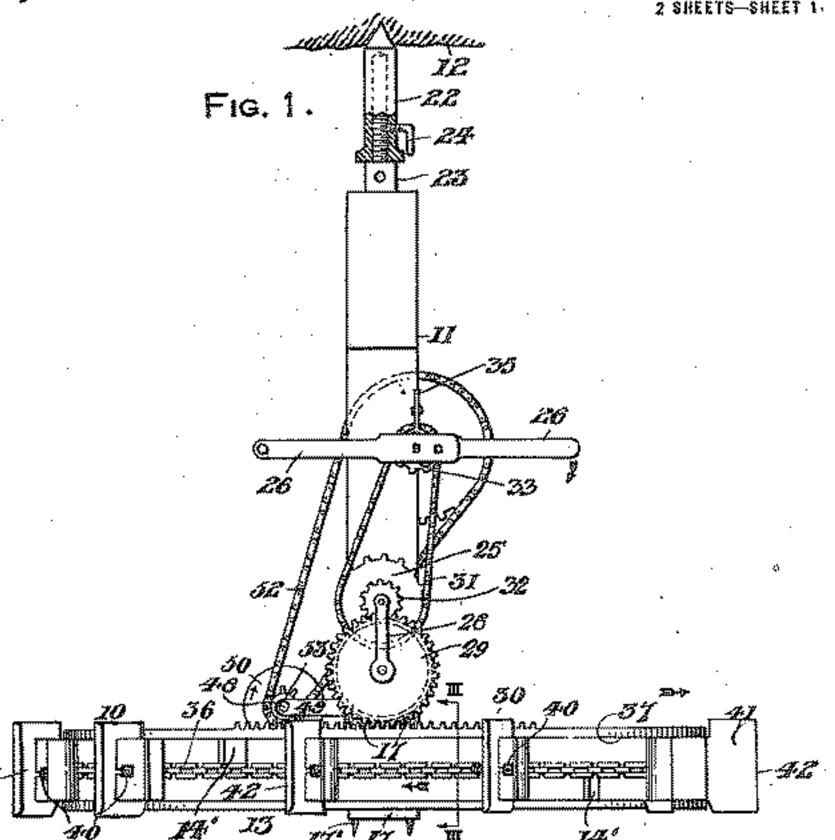
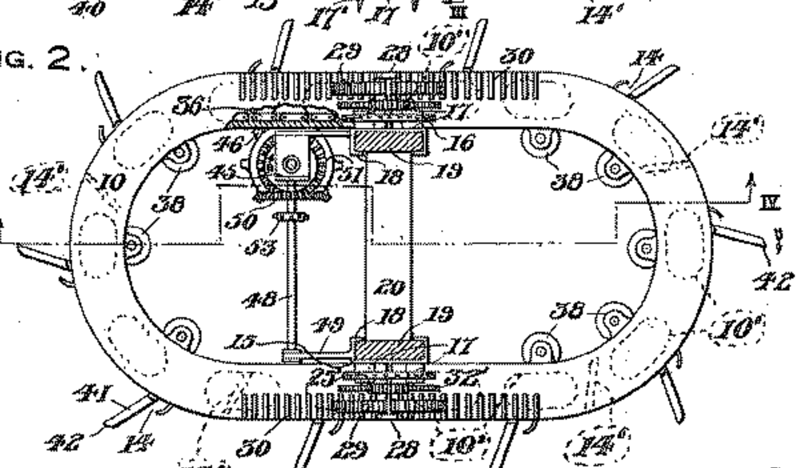


FIG. 2.



Inventor

John Gricar

By A. M. Wilson

Attorney

J. GRICAR.
COAL MINING MACHINE.
APPLICATION FILED JAN. 25, 1917.

1,278,333. Patented Sept. 10, 1918.

2 SHEETS—SHEET 2.

FIG. 3.

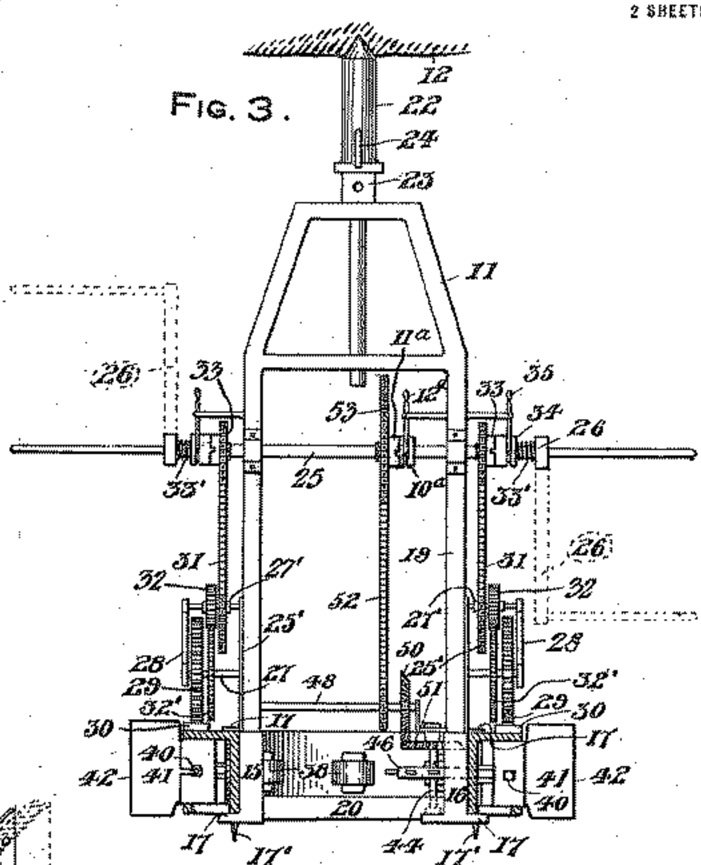


FIG. 5.

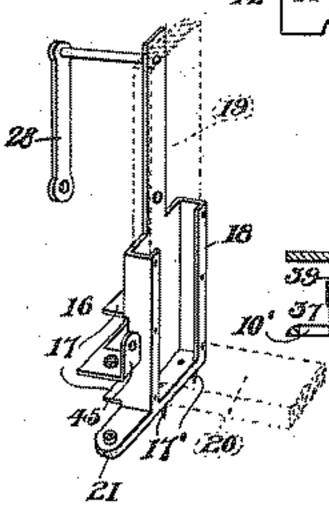


FIG. 4.

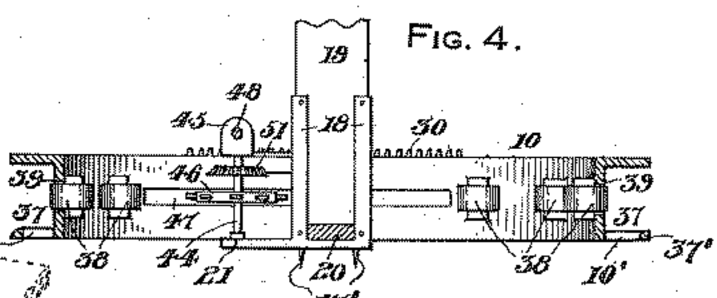
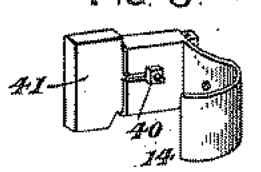


FIG. 6.



Inventor
John Gricar

By A. M. Wilson

Attorney

UNITED STATES PATENT OFFICE.

JOHN GRICAR, OF LOWELL, ARIZONA.

COAL-MINING MACHINE.

1,278,333. Specification of Letters Patent. Patented Sept. 10, 1918.

Application filed January 25, 1917. Serial No. 144,518.

To all whom it may concern:

Be it known that I, JOHN GRICAR, a subject of the Emperor of Austria, residing at Lowell, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Coal-Mining Machines, of which the following is a specification.

This invention relates to new and useful improvements in coal mining machines.

The primary object of the invention is the provision of a mining machine for coal, after the nature of the short-wall machine, the same being adapted for manual operation.

A further object of the device is the provision of a hand operated coal mining machine having an adjustable anchoring means whereby the cutting members may be fed into the work to a limited extent without shifting the anchoring means.

In the drawing forming a part of this application and in which like-reference characters refer to corresponding parts throughout the several views:

Figure 1 is a side elevation of the device.

Fig. 2 is a horizontal sectional view thereof.

Fig. 3 is a view partly in elevation and partly in section upon line III—III of Fig. 1.

Fig. 4 is a longitudinal sectional view taken upon line IV—IV of Fig. 2.

Fig. 5 is a perspective view of one of the side brackets of the anchoring member, and

Fig. 6 is a perspective view of one of the cutting members detached.

Referring more in detail to the drawing the device broadly consists of an oval-shaped frame 10 of channel-bar formation having an upright inverted substantially U-shaped arch or anchoring member 11 centrally positioned therein adapted to adjustably engage the top and bottom of the mine 12 and 13, respectively, the said frame adapted for carrying manually operable cutters 14, and being longitudinally shiftably arranged upon the said anchoring member 11.

The anchoring member for the device comprises oppositely positioned brackets 15 and 16 of similar formation arranged inwardly of the frame 10 with outwardly projecting flanges 17 within which the frame 10 is longitudinally slidably arranged in horizontal position. The inner sides of the brackets 15 and 16 are provided with parallel vertical inclosing flanges 18 within which the parallel side beams 19 of the anchoring member 11 are seated and secured and whereby the anchoring member is arranged perpendicularly with respect to the frame 10. A horizontal bottom beam 20 connects the brackets 15 and 16 together, the same assisting the enlarged feet 21 of the brackets 15 and 16 in forming a base upon which the anchoring member 11 may seat upon the mine bottom 13, affording a stable mounting means for the frame 10 of the machine, it being understood that an adjustable point 22 is threaded upon the holding member 23 at the top of the anchoring member 11 for forcible engagement with the top 12 of the mine whereby the member 11 is temporarily fixedly positioned at a desirable point within the mine. A locking screw 24 is carried by the point 22 for maintaining the same in its adjusted position upon the member 23. Calks 17′ are carried by the feet 17 for engagement with the bottom of the mine. The anchoring member 11 and brackets 15 and 16 are readily separated from the frame 10 to facilitate transportation.

An operating shaft 25 is transversely journaled upon the anchoring member 11, being provided with a plurality of turn cranks as illustrated at 26 in Fig. 1 and by dotted lines in Fig. 3 of the drawings. Stub-shafts 27 are journaled within angular arms 28 at the outer sides of the brackets 15 and 16 upon which gears 29 are secured in constant mesh with toothed racks 30 formed at opposite marginal points on the upper face of the frame 10. Sprocket chains 31 connect the shaft 25 with a sprocket 25′ upon a sleeve 27′ of the bracket 28 by running over a sprocket member 33 journaled on the shaft 25. The stub-shafts 27 are connected to the sleeves 27′ by means of gear wheels 32—32′ mounted upon the said stub-shafts and sleeves. A clutch member 34 is arranged for each of the sprocket members 33, the same being splined upon the shaft 25 and adapted to be moved in and out of clutching engagement with the sprocket members by means of shift levers 35. It will be understood that by turning either or both of the cranks 26, when the clutch members 34 are in mesh with the sprocket members 33, as normally maintained by the springs 33′ on the shaft 25, the stub-shafts 27 will be turned for feeding the frame 10 in the desired direction longitudinally upon the brackets 15 and 16, simultaneously with the operation of said cutters 14 by the means hereinafter described.

A power chain 36 is arranged within the outwardly opened channel 37 of the frame 10 being mounted upon anti-friction rollers 38 carried within the frame and projecting outwardly through slots 39, the cutting member 14 being removably secured and suitably spaced apart upon the chain 36 by bolts 40, the said members 14 being fitted for free sliding movement within the channel 37 of the frame. The cutting teeth 41 of the members 14 have sharpened outer edges 42 projecting from the frame 10 adapted for engaging the side of the mine and cutting the coal during the operative movement of the chain 36 in the direction indicated by an arrow in Fig. 2 of the drawings. Clearing teeth 14′ are alternately arranged upon the chain 36 intermediate the teeth 14 for clearing away the cuttings, while differently formed teeth may be employed if desired.

A shaft or axle 44 is journaled in the bracket 16 between an extension 45 carried thereby and the adjacent foot 21, a sprocket wheel 46 being carried by the said axle in constant operative engagement with the power-chain 36 through a longitudinal slide slot 47 of the frame 10, while a transverse shaft 48 is journaled between the extension 45 and the arm 49 of the opposite bracket 15. Beveled pinions 50 and 51 are carried by the shafts 48 and 44, respectively, being in constant mesh with each other while the shaft 48 is operatively connected with the shaft 25 by means of a sprocket chain 52 passing over sprockets 53 arranged upon the said shafts. The bottom flange 37′, of the frame 10 has a plurality of openings 10′ therethrough to allow the cuttings to drop beneath the frame, preventing the teeth from clogging.

The complete operation of the device will be apparent from this detailed description thereof, the anchoring of the machine at the desired point within the mine having been already described. With the frame 10 arranged adjacent the wall of the mine, whereby the cutting blades 42 will engage the coal, the cranks 26 are turned for revolving the sprocket wheel 46 thereby operatively moving the chain 36 and forcing the blades 42 into engagement with the work, while simultaneously therewith the stub-shafts 27 are turned for feeding the frame 10 toward the wall being operated upon. The levers 35 may be operated to release the clutches whenever it is desired to operate the cutter chain 36 without feeding the frame 10 longitudinally.

It will be noted that a clutch connection is provided between the chain 52 and the shaft 25, the same consisting of a clutch member 10ᵃ slidably splined upon the shaft 25 and adapted for clutching engagement with the sprocket member 11ᵃ which is journaled upon the shaft 25 and over which the chain 52 runs, operating lever 12ᵃ being provided for the said clutch. It will be understood that by releasing the clutch member 10ᵃ the shaft 25 may be turned for feeding the frame 10 longitudinally withdrawing the teeth 14 from the work without operating the chain 36. By the arrangement herein described, the shaft 25 may be turned without operating either of the chains 31 and 52 or all simultaneously as found desirable, while the frame 10 or the chain 36 may be separately operated.

What I claim as new is:—

1. A coal mining machine including a pair of spaced oppositely positioned supporting brackets each having a pair of spaced horizontal outwardly positioned guide flanges and a vertical inwardly positioned socket, a jack including an upright arch member having its ends removably received within the sockets of said brackets and adapted to connect the latter, a substantially oval horizontal channel frame longitudinally slidably guided and supported by said brackets between the horizontal flanges thereof, an endless coal cutter chain arranged in the channel of said frame, and means associated with said brackets and said arch member to shift said frame and to operate said cutter chain.

2. A coal mining machine including a jack having an inverted substantially U-shaped upright member, a pair of spaced oppositely positioned brackets removably attached to the lower ends of the legs of said member and having base supporting feet, a horizontal substantially oval channel frame arranged outwardly of and longitudinally shiftably guided and supported by said brackets, an endless coal cutter chain, operately arranged in the channel of said frame, and means associated with said brackets and said upright member to operate said cutter chain and to shift said frame.

3. A coal mining machine including a pair of spaced oppositely positioned brackets, each having a pair of horizontal outwardly positioned spaced flanges and a vertical inner socket, a jack including an inverted substantially U-shaped upright member having the lower ends of its legs removably received within said sockets, a horizontal substantially oval channel frame longitudi-

nally shiftably guided and supported by said brackets between said horizontal flanges thereof, an endless coal cutter chain arranged in the channel of said frame, a transverse power shaft carried by the legs of said upright member, toothed racks upon the upper flange of said frame, gears in constant mesh with said racks and having operative connections with said power shaft, and operative connections between said power shaft and the cutter chain.

In testimony whereof I affix my signature.

JOHN GRICAR.

July 17, 1923. 1,462,304

R. P. SAFFOLD

TRACTOR

Filed Jan. 7, 1920

Fig. 1.

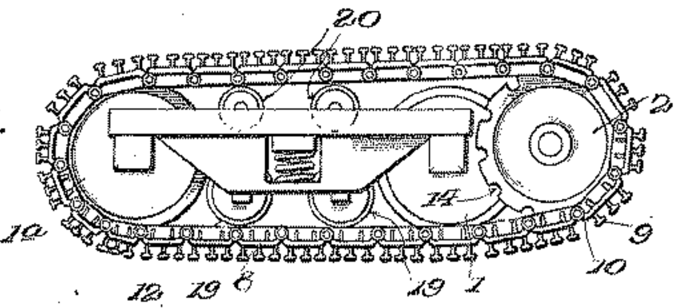


Fig. 2.

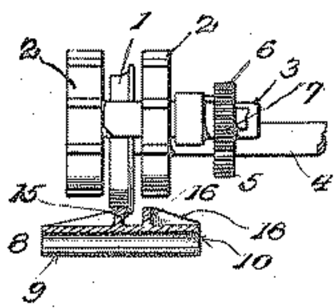
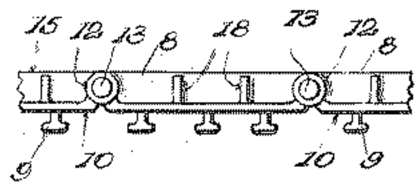


Fig. 3.



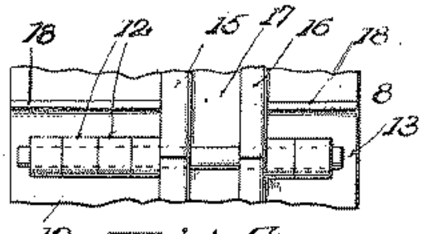


Fig. 4.

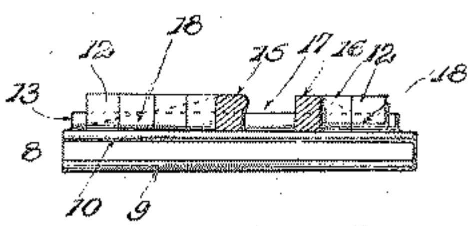
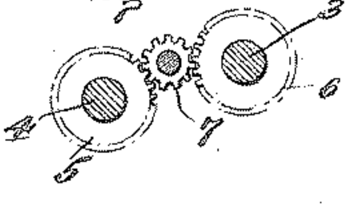


Fig. 5.

Fig. 6.



Inventor
Roy P. Saffold

by Whitt & Maguire
his Atty's.

Patented July 17, 1923. 1,462,304

UNITED STATES PATENT OFFICE.

RAY P. SAFFOLD, OF BISBEE, ARIZONA.

TRACTOR.

Application filed January 7, 1920. Serial No. 349,849.

To all whom it may concern:

Be it known that I, RAY P. SAFFOLD, a citizen of the United States, and residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Tractors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has primary reference to those vehicles whose running wheels are of the car wheel design, that is, having a tread surface and a flange. My primary object is to provide improved means for applying the tractor belt and readily removing it according as the vehicle may be moved over ground having no tracks or one having a track surface.

Figure 1 shows a side elevation of a tractor belt and complementary parts. Figure 2 is a section of the tractor belt and an edge view of one of the running wheels and the operating gears. Figures 3, 4 and 5 are details of the belt. Figure 6 is a detail, showing the driving connection between the car axle and the gear wheels. I have illustrated the car truck equipped with ordinary running wheels 1, 1^a, having the usual flanges at their inner edges. Secured to the car truck adjacent the running wheel 1 is a pair of gear wheels 2 mounted on a shaft 3 journaled in the car truck. 4 designates the axle on which the running wheel is mounted. It carries a pinion 5 and the shaft 3 also has a pinion 6. A gear 7 meshes with the two pinions. By this means the gear wheels 2 will rotate with the running wheels and at the same speed.

I make the self laying track of a series of links 8. Each of these is formed with a tread surface 9 above which is a plate 10 suitably secured to the tread surface. At each end of the link the plate is formed with a series of perforated ears 12, the ears on the plates of adjacent links being arranged to alternate so that when they are brought together their perforations will be in alinement to receive a bolt 13. This permits of ready flexing of the track and it also provides appropriate means for engagement with the gear wheels. These are shown formed with transverse peripheral grooves 14 corresponding in formation to the ears 12 and correspondingly spaced apart so that the ears may enter the grooves as the gear wheels are operated.

Also mounted upon the plate 10 of each link is a track 15 of the usual formation to receive the flanged running wheels 1, 1^a. Spaced apart from this way or track 15 is a guard rail 16, the flange of the wheel being received by the intermediate space 17. These rails are maintained in proper position by braces 18. When it is desired to remove the track it is only necessary to remove one of the bolts 13 to disconnect any two of the links 8.

As indicated in Figure 1 the car may be equipped with guide wheels 19 swiveled upon the truck. These are of assistance in the transportation of heavy loads and they tend to maintain the tractor belt in proper relationship. I have also shown the truck equipped with guide rollers 20 over which the belt may pass.

It will be understood that I provide one of the continuous tracks for each side of the car and that owing to the effective manner in which the belt is held to the running wheels by the rails 15, 16, it is not necessary to duplicate the gear wheels 2, that is, it is not necessary to provide them for both the rear as well as the front wheels of a truck as the belt will maintain its proper position in traveling over running wheel 1^a.

My invention is adapted to motor cars as well as to trailers.

I claim as my invention:

1. The combination with a car truck, running wheels, an axle, a small wheel on said axle, of a shaft on said truck, a wheel on said shaft, a smaller wheel on said shaft, a wheel meshing with the small wheels on said axle and shaft, and a continuous laying track adapted to pass over said running wheels and the larger wheel on said shaft.

2. The combination with car supporting wheels journaled in a truck, one of said wheels being a driver, of an endless track having a tread surface and a rail surface on which the wheels are supported for travel, and a positive connection between said

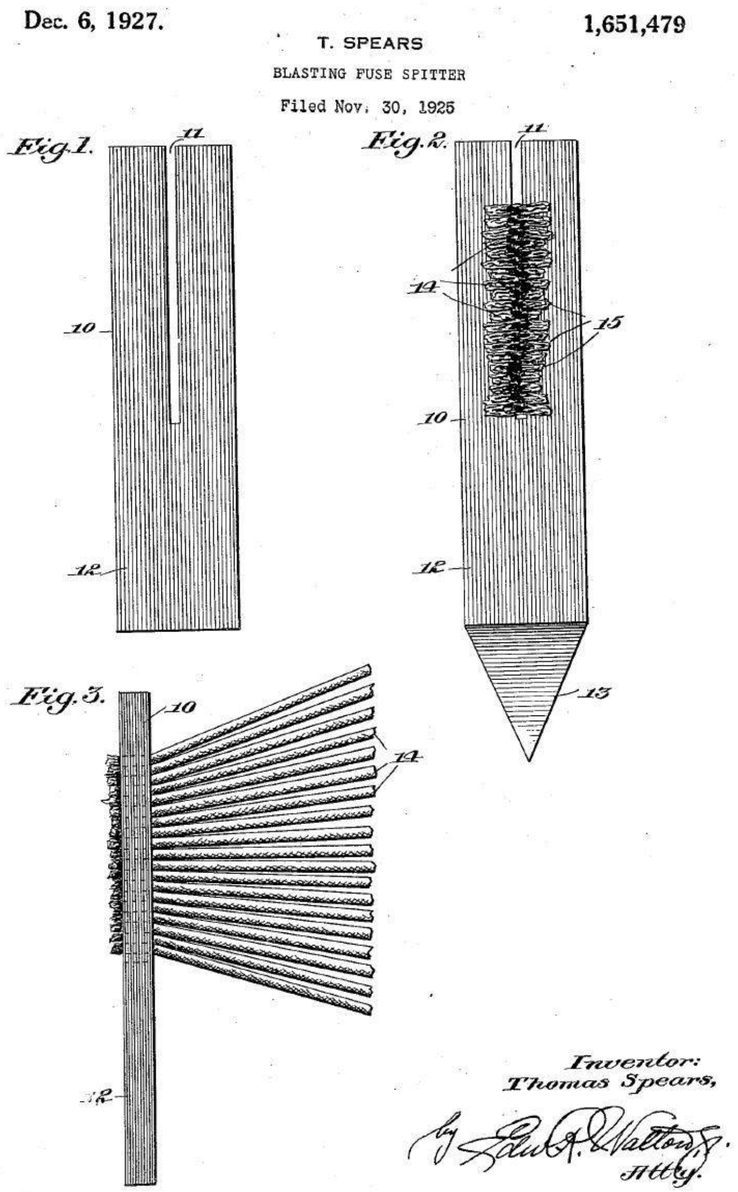
driver and track for positively driving the endless track, said driver driving the car on the rail surface.

3. The combination with a car truck, running wheels, an axle and a pinion on said axle, of a shaft on said truck, a gear wheel on said shaft, a pinion on said shaft, a gear meshing with the pinions on said axle and shaft, and a continuous self laying track adapted to pass over said running wheels and gear wheel.

In testimony whereof I have signed this specification.

RAY P. SAFFOLD.

Blasting



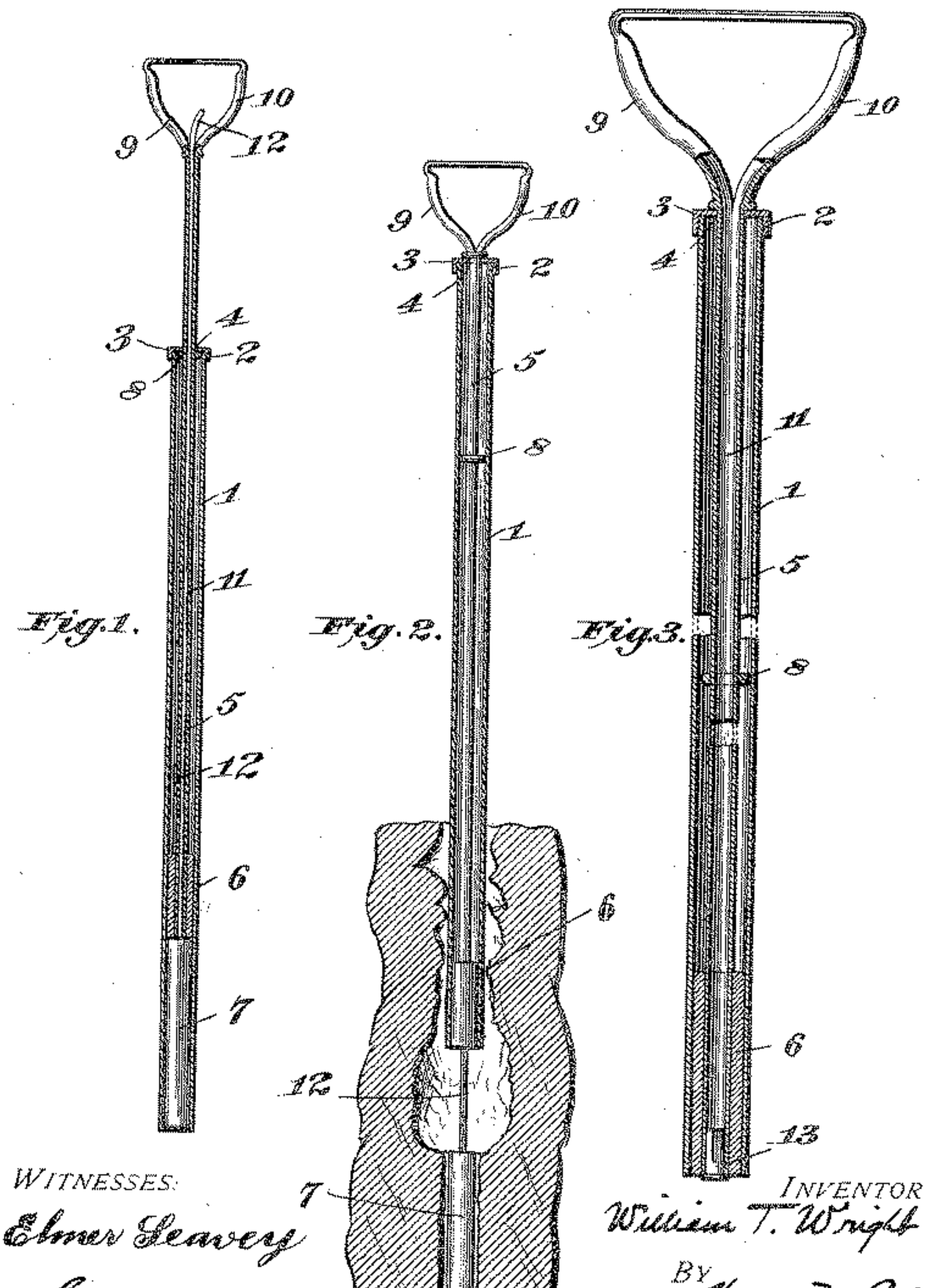
Dec. 6, 1927.
T. SPEARS
1,651,479
BLASTING FUSE SPITTER
Filed Nov. 30, 1925
Fig.1.
Fig.2.
Fig.3.
11
10
12
14
15
13
Inventor:
Thomas Spears,
by
Atty.

No. 780,467. PATENTED JAN. 17, 1905.

W. T. WRIGHT.

BLAST HOLE LOADER.

APPLICATION FILED MAR. 30, 1904.



WITNESSES:

Elmer Seavey

Geo. H. Hamlin

INVENTOR

William T. Wright

BY Henry W. Copp

his Attorney

No. 780,467. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM T. WRIGHT, OF BISBEE, ARIZONA TERRITORY.

BLAST-HOLE LOADER.

SPECIFICATION forming part of Letters Patent No. 780,467, dated January 17, 1905.

Application filed March 30, 1904. Serial No. 200,834.

To all whom it may concern:

Be it known that I, WILLIAM T. WRIGHT, a citizen of the United States, residing at Bisbee, county of Cochise, and Territory of Arizona, have invented certain new and useful Improvements in Blast-Hole Loaders, of which the following is a specification.

This invention relates to blast-hole loaders, and more especially to that class of loaders which are adapted to load dynamite cartridges, although the device may be used for loading giant-powder into blast-holes or for loading black powder.

The object of the invention is the provision of means for limiting the movement of the plunger in both directions.

A still further object consists in providing the plunger with an elongated aperture for the reception of the fuse.

The invention consists in the novel features and combination of parts, which will be more fully hereinafter described, and pointed out in the appended claims.

Referring to the accompanying drawings, Figure 1 represents a longitudinal section of the device with the cartridge in position for loading. Fig. 2 is a similar view of the device inserted in a blast-hole and the cartridge displaced by the plunger and showing the tube partially removed. Fig. 3 is a longitudinal section of the device, omitting the cartridge and showing the dirt-cap in place.

Referring more especially to the drawings, 1 represents a tube of any desired length or size, provided with screw-threads 2 at its upper end, which are adapted to be engaged by a cap 3, having an aperture 4. Slidably mounted within the tube 1 is a plunger-rod 5, having on its lower end a head 6 of slightly smaller diameter than the tube 1, which head is adapted to bear upon the top of the cartridge 7. This plunger-rod 5 is adapted to slide through the aperture 4 of the cap 3. Suitably secured at the proper distance from the top of the plunger-rod 5 is an annular shoulder 8, adapted to contact with the cap 3 to limit the upward movement of the plunger-rod. At the top of the rod a similar shoulder is secured thereto to limit the downward movement of the rod. At this point the plunger-rod is split in half, forming arms 9 10, which diverge for a predetermined distance and are then bent at an angle and secured together by any suitable means. This forms the handle of the device. Centrally through the plunger-rod 5 is an aperture 11, adapted to receive the fuse 12, which is secured to the cartridge 7, and at the end of said central aperture a cap 13 is inserted to prevent the access of dirt or other foreign substance when the device is not in use.

In operation the cap 13 is removed, and the fuse of the cartridge is inserted through the central aperture of the plunger-tube until it projects beyond the upper end thereof, and then the plunger is withdrawn and the cartridge forced into the tube 1 until the shoulder 8 comes in contact with the cap 3 or until the lower end of the cartridge is flush with the lower end of the tube 1. The device is now inserted in the hole and the plunger forced downward and held in its lowermost position and the tube 1 withdrawn until the cartridge is wholly exposed to the sides of the blast-hole. The entire device will then be withdrawn, as shown, and the cartridge will be left in the blast-hole, and the fuse will project from the upper end thereof. If it is desirable at this point, the tube 1 may be removed and the fuse inserted in the aperture, and the device may be used to tamp sand on top of the cartridge, the fuse working up and down within the central aperture of the plunger.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A device of the class described comprising a cartridge-receptacle, and a plunger working within said receptacle provided with means for holding a fuse.

2. A device of the class described comprising a cartridge-receptacle, a plunger working within said receptacle, and a fuse-receptacle within said plunger.

3. A device of the class described comprising a cartridge-receptacle, a plunger working within said receptacle, a head carried by said plunger, and means for limiting the movement of said head.

4. A device of the class described comprising a cartridge-receptacle, and a tubular plunger free to reciprocate within said cartridge-receptacle and adapted to hold a fuse.

5. A device of the class described comprising a cartridge-receptacle, a tubular plunger free to reciprocate within said receptacle adapted to hold a fuse, and means for limiting the movement of said plunger.

6. A device of the class described comprising a cartridge-receptacle, a plunger adapted to hold a fuse reciprocally mounted within said receptacle, and means for limiting the movement of said plunger.

7. A device of the class described comprising a cartridge-tube, a tube within said cartridge-tube, a head on said inner tube, and a handle formed of a continuation of said inner tube.

8. A device of the class described comprising a cartridge-tube, a plunger-tube within said cartridge-tube adapted to hold a fuse, a cap on said cartridge-tube, and a shoulder on said plunger-tube adapted to contact with said cap to limit the movement of said plunger-tube.

9. A device of the class described comprising a cartridge-tube, a plunger-tube within said cartridge-tube, and independent means for closing the end of said plunger-tube.

10. A device of the class described comprising a cartridge-tube, a plunger-head operating within said cartridge-tube, a plunger extending through said head and provided with means for holding a fuse, and shoulders on said plunger adapted to limit the movement of said plunger.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

WILLIAM T. WRIGHT.

Witnesses:
GEORGE J. McCABE,
S. W. CLAWSON.

A. D. REESE.

REGISTERING DEVICE.

APPLICATION FILED OCT. 18, 1917.

1,264,439. Patented Apr. 30, 1918.

2 SHEETS—SHEET 1.

Fig. 1

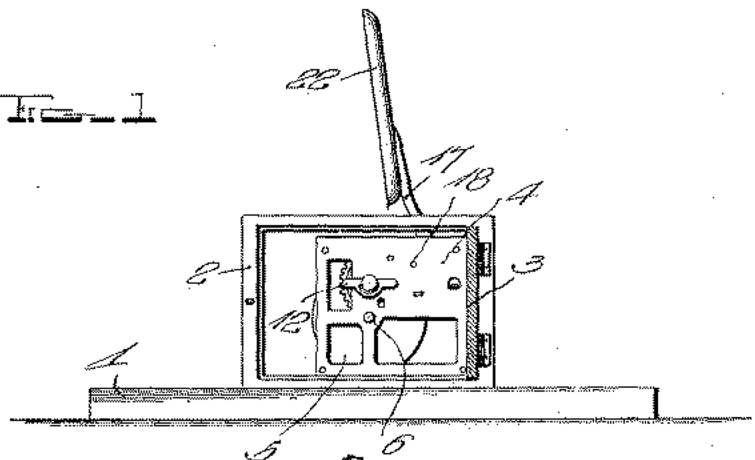


Fig. 2

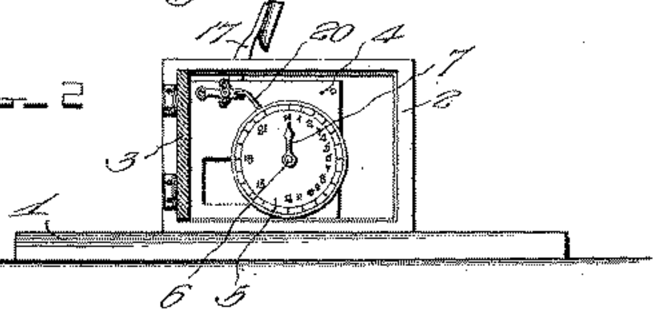
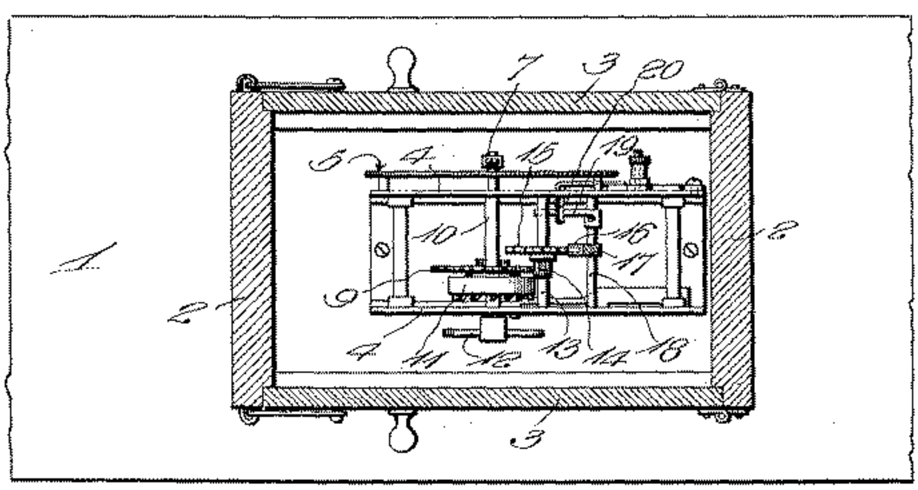


Fig. 3



Inventor

Alba D. Reese

Witness

By A. B. Willson & Co.

Attorneys

A. D. REESE.

REGISTERING DEVICE.

APPLICATION FILED OCT. 18, 1917.

1,264,439. Patented Apr. 30, 1918.

2 SHEETS—SHEET 2.

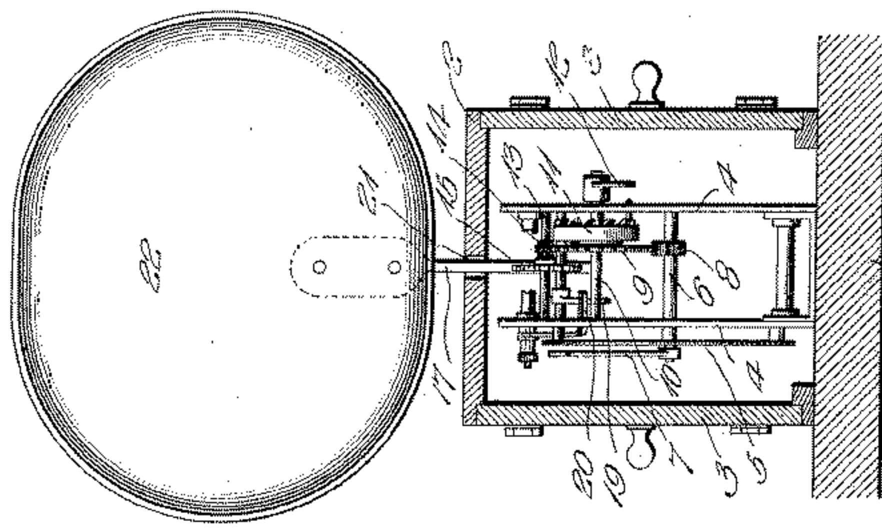


Fig. 5

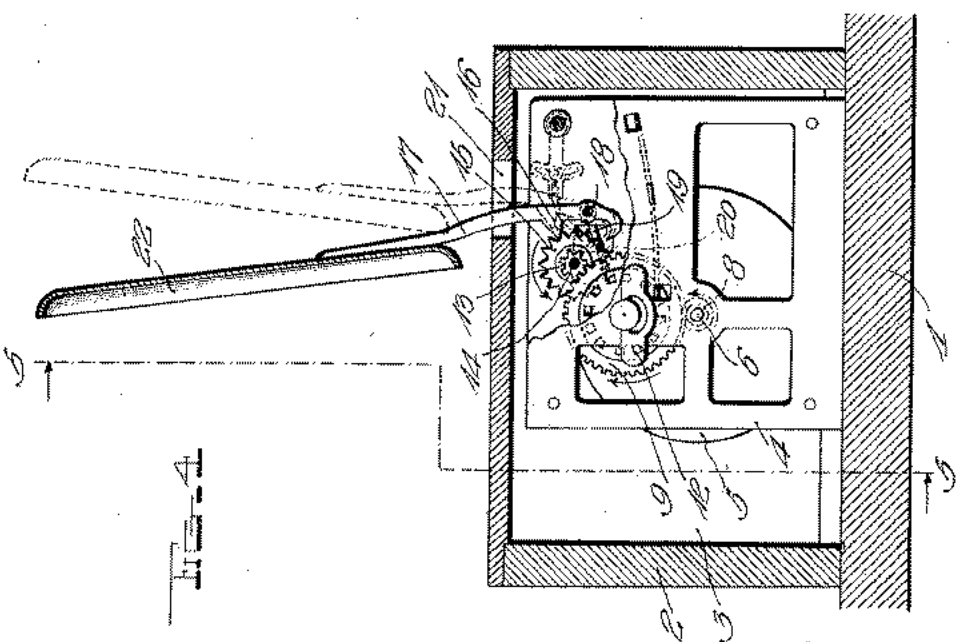


Fig. 4

Inventor

Witness

Alba D. Reese

By H. B. Willson & Co.

Attorneys

UNITED STATES PATENT OFFICE.

ALBA D. REESE, OF BISBEE, ARIZONA.

REGISTERING DEVICE.

1,264,439. Specification of Letters Patent. Patented Apr. 30, 1918.

Application filed October 18, 1917. Serial No. 197,294.

To all whom it may concern:

Be it known that I, ALBA DAVID REESE, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Registering Devices; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain new and useful improvements in registering devices.

The primary object of the invention is to provide a device which is adapted to be placed in a mine or tunnel where blasting is to be done, said device including registering mechanism and a member acted upon by the concussion of the air caused by the blast to operate the registering mechanism.

Another object of this invention is to provide a device of this character which will be comparatively simple, strong, durable and inexpensive in construction, efficient and reliable in operation, and well adapted to the purpose for which it is designed.

With these and numerous other objects in view, the invention consists of certain novel features of construction, and the combination and arrangement of parts as will be hereinafter fully described and claimed.

In the accompanying drawings forming a part of the application and in which similar reference characters are used to designate like parts throughout the several views:

Figure 1 is an elevation of one side of a device constructed in accordance with this invention, the door on this side of the device being shown open and in section;

Fig. 2 is a similar view of the other side of the device;

Fig. 3 is a horizontal sectional view through the device;

Fig. 4 is a longitudinal sectional view of the same; and

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 4.

Referring more particularly to the drawings, the numeral 1 designates a suitable base upon which a housing or casing 2 is mounted. This housing 2 is of rectangular shape in configuration and has its opposite sides provided with doors 3 so that access to the interior of the housing may be obtained from either side.

Mounted within the housing 2 is a registering mechanism, the frame work of which includes a pair of side plates 4. Mounted on the exterior side of one of the side plates 4 in any suitable manner is a dial 5, the latter being provided with a series of successive numbers as clearly shown by Fig. 2. Extending through the central portion of the dial 5 and mounted in the side plates 4 is a shaft 6 which carries a pointer 7 on its outer end and a pinion 8 intermediate of its ends. The pointer 7 is designed to coöperate with the graduation on the dial 5.

Meshing with the pinion 8 is a gear wheel 9 carried by a shaft 10 mounted between the plates 4. The shaft 10 also carries a suitable spring device 11 whereby motion may be imparted to the detent to be hereinafter explained. The spring device may be wound up by a key 12 fixed to the shaft 10 and disposed on the exterior side of one of the side plates 4.

The numeral 13 represents another shaft which is mounted between the plates 4 and which carries a pinion 14 meshing with the gear wheel 9. Carried also by the shaft 13 is an escape wheel 15, the latter being engaged by a detent 16, formed at the inner end of an arm 17 which is fixed to a shaft 18 mounted between the side plates 4. The shaft 18 also carries an arm 19 against which bears one end of a spring 20 fastened to one of the plates 4.

The arm 17 extends through a slot or opening 21 arranged in the top of the housing to the exterior of the same. Riveted or otherwise secured to the outer end of this arm 17 is a blade 22, the latter being here shown in the form of a substantially oval shaped plate having its edges curved or dished outwardly.

The detent 16 is maintained in engagement with the escape wheel 15 to hold the registering mechanism normally inactive by the spring 20 and the blade 22 is consequently held in one of its two positions by the same means. Whenever the blade 22 is moved backwardly or to its other position, the detent will disengage the escape wheel 15 for a moment and permit the spring means 11 to impart motion to the pointer 7. As soon as the pressure is removed from the blade 22 the spring 20 will return the parts to their normal positions and again disengage the detent 16 from the escape wheel 15 and permit the pointer to be moved another predetermined amount. The numbers upon the dial 5 are so spaced that the pointer will move from one number to another when the plate 22 is moved from its normal to its other position and then back again to its normal position.

The device is designed primarily for use as what may be termed a blast or explosive register, and obviously must be placed in the mine or tunnel where the blasting is to be done. When a blast takes place the concussion of the air caused by the blast will move the plate 22 backwardly and set the registering device into operation. Every time there is a blast, the registering device will operate and thus a number of blasts will be registered.

By putting the device in a mine or tunnel where a number of blasts are to be set off in succession, the number of blasts which actually fire will be registered and hence the many accidents which have heretofore occurred by drilling into "missed holes" will be lessened.

From the foregoing description taken in connection with the accompanying drawings, the construction, use and operation of the device will be readily understood without a more extended explanation.

As various changes in form, proportion, and in the minor details of construction may be resorted to without departing from the spirit of the invention, it is to be understood that I do not wish to be limited to the construction herein shown and described other than as claimed.

I claim:—

An explosion registering device comprising a plate adapted to receive power from the shocks resulting from explosions and to be moved toward one side by the power obtained from the shock-forces, a support, an arm pivotally mounted on said support and extending approximately vertically therefrom and supporting said plate in approximately vertical position and movable thereby and therewith to and from normal position, a registering mechanism, means constantly tending to drive said registering mechanism, a detent carried by said arm and normally engaging with said registering mechanism to prevent untimely operation of the latter, and a second detent carried by said arm in position to engage with said registering mechanism and arrest movement of the latter after it has been released by the first said detent and thereby allowed to register a shock.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALBA D. REESE.

Witnesses:
REX RICH,
D. DIER.

A. D. REESE.

DEVICE FOR REGISTERING EXPLOSIONS.

APPLICATION FILED JULY 22, 1918.

1,343,875. **Patented June 15, 1920.**

2 SHEETS—SHEET 1.

Fig. 1

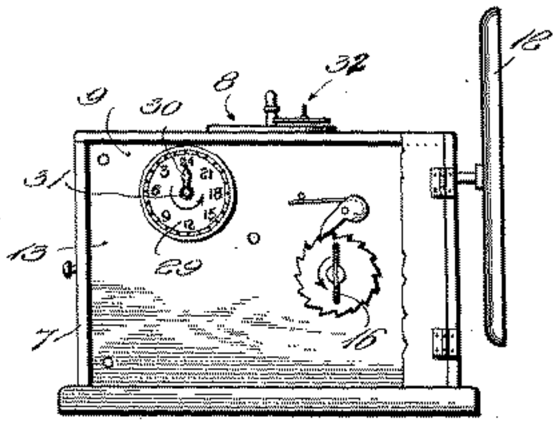


Fig. 2

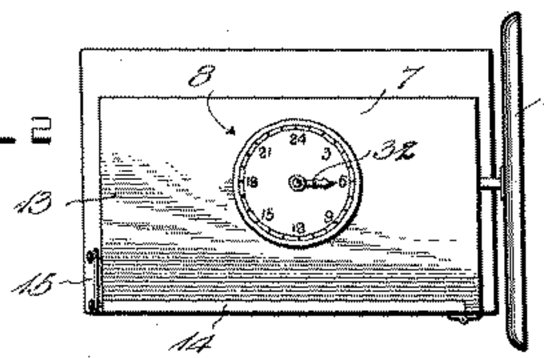
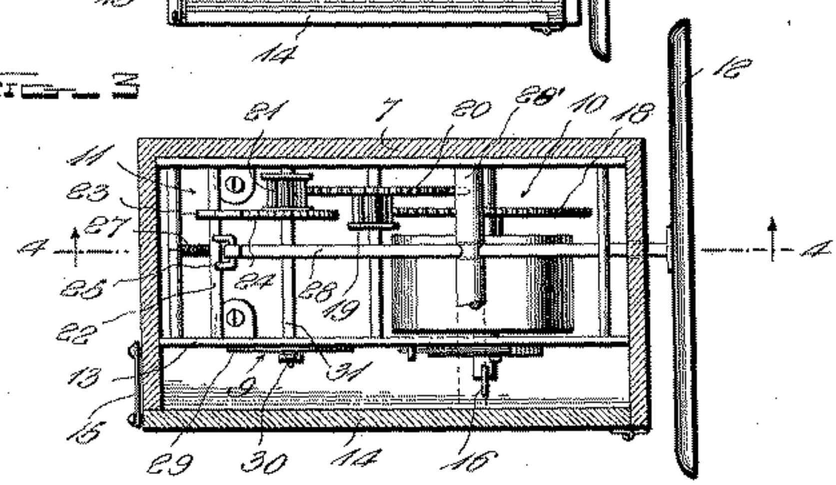


Fig. 3



Inventor

Alba D. Reese

Witness

By H. B. Willson & Co.

Attorneys

A. D. REESE.

DEVICE FOR REGISTERING EXPLOSIONS.

APPLICATION FILED JULY 22, 1918.

1,343,875. **Patented June 15, 1920.**

2 SHEETS—SHEET 2.

Fig. 5

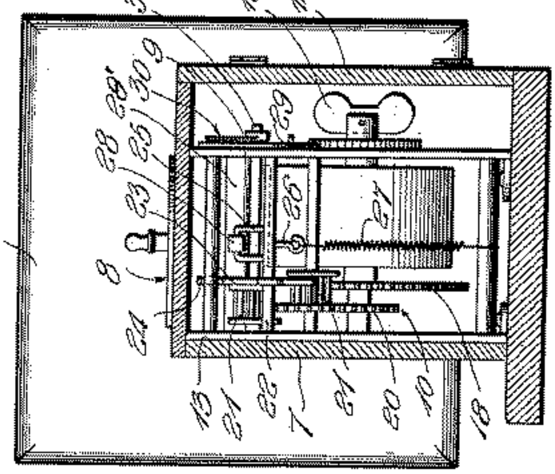
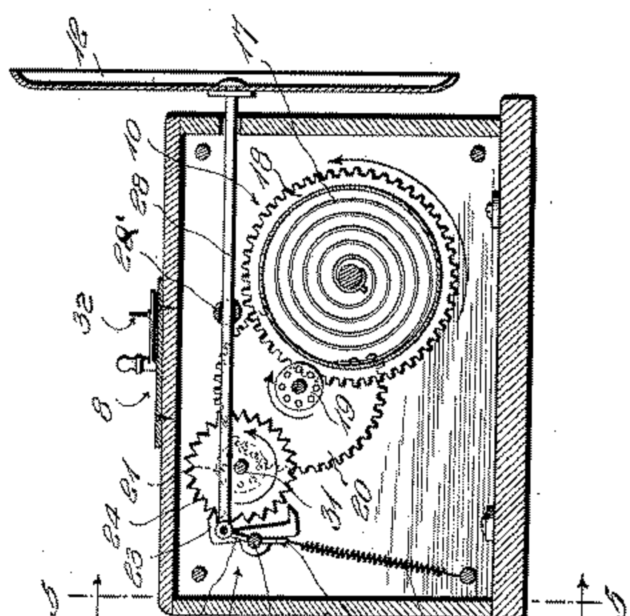


Fig. 4



Inventor

Alba D. Reese

Witness

By H. B. Willson & Co.

Attorneys

UNITED STATES PATENT OFFICE.

ALBA DAVID REESE, OF BISBEE, ARIZONA.

DEVICE FOR REGISTERING EXPLOSIONS.

1,343,875. Specification of Letters Patent. Patented June 15, 1920.

Application filed July 22, 1918. Serial No. 246,172.

To all whom it may concern:

Be it known that I, ALBA DAVID REESE, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Devices for Registering Explosions; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved device for registering explosions, and it relates more particularly to certain improvements over my device of this character which is described and claimed in my Patent No. 1,264,439, dated April 30, 1918. One object of this invention is to shorten the distance which it is necessary for the shock-receiving plate or vibrator to move in response to a shock, for effecting a registration of the shock;

Another object is to provide for shielding one side of the vibrator plate from a considerable portion of the reverberating shock forces, so as to avoid counter pressure, or resistance against the primary action of the shock;

Another object is to provide for registering the number of blast charges to be exploded, or the number of shocks which occur, as well as to register the number of explosions so that the two registers combine to indicate whether or not all of the charges have exploded;

Another object is to render the register controlling mechanism very sensitive, while eliminating very delicate elements by disposing the pallet-controlling spring transversely of the direction of movement of the detent or pallet.

Other objects and advantages will become apparent to persons who read the following details of description in connection with the accompanying drawings in which:

Figure 1 is a side elevation, a portion of the door being broken away so as to disclose the winding device and one of the register indicating devices;

Fig. 2 is a top plan view of my improved shock registering device, showing the indicator or registering device, which is settable to register the number of blasts or shocks which should occur;

Fig. 3 is a somewhat enlarged horizontal sectional view;

Fig. 4 is a vertical sectional view along the line 4—4 of Fig. 3, and

Fig. 5 is a vertical sectional view along the line 5—5 of Fig. 4.

Referring to those drawings in detail, in which similar reference characters correspond with similar parts throughout the several views, the device comprises a casing 7, registers 8 and 9, a register driving mechanism 10, a register controlling mechanism 11, a shock receiving plate 12, and correlated elements which will hereinafter be specified.

In this embodiment of my invention I preferably provide the case 7 with a frame 13 which is secured therein and carries the register and the mechanism for driving and controlling the register 9. The casing 7 is provided with a door 14 which normally protects the interior mechanism from dust and other foreign matter, and a latch or other suitable fastening element 15 is provided for keeping the door 14 closed. By opening the door, access may be had to a winding device 16 whereby a spring 17 may be wound. This spring constitutes a part of the register driving mechanism, as it transmits its motion to the register 9 through the medium of a train of gears 18, 19, 20, and 21, and shafts on which these gears rotate.

The register controlling device 11, comprises a shaft 22, a pallet 23 on the shaft, a toothed wheel 24, an arm 25 on the shaft 22, a second arm 26 on said shaft 22, a spring 27 connected to the arm 26 and to an element of the frame 13, and a reciprocative member or rod 28, the latter having one end pivotally connected to the arm 25 and having its other end secured to the central part of the plate 12 and supporting the latter. The intermediate portion of the rod 28 is slidable in a bearing element 28′ which constitutes a part of the frame 13, the outer end portion of the rod 28 extending horizontally through an aperture in the casing 7. Although the indicator driving mechanism and a portion of the indicator controlling mechanism is identical with that of my former patent, it is hereby described in detail to prevent the necessity for referring to said former patent in order to gain a perfect understanding of the construction and operation of this improved device.

Register 9 consists of a dial 29 provided with any desired number of graduations, which are indicated by the numerals thereon, and an indicator or indicating finger 30 which is mounted on a shaft 31, this being the shaft on which the gear wheels 21 and 24 are mounted; and it will be seen, therefore, that the spring 17 continually tends to turn the indicating finger 30 through the medium of the train of gearing and shafts; while the controlling device 11 prevents the turning of the finger 30 except when the pawl or pallet 23 is swung or rocked so as to disengage one of its detents with the wheel 24 and allow this wheel to move a step and then be stopped by the other detent of the pallet 23, such movement of the pallet being effected by means of a shock which forces the plate 12 toward the casing 7, thereby moving the rod 28 inward so as to rock the shaft 22 against the tension of the spring 27. As soon as the plate 12 is relieved from the force of the shock, the spring 27 returns it, through the medium of the elements 26, 22 and 25, to the normal position shown in Figs. 3 and 4. This combined inward and outward movement or reciprocation of the rod 28 has now caused the finger 30 to indicate that one shock or blast has occurred, and this movement or reciprocation is repeated with each subsequent blast or shock, so that the register 9 shows at a glance how many shocks have occurred.

The manually settable register 8 is similar to the register 9, except that it is not connected with any operating or controlling mechanism, and may be provided with any suitable means, for instance, such as indicated at 32 whereby its finger may be turned to register with the numeral which indicates the number of shocks which should occur; that is, the number of separate charges of a series which are to be exploded. Register 8 effectually prevents error which would otherwise result from forgetfulness and thereby prevents great danger and the loss of life which so often occurs because of the erroneous belief that all of the intended blasts have occurred. By carefully setting the register 8 to correspond with the number of shocks which should occur, and then properly locating and positioning this device with relation to the blasts, and afterward comparing the registration on the register 9 with that of the register 8, it may be determined at a glance whether or not all of the shocks or blasts which should have occurred, have occurred; and if it is found that the number indicated by the register 9 is less than that which is indicated by the register 8, it is known that one of the blast charges has not yet exploded, and the workmen remain at a safe distance until such charge or charges have exploded, or until sufficient time has elapsed to assure the workmen that such blast charge or charges will not explode.

By the construction of the controlling mechanism which is clearly disclosed in Fig. 4, a considerable portion of the plate 12 is shielded by the adjacent surface of the casing 7, so that the reverberating shock force of one blast or shock will not counteract the effect of a subsequent shock in moving the plate 12 toward the casing. Moreover, because of the shortness of the arm 25, only a slight movement of the plate 12 is required to rock the pallet 23 sufficiently to effect the step by step movement of the wheel 24. The combined weight of the rod 28 and the plate 12 effects a frictional engagement of the rod with the bearing 28; and this prevents undue vibration of the pallet so that all danger of registering excessively is avoided.

Although the spring 27 is formed of wire sufficiently heavy to withstand the effects of damp air and gas of mines, tunnels, etc., it is sufficiently sensitive to yield under the comparatively slight pressure which results from explosions at a distance from the plate 12. This is true because of the position of the spring with relation to the shaft or locking member 22, as shown in Fig. 4, where it will be seen that this spring extends substantially radially with relation to the shaft 22 and pulls in the radial direction, that is, its pull is exerted along a line which extends transversely of the path of movement of the upper and lower detents of the pallet 23.

Although I have described this embodiment of my invention very specifically, it is not intended to limit my invention to these exact details of construction and arrangement of parts, but I am entitled to make changes without departing from the inventive idea disclosed in the foregoing description and following claims:

What I claim as my invention is:

1. In a device for registering shocks resulting from explosions, a plate mounted for movement and adapted to be moved by the shock forces and to control the registering operations, and shielding means to shield one side of said plate against at least a part of the shock forces so as to avoid counter pressure, substantially as described.

2. In a device for registering shocks resulting from explosions, a plate mounted for movement and adapted to be moved by the shock forces and to control the register-

ing operations, and a casing to inclose a register operating mechanism and support the said plate, said casing also constituting a shielding means to shield one side of said plate against at least a part of the shock forces so as to avoid counter pressure, substantially as described.

In testimony whereof I have hereunto set my hand.

ALBA DAVID REESE.

Witnesses:
J. A. KEMPTON,
CHAS. G. BROOKS.

Dec. 6, 1927. 1,651,479

T. SPEARS

BLASTING FUSE SPITTER

Filed Nov. 30, 1925

Fig.1.

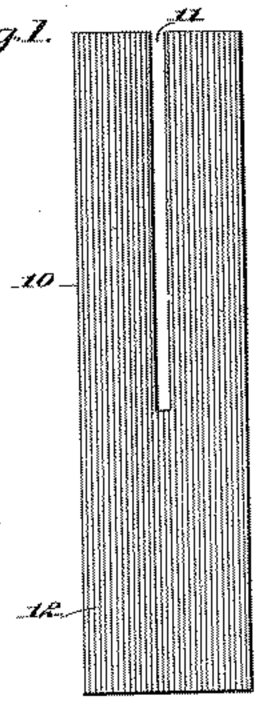


Fig.2.

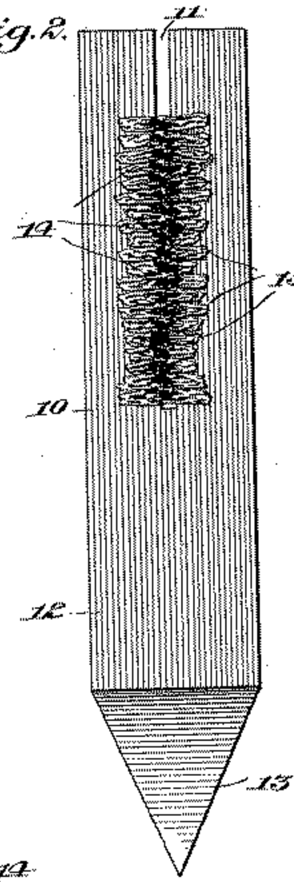
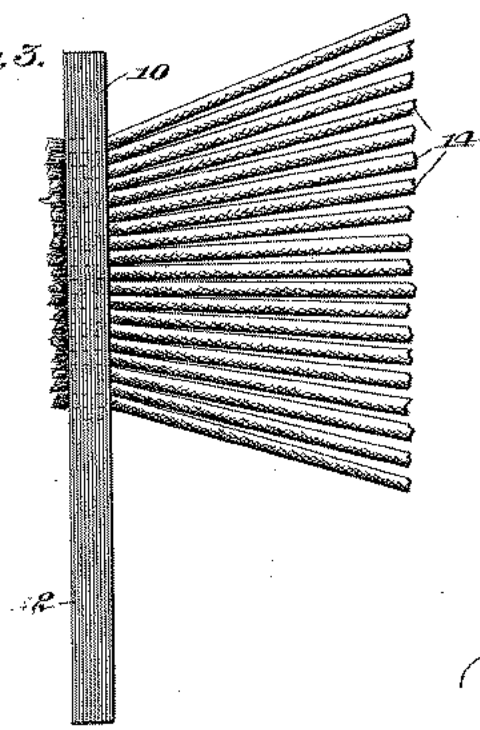


Fig.3.



Inventor:
Thomas Spears,

By Edw. A. Watton, Jr.
Atty.

Patented Dec. 6, 1927. **1,651,479**

UNITED STATES PATENT OFFICE.

THOMAS SPEARS, OF BISBEE, ARIZONA.

BLASTING FUSE SPITTER.

Application filed November 30, 1925. Serial No. 72,221.

The present invention is a blasting fuse spitter for effecting the ignition of a plurality of fuses simultaneously for blasting purposes, and further consists of the method employed in effecting this result, and the maintenance of the fuse in the spitter.

In mine blasting, it is the practice to run ordinary powder fuses to the holes or points where the blasting charge has been deposited, there usually being a multiplicity of such charges distributed at spaced points or places for effecting the character blast desired; and it is now the general practice to apply a torch or lamp to the end of each fuse independently one after the other. This practice is rather dangerous to the miner, as it is necessary for him to light all the fuses, before retiring to a place of safety. The smoke from the first few fuses fills the working place necessitating him to feel around for remaining fuses or charges, which often detains him longer than he is aware, and the first lighted fuse explodes before he gets to a safe place. Also, many times the lamps or torches are blown out by the spurting of the powder from the end of the fuse, leaving the miner without a light, and causing him to grope around in the dark to a place of safety, or forcing him to attempt to relight the lamp before the blast occurs. The resultant accidents are said to be from premature explosions and the vast majority of blasting accidents are thus occasioned.

It is the object of the present invention, therefore, to overcome the above stated drawbacks by the provision of a fuse spitter which is extremely economical, and which is constructed to hold and retain the ends of the fuses in such a manner that all ends may be directly ignited by one flashing of a torch or lamp at the same time, the ends of the fuses being grouped together and arranged in close relation, so that every lighting of one or any number of the grouped ends of the fuses will result in the ignition of the entire group.

A further object of the invention is in the quick and simple method employed in grouping and retaining the ends of the fuses in a holding device or spitter.

With the above and other objects in view, the invention resides in the sundry details of construction, combination and arrangement of parts, and in the steps of the method employed hereinafter more fully described and set out in the appended claims.

In this specification and annexed drawings the invention is disclosed in the form in which it is considered to be the best, but the invention is not limited to such form and method, because it is capable of being embodied in other forms, and being performed in different manners; and it is to be understood that by and in the claims following the description herein, it is intended to cover the invention in whatever from it may be embodied, or in whatever manner it may be practiced within the scope of said claims.

In the drawings which show the preferred embodiment of the invention as at present devised, and the manner in which the fuse ends are held in the spitter:

Fig. 1 is a front elevation of the spitter constructed in accordance with the invention;

Fig. 2 is a front elevation of the spitter showing the fuse ends attached thereto and the method by which they are held and retained in grouped relation in the spitter; and

Fig. 3 is a side view of the spitter shown in Fig. 2.

Referring in detail to the drawings, the spitter of this invention consists of a panel or elongated stick of wood or other suitable material 10, which is slotted as indicated at 11. The slot 11 preferably extends from the upper end of the spitter for a desired distance inwardly thereof, although the slot may be arranged in any desired manner. The slot 11 is to be of such width as will permit the ends of the fuses to extend therethrough, and is preferably no wider than will accomplish this, so that the ends of the fuses may to an extent bind themselves in the slot. The slot 11 may be of any desired length, but at least sufficient to accommodate the usual number of fuses which it is desired to ignite at one time.

While the spitter 10 is shown in the form of an elongated panel with the slot extending from one end, leaving a handle portion 12 at the other end, so that the spitter may be conveniently held in one hand by the miner, this handle portion 12 may have its lower extremity pointed as at 13 in order that it may be stuck into the dirt, crevice, or other such place. The spitter 10 can be made of any suitable material, and preferably from any waste strip of wood which is convenient and at hand, so that should the spitter become destroyed as a result of the blasting, the loss is very small.

The slot 11, as above stated, is adapted to have inserted therein a plurality of ends of fuses 14, the ends of the fuses being moved together in close relation, as illustrated in Figures 2 and 3, preferably one above the other. The free extremities of the fuses which usually are of a corded construction are mashed or spread, as particularly shown in Fig. 2, so that these extremities will be wider than the slot 11, and prevent the same from falling out. Also, this mashing or spreading of the ends of the fuses as at 15, causes the powder in said ends to be exposed, for convenient ignition. Since the ends of the fuses 14 are in grouped juxtaposition in the slot 11, the ignition can be effected by merely applying a torch generally to the ends 15 of the fuses with the spitter. Of course, it is the practice for the miner to run the torch along the ends of the fuses in order to use an abundance of precaution to insure the proper ignition of all of the fuses.

The ends 15 of the fuses, as above stated, are mashed or spread to a size larger than the width of the slot 11, but this in some instances may be better effected by splitting the ends of the fuses with a knife or other implement.

It is also to be understood that it is within the purview of the present invention that the slot 11 be closed at both ends, but by having at least one end of the slot open it is found that the fuses may be inserted into the slot from this end with greater facility and celerity.

From the foregoing, it will be seen that applicant has made a very simple and economical invention requiring no special and expensive parts, and it maintains the fuse ends in position as the same are merely disposed in the end of a slot, which is, preferably, of such size as to bind the ends therein; and by spreading the ends of the fuses in order to properly expose the powder therein for ignition, thereby requiring no supplemental or auxiliary detonator, or igniting charge to light the ends of the fuses.

What is claimed is:

1. A blasting fuse spitter comprising a flat solid body member of substantial width and having a slot therein in which the ends of a plurality of fuses may be transversely extended with the ends of the fuses spread on a surface of the body member and grouped together for simultaneous ignition, said slot being of such width as to hold the fuses therein and said body member being of such width that the edges thereof project beyond the spread end of the fuses so when laid on one of its side edges it will support the ends of the fuses above supporting surface.

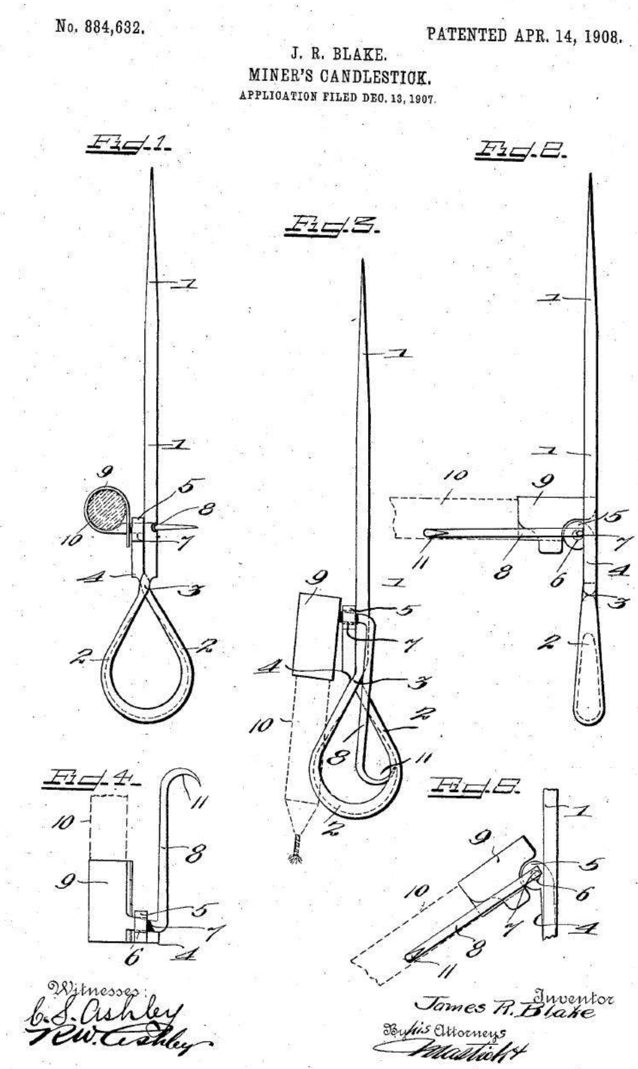
2. In combination, a unitary non-resilient fuse spitter comprising a solid body member having a slot extending for a distance thereinto from one edge thereof so as to provide an unslotted portion beyond the inner end of the slot, said slot being of a width to hold fuses transversely therein, the ignitible extremities of the fuses having bent over portions adjacent to the edges of the slot.

3. In combination, a unitary non-resilient fuse spitter comprising a body member having a slot extending for a distance thereinto from one edge thereof so as to provide an unslotted portion beyond the inner end of the slot, said slot being of a width to hold fuses transversely therein, said unslotted portion providing a handle having a penetrating end, the ignitible extremities of the fuses having bent over portions adjacent to the edges of the slot.

In testimony whereof I have hereunto set my hand.

THOMAS SPEARS.

Personal Equipment



No. 877,574. PATENTED JAN. 28, 1908.

D. B. LEWIS.

MINER'S SHOVEL.

APPLICATION FILED JAN. 2, 1907.

FIG-1-

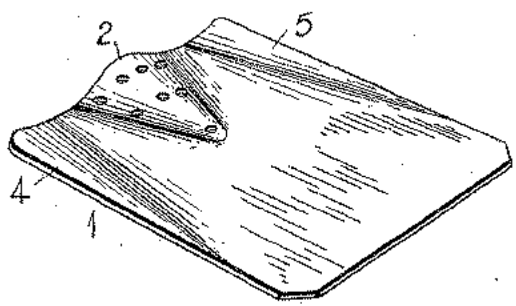


FIG-2-

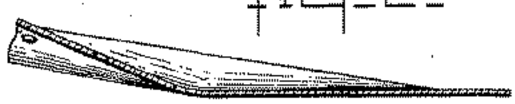


FIG-3-

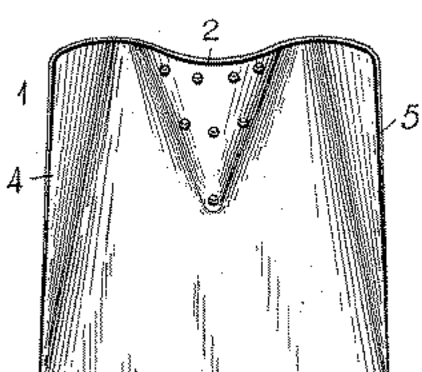
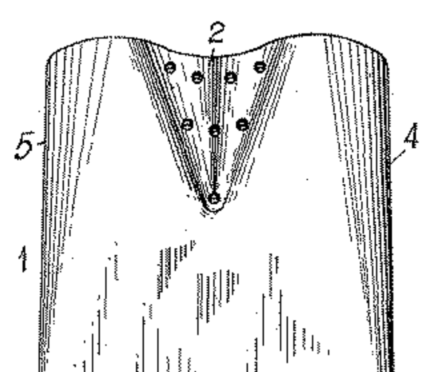


FIG-4-



Witnesses

L. B. James

S. M. McColl

Inventor

D. B. Lewis

by A. B. Willson & Co.

Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

DAVID B. LEWIS, OF BISBEE, ARIZONA TERRITORY.

MINER'S SHOVEL.

No. 877,574. Specification of Letters Patent. Patented Jan. 28, 1908.

Application filed January 2, 1907. Serial No. 350,424.

To all whom it may concern:

Be it known that I, DAVID B. LEWIS, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and Territory of Arizona, have invented certain new and useful Improvements in Miners' Shovels, of which the following is a specification.

This invention relates to hand shovels and more especially to square miner's shovels.

The object of the invention is to provide an improved shovel blade for taking up rock and ore which will slip easily thereunder and scoop it up clean.

In the accompanying drawings, Figure 1 represents a perspective view of a shovel blade embodying this invention; Fig. 2 represents a longitudinal section thereof; Fig. 3 represents a top plan view of the blade; Fig. 4 represents a bottom plan view of the blade.

In the embodiment illustrated, a square blade 1 is shown, the upper or rear end of which is of the ordinary construction, being bent upwardly and having an upstruck apertured portion 2 to receive the handle 3. The side edges 4 and 5 of the blade are curved upwardly at the rear end thereof and inclined gradually downwardly and outwardly from the rear toward the front and merge into the flat front end near the middle of the blade about three inches, more or less, from the edge of said front end. These side edges are parallel with each other and lie in the same plane, and the front portion of the blade being flat across the entire width thereof presents no obstructions to the coal or ore to be elevated, and permits the blade to slip readily thereunder with the least possible resistance. By this construction the inner faces of the side edges are arranged in approximately a horizontal plane.

I claim as my invention:—

A square shovel blade composed of a single thin sheet of metal having its front portion flat and straight across its entire width with the sides thereof curved upwardly at the rear end of the blade and bent outwardly and downwardly toward the front, merging into said flat front portion near the middle of the blade and with their inner faces lying in approximately a horizontal plane, said sheet having its rear end bent upwardly from a point beyond the middle, whereby a central depression is formed to receive the material to be lifted.

DAVID B. LEWIS.

Witnesses:

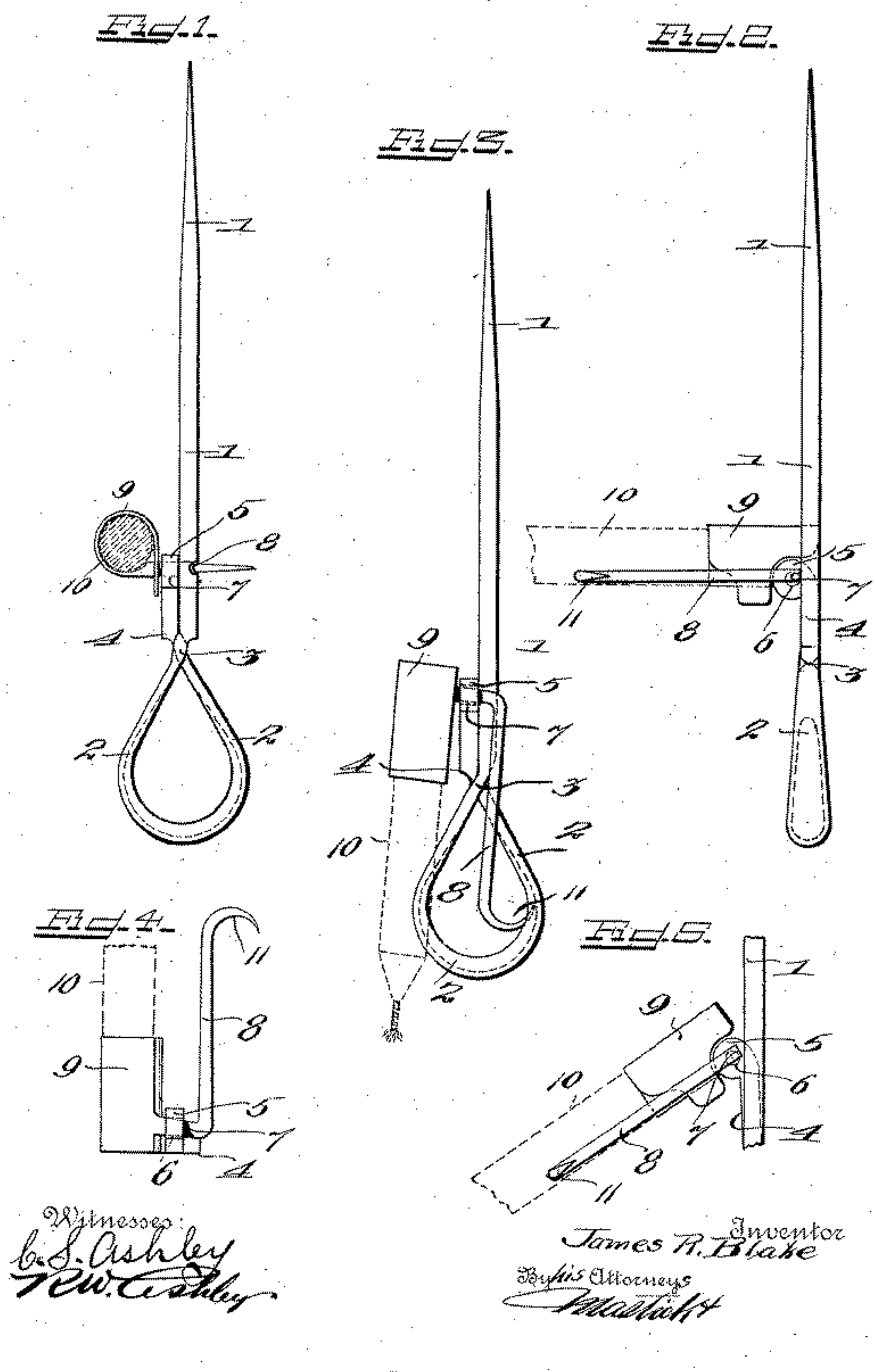
R. C. STANFORD,
S. A. MERRITT

No. 884,632. PATENTED APR. 14, 1908.

J. R. BLAKE.

MINER'S CANDLESTICK.

APPLICATION FILED DEC. 13, 1907.



THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES R. BLAKE, OF BISBEE, ARIZONA TERRITORY.

MINER'S CANDLESTICK.

No. 884,632. Specification of Letters Patent. Patented April 14, 1908.

Application filed December 13, 1907. Serial No. 406,264.

To all whom it may concern:

Be it known that I, James R. Blake, a citizen of the United States, residing at Bisbee, in the county of Cochise and Territory of Arizona, have invented certain new and useful Improvements in Miners' Candlesticks, of which the following is a specification.

The invention relates to improvements in miners' candlesticks.

The object of the invention is the providing of means whereby the candle-holder and suspending hook may be thrown back on or closed and locked in a position substantially parallel to the shank or impaling iron, thus rendering it possible to fold the candlestick so as to be readily carried in the pocket of the user.

In the following is described in connection with the accompanying drawings one embodiment of the invention, the features thereof being more particularly described hereinafter in the claims.

Figure 1 is a plan view of the device. Fig. 2 is a side elevation of the device showing the candle-holder and suspending hook in their open and operative positions. Fig. 3 is a plan view of the device showing the candle-holder and suspending hook in a closed and locked position. Fig. 4 is a detail view of the candle-holder and suspending hook, and Fig. 5 is a detail view of the candle-holder and suspending hook illustrating the same partly open.

Similar numerals of reference indicate similar parts throughout the several views.

1 indicates the shank or impaling iron of the candlestick preferably tapering to a point and square in cross section and having formed thereon a handle 2, the return end of which passes preferably under shank 1, as at 3, to form a spring end 4. The upper end of spring 4 is enlarged as at 5 to form a suitable bearing for the shank 7 of suspending hook 8. The bearing surface 6 formed in bearing 5 is preferably round and shank 7 is preferably square in cross section in order to coöperate therewith in holding the flat side of shank 7 against a correspondingly flat side of impaling iron 1, spring 4 being stiff enough to hold the parts firmly in any position and either open or closed. Shank 7 is preferably turned at such an angle to hook 8 and candle-holder 9 as to cause the hook point 11 of hook 8 to fall within handle 2 when the candlestick is in folded or closed position, the candle-holder and hook extending in the same direction from shank 7 and substantially parallel. Candle-holder 9 is suitably supported on the end of shaft 7 or it may be integral therewith and is adapted to accommodate a candle 10.

When the candlestick is in open or operative position the candle 10 and hook 8 are substantially perpendicular with reference to impaling iron 1 so that the candle will be in substantially a vertical position, for example, if hook point 11 is caught on a rough surface, or impaling iron 1 is stuck into a suitable crevice or timber.

When the candlestick is in its folded position with hook point 11 within handle 2 it can be readily placed in the pocket or otherwise carried without danger of catching in anything. This permits making the hook of sufficient length to hang well without adding to its inconvenience when not in use.

By the term "candle" I mean to include as well other lighting means such as a lamp or electric light, and the terms "candle-holder" and "candlestick" are intended to include as well means for holding such other lighting means.

It is obvious that the details of construction as herein described may be varied without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:—

1. A candlestick comprising an impaling iron, a handle and spring integral therewith, a bearing in said spring, a suspending hook, a candle-holder and a shank connecting said hook and holder and rotatable in said bearing.

2. A candlestick comprising an impaling iron, a handle, a spring, a suspending hook, a candle-holder, a shank connecting said hook and holder and inclined towards each of them and having a bearing in said spring to permit said hook to be folded into said handle.

3. A candlestick comprising an impaling iron, a handle integral therewith and turned up thereunder so that its end is adapted to form a spring, a suspending hook, a candle-

holder, a shank connecting said hook and holder, a bearing in said spring for said shank and means permitting said shank to turn in said bearing whereby the hook may be folded into the handle and the holder substantially parallel therewith.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES R. BLAKE.

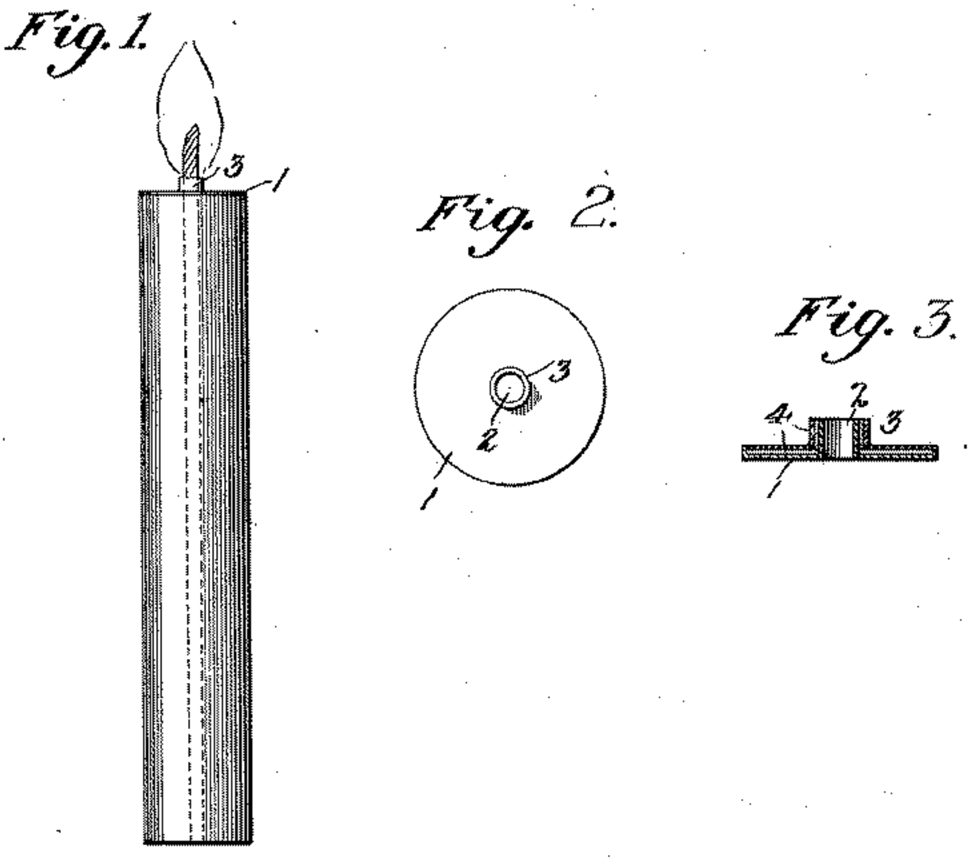
Witnesses:
FRED. P. DE WILDE,
F. A. BLAKE.

M. H. STERLING.

CANDLE PROTECTOR.

APPLICATION FILED NOV. 22, 1909.

977,567. Patented Dec. 6, 1910.



Inventor,

Witnesses
Jos F. Collins.
F. B. MacNab

Mark Howard Sterling

By Knight Bros

Attorneys

UNITED STATES PATENT OFFICE.

MARK HOWARD STERLING, OF BISBEE, ARIZONA TERRITORY.

CANDLE-PROTECTOR.

977,567. Specification of Letters Patent. Patented Dec. 6, 1910.

Application filed November 22, 1909. Serial No. 529,503.

To all whom it may concern:

Be it known that I, Mark Howard Sterling, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and Territory of Arizona, have invented a certain new and useful Candle-Protector, of which the following is a specification.

The object of my invention is to economize in the consumption of candles by lessening the waste of the combustible substance during burning.

The principal causes of such waste are the escape of the melted fuel from the reservoir, which is maintained around the wick while the candle is burning, as when the candle is held in an inclined position or a draft of air blows the flame against one side and burns a hole in the confining rim, which naturally forms when the candle burns undisturbed, also the too free feeding of the melted wax or tallow by the wick which is manifested by the smoking of the flame.

My invention avoids the causes of waste above referred to by providing flat disks provided with an inclosed air chamber, preferably corresponding in diameter to the diameter of the candle so that the protector may lie upon the upper end of the candle and having a central perforation, (preferably though not necessarily provided with a cylindrical extension or flange) which will feed the wick with sufficient accuracy to prevent displacement of the protector. The protector thus applied, forms a cap or cover for the reservoir of melted fuel of which the candle is formed, prevents excessive melting due to the direct radiation of heat from the flame, prevents melted fuel from spilling over the sides, and prevents excessive feed of the fuel up through the wick with the results that whether the candle be held vertical or not, it will burn approximately fifty per cent. longer, smoking will be prevented, and the flame will be improved as compared with the same candle burned under identical conditions with the protector.

In order that the invention may be fully understood, I will proceed to describe the same with reference to the accompanying drawings, wherein,

Figure 1 is a view of candle having my invention applied thereto; Figs. 2 and 3 are respectively, a top plan view and a cross sectional view of the protector removed from the candle.

Referring to the drawings wherein like numerals indicate like parts throughout the different views, the numeral 1 indicates a pair of superposed disks connected together throughout their peripheries, each of said disks being preferably of dimensions corresponding approximately to the sectional area of the candle to which it is to be applied.

In securing the peripheries of the disks together, an air chamber 4 is formed between the disks, which extends into the upwardly projecting sleeve 3, which in turn surrounds a central opening 2 formed in the disks to permit the passage of the wick therethrough. This opening or passage 2 is so reduced as to enable the wick to resist lateral displacement of the disk when in use, though not sufficiently restricted to choke the use of the melted fuel. The sleeve 3 is of sufficient axial extent to resist the tendency of the disk to tip or assume an inclined position should it become unevenly supported temporarily, by unequal melting of the tallow or wax, which constitutes the fuel of the candle.

By forming the protector with an inclosed air chamber, excessive melting or evaporation of fuel will be prevented, while the efficiency of the protector as an insulator against the heat of the candle flame may be increased by partially or wholly exhausting the air from the inclosed chamber. This hollow construction also increases the buoyancy of the protector and prevents displacement of the melted candle substance by sinking in it.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent is:—

A candle protector comprising a cap provided with an inclosed air chamber formed therein, said cap having a central perforation for the passage of the wick.

MARK HOWARD STERLING.

In presence of two witnesses:

G. B. Austin,

Thos. Muat.

C. KLEMMER.

PORTABLE MAGNETO ELECTRIC MACHINE.

APPLICATION FILED FEB. 19, 1912.

1,131,063. Patented Mar. 9, 1915.

Fig. 1.

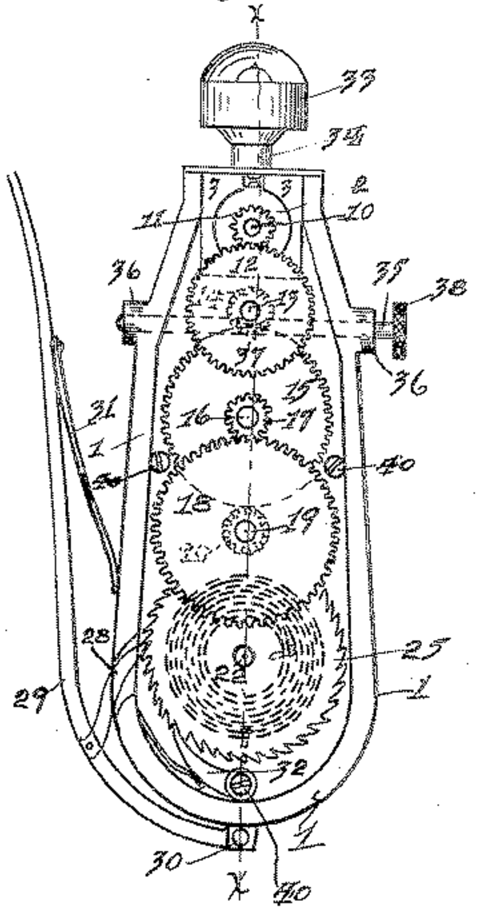
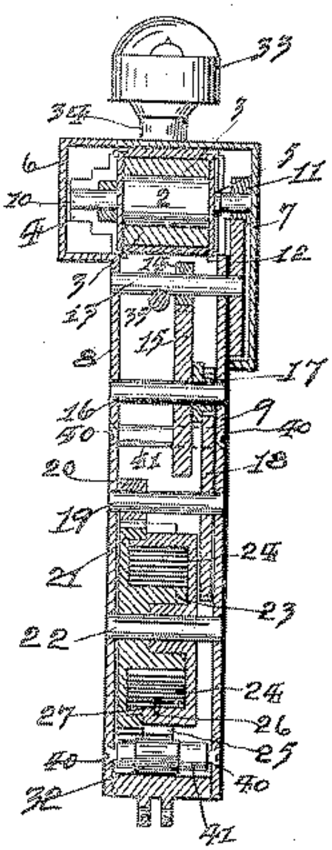


Fig. 2.



WITNESSES:

C.M. Baumeister

K. Dolbey

INVENTOR

Conrad Klemmer

BY

Harry Lea Dodson

His ATTORNEY

UNITED STATES PATENT OFFICE.

CONRAD KLEMMER, OF BISBEE, ARIZONA.

PORTABLE MAGNETO-ELECTRIC MACHINE.

1,131,063. Specification of Letters Patent. **Patented Mar. 9, 1915.**

Application filed February 19, 1912. Serial No. 678,477.

To all whom it may concern:

Be it known that I, CONRAD KLEMMER, a subject of Czar Nicholas the Second of Russia, and a resident of Bisbee, county of Cochise, and State of Arizona, have invented a certain new and useful Improvement in Portable Magneto-Electric Machines, of which the following is the specification.

My invention relates to that class of lights which are designed for flash light purposes corresponding in use to the well-known pocket search lights and has for its object to provide a lamp which will generate the current consumed by the light within itself, thereby eliminating the objectionable feature of the battery flash lights, to wit: that of the battery becoming exhausted, so that when it is wanted the light is worthless.

I am aware that magneto generators have been made which are manually operated, but I am not aware of any machine which is constructed so as to be carried in the hand of the user as mine is intended to be, and in which all of the working parts are inclosed in a casing which not only protects them from dust, but insures perfect lubrication and has for its further object to use an essential element of the generating mechanism as a part of the inclosing case.

My means of accomplishing the foregoing may be more readily understood by having reference to the accompanying drawings, which are hereunto annexed and are a part of this specification, in which:

Figure 1 is a side view of my improved light, the outer cover being removed for the purpose of disclosing the interior construction. Fig. 2 is a vertical sectional view taken on the line *x x* in Fig. 1.

Similar reference numerals refer to similar parts throughout the entire description.

As shown in the drawings, a horseshoe magnet 1, is provided to excite the field coils of the generator. This magnet constitutes the side walls of the inclosing case, all of the operative parts being within the said magnet, except one gear and pinion and the bearing for the armatures. An armature 2 and pole pieces 3 of the usual or well-known type are associated therewith, the shaft of the armature being mounted in bearings 4 and 5 formed in lateral extensions 6 and 7 of the side plates 8 and 9. These plates, as will be apparent from an inspection of the drawings, serve to completely inclose the entire operative mechanism, thereby not only protecting them from dust and dirt, but effecting most efficient lubrication.

The shaft 10 of the armature 2 has mounted thereon a driving pinion 11, which meshes with a gear 12 carried by a shaft 13 which has mounted thereon a driving pinion 14, which meshes with a gear 15 suitably mounted upon a shaft 16, which has a pinion 17 mounted thereon, the pinion meshing with a gear 18 mounted upon a shaft 19, which carries a pinion 20, which is in mesh with the master gear wheel 21, which is rotatably mounted upon a shaft 22. This gear wheel is provided with a laterally extending hub 23 and has secured to it one end of a coil spring 24, which is located in an annular recess formed in the interior of a ratchet wheel 25, the other end of the coil spring 24 being secured to the annular rim 26 of the ratchet wheel 25 by means of a screw 27 or any other convenient manner.

28 is a pawl which is adapted to engage the teeth of the ratchet wheel and is carried by the lever 29, which is pivotally attached by means of a pin or pivot 30 to the end of the horseshoe magnet 1.

31 is a spring which operates to hold the lever normally in the position shown in Fig. 1.

32 is a detent adapted to prevent the ratchet wheel from moving in a reverse direction.

33 is the lamp which is mounted in a socket 34 of the usual or ordinary construction, suitable electric connections being provided to carry the current generated by the rotation of the generator 2 to light the lamp 33. The side plates 8 and 9 are secured together by means of screws 40, which are threaded into rods 41 located in suitable or convenient places, though any other convenient form of fastening may be employed which will insure a tight joint between the magnet and the side plates.

The operation of the device is as follows: The operator grasps the lever in his hand between the thumb and fingers and by squeezing moves the lever inwardly, in this manner rotating the ratchet wheel 25 and winding up the coil spring 24. The spring in turn causes the rotation of the master gear 21 and through the train of gears drives the armature 2 at a very high rate of speed. The operation is continued intermittently, thus maintaining a steady light for any desired length of time. In some places and at some times it may be found necessary to have a steady light without the necessity of manipulating the lever 29. I accomplish this by a brake arrangement, which is shown acting upon the shaft 13, which consists of a rod 35 slidably mounted in bearings 36. It is provided with a cut-out portion or recess, as at 37, which is sufficient to clear the shaft 13 when in normal position. The shaft 35 is provided with a head 38. By pressing upon this head or button 38 the shaft is moved inwardly, putting a brake upon the shaft 13. The lever 29 can then be operated until the spring 24 is wound up tight, when by pulling the pin out until the recess 37 clears the shaft 13, the action of the spring will furnish sufficient power to rotate the gears for a considerable length of time, so as to furnish a clear light for some seconds without the necessity of pumping, and this light can then be maintained by an occasional application of power to the lever 29, the spring in the meantime acting as a booster, so as to maintain a clear light.

Having described my invention what I regard as new and desire to secure by Letters Patent is:

1. A mechanism for generating electric current adapted to be held in the hand and manually operated, comprising the combination of a horse shoe magnet, an armature and pole pieces located between its poles, side plates mounted on its sides, a train of gears adapted to rotate said armature, a spring which drives the master gear, a ratchet wheel journaled on the shaft which carries the master gear having an annular recess therein in which the said spring is located, one end of said spring being secured to the hub of the master gear, the other end being secured to the ratchet wheel, a detent to prevent the reverse movement of said ratchet wheel, a lever pivotally attached to said magnet, a pawl, carried by the lever, which engages the teeth of the ratchet wheel, and a spring to hold said lever normally away from said magnet, all of said mechanism being located between the side plates, which together with the magnet completely inclose said mechanism, whereby it is protected from dust and dirt.

2. A mechanism for generating electric current adapted to be held in the hand and manually operated, comprising the combination of a horse shoe magnet, an armature and pole pieces located between its poles, side plates mounted on its sides, a train of gears adapted to rotate said armature, a spring which drives the master gear, a ratchet wheel journaled on the shaft which carries the master gear having an annular recess therein in which the said spring is located, one end of said spring being secured to the hub of the master gear, the other end being secured to the ratchet wheel, a detent to prevent the reverse movement of said ratchet wheel, a lever pivotally attached to said magnet, a pawl, carried by the lever, which engages the teeth of the ratchet wheel, and a spring to hold said lever normally away from said magnet, a brake for said train of gears to hold them from said rotation, all of said mechanism being located between the side plates, which together with the magnet completely inclose said mechanism, whereby it is protected from dust and dirt.

In testimony whereof I have signed the foregoing specification.

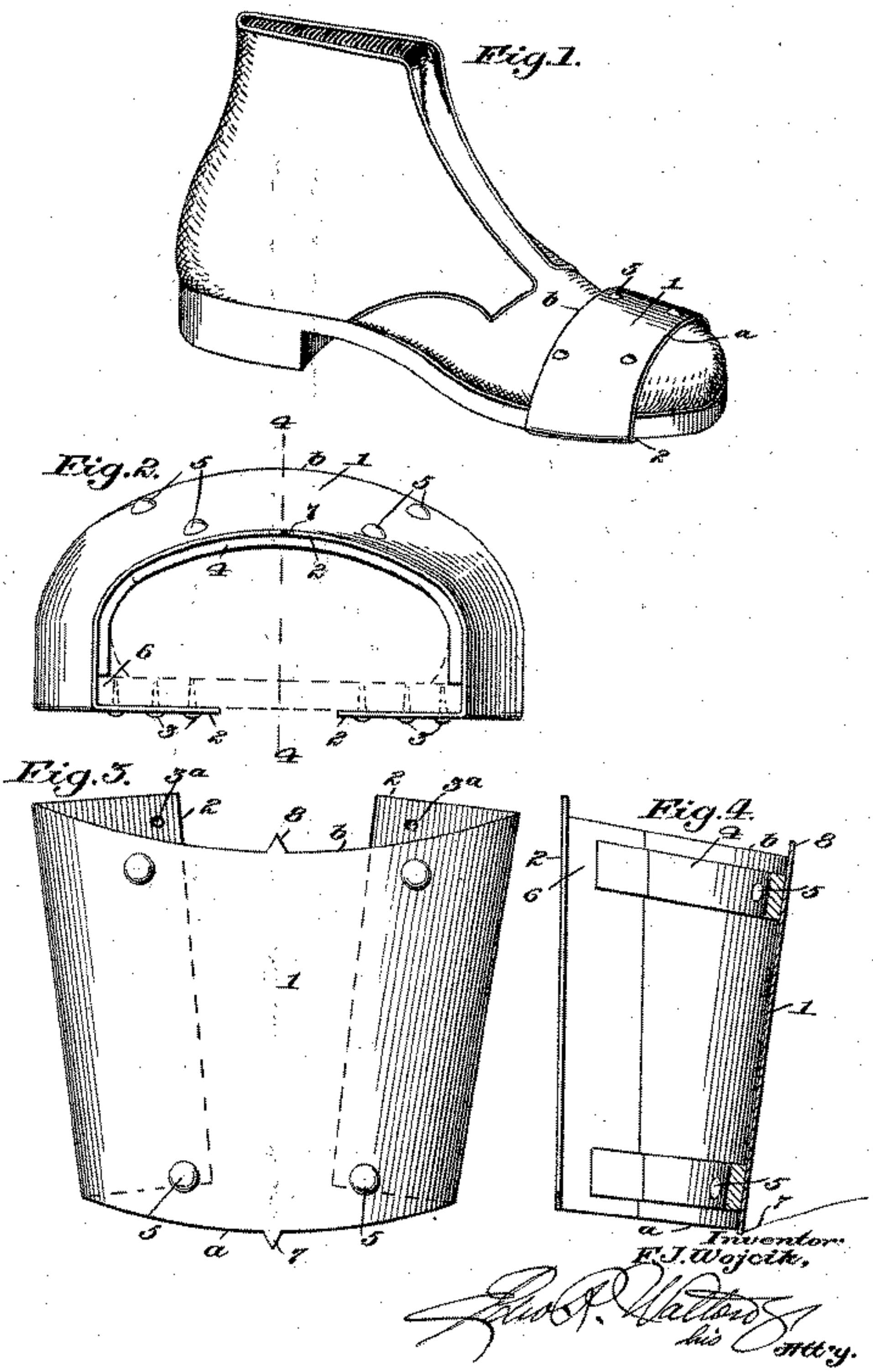
CONRAD KLEMMER.

Witnesses:
C. M. Baumeister,
K. Wolbey.

April 26, 1927. F. J. WOJCIK 1,626,489

FOOT SHIELD

Filed Aug. 30, 1926



Patented Apr. 26, 1927. **1,626,489**

UNITED STATES PATENT OFFICE.

FRANK JOE WOJCIK, OF LOWELL, ARIZONA.

FOOT SHIELD.

Application filed August 30, 1926. Serial No. 132,592.

The present invention is a foot guard, especially designed to be worn over the shoes of workmen, miners and the like in order to protect the foot from falling rock and other materials which may crush or otherwise injure the toes or fore-part of the foot.

The object of this invention is to provide a shield or guard of the above stated character of sheet metal constructed to fit over the toe portion of the shoe and to extend rearwardly thereof to a point overlying the vamp of the shoe. Another object of the invention is the production of such a guard or shield, as above stated, which will be extremely strong and durable to withstand the impact of falling material, yet, extremely simple in construction and economical to manufacture and easily applied or removed from the shoe.

With the above and other objects in view, the invention resides in sundry details of construction, combination and arrangement of parts, hereinafter more fully described and pointed out in the appending claims.

In this specification and the annexed drawings, the invention is disclosed in the form in which it is considered to be the best, but the invention is not limited to such form because it is capable of being embodied in other forms; and it is to be understood that in and by the claims following the description herein it is intended to cover the invention in whatever form it may embody within the scope thereof.

In the drawings which show the preferred embodiment of the invention as at present devised:—

Figure 1 shows the shield or guard of the invention applied to a shoe;

Figure 2 is an enlarged front end view of the shield or guard removed from the shoe;

Figure 3 is a top plan view of the shield or guard as shown in Figure 2; and

Figure 4 is a longitudinal sectional view of the guard taken substantially on line 4—4 of Figure 2.

Referring particularly to the drawings in detail wherein like characters denote similar and like parts throughout the several views, 1 designates the shield which consists of an elongated strip of sheet metal which is bent transversely on an arc of suitable radius to form an arch with its end portions bent inwardly to provide the inwardly extending flanges 2.

In bending the metal forming the shield to form the arch, it is preferred to so shape the same that its forward end *a* will form a flatter arch than the rear end *b*, and at the same time the walls of the shield widening from the forward end *a* to the rearward end *b*, so as to be somewhat wedge-shaped to readily slip on and fit over the toe of the shoe, in the manner which will be clearly understood and which is shown in the drawings. The flanges 2 are to underlie the sole of the shoe and are perforated to receive nails or other securing means 3 for securing the shield to the shoe. In order to give added rigidity and strength to the shield, it is provided at points adjacent its ends *a* and *b* with rigid arcuate reinforcing members or strips of metal 4, which, if not made integral with the shield, are riveted to the same as shown in the drawings, at 5. These reinforcing strips take the same contour as that portion of the shield which they engage and in lieu of being riveted may be welded.

These reinforcing arches, preferably, have their ends terminated at a point above the inwardly extending flanges 2 and are designed to rest upon the top of the sole of the shoe, as clearly indicated in Figure 2.

By this construction, the shield is held firmly on the shoe as the sole will slide in guide-ways 6 formed by the lower ends of reinforcing strips 4 and the flanges 2, while at the same time, the sole of the shoe will form a support for the reinforcing members and will, to a degree, cushion any impacts imparted to the shield. Also, this construction enables the shield to more closely fit the contour of the shoe and readily adjusted in position.

The shields will be made in varying sizes to correspond with the varying sizes of shoes, and in view of their tapered construction may be adjusted along the length of the fore-part of the shoe to meet the needs and desire of the wearer.

It will also be understood that the width of the shield may be varied in order to cover more or less of the shoe or foot as may be found needed for particular purposes.

In some forms of the invention the shield is provided on its end edges with prongs 7 and 8 which may be pressed downwardly to extend into the material of the shoe so as to more permanently secure the upper portion of the shield to the shoe and to keep the same from having undue relative movement with respect to the upper.

The inventive thought may have a variety of expressions as is contemplated in what is claimed and desired to be secured by U. S. Letters Patent, as follows:

1. A foot shield to be worn over the forepart of a shoe comprising an elongated strip bent transversely on an arc forming an arched shield open at its ends, the terminal portions of said strip forming inwardly extending flanges, said shield having bendable means on the ends thereof adapted to be extended into the material of the shoe upper for maintaining the same in position with respect thereto.

2. A foot shield to be worn over the forepart of a shoe comprising an elongated strip bent transversely on an arc and having its terminal portions forming inwardly extending flanges, said flanges being adapted to engage with the bottom of the soles of the shoe and having perforations therein to receive securing elements for securing the shield to the shoe, reinforced arched portions on the inner face of the shield having their ends terminating at a distance above said flanges to engage the top surface of the sole of the shoe.

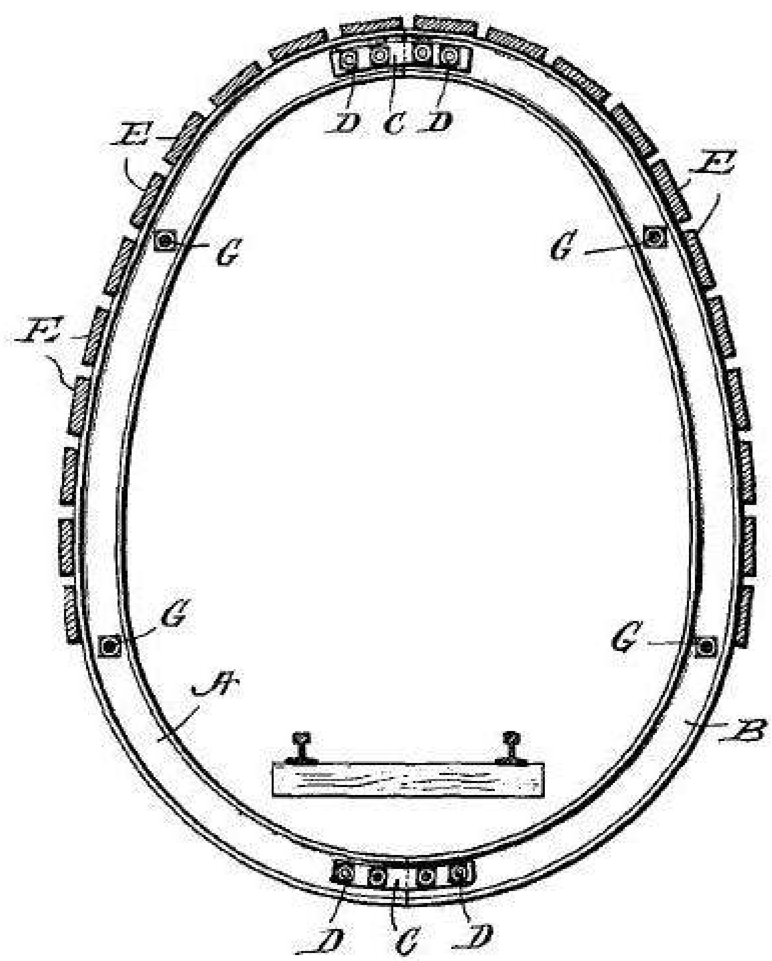
3. A foot shield to be worn over the forepart of a shoe comprising an elongated strip bent transversely on an arc forming the arched shield open at its ends, the terminal portions of the strip forming inwardly extending flanges, arched reinforcing strips at the arched end portions of said shield.

4. A foot shield to be worn over the forepart of a shoe comprising an elongated strip bent transversely on an arc and havings its terminal portions forming inwardly extending flanges, arched reinforcing strips on the inner face of said shield and having their ends terminated at a point above said flanges to co-operate with the latter to form guide-ways to receive the sole of the shoe, said shield being tapered toward its outer end.

In testimony whereof I have hereunto set my hand.

FRANK JOE WOJCIK.

Mine Support



C. C. FINLAYSON & J. N. CAIN.
TUNNEL SUPPORT.
APPLICATION FILED OCT. 27, 1909.

963,536. Patented July 5, 1910.

Fig. 2.

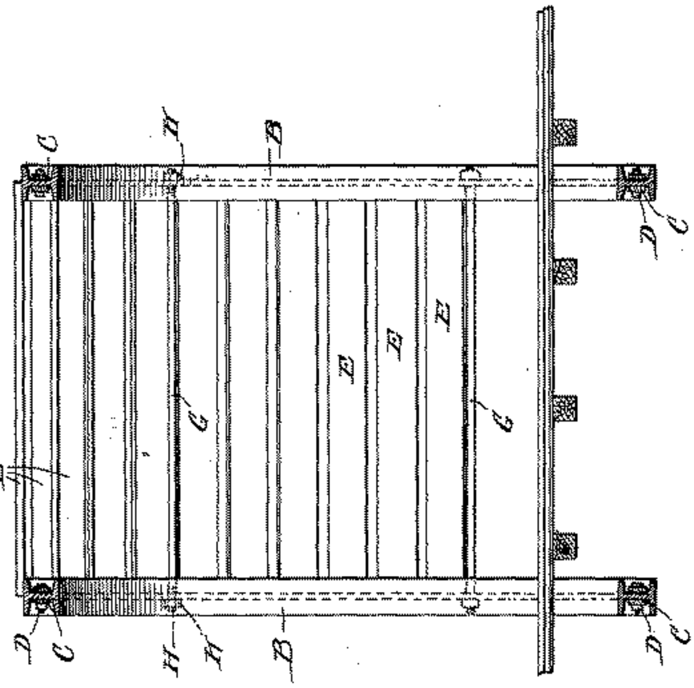
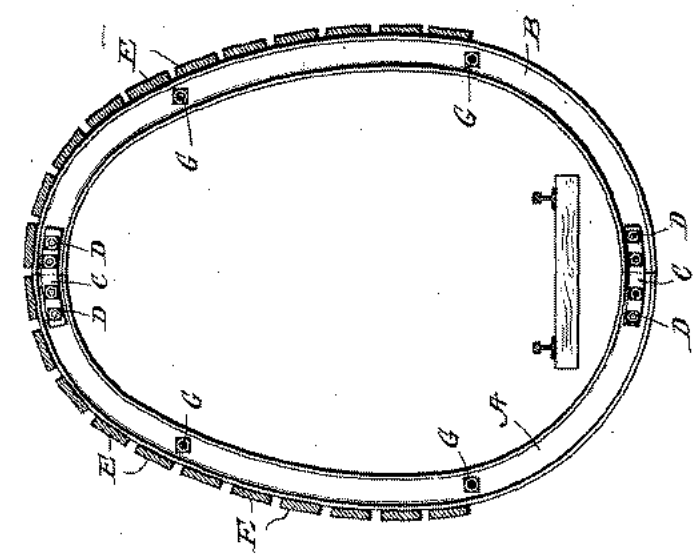


Fig. 1.



WITNESSES

L. H. Schmidt

C. E. Trainor

INVENTORS
CHRISTOPHER C. FINLAYSON,
JAMES N. CAIN,
BY Munn & Co.
ATTORNEYS

UNITED STATES PATENT OFFICE.

CHRISTOPHER COLUMBUS FINLAYSON AND JAMES NATHAN CAIN, OF BISBEE, ARIZONA TERRITORY.

TUNNEL-SUPPORT.

963,536. Specification of Letters Patent. Patented July 5, 1910.

Application filed October 27, 1909. Serial No. 524,825.

To all whom it may concern:

Be it known that we, CHRISTOPHER C. FINLAYSON, a citizen of the United States, and JAMES N. CAIN, a subject of the King of England, and residents of Bisbee, in the county of Cochise and Territory of Arizona, have invented certain new and useful Improvements in Tunnel-Supports, of which the following is a specification.

Our invention is an improvement in tunnel supports, and consists in certain novel constructions, and combinations of parts, hereinafter described and claimed.

The object of the invention is to provide an improved form of drift support for mining purposes, which will be strong, durable and economical in construction, which will consists of few parts, and which may be cheaply constructed, and will require no change in the usual methods of mining.

Referring to the drawings forming a part hereof, Figure 1 is a transverse section of a section of the improved support, and Fig. 2 is a vertical section.

In driving drifts or tunnels in metal mining, the walls of the tunnel are subject to pressure from every side, and the support for the wall should be approximately equal in every direction. The heaviest pressure is however vertically downward, and the next heaviest vertically upward, while of course the pressure on each side of the tunnel or drift is approximately the same. A perfect support must necessarily have the greatest power of resistance in the directions above set forth. The supports ordinarily used are in sections of six or seven feet in length, and are placed as soon as the material is excavated, or in some cases a portion of the section is placed before the excavation is commenced. The embodiment of the invention shown in the drawings is adapted to be constructed and used in the same manner, and comprises a plurality of substantially elliptical metal frames, which form the base of the support, and a system of lagging or siding in connection with the frames.

Each of the frames is composed of I bars, and is formed in two similar sections A and B, and the ends of the sections are connected by fish plates C, and bolts D, the plates being lapped on the adjacent ends of the sections, and the bolts passed through registering openings in the plates and I bars.

The complete frames are substantially egg-shaped as shown in Fig. 1, and are arranged transversely of the drift or tunnel, with the large end downward, at intervals of six or seven feet. The lagging consisting of strips E is placed longitudinally of the drift, with the ends of the strips engaging the frames. Each strip engages one frame with one end, and the adjacent frame with the other, and the strips are spaced apart slightly laterally, and are omitted at the bottom and for a short distance up the sides. The arrangement is however in accordance with the conditions, and in some cases it might be necessary to make the lagging complete. The frames are also connected with each other by means of rods G having threaded ends H which extend through registering openings in the frames, and are engaged by nuts K. The bolts prevent lateral movement of the frames, thus preventing displacement of the lagging.

In using the improved structure, the sections of the frame are placed, and secured together by the fish plates and bolts. The bolts G are then inserted, and secured in place by the nuts K, after which the lagging E is placed in position. The ties M are placed, usually on the floor of the tunnel, and the rails N are secured to the ties in the usual manner. When the lagging is omitted from the bottom of the frames, the said bottoms may be sunk in the floor of the tunnel.

It will be evident from the description that each frame is substantially oval in form and consists of a plurality of arches, each of which is especially shaped for the relative amount of pressure to which it will be subjected. At the top the radius of the arch is short, while at the sides it is long, thus providing a maximum amount of strength and head room with a minimum of material. The radius of the bottom arch is also greater than that of the top arch.

We claim:

1. A tunnel or drift supporting structure comprising a plurality of frames, each of which is composed of four arches, the radius of the end arches being of lesser length than the radius of the side arches, and the radius of the lower end arch being of greater length than that of the upper arch, each of said frames being divided at its top and bottom into substantially similar sections, fish plates overlapping the adjacent ends of

the sections, and bolts securing the fish plates on the sections, bolts connecting the frames, and a plurality of strips each having its ends engaging adjacent frames.

2. A structure of the character specified, comprising a plurality of substantially oval frames, arranged with their large ends downward, said frames being I-shaped in cross section, and each being divided vertically into sections, means for detachably connecting the ends of the sections, a connection between the frames, and lagging consisting of parallel strips engaging the outer faces of the frames.

3. A structure of the character specified, comprising a plurality of frames, each of which is oval in form and presents a convex surface at every point of its periphery, a connection between the frames, and a covering for the frames.

4. In a structure of the character specified, a substantially annular frame, oval in form, and presenting a continuous curve.

5. In a structure of the character specified, an annular frame whose sides are formed on equal arcs, the base on an arc of less radius than the arc of the sides, and the top on an arc of less radius than the arc of the base.

6. In a structure of the character specified, an annular substantially elliptical frame, one end of the frame being formed on an arc of greater radius than the other.

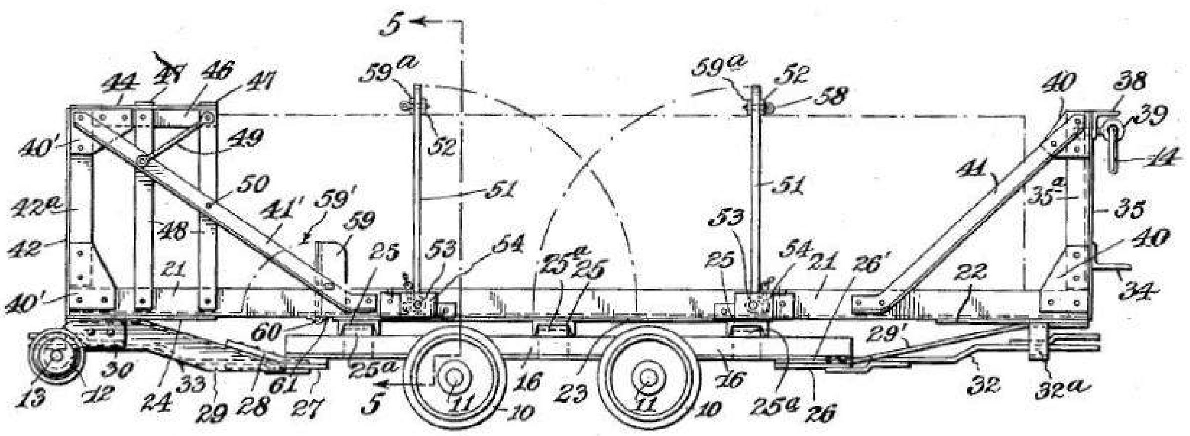
7. In a structure of the character specified, a supporting frame, annular in form, and formed from a plurality of arcs merging into each other at their ends, the arc of the base being of greater diameter than the arc of the top.

8. A frame substantially as herein described in oval form with its major axis vertical and having its lower or base portion arched downwardly.

CHRISTOPHER COLUMBUS FINLAYSON.
JAMES NATHAN CAIN.

Witnesses:
DONALD G. ROSS,
CHARLES R. MORFOOT.

Material Handling



Jan. 1, 1929. 1,697,824

J. W. SCOTT

CLUTCH FOR MATERIAL CARRIERS

Filed Oct. 26, 1926 2 Sheets-Sheet 1

Fig. 1.

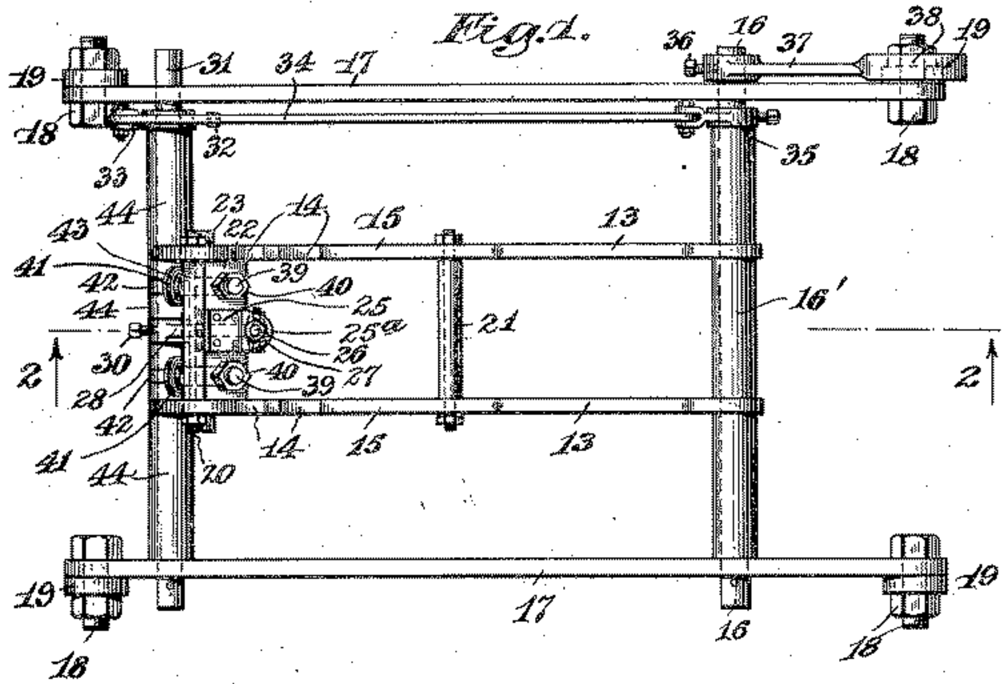
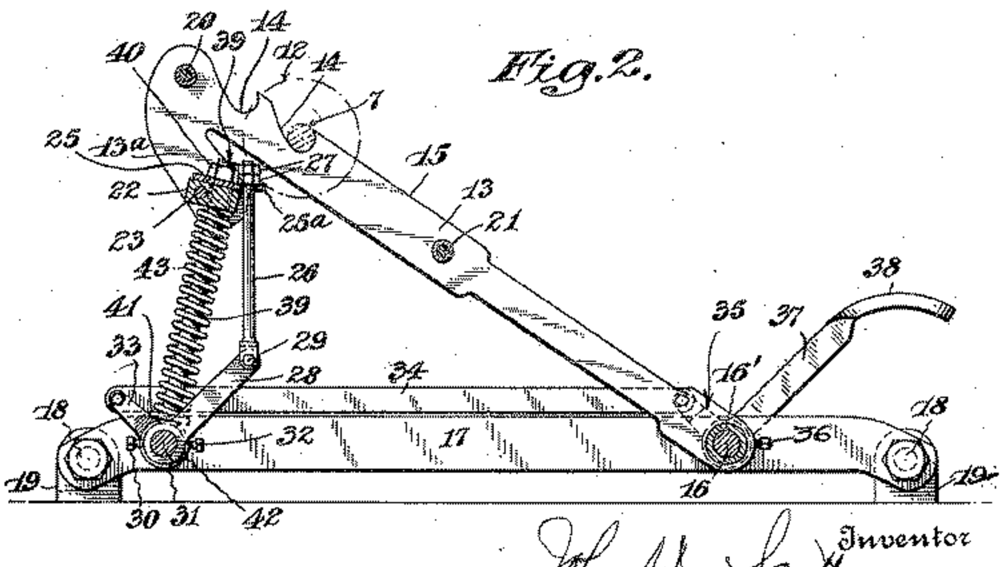


Fig. 2.



John W. Scott Inventor

By his Attorney

Frank J. Kent

Jan. 1, 1929. 1,697,824

J. W. SCOTT

CLUTCH FOR MATERIAL CARRIERS

Filed Oct. 26, 1926 2 Sheets-Sheet 2

Fig. 4.

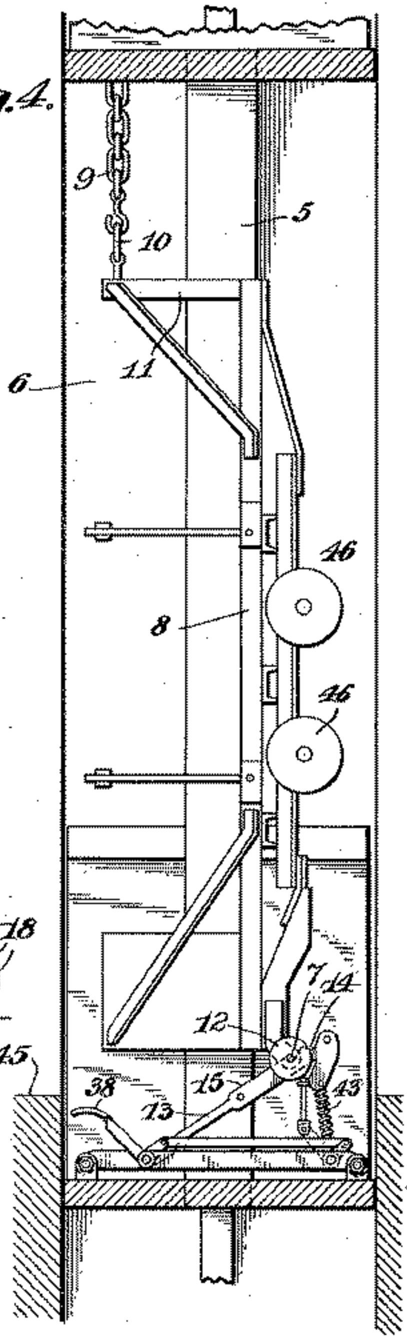
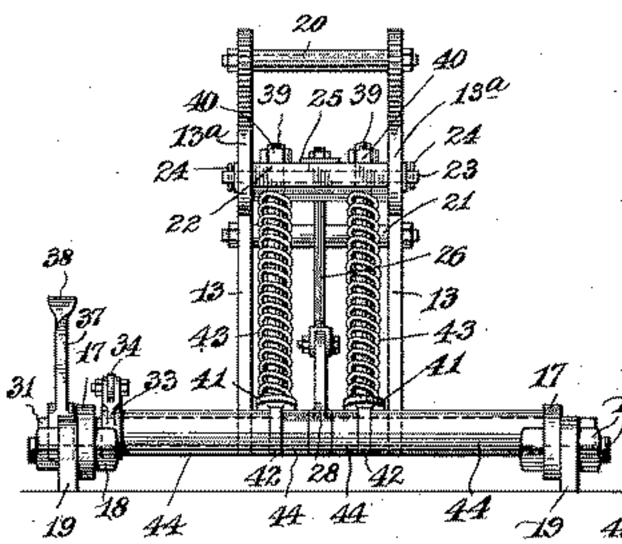


Fig. 3.



John W. Scott Inventor

By his Attorney

Frank J. Keef

Patented Jan. 1, 1929. **1,697,824**

UNITED STATES PATENT OFFICE.

JOHN WILLIAM SCOTT, OF BISBEE, ARIZONA.

CLUTCH FOR MATERIAL CARRIERS.

Application filed October 26, 1926. Serial No. 144,274.

The subject of the present invention is a clutch or retaining means for the lower end of say an up-ended truck or car when the latter has been transferred from a level, say a surface level, to a cage or other elevating means in a hoistway, for transport in said hoistway to another level, say an underground level, where the car and its load are transferred to the latter level for movement of the car and its load over the same to say a material supply point more or less distant from the hoistway.

While the new clutch is of particular value in connection with a hoistway cage where the hoistway is vertical rather than inclined, and also of particular value in connection with a truck or car constructed pursuant to the invention disclosed and claimed in my copending application Serial No. 144,273, filed October 26, 1926, it will of course be understood that the clutch of the present invention is not thus to be limited as to utilization.

An important object of the present invention is to provide a simple, rugged, inexpensive and reliable clutch or retainer for the lower portion of any structure intended to be transported while held in such manner that the structure is supended, or at least held so that its weight is practically completely supported, at a point or points above the clutch or retainer.

A further object is to provide a clutch as just described, wherein simple means are incorporated such that the clutch automatically comes into action, or functions, when the structure to be conveyed in the hoistway is finally moved into place in the cage or the like.

Another object is to provide a simple and reliable clutch for retaining in a cage or the like a structure to be moved to a different level therein, to prevent outswinging of said structure, but a clutch of the latch-lock type, so that a simple and instantaneous deliberate release thereof is possible, as by foot-pressure on a pedal element.

Various other objects and advantages of the invention will be specifically pointed out or apparent hereinafter, in the course of a description of a preferred one of the various possible forms of the invention as shown in the accompanying drawings; it being understood, of course, that such form is merely illustrative of one combination and arrangement of parts calculated to attain the objects of the invention, pursuant to present preference, and hence the detailed description of such form now to be given is not to be taken as at all defining or limiting the invention itself. That is to say, the scope of protection contemplated is to be taken solely from the appended claims, interpreted as broadly as is consistent with the prior art, and with explanatory reference to the specification only where a claim is ambiguous or to be impliedly limited beyond its express terms to avoid such art in order to save the validity of said claims.

In the accompanying drawings:

Fig. 1 is a top plan view of one form of clutch according to the invention.

Fig. 2 is a vertical longitudinal section, taken on line 2—2 of Fig. 1.

Fig. 3 is a front elevation of said clutch, looking toward the right in Fig. 1, but toward the left in Fig. 4; and

Fig. 4 is a view illustrating the clutch, shown again in side elevation, in operative condition relative to a rear axle of a wheeled car up-ended and hung vertically in a cage in a vertical hoistway.

As shown in Fig. 4, the new clutch, in the form illustrated, is particularly adapted for use in the bottom of a cage 5, operating in a vertical hoistway, 6, for engaging and securing a rear axle 7 of a material handling car 8, to hold the lower end of the car against outswinging, when the car has been suspended by chains 9 or the like, anchored at their upper ends to the roof of the cage and hooked at their lower ends into swing-rings 10 forming parts of the forward superstructure unit 11 of the car, all as explained in my copending application aforesaid. Also as explained in said application, it is particularly convenient, when the new clutch is used in connection with the invention there disclosed and as there preferably embodied, to have the hook, notch or keeper of the clutch engage the axle 7 of the car.

Such axle, and one of the wheels 12 thereon, are shown in dot and dash lines in Fig. 2.

The form of clutch illustrated includes a pair of spaced and inclined bars 13 carrying as axle-keepers a series of hook-depressions or upwardly sharply breasted notches 14 for engaging the axle 7 as shown. Each of these bars, below said notches, has a ramp-edge 15, constituting such ramp in the present case as the result of the inclination of the bar 13 rather than as the result of a particular shaping of said edge. These bars are pivotally mounted at their lower ends by being fixedly connected to sleeve 16′ loose on a shaft 16 journalled at opposite ends in a pair of horizontal side-frame members 17 forming parts of the bed-structure of the clutch by being bolted at 18 to short standards 19 suitably secured to the floor of the cage.

The bars 13, spaned by spacing and tie bars 20 and 21 above and below the series of notches 14, are also provided with downwardly extended goose-neck portions 13ª. Between these portions 13ª is pivotally hung a cross-block 22 on a rod 23 pinned at both ends as indicated in Fig. 3. A small plate 25 carrying a protruding terminal lip 25ª is riveted transverse to and at the middle of the cross-block; said lip having a through aperture slightly loosely taking the upper end-portion of a pull-rod or link 26 the upper end of which is threaded for nuts 27 and the lower end of which is bifurcated for embracing the upper end of an arm 28 to which such bifurcation is pivoted as indicated at 29. The lower end of this arm is fast, by means of a set-screw 30, on a shaft 31 journalled in the side-frame members 17, at the back of the clutch. Also fast on said shaft 31, by a set-screw 32, is another arm 33 connected at its upper end by a link 34 to the upper end of a similar arm 35 similarly fixed to the shaft 16 at the front end of the clutch, between one end of the sleeve 16′ and the adjacent side frame member 17. Beyond said frame member 17, said shaft 16 has fixed thereto by a set-screw 36, an arm 37 forwardly and upwardly inclined and shaped at its free end to constitute a depressible pedal 38.

Cross-block 22, at opposite sides of plate 25, has a pair of through apertures surrounding the upper end-portions of two spring-rods 39, the upper ends of said rods being threaded for the application of nuts 40 and the lower ends of said rods having coil spring supporting collars 41, expansive coil springs 43 being mounted on the rods as shown. Each rod and collar form parts of a single rigid structure, a complementary part of which is a larger and heavier collar 42 in a vertical plane loose on shaft 31. Spacing sleeves 44, of various lengths, are on said shaft 31 as clearly indicated in Fig. 2.

Operation.

Assume that an up-ended object, suspended as to its entire weight from an upper portion thereof, as the car 8 when suspended from the chains 9, is swung into the cage 5 to take up its natural position of suspension therein. Then the car would have an inclination such that the axle 12 lies directly under the swing-rings 10 of the car. This position would, in the case illustrated, represent the final step in transferring the car from the level 45 completely past and out of contact with said level, following the steps of rolling the car on its wheels 46 to bring its lead-end 11 up close to the hoistway, bringing the cage to a position where the hooks on the lower ends of the chains 9 could be secured to the swing-rings 10, and raising the cage first to tauten said chains, then to pull them upward to up-end the lead-end of the car and rock the trail-end of the car downwardly about the rear pair of the wheels 46 onto the trailer wheels 12, and then to pull said chains further upward to roll the car on said trailer wheels and toward the hoistway and into the same to suspend the car entirely free from any support at level 45.

All an attendant has to do now, then, is to exert a moderate pushing pressure on the slightly outswung trail-end of the car, in the direction of the spring-carrying end of the clutch. Axle 7 thereupon engages the ramp-edges 15 of the inclined bars 13; these bars are depressed against the compression of springs 43, and the axle is seized securely by a pair of notches 14.

When the cage has arrived at the destination level, all the attendant has to do, to permit swinging out of the trail-end of the car, to permit the trailer wheels to come to rest on said level when the cage is thereafter slightly lowered, is to apply his foot to pedal 38 and depress the same.

As already emphasized, the new clutch or retainer is capable of various other uses than as an element of a system of inter-level transportation for wheeled trucks or cars and their loads; although the particular embodiment of the invention illustrated has been particularly designed, as to structure, and particularly described, as to operation, with the present thought in mind that an especially useful employment of the new clutch is in connection with an inter-level transportation system of the kind mentioned.

Inasmuch as many changes could be made in the above construction, and many apparently widely different embodiments of my invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language contained in the following claims is intended to cover all the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. An elevating means for an up-ended wheeled car, comprising a structure including, in combination with an upper support having means for engaging the car near its lead-end, a lower support, and a retaining device on the lower support for engaging the car near its trail-end when the car is swung

relative to the upper support to a position substantially parallel to the line of travel of said elevating means.

2. An elevating means for a wheeled car, comprising, the combination with a hoistway and a hoisting means therein, of a conveyor on said hoisting means comprising the combination of a suspension device attachable to the car to up-end the same during upward movement of said conveyor, and a hook means for engaging the car near its trail-end on further upward movement of said conveyor.

3. An elevating means for a wheeled car, comprising, the combination with a hoistway and a hoisting means therein, of a conveyor on said hoisting means comprising the combination of a suspension device attachable to the car to up-end the same during upward movement of said conveyor, and a latch device for engaging the car near its trail-end on further upward movement of said conveyor.

4. An elevating means for a wheeled car, comprising, the combination with a hoistway and a hoisting means therein, of a conveyor on said hoisting means comprising a means for connection to the lead-end of the car to rock the same about the axis of one of its wheels during upward movement of said conveyor, and a lower support having automatically operating means for releasably locking the car against outward movement in the conveyor when the conveyor is elevated sufficiently to cause free suspension of the car therein.

5. In a material transportation system the combination with a wheeled carrier and an elevating carrier for transferring the wheeled carrier to another level, of a device for securing the lower end of the wheeled carrier when up-ended and disposed on the elevating carrier, said device including a movable member carrying a gripper portion for a part of the wheeled carrier when disposed as aforesaid, and a movable member for moving the first movable member to release said gripper portion from said part of the wheeled carrier.

6. In a material transportation system, the combination with a wheeled carrier and an elevating carrier for transferring the wheeled carrier to another level, of a device for securing the lower end of the wheeled carrier when up-ended and disposed on the elevating carrier, said device including a detent element for engaging a predetermined part of said wheeled carrier and an element engaged by the wheeled carrier while moving toward the field of operation of said detent adapted as the result of said engagement to cause said detent to engage said wheeled carrier when said predetermined part arrives at said field of operation.

7. In a material transportation system, the combination with a wheeled carrier and an elevating carrier for transferring the wheeled carrier to another level, of a device for securing the lower end of the wheeled carrier when up-ended and disposed in the elevating carrier, said device including a movably mounted member carrying a means for engaging a predetermined part of the wheeled carrier when said means and said part are in predetermined positions, means for holding said movably mounted member normally to maintain said engaging means in its said predetermined position, and means operable at will for moving said engaging means away from its said predetermined position to release the wheeled carrier.

8. In a material transportation system, the combination with a wheeled carrier and an elevating carrier for transferring the wheeled carrier to another level, of a device for securing the lower end of the wheeled carrier when up-ended and disposed in the elevating carrier, said device including a movably mounted member carrying a means for engaging a predetermined part of the wheeled carrier when said means and said part are in predetermined positions, means for holding said movably mounted member normally to maintain said engaging means in its said predetermined position, and means operable at will for causing relative movement between said engaging means and said part to release the wheeled carrier.

9. In a material transportation system, the combination with a wheeled carrier and an elevating carrier for transferring the wheeled carrier to another level, of a device for securing the lower end of the wheeled carrier when up-ended and disposed in the elevating carrier, said device including a movably mounted member carrying a means for engaging a predetermined part of the wheeled carrier when said means and said part are in predetermined positions, said movably mounted member also having means associated therewith for automatically moving said engaging means away from its said predetermined position and out of the path of movement of said part of the wheeled carrier as the latter moves toward its said predetermined position and for thereupon automatically returning said engaging means to its said predetermined position when said part arrives at its said predetermined position.

10. An elevating means for a wheeled car, comprising an upper support, means for detachably suspending one end of the wheeled car from the upper support, a lower support, and a retaining device for holding the lower end of the car in alinement with the elevator.

11. An elevating means for a car having wheels for normally supporting it with its longest axis horizontal, comprising a cage adapted to receive the car in a position with its longest axis vertical, the cage having an upper support, means for detachably suspending the car in vertical position from the upper support, and a retaining device for

holding the lower end of the car within the boundaries of the cage.

12. A clutch comprising side frame members, a shaft extending between the side frame members, a bar pivoted to the shaft and carrying a notch near the end remote from the shaft, a second shaft extending between the side frame members, toggle levers mounted on the second shaft and connected to the notched end of the bar for depressing the bar, a spring device normally biasing the bar upward, and a foot pedal connected to the toggle levers.

In testimony whereof I affix my signature.

JOHN WILLIAM SCOTT.

Dec. 23, 1930. J. W. SCOTT 1,785,982

MATERIAL CARRIER

Filed Oct. 26, 1926 3 Sheets-Sheet 1

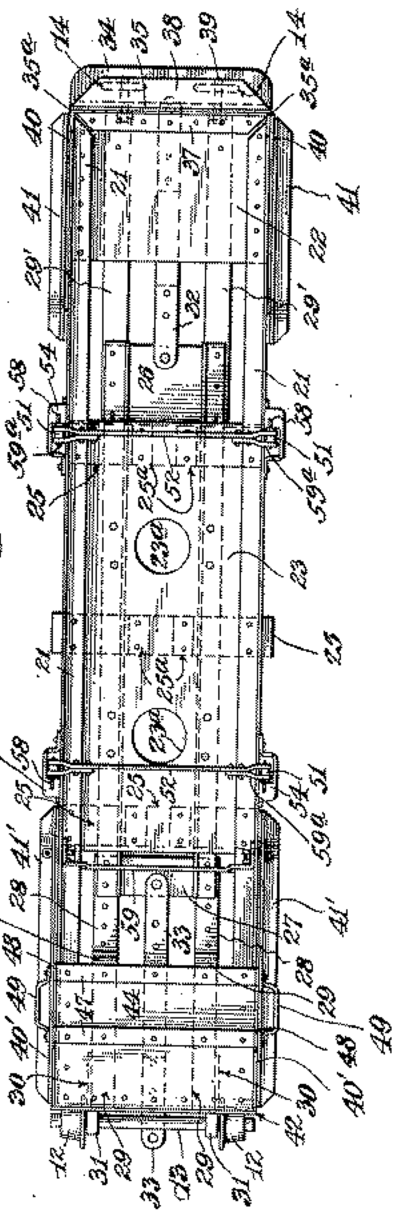


Fig. 1.

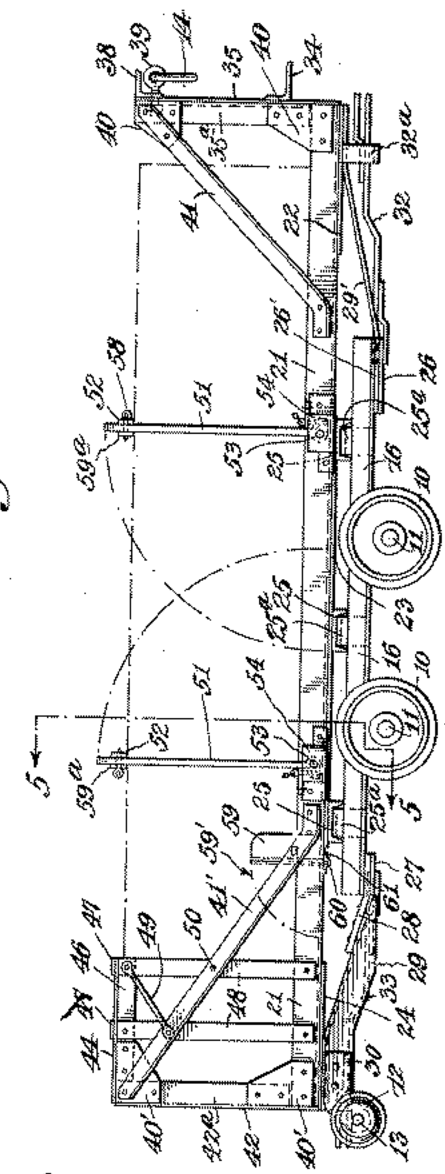


Fig. 2.

John W. Scott Inventor

By his Attorney Frank J Kent

Dec. 23, 1930. J. W. SCOTT 1,785,982

MATERIAL CARRIER

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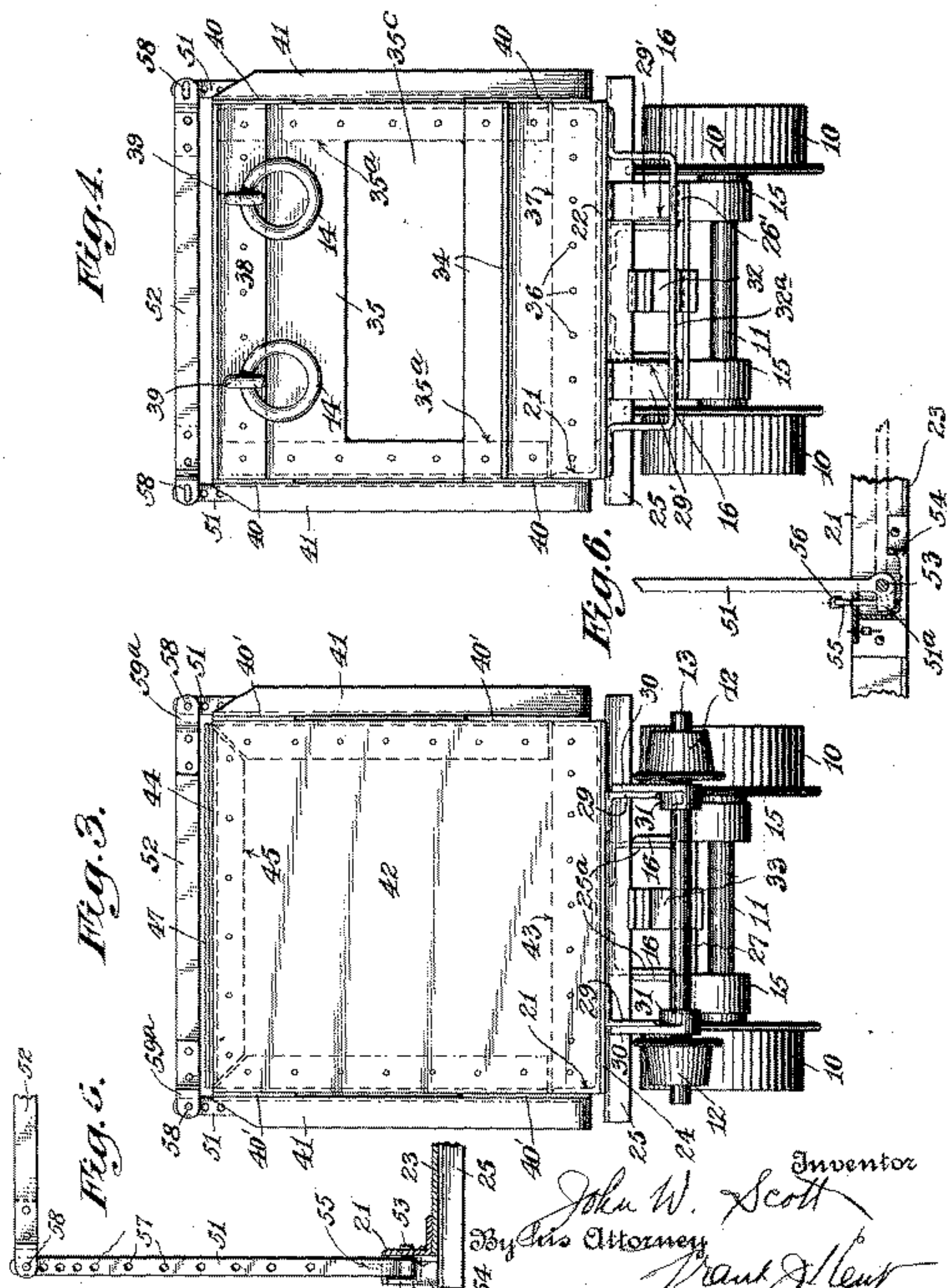

Fig. 4. Fig. 3. Fig. 5. Fig. 6.

Inventor

John W. Scott

By his Attorney

Frank J. Kent

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MATERIAL CARRIER

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Fig. 7.

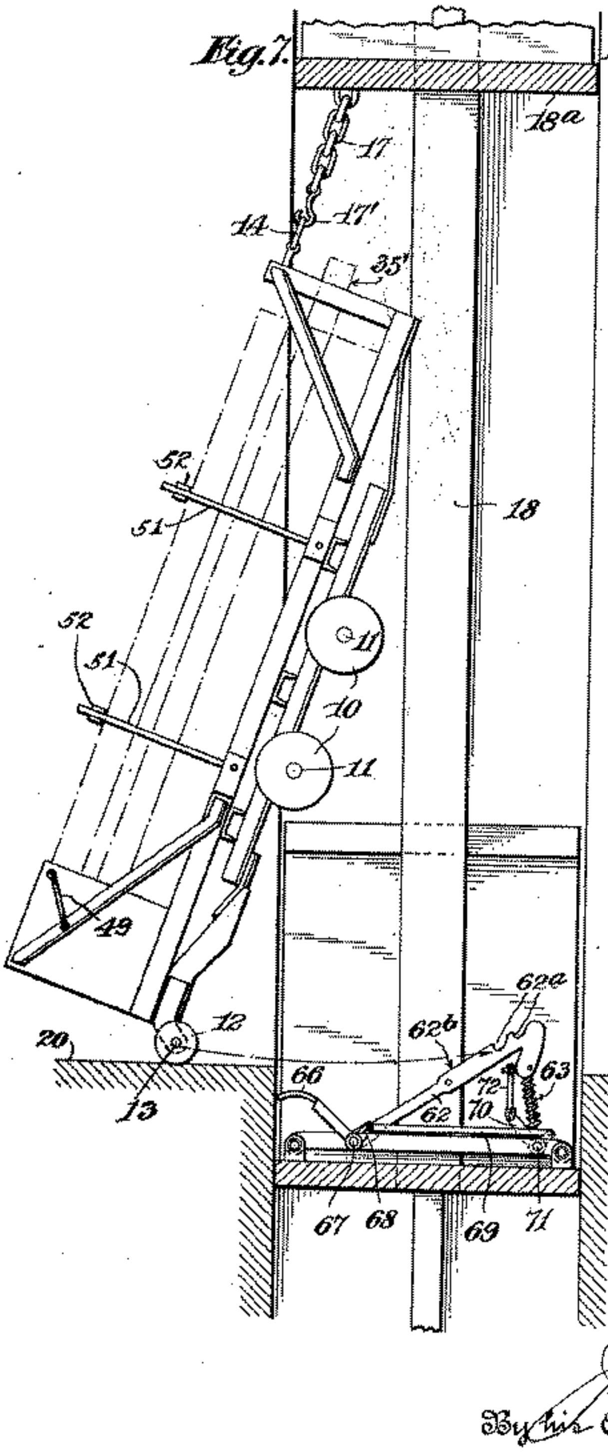
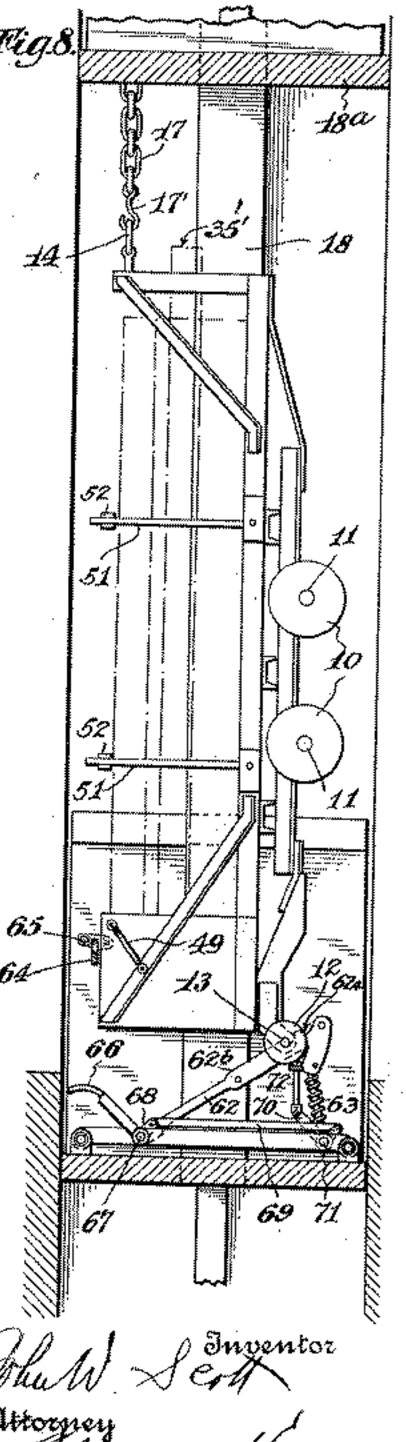


Fig. 8.



Inventor
John W. Scott
By his Attorney
Frank J. Kent

Patented Dec. 23, 1930 **1,785,982**

UNITED STATES PATENT OFFICE

JOHN WILLIAM SCOTT, OF BISBEE, ARIZONA

MATERIAL CARRIER

Application filed October 26, 1926. Serial No. 144,273.

This invention relates to material handling, and has for its principal object the provision of a material carrier, preferably of the wheeled or car type, adapted for the transportation of material without intermediate loading between the supply point and the point of destination, where the travel of the carrier from one of said points to the other involves inclined and even vertical transportation, as well as horizontal transportation or transportation along an approximately horizontal path at the ground "level", at a subterranean level (as, for instance, in mining operations), or at any other level.

Thus an important object of the invention, especially when carried out in connection with underground workings, is to provide a truck or car so constructed and equipped that the same may be loaded at the surface or at a station underground, then swung vertically into a cage in a hoistway or well, then uncaged at a different level from the loading level, and then run along at the last-mentioned level to the point where the timber or other material is needed and there unloaded for the first time, so as completely to do away with the handling and rehandling of material to and from trucks and cages or the like as heretofore.

Another object is to provide a material handling truck or car as above described, and one which may, when desired, run on tracks laid at a particular level, and clear away from and alight upon said tracks incident to delivery to discharge from a cage or other elevating means; all without the aid of more than one attendant, and without imposing on such attendant other than a series of easily and quickly performed and comparatively light tasks.

Another object is to provide a material handling truck or car for permitting vertical, inclined and horizontal transportation of material without intermediate loading, which may be transferred from a horizontal line of travel to a vertical one, or vice versa, primarily by the power available at the hoist-cage or other elevating means employed for the vertical path of travel, and at the same time without dragging or other damage to or appreciable frictional resistance from either end of the truck or car.

Another object is to provide a material handling truck or car operable as and with the advantages just described, and which, for maximum load capacity, may have a flat bottom from end to end, be of considerable length, and at the same time be adapted for movement around fairly sharp corners or at fairly sharp rail curves in narrow passages at a particular level, due to a then functioning wheel sufficiently near to the middle of the car.

Another object is to provide a material handling truck or car for transport as one unit with its load, according to the invention broadly, and which has a load-housing superstructure above its running gear of great strength and rigidity, of considerable lightness, and of wide adjustability in regard to loads of various kinds, as to kinds of material loaded as well as to the magnitude of any particular load.

Another object is to provide a material handling truck or car for transport as one unit with its load, according to the invention broadly, and which has a load-housing superstructure including a readily adjustable means for retaining against shift a "short load" while maintaining the center of gravity of car and load at such point as always naturally to facilitate utilization of the power available at the hoistway to transfer the car and its load to and from said hoistway.

Various other objects and advantages of the invention will be specifically pointed out or apparent hereinafter, in the course of a description of a preferred one of the various possible forms of the invention as shown in the accompanying drawings; it being understood, of course, that such is merely illustrative of one combination and arrangement of parts calculated to obtain the objects of the invention, pursuant to present preference, and hence the detailed description of such form now to be given is not to be taken as at all defining or limiting the invention itself. That is to say, the scope of protection contemplated is to be taken solely from the appended claims, interpreted as broadly as is consistent with the prior art, and with explanatory reference to the specification only where a claim is ambiguous or to be impliedly limited beyond its express terms to avoid such art in order to save the validity of said claim.

In said drawings,

Fig. 1 shows one form of car pursuant to the invention, in top plan;

Fig. 2 shows said car in side elevation;

Fig. 3 shows the car in end elevation, facing the trail-end;

Fig. 4 is a similar view, facing the lead-end:

Fig. 5 is an enlarged fragmentary detail view, being a section approximately on the line 5—5 of Fig. 2;

Fig. 6 is a similar detail view, looking toward the right in Fig. 5;

Fig. 7 shows the car during delivery to a hoistway or elevator, with the car's lead-end chain-supported from an upper part of a partially elevated shaft-cage and with the car's trail-end ready to swing into the lower part of such cage on a further slight rise thereof; and

Fig. 8 shows the cage moved slightly higher than as shown in Fig. 7, and the car swung completely into the same to hang vertically therein.

The car of course may be of any desired size or load capacity, according to the special requirements of the erecting, wrecking, routing, mining or other material-handling situation, but naturally due regard will be had to the dimensions of the hoistway or elevator-well and of its cage, conveyor chains or the like for moving freight up and down the well, if a well and cage already installed are to be employed pursuant to the invention, and if the up-ending and suspension means for the car are like those shown in the drawings. As will be understood from what has already been said, the new car is designed to travel toward or away from a hoistway at a particular level, as well as for travel up or down in such hoistway, to transfer the car and its load as one unit from one level to another.

To these ends, the car includes, in the preferred form shown in Figs. 1 to 6, a set of main wheels 10, here illustrated as track wheels arranged in two pairs on two axles 11 located near the middle of the car; a pair of smaller wheels 12, on an axle 13, slightly elevated, at the trail-end of the car; and a pair of swing-rings 14, near the top of the car and at the lead-end thereof. The main wheels 10, forming with the axle-journals 15 parts of a truck 16, support the car for movement as an ordinary wheeled car or as one of a train of several cars. The new car, however, may be readily raised at its lead-end, as by means of the rings 14. The car is thus raised when these rings are pulled up by suitable hoisting chains or the like, such as the pair of parallelly suspended and swinging chains 17 of Figs. 7 and 8, anchored at their upper ends to the upper part or roof 18a of a hoisting cage 18, and engaged by way of hooks 17′ at their lower ends with the rings 14 on the car. Due to the dispositions of the upper ends of the chains 17 in the cage 18, and due to the dispositions of the rings 14 on the car, relative to the center of gravity of the car or of the car and a load of material secured thereon, the car may be readily raised so high at its lead-end, merely by hoisting properly the cage 18, that the trail-end of the car can swing fully into the cage in said manner that the entire car will naturally tend to hang truly vertical and thus be disposed in a cage having inside dimensions very slightly greater than the over-all dimensions of the fully loaded car. The smaller wheels 12, hereinafter called the loading and unloading wheels, come into play, at the level at which the car is being loaded onto or unloaded from the cage or other hoisting means in the hoistway, while the car is finally swinging toward the vertical, in the hoistway or is being first swung toward the horizontal from the hoistway. Examine Fig. 7 in this connection; the wheels 12 have been for some past upward travel of the cage 18 in rolling contact with the loading level 20. The advantage of disposing the wheels 12 as shown, is that these wheels make rolling contact with the level 20 as soon as the lead-end of the car is lifted sufficiently by the rising cage to rock the car slightly about the rear axle 11 (the lower axle 11 of Fig. 7). In other words, with the last-mentioned axle fairly close to the middle of the car, as is desirable in providing an equipment of wheels 10 for permitting the car to turn sharp corners whenever required during normal movement on a particular level, the car bottom at the trail-end thereof, especially if made flat for maximum load capacity, would be unprotected against dragging and scraping during a large part of the up-ending of the car, were there not present the auxiliary wheels 12 or an equivalent. Similarly, the trouble would be even more serious, during out-swinging of the trail-end of the car in transferring the car and its load from the hoistway to a delivery level.

With the loading and unloading wheels 12 present, however, a transfer of the car and its freight to the hoistway at any level, whether such hoisting be inclined, or vertical as illustrated, is easy and quick, being practically automatic, when the cage or other conveyor-means in the hoistway is properly manipulated; while a transfer of the car and its freight from the hoistway to any level is equally quick and easy, even in a vertical hoistway, once an attendant has swung the lower end of the car outward to engage the wheels 12 with the delivery level during slow downward movement of the cage in the well.

Yet, as already pointed out, it will be noted that the car body may be constructed to have a flat bottom, and thus constructed as a rectangular box car, having side and end walls at right angles to the flat bottom and to each other; for maximum loading capacity and maximum loading convenience.

Such car body may be of any desired construction; but, as here shown, is of skeleton type, as illustrated clearly in Figs. 1 and 2.

Even the flat bottom is partially of skeleton construction, including side angle pieces 21 having lower inwardly directed flanges riveted to and over floor plates 22, 24, and 23, respectively located at the lead-end of the car, at the trail-end thereof, and midway of such ends. The middle plate 23, several times the size of the end plates 22 and 24, may be provided with a plurality of lightening holes as indicated at 23*a* in Fig. 1. Such a large middle plate is a convenient means for mounting the truck 16. Said plate has riveted to its underside three transverse channels 25, which are in turn riveted to the horizontal flanges of angle brackets 25*a* the vertical flanges of which are riveted to said truck. The truck itself is very light, being really made up merely of a pair of spaced angle strips joining the two journals 15 for the axles 11 on which the main wheels 10 are mounted. These angle strips extend beyond both ends of the middle plate 23. Riveted to the horizontal flanges of said angle pieces just beyond the forward end of the middle plate 23, are blocking pieces 26′ and a wide cross plate 26, and riveted to the same flanges, just beyond the rear end of said middle plate, is a cross plate 27, somewhat narrower than the cross plate 26. The cross plate 27 is not riveted directly to the truck flanges, spacer bars 28 being interposed between cross plate 27 and said flanges. These bars are upwardly obtusely bent as shown best in Fig. 2; and their upwardly bent portions are riveted as indicated in Fig. 1 to the inwardly directed upper flanges of a pair of spaced hangers 29. As will be seen from a comparison of Figs. 1 and 2, these hangers are of inverted L cross section.

Said hangers are really auxiliary truck members, because their inwardly directed upper flanges, where horizontal and where they lie flat under bottom plate 24, as indicated at the extreme left of Fig. 2, are riveted to the under side of said plate, and brackets 30, carrying journals 31 for the axle 13 on which wheels 12 are mounted, are riveted to the hangers. As will be seen from Figs. 1, 2 and 3, these brackets include flat vertical plates riveted flat against the outer faces of the depending vertical flanges of the hangers 29.

As indicated in Fig. 3, it is recommended, especially where the wheels 10 are track wheels, that the auxiliary wheels 12 be set somewhat wider apart than said wheels 10, if all the wheels are not set to the same gage.

At 32 and 33, respectively, are indicated draw bars for the lead-end and trail-end of the car. Draw-bar 32 is pivoted to cross plate 26; and draw bar 33 is pivoted to cross plate 27. Draw bar 32 plays near its forward end within a cradle bar 32*a*.

The lead-end of the car may be provided with a bumper 34, found to be particularly desirable when the car is to be intended also for possible use as one of a train of several cars, for ordinary travel along a path at a particular level.

Just as the hangers 29 serve to connect and brace the rear ends of the truck 16 and the car bottom, two straps 29′ are provided to connect and brace the forward ends of the truck and the car bottom. It is recommended, and as the invention is now understood it is believed to constitute an important feature thereof, that the car body include a permanent superstructure which is chiefly at the two ends thereof.

In the present case, the forward superstructure unit is illustrated as including a front plate 35 having at its opposite sides vertical flanges 35*a*; such plate at its top and at its bottom riveted as indicated at 36 in Fig. 4 to the upstanding vertical flange of an angle-piece 37 the bottom horizontal flange of which is riveted as shown in Fig. 1 to floor-plate 22.

Front-plate 35 has a very large rectangular cut-out as shown best in Fig. 4, so as to constitute a rectangular frame carrying along its top stretch an angle-piece 38 to aid in rigidifying the plate and to make a very strong anchorage for a pair of horizontally spaced eyes 39 carrying the suspension rings 14. Near the bottom of the front-plate 35 the bumper 34 is riveted in place; the top of the bumper marking about the bottom of said rectangular cut-out.

Such a cut-out provides at the lead-end of the car an opening 35*c* through which pieces of material, as long timbers loaded on the car, may be protruded, as indicated at 35′ in Fig. 7. At opposite sides of the front plate 35, top and bottom gusset plates 40 are riveted to the side flanges 35*a* of said plate; and angle pieces 41, constituting inclined struts at opposite sides of the car, are riveted at their tops to the upper gusset-plates 40 and at their lower ends to the upstanding vertical flanges of side angle-pieces 21. Lower gusset plates 40 are riveted also to the last mentioned flanges.

The trail-end superstructure unit is illustrated as including a roofed over compartment having an open front end and slatted sides; the structural elements of such compartment comprising a back-plate 42, riveted at its bottom to an angle-piece 43 (Fig. 3) similar to the floor angle-piece 37 at the front end of the car, this angle-piece 43 having its bottom flange riveted to rear floor plate 24; a roof-plate 44, riveted at its rear under edge portion to an angle-piece 45 (Fig. 3) to which the upper forward edge portion of back-plate 42 is riveted; angle-pieces at opposite sides of the car riveted to the side under edge portions of the roof-plate 44, and having depending flanges, such as the one indicated at 46 in Fig. 2; vertical angle-pieces 42*a*, similar to the angle-pieces 35*a* of the forward superstructure unit, riveted to the back-plate 42; top and bottom gusset-plates 40′, corresponding to the gusset-plates 40 of the forward superstructure unit, and riveted to the various overlapping angle-pieces as clearly shown in Figs. 1, 2 and 3; top stiffener-strips 47 riveted onto roof-plate 44; and vertical slats 48 at opposite sides of the car riveted at their upper and lower ends to angle-pieces 46 and 21.

Angle-pieces 41′, constituting inclined struts at opposite sides of the car, and corresponding in function to the angle-pieces 41 of the front superstructure unit, are riveted at their tops to the upper gusset plates 40′ and at their lower ends to the upstanding vertical flanges of side-angle pieces 21.

At opposite sides of the car, handles 49 are riveted in place as shown, so that the rivet at the lower end of each of said handles also locks one of the slats 48 on the same side of the car to the intersecting strut angle-piece 41′. At each side of the car, also, the other slat 48 is riveted to the strut angle-piece as indicated at 50 in Fig. 2.

Handles 49 are used by one or more attendants in guiding the car as it is being loaded onto or unloaded from the elevating device, as the cage 18 shown in Figs. 7 and 8.

Various means for retaining the load on the car may be provided. For merely a plurality of long rods, pipe, timbers or the like, up to an aggregate such that portions of all the pieces of the load could be protruded through cutout 35*a* in front plate 35 while the opposite end portions of said pieces are tucked in under roof plate 44 of the trail-end superstructure unit, the car so far described would act satisfactorily pursuant to the invention.

The invention also aims, however, to provide a superstructure for the car so constructed that considerably shorter pieces of material may be handled, either alone or in combination with longer pieces; as well also as a superstructure so constituted that whatever be the character of the load, the same may be retained at a plurality of points along the length of the car and thus all load components securely held down, however heterogeneous be the pieces composing the load. To these ends I prefer to arrange along the length of the car a plurality of pairs of side standards and retaining bars for the tops of such standards, one bar for each pair of standards. Two of such pairs of standards are indicated in the drawings, at 51, and the two retaining bars at 52.

In the present case, each of these retaining means 51, 52, and now see Figs. 5 and 6 as well as Figs. 1 and 2, is constructed as follows: Each standard 51 is pivotally mounted at its bottom at one side of the car, on a pin 53 set in angle-piece 21 and in a box 54 on said angle-piece, so that said standard may be swung down, as indicated by dot and dash lines in Fig. 2, to lie outside the loading chamber defined by the skeleton frame-work, or arranged as shown in said Fig. 2, before or during the course of loading such chamber. In order to provide means for locking a standard thus upright, each standard at its bottom carries an offset portion or foot 51*a*, provided with a through aperture which when the standard is upright is vertically disposed for the reception of a drop-pin 55. When a standard is to be lowered as shown in dot and dash lines in Fig. 6, this pin may be lifted clear of box 54. In order to avoid loss of the pin, the same is carried on a chain the terminal links of which are indicated at 56 in Fig. 6. As shown best in Fig. 5, each standard is provided with a series of bolt holes 57, so that the retaining bar 52 for that pair of standards may be secured in place to the standards at the proper height to bear down tightly on top of the load. Eye-bolts 58, which may coact with forks as indicated at 59*a* in Fig. 2, are employed for securing the bars 52 to the standards 51 when the former are properly adjusted on the latter. It will of course be understood that it is desirable that the bars 52 be disconnected from the standards when the latter are swung down as indicated by dot-and-dash line in Fig. 2, so as not to reduce in any way the load capacity of the car.

The invention further provides, as a preferably present feature, a means for retaining and supporting a heavy load of short material in such a position in the loading chamber of the car that the center of gravity of the entire load will be at the proper point to facilitate transferring the car to or from an inclined or vertical hoistway, say while suspending the car from the rings 14 by the chains 17 as shown in Figs. 7 and 8. In the present case a very simple addition to the superstructure is shown, for attaining this object. Such means comprises a U-shaped cross-plate or abutment member 59 (see Figs. 1 and 2) having portions (not shown) near its bottom as seen in Fig. 2 crimped or curled about pivot pins 60 set in brackets 61 at opposite sides of the car. Thus the element 59 may be arranged as shown in full lines in Figs. 1 and 2, or swung down as indicated by the dot and dash curve 59′ of the latter view. It will be seen from Fig. 1 that the shape of this element is such that when it is thus swung downward it does not affect the load capacity of the car relative to a long load. However, when said element 59 is arranged as shown in Figs. 1 and 2, in which disposition it may be locked by applying the eye bolts and wing nuts clearly shown in Figs. 1 and 2, a short load may be placed on the car, with its rear limit at said element 59, and then one or both of the sets of standards 51 and retaining bars 52 may be applied as above to hold the short load against shift.

Referring finally to Figs. 7 and 8, in which views it will be noted that the car is shown more or less diagrammatically, there is disclosed a means particularly adapted for use in a cage in a vertical hoistway, for engaging and latch-locking the car along a line substantially diagonally opposite the line of suspension rings 14, after the car has naturally assumed or been forced to assume a vertical suspension within the cage. This means is fully described and claimed in my copending application Serial No. 144,274, filed October 26, 1926, now Patent No. 1,697,824 of January 1, 1929. Briefly described, the same includes one or more inclined bars 62 carrying one or more notches 62*a* for engaging axle 13 or a similarly located element of the car; the ramp feature 62*b* being preferably present so that as the car swings in from the location shown in Fig. 7 toward the location shown in Fig. 8, the bar will be depressed by such axle against the expansible spring or springs 63 and thus cause a notch 62*a* to be snapped about said axle when the car becomes disposed as shown in Fig. 8. When the cage arrives at the delivery level, the lower end of the car may be detached from the bar 62 by depressing a pedal 66 pivoted at 67 and carrying an integral arm 68 connected by a link 69 to a bell-crank lever 70 pivoted at 71. Depression of the pedal 66 rocks said lever to actuate a pull rod 72 to swing down bar 62 against the compression of the spring or springs 63.

If desired, the car may also be held in vertical position, during ascent or descent of the cage 18, by dropping down across the front of the lower portion of the cage a retaining bar 64 pivoted to one side of the cage and adapted to be dropped into a suitable keeper on the other side of the cage. Such a bar is familiar in the art of elevating; a pivotal mount of the kind just referred to being indicated in Fig. 8 at 65.

Inasmuch as many changes could be made in the above construction, and many apparently widely different embodiments of my invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language contained in the following claims is intended to cover all the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. A car for handling material comprising a body, two axles secured below the body, each axle being nearer the middle than an end of the car, a plurality of rolling wheels on each axle, for normally supporting the car in horizontal position, a third axle secured near one end of the car, said third axle being mounted in fixed relation to the body, a plurality of rolling tilting wheels concentrically mounted on the third axle, the parts being so arranged that the rolling wheels on the first-mentioned two axles extend a greater distance from the body than the tilting wheels on the third axle, the peripheries of said tilting wheels extending below the end of the car.

2. A car for handling material comprising a body, two pairs of running wheels mounted near the middle of the body for carrying the body along a horizontal support, a pair of tilting wheels near one end of the body, the tilting wheels being out of contact with the horizontal support when the car is riding on the running wheels, and the peripheries of said tilting wheels extending rearwardly and downwardly beyond the end of the car to rollingly support the car when the opposite end is being elevated.

3. A car for handling material, comprising a framework for carrying the material, a plurality of running wheels for carrying the body along a horizontal support, means carried at the lead-end of the car for detachably connecting that end of the car to elevating means, and a pair of tilting wheels extending below the framework at the trail end of the car, said tilting wheels being normally out of contact with a horizontal support when the car is moving thereover, but being adapted to rollingly support the car when the lead end is being elevated.

4. A car for handling material, comprising a body, wheels supporting the body, means carried at the lead end of the car for detachably connecting that end of the car to elevating means, a pair of tilting wheels extending below the framework at the trail end of the car, said tilting wheels being normally out of contact with a horizontal support when the car is moving thereover, but being adapted to rollingly support the car when the lead end is being elevated, and a pair of handles secured to the trail end of the car to guide the body in its tilting movements.

5. A car of the kind described comprising a plurality of wheels nearer the middle than an end of the car, a wheel toward the trail-end of the car, and means carried near the lead-end of the car for detachably connecting

that end of the car to elevating means in a hoistway.

6. A car for handling material at and between different levels, comprising a wheeled truck, a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, and means carried by the superstructure at an elevated point thereon near the lead-end of the car for connecting that end of the car to elevating means in a hoistway, said car also having a trailer wheeled-truck for rollingly supporting the trail-end of the car when the latter is up-ended at its lead-end on actuating said elevating means.

7. A car for handling material at and between different levels, comprising a wheeled truck, a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, and means carried by the superstructure at an elevated point thereon near the lead-end of the car for connecting that end of the car to elevating means in a hoistway, said car also having a trailer wheeled-truck including a wheel at a higher level than the wheels of the first mentioned truck when the car is substantially horizontal, said wheel being then less elevated than said point.

8. A car for handling material at and between different levels, comprising a wheeled truck, a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, said superstructure including a permanent superstructure unit at one point along the length of the car, said unit including a structure for holding material as aforesaid and a collapsible superstructure unit at another point along the length of the car, and means for detachably connecting the car to an elevating means in said hoistway to cause up-ending of the lead-end of the car when said elevating means is actuated.

9. A car for handling material at and between different levels, comprising a wheeled truck, and a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, said superstructure including a permanent superstructure unit forming an upright transverse frame presenting a cut out opening near the lead-end of the car.

10. A car for handling material at and between different levels, comprising a wheeled truck, and a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, said superstructure including a permanent superstructure unit at the trail-end of the car having side members and a roof or bridge member.

11. A car for handling material at and between different levels, comprising a wheeled truck, and a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, said superstructure including a permanent superstructure unit near the trail-end of the car forming a roofed-over compartment having a forward opening substantially as large as the cross section of the compartment.

12. A car for handling material at and between different levels, comprising a wheeled truck, and a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, said superstructure including a permanent superstructure unit at one point along the length of the car and a collapsible superstructure unit at another point along the length of the car, the last mentioned unit being collapsible on the car without affecting the maximum load capacity of the car.

13. A car for handling material at and between different levels, comprising a wheeled truck, a superstructure for holding material while the car is wheeled on said truck and while the car is up-ended for transport along a hoistway, and a plurality of means at different levels near the lead-end of the car for selective connection to a traction means operating at a particular level or to a traction means operating between different levels.

In testimony whereof I affix my signature.

JOHN WILLIAM SCOTT.

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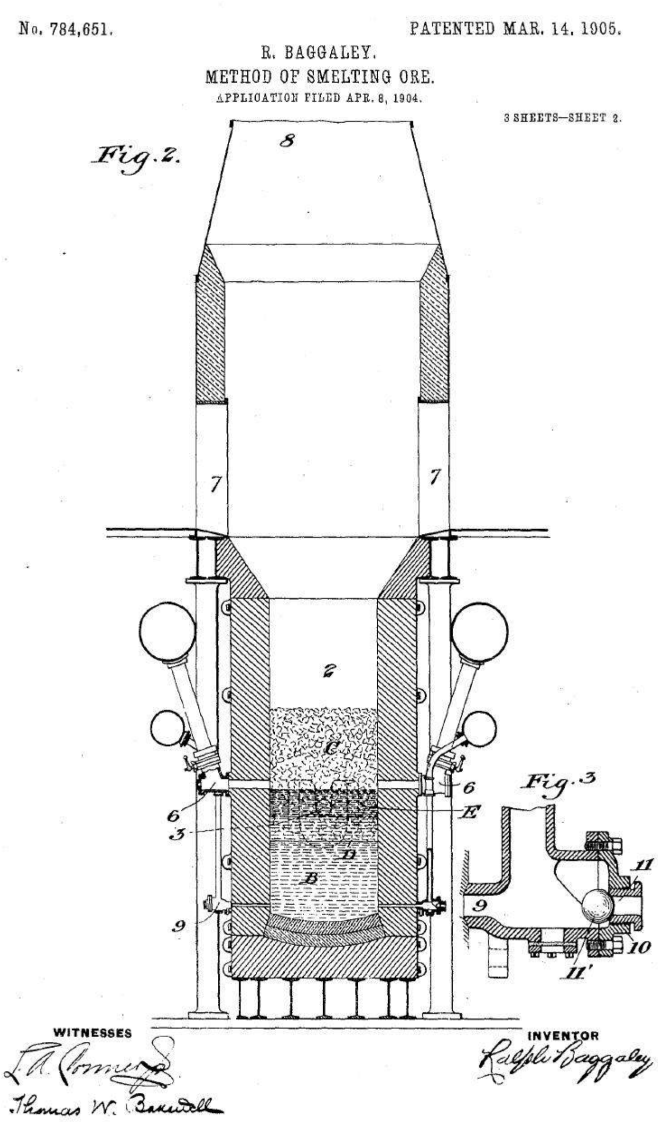


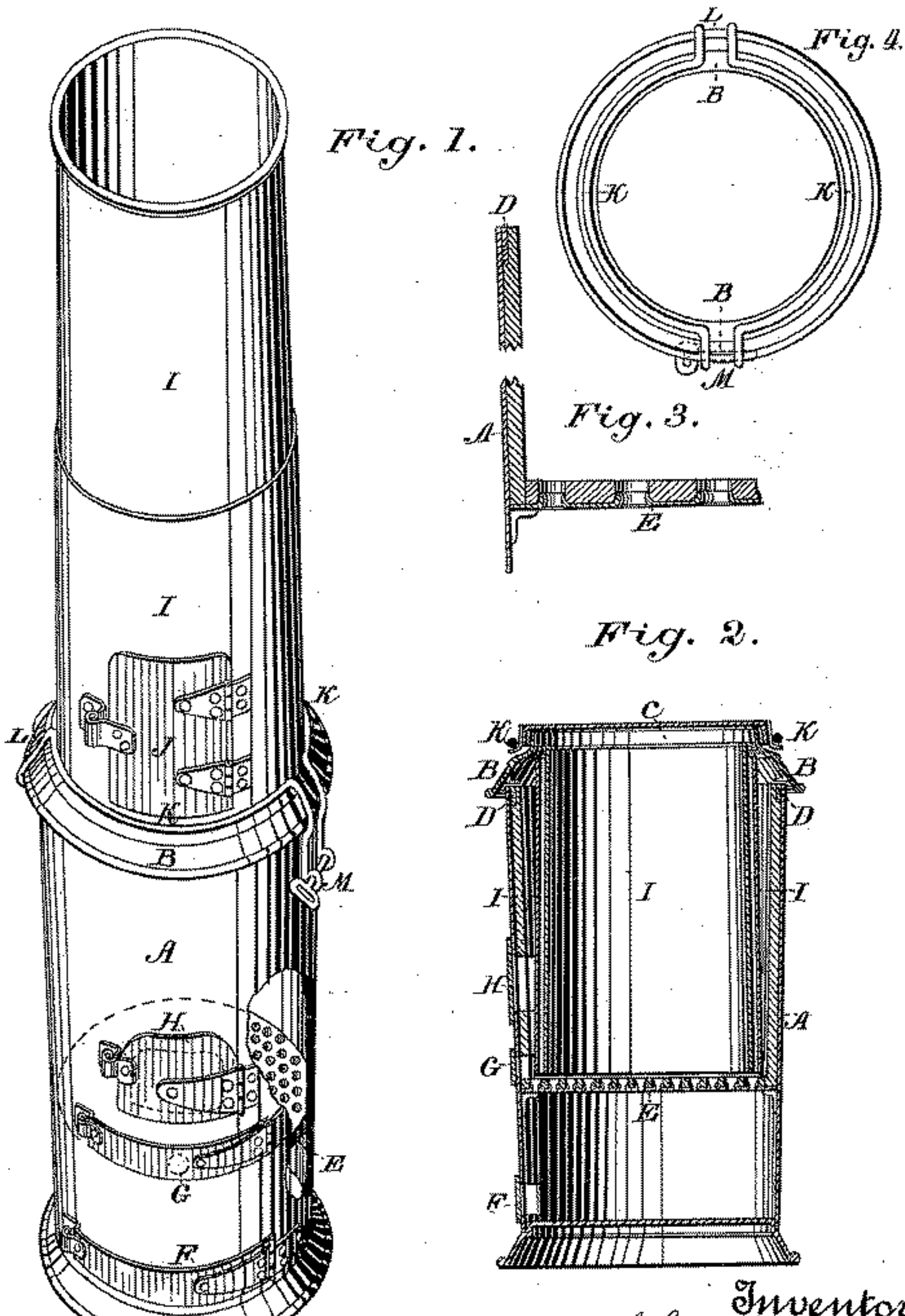
No. 784,651.
PATENTED MAR. 14, 1905.
R. BAGGALEY.
METHOD OF SMELTING ORE.
APPLICATION FILED APR. 8, 1904.
3 SHEETS—SHEET 2.
Fig. 2.
Fig. 3
WITNESSES
INVENTOR

(No Model.)

J. C. TAPPEINER.

ASSAY FURNACE.

No. 272,599. Patented Feb. 20, 1883.



Witnesses
Geo. H. Strong.
J. H. Nourse

Inventor
John C. Tappeiner
By Dewey & Co.
Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

JOHN C. TAPPEINER, OF BISBEE, ARIZONA TERRITORY.

ASSAY-FURNACE.

SPECIFICATION forming part of Letters Patent No. 272,599, dated February 20, 1883.

Application filed September 12, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. TAPPEINER, of Bisbee, county of Cochise, Territory of Arizona, have invented an Improved Portable Assay-Furnace; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to an assay-furnace which is intended for the use of miners and prospectors, and to be easily packed up and carried from place to place, as needed; and it consists in the combination of devices hereinafter explained and claimed. At the top it is decreased in size, and has a collar, upon which the lower section of the pipe is made to fit. The pipe is made tapering, decreasing in size toward the top, and in sections which may be telescoped together, so that the whole can be reversed and placed in the furnace above the grate. A cap then closes the whole and is retained in place by a hinge-clamp and lock, which also serve to retain the pipe in place when in use.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a view of my furnace set up ready for work. Fig. 2 is a section showing it packed. Fig. 3 is a detail. Fig. 4 is a plan of cover.

A is the body of my furnace, the exterior casing of which is made of metal or suitable material and the interior lined with fire-brick, clay, or any non-conducting heat-resisting material. The body is made tapering, from four to ten inches in diameter, and about three times as high, increasing in size from the bottom to the shoulders at the top, so that it has the greatest diameter where the greatest amount of room is required. This also gives a better draft. The shoulders B of the cover are curved inward from the point of greatest diameter, and a collar, C, is formed at the top to receive the pipe. Within the furnace and around the upper edge is an iron ring, D, about one inch wide and one-fourth of an inch thick. This ring resists external pressure and prevents the furnace being crushed when it is packed upon an animal for transportation.

E is the fire-grate, which is preferably made of sheet-iron, coated also with fire-clay, and with round holes punched in it. The burrs formed by punching the holes are turned up, and they assist in holding the coating of fire-clay in place, the holes passing through the clay also. Below the grate is a draft regulating door, F, and G is a door about three-fourths of an inch above the grate, for the introduction of picks, drills, &c., to heat them for tempering when desired. Above this in another door, H, of the proper shape to receive a muffle, which fits it, and may be introduced whenever needed.

I I are sections of pipe made tapering so that the lower end of the lower section will fit over the collar C at the top of the furnace, and the lower end of each succeeding joint or section fits tightly into the top of the next lower one, as shown, when they are all drawn out, thus making a pipe of any desired height.

J is a door made in the side of the lowest section, through which fuel is supplied to the furnace from time to time, as needed, and through which the crucibles may be introduced.

In order to hold the cover B in place and steady it and the pipe, I employ a clamp, K, which surrounds the collar. One end extends down upon the side of the furnace and has a hinge-joint at L, and the other end extends down upon the opposite side of the furnace, and has a lock of any suitable description at M.

When the furnace is to be transported or is not in use the pipe is taken off, and by reversing it and pressing its small end upon the ground the joints will be loosened where the end of one section binds within the next, and the sections may all be telescoped one within the other. The top of the upper section is flanged or beaded, so as to prevent its being bent or broken when it is pressed upon the ground. When the pipes have been telescoped they are placed in the furnace small end down, and occupy the space between the grate and the top.

Three pairs of assay-tongs will fit between the pipe and the inside of the furnace.

The flux-boxes are made round, about two inches high, with central partitions and hinges, so that each will form two boxes, and they will fit loosely inside the pipe. The iron muffle will also fit inside the pipe, and will be in no no danger of breakage during transportation.

When the whole is in place the cover is shut down upon the top and is secured by the clamp, the whole being then ready for transportation.

This apparatus is designed for the use of assayers, miners, or prospectors, and is compact and portable. It can be packed upon an animal over any trail, and into districts where it can be made available in determining the value of the ores upon the spot. It is also useful for sharpening and tempering picks, drills, and other tools.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A portable furnace consisting of the upright body A, with its doors F, G, and H, grate E, and cover B, with collar, as shown, in combination with the pipe made in tapering sections I, so as to be extended or closed telescopically or reversed into the furnace, and having the charging-door J in the lower section, substantially as herein described.

2. The upright body A, with its cover B and sectional telescopic pipe I I, constructed as described, whereby it may be packed in the main body A, as shown, in combination with the clamp K, hinged to the body of the furnace, and locking devices, as described.

3. A mining and assay furnace consisting of the tapering body A, with its fire-resisting grate E, doors F, G, and H, cover B, and clamp K, in combination with the tapering telescopic sectional pipe I I, constructed as described, whereby it may be packed in the main body A, substantially as specified.

In witness whereof I hereunto set my hand.

JOHN C. TAPPEINER.

Witnesses:
LEWIS WILLIAMS,
W. W. FENNER.

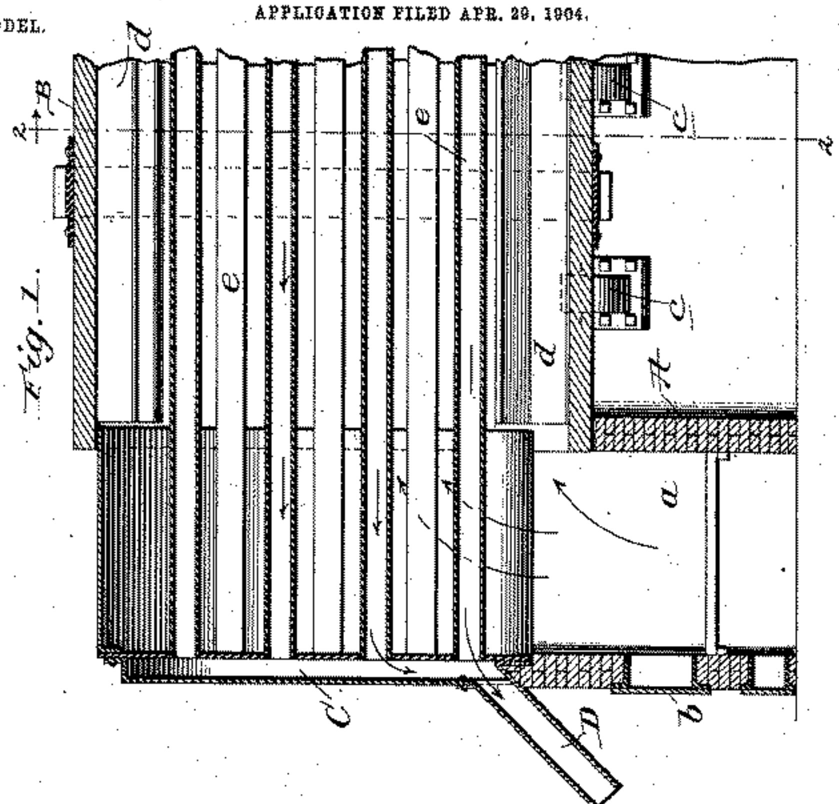
No. 769,263. PATENTED SEPT. 6, 1904.

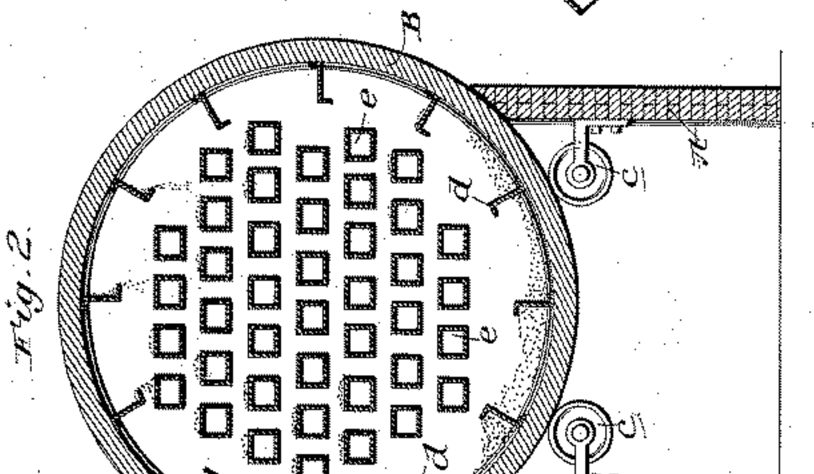
J. HERMAN.

PROCESS OF UTILIZING WASTE FURNACE GASES AND SIMULTANEOUSLY REDUCING ORES.

APPLICATION FILED APR. 29, 1904.

NO MODEL.





Witnesses
C. H. Raeder.
N. C. Healy

Inventor
John Herman.
By James J. Sheehy Attorney

No. 769,263. Patented September 6, 1904.

UNITED STATES PATENT OFFICE.

JOHN HERMAN, OF BISBEE, ARIZONA TERRITORY.

PROCESS OF UTILIZING WASTE FURNACE-GASES AND SIMULTANEOUSLY REDUCING ORES.

SPECIFICATION forming part of Letters Patent No. 769,263, dated September 6, 1904.

Application filed April 29, 1904. Serial No. 205,613. (No specimens.)

To all whom it may concern:

Be it known that I, JOHN HERMAN, a citizen of the United States, residing at Bisbee, in the county of Cochise and Territory of Arizona, have invented new and useful Improvements in Processes of Utilizing Waste Furnace-Gases and Simultaneously Reducing Ores, of which the following is a specification.

My invention pertains to the use of waste furnace-gases in conjunction with oxidized ores or metallic oxids with a view of utilizing the calorific value of the gases and reducing metallic oxids to globules of metals at one and the same time, the reduction of the metallic oxids to metallic globules being advantageous in that it adapts the metals for concentration by well-known processes.

With the foregoing in mind the invention will be fully understood from the following description and claim when taken in connection with the accompanying drawings, forming part of this specification, in which—

Figures 1 and 2 are views of the apparatus which I prefer to employ in carrying out my process.

In one embodiment of my invention I make use of metallic oxids—such, for instance, as roasted ore—through or over which I pass furnace-gases which would otherwise go to waste. When this is done, the carbon monoxid present is oxidized to carbon dioxid, and the metallic oxids are reduced either to lower oxids or to the metallic state. When desirable, the ore may then be reoxidized by the admission of air, and thereby adapted to do its work continuously for an indefinite period. Incident to the passage of the waste furnace-gases through or over the roasted ore or other metallic oxids ten thousand and fifty British thermal units of heat are liberated for each pound of unsaturated carbon in the gases, and the following are typical reactions, viz:

$$Fe_2O_3+CO=2FeO+CO_2.$$
$$2CuO+CO=Cu_2O+CO_2$$

and

$$Cu_2O+CO=2Cu+CO_2.$$

The reoxidation is as follows:

$$2FeO+O=Fe_2O_3.$$
$$2Cu+O=Cu_2O—$$

and

$$Cu_2O+O=2CuO.$$

The heat generated in the manner described may be used for heating air-blasts for furnaces or for heating boilers or other devices or for general heating purposes.

As will be readily appreciated, the embodiment of my invention described is materially advantageous because the full calorific value of the waste furnace-gases is utilized instead of a mere fraction of such value.

In copper-matting and lead-blast furnace practice at least three-fourths down to two-thirds of the carbon in the charge is burned to carbon monoxid instead of being burned to carbon dioxid, with the result that half of the fuel value of the entire charge is lost. This will be appreciated when it is remembered that the calorific value of carbon when burned to carbon dioxid is eight thousand and eighty, while it is only two thousand four hundred and seventy when carbon monoxid is produced.

As furnace-gases will not unite with air alone, it follows that heating the blast with such gases as now practiced affords only the advantage of the temperature of the gases and not their fuel value. My process affords both and is more efficient than heating the blast with fuel, since the gases are already hot, the cost of installation is comparatively small, all fuel is saved, and a comparatively small amount of labor and attention is required. When used for treating ores, the full value of fuel is used, and the metals and gangue are left in good condition for mechanical concentration.

In utilizing the heat generated as described for heating air-blasts for furnaces or for heating boilers or for general heating purposes pipes are passed through the compartment containing the metallic oxids of the preferred furnace, which I will now proceed to describe.

Referring by letter to the drawings, A is a furnace having a fire-box *a* and a feed-door *b*, and B is a cylinder, preferably a revolving cylinder, mounted on rollers *c* and arranged to receive gases from the furnace after the manner shown in Fig. 1. The said cylinder B, which resembles a Bruckner cylinder, is provided on its inner side with shelves *d* for roasted ore, Fig. 2, and contains a plurality of air-pipes *e*, which are preferably square in cross-section, as shown, this in order to enable them to serve as shelves and bring metallic oxids and flue-gases in contact to a considerable extent. By this means also the surface of ore exposed is renewed. The speed of the cylinder may be very low or the cylinder may be left idle, as preferred.

The ends of the pipes *e* remote from the furnace A are designed to be connected with a blast or other source of fluid-pressure supply, which I have deemed it unnecessary to illustrate, while the other ends of the said pipes are arranged to discharge into a receiver C, (shown at the left of Fig. 1,) which receiver is provided with a conduit D for carrying the hot air to the point where it is to be utilized.

While I have shown and described an apparatus for carrying out my process, I desire it distinctly understood that the apparatus may be modeled after any desirable type of roaster or may be of any other construction without affecting my invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

The process described which consists in subjecting metallic oxid to the action of furnace-gases to reduce the metallic oxid to a lower oxid or the metallic state, burn the carbon monoxid present to carbon dioxid, and recover the heat values lost by the incomplete combustion of fuel, at one and the same time, utilizing the heat values so recovered for an extraneous purpose, and admitting air to the metallic oxid at intervals to adapt the same to do its work continuously.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN HERMAN.

Witnesses:
H. S. Morrow,
E. B. Moore.

No. 784,651. PATENTED MAR. 14, 1905.

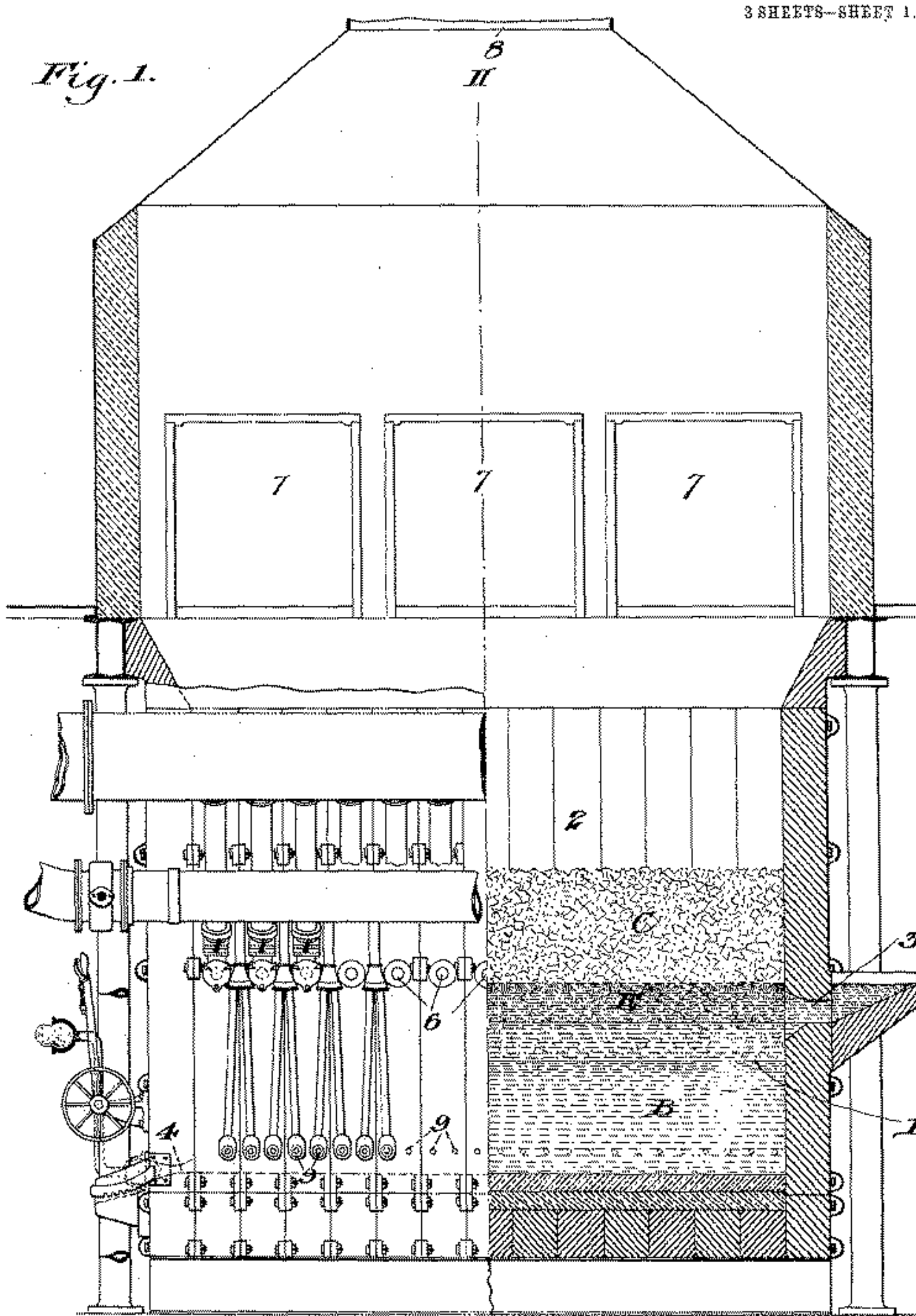
R. BAGGALEY.

METHOD OF SMELTING ORE.

APPLICATION FILED APR. 8, 1904.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

L. A. Conner

Thomas W. Bakewell

INVENTOR

Ralph Baggaley

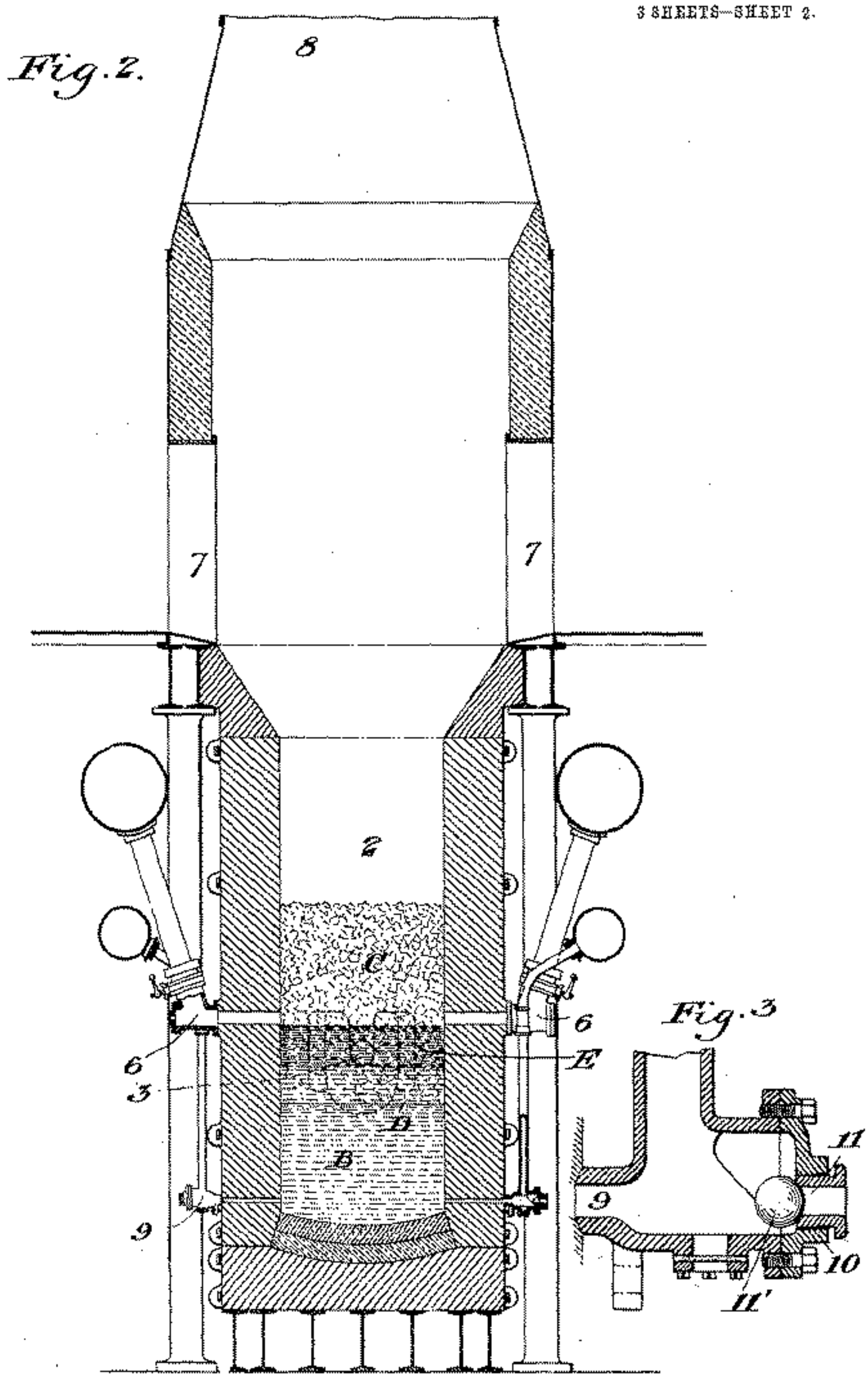
No. 784,651. PATENTED MAR. 14, 1905.

R. BAGGALEY.

METHOD OF SMELTING ORE.

APPLICATION FILED APR. 8, 1904.

3 SHEETS—SHEET 2.



WITNESSES

L. A. Conner

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INVENTOR

Ralph Baggaley

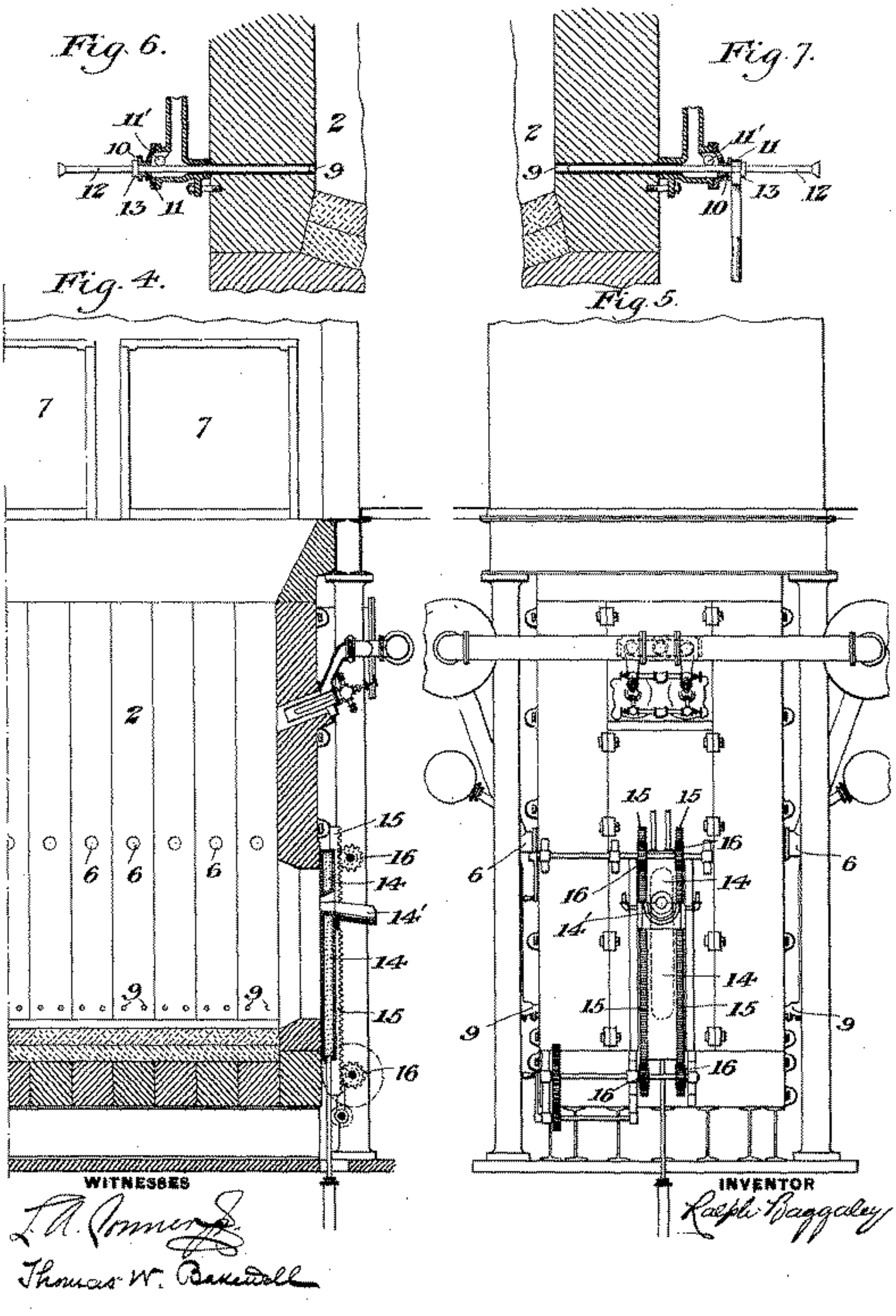
No. 784,651. PATENTED MAR. 14, 1905.

R. BAGGALEY.

METHOD OF SMELTING ORE.

APPLICATION FILED APR. 8, 1904.

3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA.

METHOD OF SMELTING ORE.

SPECIFICATION forming part of Letters Patent No. 784,651, dated March 14, 1905.

Application filed April 8, 1904. Serial No. 202,195.

To all whom it may concern:

Be it known that I, RALPH BAGGALEY, of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented a Method of Smelting Ore, of which the following is a description, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of a furnace suitable for the practice of my invention. Fig. 2 is a vertical cross-section on the line II II of Fig. 1. Fig. 3 is a detail view of the twyer connection. Fig. 4 is a longitudinal section of one-half of a furnace of modified construction. Fig. 5 is an elevation thereof. Figs. 6 and 7 are detail views of a part, showing modified constructions.

My invention provides means for the continuous smelting of sulfid and other ores of copper without need of previous water-concentration and calcination and with the use of no carbonaceous fuel or a very small proportion of such fuel.

I use in my process from two to three times the volume of air-blast utilized in prior practice. This entails a greater expense; but it is fully justified, because I am able through this means to eliminate (*a*) the enormous investments and expenses incident to the water concentration process; (*b*) the twenty-per-cent. or even greater losses in mineral values inseparably attached to water concentration; (*c*) the investments, expenses, and losses connected with calcining; (*d*) the flue-dust and volatilization losses due to slow smelting as heretofore practiced; (*e*) the costs of handling and railroad freights in transporting ore as heretofore to points where an abundant water-supply for concentration is available. In short, the practice heretofore used involves the production of a fifty-per-cent. matte by means of water concentration, calcination, and slow smelting, while my process consists in quickly smelting the entire ore tonnage, eliminating the worthless portion of it, comprising about nine-tenths of the tonnage in the form of slag, through fusion alone, and enriching the remainder by means of converting-twyers to any degree that may be desired within certain limits.

Former practice represents enrichment by water concentration, calcination, and slow smelting, with heavy expenses and mineral losses of at least thirty per cent., while my process represents concentration through the medium of intense heats, with very small mineral losses, with only a fraction of the expenses for most purposes, and with only a slight increase of investment and expense, due to the large volume of converting-blast which I employ.

The losses inseparably connected with the practice heretofore followed in the Butte district computed from the raw ores in the charging-bin to blister-copper generally average thirty-five per cent. of all the mineral values contained in the ores, and they even exceed this percentage. In the best practice these losses have not fallen below thirty per cent. in the portion of the treatment that covers alone the transforming of ore into blister-copper.

The art of producing copper as practiced heretofore has comprised the following processes:

First. The process used by the Spaniards in Mexico and in the southern portions of the United States and in Central and South America, which consisted simply in repeated smeltings and roastings in primitive furnaces until the impurities had in this laborious manner been ultimately eliminated.

Second. The various methods of roasting, smelting, and leeching as practiced at Rio Tinto, Spain, since the time of the Roman Empire.

Third. The "Mabuki" process as practiced in Japan since ancient times and which consists in smelting and roasting in primitive furnaces and thereafter in bessemerizing the matte in extremely crude apparatus.

Fourth. The art as practiced at Swansea, Wales, for certainly two centuries past and at Stora Kopparberg, in Sweden, for a shorter period, which consists in repeated roastings and repeated smelting in small reverberatory furnaces, the oxidizing action of the air-current in its flight through the furnace to the stack being slightly aided by flapping or splashing the molten bath with a hand-tool. Finally the bath was refined by green-wood poles submerged in the bath, whereby the heat of the latter was utilized to produce hydrocarbon reducing-gases.

Fifth. The art as practiced at Mansfield, in Germany, which consists in repeated roastings and repeated smeltings, the latter being done in small circular cupolas or furnaces, usually supplied with a single smelting-twyer, but sometimes equipped with two such twyers.

Sixth. The art as practiced in New Jersey, which consists of the use of large brick furnaces both for oxidizing and for reducing, the treatment itself being similar to that practiced at Swansea, Wales.

Seventh. The art as practiced at a Butte reduction works, which consists in stall-roasting, smelting in a common blast-furnace to produce the converter-matte, and thereafter treating this matte in large furnaces.

Eighth. The art as practiced at Jerome, Arizona, which consists in heap-roasting about half of the ore tonnage of the mines in the open air for four months and a half and thereafter smelting the roasted ores in the proportion of half and half with the richer ores produced from the same mines in order to produce converter-matte, thereafter the treatment of this matte in bessemer converters in the usual manner, and thereafter the treatment of the blister-copper by the poling process in large brick tilting furnaces.

Ninth. The art as practiced at Bisbee, Arizona, which consists of the use in the furnace charge of carbonate and oxid ores exclusively, excepting only a minute proportion of sulfids that have unavoidably been mined while removing the carbonates and oxids. These sulfids are thoroughly calcined in rotary roasters and are then added to the charge. The ores are smelted in small oval cupolas—a modification of the little German cupola in use at Mansfield, Germany—and are then bessemerized. The subsequent treatment of the blister-copper is in the ordinary brick refining-furnace with reducing-gases supplied by the poling process.

Tenth. The art as practiced near Greenwood, British Columbia, which consists in smelting a favorable low-grade self-fluxing ore in ordinary water-jacketed blast-furnaces with about ten per cent. of high-grade coke and thereafter treating the matte in ordinary converters up to blister-copper.

Eleventh. The art as practiced at Luster, near Durango, Mexico, in which a favorable sulfid ore is smelted in a small special water-jacketed blast-furnace with a consumption of seven or eight per cent. of coke, producing a fifty to sixty per cent. matte, in which form the product is sold. The low percentage of coke used is due to the peculiarity of the ore and to the use of a heated blast provided through the use of wood found in the neighborhood.

Twelfth. The art as practiced at Mount Lyell, Tasmania, which consists in smelting favorable sulfid ores in blast-furnaces with a large valume of blast and with from three to four per cent. of carbonaceous fuel as a means of producing the converter-matte, thereafter treating this matte in converters in the usual manner, and thereafter treating the blister-copper in refining-furnaces by the poling process.

Thirteenth. The art as practiced at Douglas, Arizona, in which the ore charge consists exclusively of carbonates and oxids which simply require fusion with coke in order to transform them into rich converter-mattes.

Fourteenth. The art as at present practiced at Ducktown, Tennessee, which consists in smelting a low-grade pyrrhotite ore in large water-jacketed furnaces supplied with blast by a blowing-engine that delivered into the furnace twenty-two thousand and eighty cubic feet of air per minute. The low-grade matte so produced was resmelted when mixed with rich converter-slag and with six per cent. of coke, and the resultant matte was then treated in a bessemer converter.

Many attempts, with great outlay of money, have been made to successfully smelt and convert ordinary copper ores without water concentration and calining directly to blister-copper or to converter-matte; but none of these efforts have ever been put into successful commercial operation, although the advantages of so doing are of the greatest importance.

The accompanying drawings show apparatus well adapted to the practice of my invention.

2 is a furnace which is constituted of a material which is indestructible by the high temperature and corrosive slag and matte produced in my process and which will not conduct the heat so rapidly from the charge as to chill it and interrupt the metallurgical operation. For this purpose I prefer to construct it of thick slabs or blocks of metal, such as copper or cast-iron, which may have passages formed near their outer faces for the circulation of cooling streams of water, air under pressure, or simple air circulation.

3 is the slag-outlet.

4 is the matte-outlet.

6 6 are the smelting-twyers, which enter the furnace somewhat above the level of the slag-overflow.

The furnace has charging-openings 7 and a stack 8. Converting-twyers 9 9 are shown near the furnace-bottom, and the matte tap-hole, with its safety-bot, is shown in Fig. 1. The slag-overflow and its cover may be adjusted as shown in Figs. 4 and 5.

At their outer ends the twyers have heads 10, formed with openings 11 for the insertion of a bar and blast-plugs, the openings being normally closed with ball-valves 11′. The converting-twyers are provided with cardboard-bottom gaskets, Fig. 3, so that should matte escape from any cause it will burn the cardboard and flow onto the ground in a stream until the twyer has been plugged instead of solidifying in the twyer-box.

As a means of regulating and controlling the volume of blast delivered into the bath I use bars 12, Fig. 6, preferably made of iron, which I insert into any or all of the twyers at which I wish to shut off the blast. The bars are made large enough in diameter to practically shut off the twyers and prevent the blast from entering the furnace. For instance, if the twyer be one inch in diameter I may use a round bar seven-eighths or even three-quarters inch in diameter. The length of the bar is such that when the shoulder 13 engages or strikes against the wind-box on the outside of the twyer the bar will reach within an inch or half-inch of the point at the inside limit of the twyer-orifice where the blast enters the matte. By inserting such bar into the twyer-hole the blast will be shut off from this one twyer and a small quantity of matte will chill against the bar at the inside end of the orifice. This small quantity of chilled matte—say one-half inch or one inch in thickness—will at once make an air-tight joint for the blast, a non-conducting protecting-layer for the end of the bar, and a seal against the escape of matte. The shoulder 13 on this bar is preferably made square, so that it may be turned with a wrench and so that the joint with the matte plug may thus be ruptured and the bar removed. The matte seal or plug may then be removed whenever it is desired to reopen the twyer by using the ordinary punching-bar.

If desired, the shoulder on the bar may be set one or two inches farther back, and a loop of the same width may be used inside the shoulder when the bar is inserted into the twyer. This loop (shown in Fig. 7) will admit of the bar being inserted into the twyer only the exact distance required, so that its end shall be one-half or one inch distant from the end of the twyer-hole. When it is desired to reopen the twyer, this bar can be driven in with a hammer as a means of rupturing the seal and for the removal of the bar from the twyer. I have found in practice, however, that the simplest and best method of closing a twyer is to use a short bar as first described having a square shoulder, so that it can be turned with a wrench and thus removed, and of the exact length that when the shoulder presses against the outside of the twyer the end of the bar will reach to within one-half inch of the inside of the twyer-orifice. In practice I insert this bar for a few moments or long enough to enable it to chill the inside matte seal, and I then turn it with a wrench by engaging the square shoulder, and I then remove the bar from the twyer entirely, depending thenceforth on the matte seal alone for closure of the twyer, which I have found by experience it is perfectly safe to do. I can throw this closed twyer again into action by using an ordinary punching-bar, supplemented, if necessary, with a hammer. By using these bars I can close all the smelting and converting twyers without injury to the furnace or to its subsequent working, and I can thus reduce the volume of blast at will. I can also quickly close the lower twyers when it is desired to shut off the blast preliminary to tapping the slag or matte.

In the practice of my invention after having heated the furnace by burning wood, gas, or oil I supply it with a molten matte rich in oxidizable fuel-making constituents, such as sulfur, iron, &c. This matte is made by smelting sulfid ores—*i. e.*, ores high in matte-making elements and relatively low in silica. The matte thus provided constitutes the molten bath with which my invention is practiced. It may be melted in the furnace itself or it may be supplied from an outside source. The latter is better, because when the charge is melted in the furnace with coke some of the coke will always remain unconsumed and becoming enveloped in molten slag or matte will remain as an infusible obstruction on the furnace-bottom, or if eventually loosened by the action of the converting-twyers it will float in an infusible state on the surface of the matte. The furnace having thus been charged with a layer B of molten matte, which fills the crucible or hearth up to the level of the slag tap or overflow and safely covers and thus protects the converting-twyers from slag, the operator then charges into the furnace a body C of ore, together with a small percentage of coke—say about three per cent. of the latter. This is introduced and maintained in such limited volume that it will float in the bath B well above the bottom of the furnace. Thus in Fig. 1 I show the ore body as extending down to the level D. It is essential that the weight of the body of ore thus introduced should be restricted in this manner, because if it should be introduced in a mass of considerable size, as in processes heretofore attempted, its weight will force it down within the body of molten matte until its base engages the bottom of the furnace. This so obstructs and fills the hearth or crucible as to interfere with the operation of the converting-twyers, and it causes slag to form at the level of these twyers, and as these are relied upon to supply the air which combines with the oxidizable elements of the matte and develops the necessary heat the obstruction of the furnace by the chilled slag and ore would prevent successful operation and by causing the furnace to chill after tapping off the matte would bring the process to a stop. This will be understood and appreciated by those skilled in the art, for it is well known that when the blast is delivered into pure matte it produces intense heats, while when it plays into slag, particularly when it is mixed with ore, it exerts a chilling effect.

Blasts of air are introduced through the upper and lower rows of twyers. The air from the upper row of twyers acts upon the body of coke and ore and smelts it, while the blast of air from the lower row of converting-twyers being thus forced to play into pure matte alone by combining with and oxidizing the combustible elements of the bath—such as sulfur, iron, &c.—generates in the bath a very high temperature. The heated bath acting upon the submerged portions of the ore dissolves the metallic sulfids therefrom, while the silica flux, combining with the oxidized iron of the bath, forms slag, which floats in a layer E and is drawn off through the slag tap or overflow. The operation of the furnace is thus continuous, the bath of matte being enriched by the blast and dissolving the ore which floats in it, the matte produced by smelting of the body of ore above descending and becoming incorporated with that below.

The ore which is charged is selected with reference to the condition of the matte and the temperature of the furnace. A portion of sulfid ore rich in matte-making elements, such as the ordinary pyrrhotite ore, is introduced in order to supply the bath with fuel components, and charges of highly-silicious ore are introduced to serve as a flux for the oxidized iron and to yield values to the bath. These charges, with perhaps other fluxes, such as lime, when necessary, are fed to the bath alternately and in quantities as required; but they must not be fed in such quantities as to force the ore and coke down to the bottom of the furnace or even near to the level of the converting-twyers.

As the bath of matte B accumulates portions are withdrawn for further treatment, care being taken to leave sufficient of it in the furnace to cover the converting-twyers to an ample depth.

Care must also be taken that the matte-bath shall not become too highly enriched—that is to say, its contents of sulfur, iron, and other fuel values should not become lessened to such an extent as to endanger the operation of the furnace by causing it to chill. For these reasons the matte in the bath should never be allowed to exceed sixty per cent. in values, and it should preferably not exceed forty per cent. Its condition in this regard can be regulated quickly and readily by changing the character of the ore introduced into the furnace. Thus if the matte should become too highly enriched sulfid ore containing relatively large portions of sulfur and iron should be introduced, and when the matte is found by the operator to be low in values, and as a consequence the furnace is working hot, ores high in metal values and in silica and low in fuel values may be introduced with the charge. By thus changing the charge and by varying the volume of blast introduced at the twyers the operator is enabled to maintain perfect control over the working of the furnace.

I have learned that without the floating body to serve as a cover for the bath it is impossible to carry on a successful smelting process in this manner for any length of time with open furnaces, such as that shown in the drawings and such as have heretofore been used by all experimenters heretofore in this field, all of whom have been unsuccessful because of the fact, among other things, that slag and matte are continuously splashed up against the side and end walls of the furnace and, becoming chilled by the water-jackets, constantly accumulate on these walls above the bath until they finally choke the furnace by scaffolding, and thus quickly bring the process to a full stop. As a result of this experience I have designed a special furnace to meet and to correct these troubles, which forms the subject-matter of United States application, Serial No. 202,391, filed April 9, 1904. In my present invention it will be noted that I use an open furnace with side and end walls that hold and conserve the internal heat instead of constantly extracting and dissipating it, as thin water-jackets must do, and I effectually prevent all splashing and all possibility of accretions on the furnace-walls by constantly maintaining a floating charge of ore and coke deep enough to prevent such splashing.

In the modification of my invention shown in Figs. 4 and 5 I illustrate an adjustable slag-tap designed to permit the slag-opening to be enlarged when the slag is thick and viscous and when it needs to be raked or rabbled out of the furnace. In this case I provide above and below the slag-tap vertically-sliding water-cooled pieces 14 14, the adjacent ends of which form the limits of the slag-tap hole and one of which carries a slag-spout 14′. These are moved vertically by a powerful mechanism—to wit, by racks 15 and pinions 16—and by thus moving the lower spout-piece and its upper cover in opposite directions the slag-opening can be enlarged and ready access afforded for a rabbling-tool, with which any sticky slag may be removed. By lowering the spout the flow of the slag may be accelerated. By using water-jacketed pieces in this portion of the furnace I prevent the inner skull or slag lining from forming a bond with the inside of the jacket, and I am thus enabled to move these pieces by means of the powerful mechanism, as stated.

Within the scope of my invention as defined in the claims the steps of the process may be modified in many ways, since

What I claim is—

1. The method herein described of producing matte which consists in forming a molten bath of matte, and charging a body of ore in such limited quantity that it will float with

its bottom above the bottom of the furnace, and blowing air into the bath; substantially as described.

2. The method herein described of producing matte which consists in forming a molten bath consisting of matte, charging a body of ore in such limited quantity that it will float with its bottom above the level of the converting-twyers, and blowing air into the bath and into the body of ore above the bath; substantially as described.

3. The method herein described of producing matte, which consists in forming a molten bath of matte, charging a body of ore in such limited quantity that it will float with its bottom above the bottom of the furnace, and blowing air into the bath, and renewing the floating body of ore from time to time; substantially as described.

4. The method herein described of producing matte which consists in forming a molten bath of matte, charging a body of ore in such limited quantity that it will float with its bottom above the bottom of the furnace, and blowing air into the bath, withdrawing the slag above the level of the bath, and blowing air into the ore body above the level of the slag-outlet; substantially as described.

5. The method herein described which consists in blowing a converting-blast into a body of molten matte and maintaining a floating body of unfused charge material to retain heat in the bath and prevent splashing of slag or matte from the action of the converting-twyers; substantially as described.

In testimony whereof I have hereunto set my hand.

RALPH BAGGALEY.

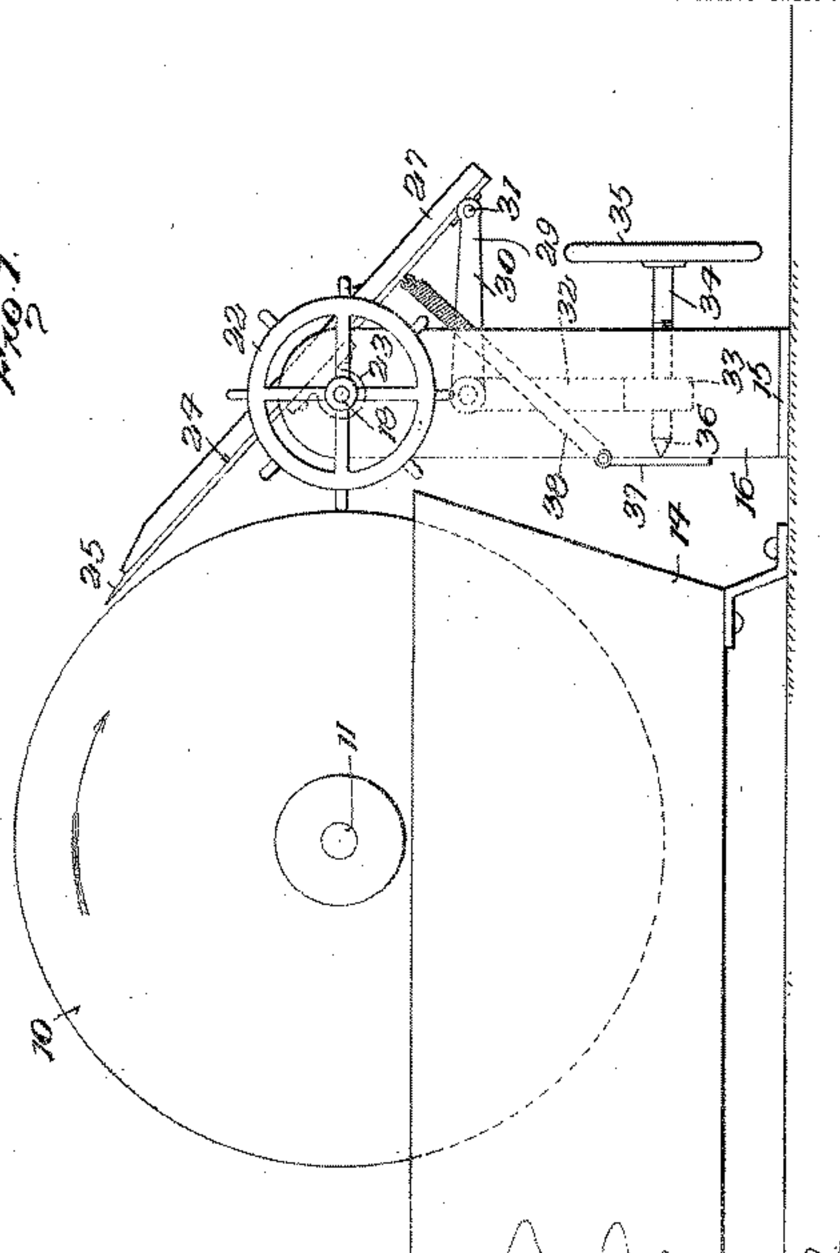
Witnesses:
J. H. Reed,
Thomas W. Bakewell.

M. KRAUT.
FEEDING MECHANISM.
APPLICATION FILED JUNE 16, 1915.

1,162,291. Patented Nov. 30, 1915.

2 SHEETS—SHEET 1.

Fig. 1.



Inventor

M. Kraut

By

Attorneys

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2 SHEETS—SHEET 2.

Fig. 3

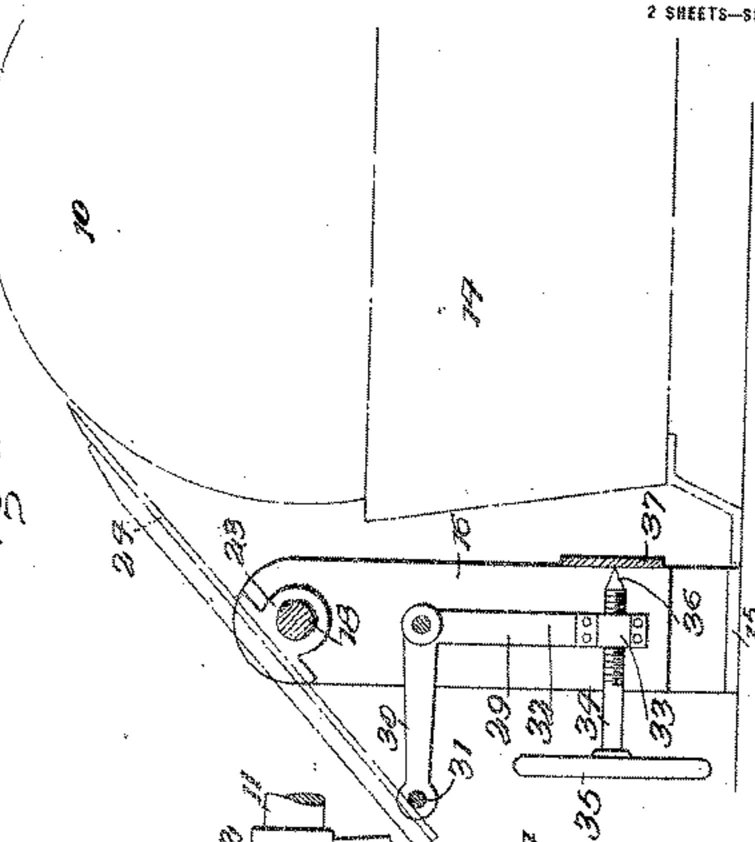
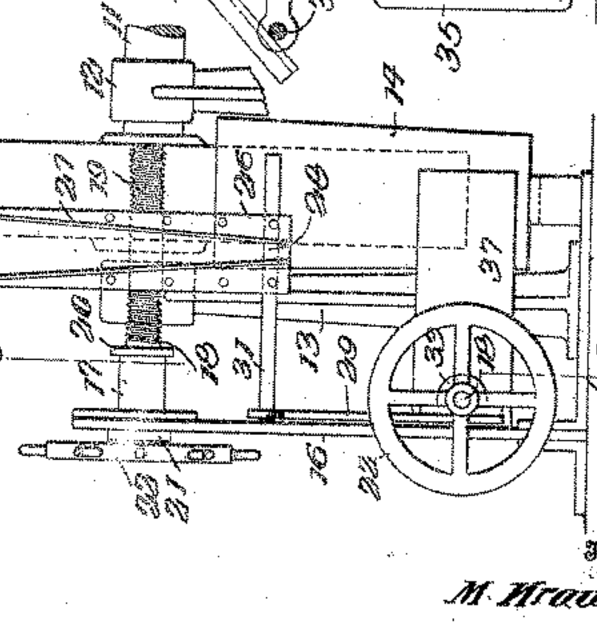


Fig. 2



Inventor

M. Kraut

By

Attorney

UNITED STATES PATENT OFFICE.

MAX KRAUT, OF BISBEE, ARIZONA.

FEEDING MECHANISM.

1,162,291. Specification of Letters Patent. Patented Nov. 30, 1915.

Application filed June 16, 1915. Serial No. 34,436.

To all whom it may concern:

Be it known that I, MAX KRAUT, a citizen of the United States, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Feeding Mechanism, of which the following is a specification.

My invention relates to new and useful improvements in feeding mechanisms, the primary object of my invention being the provision of a device for delicately and accurately feeding predetermined quantities of liquids and particularly designed for insuring a positive, reliable and steady feed of oil, acid or other liquids in connection with flotation machines in ore dressing.

In the art of ore dressing, particularly by flotation methods, it is necessary that a steady and reliable feed of oil, acid and other liquids be insured, these liquids, in many instances, being of a viscous or semi-viscous nature and sometimes gritty. Because of this, it is almost impossible to insure the proper feed by the use of valves as the valves soon become clogged. The chief object of my invention is the provision of a device which cannot become clogged, under any circumstances, and which may be delicately adjusted to feed any desired amount of liquid.

More specifically, my invention comprehends a revolving feed cylinder, the peripheral face of which is partially immersed in the liquid to be fed and a scraper designed to take any desired amount of the liquid picked up by the feed cylinder from the face thereof.

In this connection, a still further object of my invention consists in the provision of a simple and delicate mechanism by means of which the scraper may be moved toward and away from the feed cylinder to vary the thickness of the liquid layer which will be removed from the peripheral face of the cylinder.

A still further object of my invention consists in providing a further and independent adjusting mechanism by means of which the scraper may be moved longitudinally of the cylinder to vary the width of the layer of liquid which it will remove.

With these and other objects in view, my invention will be more fully described, illustrated in the accompanying drawings, and then specifically pointed out in the claims which are attached to and form a part of this application.

In the drawings, Figure 1 is a side elevation of my improved liquid feeding mechanism; Fig. 2 is a front elevation of the mechanism; Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

My present invention includes a feed cylinder 10 of any suitable material, generally metal, mounted upon a revoluble shaft 11 journaled in bearings 12 carried by any suitable frame structure 13 and vertically disposed in such a manner that its lower peripheral portion extends into a liquid container 14 and below the level of the liquid therein. This feed cylinder may be of any suitable dimensions, being generally one-half inch to an inch in length and may be driven in any desired manner and at any proper speed, the speed at which it is driven being, of course, one of the factors determining the rate of feed of the liquid contained in the receptacle 14. Preferably, the frame 13 extends from a base 15 and extending from this base is a frame forming plate 16 which, adjacent its upper end and preferably in the same horizontal plane as the shaft 11, is provided with a laterally directed tubular bearing 17 to revolubly receive the unthreaded shank portion 18 of a feed screw 19, which screw is held against longitudinal movement through the bearing sleeve 17 by spaced collars 20 and 21. The outer end of the shank 18 is provided with a hand wheel 22 and the threaded portion 19 of the feed screw engages in a threaded nut 23 which, in turn, is secured to the lower face of a scraper, indicated as a whole by the numeral 24. This scraper, which is preferably formed of metal, generally steel, is of such length that when its upper end is swung in engagement with the upper face of the feed cylinder, it will extend tangentially to the cylinder and such upper end has its upper face beveled to provide a knife edge 25 for engagement with the feed cylinder. Strips of metal 26 are generally secured to the upper face of this scraper 24, extending longitudinally thereof, and having upwardly directed flanges 27 which converge from the upper to the lower end of the scraper to provide a feed passage 28 through which the oil, acid or other liquid scraped from the feed cylinder will pass, these flanges therefore, preventing any escape of the liquid being fed from the sides of the scraper. It will of course be apparent that the scraper blade should be equal in width to the length of the feed cylinder and preferably that edge which engages the feed cylinder, while of such width, is somewhat narrower than the body of the scraper in order to insure the passage of all liquid scraped from the cylinder into the feed passage 28.

A bell crank lever 29 is pivoted to the frame 16 and the free end of its substantially horizontally disposed arm 30 carries a laterally directed rod 31 which, at all times, engages against the lower face of the scraper 24 near its lower end. The free end of the arm 32 of the lever 29 carries a nut 33 through which is threaded an adjusting screw 34 having a hand wheel 35 at its outer end and a conical point 36 at its inner end. This point engages a bearing plate 37 carried by the frame 16 and it will therefore be seen that turning of the hand wheel 35, as long as the point 36 is held in engagement with the plate 37, will cause swinging of the bell crank lever 29. A helical spring 38 connects the scraper blade and frame in such a manner as to, at all times, hold the scraper in engagement with the rod 31 and, consequently, at all times, hold the conical point 36 of the adjusting screw 34 in engagement with the plate 37.

From the foregoing description, the operation of my improved liquid feeding device will be readily understood. Assuming that the container 14 is filled with the liquid to be fed, at a level above the lower peripheral face of the feed cylinder 10 and that this cylinder is being driven in the direction of the arrows in Figs. 1 and 2 of the drawings, it will be clear that if the knife edge 25 of the scraper 24 is brought closely enough to the peripheral face of the feed cylinder, a part or all of the liquid adhering to the peripheral face of the cylinder will be scraped off and will flow through the passage 28. By proper adjustment of the screw 34, the knife edge 25 of the scraper may be brought as closely as desired to the peripheral face of the feed cylinder, thereby permitting adjustment of the device to remove a layer of liquid from the cylinder of any desired thickness. Again, by adjustment of the feed or adjusting screw 19, the scraper may be moved longitudinally of the peripheral face of the feed cylinder to adjustably vary the width of the layer which shall be removed from the peripheral face of the cylinder, it being apparent that the greater the width and thickness of the layer removed, the more rapid will be the feed of liquid. It will therefore be clear that the amount of any particular liquid fed will be dependent upon the speed at which the feed cylinder 10 is rotated, how close the scraper blade is held to the feed cylinder and what proportion of the length of the feed cylinder the scraper is in juxtaposition to.

The above described mechanism may be cheaply manufactured, will not get out of order and will insure a positive, reliable and steady feed of liquids, irrespective of their viscosity or any foreign matter which may be present.

It will of course be understood that, although I have illustrated and described my invention in all its details, I do not wish to be limited to such details, as various minor changes, within the scope of the appended claims, may be made at any time, without in the slightest degree departing from the spirit of my invention.

Having thus described the invention, what is claimed as new is:

1. A feeding mechanism including a container, a revoluble feed cylinder extending into the container, a scraper disposed in juxtaposition to the peripheral face of the cylinder, and means for adjusting the scraper longitudinally of the peripheral face of the cylinder and locking it in adjusted position.

2. A feeding mechanism including a container, a revoluble feed cylinder extending into the container, a scraper disposed in juxtaposition to the peripheral face of the cylinder, means for adjusting the scraper longitudinally of the peripheral face of the cylinder, and means for adjusting the scraper to swing one end of it toward and away from the peripheral face of the cylinder, the adjusting means in each case holding the scraper in adjusted position.

3. A feeding mechanism including a feed cylinder adapted to extend into a liquid containing receptacle, a scraper supported with one end adjacent the peripheral face of the cylinder, means normally tending to move such end away from the cylinder, and means for adjustably moving such end toward the cylinder and rigidly holding it in adjusted position.

4. A feeding mechanism including a feed cylinder adapted to extend into a liquid containing receptacle, a scraper supported with one end adjacent the peripheral face of the cylinder, means normally tending to move such end away from the cylinder, and means for adjustably moving such end toward the cylinder, said means including a lever pivoted intermediate its length, a rod carried by one end of the lever and engaging against the lower face of the scraper, and an adjusting screw threaded through the opposite end of the lever and held against longitudinal movement.

5. A feeding mechanism including a liquid

container, a feed cylinder projecting into the container, a supporting frame, an adjusting screw rotatably mounted in the frame, a scraper disposed with one end in juxtaposition to the peripheral face of the cylinder, and a nut carried by the scraper and engaging the adjusting screw, whereby the screw may be turned to move the scraper longitudinally to bring any desired portion of the scraper in engagement with the peripheral face of the cylinder and whereby when not turned, the screw will hold the scraper in adjusted position.

6. A feeding mechanism including a liquid container, a feed cylinder projecting into the container, a supporting frame, an adjusting screw rotatably mounted in the frame, a scraper disposed with one end in juxtaposition to the peripheral face of the cylinder, a nut carried by the scraper and engaging the adjusting screw, whereby turning of the screw will move the scraper longitudinally across the peripheral face of the cylinder, and means for swinging the scraper to move its end toward and away from the peripheral face of the cylinder, said means holding the scraper in adjusted position.

7. A feeding mechanism including a revoluble feed cylinder, a scraper disposed in juxtaposition to the cylinder, means for adjusting one end of the scraper toward and away from the cylinder, and means for adjusting the scraper longitudinally of the cylinder, each of said means maintaining the scraper in the position to which said means has moved it.

8. A feeding mechanism including a feed cylinder adapted to extend into a liquid containing receptacle, a supporting frame, an adjusting screw rotatably mounted in the frame, a scraper disposed with one end in juxtaposition to the peripheral face of the cylinder, a nut carried by the scraper and engaging the adjusting screw, whereby the screw may be turned to move the scraper to dispose the scraper along any portion of the cylinder, a lever pivoted intermediate its length, a rod carried by one end of the lever and engaging against the lower face of the scraper, a second adjusting screw threaded through the opposite end of the lever and held against longitudinal movement, and a spring constantly holding the scraper in engagement with the rod.

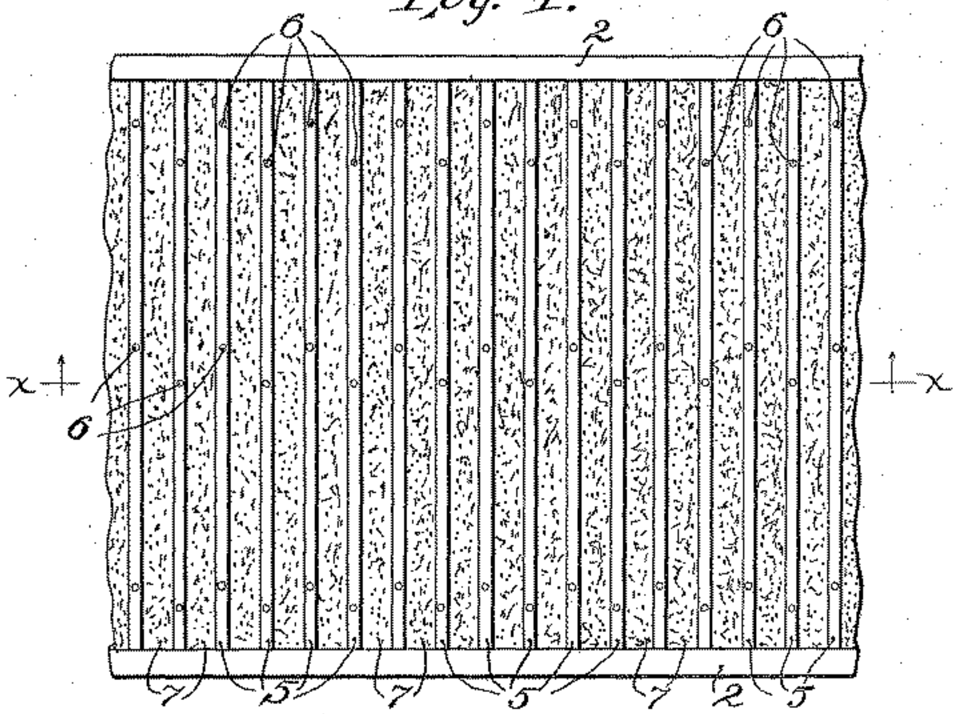
In testimony whereof I affix my signature.

MAX KRAUT [L. S.]

F. B. KOLLBERG.
RIFFLE TABLE FOR CONCENTRATING APPARATUS AND METHOD OF CONSTRUCTING THE SAME.
APPLICATION FILED APR. 12, 1915.

1,168,009. Patented Jan. 11, 1916.

Fig. 1.



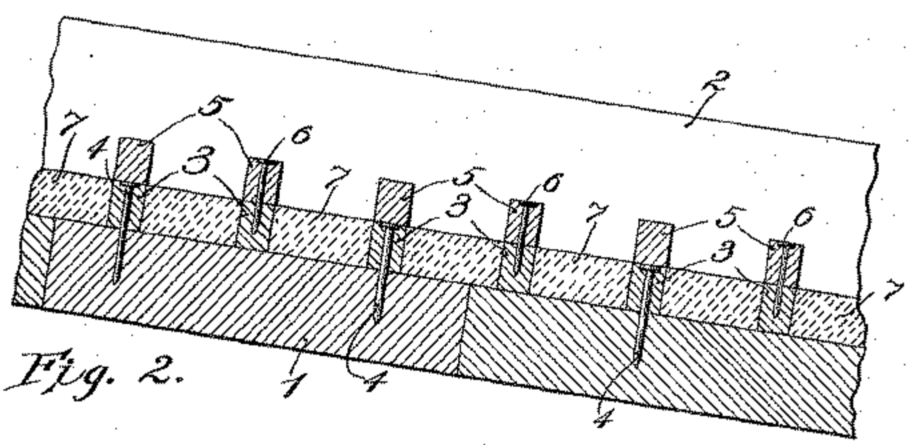


Fig. 2.

Witnesses:
Leonard E. Bogue
A. A. Olson

Inventor
Frederic B. Kollberg.
By Joshua R. H. Potts
His attorney.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FREDERIC B. KOLLBERG, OF BISBEE, ARIZONA.

RIFFLE-TABLE FOR CONCENTRATING APPARATUS AND METHOD OF CONSTRUCTING THE SAME.

1,168,009. Specification of Letters Patent. Patented Jan. 11, 1916.

Application filed April 12, 1915. Serial No. 20,913.

To all whom it may concern:

Be it known that I, FREDERIC B. KOLLBERG, a citizen of the United States, and a resident of the town of Bisbee, county of Cochise, and State of Arizona, have invented certain new and useful Improvements in Riffle-Tables for Concentrating Apparatus and Methods of Constructing the Same, of which the following is a specification.

My invention relates to riffle tables for concentrating apparatus, and has for its object the production of a table cover which will be of improved construction, and efficient in operation.

A further object is the production of a table cover which will be of durable and economical construction, and one which will permit of a simple method of construction.

Other objects will appear hereinafter.

With these objects in view, the invention consists in the combinations and arrangements of parts hereinafter described and claimed.

The invention will be best understood by reference to the accompanying drawing forming a part of this specification, and in which,

Figure 1 is a top plan view of a fragment of a riffle table embodying the invention, and Fig. 2 is a section taken on line x—x of Fig. 1.

The construction illustrated in the drawing comprises a table 1 which is of the usual construction. Said table is shown as being provided with side boards or flanges 2 at its longitudinal edges, but these side boards form no part of the invention, and may or may not be used in conjunction with the table.

Provided upon the upper side of the table 1 are spaced riffles which are arranged according to any standard method desired, each of said riffles comprising a base section 3 secured to the table by nails 4, and an upper section 5 secured to the section 3 by nails 6. Arranged upon the table 1, in the spaces between the riffles, is a layer 7 of cement the upper surface of which is flush with the upper edges of riffle sections 3, as clearly shown in Fig. 2. In the construction of the table cover, the base sections 3 of the riffles are first secured in position. The cement is then introduced into the spaces between the sections 3 and leveled off so as to be flush with the upper edges of said sections, a suitable straight edge being used in the leveling-off process, as will be understood by those skilled in the art. After the cement has set, the riffle sections 5 are secured to the exposed upper edges of the sections 3.

Through the alternating arrangement of the cement and riffles, a construction is provided in which a thin sheet or layer of cement may be placed upon the upper surface of the table without fear of the cement cracking or buckling. Also, with this arrangement the wooden riffles in addition to serving as a means of anchoring the cement in position, permit also of contraction and expansion of the same under different temperatures. The cement forms an ideal wearing surface and will be perfectly smooth and flat. Through the sectional construction of the riffles, it will be seen that, the application of the layer of cement to the upper side of the table between the riffles may be effected with ease and expedition, it being clear that without the sectional construction of the riffles, the leveling-off of the layer of cement between adjacent riffles would be a tedious and laborious undertaking. The cement also serves to securely anchor the base sections of the riffles in place affording a secure and rigid base on which to secure the upper rifle sections. Also, the sectional construction of the riffles permits of easy and ready removal of the upper sections for renewing the same when worn.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. For instance, it is understood that the riffle table cover is not limited to its use in connection with the specific form of table shown, nor the specific arrangement or disposition of the riffles upon the table, but I desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In concentrating apparatus, the combination of a table; riffles spaced on said table, each of said riffles being formed of two superimposed sections; and a layer of plastic material on said table arranged between

said riffles, said layer being of a thickness substantially the same as the height of the lower sections of said riffles, substantially as described.

2. In concentrating apparatus, the combination of a table; riffles spaced on said table, said riffles being formed of base sections and sections fastened to the upper sides of said base sections; and a layer of plastic material arranged on said table between said riffles, said layer being of a thickness substantially the same as the height of the base sections of said riffles, substantially as described.

3. In concentrating apparatus, the combination of a table; transversely extending riffles spaced on said table, each of said riffles being formed of two superimposed sections; and a layer of plastic material on said table positioned between said riffles, said layer being of a thickness substantially the same as the height of the lower sections of said riffles, substantially as described.

4. In concentrating aparatus, the combination of a table; riffles spaced on said table, each of said riffles being formed of two superimposed sections; and a layer of cement on said table arranged between said riffles, said layer being of a thickness substantially the same as the height of the lower sections of said riffles, substantially as described.

5. In concentrating apparatus, the combination of a table; riffles spaced on said table, said riffles being formed of base sections of uniform height and sections fastened to the upper sides of said base sections; and a layer of plastic material on said table between said riffles having its upper surface flush with the upper sides of said base sections, substantially as described.

6. The method of constructing a concentrating apparatus comprising a table having spaced riffles thereon each of which consists of two superimposed sections, and a layer of plastic material on the table arranged between said riffles, which consists in first applying the lower sections of said riffles to the table; then filling in the spaces between the lower riffle sections with the plastic material; then leveling said plastic material off flush with the upper edges of said lower riffle sections; and in subsequently applying the upper riffle sections to the upper edges of said lower riffle sections, substantially as described.

7. In concentrating apparatus, the combination of a table; riffles spaced on said table; and a layer of plastic material on said table arranged between said riffles, said riffles protruding from said layer of plastic material, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERIC B. KOLLBERG.

Witnesses:
C. M. BENSON,
M. S. FRANKOVICH.

J. C. GREENWAY.

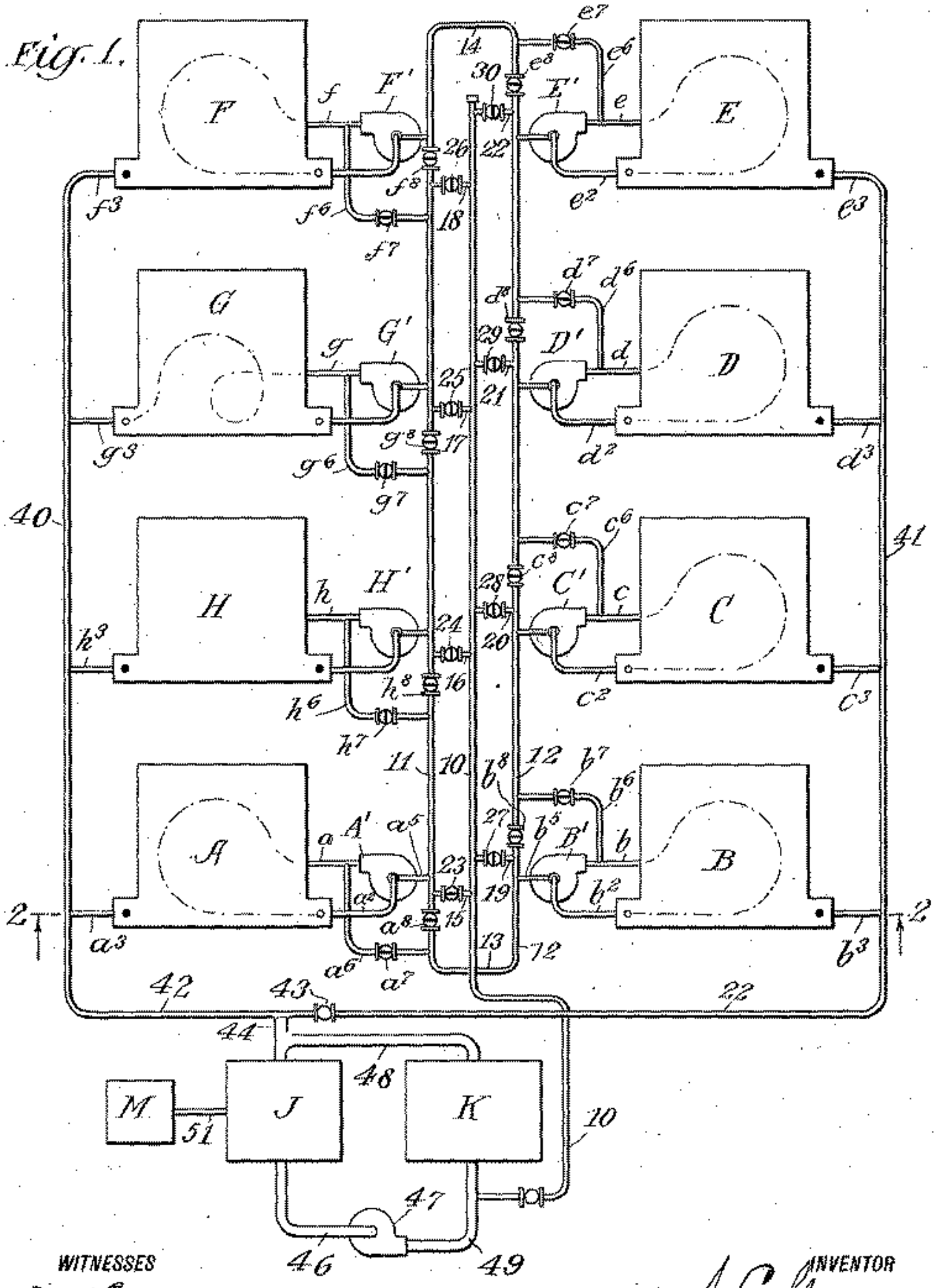
APPARATUS FOR EXTRACTING METALS FROM THEIR ORES.

APPLICATION FILED MAR. 31, 1915.

1,200,832. Patented Oct. 10, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

John J. Ranagan

Frank Eufemia

INVENTOR

J. C. Greenway

BY Wm. A. Megrath

ATTORNEY

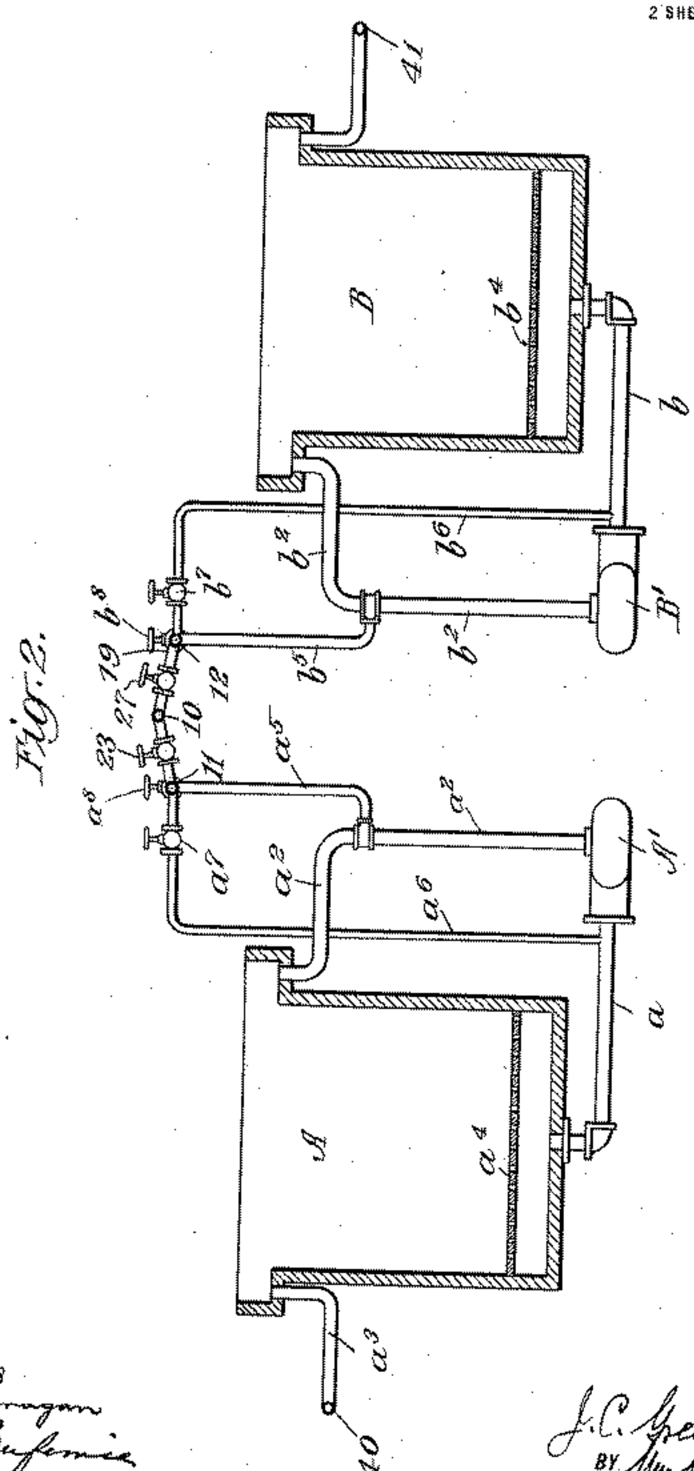
J. C. GREENWAY.

APPARATUS FOR EXTRACTING METALS FROM THEIR ORES.

APPLICATION FILED MAR. 31, 1915.

1,200,832. Patented Oct. 10, 1916.

2 SHEETS—SHEET 2.



WITNESSES

John J. Ranagan

Frank Eufemia

J. C. Greenway INVENTOR

BY Wm A. Megrath

ATTORNEY

UNITED STATES PATENT OFFICE.

JOHN C. GREENWAY, OF WARREN, ARIZONA.

APPARATUS FOR EXTRACTING METALS FROM THEIR ORES.

1,200,832. Specification of Letters Patent. **Patented Oct. 10, 1916.**

Application filed March 31, 1915. Serial No. 18,289.

To all whom it may concern:

Be it known that I, JOHN C. GREENWAY, a citizen of the United States, and a resident of Warren, county of Cochise, State of Arizona, have invented certain new and useful Improvements in Apparatus for Extracting Metals from Their Ores, of which the following is a specification.

My invention relates to improvements in apparatus for extracting metals, preferably copper, from their ores by leaching in such a manner as to obtain a good extraction and at the same time maintain the solution low in impurities in order that the copper can be economically separated without further preparation or purification.

Before describing my invention, the advantages and objects thereof, I will review some of the previous processes for leaching and recovering the metals carried by the lixiviant, and the disadvantages thereof. The processes referred to can be broadly divided into three groups or classes.

First: Those processes using the electric current as a means of separating the metals from the solution, as for example, the electrolytic deposition of copper. The principal disadvantage of this class of processes has been the interference of other metals. Of these, iron in excess is the most troublesome, as its alternate oxidation and reduction at the anode and cathode causes the solution of copper, thus reducing the electrical efficiency, this reduction in some cases being so great as to make electrolytic deposition prohibitive. In addition, it is generally necessary to use the lixiviant over and over, thus fouling the solution by the accumulation of impurities which further reduces the efficiency of the process. The detrimental effects of these impurities may be partly overcome by (*a*) the use of permeable diaphragms around the anodes; (*b*) by the removal of the impurities from the electrolyte previous to its entrance into the electrolytic cell; (*c*) by converting the iron from the ferric to the ferrous state by supplemental treatment in a plant extraneous to the leaching system. To accomplish this reduction it is generally necessary to use various reagents with or without the aid of heat or pressure or both. All of these methods are expensive and unsatisfactory and have not yet been found practicable on a commercial scale.

Second: Those processes in which the metals are removed by simple replacement or substitution with another metal, as for example, the precipitation of copper from a solution by means of metallic iron. Among the disadvantages of this class may be mentioned the high consumption of precipitant, due to the free acid invariably present in lixiviants unless previously neutralized. Neither the free or combined acid nor the precipitant in these processes can be economically regenerated.

Third: Those processes in which the metals are precipitated by the addition of one or more reagents with or without the aid of heat and pressure, or both. Of this class, I may mention the precipitation of copper as copper sulfid by the use of hydrogen sulfid or the precipitation of metallic copper in a sulfate solution by means of sulfur dioxid, with the aid of heat and pressure. Among the disadvantages of using processes of this class is their complexity, and number of manipulations which increases the cost of operation.

I have discovered that when copper bearing solutions containing ferric sulfate are rendered neutral by repeated circulation of the solution on the ore, and when thus neutral, are subjected to an excess of natural oxidized copper compounds, the detrimental ferric sulfate will be precipitated from the solution in an insoluble or partly insoluble oxid. This is then removed from the system with the mechanical moving of the tails.

The chemical equation involved in this process is important, the reaction probably being as follows:

$$3CuO + Fe_2(SO_4)_3 = 3CuSO_4 + Fe_2O_3$$

The chief object of my invention is to provide a means for leaching a series of bodies of ore, such that the leaching solution will be discharged from the last body substantially neutral, thereby requiring a minimum amount of acid and giving a very efficient extraction of the metal, and at the same time to remove impurities from the solution, thereby facilitating the separation of the metal from the solution.

One form of apparatus which I have found very suitable for carrying out my process is illustrated in the accompanying drawings in which the same reference character indicates the same part in the several views.

Referring to the drawings: Figure 1 is a diagrammatic plan view of the apparatus. Fig. 2 is a cross sectional view on line 2 of Fig. 1.

On the drawing the part marked K represents an electrolytic tank or system of tanks of the usual well known construction where copper is recovered from the solution of electrolyte in the tank in the form of a cathode. 10 is a pipe connected to the said tank leading toward the system of ore or leaching tanks to be hereinafter referred to. 11 and 12 are other pipes extending adjacent to the pipe 10, the latter two pipes being connected together by the pipes 13 and 14. The pipes 10 and 11 are connected together by the pipes 15, 16, 17 and 18, respectively, and the pipe 10 is connected to the pipe 12 by connecting pipes 19, 20, 21 and 22. Each of these connecting pipes is provided with a valve 23, 24, 25, 26 and 27, 28 and 29 and 30, respectively.

A, B, C, D, E, F, G and H are leaching tanks, in the bottom of each of which is a perforated false bottom, a^4, b^4, and so forth. The construction and connection of these tanks to the pipes 10, 11 and 12 are the same and the description of one will answer for all.

A′ is a pump. Extending from said pump to the bottom of the tank A is a supply pipe a. Extending from the top of the tank A and leading to the pump A′, is the overflow pipe a^2, and a^3 is another overflow pipe at the opposite side of the tank. Connected to the pipe 11 and communicating with the overflow pipe a^2 is a supply pipe a^5.

a^6 is a branch pipe leading from the pipe a and connected to the pipe 11. In said pipe a^6 is a regulating valve a^7. In the pipe 11 between the branch pipe a^6 and supply pipe a^5 is a cut-off valve a^8.

40 is a line pipe adjacent to the tanks A, H, G and F for instance, and 41 is another pipe adjacent to the tanks B, C, D and E. The overflow pipes a^3, h^3, g^3 and f^3 are connected to the pipe 40, and the overflow pipes b^3, c^3, d^3 and e^3 are connected to the line pipe 41. The line pipes are connected together by the pipe 42 having a cut-off valve 43 therein. Extending from the pipe 42 is another pipe 44, which communicates with the sump J.

46 is a pipe extending from the sump J to the electrolytic tank K, and 47 is a pump in said pipe 46. Extending from the electrolytic tank K and connected with the pipe 44 is another pipe 48. M is a sulfuric acid tank and 51 is a pipe extending to said tank and communicating with sump J.

The operation of the apparatus is as follows: We will consider that the leaching tanks A to H have been successfully filled with ore, the tank A being filled seven or more days in advance of tank G, the tank B, six days in advance of G, the tank C, five days in advance of G, and so forth. The tank H having been filled eight days in advance of G and having been running that number of days, it has been cut out of the system for cleaning, washing and refilling. All of the tanks and pipes have been filled with a solution containing a certain amount of sulfuric acid and as this acid circulates through the system of pipes and leaching tanks, the amount of acid contained in the solution runs from 3 to 4 per cent. as it circulates through tank A to a substantially neutral solution as it circulates through G. We will suppose that the amount of solution circulating through each tank, A for example, is 100 gallons per minute. This solution is forced up by the pump A′ through the pipe a, up through the tank and it overflows through the pipe a^2 back to the pump. Circulating through the pump 47, for example in the same time are 110 gallons of solution, 100 of which go into the electrolytic tank K, and 10 gallons of which are forced into the pipe 10. The solution passes out of pipe 10 through valve 23, through the pipe a^5 and into the overflow pipe a^2, supplying 110 gallons to the pump A′. During the same period of time 110 gallons leave the pump A′, but 10 gallons pass out of the pipe a^6, into the pipe 11 on the other side of the valve a^8, and thence through the connecting pipe 13, into the pipe 12, through the pipe b^5 into the overflow pipe b^2, making 110 gallons which are forced out of the pump B′, through the pipes b and b^6, 100 gallons going through the first mentioned pipe into the bottom of the leaching tank B, and overflowing back into the pipe b^2, the 10 gallons going through pipe b^6 back into pipe 12, on the opposite side of the valve b^8. This course is taken by the solution through the system until it reaches G. At G, 10 gallons overflow through the overflow pipe g^3 and circulate through pipe 40 to pipe 42, to pipe 44 and into the sump J. The incoming solution of 10 gallons meets the 100 gallons coming from the electrolytic tank K, through pipe 48 and thus circulates through the sump J, 110 gallons which are forced out through pipe 46 by the pump 47 into the pipe 49, where it branches, 100 gallons going into K and 10 gallons going into pipe 10.

From this it is apparent that the ore in leaching tank A has been subjected to seven days' treatment, the ore in B to six days' treatment and so on down to G where there has been only one days' treatment of the ore. During this operation there has been extracted various quantities of copper from the ore in each tank. The solution resulting from the disposition of the copper sulfate in the tank K together with the new acid added from the tank M, which may be done from time to time through the pipe

51 into the sump J, is first brought in contact with the ore in that tank A, which has already been leached six days. This solution is continuously circulating through all the tanks as has just been described.

I prefer to maintain an upward circulation through the ore in the tanks, as I have shown and described, as I thereby introduce a tendency to make the body of ore porous, while a downward circulation tends to pack the ore. It is to be understood, however, that in some cases, I can successfully circulate the solution downward. Furthermore, the upward circulation has a tendency to decrease the segregation which will form in leaching tanks under certain conditions. This so called segregation forms a layer of impervious material which the acid cannot penetrate and thus prevents good extraction of the metal. It is apparent, also, that I can circulate the solution continuously or intermittently through the system, and the system is such that I can circulate the solution through any one tank and from any one tank to a succeeding tank, or from any one tank past the succeeding or any number of succeeding tanks to any other system, and from the last mentioned tank back to the electrolyte through the sump. The lixiviant in going from a leaching tank of one age to a leaching tank of a lesser age, and consequently through a charge containing a greater copper content, will extract the copper and become poorer and poorer in free acid.

I have shown eight leaching tanks in my system. The number of tanks, however, may be varied, according to the kind of ore being treated and other conditions, and the number of days the ore is leached may be likewise changed. It is essential, however, that there be a sufficient number of tanks used so that the solution becomes neutral in passing through the last tank. It is also apparent that instead of introducing the acid solution from the tank M into the sump J, that it may be introduced into the system at any other point or points. The solution coming in contact with the new or latest charge of ore in tank G, for example, re-acts upon the copper oxids, precipitating ferric sulfate to a greater or less extent, depending upon the relative quantities of ferric sulfate and copper carbonate or oxids, or a mixture of both. During the operation, ferric oxid is uniformly precipitated through the system and channeling is avoided and better extraction is secured.

The cathode copper resulting from the electrolytic action in tank K is of unusual purity. The detrimental elements of electrolytic copper, such as arsenic and antimony, are removed with the tails. I may also state that in treating the copper ore by my process, the iron and alumina are removed therefrom by precipitation either in an insoluble or partly insoluble form in the leaching system itself and they are also removed and passed from the system with the mechanical removal of the tails.

While I have described the use of electricity—and this is the means which I prefer to use to recover the copper leached out of the ore—I do not confine myself to its use. The fact that the copper sulfate solution obtained by me is in a neutral state and is free or practically free from ferric sulfate enables me to precipitate the copper on iron in an economical way.

It is apparent from what I have described that some of the specific advantages of my process are: 1. That I can leach the ore containing the copper with a minimum amount of sulfuric acid. 2. I can obtain a high percentage of extraction. 3. I can produce a lixiviant direct from the leaching system which is of such purity as to permit of its economical treatment by electrolysis, using standard non-diaphragm electrodes.

I am thus enabled to produce a lixiviant direct from the leaching system which will be of such purity as to cause the minimum amount of oxidation and deterioration of anodes and am thus able to get a low anode replacement cost.

I can extract the copper values from an ore and at the same time produce a lixiviant having a high copper content and which is practically neutral. In this manner, a lixiviant is produced which is particularly suitable for economic precipitation of copper, either by electricity or some form of chemical precipitant. The lixiviant having thus been purified by the natural carbonate or oxid of copper or both, while passing through the charge, has had removed from it, elements not only detrimental to the electrolytic deposition, but also elements like arsenic, antimony and bismuth which would necessitate the refining of the resultant product. I precipitate the objectionable salts of iron and alumina in the leaching system itself in an insoluble or partly insoluble form and these are removed mechanically with the tailings.

I am enabled by neutralizing the lixiviant before mixing it with the electrolyte to render the iron that may be present in such condition that when subjected to the electrolysis by an insoluble anode a reduction and not an oxidization takes place in the electrolytic cell. If free sulfuric acid were present in the lixiviant when introduced into the electrolytic cell, an oxidization would take place and there would be a decrease in the ferrous sulfate and an increase in the ferric sulfate. By my invention I am enabled to increase the ferrous sulfate and decrease the ferric sulfate.

Having now described my invention, what

I claim as new and desire to secure by Letters Patent is:

1. An apparatus for extracting metal from its ores comprising a series of leaching tanks adapted to contain the ore, a circulating pump for each tank having its inlet and outlet connected to said tank for circulating leaching solution in each tank, means for advancing the solution from each tank to the succeeding tank, means for supplying solution to the first tank of the series, and means for withdrawing solution from the last tank of the series.

2. An apparatus for extracting metal from its ores comprising a series of leaching tanks adapted to contain the ore, a circulating pump for each tank having its inlet and outlet connected to said tank for circulating leaching solution in each tank, and means for advancing the solution from each tank to the succeeding tank, means for supplying solution to the first tank of the series, and means for withdrawing solution from the last tank of the series, said supply and withdrawal connections for the solution being interchangeably connected to all the tanks to permit cyclic shifting of the operation throughout the series of tanks.

3. The combination of a series of leaching tanks, a precipitating apparatus, a circulating pump for each tank having its inlet and outlet connected to said tank for circulating leaching solution in each tank, and means for circulating leaching solution through all the series of tanks and through the said precipitating apparatus.

4. In apparatus for extracting metals from their ores, a series of leaching tanks, a circulating pump for each tank having its inlet and outlet connected to said tank for repeatedly circulating a solution through each tank, a precipitating apparatus, outlet means from each tank leading to said precipitating apparatus, a supply pipe leading from said precipitating apparatus and having controllable communication with each tank, means connecting successive tanks of the series to advance a portion of the solution from each tank to the succeeding tank, and means for shutting off any one of the tanks from the supply connection.

5. An apparatus for leaching ores comprising a series of leaching tanks adapted to contain the ore to be treated, pumping means for each tank having inlet and outlet connections to each tank for circulating a solution upwardly through the ore in each tank, advance connections between successive tanks in the series, and means for circulating solution through said tanks and said advance connections.

6. An apparatus for separating a metal from its ores, comprising a series of leaching tanks adapted to contain the ore, a sump, a precipitator, a pump and pipe connections for circulating leaching solution through said sump and said precipitator in a precipitating cycle, and a pump and pipe connections for each tank for circulating leaching solution in each tank in a local leaching cycle, said pumps and pipe connections also being adapted to continuously circulate said leaching solution through the series of tanks, the sump, and the precipitator in a general leaching and precipitating cycle.

7. An apparatus for separating a metal from its ores, comprising a series of leaching adapted to receive the ore, a sump, a precipitator, a pump and pipe connection, for circulating leaching solution through the sump and the precipitator in a precipitating cycle, a pump and pipe connections for each tank for circulating said leaching solution through each tank in a local leaching cycle, and means for circulating said leaching solution through the series of tanks, the sump, and the precipitator in a general leaching and precipitating cycle.

In witness whereof I have hereunto set my hand at Warren, county of Cochise and State of Arizona, this 25th day of March, 1915.

JOHN C. GREENWAY.

In presence of—

PAUL STEVENS,
WINIFRED COUMLES.

M. KRAUT & F. B. KOLLBERG.

PROCESS FOR AERATING LIQUID.

APPLICATION FILED NOV. 8, 1916.

1,261,556. Patented Apr. 2, 1918.

2 SHEETS—SHEET 1.

Fig.1.

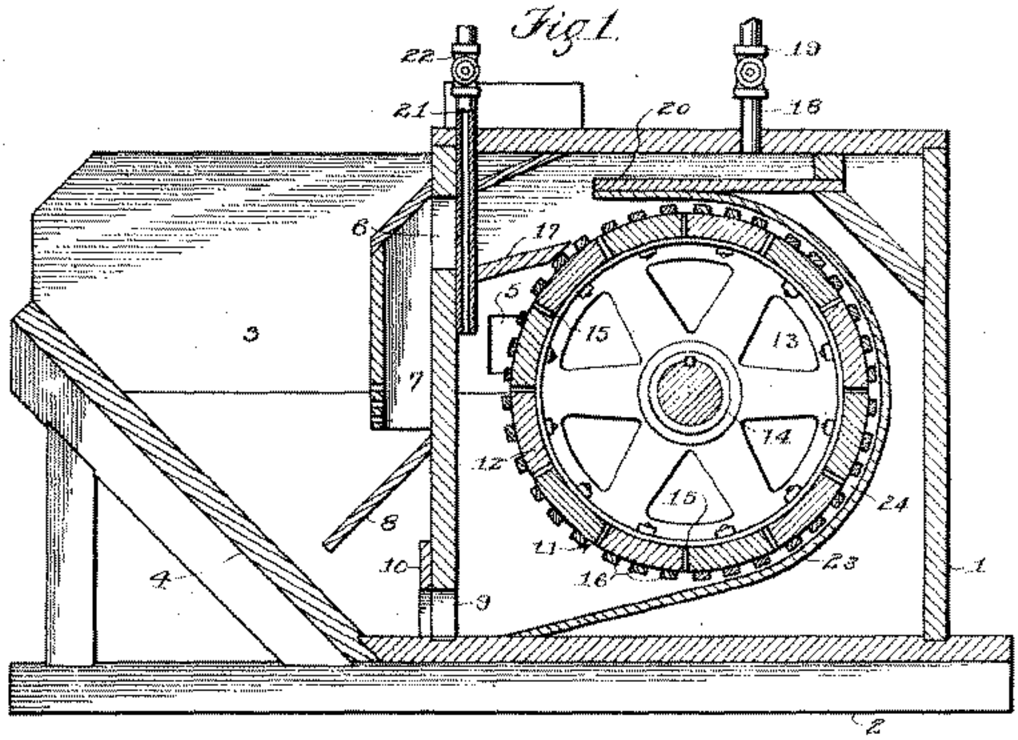


Fig.2.

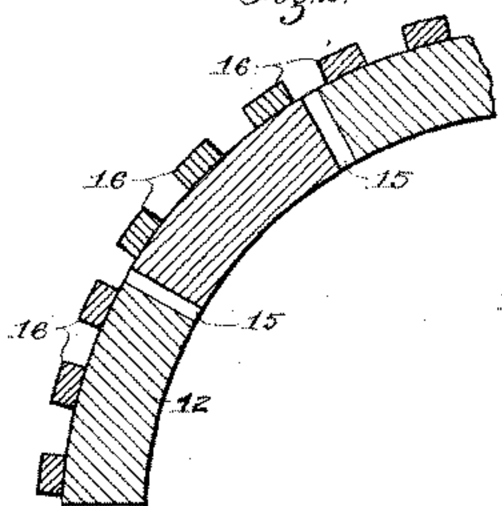
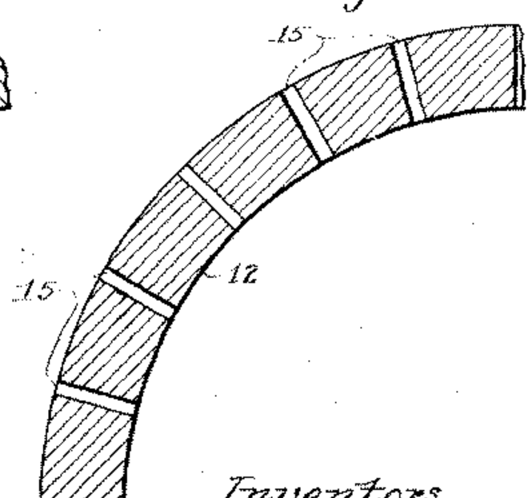


Fig.3.



Inventors.
Frederick B. Kollberg
Max Kraut.

by Edmund A. Strause Atty.

M. KRAUT & F. B. KOLLBERG.

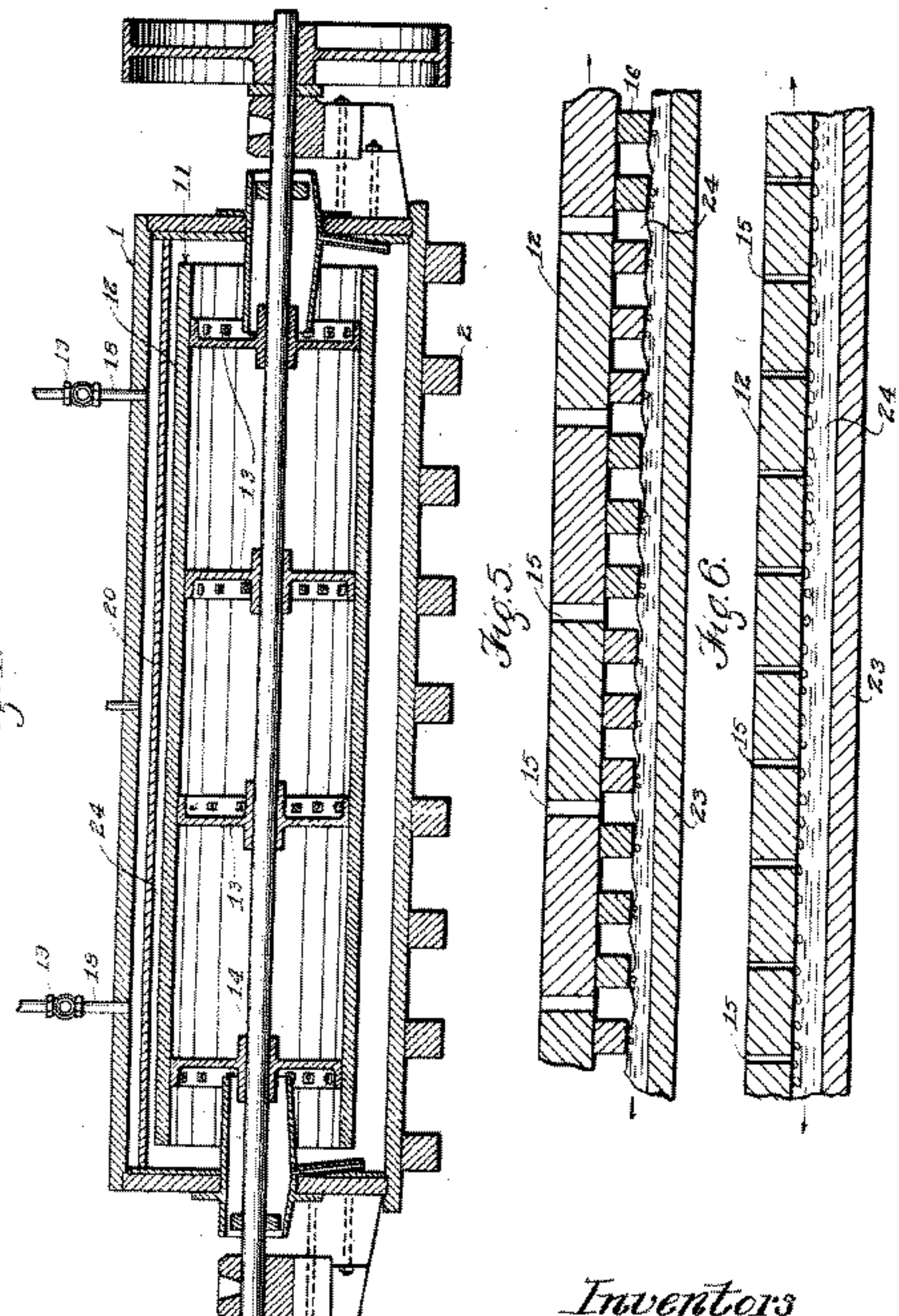
PROCESS FOR AERATING LIQUID.

APPLICATION FILED NOV. 8, 1916.

1,261,556.

Patented Apr. 2, 1918.

2 SHEETS—SHEET 2.



Inventors
Frederick B. Kollberg
Max Kraut.
by Edmund A. Strauss
Atty.

UNITED STATES PATENT OFFICE.

FREDERICK B. KOLLBERG, OF BISBEE, ARIZONA, AND MAX KRAUT, OF LOS ANGELES, CALIFORNIA, ASSIGNORS TO SOUTHWESTERN ENGINEERING COMPANY, A CORPORATION OF CALIFORNIA.

PROCESS FOR AERATING LIQUID.

1,261,556. Specification of Letters Patent. Patented Apr. 2, 1918.

Application filed November 8, 1916. Serial No. 130,170.

To all whom it may concern:

Be it known that we, FREDERICK B. KOLLBERG, residing at Bisbee, in the county of Cochise, State of Arizona, and MAX KRAUT, residing at Los Angeles, in the county of Los Angeles, State of California, both citizens of the United States of America, have invented new and useful Improvements in Processes of Aerating Liquid, of which the following is a specification.

This invention relates to a process of aerating liquid and is especially adaptable for aeration of pulp in mineral separation processes.

It is an object of this invention to provide a process whereby air or other fluid may be introduced into liquid to form a froth, with a minimum of energy.

Heretofore mechanical agitation of pulp in flotation machines for the purpose of producing froth has been very inefficient, because of the wastage of energy in moving the pulp about without accomplishing the entertaining of any great amount of air. By our process we expose a maximum of surface of the pulp to the air, introduce the air into a passage, move the pulp over the air, thereby forming bubbles and move the bubbles and pulp from the passage.

A means for carrying out this process is disclosed in our application, S. N. 107,202 filed July 1, 1916, for reissue of Patent 1,174,737, Mar. 7, 1916, in which the flotation separation chambers are claimed, and in a co-pending application S. N. 130,169, filed Nov. 8, 1916, in which the aeration apparatus is claimed.

In the drawings, Figure 1 is a vertical transverse section through the aeration chamber of the apparatus.

Fig. 2 is a detail sectional fragment of the preferred form of aerating drum shown in Fig. 1.

Fig. 3 is a detail sectional view of a fragment of a modified form of aeration drum.

Fig. 4 is a vertical central longitudinal section through the aeration chamber of the apparatus.

Fig. 5 is a developed fragmentary diagrammatic view in section of the preferred form of aerating drum and casing. Fig. 6 is a diagrammatic view similar to Fig. 5 of the modified form of aerating drum, shown in Fig. 3 and casing.

Referring more particularly to the drawing, an elongated substantially rectangular aeration chamber 1 is mounted upon a suitable supporting framework 2. Extending along one side of the chamber 1 and substantially co-extensive therewith, is a frothing chamber or box 3, which is open at its upper side and provided with an inclined bottom 4. Communicating with the head end of the aeration chamber 1 is an entrance opening or passage 5, through which the pulp to be treated is introduced into said chamber. Leading from the bottom of the frothing chamber 3 at the opposite or tail end of the machine is a discharge pipe, not shown, through which tailings are discharged.

Formed in one side of the chamber 1 adjacent the upper edge thereof and extending longitudinally thereof is an aeration chamber discharge outlet 6 from which leads a downwardly extending passage 7 which communicates at its lower end with the chamber 3 as shown.

Arranged below the lower end of passage 7 is a baffle board or flange 8 which serves to deflect the pulp discharged through said passage outwardly. Leading from the bottom of the frothing chamber 3 to the bottom of the aeration chamber 1 are spaced return openings 9 which are controlled by a sliding gate 10 having a notched lower end to correspond with said openings 9.

Arranged in the aeration chamber 1 is the aeration element or drum 11. Said drum consists of a cylindrical wall 12 which is bolted as shown to spiders 13 fixed to a shaft 14 extending centrally through the aeration chamber and having its ends suitably mounted in bearings provided at the ends of said chamber. Air may freely circulate through the drum around the spider arms. The cylindrical wall 12 is provided with slots 15 which extend therethrough and communicate with the interior of the drum. The outer surface of the wall 12 is preferably made irregular in form, as clearly shown in the various figures of the drawing by means of a plurality of closely spaced longitudinally extending riffles 16 as shown in Fig. 2

The riffles 16 serve to entrap air therebetween and pocket or hold the same while the pulp slips thereover. In Fig. 3 the air is held by frictional contact with the surface of the drum and pulp slips thereover.

Provided in the chamber 1 at the lower edge of the outlet opening 6 is an inwardly projecting flange 17 which serves to direct toward said outlet opening the thin sheet of pulp centrifugally thrown from the aeration drum. Communicating with the upper end of the aeration chamber is a plurality of air supply pipes 18, passage through which is controlled by valves 19. Arranged in chamber 1 below the lower end of the air supply pipe 18 is a deflecting board 20 so arranged that the air which is supplied to the chamber 1 will be introduced into said chamber and adjacent the periphery of the aeration element tangentially thereto and in a direction toward the outlet opening 6. The thin sheet of pulp thrown from the aeration drum induces air from pipes 18 increasing the aeration of the pulp.

Oil supply pipes 21 are employed, communicating with the interior of the chamber, and are controlled by valves 22. A casing 23 is spaced from and about the rear portion of the drum 11 as indicated in Fig. 1, thereby providing an aeration space 24 of arcuate section through which the pulp travels and in which it is aerated. The casing 23 at its lower part is extended to the floor of the aeration chamber in a direction tangential to the aeration drum. This construction assists in the direction of pulp to the inlet of the aeration space.

In operation the aeration drum 11 is rotated at a suitable speed. The pulp level inside the aeration chamber is maintained by means of the gate 10 at such a height that the outer surface of the aeration drum is slightly immersed in the pulp, the latter being slightly higher than a tangent to the lower surface of the drum. The level is maintained just sufficient to fill the entrance to the aeration space 24. A greater height is not desirable, as agitation and beating of the pulp will result. This is ineffective in producing aeration and results in a loss of power. Excessive beating of the pulp may also result in emulsification which is found to be undesirable.

In the rotation of the drum the adhesion of the pulp to the drum causes a flow of the pulp at high velocity through the aeration space 24. This produces a high velocity head and a low pressure head, the pressure head decreasing with the increase of velocity head. By imparting sufficient velocity to the pulp the pressure head may be decreased to less than atmospheric pressure, and air induced through the perforations 15. It will be noted, that air may readily enter the interior of the drum through the hollow drip cups at each end of the chamber 1. Air is thereby introduced into the pulp and commingled therewith. Aerated pulp is thrown off the surface of the drum at the upper end of casing 23, due to the centrifugal action and encounters the apron 17, being directed thereby into the outlet opening 6; air is also induced through the pipe 18 into the aerating chamber, mixing with the pulp as it is thrown from the drum.

As the pulp passes into the passage 7, it moves downwardly into the frothing chamber. The froth overflows from the top of the frothing chamber carrying with it mineral, and the pulp sinks to the bottom for retreatment on return through opening 9 to the air chamber.

In mechanically actuated flotation machines especially of the horizontal type, bearings are necessary for the shaft carrying the agitators. These bearings, when below the level of the pulp, must be packed to prevent the pulp from leaking therethrough. Due to the sand and other gritty material in the pulp, the bearings and shaft rapidly wear and must be repaired and replaced. Our machine is not subject to such difficulty, as the bearings for the aeration drum shaft are not in contact with the pulp.

In the aeration device, shown herein, air is induced through slots 15, meets the surface of the thin stream of pulp which is moved by the drum through passage 24, because of adhesive and viscous action. There is a slippage of pulp relative to the drum, and the air entering the passage slips along the surface of the drum pocketing itself between riffles 16, in the preferred form of drum, or being held by the frictional action of the drum surface in the modified form, shown in Fig. 3. While held thus, the pulp draws a film thereover and bubbles are formed. The pulp and bubbles are then carried by the drum to the discharge exit of the passage 24 and thrown from the drum through opening 6 into the frothing chamber. This machine does not depend upon agitation for aerating of the pulp as a very slow rotation of the drum will result in aeration.

In Fig. 5, the pulp passing through aeration space 24 is shown with air pocketed between the riffles 16, the relative movement of the pulp and the wall 12 of the drum being indicated by arrows. The moving wall 12 carries the pocketed bubbles to the outlet of space 24 and discharges the pulp and bubbles in the form of a pulp. In Fig. 6 the air is drawn through perforations 15 into the space 24, being held by frictional contact with wall 12. Bubbles are thus formed and the pulp and bubbles moved through space 24 to the outlet.

What we claim is:

1. A process for separating minerals,

which consists in moving a liquid pulp along a partially cylindrical passage, injecting air into said passage upon the surface of said liquid pulp, holding said air in said passage so that the liquid pulp passes thereover and draws a film thereof over said air, thereby forming bubbles from said liquid pulp, and moving said bubbles along said passage.

2. A process for separating minerals, which consists in moving a liquid pulp containing a percentage of oil therein along a partially cylindrical passage, placing the surface of said liquid pulp in contact with air, inducing the same into the passage upon the surface of said liquid pulp, pocketing the air between the surface of said liquid pulp and a wall of said passage, so that the liquid pulp passes thereover and draws a film thereof over said pocketed air, thereby forming oleaginous bubbles, and moving said bubbles along said passage.

In witness that we claim the foregoing we have hereunto subscribed our names this 9th day of October, 1916.

FREDERICK B. KOLLBERG.
MAX KRAUT.

F. B. KOLLBERG & M. KRAUT.

FLOTATION MACHINE.

APPLICATION FILED JULY 1, 1916.

Reissued Sept. 17, 1918. 14,522.

2 SHEETS—SHEET 1.

Fig.1

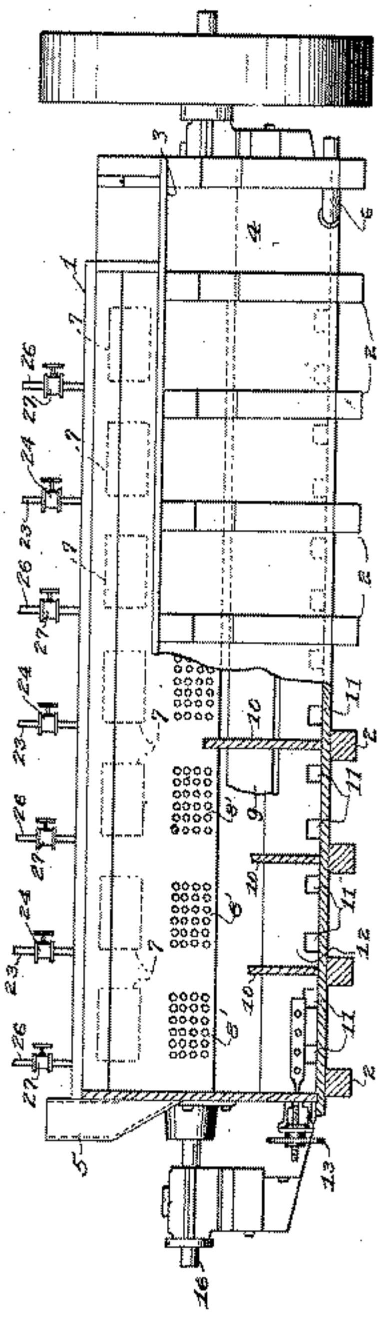
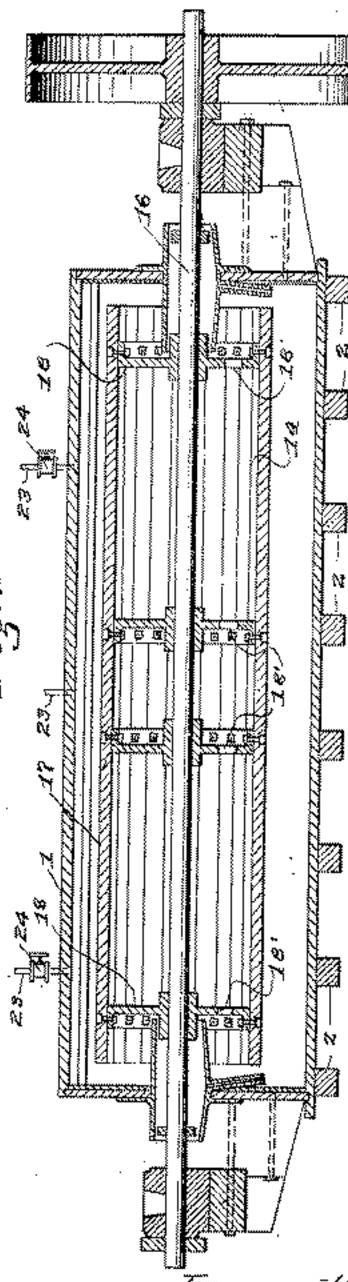


Fig.2



Inventors.
Frederick B. Kollberg
Max Kraut.

by.

Edmund A. Strause
Atty.

F. B. KOLLBERG & M. KRAUT.
FLOTATION MACHINE.
APPLICATION FILED JULY 1, 1916.

Reissued Sept. 17, 1918. 14,522.

2 SHEETS—SHEET 2.

Fig. 3.

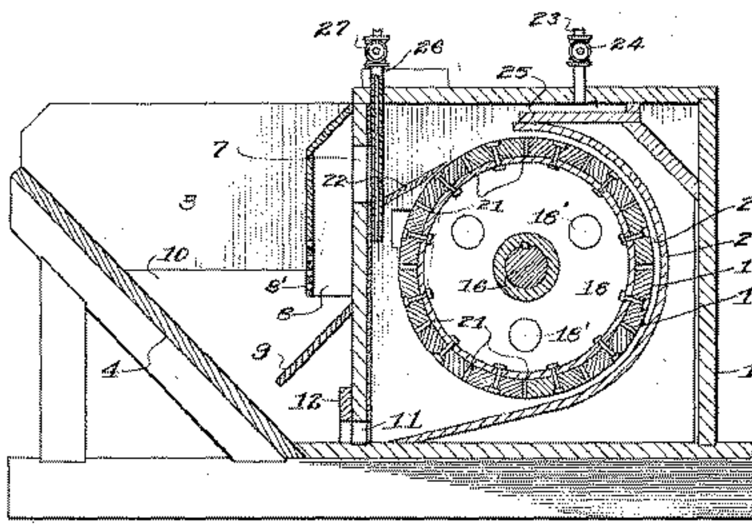


Fig. 7.

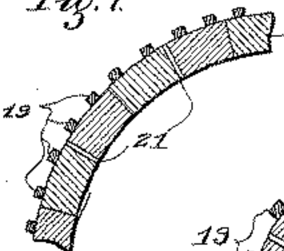


Fig. 4.

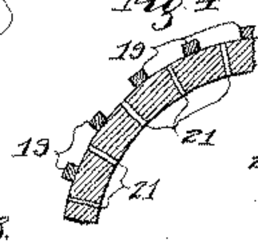


Fig. 5.

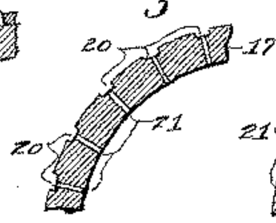


Fig. 6.

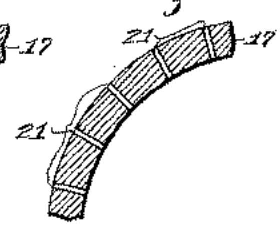
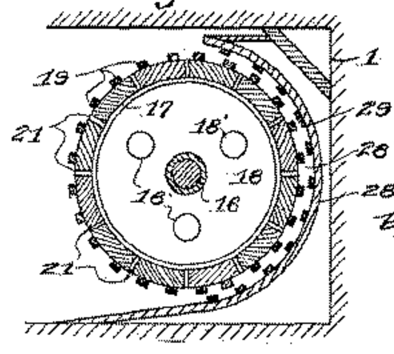


Fig. 8.



Inventors.
Frederick B. Kollberg.
Max Kraut.
by Edmund A. Strause.
Atty.

UNITED STATES PATENT OFFICE.

FREDERICK B. KOLLBERG, OF BISBEE, ARIZONA, AND MAX KRAUT, OF LOS ANGELES, CALIFORNIA, ASSIGNORS TO SOUTHWESTERN ENGINEERING COMPANY, A CORPORATION OF CALIFORNIA.

FLOTATION-MACHINE.

14,522. Specification of Reissued Letters Patent. Reissued Sept. 17, 1918.

Original No. 1,174,737, dated March 7, 1916, Serial No. 43,218, filed August 2, 1915. Application for reissue filed July 1, 1916. Serial No. 107,202.

To all whom it may concern:

Be it known that we, FREDERICK B. KOLLBERG, of the town of Bisbee, county of Cochise, State of Arizona, and MAX KRAUT, of the city of Los Angeles, county of Los Angeles, State of California, both citizens of the United States, have invented new and useful Improvements in Flotation-Machines, of which the following is a specification.

This application is a continuation in part of our application for flotation machines, S. N. 31,274, filed May 29, 1915, as to the subject matter of a single compartment aeration chamber, a frothing chamber, and aerating means in said aeration chamber, and means of communication therebetween, whereby the pulp passes in a helical path through the aeration chamber.

The objects of this invention are first, to provide a single compartment aeration chamber in which the pulp is successively retreated in its passage through the machine; second, to successively retreat the pulp by causing it to describe a substantially helical path through the aeration means and frothing chamber from the pulp inlet end of the machine to the tailings discharge end; and third, to control the passage of the pulp along said helical path to effectively demineralize the pulp depending upon its character.

We accomplish the above mentioned objects by means of the embodiment of our invention disclosed in the accompanying drawing.

Figure 1 is a partial sectional front elevation of a flotation apparatus embodying the invention.

Fig. 2 is a vertical central longitudinal section through the aeration chamber of the apparatus.

Fig. 3 is an enlarged vertical transverse section of the apparatus.

Figs. 4, 5, 6 and 7 are detail sectional fragments of the aeration drum showing various forms which may be employed.

Fig. 8 is a detail section illustrating a modified form of casing for the drum.

The preferred form of construction as illustrated in the drawing, comprises an elongated substantially rectanuglar aeration chamber 1, mounted upon a suitable supporting framework 2. Extending along one side of the chamber 1 and substantially co-extensive therewith is a frothing chamber or box 3 which is open at its upper side and provided with an inclined bottom 4. Communicating with the head end of the aeration chamber 1 is an entrance opening or inlet 5 through which the pulp to be treated is introduced into said chamber. Leading from the bottom of the frothing chamber 3 at the opposite or tail end of the machine is a discharge pipe 6 through which tailings is discharged.

Formed in one side of the chamber 1 adjacent the upper edge thereof and extending longitudinally thereof is a plurality of aeration chamber discharge outlets 7 from which lead downwardly extending passages 8 which communicate at their lower ends with the chamber 3 as shown. In a wall of the passage 8 adjacent its lower end are openings 8′ for a purpose later described.

Arranged below the lower ends of passage 8 is a baffle board or flange 9 which serves to deflect the pulp discharged through said passage outwardly. Provided in the bottom of the frothing chamber 3 is a plurality of vertically extending partitions 10, the lower ends of the passage 8 terminating below the plane of the upper edges of said partitions as shown in Fig. 3. These partitions are arranged to obstruct the passage of pulp from the head end of the frothing chamber to the tail end.

Leading from the bottom of the frothing chamber 3 to the bottom of the aeration chamber 1 is a plurality of spaced return openings 11 which are controlled by a sliding gate valve 12 having a notched lower end to correspond with said openings 11. Said valve 12 is manually adjusted through the medium of a hand wheel 13 coöperating with one end thereof, and controls the return of pulp from the frothing chamber for retreatment.

Arranged in the aeration chamber 1 is the aeration element or drum 14. Said drum consists of a cylindrical wall 17 which is bolted as shown to disks 18 fixed to a shaft 16 extending centrally through the aeration chamber and having its ends suitably mounted in bearings provided at the ends of said chamber. The disks have perforations 18′ to admit air, and if desired spiders may be substituted for the disks. The construction required is merely means to mount the drum upon the shaft and permit free entrance of air. The cylindrical wall 17 is provided with perforations 21 which extend therethrough and communicate with the interior of the drum. The periphery of the wall 17 is roughened by arranging thereon a plurality of closely spaced longitudinally extending riffles 19 as shown in Fig. 4 or correspondingly arranged recesses 20 as shown in Fig. 6, or by providing said wall with closely arranged perforations 21 as shown in Fig. 6, or both riffles and perforations as shown in Fig. 7. The roughening of the wall 17 causes greater adhesion of the pulp and more efficient action in moving the latter. The riffles or their equivalents assist in moving any sand which may be mingled with the pulp.

Provided in the chamber 1 at the lower edge of the outlet opening 7 is an inwardly projecting flange 22 which serves to direct toward said outlet opening the thin sheet of pulp centrifugally thrown from the aeration element. Communicating with the upper end of the aeration chamber is a plurality of air supply pipes 23, passage through which is controlled by valves 24. Arranged in chamber 1 below the lower ends of the air supply pipes 23 is a deflecting board 25 so arranged that the air which is supplied to the chamber 1 will be introduced into said chamber adjacent the periphery of the aeration element tangentially thereto and in a direction toward the outlet opening 7. The thin sheet of pulp thrown from the aeration drum draws air through pipes 23 increasing the aeration of the pulp.

Oil supply pipes 26 are employed communicating with the interior of the chamber which are controlled by valves 27.

A casing 28 is spaced from and about the rear portion of the drum 17 as indicated in Fig. 3, thereby providing an aeration space 28′ of arcuate section through which the pulp travels and in which it is aerated. Longitudinal riffles, in case agitation should be desired, are provided on the interior surface of casing 28, as indicated in Fig. 8. The casing 28 at its lower part is extended to the floor of the aeration chamber in a direction tangential to the aeration drum. This construction assists in the direction of pulp to the inlet of the aeration space.

In operation the aeration element of the drum 14 is rotated at a suitable speed. The pulp level inside the aeration chamber is maintained by means of the gate 12 at such a height that the outer surface of the aeration drum is slightly immersed in the pulp, the latter being slightly higher than the tangent to the lower surface of the drum. The level is maintained just sufficient to fill the entrance of the aeration space 28′. A greater height is not desirable as agitation and beating of the pulp will result. This is ineffective in producing aeration and results in a loss of power. Excessive beating of the pulp may also result in emulsification which is found to be undesirable.

In the rotation of the drum the adhesion of the pulp to the drum causes a flow of the pulp at high velocity through the aeration space 28′. This produces a high velocity head and a low pressure head, the pressure head decreasing with the increase of velocity. By imparting sufficient velocity to the pulp, the pressure head may be decreased to less than atmospheric pressure, and air induced through the perforations 21. It will be noted that air may readily enter the interior of the drum through the hollow drip cups at each end of the chamber 1. Air is thereby introduced into the pulp and co-mingled therewith. Aerated pulp is thrown off the surface of the drum at the upper end of casing 20, due to the centrifugal action and encounters the apron 22 being directed thereby into the outlet openings 7; air is also induced through the pipe 23 into the aerating chamber, mixing with the pulp as it is thrown from the drum.

As the pulp passes into the passage 8 it moves downwardly into the frothing chamber and some of it passes through the openings 8′ thereby avoiding eddies which would carry the froth and mineral downwardly to the bottom of the frothing chamber. If the pulp is passed directly downwardly without some such means as the perforations 8′ eddies or whirls would be set up about horizontal axes. These eddies are found to carry a large amount of mineral to the bottom of the frothing chamber with the pulp.

The froth overflows from the top of the frothing chamber carrying with it mineral, and the pulp sinks to the bottom. This pulp returns to the aeration chamber for retreatment. As the discharge pipe 6 for tailings is opened, a movement of the pulp occurs toward the tail end of the frothing chamber bringing some of the pulp to openings 11 nearer the tail end. This pulp then passes through the openings 11 into the aeration chamber and is again carried through the aeration space 28′ where it is aerated and discharged at a point farther from the head end. As there is a movement of the pulp longitudinally of the drum from the head end to the tail end of the machine, and also a movement of the pulp about the drum, the pulp in its successive retreatments is describing a substantially helical path from the head end of the machine toward the tail end, and when it reaches the tail end is completely demineralized.

In mechanically actuated flotation machines especially of the horizontal type, bearings are necessary for the shaft carrying the agitators. These bearings when below the level of the pulp must be packed to prevent the pulp from leaking therethrough. Due to the sand and other gritty material in the pulp the bearings and shaft rapidly wear and must be repaired and replaced. Our invention is not subject to such difficulties as the bearings for the aeration drum shaft are not in contact with the pulp.

What we claim is:

1. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means in said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path.

2. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; a rotary aerating means therein coextensive with said aeration chamber; a frothing chamber; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path.

3. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means in said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; and means to regulate the flow of pulp through said means of communication.

4. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means therein co-extensive with said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; and means to regulate the flow of pulp through said means of communication.

5. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means in said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; and means in said frothing chamber to obstruct the flow of pulp in said frothing chamber from the head end to the tail end thereof.

6. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; a rotary aerating means therein co-extensive with said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; and means in said frothing chamber to obstruct the flow of pulp from the head end to the tail end thereof.

7. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means in said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; means to regulate the flow of pulp through said means of communication; and means in said frothing chamber to obstruct the flow of pulp in said frothing chamber from the head end to the tail end thereof.

8. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means therein co-extensive with said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; means to regulate the flow of pulp through said means of communication; and means in said frothing chamber to obstruct the flow of pulp in said frothing chamber from the head end to the tail end thereof.

9. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end thereof; rotary aerating means in said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; and a plurality of spaced transversely extending partitions provided in said frothing chamber at the bottom thereof to obstruct the flow of pulp from the head end to the tail end thereof.

10. A flotation machine comprising, the combination of a single compartment aera-

tion chamber having an inlet for pulp at the head end thereof; rotary aerating means therein co-extensive with said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means, whereby pulp circulates through said chambers in a helical path; and a plurality of spaced transversely extending partitions provided in said frothing chamber at the bottom thereof to obstruct the flow of pulp from the head end to the tail end thereof.

11. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means in said aeration chamber; a frothing chamber having a tailings discharge at the tail end; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; means to regulate the flow of pulp through said means of communication; and a plurality of spaced transversely extending partitions provided in said frothing chamber at the bottom thereof to obstruct the flow of pulp from the head end to the tail end thereof.

12. A flotation machine comprising, the combination of a single compartment aeration chamber having an inlet for pulp at the head end; rotary aerating means therein co-extensive with said aeration chamber; a frothing chamber having a tailings discharge at the tail end thereof; said frothing chamber and said aeration chamber provided with means of communication, whereby pulp circulates through said chambers in a helical path; means to regulate the flow of pulp through the means of communication; and a plurality of spaced transversely extending partitions provided in said frothing chamber at the bottom thereof to obstruct the flow of pulp from the head end to the tail end.

13. In a flotation machine, the combination of a single compartment aeration chamber having an inlet for pulp at the head end thereof, a frothing chamber having an outlet for tailings at the tail end thereof, there being discharge means establishing communication between the upper part of said aeration chamber and said frothing chamber and pulp return means establishing communication between the lower part of said frothing chamber and said aeration chamber, a drum mounted in said aeration chamber, a casing spaced from the said drum and aeration means in said chamber.

14. In a flotation machine, the combination of a single compartment aeration chamber having an inlet for pulp at the head end thereof, a frothing chamber having an outlet for tailings at the tail end thereof, there being discharge means establishing communication between the upper end of said aeration chamber and said frothing chamber and pulp return means establishing communication between the lower part of said frothing chamber and said aeration chamber, an aeration drum mounted in said aeration chamber, a casing partially encircling and spaced from said drum forming therewith an aeration space open at its lower end adjacent said return means and open at its upper end adjacent said discharge means.

15. In a flotation machine, the combination of a single compartment aeration chamber having an inlet for pulp at the head end thereof, a frothing chamber having an outlet for tailings at the tail end thereof, there being discharge means establishing communication between the upper part of said aeration chamber and said frothing chamber and pulp return means establishing communication between the lower part of said frothing chamber and said aeration chamber, aeration means in said aeration chamber, and adjustable means regulating the area of said return means.

16. In a flotation machine, the combination of a single compartment aeration chamber having an inlet for pulp at the head end thereof, a frothing chamber having an outlet for tailings at the tail end thereof, there being discharge means establishing communication between the upper end of said aeration chamber and said frothing chamber and pulp return means establishing communication between the lower part of said frothing chamber and said aeration chamber, an aerating drum in said aeration chamber, a casing partially encircling and spaced from said drum forming therewith an aeration space open at its lower end adjacent said return means and open at its upper end adjacent said discharge means, and adjustable means regulating the area of said return means.

17. A flotation machine, comprising a single compartment aeration chamber, a rotary aeration element in said chamber; a frothing chamber, there being an outlet opening through which the pulp aerated in said aeration chamber is adapted to pass to said frothing chamber; and a casing closely surrounding a portion of said aeration element extending from the underside thereof to a point at which the pulp in leaving said element passes toward said opening to said frothing chamber.

18. A flotation machine, comprising an aeration chamber; a rotary element in said chamber; a frothing chamber, there being an outlet opening through which the pulp aerated in said aeration chamber is adapted to pass to said frothing chamber; a fluid supply communicating with said aeration

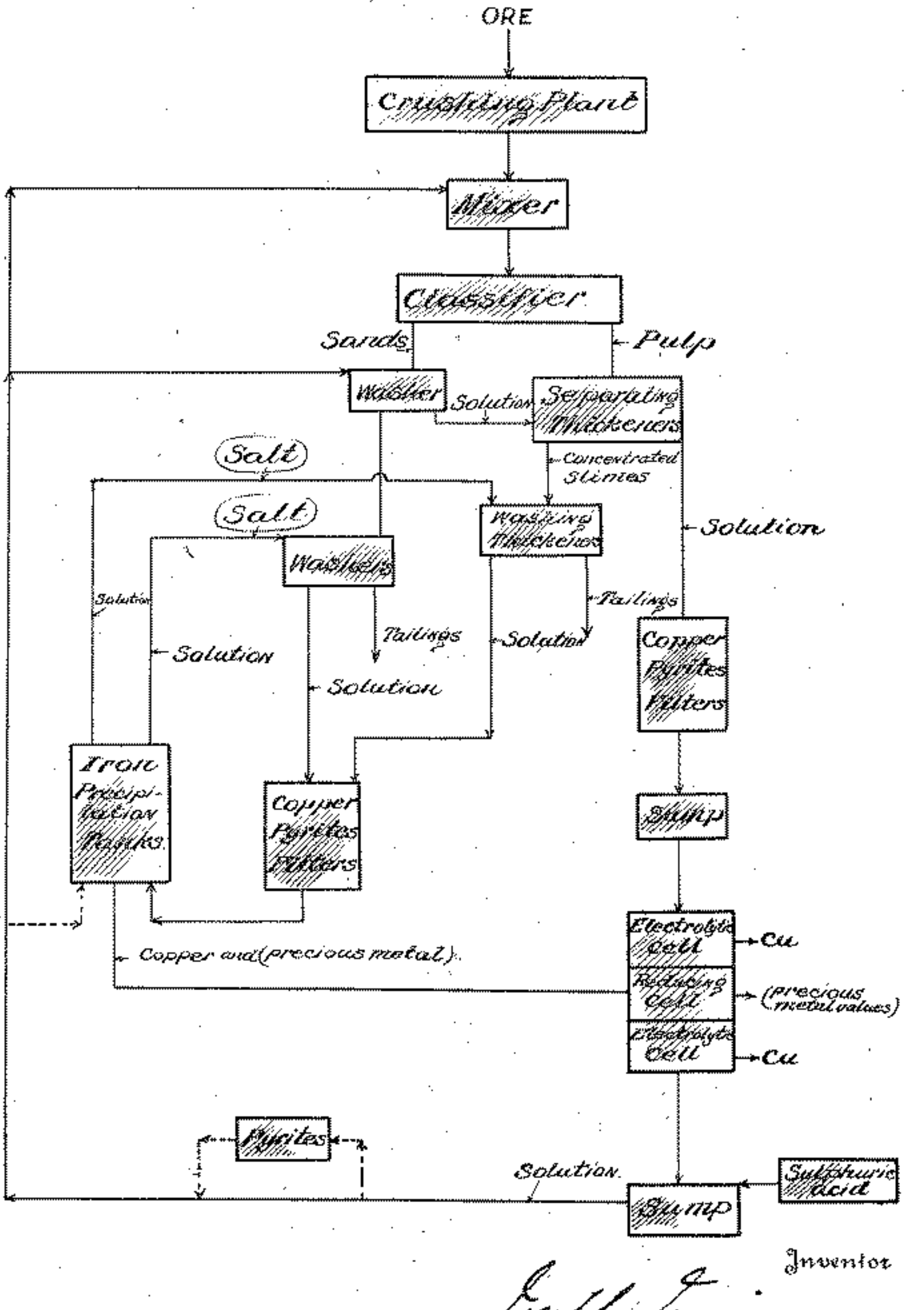
chamber; means in said aeration chamber for directing the fluid supplied thereto in a direction substantially tangential of said aeration element and toward said outlet opening; and a casing closely surrounding a portion of said aeration element extending from the underside thereof to said last mentioned means.

19. A flotation machine, comprising an aeration chamber; a rotary element in said chamber; a frothing chamber, there being an outlet opening through which the pulp aerated in said aeration chamber is adapted to pass to said frothing chamber; a fluid supply communicating with said aeration chamber; means in said aeration chamber for introducing thereinto the fluid supplied thereto adjacent the periphery of said aeration element and in the direction of said outlet opening; and a casing closely surrounding a portion of said aeration element extending from the underside thereof to said last mentioned means substantially as described.

FREDERICK B. KOLLBERG.
MAX KRAUT.

J. IRVING.
PROCESS FOR TREATING ORES.
APPLICATION FILED JAN. 27, 1917.

1,296,523. Patented Mar. 4, 1919.



Inventor
Joseph Irving
By [signature] his Attorneys

UNITED STATES PATENT OFFICE.

JOSEPH IRVING, OF BISBEE, ARIZONA.

PROCESS FOR TREATING ORES.

1,296,523. Specification of Letters Patent. Patented Mar. 4, 1919.

Application filed January 27, 1917. Serial No. 144,890.

To all whom it may concern:

Be it known that I, JOSEPH IRVING, of Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Processes for Treating Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a process for the treatment of cupriferous ores, compounds or products for the extraction of the metal values therefrom in soluble form and for the recovery of these metal values. Its objects are to effect in such a process a continous regeneration of the reagents, the presence of which is desired, and simultaneously to eliminate undesirable reagents to avoid waste, and to reduce the amount of added chemicals required to a minimum, and to render the process cyclic in all its parts in so far as is possible. Further objects of my invention will more fully hereinafter appear.

In carrying out my invention I have applied it to the treatment of copper ores, compounds or products, by wet extraction of the metal values therefrom by means of a solvent or electrolyte, subsequently subjecting this electrolyte containing the dissolved metal values to a treatment including an electrolytic precipitation for the separation of the metal values therefrom and for the simultaneous regeneration within the electrolyte of those compounds which make it effective as a solvent. I then repeat the cycle of operation upon fresh ore, using the regenerated electrolyte or solvent for this purpose. I have also provided therein for the formation within the solution of depolarizing agents prior to and during the electrolytic precipitation as well as for the regeneration of solvent chemicals therein. Furthermore I have provided in my process for the continuous production and regeneration of solvent washing solutions and have thus reduced to a minimum the addition of useless liquid during the cycle of operation.

In treating a cupriferous ore, for example, a low grade carbonate ore, I first grind the ore to a suitable degree of fineness and subject it to the action of the solvent or electrolyte. I may grind the ore dry in a crushing plant and send it to the mixer, where it is mixed with the required amount of solvent or electrolyte, or I may grind it wet with a small amount of the solvent or electrolyte and send it to the mixer, where sufficient electrolyte is added to bring the total quantity of electrolyte solvent to the required amount.

The electrolyte, when used at this point as a solvent, is derived from the electrolytic copper precipitation tanks at a subsequent step in the process, and is a dilute solution containing as its principle actively solvent ingredients sulfuric acid and ferric sulfate. It is apparent, of course, that in initially installing my process it may be necessary to use a dilute solution containing sulfuric acid as the primary solvent, but once the process is set in operation, the electrolyte from the copper precipitation tanks becomes available, and the active componenets are substantially as above set forth. The proportions of the ingredients of the electrolyte are variable to a considerable extent, being dependent upon the conduct of the steps of the process subsequent to the extraction of the ore, the requirements of the precipitation bath, etc. I have found, however, that a suitable working strength is an acid concentration of about 1% H_2SO_4 by weight and that a suitable proportion of electrolyte to ore in the case of the copper carbonate ore mentioned is about 300 gal. of solvent per ton of ore.

After the electrolyte or solvent and the ore have been in contact in the mixers while subjected to mechanical agitation for a sufficient length of time, the pulp and sand are run into suitable classifying and separating devices, preferably continuous flow devices in which separation may be effected simultaneously with a washing of the solid present by a counter current of solvent. I may use, for example, a series of displacement tanks, or counter current overflow thickeners of the Dorr type, or other like devices. Thus, for example, I may pass the pulp from the mixers first to a suitable settling tank or classifying machine, where the sands are separated from the pulp. The pulp is then passed to a series of thickening devices, in which a further washing or leaching is effected. The separated sands are further leached and washed with a suitable quantity of fresh electrolyte or solvent, which, after being separated from the sands, is added to pulp first separated therefrom while flowing from the settling tanks or classifying machines, and passes with it through the subsequent thickening and washing steps.

Further washing of the sands is effected by means of the solution obtained from iron precipitation tanks on passing portions of electrolyte containing copper over metallic iron. The solution is brought into intimate contact with the sands, the ferric sulfate therein acting to leach out all undissolved copper possible. The solution is then returned to the iron precipitation tanks after being passed through a copper pyritic filter in which any ferric sulfate remaining in the solution is reduced to ferrous sulfate, copper being at the same time dissolved. In this way a closed circuit of the washing solution is maintained, the continual addition of water is avoided, and the amount of liquid necessary for the operation of the process is reduced to a minimum. The sands, after this washing, are discharged as tailings.

I may next subject the pulp from the settling tanks, to which the solution derived from the first washing of the sands by electrolyte solvent has been added, to a treatment adapted to effect a separation of the liquid therein from the solids and to wash the separated solids. This I may effect, for example, by a series of gravity, counter current thickeners, displacement tanks or other suitable devices, preferably arranged in two groups of one or more each. In the first group I effect substantially completely the separation of the slimes or solid materials in concentrated form from the solution, now carrying the metal value of the ore in solution, and I then pass the concentrated slimes into the second group for washing, while the solution is passed to the electrolytic precipitation system.

In passing the concentrated slimes into the second group of thickeners or other selected devices I add thereto a sufficient quantity of the solution obtained from iron precipitating tanks to cause a continuous flow through this group. Water may also be added at this point to reduce the concentration of the liquid when necessary. I thereby effect a further concentration of the slimes and at the same time wash or leach them, further depriving them of any copper contained therein by virtue of the solvent action of the ferric sulfate in the solution added. The washed and concentrated slimes are now discharged as tailings and the washing solution is passed through the copper pyrites filter bed, thereby exhausting the solvent power of any ferric sulfate remaining therein and is returned to the iron precipitation tanks.

In this way, as in the case of the washing solution for the sands described above, there is a closed circuit of the washing solution with all the advantages derived therefrom. Both washing solutions are thus taken from the iron precipitation tanks and after use returned thereto.

The electrolyte or solution obtained from the first group of thickeners is next passed through a filter of finely ground copper pyrites. By this means any ferric sulfate remaining in the electrolyte is reduced to ferrous sulfate, copper and iron being dissolved therein. From the copper pyrites filter the solution passes to a sump tank, where any slimes present are allowed to settle out. From here the electrolyte is sent to a series of alternately arranged reducing cells and electrolytic cells to effect the deposition of the copper and other metal values.

In the reducing cells the electrolyte is brought in contact with the copper precipitate obtained from the iron precipitation system or from an outside source for the purpose of reducing any ferric sulfate present to ferrous sulfate. The ferrous sulfate serves in the electrolytic cells as a depolarizing agent, and is therein oxidized to ferric sulfate. By the use of a series of alternating reducing and electrolytic cells and causing a continuous flow of the copper bearing electrolyte therethrough, the ferric sulfate formed by anodic oxidation in each electrolytic cell is reduced by the copper precipitate in the succeeding reducing cell, copper being dissolved, and the electrolyte passes into the next electrolytic cells with its depolarizer regenerated and a somewhat increased copper content. The copper dissolved is then deposited. The sulfuric acid formed in the electrolytic cells also dissolves additional copper in the reducing tanks, and thus is prevented from becoming too concentrated. The number of reducing and electrolytic cells may vary as found desirable. I have found a series of two or three of each to effect a satisfactory deposition of the copper. By arranging the cells in successive order I provide for a continuous flow of the electrolyte through the entire system.

The final electrolytic cell of the series I purposely construct of extra large size in order to increase to some extent the anodic oxidation and the formation of ferric sulfate in the electrolyte, although cathodic efficiency is thereby slightly diminished. In the series of electrolytic cells the copper content of the electrolyte is reduced to about two per cent., this being the minimum quantity necessary for successful operation. From the last cell of the series of reducing and electrolytic cells the depleted electrolyte flows into a sump or settling tank, from which it is returned to the starting point of the process to be mixed with ore and to leach the same.

While in the sump tank the sulfuric acid concentration of the electrolyte is, if necessary, brought to the point most suitable for leaching the ore by the addition of sulfuric acid. If the electrolyte is found to be deficient in sulfate of iron, a part of it, in passing from the tank to the ore leaching apparatus, is diverted through a bed of finely ground pyrites, whereby its content of iron sulfate is increased to the desired point.

In case the electrolyte becomes foul, that is, accumulates so large an amount of foreign salt or of salts necessary for the operation of the process as to interfere with the operation thereof, I cause a part of the electrolyte to pass into the iron precipitation system, where it is passed over metallic iron.

The copper in the electrolyte is thereby precipitated and the solution containing foreign salts may be discharged as waste, or caused to pass into the secondary washing solution used in the final washing of the sands or pulp, as hereinbefore described. The electrolyte may then be replenished, if necessary, with dilute acid of a suitable concentration. The copper here obtained is used in the reducing cells arranged in series with the electrolytic cells, where it is redissolved in reducing the ferric sulfate, to be subsequently redeposited. If it is desired to increase the amount of copper precipitate resulting after precipitation in the iron precipitating system I may divert thereto a part of the solution obtained by the primary leaching of the ore with electrolyte.

It is apparent from the above description of my process that in it I have provided for a continuous flow of the working solution in such a manner as to extract the metal values from the ore, remove them and return the solution to the work of extraction on the ore, and have also provided that at each step in the process the solution be brought to a state whereby its efficiency in carrying out the next step is a maximum. Furthermore I have provided not only that the working solution be maintained in a closed circuit, but also that the various washing solutions used are maintained in closed circuits. I have thereby reduced the necessity of cumulative additions of water and other inert materials to a minimum and have brought the amount of waste to the lowest possible degree.

My process readily adapts itself for the treatment of copper ores containing gold or silver. In such case I effect the primary leaching of the ore with the electrolyte as obtained from the copper depositing tanks and the separation thereof from the sands and slime in the same manner as above described. The sands and slimes in this case also I wash with the solution yielded by the iron precipitation tanks, but add thereto a quantity of salt. The resulting solution of chlorids and sulfates acts to dissolve the gold and silver values in the sands and slimes, as well as to wash out the undissolved copper. This washing solution is returned in the cycle as previously described to the iron precipitation tank, when the gold and silver value are precipitated together with the copper to form the copper precipitation which is used in the reducing cells which alternate with the electrolyte cells. The copper is here dissolved, but the gold and silver are left undissolved in the sludge and are thus recovered.

My process as above described is illustrated by the flow sheet shown in the accompanying drawing. In this drawing the steps in my process wherein only a portion of a material is treated are indicated by dotted flow lines and the reagents added in recovering precious metals are indicated by surrounding the same with circles.

I claim as my invention:

1. In the treatment of cupriferous ores, compounds or products, subjecting the ore to the action of iron-containing electrolyte from the copper depositing tanks, removing the electrolyte and removing the copper therefrom, washing the treated ore with an iron-containing solution, passing the said solution over iron, thereby reducing the iron salts contained therein and precipitating copper therefrom, and again washing treated ores with the said solution.

2. In the treatment of cupriferous ores, compounds or products, subjecting the ore to the action of iron-containing electrolyte from the copper depositing tanks, removing the electrolyte, washing the thus treated ore with an iron containing solution, then passing said solution over iron, thereby reducing the iron salts contained therein and precipitating copper therefrom, removing said copper and treating the electrolyte from the treatment of the ore therewith, thereby reducing the iron content of said electrolyte and dissolving the copper, and depositing the copper in said electrolyte electrolytically.

3. In the treatment of cupriferous ores, compounds or products subjecting the ore to the action of iron-containing electrolyte from the copper depositing tanks, removing the electrolyte, washing the thus treated ore with an iron containing solution, then passing said solution over iron, thereby reducing the iron salts contained therein and precipitating copper therefrom, removing said copper and treating the electrolyte from the treatment of the ore therewith, thereby

reducing the iron content of said electrolyte and dissolving the copper, depositing the copper in said electrolyte electrolytically and again treating ore with the electrolyte thus obtained.

4. In the treatment of cupriferous ores, compounds or products, subjecting the ore to the action of the iron-containing electrolyte from the copper depositing tanks, reducing the iron salts contained therein, depositing the copper therefrom electrolytically and thereby re-oxidizing the iron contained therein, increasing the iron content of the electrolyte and then again treating ore with the resulting liquid.

5. In the treatment of cupriferous ores, compounds or products, subjecting the ore to the action of the iron-containing electrolyte from the copper depositing tanks, passing said electrolyte through a pyritic filter, depositing the copper therefrom electrolytically, and thereby reoxidizing the iron contained there, passing a portion of said electrolyte through pyrites, thereby increasing the content of iron salts therein and causing it to rejoin the remainder of the electrolyte, and again treating ore with the resulting liquid.

6. In the treatment of cupriferous ores, compounds or products, subjecting the ore to the action of iron-containing electrolyte from the copper depositing tanks, reducing the iron salts contained therein, depositing the copper therefrom electrolytically and thereby re-oxidizing the iron contained therein, passing a part thereof over metallic iron and replenishing the volume of the electrolyte, thereby diminishing its content of foreign salts, again treating the ore with the resulting liquid, and utilizing the liquid resulting from the precipitation with iron to wash ore previously treated with electrolyte.

7. In the treatment of cupriferous ores, compounds or products, subjecting the ore to treatment with an iron-containing solvent, separating the solvent therefrom, subjecting the separated solvent to a reducing reagent, subsequently precipitating the copper electrolytically therefrom under conditions adapted to cause oxidization of the iron content thereof, and subsequently treating ore with the solvent thus obtained.

8. In the treatment of cupriferous ores, compounds or products, subjecting the ore to treatment with an iron-containing solvent, separating the solvent therefrom, repeatedly subjecting the separated solvent alternately to a reducing reagent, and to th action of an electric current to effect deposition of the copper, the final electrolytic treatment being under conditions adapted to effect a relatively extensive oxidation of the iron content thereof, and subsequently treating ore with the solvent thus obtained.

9. In the treatment of cupriferous ores, compounds or products, subjecting the ore to treatment with an iron-containing solvent, separating the solvent therefrom, washing the treated ore with an iron-containing solution, passing said washing solution over iron, thereby precipitating copper therefrom and regenerating the washing solution for further use in washing and leaching ore, subjecting the first solvent alternately to the action of an electric current and to the copper-iron deposit from the washing solution, and finally to an electrolytic treatment adapted to effect a relatively extensive oxidation of the iron content, thereby regenerating the solvent for reuse in treating fresh ore.

10. In the treatment of cupriferous ores, compounds or products, containing precious metals, subjecting the ore to the action of iron-containing electrolyte from the copper depositing tanks, removing the electrolyte, washing the thus treated ores with a solution containing iron and chlorides, then passing said solution over iron, thereby reducing the iron contained therein and precipitating copper and the precious metals, and again washing treated ores with the said solution.

11. In the treatment of cupriferous ores, compounds or products, containing precious metals, subjecting the ore to the action of iron-containing electrolyte from the copper depositing tanks, removing the electrolyte, washing the thus treated ore with a solution containing iron and chlorids, then passing said solution over iron, thereby reducing the iron contained therein and precipitating copper and the precious metals, removing the precipitate and treating the electrolyte from the treatment of the ore therewith, thereby reducing the iron contained in said electrolyte and dissolving the copper, recovering the precious metals from the residual sludge and depositing the copper in said electrolyte electrolytically.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

JOSEPH IRVING.

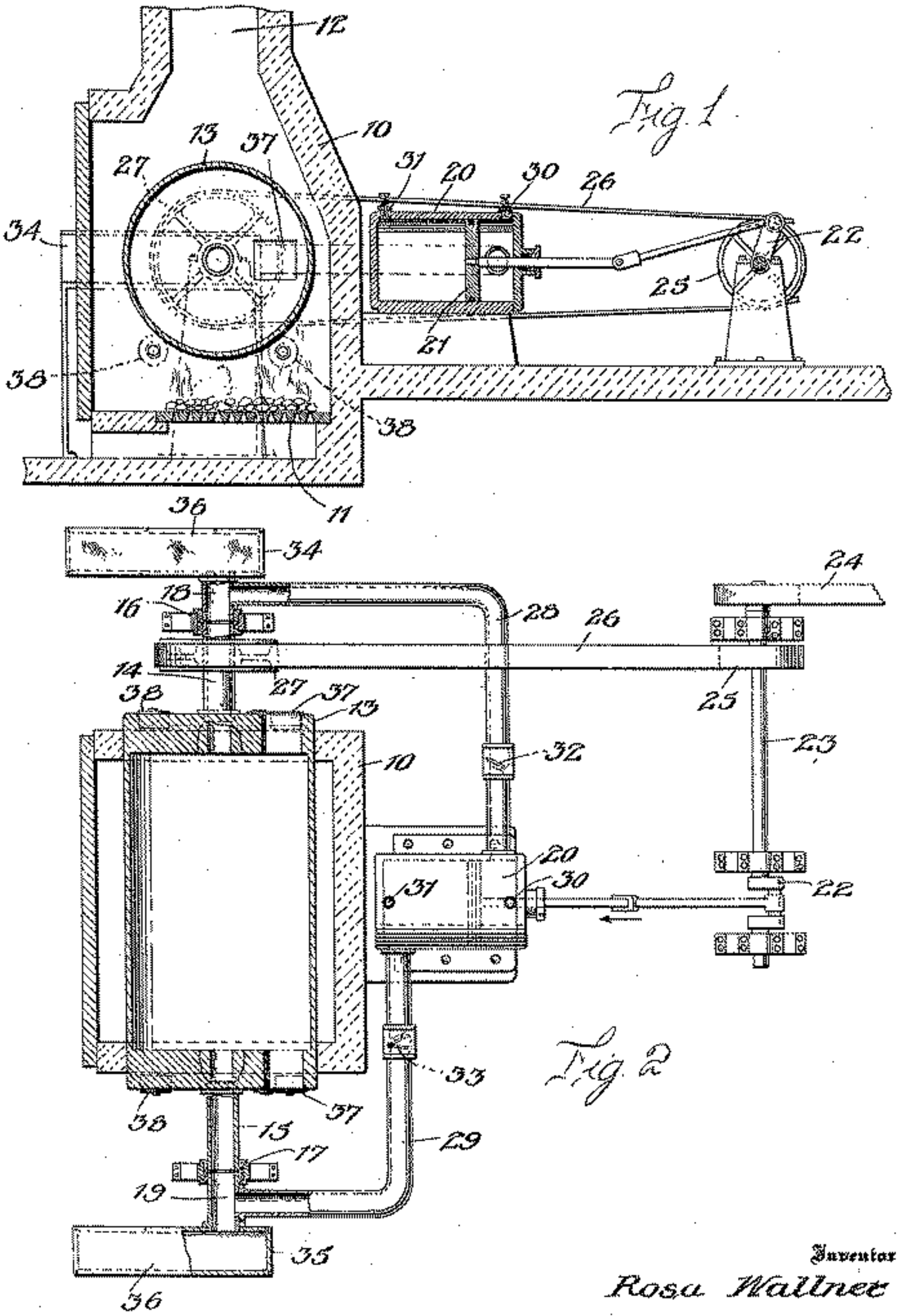
Witnesses:
CLIFTON MATHEWS,
JEAN BOYD.

R. WALLNER.

PROCESS AND APPARATUS FOR EXTRACTING ORES.

APPLICATION FILED OCT. 20, 1917.

1,326,125. Patented Dec. 23, 1919.



Inventor
Rosa Wallner

By Mason Fenwick & Lawrence,
Attorneys

UNITED STATES PATENT OFFICE.

ROSA WALLNER, OF BISBEE, ARIZONA.

PROCESS AND APPARATUS FOR EXTRACTING ORES.

1,326,125. Specification of Letters Patent. Patented Dec. 23, 1919.

Application filed October 20, 1917. Serial No. 197,689.

To all whom it may concern:

Be it known that I, ROSA WALLNER, a subject of the Emperor of Germany, residing at Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Processes and Apparatus for Extracting Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatuses and processes for roasting ores preparatory to further treatment in the extraction of the metal content, and has for an object to provide a retort mechanism adapted to subject the ore therein to the required degree of heat while agitating the contained ores and subjecting such ores to a flow of fresh air through the interstices of the ore mass within the retort, thus more rapidly and completely effecting the desired chemical change.

A further object of the invention is to provide a retort located within a furnace with means for rotating the retort while air is forced alternately in opposite directions through the retort during such rotation and roasting process.

In the drawings,—

Figure 1 is a vertical sectional view through the furnace, retort and air pump.

Fig. 2 is a horizontal sectional view through the furnace and retort showing the pump in top plan.

Like characters of reference designate corresponding parts throughout the several views.

The present process may be carried out in apparatuses varying somewhat from the apparatus disclosed in the drawing, but must embody substantially a furnace 10 having means for supporting combustion as indicated at 11 with a flue 12 for carrying off the products of combustion. A retort 13 is mounted to rotate in the furnace by being extended longitudinally through the furnace, the apertures in the furnace corresponding substantially with the size of the retort, permitting rotation. The retort is mounted upon hollow shafts 14 and 15 which are in turn journaled in bearings 16 and 17, respectively, pipes 18 and 19 communicating also with such bearings and forming non-rotatable extensions of the hollow shafts 14 and 15.

Conveniently located an air pump 20 is employed having a piston 21 mounted therein operated from a crank 22 carried upon a shaft 23 driven in any approved manner as by the belt 24. Mounted also upon the shaft 23 is a pulley 25, a belt 21 being carried therefrom to a pulley 27 mounted upon the hollow shaft 14 so that the retort 13 is also driven from the shaft 23.

From opposite ends of the pump 20 pipes 28 and 29 are carried communicating respectively with the pipes 18 and 19. The pump is provided with inlet valves 30 and 31 and check valves 32 and 33 are mounted in the pipes 28 and 29, respectively.

The pipes 18 and 19 at their ends opposite the shafts 14 and 15 communicate respectively with boxes 34 and 35 which are covered with a foraminous material 36.

The retort 13 is provided with one or more doors 37 in one or both ends where the retort extends outwardly beyond the lines of the furnace 10. Also the furnace 10 is provided with rollers 38 upon which the extended ends of the retort bear and rotate.

In operation, the ore to be roasted is inserted into the retort through one or both of the door openings 37 and commingled with charcoal or other fuel if found desirable to accomplish the purpose aimed at. The combustion supported below the retort as shown particularly at Fig. 1, raises the temperature within the retort to such degree as to roast the ore and to ignite the fuel contained therein if fuel is commingled with the ore, as stated. When the temperature of the ore mass has been raised to the desired temperature the pump 20 is started by the rotation of the shaft 23, also rotating the retort 13. The rotation of the retort agitates the ore mass contained therein to expose new and uneffected ore surfaces to the action of the air passed through such retort by the action of the pump 20. The air forced by the pump 20 through the pipe 28 upon the movement of the piston 21 in one direction passes into the pipe 18 and from such pipe branches one part of the air passing directly through the hollow shaft 14 and the retort, another part passing into the box 34. When the piston has reached the limit of its stroke the check valve 32 operates to prevent return of the air from the pipe 28, which has been passed through the retort, the shaft 15, and pipe 19 into the box 35, carrying therewith dust and other impure matters. The foraminous covers of the boxes 34 and 35 permit the escape slowly of the vitiated air while retaining the dust and the like within the box. The return stroke of the piston 21 produces the same effect in reversed order through the pipe 29 and shaft 15 into the box 34.

I claim:

1. The process of roasting ores, consisting in introducing the ores into a rotating retort, maintaining heat upon the exterior of the retort, forcing fresh air alternately in opposite directions through the rotating retort and discharging the air vitiated by passing through the retort.

2. The process of roasting ores, consisting in introducing the ores into a rotating retort commingled with a combustible material, maintaining heat upon the exterior of the retort sufficient to raise the ore to the desired temperature and ignite the combustible material, forcing fresh air in opposite directions through the heated and ignited mass and discharging the air vitiated by passing through the retort.

3. An apparatus for roasting ores comprising a furnace, a rotating retort mounted in the furnace and having its ends extending beyond the exterior lines of the furnace, an air pump communicating by conduits with the axes of the rotating retort, said pump being provided with means to take in fresh air, and means to discharge the gases resultant upon forcing air through the retort.

4. An apparatus for roasting ores comprising a furnace, a cylindrical retort mounted within and having its opposite ends extending outwardly beyond the lines of the furnace, a charging door formed in one of the extended ends of the cylindrical retort, hollow pipes forming trunnions for the retort, an air pump communicating by conduits with the hollow trunnions, said pump provided with means to take in fresh air, and means to discharge the gases resultant upon forcing air through the retort.

5. In an apparatus for roasting ores, a furnace, a retort mounted movably within the furnace, means to move the retort to agitate the contents, an air pump, conduits extending from the air pump into opposite sides of the retort, receptacles having foraminous portions communicating also with the conduits and means to discharge the gases resultant upon forcing air through the retort.

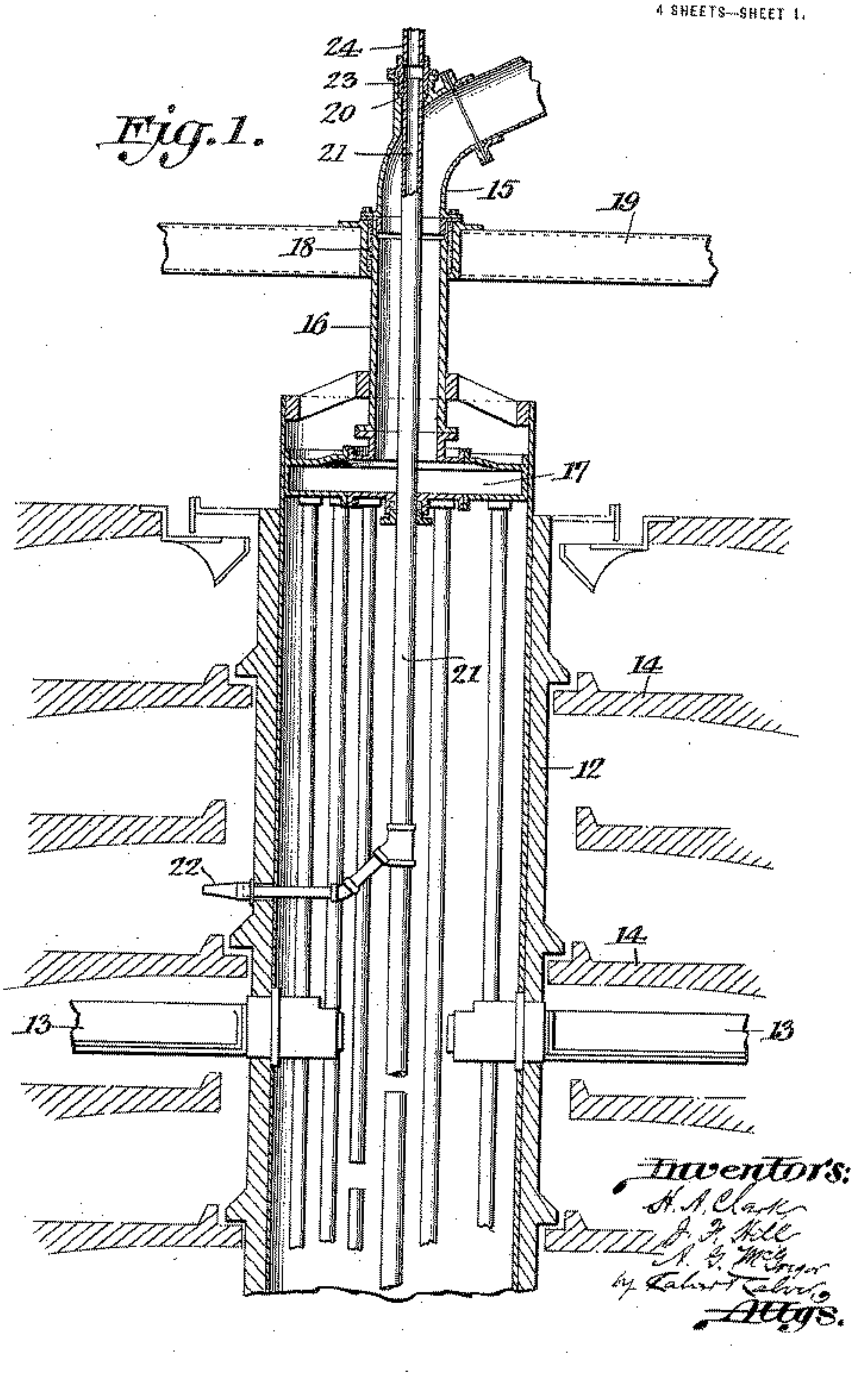
In testimony whereof I affix my signature.

ROSA WALLNER.

H. A. CLARK, J. F. HILL AND A. G. McGREGOR.
ORE ROASTING FURNACE.
APPLICATION FILED JULY 19, 1920.

1,380,529.

Patented June 7, 1921.
4 SHEETS—SHEET 1.



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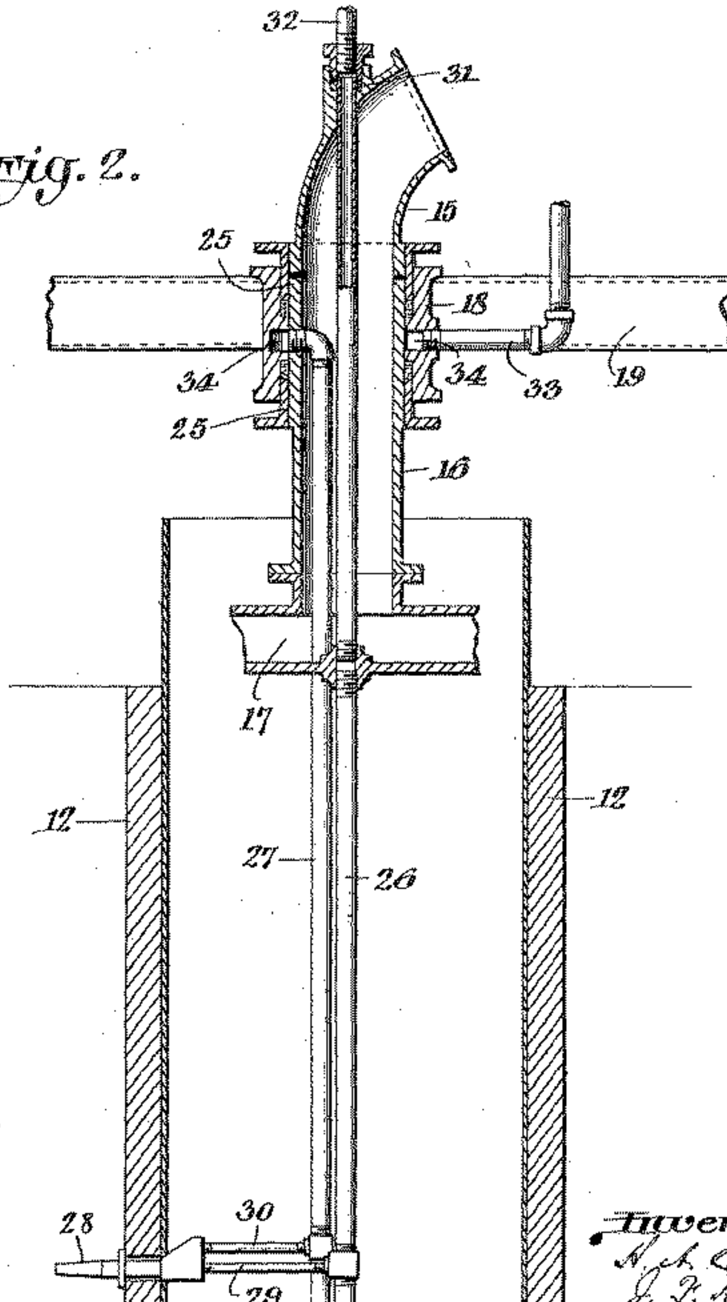
4 SHEETS—SHEET 2.

Fig. 2.



Inventors:
H. A. Clark
J. F. Hill
A. G. McGregor
by Coburn Kalm
Attys.

H. A. CLARK, J. F. HILL AND A. G. McGREGOR.
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APPLICATION FILED JULY 19, 1920.

1,380,529.

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4 SHEETS—SHEET 3.

Fig. 3.

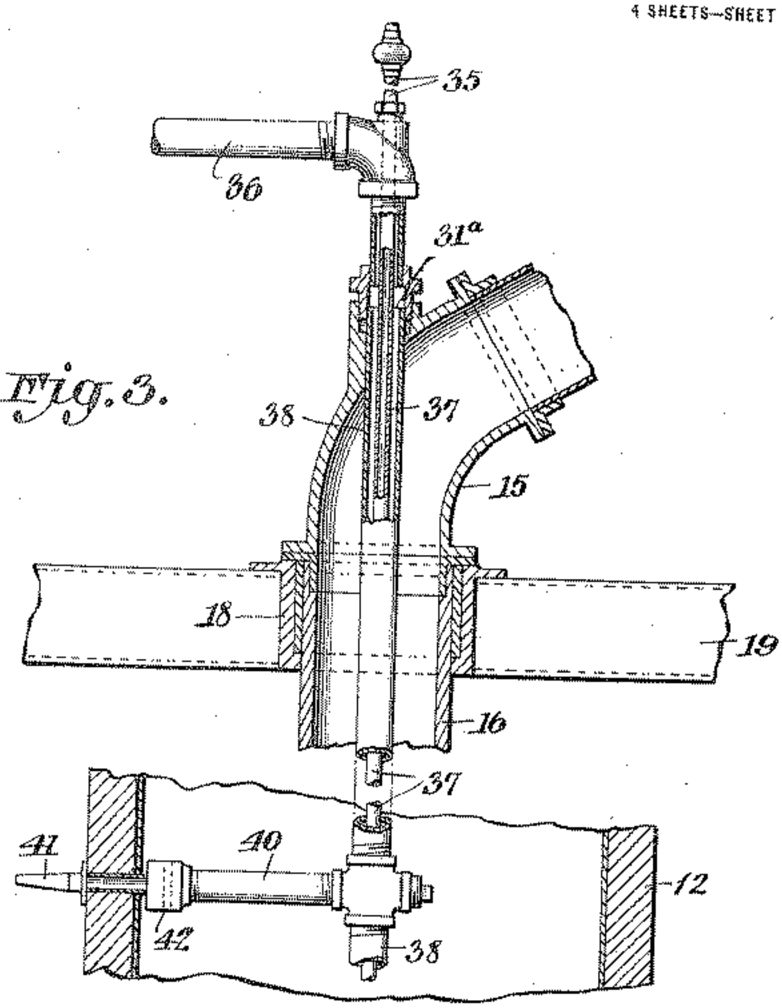
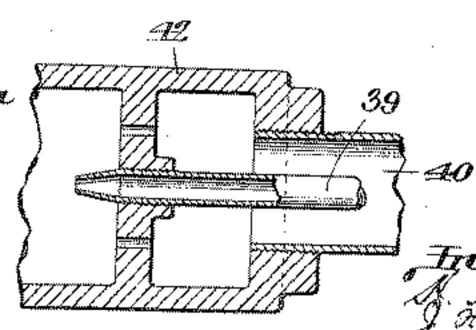


Fig. 3.a



Inventors:
H. A. Clark
J. F. Hill
A. G. McGregor
by Cobum & Schmidt
Attys.

H. A. CLARK, J. F. HILL AND A. G. McGREGOR.
ORE ROASTING FURNACE.
APPLICATION FILED JULY 19, 1920.

1,380,529.

Patented June 7, 1921.
4 SHEETS—SHEET 4.

Fig. 5

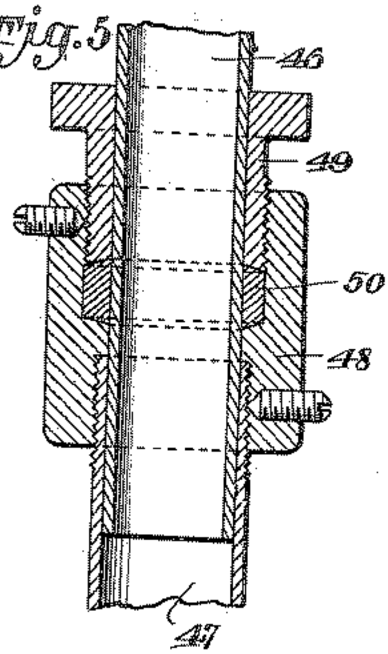


Fig. 6.

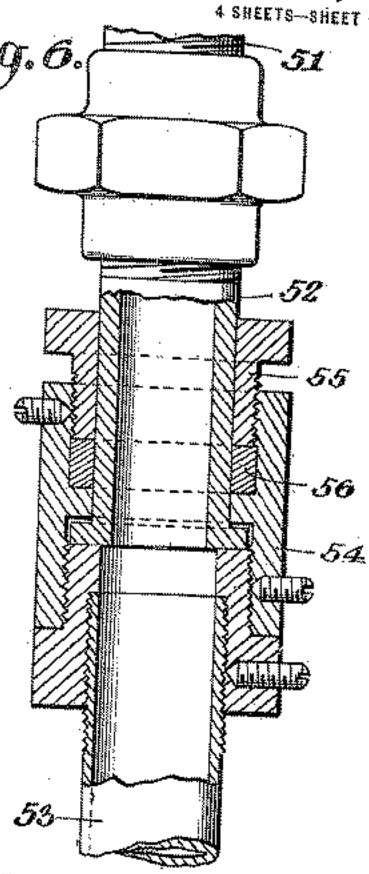
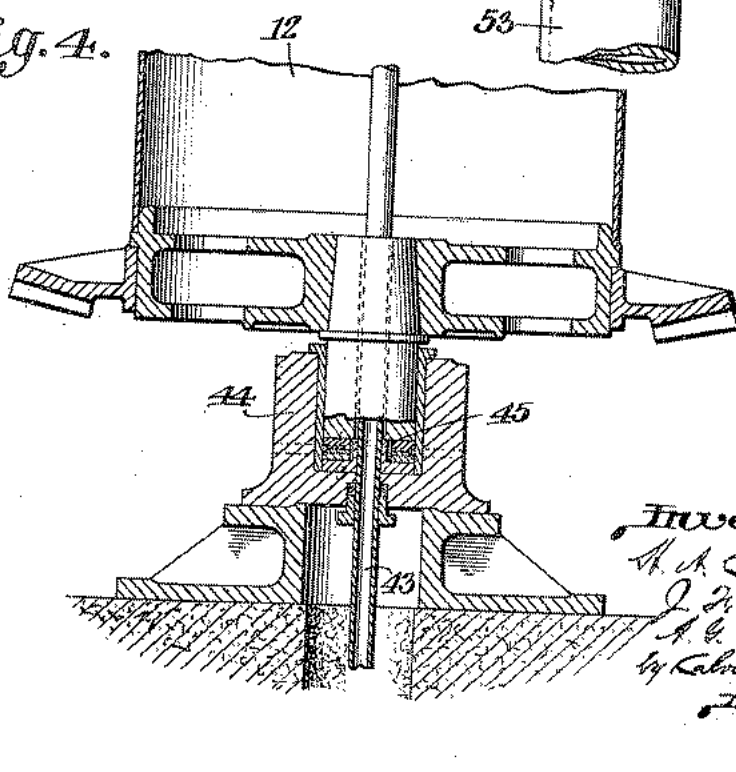


Fig. 4.



Inventors
H. A. Clark
J. F. Hill
A. G. McGregor
by Calver Calver
Attys.

UNITED STATES PATENT OFFICE.

HARRY ALLEN CLARK AND JOHN FRANCIS HILL, OF DOUGLAS, AND ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

ORE-ROASTING FURNACE.

1,380,529. Specification of Letters Patent. Patented June 7, 1921.

Application filed July 19, 1920. Serial No. 397,371.

To all whom it may concern:

Be it known that we, HARRY ALLEN CLARK and JOHN FRANCIS HILL, of Douglas, Arizona, and ALEXANDER GRANT McGREGOR, all citizens of the United States, residing, respectively, at Douglas and Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Ore-Roasting Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improvement in ore roasting furnaces of the Wedge or Hereshoff type, comprising a series of hearths, one above the other, and to which the ore is successively fed from the top of the furnace, this downward feed of the ore in the furnace being effected by rakes or rabbles mounted on arms carried by a central rotating shaft.

When the ore to be roasted contains 25% or more of sulfur it can generally be roasted without adding outside fuel after the furnace is heated up at starting. With this amount of sulfur sufficient heat is generated to drive off the moisture and ignite the sulfur by the time it gets to about the third hearth, but in ores having too much moisture or not enough sulfur it is often necessary to introduce added fuel to the furnace. Sometimes coal has been added to the ore to overcome this trouble; but a more efficient method, however, has been to employ a fire box, the heated gas from the fire box passing through an opening in the shell of the furnace. Also it is common to place an oil burner in the furnace wall above one of the hearths so that a mixture of oil and air will be discharged into the furnace just inside of the furnace lining. These furnaces generally have doors, constructed circumferentially around the shell, for each hearth. It is common practice to put the oil burner through one of these doors. Also in a similar way powdered coal is sometimes fed to the inside of the furnace. The fuel is generally admitted into the furnace just above the next to the bottom hearth. If fire boxes are used they are generally arranged so that gases from them are taken into the furnace on the hearth next to the bottom.

There are, however, objections to these methods of applying fuel to roasting furnaces, and which objections we aim to overcome by our improvements. With the center shaft revolving with its arms and rakes or rabbles and the crushed ore dropping from hearth to hearth, considerable dust is raised in the furnace, so that when the fuel is applied to the furnace at one place, as has been the practice heretofore, crusts and accretions pile up on the lower side of the hearth just above the flame. It is necessary to break off these accumulations from time to time, but even with a great deal of care there is generally an accumulation over the flame. This accumulation weighs down the hearth and often causes it to sag, and repairs on this account are necessary from time to time.

These roasting furnaces are often installed so that there are as many as sixty roasters in one building, and one man may be called upon to look after eight roasters. Sometimes, due to an interruption in the power, a break in the power transmission system, or for other cause, the central shaft of the furnace will stop revolving. The stoppage of the central shaft is not particularly noticeable to the attendant. If an arm carrying its rabbles happens to stop near the flame it is badly burned and warped and becomes unusable in a few minutes, if the attendant does not happen to notice it quickly and shut off the flame or start the furnace shaft revolving again.

To avoid the objections above referred to we mount a burner on the central hollow rotating shaft carrying the arms and rakes or rabbles, and we supply this burner with fuel, either pulverized coal or oil, which may be introduced either from the top or the bottom of the central rotating shaft. By mounting the burner on the rotating shaft the flame from the burner sweeps around the furnace chamber as the shaft revolves, and accumulations such as are above referred to are avoided; and as the burner is located at a point between the arms carrying the rakes or rabbles there is no danger of burning the same, should the rotation of the shaft be accidentally interrupted, as hereinbefore referred to.

Our invention is somewhat conventionally illustrated in the accompanying drawings in which Figure 1 illustrates one form of the invention in which the burner is to be supplied with pulverized coal introduced by air pressure from the top of the furnace. Fig. 2 is a partial view illustrating a construction in which an oil burner is employed, and in which the oil and air are introduced from the top of the furnace. Fig. 3 is a somewhat fragmentary view showing a modified form of the invention employing an oil burner, and Fig. 3ª is a detail view showing a form of mixing chamber for the oil burner. Fig. 4 is a detail view showing a construction whereby the fuel may be introduced to the rotating shaft from the bottom of the latter. Figs. 5 and 6 are detail views illustrating alternative forms of joints which may be employed between the stationary and rotating pipes in introducing fuel to the furnace.

Referring to the drawings, and more particularly just now to Fig. 1, 12 denotes the central hollow, rotating shaft of the well-known type of roasting furnace as hereinbefore referred to, this shaft being in practice provided with arms 13 which carry the rakes or rabbles for causing the ore to be successively fed downward from the top of the furnace to the several hearths thereof, these hearths 14 being fragmentarily illustrated in dotted lines in Fig. 1. The arms 13, in practice, are air cooled, the air being supplied from a stationary or non-rotating pipe 15 communicating through a rotating pipe 16 which opens into an air manifold 17 rotating with the shaft 12. The pipe 16 enters a bearing 18 supported by a beam 19, this bearing being properly packed to afford an air-tight joint. Mounted in a bearing 20 on the pipe 15 is a rotating fuel pipe 21 extending down the shaft 12 and communicating with a burner 22 projecting through the wall of the hollow rotating shaft 12, the said burner thus opening into the furnace chamber above one of the hearths of the furnace. Communicating with the pipe 21, through a stuffing box 23, is a stationary or non-rotating inlet pipe 24 through which pulverized coal and air may be introduced and carried through the pipe 21 to the burner 22.

Referring now particularly to Fig. 2 the stationary or non-rotating air inlet pipe 15 communicates with a rotating pipe 16 opening into the air manifold 17. The rotating pipe 16 has a bearing in a collar or part 18 which is supported by the beam 19, and is provided with stuffing boxes 25 for affording tight joints between the stationary pipe 15, the rotating pipe 16 and the said bearing collar or part 18. Rotating with the pipe 16 and the hollow central shaft 12 are oil and air pipes 26 and 27 communicating with an oil burner 28 through pipes 29 and 30. The rotating oil pipe 26 communicates, through a stuffing box 31, with a stationary or non-rotating oil inlet pipe 32, and the air inlet pipe 27 communicates with an air inlet pipe 33 through an annular chamber 34 formed in the bearing collar or part 18.

In the construction shown in Fig. 3 the air inlet pipe 15 communicates with the rotating pipe 16 extending into a bearing collar or part 18 supported by the beam 19, as in Fig. 1; and in this form of the invention the stationary and non-rotating oil and air supply pipes 35 and 36 communicate with the rotating oil and air pipes 37 and 38 through the stuffing box 31ª on the pipe 15. The oil pipe 37 communicates with the branch oil pipe 39, and the air pipe 38 communicates with a branch air pipe 40, these branch pipes 39 and 40 leading to the burner 31 through a mixing chamber afforded by a casing 42.

Instead of introducing the fuel from the top of the central rotating shaft of the furnace, as in the constructions above described, the fuel may be introduced from the bottom of the said central rotating shaft 12 as shown in Fig. 4 through a fuel pipe 43 passing through the bottom stepped bearing 44 of the said shaft 12, as illustrated in Fig. 4, and this fuel inlet pipe, which may be either for oil or pulverized coal, may rotate with said shaft, a tight joint between the said pipe and the said stepped bearing being afforded by a stuffing box 45.

Instead of using the joints thus far described between the stationary and rotating fuel inlet pipes, the alternative forms of joints shown in Figs. 5 and 6 may be employed. In Fig. 5 the stationary pipe 46 is inside of the rotating pipe 47, with which latter the collar 48 and the bushing 49 also rotate, a tight joint being afforded between the stationary and rotating pipes by the packing 50. In the construction shown in Fig. 6 the stationary pipe 51 is coupled to the stationary pipe 52, and the rotating pipe 53 is connected with a sleeve 54, and a bushing 55 which both rotate with said pipe, a tight joint being afforded by the packing 56.

From the foregoing it will be understood that, when the burner is in operation, as the central shaft 12 rotates the flame from the burner, which opens into the furnace chamber, will sweep in a circle around said chamber, thus evenly distributing the heat and avoiding accumulations on the hearths, as also avoiding danger of burning the rabble or rake arms, the burner being located between and away from said arms. The burner may be located above any one of the hearths, and more than one burner may be employed, if desired.

The invention is not to be understood as being limited to the particular constructions herein shown and described, as the details of construction may be varied widely, within the province of mechanical skill, without departing from the spirit of the invention.

Having thus described our invention we claim and desire to secure by Letters Patent:—

1. In a roasting furnace of the class described, the combination with a central hollow rotating shaft, of a burner mounted to rotate therewith and opening into the chamber of the furnace, and means for supplying fuel to said burner, said means comprising oil and air supply pipes within and rotating with said shaft, stationary oil and air supply pipes, and packed joints between said rotating and stationary pipes.

2. In a roasting furnace of the class described, the combination with a central hollow rotating shaft, of a burner mounted to rotate therewith and opening into the chamber of the furnace, and means for supplying fuel to said burner, said means comprising oil and air supply pipes within and rotating with said shaft, stationary oil and air supply pipes, and packed joints between said rotating and stationary pipes, said oil pipe being within said air supply pipe.

3. In a roasting furnace of the class described, the combination with a central hollow rotating shaft, of a burner mounted to roate therewith and opening into the chamber of the furnace, and means for supplying fuel to said burner, said means comprising oil and air supply pipes within and rotating with said shaft, stationary oil and air supply pipes, and packed joints between said rotating and stationary pipes, and branch oil and air supply pipes between the main oil and air supply pipes and said burner.

4. In a roasting furnace of the class described, the combination with a central hollow rotating shaft, of a burner mounted to rotate therewith and opening into the chamber of the furnace and means for supplying fuel to said burner, said means comprising oil and air supply pipes within and rotating with said shaft, stationary oil and air supply pipes, packed joints between said rotating and stationary pipes, said oil pipe being within said air supply pipe, and branch oil and air supply pipes, the former within and surrounded by the latter, between the main oil and air supply pipes and said burner.

In testimony whereof we affix our signatures.

HARRY ALLEN CLARK.
JOHN FRANCIS HILL.
ALEXANDER GRANT McGREGOR.

A. G. McGREGOR.
CONVERTER PLANT.
APPLICATION FILED AUG. 26, 1920.

1,417,538. Patented May 30, 1922.

4 SHEETS—SHEET 1.

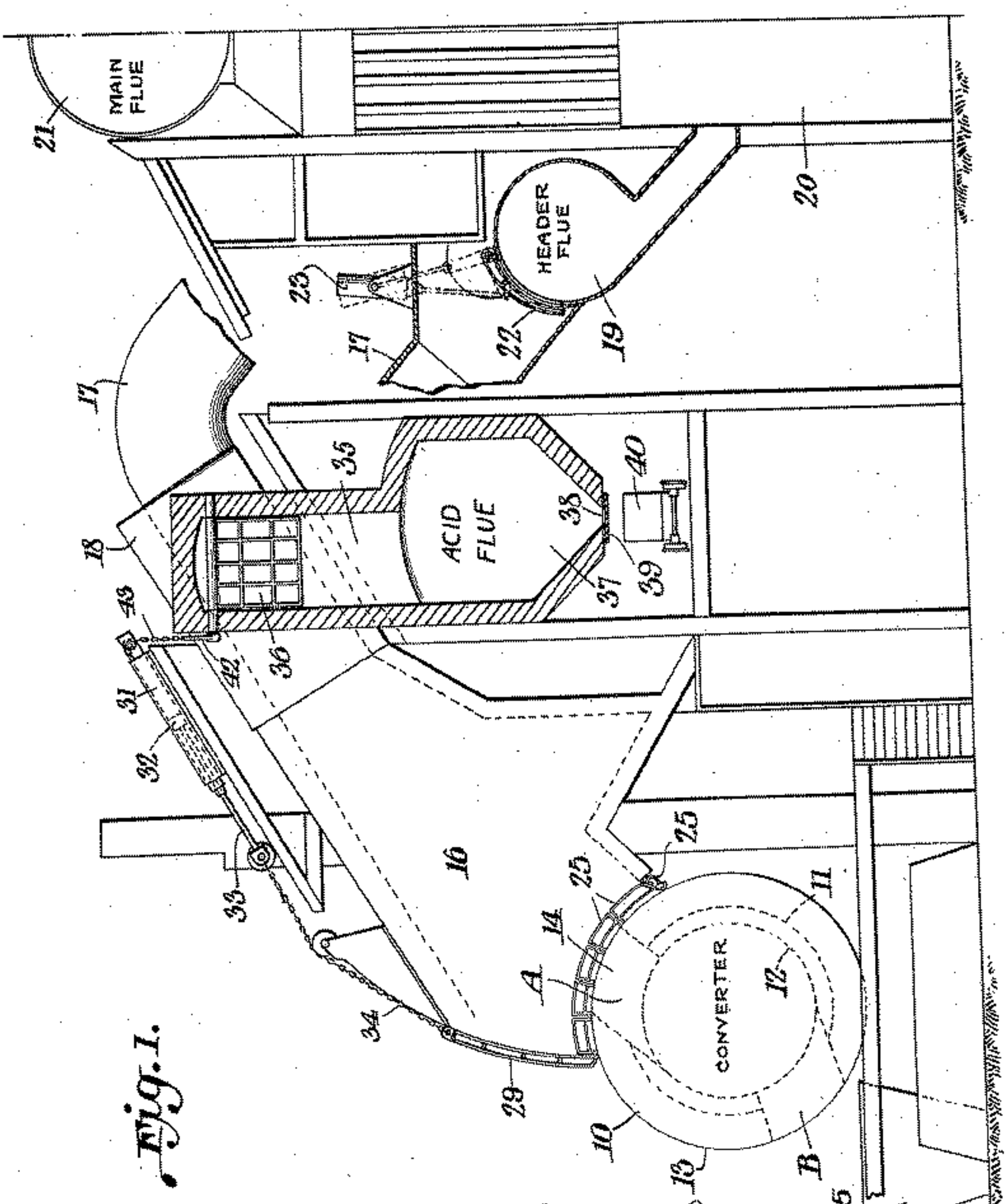


Fig. 1.

Alexander G. McGregor INVENTOR.

BY

Edwin Calver ATTORNEYS

A. G. McGREGOR.
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1,417,538. **Patented May 30, 1922.**

4 SHEETS—SHEET 2.

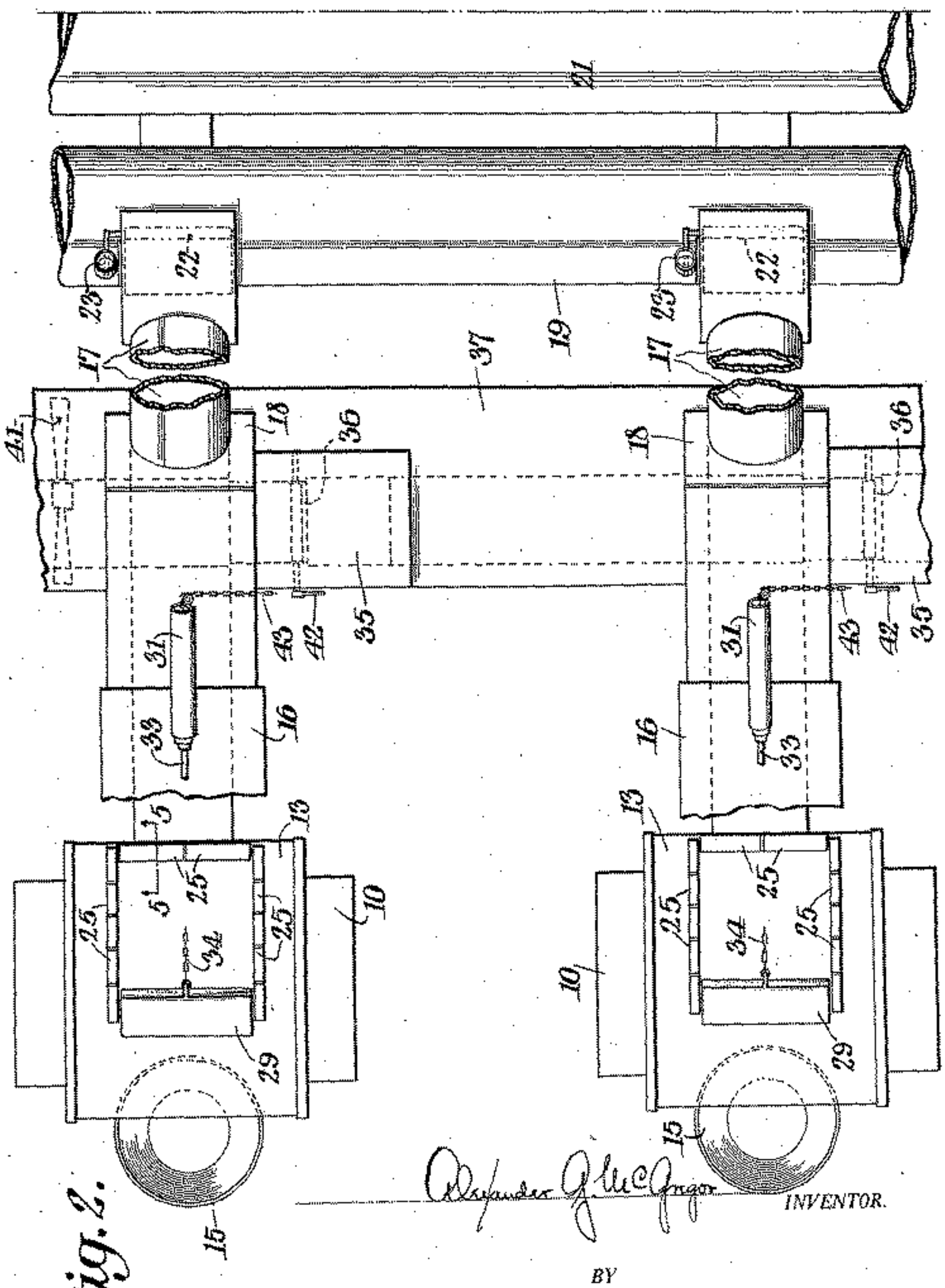

Fig. 2.

Alexander G. McGregor INVENTOR.

BY

ATTORNEYS

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4 SHEETS—SHEET 3.

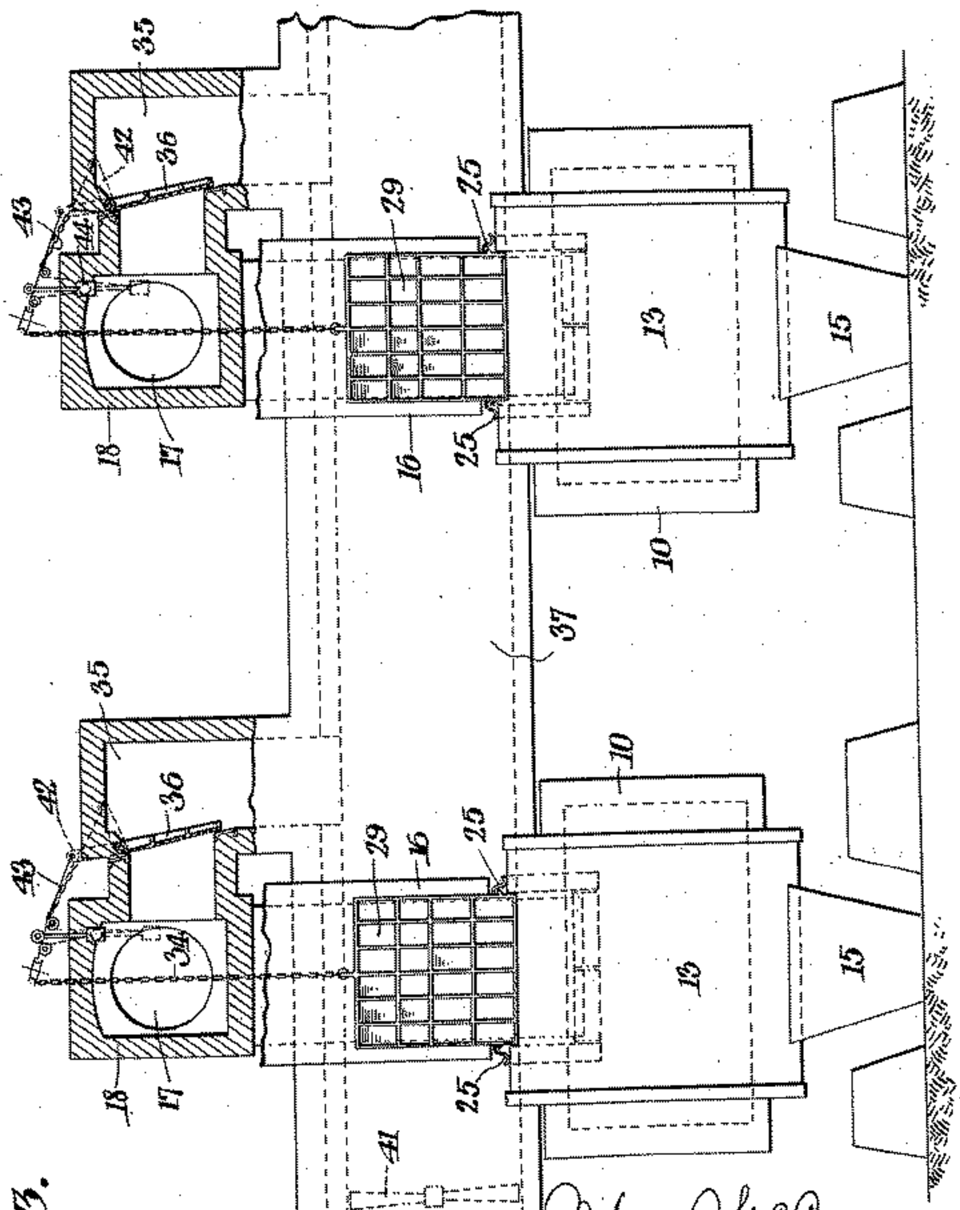

Fig. 3.

Alexander G. McGregor
INVENTOR.

BY

ATTORNEYS

A. G. McGREGOR.
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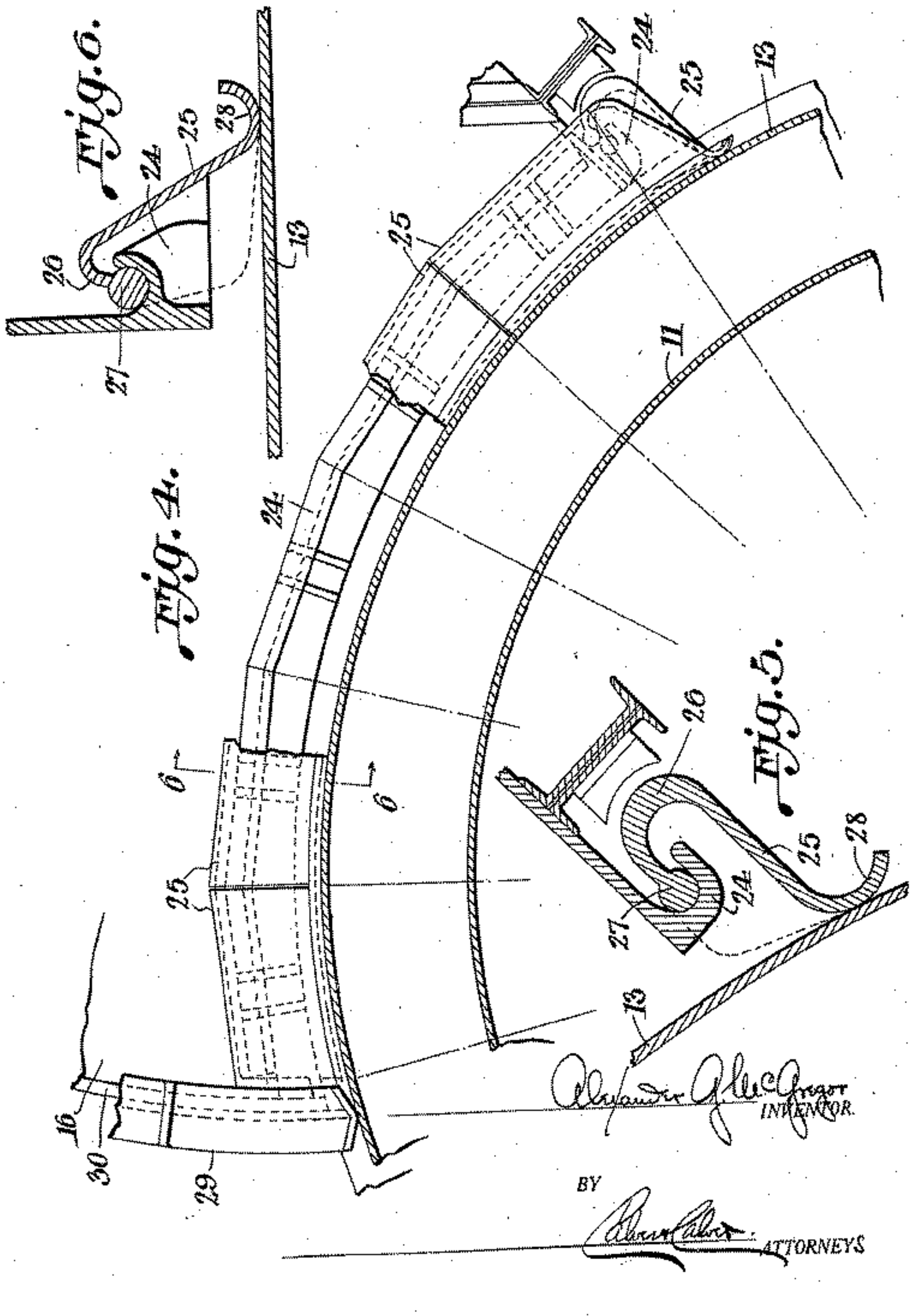
4 SHEETS—SHEET 4.



UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

CONVERTER PLANT.

1,417,538. Specification of Letters Patent. Patented May 30, 1922.

Application filed August 26, 1920. Serial No. 406,119.

To all whom it may concern:

Be it known that I, ALEXANDER G. McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Converter Plants, of which the following is a specification, reference being had therein to the accompanying drawings.

In the process of smelting or refining certain metals, particularly copper, the molten matte from the reverberatory or blast furnace is transferred to a tilting or rotary furnace, known as a converter, said converter being provided with tuyères, by means of which air can be blown through the molten matte, and having an opening or spout which, during the operation of the converter, is turned upwardly, but which, after the operation, may be turned downwardly in order to discharge the contents of the converter. Copper matte usually contains from 25% to 50% metallic copper, depending upon the nature of the ore smelted, the other elements being sulphur and iron.

The air blown in through the tuyères of the converter passes up through the molten matte, slag, etc., producing very dense sulphur fumes. In order to dispose of these fumes, a hood, communicating with a stack or flue, is usually located over the converter spout when the latter is turned upwardly, but as there is more or less warping and unevenness in the converter shell, and as accumulations of slag are likely to form in the hood and on the converter shell, it is impossible to make this hood fit very tightly over the shell while at the same time permitting the rotation of the converter, a clearance of three inches or more being usually necessary in practice. If there is not much draft in the hood, a great deal of the sulphur gas will therefore escape into the building in which the plant is located, while if there is an excess of draft in the hood, a considerable amount of outside air is drawn into the hood along with the gases from the converter, diluting and cooling said gases. If the latter are to be discharged from the stack directly into the atmosphere, such dilution and cooling is not objectionable, but when, in accordance with the coming practice, the sulphur fumes are to be saved for the purpose of making liquid sulphur dioxide, sulphuric acid, or other by-product, it is desirable to maintain these gases in as concentrated a form as possible, and that unnecessary cooling be avoided.

The present invention accordingly has for one object the provision of means whereby the sulphur fumes from a converter of the type above described may be prevented from escaping and may be delivered to an acid or other plant in which they are to be utilized with as little dilution and cooling as possible, said means comprising devices for substantially closing the space between the hood and the converter shell, so as to reduce leakage of air through said space, while permitting the free rotation of the converter.

From time to time in the operation of the rotary or tilting converter it is necessary to turn the converter spout part way down in order to skim off the slag. Also the converter is turned into the position last referred to in order to receive a charge of matte and is turned with its spout in the lowermost position in order to discharge the resultant product. In order thus to turn the converter spout from its uppermost to a lowered or partly lowered position, and vice versa, it is necessary that the devices last referred to be of such a nature as to permit the converter spout to pass, this, in the preferred form of the invention, being accomplished by so constructing the devices in question that a suitable portion thereof may be withdrawn into an inoperative position at the proper time. When this is done leakage of outside air into the hood is not prevented, and, particularly in the case of a plant employing a plurality of converters all communicating with the same acid flue, it is desirable that the hood co-operating with an inoperative converter be placed out of communication with said flue, while permitting a greater or less amount of draft therethrough in order to prevent escape of fumes.

The invention has therefore for another object the provision of a converter plant, preferably a plant comprising a plurality of converters provided with hoods all communicating with a common acid flue, said plant having means whereby the fumes from the converter, or any of them, or the gases drawn through a converter hood, if unsuitable for discharge into the acid flue, may readily be diverted therefrom and otherwise disposed of.

The foregoing and other objects of the invention, together with means whereby the same may be carried into effect, will best be understood from the following description of one form or embodiment thereof illustrated in the accompanying drawings. It will be understood, however, that the particular construction and arrangement described and shown has been chosen for illustrative purposes merely, and that the invention, as defined by the claims hereunto appended, may be otherwise practiced without departing from the spirit and scope thereof. For convenience the invention is herein described with reference to its application to the conversion of copper matte, but it will be readily understood by those skilled in the art that its utility is not limited to the reduction of this particular metal, but that it may be employed in the refining of other metals wherever a similar process is applicable.

In said drawings:

Fig. 1 is an end elevation, partly broken away and partly in section, of a complete converter plant.

Fig. 2 is a plan view, partly broken away, of two of the converter units of such a plant.

Fig. 3 is a side elevation of the parts shown in Fig. 2, looking from the left in the latter figure.

Fig. 4 is an enlarged end elevation, partly broken away and partly in section, of a portion of the converter and the adjacent portions of the hood.

Fig. 5 is an enlarged detail section taken substantially on the line 5—5, Fig. 2.

Fig. 6 is a section on the line 6—6, Fig. 4.

As herein shown, the complete plant comprises a plurality of cylindrical, rotary or tilting converters 10 arranged in axial alinement, each of said converters comprising an inner shell 11 (Figs. 1 and 4) having a refractory lining 12 (Fig. 1), a cylindrical outer shell or apron 13 suitably spaced from said inner shell, and in its side an opening or spout 14 leading from the interior of the lining 12 to the exterior of the apron 13, each of said converters being rotatable through a sufficient arc to permit its spout 14 to be moved between the upper or operative position, designated by the letter A in Fig. 1, and the lower or discharge position, designated by the letter B in said figure, in which latter position the contents of the converter may be discharged into a suitable ladle or other receptacle 15. Only two converters are herein shown, but it will be understood that they may be of any desired number. Suitable means are provided for rotating the converters, but neither such rotating means nor the precise details of construction of the converters are shown herein, as they are well known in the art, specifically form no portion of the present invention, and may be of any usual or suitable form.

Associated with and located above each of the converters 10 is a hood 16 having its lower end or mouth shaped substantially in conformity with the outer surface of the apron 13 and disposed about the converter spout 14 when the latter is turned into its upper or operative position A. Each of the hooks 16 communicates at its upper end with a chamber 18 from which a conduit 17 leads to a header flue 19, the latter communicating, through a suitable dust collector 20 or other apparatus usual in plants of this character, with a main flue 21 leading to the stack. Preferably, and as herein shown, there is interposed between the header flue 19 and each of the conduits 17 a damper 22 having suitable fluid pressure or other operating means 23 of any well known form, whereby communication between the several conduits and the header flue may be controlled.

The lower end of each of the hoods 16, adjacent the corresponding converter 10, is formed at its sides and rear with a channelled flange 24 (see Figs. 4 to 6) which supports a series of segments or plates 25 formed at their upper ends with hooked flanges 26 having beadings 27 adapted to rest in the channeled flange 24, and having curved lower ends 28 adapted to rest by gravity upon the outer shell or apron 13 of the converter. The plates 25 are placed in close proximity to one another and are of such shape as substantially to close the space between the converter apron 13 and lower edge of the hood at the sides and rear of said hood, while by reason of their loose support on the flange 24 and their gravity engagement with the apron 13 are free to move up and down individually in order to permit the passage thereunder of any irregularities of or upon the apron when such irregularities are brought into engagement with the curved lower ends 28 of said plates. The space between the apron 13 and the lower edge of the hood 16 at the forward side of said hood is closed, when the converter is in operation, by a gate 29 mounted for vertical sliding movement on guides 30 (Fig. 4) on the forward side of the hood, said gate, when the converter is in operation, resting at its lower edge upon the apron 13, but being adapted to be opened or raised in order to facilitate the turning of the converter upon its axis. Any suitable means may be employed for raising and lowering the gate 29, said means as herein shown comprising a fluid pressure cylinder 31 containing a piston 32 connected by a piston rod 33 and chain 34 or similar connector with the upper edge of the gate 29.

It will be understood that, while the segments or plates 25 and gate 29 do not form an absolutely air tight joint between the hood and converter shell, they serve effectually to reduce the leakage of outside air to a negligible amount. By reason of the loose detachable connection of the segments or plates with the hood, they may be readily removed to facilitate the cleaning of accretions of slag from the apron and hood.

Communicating with each of the chambers 18 is a conduit 35 controlled by a damper 36 and leading to an acid flue 37 common to all of said conduits 35, said acid flue being preferably provided with a clean out opening 38 closed by a suitable door 39, whereby matter accumulating in said flue may be discharged into a suitable car or other receptacle 40. A current of air, flowing from the converters and toward the acid or other plant (not shown) in which the sulphur fumes are to be utilized, is maintained in the acid flue 37 by any suitable means, such, for example, as a fan blower 41. Each of the dampers 36 is provided with an operating arm 42 which is preferably connected, as by a chain 43, with the piston 32, whereby when any gate 29 is opened the corresponding damper 36 will be closed, and vice versa. A suitable amount of slack is preferably provided in the chains 34 and 43 to ensure a complete closing of one of said members before the other commences to open, said slack being, if desired, controlled by suitable take-up weights 44 (Fig. 3).

When all of the converters of the series are in operation, the gates 29 and dampers 22 controlling the header flue are all closed, while the dampers 36 are all open. The spaces between the several converters and their respective hoods being closed by the segments or plates 25 and gates 29, the fumes from the converter spouts 14 are drawn, by the suction induced by the fan 41, into the hoods 16 and thence pass, through the chambers 18, conduits 35, and acid flue 37, to the acid or other plant, communication with the main flue 21 and stack being closed by the dampers 22. When for any reason it is desired to turn down a converter 10, the piston 32 is operated, by the admission of suitable motive fluid to its cylinder 31, to cause a movement of said piston in a direction first to close the damper 36 and thereafter to raise the gate 29. The corresponding damper 22 is at the same time opened. The raising of the gate 29 permits the converter 10 to be turned forwardly, either to skim the slag from the matte, or for the purpose of emptying or re-charging the converter. At this time the damper 36 closes communication between the hood 16 and the acid flue 37, while the opening of the damper 22 establishes communication between said hood and the main flue 21, so that air drawn into the hood is not permitted to enter the acid flue but is carried to the stack.

It will therefore be seen that by means of apparatus embodying the present invention, there is provided a multiple unit converter plant wherein objectionable dilution and cooling of the fumes going to the acid or other plant is avoided and a stream of practically uniform gas of the desired temperature and concentration maintained in the acid flue, wherein any converter unit may be rendered inoperative at proper times and turned into the position for discharging, recharging, or other necessary operations without affecting the operation of the others or of the plant as a whole, and wherein the escape of fumes into the building is entirely avoided, the latter result being accomplished, when any gate 29 is opened and the corresponding converter turned into inoperative position, by the draft in the main flue and stack, with which the corresponding hood is, at this time, in communication.

Having thus described my invention I claim and desire to secure by Letters Patent:—

1. The combination with a horizontally disposed, tilting or rotary converter having in its side an opening or spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter, said means being adapted to permit rotation of said converter.

2. The combination with a horizontally disposed, tilting or rotary converter having an outer shell and having in its side an opening or spout, and a hood having a mouth spaced from said outer shell and disposed about said spout when said converter is in operative position, of means for reducing leakage of air into said hood between the same and said shell, said means being adapted to permit the free rotation of said converter notwithstanding relative unevenness of said shell and hood, or accretions thereon.

3. The combination with a horizontally disposed, tilting or rotary converter having in its side an opening or spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means having movable engagement with said converter and hood for closing the space between the same notwithstanding an unevenness on the adjacent surfaces of these parts due to accumulations of material.

4. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter; said means including a series of plates loosely supported by said hood and resting by gravity upon the surface of said converter.

5. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter, said

means including a series of plates loosely supported by said hood and having curved lower ends resting by gravity upon the surface of said converter.

6. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter; said means including a series of plates hinged at their upper ends to said hood and resting by gravity upon the surface of said converter.

7. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of a series of plates hinged at their upper ends to said hood and having curved lower ends resting by gravity upon the surface of said converter, said plates being disposed closely adjacent to one another.

8. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, said hood having at its lower end a channelled flange, of a series of plates disposed closely adjacent one another and having hooked upper ends engaging and supported by said flange, said plates having curved lower ends resting by gravity upon the surface of said converter.

9. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of means for closing the space between said hood and the outer surface of said converter, said means including a series of plates loosely supported by said hood about the sides and back of the latter and resting by gravity upon the surface of said converter.

10. The combination with a rotary converter having an outer shell and a spout, and a hood having a mouth spaced from said shell and disposed about said spout when said converter is in operative position, of means for reducing leakage of air into said hood between the same and said shell, said means including a series of plates loosely supported at their upper ends on said hood and resting at their lower ends upon said shell, whereby the lower ends of said plates are free to move up and down as required by relative unevenness of said shell and hood or accretions thereon when said converter is rotated.

11. The combination with a rotary converter having an outer shell and a spout, and a hood having a mouth spaced from said shell and disposed about said spout when said converter is in operative position, of means for reducing leakage of air into said hood between the same and said shell, said means including a series of plates loosely supported at their upper ends on the sides and back of said hood and resting at their lower ends upon said shell, whereby the lower ends of said plates are free to move up and down as required by relative unevenness of said shell and hood or accretions thereon when said converter is rotated.

12. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of a gate carried at the front of said hood and adapted, when lowered, to engage the outer surface of said converter, said gate being adapted to be raised to permit rotation of said converter, and means for closing the space between said hood and the outer surface of said converter at the sides and back of said hood and adapted to permit rotation of said converter.

13. The combination with a rotary converter having a spout, and a hood having a mouth disposed about said spout when said converter is in operative position, of a series of plates loosely supported by said hood about the sides and back of the latter and resting by gravity upon the surface of said converter, and a gate carried by the front of said hood and adapted, when lowered, to engage the outer surface of said converter.

14. The combination with a rotary converter having an outer shell and a spout, and a hood having a mouth spaced from said shell and disposed about said spout when said converter is in operative position, said hood having at its lower end a channelled flange disposed about its sides and back, of a series of plates disposed closely adjacent one another and having hooked upper ends engaging and supported by said flange, said plates having curved lower ends resting by gravity upon said converter shell and free to move up and down as required by relative unevenness of said shell and hood or accretions therein when said converter is rotated, and a sliding gate carried at the front of said hood and adapted, when lowered, to engage said shell, said gate being adapted to be raised out of engagement with said shell when said converter is rotated.

15. A converter plant comprising, in combination, a plurality of tilting converters, a flue connected to receive gases from all of said converters, a second flue also connected to receive gases from all of said converters, and devices for independently controlling communication between the several converters and one of said flues.

16. A converter plant comprising, in combination, a plurality of converters, a flue connected to receive gases from all of said converters, a second flue also connected to receive gases from all of said converters, and devices for independently controlling com-

munication between the several converters and each of said flues.

17. A converter plant comprising, in combination, a plurality of converters, an acid flue connected to receive gases from all of said converters when the latter are operating normally and producing relatively rich gases, a main flue connected to receive weak or dilute gases from all of said converters, a series of dampers adapted respectively to control communication between the several converters and said acid flue, and a second series of dampers adapted respectively to control communication between the several converters and said main flue.

18. A converter plant comprising, in combination, a plurality of rotary converters each having a spout, a plurality of hoods having mouths disposed respectively about said spouts when said converters are in operative positions, means for closing the spaces between said hoods and the outer surfaces of said converters and adapted to permit rotation of said converters, a plurality of flues each connected to receive gases from all of said hoods, and devices for independently controlling communication between the several hoods and one of said flues.

19. A converter plant comprising, in combination, a plurality of rotary converters, a plurality of hoods associated respectively with the several converters, a gate carried by each of said hoods and adapted, when the corresponding converter is in operative position, to engage the outer surface of said converter, said gates being adapted to be raised to permit rotation of said converters, a plurality of flues each connected to receive gases from all of said hoods, and dampers for independently controlling communication between the several hoods and one of said flues.

20. A converter plant comprising, in combination, a plurality of rotary converters, a plurality of hoods associated respectively with the several converters, a gate carried by each of said hoods and adapted, when the corresponding converter is in operative position, to engage the outer surface of said converter, said gates being adapted to be raised to permit rotation of said converters, a plurality of flues each connected to receive gases from all of said hoods, dampers for independently controlling communication between the several hoods and one of said flues, and means for alternatively raising each of said gates and closing the corresponding damper, and vice versa.

21. A converter plant comprising, in combination, a plurality of rotary converters, a plurality of hoods associated respectively with the several converters, a gate carried at the front of each of said hoods and adapted, when lowered, to engage the outer surface of the corresponding converter, said gates being adapted to be raised to permit rotation of said convertors, means for closing the space between each of said hoods and the corresponding converter at the sides and back of the hood and adapted to permit rotation of the converter, a plurality of flues each connected to receive gases from all of said hoods, and devices for independently controlling communication between the several hoods and one of said flues.

22. A converter plant comprising, in combination, a plurality of converters, a plurality of hoods associated respectively with the several converters, an acid flue, a header flue, a main flue communicating with said header flue, a series of conduits respectively connecting the several hoods with said header flue, a series of dampers respectively controlling communication between the several conduits and said header flue, a second series of conduits respectively connecting the several hoods with said acid flue, and a second series of dampers respectively controlling communication between the several conduits of said last-named series and the corresponding hoods.

23. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, and means for alternatively raising said gate and closing said damper, and vice versa.

24. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, and means for alternatively raising said gate and closing said damper, and vice versa, said last-named means being constructed and arranged to fully close one of said parts before commencing to open the other.

25. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, and means including a fluid pressure cylinder and piston for alternatively opening said gate and damper, respectively.

26. In a converter plant, in combination, a rotary converter, a hood associated therewith, a gate carried by said hood and adapted to be closed or lowered into engagement

with said converter, or to be opened or raised out of engagement therewith, a conduit leading from said hood, a damper controlling communication between said hood and conduit, a fluid pressure cylinder, a piston therein, and chains or the like connecting said piston with said gate and damper whereby movement of said piston in opposite directions causes opening of said gate and damper respectively, said chains being of sufficient length to permit said gate to fully close before said damper commences to open, and vice versa.

27. In a converter plant, in combination, a rotary converter, a hood associated therewith for receiving fumes therefrom when said converter is in operation, a flue into which the fumes received by said hood are normally discharged, and means for diverting the gases in said hood from said flue when said converter is turned into an inoperative position while maintaining a draft through said hood.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

H. K. BURCH.
REVOLVING SCREEN OR GRIZZLY.
APPLICATION FILED MAY 16, 1921.

1,420,685. Patented June 27, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

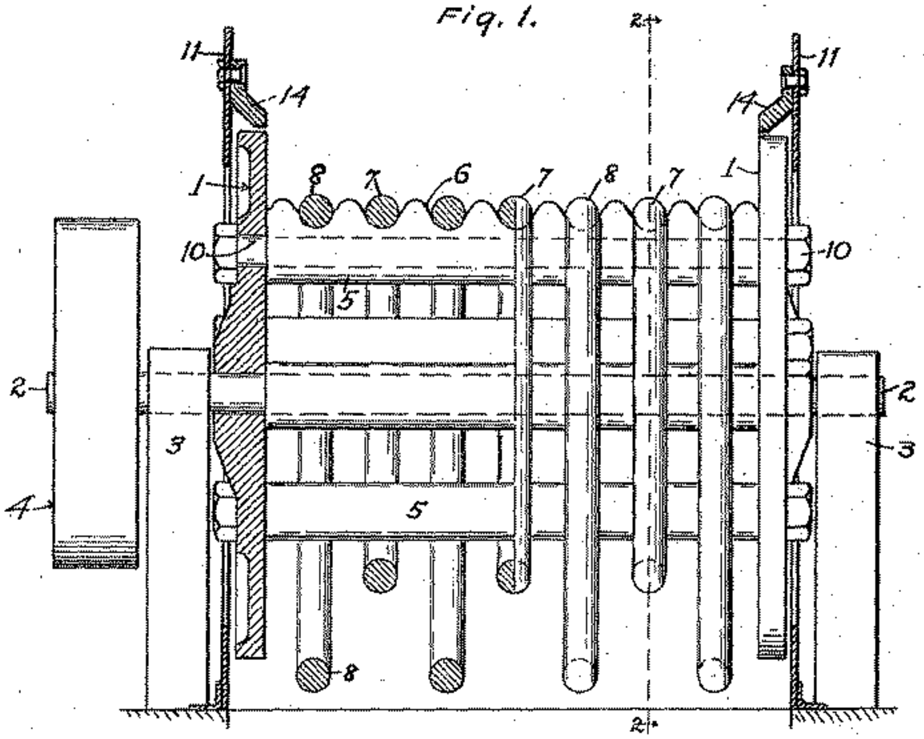
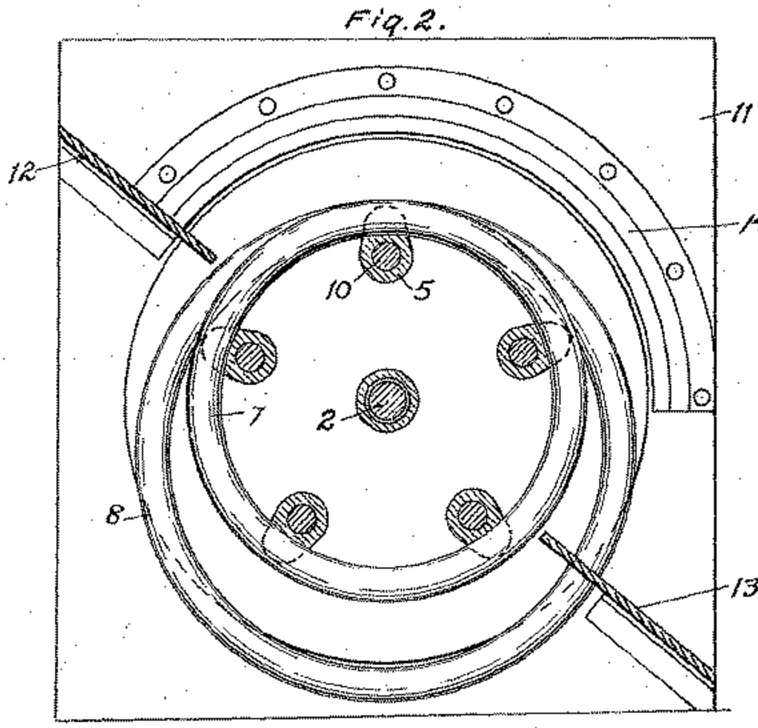


Fig. 2.



Inventor:
Henry Kenyon Burch
by Arthur P. Knight
Attorney

H. K. BURCH.

REVOLVING SCREEN OR GRIZZLY.

APPLICATION FILED MAY 16, 1921.

1,420,685.

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3 SHEETS—SHEET 2.

Fig. 3.

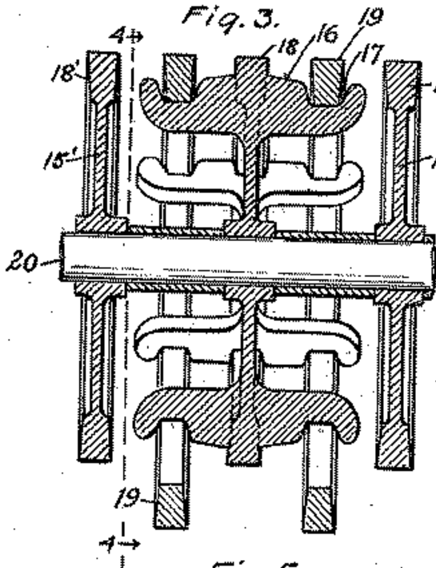


Fig. 4.

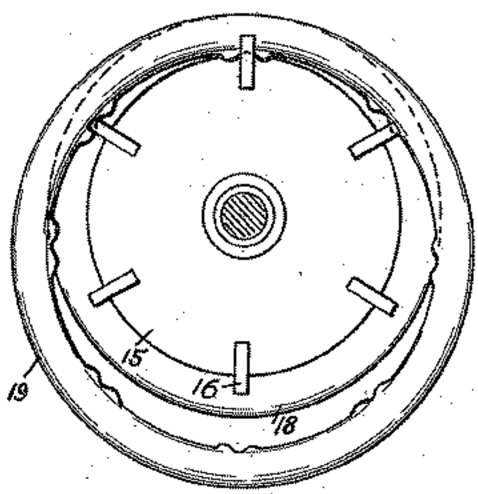


Fig. 5.

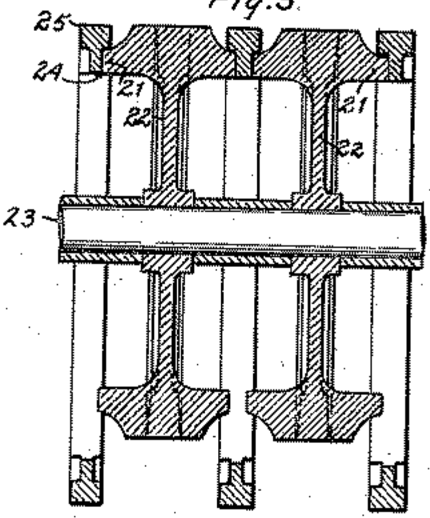


Fig. 6.

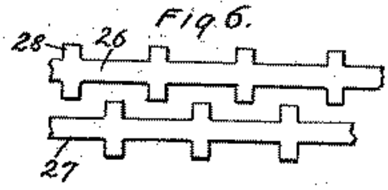


Fig. 7.

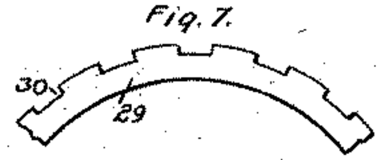
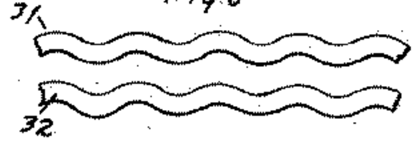


Fig. 8



Inventor:

Henry Kenyon Burch

by Arthur P. Knight

Attorney.

H. K. BURCH.

REVOLVING SCREEN OR GRIZZLY.

APPLICATION FILED MAY 16, 1921.

1,420,685. Patented June 27, 1922.

3 SHEETS—SHEET 3.

Fig. 9. Fig. 10. Fig. 11.

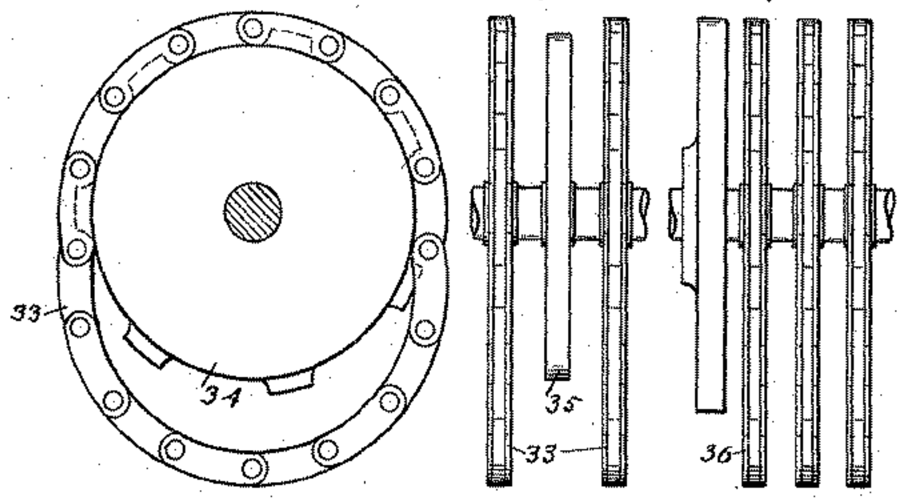
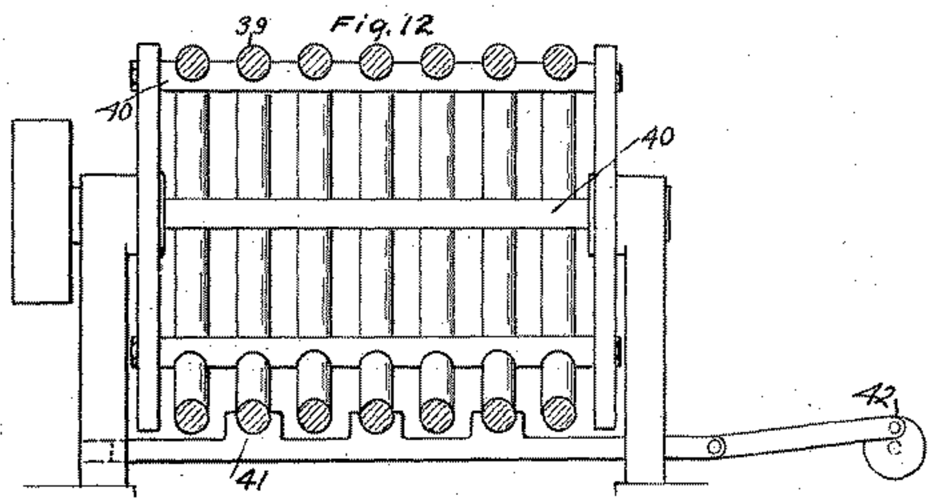


Fig. 12



Inventor:
Henry Kenyon Burch
by Arthur P. Knight
Attorney

UNITED STATES PATENT OFFICE.

HENRY KENYON BURCH, OF WARREN, ARIZONA.

REVOLVING SCREEN OR GRIZZLY.

1,420,685. Specification of Letters Patent. **Patented June 27, 1922.**

Application filed May 16, 1921. Serial No. 469,867.

To all whom it may concern:

Be it known that I, HENRY KENYON BURCH, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented a new and useful Improvement in Revolving Screens or Grizzlies, of which the following is a specification.

This invention relates to a screen or grizzly for removing the finer particles or pieces ("undersize") of ore, rock, gravel, coal, etc., from the coarser pieces ("oversize") of such material.

The main object of the present invention is to provide a rotary screen or grizzly for this purpose which will be simple and cheap in construction and economical and effective in operation.

Further objects of the invention are as follows:

To provide a machine for this purpose requiring only a small power to operate;

To provide for the stated purpose a machine which will be self-cleaning and will not become choked with material lodging within it;

To so construct the machine that the necessary repairs and replacements can be made readily and without the attention of skilled mechanics;

To reduce the wear on the machine to a minimum by so constructing the machine that the revolving rings, disks or screening elements travel in the direction of the heaviest and coarsest material and offer the least possible interference to the travel of the material.

The accompanying drawings illustrate embodiments of my invention, and referring thereto:

Figure 1 is a partly sectional side elevation of one form of the invention;

Fig. 2 is a section on line 2—2 in Fig. 1;

Fig. 3 is a longitudinal section showing another form of the invention;

Fig. 4 is a section on line 4—4 in Fig. 3;

Fig. 5 is a longitudinal section of another modification;

Fig. 6 is a developed plan view of a modified form of screening element;

Fig. 7 is a side elevation of another modified form of screening element for use with the invention;

Fig. 8 is a plan view of another modification of the screening element;

Fig. 9 is a transverse section of another form of the invention in which a chain or flexible member is used as a screening element;

Fig. 10 is a partial side elevation of the construction shown in Fig. 9;

Fig. 11 is a partial side elevation of another modification;

Fig. 12 is a longitudinal section of a further modification.

My invention comprises, for example, as shown in Figs. 1 and 2, a plurality of screen elements mounted on rotating supporting means, said screen elements comprising, for example, a series of circular rings mounted on a revolving frame or carrier. Said revolving frame may comprise heads or disks 1 mounted by trunnions or shaft means 2 in bearings 3 and driven by operating means such as a driving wheel 4; and bars 5 rigidly connected to said disks or heads and carrying the screen elements.

The bars 5 are provided with notches or saddles 6 to receive and support the screen elements which are formed as rings seated in said saddles or notches. Alternate rings, indicated at 7, are or may be rigidly mounted in said seats in the bars 5 and the intervening rings 8 may be loosely mounted in their seats in said bars and are preferably larger than the rings 7 so that the lower portions of the loose rings 8 will extend below the lower portions of the fast rings 7 to provide for clearance for "undersize" material passing through the screen. The upper portions of the respective rings 7 and 8 may be of substantially the same height, or, if desired, the rings 8 may be somewhat lower or somewhat higher than the rings 7 at the upper portion thereof. The bars 5 for mounting the respective rings 7 and 8 may be secured to the heads 1 in any suitable manner, for example, by bolts 10, said bars and heads constituting a rigid rotary frame. With this construction it is not necessary that the shaft means 2 should extend through the frame, and the portion of said shaft means between the heads of the frame may, therefore, be omitted.

Side plates 11 may be provided having

deflector flanges 14 for guiding the material onto the screen or grizzly and upper and lower guide plates or chute means 12 and 13 may be provided for supplying material to the screen and conveying away the "oversize."

The operation of the apparatus is as follows:

The material to be screened (ore, rock, gravel or coal) is supplied to the grizzly by chute means 12 and passes down onto and over the screen elements 7 and 8, which are caused to revolve or travel forward in the direction of motion of the material by operation of the shaft means 2. The supporting means for the loose rings 8 maintains them in proper position parallel to and spaced from the alternate fast rings 7 so as to always maintain a suitable spacing for the operation of the screen or grizzly, but the mounting of the loose rings is such as to permit a slight yielding thereof in case there is any tendency to bind or clog. The "undersize" will pass between the rings or disks and fall through the grizzly directly to an "undersize" chute, while the "oversize" will be carried over and out of the stream by the rotation of the grizzly, and will fall into the "oversize" chute. The rotation of the framework not only will give a rotating motion to the loose rings which will carry forward the coarse ore, but also a slight up and down and oscillating motion, which will further tend to break up the ore stream and release the undersized particles, so that they will fall through the grizzly. The increased clearance between the adjacent rings at their lower edges which constitute the discharge portion of the screen will prevent any wedging of the undersized particles in the grizzly, with the result that it will be self-cleaning and thus operate at maximum efficiency. The fact that the screen elements extend and travel in the direction of travel of the "oversize" tends to reduce to a minimum the wear on these parts. "Undersize" material passing through the upper portions of the rings 7 and 8 has a free exit at the bottom portion of said rings by reason of the relatively larger opening at such portion, due to the fact that the loose rings 8 are larger than the fast rings 7. The described arrangement, in which the material is fed on top of the screen and travels circumferentially of the screen, gives a width of screening surface equal to the length of the screen, whereas, in screens of the trommel type, in which the material is fed into the interior of the screen and travels longitudinally or parallel to the rotative axis of the screen, the width of screening surface is limited to a relatively narrow zone at the concave lower part of the screen. Moreover in screens of the trommel type having circumferential screen bars, the axial travel of the material causes excessive wear and expenditure of power, due to the long path of travel of the material over and transverse to said bars, as compared with the short travel of the material parallel to the bars and over the top of the screen in the construction herein described.

With the larger openings at the discharge part of the screen at the bottom thereof and with the feed on top of and over the screen as herein described, there is no liability of the material entering between converging surfaces of the screen in the rotation thereof, and being crushed or subjecting the parts to undue strains.

Furthermore, the construction described is advantageous in that it requires no machine work aside from the bearings and the mounting of the frame bars in the heads; the parts being otherwise assembled in rough condition and at minimum expense.

In the form of the invention shown in Figs. 3 and 4 the rigid or fast screen members are formed as annular flanges 18 on disks 15 carried by the shaft of the rotating frame, said disks having lateral projections or lugs 16 provided with notches 17 in which the loose rings 19 are seated. These disks 15 alternate with disks 15′ having flanges 18′ acting as screen elements, all the disks 15 and 15′ being rigidly mounted on the carrying shaft 20 and being so spaced from one another and from the loose rings as to permit free passage of the "undersize" which it is desired to separate.

A similar construction is shown in Fig. 5, except that the lateral lugs or arms 21 on the disks 22 carried by the rotating shaft 23 engage with lateral notches 24 in the loose rings 25 to support said rings.

As shown in Fig. 6, the rings or screen elements, indicated at 26 and 27, may be provided with lateral lugs or projections 28 in staggered relation on adjacent rings to form the sizing screen. The rings or screen elements may be smooth, or, as shown in Fig. 7, the rings, indicated at 29, may be provided with peripheral notches 30. In some cases it may be desirable to form the rings or screen elements as shown at 31 and 32 in Fig. 8, with wavy undulating contour.

The screen elements may be formed as chains or flexible members, thus, as shown in Fig. 9, a series of chains 33 may be mounted on rotating carrier disks or wheels 34 spaced apart to provide for passage of the "undersize" therebetween. These chain members may alternate with rigid members, as shown at 35 in Fig. 10, or, as shown in Fig. 11, all of the screening elements may consist of chains 36 suspended from the rotating carrier wheels 27 and extending sufficiently below said carrier wheels to provide for lateral displacement of the chains at the lower portions thereof, so as to prevent any choking of such portions by descending "undersize" material. The screen elements may all be at the same level at their upper portions, or, as shown in Fig. 10, certain of said elements, for example, the rigid elements, may be at a different level from the intervening screen elements.

In the place of making the rings of different diameter, they may all be made of the same diameter, as shown in Fig. 12, said rings 39 being mounted on rotating carrier means 40 and certain of said rings may be loose and may be operated by reciprocating means 41 driven by crank or other driving devices 42, so as to move the lower portions of such loose rings back and forth to free any material which might tend to choke the lower portions of the revolving screen. Or, if desired, such reciprocating means may be omitted and the rings may, in some cases, be left free to move laterally at their lower portions, under the weight of the descending material, to allow such material to pass through. As shown in this figure all of the rings may be loose. The rings as shown in this figure are of larger diameter than the rotating carrier means, 20, as to rest on said carrier means at their upper portions, but to hang below and free of said carrier means at their lower portions.

The entire mechanism exposed to the stream of ore, rock, or gravel, will be made of materials that will resist abrasion, and those parts especially subject to wear may be made renewable.

What I claim is:

1. A revolving screen comprising a rotating supporting means, a plurality of screen elements extending in the direction of rotation of said supporting means, and supported at their upper ends on said means, said screen elements extending at substantially the same level at their upper parts to form a receiving portion, and extending at different levels at their lower parts forming a discharging portion with relatively larger discharge openings.

2. A construction as set forth in claim 1 and comprising in addition, means for feeding material to the top of the screen over said receiving portion.

3. A revolving screen comprising a rotatably mounted frame and a plurality of screen elements mounted on said frame to revolve therewith and extending in the direction of motion of the frame, said screen elements being supported at their upper portions on said frame, and certain of said screen elements being loosely mounted on the frame and being free at their lower portions to permit movement thereof transverse to the direction of motion of the rotating frame.

4. A rotating screen comprising a rotating frame, a plurality of screen elements mounted on said frame to revolve therewith, certain of said screen elements being rigidly mounted on the frame and alternate screen elements being loosely mounted on the frame and extending below the screen elements rigidly mounted on the frame to provide increased spacing at the lower portions of such screen elements.

5. A revolving screen comprising a rotating member, a plurality of rings rigidly mounted thereon, loose rings alternating with the aforesaid rings and mounted on the said frame, so as to be suspended from their upper portions and to be loose at the lower portions.

6. A construction, as set forth in claim 5, in which said loose rings are of larger diameter than the other rings to provide for increased spacing at the lower portions of the revolving screen.

In testimony whereof I have hereunto subscribed my name this 3rd day of May 1921.

HENRY KENYON BURCH.

A. G. McGREGOR.

APPARATUS FOR HANDLING COMMINUTED MATERIAL.

APPLICATION FILED JUNE 21, 1920.

1,422,997. Patented July 18, 1922.

3 SHEETS—SHEET 1.

Fig. 1

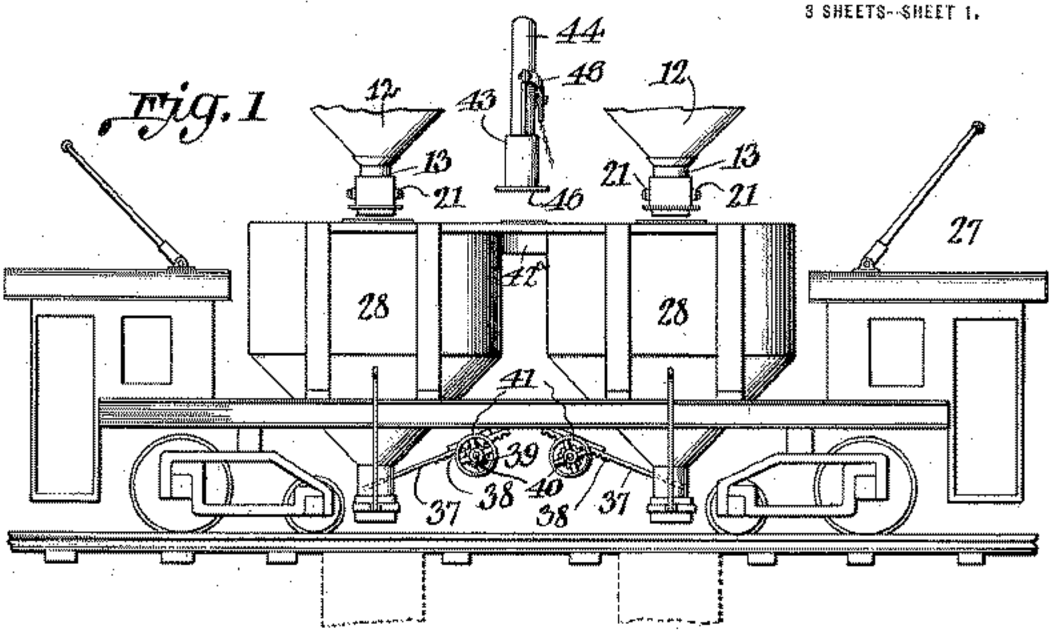


Fig. 5.

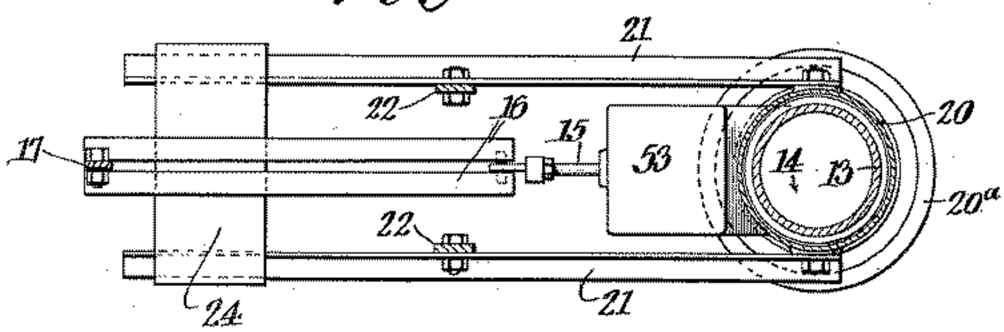
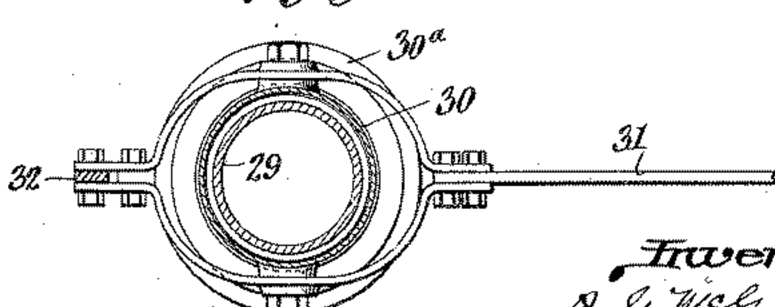


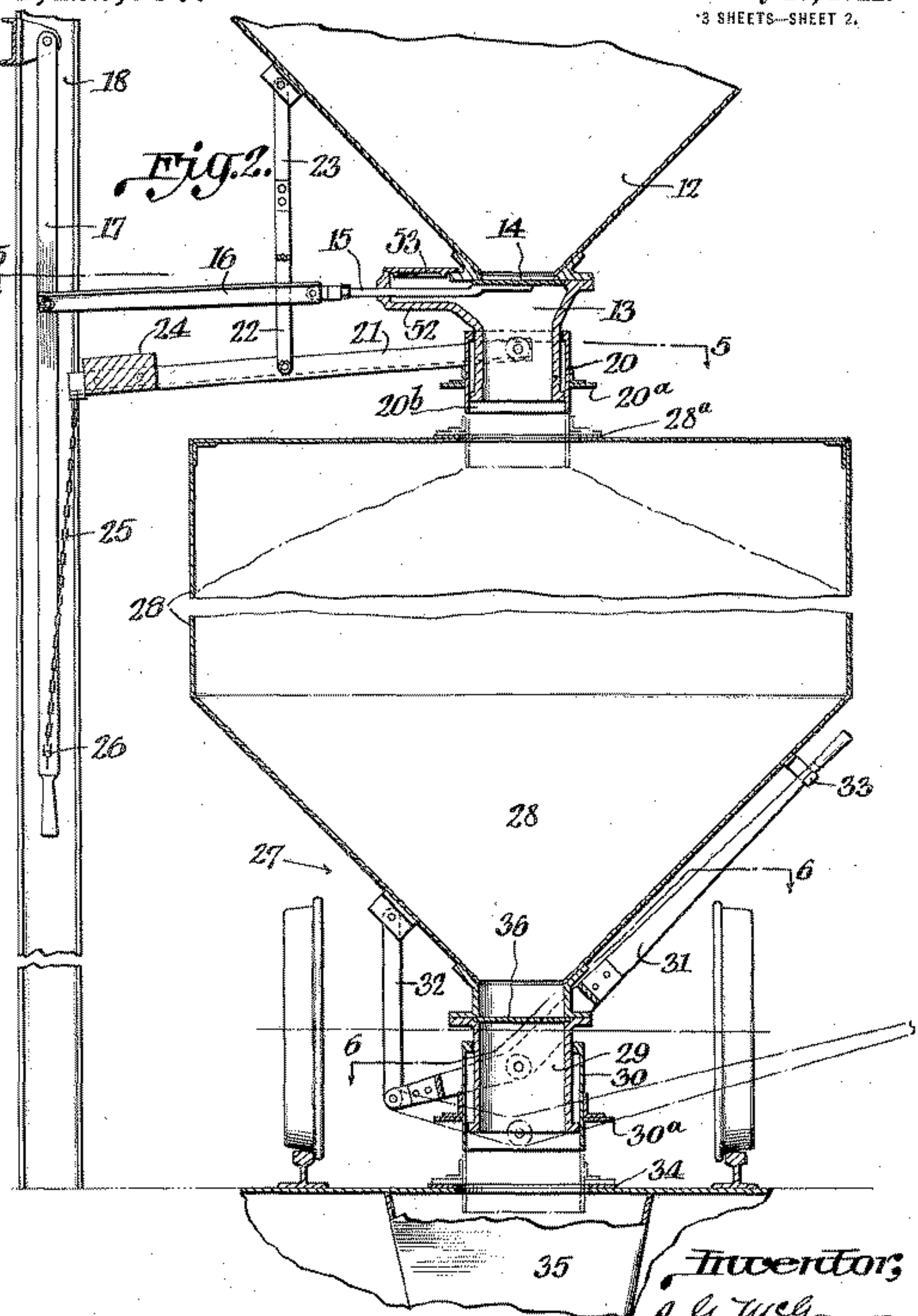
Fig. 6.



Inventor,
A. G. McGregor,
by Calver & Calver,
Attys.

A. G. McGREGOR.
APPARATUS FOR HANDLING COMMINUTED MATERIAL.
APPLICATION FILED JUNE 21, 1920.

1,422,997. Patented July 18, 1922.
3 SHEETS—SHEET 2.



Inventor;
A. G. McGregor,
by Calvert Tobin(?)

A. G. McGREGOR.
APPARATUS FOR HANDLING COMMINUTED MATERIAL.
APPLICATION FILED JUNE 21, 1920.

1,422,997.

Patented July 18, 1922.

3 SHEETS—SHEET 3.

Fig. 3.

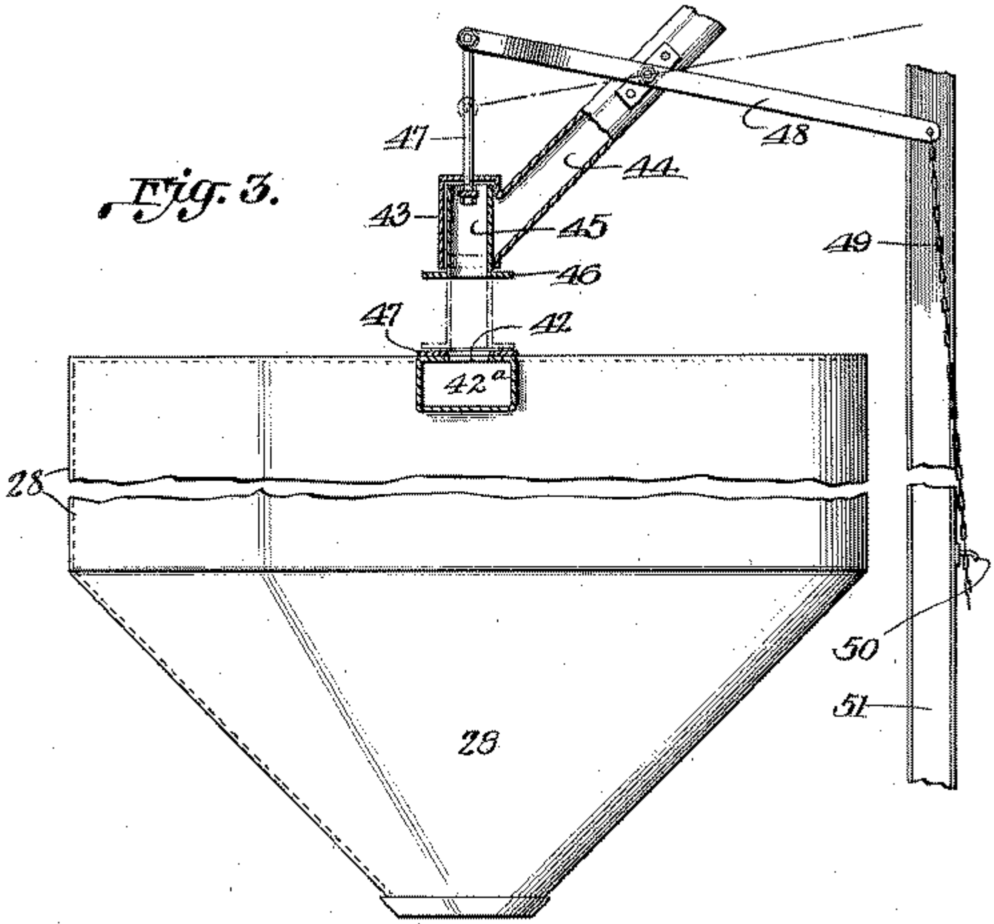
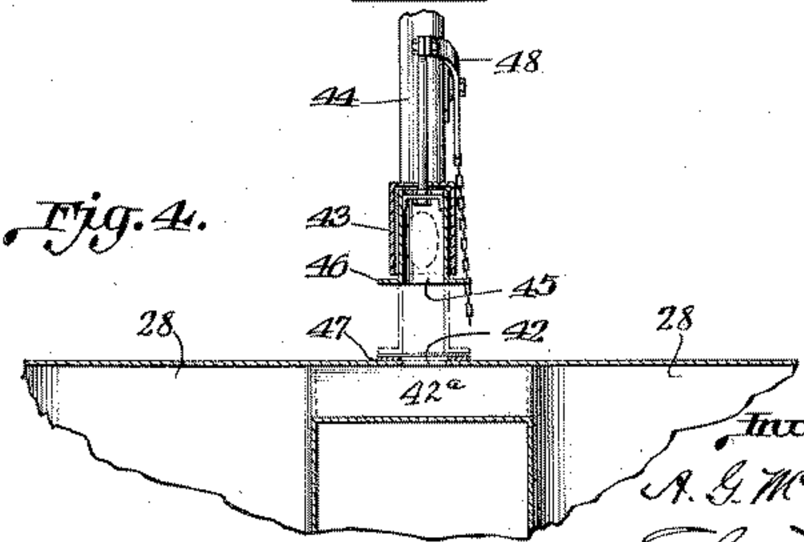


Fig. 4.



Inventor;
A. G. McGregor,
by Kalms Kalms
Attys.

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

APPARATUS FOR HANDLING COMMINUTED MATERIAL.

1,422,997. Specification of Letters Patent. Patented July 18, 1922.

Application filed June 21, 1920. Serial No. 390,466.

To all whom it may concern:

Be it known that I, ALEXANDER G. McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Apparatus for Handling Comminuted Material, of which the following is a specification, reference being had therein to the accompanying drawings.

In extracting copper from its ores, the ores or concentrates are often roasted in roaster furnaces, and the calcine, which is the product of the roaster furnaces, is smelted in reverberatory furnaces. Usually these roaster furnaces are some distance from the reverberatory furnaces, and the calcine is delivered from the roaster furnaces to the reverberatory furnaces in what are called calcine cars. Also the dust, which is called flue dust, and which is collected in dust chambers, Cottrell treaters and flues, is collected in the calcine cars and charged into the reverberatory furnaces.

According to the usual present practice, the calcine hopper of the roaster furnace has had a slide gate at its bottom, and a short spout or chute through which dust is drawn and deposited in the calcine car. The calcine car usually has an opening somewhat larger in diameter than the chute, and there is usually several inches clearance between the chute and the top of the car. The calcine is dusty, as is also the flue dust, with the result that much of the dust is thrown out of the car opening in the form of a cloud, causing a loss of valuable dust and causing serious annoyance to the attendant. Also, if the attendant does not watch closely, the gate in the chute may not be shut in time to prevent an overflow of dust on top of the car. Then when the car is moved to the furnace the wind blows the dust off the car, or it may be jarred from the top of the car, and this also entails loss of valuable dust.

Also in discharging calcine from the calcine cars into the bins or hoppers over the reverberatory furnaces there is much waste owing to the loose connections which have been employed between the discharging spouts of the calcine cars and the bins or hoppers over the reverberatory furnaces.

The present invention has for its object to prevent the loss of dust or calcine in charging and discharging the calcine cars. This object is effected by providing the discharge nozzles of the calcine hoppers of the roaster furnaces, as also the discharge nozzles of the calcine cars, with sliding sleeves so constructed and arranged as to make practically tight connections between the said bins or hoppers and the calcine cars when charging or filling the latter, and also practically tight connections between the calcine cars and the bins or hoppers of the reverberatory furnaces when discharging the calcine cars, all as will hereinafter more fully appear.

In the accompanying drawings Fig. 1 is a side view of a calcine car in charging or loading position. Fig. 2 is a vertical section of the same. Fig. 3 is a sectional elevation showing the vent connections and valve, and Fig. 4 is a detail section of the same taken at right angles to Fig. 3. Fig. 5 is a plan view, partly in section on the line 5—5, Fig. 2, showing the sleeve operating mechanism, and Fig. 6 is a detail section view on the line 6—6, Fig. 2.

In the accompanying drawings 12 denotes a portion of a calcine hopper or dust bin of a roaster furnace, this hopper or bin being provided with a discharge nozzle or outlet 13 the entrance to which, from said hopper, may be closed by a sliding gate 14, operated by a rod 15, connected by a link 16, to a lever 17, supported by a post 18. Encircling the outlet or nozzle 13 is a sleeve 20 which is normally held in lifted position by a two-part lever 21 fulcrumed on a fork 22 of a link 23, which is suspended from the hopper 12, said lever being preferably provided with a counter-balance 24. Connected with the lever 21 is a chain 25, which, when pulled down, may be held in lowered position by engagement with a hook 26 on the lever 17.

The calcine car 27 may comprise two receptacles or hoppers 28, each having an opening which may be brought into register with the outlets of the calcine hoppers of the roasters when it is desired to charge the receptacles of the said car with calcine from the calcine hoppers of the roasters. In order to make a close fit between a discharge outlet or nozzle 13 of a calcine hopper and a calcine car receptacle, the vertically movable sleeve 20 is mounted on said outlet or nozzle, said sleeve being provided with an exterior horizontal flange 20^a adapted to be lowered into contact with a seat 28^a on a receptacle of the calcine car, as denoted by dotted lines in Fig. 2 when the car is to be charged from the calcine hopper of the roaster. The sleeve 20 has a depending portion 20^b below said flange 20^a, which will prevent the receptacle 28 from becoming entirely filled so that there will be no overflowing dust spilling out on the top of the receptacle 28 even if the sliding gate remains open, there being sufficient space remaining in the said receptacle after the sliding gate 14 has been closed and the sleeve 20 has been lifted, so that the material which may have been stopped in the outlet nozzle 13 and the sleeve 20 can be accommodated in the receptacle 28 without overflowing the same, owing to the fact that the said depending portion 20^b extends down into said receptacle below the top thereof.

The nozzle or outlet 13 is constructed with a side extension 52 the chamber of which communicates with the chamber of said nozzle or outlet and through the chamber of which extension the rod 15 passes. The chamber of said extension receives the sliding gate 14 when the latter is in open position and said extension is provided with a removable cover 53 affording convenient access to the chamber of the extension for the purpose of cleaning out said chamber should it become clogged with dust.

The receptacle 28, preferably having a conical lower portion, is provided with a discharge outlet or nozzle 29 encircling which is a sliding sleeve 30 which will normally be held in a raised position by a lever 31 pivoted on a link 32 suspended from the receptacle 28, the upper end of said lever resting in a catch 33. By releasing said lever from said catch and lowering same to the position shown in dotted lines in Fig. 2 the sleeve 30, provided with a horizontal flange 30^a, may be lowered onto a seat 34 at the top of a bin or hopper 35, which will be over the reverberatory furnace. The said sleeve when lowered affords a tight connection between the discharge nozzle 29 and the said bin or hopper 35, as will be understood. The discharge nozzle or outlet 30 of receptacle 28 will normally be closed by a sliding gate 36 having an extension 37 provided with a rack 38 engaged by a pinion 39 on a shaft 40 provided with a hand-wheel 41. By turning the said hand-wheel the said sliding gate may be opened and closed, as will be apparent.

In charging the receptacles 28 of the calcine car it is necessary that there should be a vent for the air which will be displaced by the calcine dust entering the car, and to prevent loss of valuable dust with the escaping air a vent 42, which may be located over a passageway 42^a between two receptacles 28 will, when the car is being charged or filled with calcine dust, be brought beneath a barrel portion 43 at the lower end of a pipe or flue 44 leading to the roasting furnace or to a chamber communicating therewith and through which pipe or flue there will be an outward draft to the said roasting furnace or chamber. Within the barrel portion 43 of the said pipe or flue is a sleeve 45 having a horizontal flange 46 which may be lowered into contact with a seat 47 surrounding the vent opening 42. When the said sleeve is lifted, as shown in full lines in Figs. 3 and 4 it serves as a valve to close the lower end of the pipe or flue 44, and when it is lowered to the position shown in dotted lines in said figures it will make a tight connection between the barrel 43 and the vent 42 in the calcine car, the top of the said sleeve being open so that when lowered there will be a passageway from the said vent into the said pipe or flue 44. The sleeve 45 is held in lifted position by a link or connecting rod 47 which joins the same to a lever 48 pivoted on the pipe or flue 44, said lever being normally held in position to hold the sleeve 45 lifted by means of a chain 49 which may be attached to a hook 50 on a post 51.

The feature of providing the sleeve 20 with the depending portion or downward extension 20^b beneath the flange 20^a which limits the downward movement of said sleeve in filling a calcine car, and which extension prevents the car from being entirely filled, in that it extends down into the car below the top or cover thereof, as hereinbefore explained, is an important part of the present invention, in that it prevents the calcine from overflowing the top of the car from whence it is liable to be blown away and wasted.

From the foregoing it will be apparent that the calcine or flue dust from roasters may be handled, in transferring the same to reverberatory furnaces, without loss of valuable dust and without inconveniencing the workmen by clouds of escaping dust. While the invention is more particularly designed for use in handling calcine, as hereinbefore set forth, it will be understood that it is well adapted for handling any dusty comminuted material.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a calcine handling apparatus, the combination with a calcine receptacle having an outlet part, of a sliding sleeve mounted on said outlet part and having an exterior horizontal flange, a calcine car provided with a receptacle having a charging opening of approximately the diameter of said sleeve and which opening may be brought beneath said receptacle outlet part, and means for normally holding said sleeve in a lifted position but permitting it to be lowered into contact with said car receptacle, said means

comprising a lever connected with said sleeve, a link supported from said calcine receptacle, and means for holding down the outer end of said lever.

2. In a calcine handling apparatus, the combination with a calcine receptacle having a discharge nozzle, of a sliding sleeve mounted on said nozzle and having an exterior horizontal flange and a depending portion below said flange, a calcine car provided with a receptacle having a filling opening of approximately the diameter of said sleeve and which opening may be brought beneath said discharge nozzle, and means for normally holding said sleeve in a lifted position but permitting it to be lowered into contact with said car receptacle, said means comprising a lever connected with said sleeve, a link supported from said calcine receptacle, and means for holding down the outer end of said lever.

3. In a calcine handling apparatus, the combination with a calcine receptacle having a discharge nozzle, of a sliding gate for closing the entrance to said nozzle, an operating lever connected to said sliding gate, a sliding sleeve mounted on said nozzle and having an exterior horizontal flange, a calcine car, a receptacle mounted on said car and having a filling opening of approximately the diameter of said sleeve and which opening may be brought beneath said nozzle, and means for normally holding said sleeve in a lifted position but permitting it to be lowered into contact with said car receptacle.

4. In a calcine handling apparatus, the combination with a calcine receptacle having a discharge nozzle, of a sliding gate for closing the entrance to said nozzle, an operating lever connected to said sliding gate, a sliding sleeve mounted on said nozzle and having an exterior horizontal flange and a depending portion below said flange, a calcine car, a receptacle mounted on said car and having a filling opening of approximately the diameter of said sleeve and which opening may be brought beneath said nozzle, and means for normally holding said sleeve in a lifted position but permitting it to be lowered into contact with said receptacle.

5. A calcine receptacle having a discharge nozzle provided with a side extension affording a chamber communicating with the chamber of said nozzle, said extension having a removable cover, a sliding gate for closing said nozzle and which when in open position is received in the chamber of said extension, an operating rod for said sliding gate passing through the chamber of said extension, a calcine car, and a receptacle mounted on said car and having a filling opening which may be brought into register with said nozzle.

6. A calcine car having a receptacle with inclined lower part and a discharge nozzle communicating with the chamber of said receptacle, and a sliding sleeve fitted to said nozzle and having an exterior horizontal flange, and which sleeve may be brought into register with a bin into which the contents of said receptacle are to be discharged, with the said flange tightly closing the opening into said bin, combined with a sliding gate for closing said nozzle, and means for normally holding said sleeve in lifted position but permitting it to be lowered when necessary, said means comprising a lever connected with said sleeve, a link connected to said receptacle and on which said lever is fulcrumed, and a catch for holding said lever in lifted position.

7. In a calcine handling apparatus, a calcine car provided with a receptacle having a filling opening, means for tightly closing said opening when said receptacle is to be filled, said receptacle being provided with a vent, a dust pipe, and connecting means between said vent and said pipe, said connecting means comprising a barrel opening into said dust pipe, a sliding sleeve fitted to said barrel and serving, when lowered, to make a tight closure between said barrel and vent, and when lifted to serve as a valve to close the entrance from the chamber of said barrel to said dust pipe.

8. In a calcine handling apparatus, a car provided with a receptacle having a filling opening, means for making a tight connection between said opening and an overhead hopper when said receptacle is to be charged or filled with material from said overhead hopper, and means for preventing the said receptacle from becoming entirely filled, said means consisting of a sleeve or tube conducting the calcine or dust, the lower end of said sleeve, when the latter is in operative position, projecting down into and below the top of said receptacle, said sleeve having an exterior flange tightly closing said filling opening and serving to limit the downward movement of said sleeve and thus gage its extent of projection into said receptacle.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

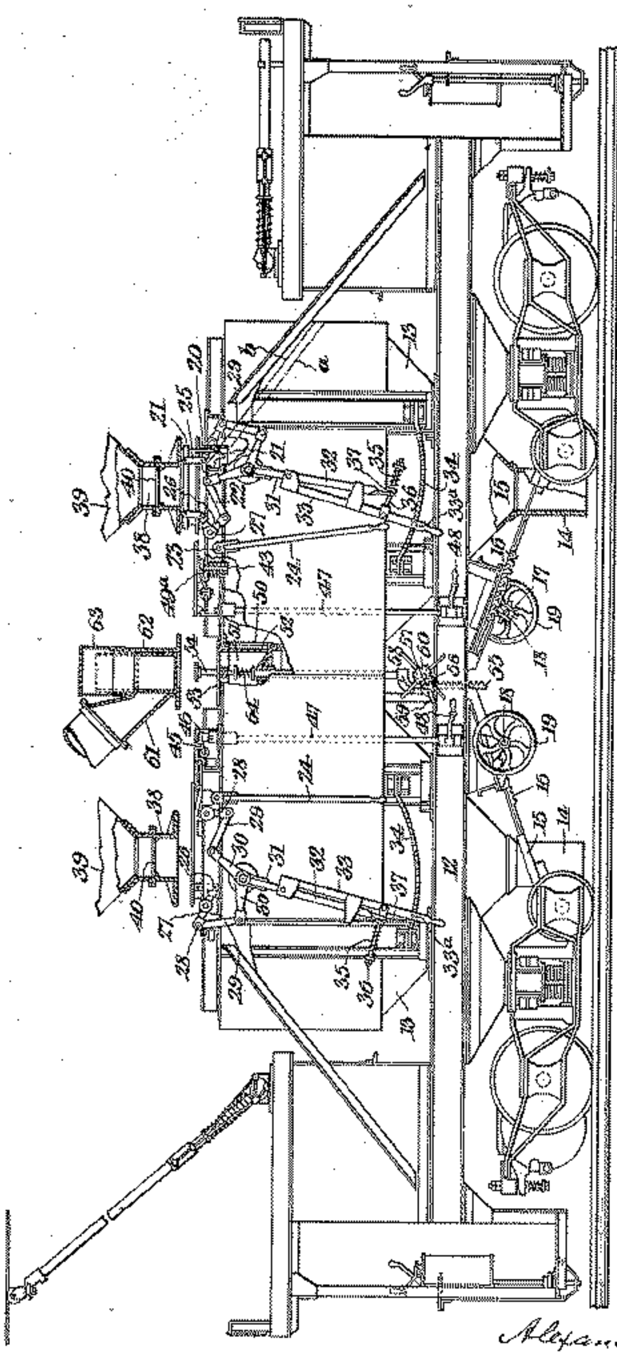
Apr. 10, 1923. 1,450,980

A. G. McGREGOR

CALCINE CAR

Filed Sept. 17, 1921 2 sheets-sheet 1

Fig. 1.



Inventor:

Alexander G. McGregor,

By Cabot Naber

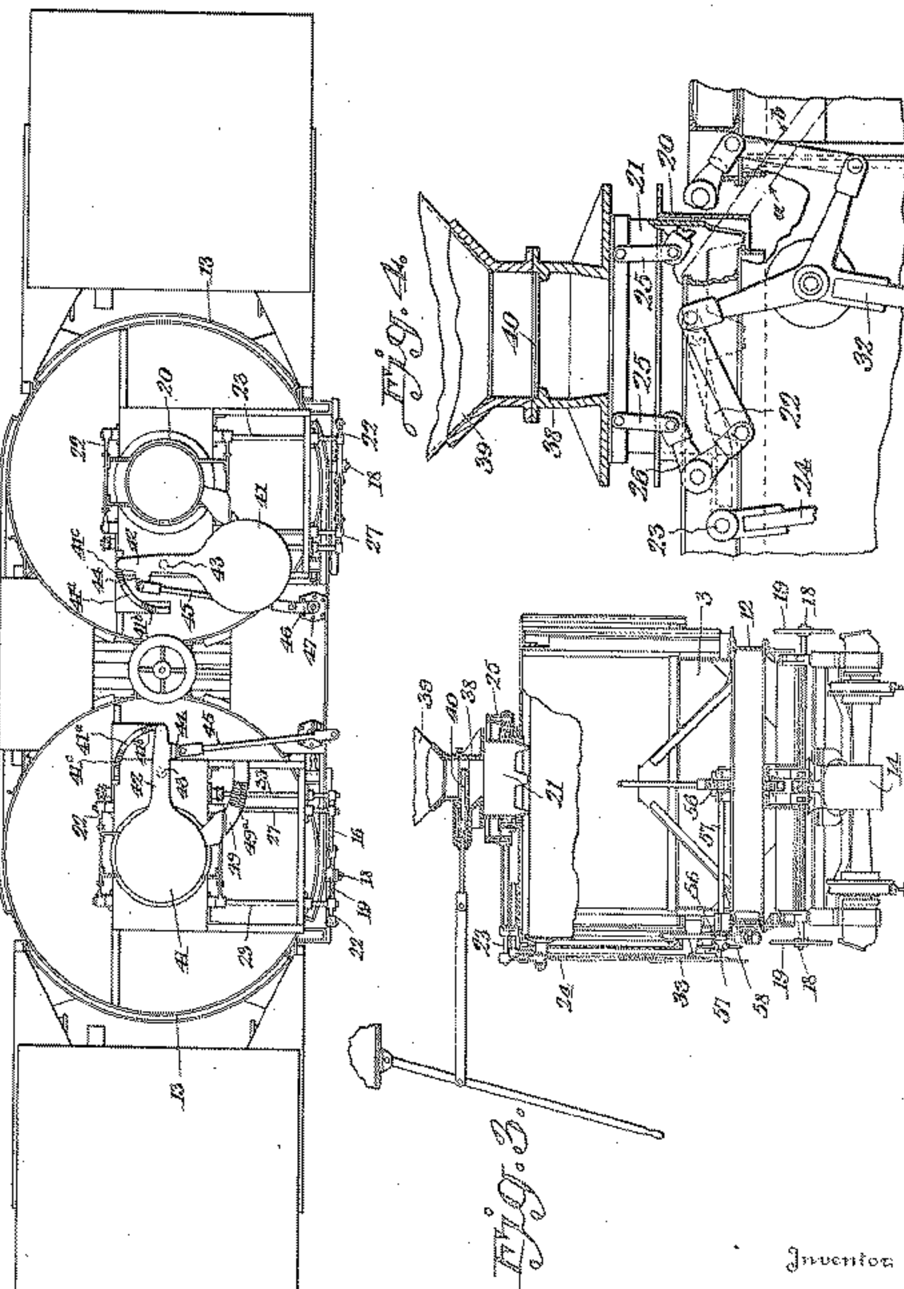
Attorneys

Apr. 10, 1923. 1,450,980

A. G. McGREGOR

CALCINE CAR

Filed Sept. 17, 1921 2 sheets-sheet 2



Inventor

Alexander G. McGregor,

By Calver & Calver

Attorneys

Patented Apr. 10, 1923. **1,450,980**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

CALCINE CAR.

Application filed September 17, 1921. Serial No. 501,383.

To all whom it may concern:

Be it known that I, ALEXANDER G. McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Calcine Cars, of which the following is a specification, reference being had therein to the accompanying drawings.

In extracting copper from its ore, the ores or concentrates are often roasted in roaster furnaces, and the calcine, which is the product of the roaster furnaces, is smelted in reverberatory furnaces. Usually these roaster furnaces are some distance from the reverberatory furnaces, and the calcine is delivered from the roaster furnaces to the reverberatory furnaces in what are called calcine cars. Also the dust, which is called flue dust, and which is collected in dust chambers, Cottrell treaters and flues, is collected in the calcine cars and charged into the reverberatory furnaces.

According to the usual present practice, the calcine hopper of the roaster furnace has had a slide gate at its bottom, and a short spout or chute through which dust is drawn and deposited in the calcine car. The calcine car usually has an opening somewhat larger in diameter than the chute, and there is usually several inches clearance between the chute and the top of the car. The calcine is dusty, as is also the fine dust, with the result that much of the dust is thrown out of the car opening in the form of a cloud, causing a loss of valuable dust and causing serious annoyance to the attendant. Also, if the attendant does not watch closely, the gate in the chute may not be shut in time to prevent an overflow of dust on top of the car. Then when the car is moved to the furnace the wind blows the dust off the car, or it may be jarred from the top of the car, and this also entails loss of valuable dust.

In the construction shown and described in my pending application filed June 21, 1920, Serial No. 390,466, the loss of valuable dust in filling calcine cars is prevented by means of flanged sleeves mounted at the lower ends of the discharge chutes below the hoppers or bins containing the fine calcine material, and which sleeves are lowered in contact with the tops of the calcine cars when the latter are being filled from the said hoppers or bins in which the fine calcine material is stored. As, however, there may be a large number, say a hundred or more, of chutes in a given plant, and only two or three calcine cars in operation in connection with these chutes, it is obvious that a considerable saving may be effected by equipping the cars, rather than the chutes, with means for making tight connections between the chutes and the cars when the latter are being loaded. It is therefore the object of this invention to provide effective means, mounted on the calcine cars, for making tight connections between the said cars and the chutes and for preventing waste of the valuable calcine dust during the filling or loading of the cars and after the cars have been filled, all as will hereinafter more fully appear.

In the accompanying drawings Fig. 1 is an elevation of a calcine car embodying my invention, the car being in loading position beneath the discharge chutes of the calcine hoppers or bins. Fig. 2 is a plan view of the calcine car shown in Fig. 1. Fig. 3 is a partly broken out end view of the same. Fig. 4 is an enlarged detail view showing the car in operative relation with the discharge chute of the calcine hopper.

Referring to the drawings, 12 denotes a portion of the framework of the car which may, generally, be of any usual or well-known construction, and which is equipped, beneath the framework, with the usual trucks comprising springs for cushioning the jars or vibration of the cars. Mounted on the car herein shown are two receptacles or hoppers 13 having depending discharge spouts or chutes 14 which may be closed by sliding gates 15 connected with rack bars 16 with which mesh pinions 17 on shafts 18 which may be operated by hand wheels 19. Each receptacle or hopper has at its top a filling opening at its otherwise closed top, and within each opening is an outer sleeve 20 provided with an annular flange, and, within each of said outer sleeves and telescopically movable therein, is an inner sleeve 21. For simplicity of description these similar devices on the two receptacles or hoppers 13 will now generally be referred to in the singular. The outer sleeve 20 has jointed connections with arms 22 carried by a rock shaft 23 suitably mounted at the top of the hopper and provided with a handle-lever 24 by which the said rock shaft may be operated to raise and lower the said outer sleeve, or to shake it up and down.

The inner sleeve 21 is connected by links 25 with arms 26 on rock shafts 27 mounted at the top of a receptacle 13, said rock shafts having other arms 28 connected by links 29 with two arms 30 of a three-armed lever, the third arm 31 of said lever having a long extension 32. An operating handle-lever 33 is pivotally connected near its outer end to the extension 32, said operating handle-lever having on its inner face a lug or tooth 33[a] for engagement with the teeth of a toothed bar or quadrant 34 so that said handle-lever may be maintained in any desired position of adjustment. The extension 32 of the arm 31 is yieldingly mounted with reference to the handle-lever 33 by virtue of a coil spring 35 on the bar or rod 36 attached to said handle-lever 33. The rod 36 is embraced by the slotted or forked lower end of the extension 32 and preferably abuts against a collar 37 slidingly mounted on said rod and which collar is yieldingly held against the said lower end of said extension 32 by said coil spring. The inner sleeve 21 may be lifted into contact with the lower end of a flanged discharge chute 38 of a storage bin or hopper 39 by operating the handle-lever 33, which handle-lever will be held in any desired position of adjustment by the toothed bar or quadrant 34; but as the car becomes filled, in loading, the said inner sleeve will still be held in close contact with said discharge chute, as the car settles on its springs, by virtue of the yielding connection just described and afforded by the coil spring 35.

To avoid waste or overflow of the material in filling a car receptacle the outer sleeve, when in its normal or lowered position, extends some little distance downward into the chamber of the car receptacle 13, so that when the said receptacle is filled and the material extends up into the discharge chute 38 the angle of repose of the top of the material, when the car is properly filled or loaded, will be denoted by the dotted line *a*. The calcine gate 40 in the chute 38 will now be closed, and then by shaking the outer sleeve by operating the handle-lever 24 back and forth, the material below the closed calcine gate may be caused to settle down into the car with an angle of repose about like that indicated by dotted line *b*. It will thus be understood that all of the material lodged in the lower end of the chute 38 and in the sleeve 21 may be caused to settle down below the top of the car receptacle 13, and there will be no material which will spill out on the top of said receptacle, to be blown about and thus wasted, when the inner sleeve 21 has been lowered to its normal position shown at the left of Fig. 1.

After the car hopper or receptacle has been filled the filling opening in the top of the car hopper will be closed by a swinging gate or cover 41, shown in closed position at the left part of Fig. 2, and in open position at the right part of said figure. The cover 41 is provided with an extension 42 suitably pivoted at 43 to the top of the car receptacle 13, said extension having a side lug 44 connected by a link 45 with a crank arm 46 at the upper end of an operating shaft 47 mounted at the side of the car and provided near its lower end with an operating handle 48 by which it may be turned in opening and closing the cover 41. The cover 41, when closed, fits tightly down on the top of the filling opening of the car hopper 13, and is frictionally held in closed position, by virtue of a guide bar 41[a] having inclines 41[b] and 41[c] over which the tail piece of the extension or shank 42 of the cover swings, and when being swung to open position the cover rests upon a guide bar 49 which is preferably provided with an inclined or cam portion 49[a] which, in co-operation with the incline 41[c] will raise said cover slightly as it is swung to open position and thus avoid a too strong frictional contact with the top of the receptacle by sagging down.

When the car hoppers or receptacles 13 are being filled from the storage bins or hoppers 39 there must necessarily be an escape of air which is replaced by the material running down into the car receptacles, and this air is, of course, laden with calcine dust. To this end each hopper or receptacle 13 is provided on one side near its top with an opening, as 50, which communicates with a vent chamber 51, said opening to said chamber being normally closed by a dust vent gate 52 having a partly open top 53. Connected with the gate 52 is a vertically movable lifting rod 54 to the lower end of which is attached a rack bar 55 which is engaged by a pinion 56 on a shaft 57 provided at one side of the car with a turnstile or handle-wheel 58. By turning the said turnstile or handle wheel 58 the vent gate 52 may be raised or lowered; and when in raised position backward rotation of the shaft 57 will be prevented by a pawl 59 engaging a ratchet wheel 60 on said shaft.

The vent chamber 51 is arranged to be placed in communication with a vent pipe 61 which will in turn be in connection with a suitable dust chamber, so that the calcine dust carried by the escaping air, as the car hoppers are being filled, will be conveyed to such dust chamber and will consequently be saved. The lower end of the dust vent pipe 61 is normally closed by a bucket gate or valve 62 adapted to be raised and lowered in a chamber afforded by a sleeve or hollow cylinder 63. The said bucket gate is lifted, by the pusher at the top of the rod 54, to permit an open passageway from the chamber last referred to to the dust vent pipe, when the vent gate 52 is lifted to open the vent openings 50 from the hoppers or receptacles or the cars to the vent chamber 51. The said vent gate 52 when lifted, affords a laterally closed passageway from the vent chamber 51 to the chamber of the cylinder 63, and thus to the dust vent pipe 61. To this end the vent gate lifting rod 54 is provided at its upper part with an extension 54ª the enlarged upper end of which will abut against the bottom of the bucket gate or valve 62 and lift the said gate or valve into the position denoted by dotted lines in Fig. 1 when the said vent gate is opened. A coil spring 64, encircling the valve lifting rod 54, enables the said rod to maintain the valves or gates 52—53 and 62 in their proper positions, when lifted, notwithstanding some slight settling of the car as it is being loaded.

Although the above description is mainly in the singular as describing one set of the devices as applied to one of the receptacles or hoppers 13, it will be understood that as these devices are duplicates the description of one set of devices will apply to the two sets shown and described, and where the invention as hereinafter claimed in the singular, as applied to the devices mounted on one calcine receptacle or hopper, it will be understood that claims which cover the invention in the singular will also cover the same in the plural.

In the use of my invention, when the calcine car is to be loaded, it is located as shown in Fig. 1 so that the openings in the tops of the receptacles or hoppers 13 are directly beneath the chutes 38 at the bottoms of the storage bins or hoppers 39 containing the calcine. The covers 41 of the openings in the tops of the car receptacles or hoppers 13 are then swung to open position as indicated at the right of Fig. 2, by operating the shafts 47 by their handles 48, said shafts being connected with said covers, as hereinbefore described. The vent gate 52 is then lifted to the position denoted in dotted lines in Fig. 1 by turning the trunstile or handle wheel 58, thus establishing a vent connection between the chambers of the car receptacles or hoppers and the dust vent pipe 61. The inner sleeves 21 are then lifted to the position shown at the right in Fig. 1 by operating the handle bars 33, and engaging the same with the rack bars or quadrants 34 several notches beyond the point which they would assume when the sleeves first bear against the flanges of the calcine chutes 38, so that the said inner sleeves will be held firmly against the said chutes even after the car settles due to the increased load on the car springs. The calcine gates 40 in the chutes 38 are then opened and the car receptacles allowed to fill, but owing to the outer sleeves 20, which extend down into the tops of the chambers of the car receptacles or hoppers, the said receptacles or hoppers will not be entirely filled, the angle of repose of the material, when the flow of the same ceases, being indicated by the dotted line *a*. The calcine gates 40 in the chutes 38 are then closed, and after this has been done the said inner sleeves will be shaken up and down by operating the handle levers 24, thus permitting the material which may be in the chutes 38 below the closed calcine gates 40 and within the inner sleeves 21, to flow down below the tops of the car receptacles or hoppers, the material at this time assuming an angle of repose as above indicated by the dotted line *b*. This avoidance of the over filling of the car receptacles, prevented by the outer sleeves 20, obviates the necessity of closely watching the filling or loading operation and avoids spilling the valuable calcine dust on the tops of the receptacles, to be blown away and wasted.

The outer sleeves are then allowed to drop down so that their peripheral flanges rest on the tops of the car receptacles or hoppers and the inner sleeves are then lowered so that they rest on the outer sleeves, as denoted at the left part of Fig. 1. The pawl 59 is then released from the ratchet wheel 60 and the turnstile or handle wheel is operated to lower the vent gate 52 to the position denoted in full lines in Fig. 1, thus lowering the bucket gate 62, and closing the lower end of the dust vent pipe 61. The covers 41 will then be swung back over the filling openings in the tops of the car receptacles or hoppers by reversely operating the handles 48 on the shafts 47 connected with said covers, the latter being now held down tightly over the said opening by the means hereinbefore described. This closing of the receptacles 13 by the covers 41 is desirable for the reason that small clouds of calcine dust will otherwise continue to rise through the filling openings after the filling or charging operation has stopped.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. A calcine car provided with a receptacle having a closed top with a filling opening therein, and vertically extensible means mounted on said receptacle for forming a laterally closed conduit between said filling opening and a chute at the bottom of a storage bin.

2. A calcine car provided with a receptacle having a closed top with a filling opening therein, and yielding, vertically extensible means mounted on said receptacle for

forming a laterally closed conduit between said filling opening and a chute at the bottom of a storage bin.

3. A calcine car provided with a receptacle having a closed top with a filling opening therein, and vertically extensible means mounted on said receptacle for forming a laterally closed conduit between said filling opening and a chute at the bottom of a storage bin, said extensible means comprising a vertically movable sleeve normally resting on the top of said receptacle.

4. A calcine car provided with a receptacle having a closed top with a filling opening therein, and yielding, vertically extensible means mounted on said receptacle for forming a laterally closed conduit between said filling opening and a chute at the bottom of a storage bin, said extensible means comprising a vertically movable sleeve normally resting on the top of said receptacle.

5. A calcine car having a receptacle with a closed top provided with a filling opening, a sleeve within said opening, a lever and suitable connections to said sleeve whereby said sleeve may be lifted into contact with a chute at the bottom of a storage bin, to form a laterally closed conduit, when said receptacle is to be filled, and means for holding said lever in any desired position of adjustment.

6. A calcine car having a receptacle with a closed top provided with a filling opening, a sleeve within said opening, a lever and suitable connections to said sleeve whereby said sleeve may be lifted into contact with a chute at the bottom of a storage bin, to form a laterally closed conduit, when said receptacle is to be filled, and means for holding said lever in any desired position of adjustment, said connections between said lever and said sleeve comprising a spring-pressed member so that said sleeve will be held up against said chute when the car settles as the load on the car increases.

7. A calcine car having a receptacle with a closed top provided with a filling opening, a sleeve within said opening, a lever and suitable connections to said sleeve whereby said sleeve may be lifted into contact with a chute at the bottom of a storage bin, to form a laterally closed conduit, when said receptacle is to be filled, means for holding said lever in any desired position of adjustment, an outer sleeve surrounding said first-named sleeve within said opening, said outer sleeve normally extending down into the top of the chamber of said receptacle, and means for lifting and shaking said outer sleeve when desired.

8. A calcine car having a receptacle with a closed top provided with a filling opening, a sleeve within said opening, a lever and suitable connections to said sleeve whereby said sleeve may be lifted into contact with a chute at the bottom of a storage bin, to form a laterally closed conduit, when said receptacle is to be filled, means for holding said lever in any desired position of adjustment, said connections between said lever and said sleeve comprising a spring-pressed member so that said sleeve will be held up against said chute when the car settles as the load on the car increases, an outer sleeve surrounding said first-named sleeve within said opening, said outer sleeve normally extending down into the top of the chamber of said receptacle, and means for lifting and shaking said outer sleeve when desired.

9. A calcine car receptacle provided at or near its top with an air and dust vent opening to a vent chamber, a vent gate mounted on said car, for normally closing said opening and adapted, when lifted, to form a tubular connection with a vent dust pipe, and means on said car for lifting said gate to opened position.

10. A calcine car receptacle provided at or near its top with an air and dust vent opening to a vent chamber, a vent gate mounted on said car, for normally closing said opening and adapted, when lifted, to form a tubular connection with a vent dust pipe, means on said car for lifting said gate to opened position, a rod for lifting said gate, a rack and pinion for operating said rod, means for operating said rack and pinion, and means for holding said gate in lifted position.

11. A calcine car receptacle provided at or near its top with an air and dust vent opening to a vent chamber, a vent gate mounted on said car, for normally closing said opening and adapted, when lifted, to form a tubular connection with a vent dust pipe, means on said car for lifting said gate to opened position, a rod for lifting said gate, a rack and pinion for operating said rod, means for operating said rack and pinion, means for holding said gate in lifted position, a shaft by which said pinion is carried, a ratchet-wheel on said shaft, and a detent pawl for engaging said ratchet wheel to hold it against backward movement.

12. A calcine car receptacle provided at or near its top with an air and dust vent opening to a vent chamber, a vent gate mounted on said car, for normally closing said opening and adapted, when lifted, to form a tubular connection with a vent dust pipe, means on said car for lifting said gate to opened position, a rod for lifting said gate, a rack and pinion for operating said rod, means for operating said rack and pinion, means for holding said gate in lifted position, and yielding means, movable with said gate, for opening a gate which normally closes the lower end of said vent dust pipe.

13. A calcine car receptacle having a

closed top provided with a charging opening, a horizontally swinging cover for closing said opening, said cover having an extension by which it is pivoted to the top of said receptacle, and an inclined guide-bar on said receptacle over which the tail piece of said extension may swing and by virtue of which guide-bar and tail piece said cover is held tightly down over said opening, when closed.

14. A calcine car receptacle having a closed top provided with a filling or charging opening, a horizontally swinging pivoted cover for closing said opening, and means for operating said cover to open and close said opening, said operating means comprising a vertical shaft having a handle at its lower part, a crank at the upper end of said shaft and a link connecting said crank with said pivoted cover.

15. A calcine car receptacle having a closed top provided with a charging opening, a horizontally swinging cover for closing said opening, said cover having an extension pivoted to the top of said receptacle, said extension having a tail piece, means for operating said cover to open and close said opening, and an inclined guide bar arranged to be engaged by said tail piece, for lifting said cover slightly as it is swung to open position.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

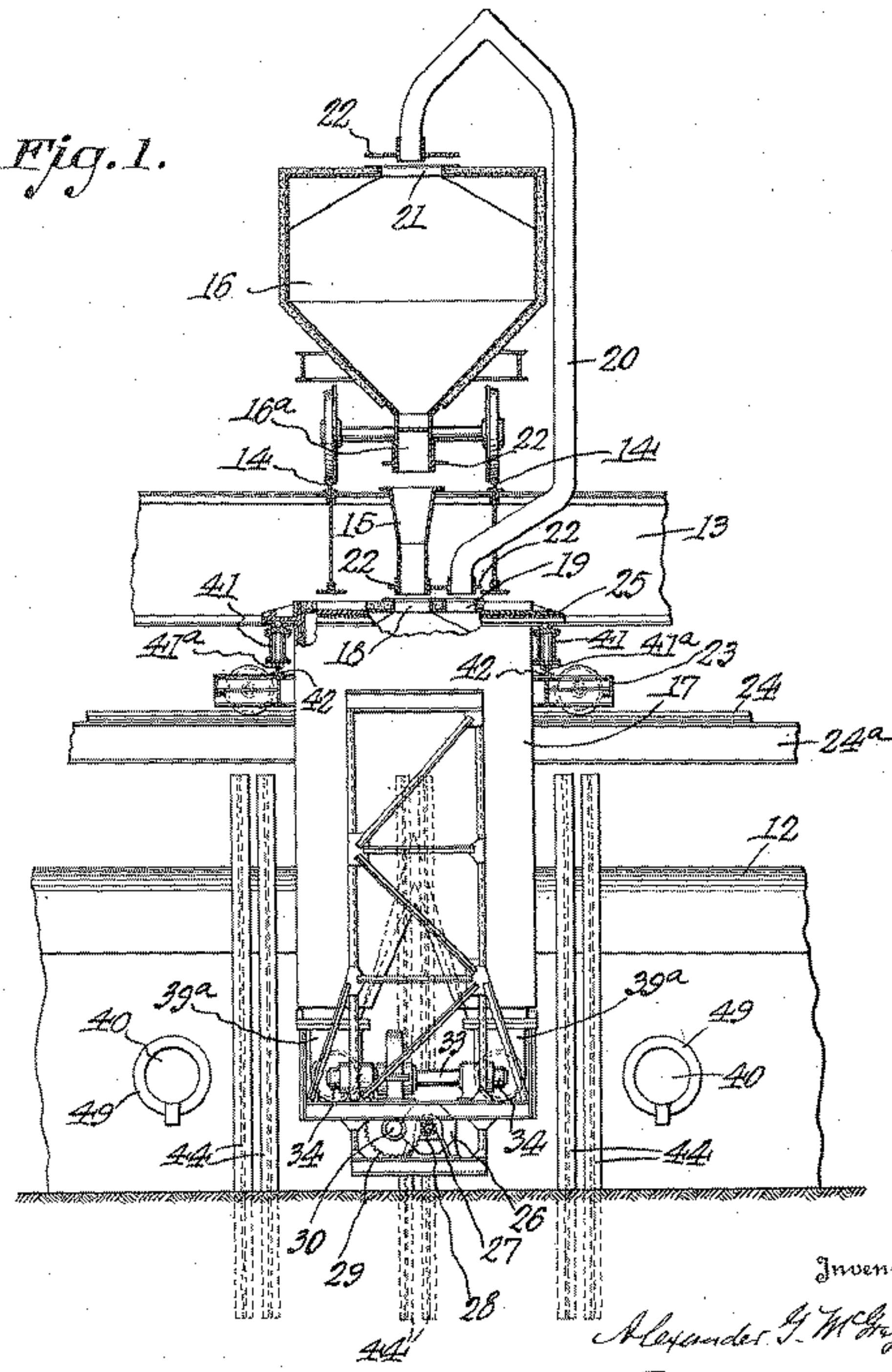
July 17, 1923. **1,461,801**

A. G. McGREGOR

APPARATUS FOR CHARGING REVERBERATORY FURNACES

Filed Jan. 9, 1922 3 Sheets-Sheet 1

Fig. 1.



Inventor:

Alexander G. McGregor,

By Calvert Nater, Attorneys.

July 17, 1923. 1,461,801

A. G. McGREGOR

APPARATUS FOR CHARGING REVERBERATORY FURNACES

Filed Jan. 9, 1922 3 Sheets-Sheet 2

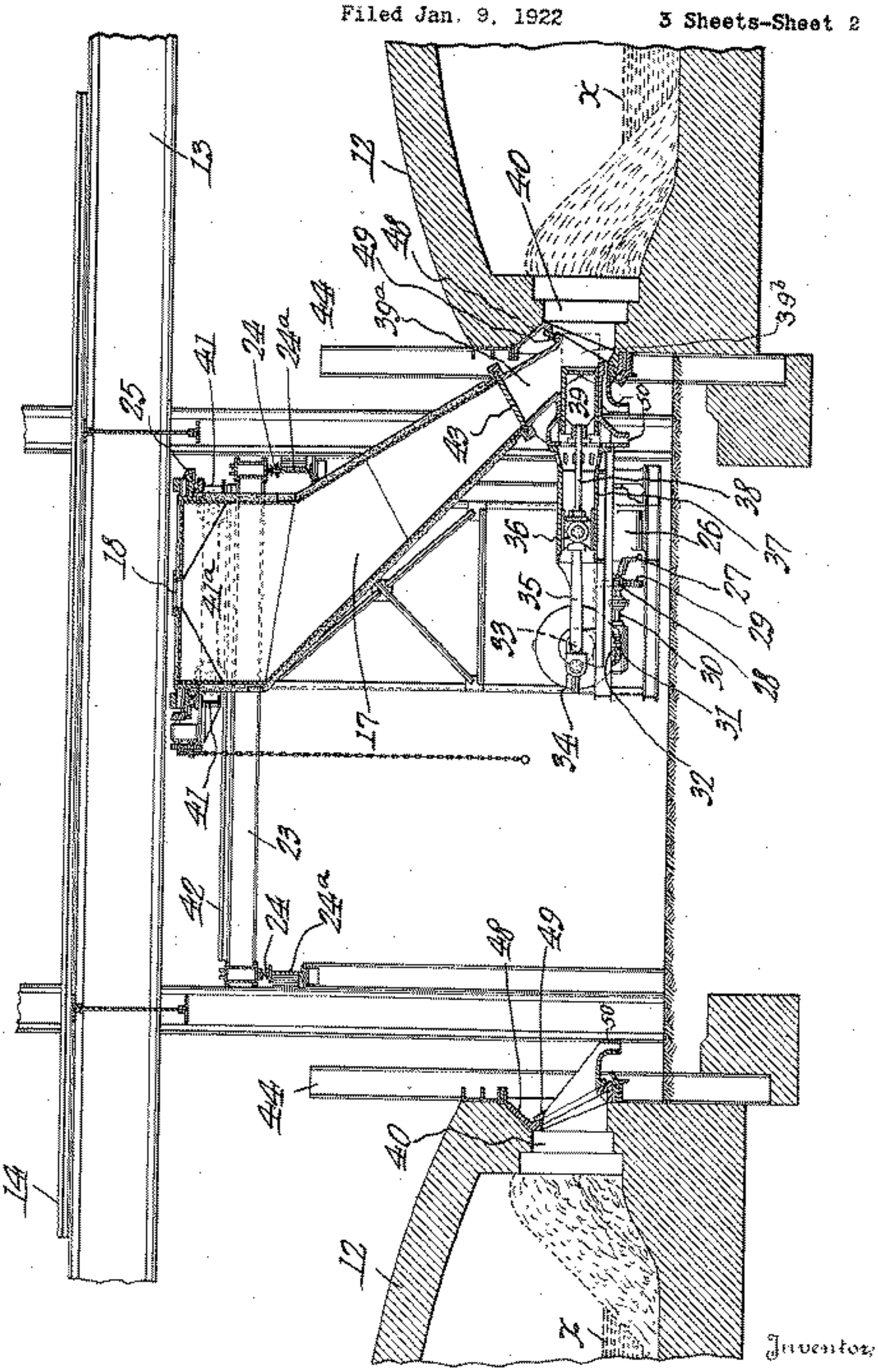


Fig. 2.

Inventor

Alexander G. McGregor,

By

Attorneys

A. G. McGREGOR

APPARATUS FOR CHARGING REVERBERATORY FURNACES

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Fig. 3.

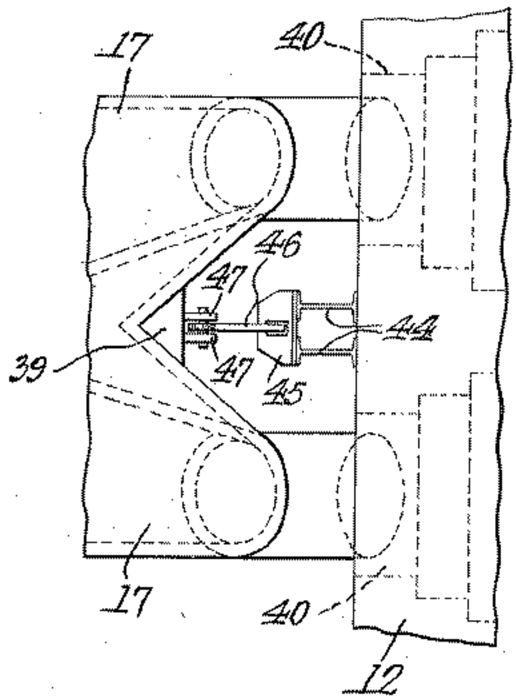
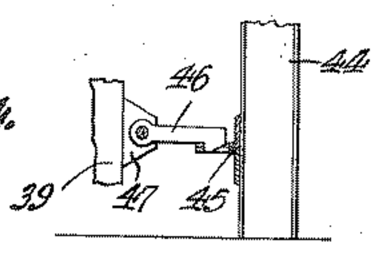


Fig. 4.



Inventor:

Alexander G. McGregor,

By Watson & Watson,

Attorneys

Patented July 17, 1923. **1,461,801**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

APPARATUS FOR CHARGING REVERBERATORY FURNACES.

Application filed January 9, 1922. Serial No. 527,987.

To all whom it may concern:

Be it known that I, ALEXANDER G. McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Apparatus for Charging Reverberatory Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to apparatus for charging reverberatory furnaces and which is intended to obviate certain difficulties heretofore existing, as set forth in my application Serial No. 420,645, filed October 30, 1920, the present invention having for its object to provide certain improvements on the apparatus described in my said application whereby the furnaces are charged through openings in the side walls thereof in such a manner as to deposit the charges inside the furnace walls just above the slag line, so that in each instance the new charge is pushed in back of and beneath the previous charge with the result that the charges advance from the side walls of the furnace step by step growing hotter as they advance until they finally become exposed to the intense heat of the furnaces and are smelted down and dissolved in the molten bath of the furnace, as fully set forth in my said application.

In the accompanying drawings Fig. 1 is a sectional elevation of an apparatus embodying the present invention, and Fig. 2 is a sectional view, taken at right angles to Fig. 1, of the apparatus shown in the lower part of Fig. 1, together with fragmentary sectional views of two furnaces between which the apparatus is located. Fig. 3 is a detail plan and Fig. 4 a detail elevation or side view illustrating means for holding the charging carriage in place during a charging operation.

Referring to the drawings, two reverberatory furnaces 12 are fragmentarily shown in Fig. 2. 13 denotes an elevated support for tracks 14 on which a calcine car, comprising a suitable hopper, may run. The support 13 will, in practice, be provided with a series of chutes 15 with one of which the discharge spout 16ª of the calcine car hopper 16 may be brought into register when the charging hopper 17 is to be filled from the calcine car, said hopper 17 having at its top an opening 18 which will be brought beneath and into register with a chute 15. The hopper 17 is also provided with a vent opening 19 which will be brought into register with the lower end of a vent pipe 20 the upper end of which is turned down so as to register with an opening 21 in the top of the calcine car hopper when the contents of the latter are to be discharged, the said vent pipe 20 being, it is understood, mounted on and stationary with the support 13. The escape of dust, when the hopper 17 is being charged, will be prevented by flanged sleeves 22 at the upper and lower ends of the vent pipe 20 and also on the discharge spout 16ª of the hopper 16, and the lower end of the chute 15, these sleeves being at this time lowered so that the flanges thereof rest on the parts beneath them. The dust escaping from the charging hopper 17, when the latter is being filled from the calcined car, will be returned to the calcined car hopper 16 through the vent pipe 20, as will be understood.

The charging hopper 17 is indirectly supported by a crane bridge 23 having wheels 23ª adapted to run on tracks 24 extending parallel to the furnace walls and resting on girders or beams 24ª, said crane bridge supporting a turn table device 25 from which the hopper 17 is suspended in such a manner that the charging machine may be partially rotated so as to be adapted to charge two furnaces which are located opposite each other.

The apparatus thus far described is similar to that set forth in my application No. 420,645, hereinbefore referred to, and the present improvement relates more particularly to the means for positively forcing the charges from the hopper 17 into the furnaces. Suitably supported beneath the hopper 17 is an electric motor 26 having a shaft 27 on which is mounted a pinion 28 meshing with a gear wheel 29 on a shaft 30 carrying a worm 31 meshing with a worm wheel 32 on a shaft 33 provided with cranks 34. The cranks 34 are connected by pitmen 35 to slides 36 to which the said pitmen are jointed and which slides 36 work in suitable guideways 37. To the slides 36 are connected rods 38 which operate plungers 39 working in suitable guideways in a discharging casting 39ª which is formed at its top with openings communicating with the openings or discharge mouths at the lower end of the charging hopper 17.

The side walls of the furnaces 12 are provided with inwardly enlarged and preferably stepped openings 40, the lower edges of the outer parts of which are preferably about on a level with or only slightly above the slag line x of the furnace to be charged, and when the charging operation is to be performed the crane bridge 23, supporting the charging hopper 17, is moved along on the tracks 24 so as to bring the plungers 39 into register with the said openings 40 in the side walls of the furnaces. The charging hopper 17 is supported directly by the turntable 25 mounted on a charging carriage 41 having wheels 41^a adapted to run on tracks 42 mounted on the crane bridge 23 and extending at right angles to the tracks 24, so that the said hopper-supporting and charging carriage and other parts connected therewith may be moved toward and from the furnaces on the said tracks 42. Thus after the plungers 29 have been brought into register with the openings 40 in the side walls of a furnace the carriage 41 and the charging hopper and other parts supported therefrom will be moved toward a furnace wall on the said tracks 42 so as to bring the lower end of the charging hopper close to the wall of the furnace to be charged, as shown in Fig. 2. The motor 26 will then be thrown into operation and, through the reducing gearing hereinbefore described, will operate the cranks 34 which will in turn move the plungers 39 back and forth, thereby forcing the successive charges, in the form of blocks or plugs through the said openings 40 in the side walls of the furnace. When the hopper is to be moved from one set of openings 40 to another the plungers 39 will be moved forward to the position denoted by dotted lines in Fig. 2 so as to close the chutes or openings in the casting 39^a and which chutes or openings communicate with the discharge mouths of the charging hopper 17, so that no material will be wasted when the carriage is shifted from one charging position to another. The casting 39^a is preferably provided with a sliding gate 43 which may be closed when it is desired to prevent the calcine from passing down into the chutes in said casting.

Of course when a charging operation is occurring it is necessary to provide some means for holding the charging carriage in place against the furnace in opposition to the thrust of the charging plungers 39, and this may be done by any suitable means. A simple holding device by which the charging carriage may be anchored in charging position is shown in Figs. 3 and 4. Attached to the buck-stays 44 of the furnace is a catch 45 adapted to be engaged by a hook or latch 46 pivotally mounted on ears 47 on the casting 39. Thus when the charging carriage 41 is moved on the tracks 42 toward the furnace 12 to charging position the hook or latch 46 will engage the catch 45, by gravity, and thus anchor the charging carriage in place for the charging operation.

When the furnace is sufficiently charged at one point the holding device or anchor for the charging carriage will be released, the carriage moved backward on the tracks 42 far enough to remove the discharging parts of the casting 39^a from the stationary parts on the furnace, and the bridge crane 23 will be moved along on the tracks 24, parallel with the furnace wall, to bring the charging machine to a new charging position opposite other openings 40 in the furnace wall, and the charging operation just described will be repeated. When the entire side of a furnace has been charged the turntable supporting charging machine may be given a half revolution to bring the parts in position for charging an oppositely located furnace.

Mounted on the side wall of the furnace is a plate or casting 48 having openings registering with the openings 40 in the said side wall, the said plate or casting having an outward slope downwardly. Attached to said plate or casting 48, preferably by bolts passing through slots permitting adjustment, is a second sloping plate or casting 49 also having openings registering with the openings in said plate or casting 48. The plate or casting 49 may be so adjusted, when being attached in place, that its openings will register properly with the discharge mouths of the casting 39^a. The discharge end portion of the casting 39^a, in which the plungers 39 work, is formed sloping, corresponding to the outwardly and downwardly sloping parts of the plates or casings 48 and 49, said lower end of said casting 39^a being entered into the openings in the said plates or castings 48 and 49 when the charging machine is in charging position against the furnace wall.

The faces of the castings 48 and the recessed faces of castings 49, as also the discharge ends of castings 39^a are sloped outward downwardly. The slope of these parts corresponds approximately to the repose angle of the charge material, so that when the charging machine is withdrawn from the furnace only a little, if any, of the charge material will fall back toward the outside of the furnace and none will fall outside of the lower part of casting 49.

The passageways or openings 40 in the furnace walls between the plungers and the inside of the furnace, for the charge material, increase in cross sectional area toward the inside of the furnace. This greatly reduces the frictional resistance to the movement of the charges from the plungers to the inside of the furnace, compared with what it would be if the inside diameters of the charge openings 40 in the furnace wall were uniform throughout and only a little larger than the outside diameter of the discharge ends of castings 39^a.

From the foregoing it will be understood that the present invention comprises means whereby successive charges in the forms of comparatively thin blocks or plugs of calcine or other powdered material may be successively forced into the openings in the side walls of reverberatory furnaces in a low down position, so that each new charge will be forced beneath and back of the previous charge and the material to be smelted will thus accumulate against the side walls of the furnace in such a manner as to protect the same, while the material first charged into the furnace will be subjected to the greatest heat and the succeeding charges will be successively heated, as hereinbefore stated.

Any surplus dust in the plunger chambers or casing 39^a will be discharged through the spouts 50 into any suitable receptacles or bags, and thus be saved.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. The combination with a reverberatory furnace the side walls of which are provided with charging holes located down near the slag line of the molten material, of a travelling charging machine comprising a hopper for the material to be entered into the furnace, a motor mounted on said machine to travel therewith, a charging member communicating at its top with the chamber of said hopper, one of more plungers working in said charging member, said connecting operating mechanism comprising a shaft operated by said motor, a second shaft geared to the motor shaft and provided with a worm, a crank shaft having a worm-wheel meshing with said worm, and one or more cranks connected with said plunger or plungers.

2. The combination with a reverberatory furnace the side walls of which are provided with charging holes down near the slag line of the molten material, of a sloping plate mounted on the furnace wall and having openings registering with the openings in said wall, a hopper for the material, a discharging member or casting having a chamber communicating with said hopper and having a discharge mouth which is formed sloping to correspond to said plate, one or more plungers working in said discharging member, and means for operating said plunger or plungers.

3. The combination with a reverberatory furnace the side walls of which are provided with charging holes down near the slag line of the molten material, of a sloping plate mounted on the furnace wall and having openings registering with the openings in said wall, a hopper for the material, a discharging member having a chamber communicating with said hopper and having a discharge mouth which is formed sloping to correspond to said plate, one or more plungers working in said discharging member, means for operating said plunger or plungers, and a movable carriage on which said hopper, discharging member, plunger or plungers and operating means are mounted.

4. The combination with a reverberatory furnace the side walls of which are provided with charging holes down near the slag line of the molten material, of a sloping plate mounted on the furnace wall and having openings registering with the openings in said wall, a hopper for the material, a discharging member having a chamber communicating with said hopper and having a discharge mouth which is formed sloping to correspond to said plate, one or more plungers working in said discharging member, means for operating said plunger or plungers, a movable carriage on which said hopper, discharging member, plunger or plungers and operating means are mounted, and a turn-table on said carriage supporting said hopper, discharging member, plunger or plungers and operating mechanism, so that when one side of a furnace has been charged the charging machine as a whole may be turned about to charge an oppositely placed furnace.

5. A reverberatory furnace having down near the slag line inwardly enlarged stepped openings in its side wall, combined with a charging machine comprising one or more reciprocating plungers for forcing material through said openings into the furnace chamber, and means for operating said plunger or plungers.

6. A reverberatory furnace having down near the slag line inwardly enlarged stepped openings in its side wall, combined with a charging machine comprising one or more reciprocating plungers for forcing material through said openings into the furnace chamber, means for operating said plunger or plungers, and a movable carriage on which said charging machine is mounted.

7. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more chambers in which said plunger or plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers.

8. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more chambers in which said plunger or

plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, a hopper surmounting said plunger casing and communicating with the latter, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers.

9. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more members in which said plunger or plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers, the discharge mouth or mouths being materially larger in diameter than the plunger chamber or chambers, and the smaller parts of the said openings in the furnace wall being materially larger than the said discharge mouth or mouths.

10. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more chambers in which said plunger or plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, a hopper surmounting said plunger casing and communicating with the latter, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers, the discharge mouth or mouths being materially larger in diameter than the plunger chamber or chambers, and the smaller parts of the said openings in the furnace wall being materially larger than the said discharge mouth or mouths.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

Jan. 20, 1925. 1,523,435

A. G. McGREGOR

CRUSHING AND SEPARATING PLANT

Filed May 1, 1923 3 Sheets-Sheet 1

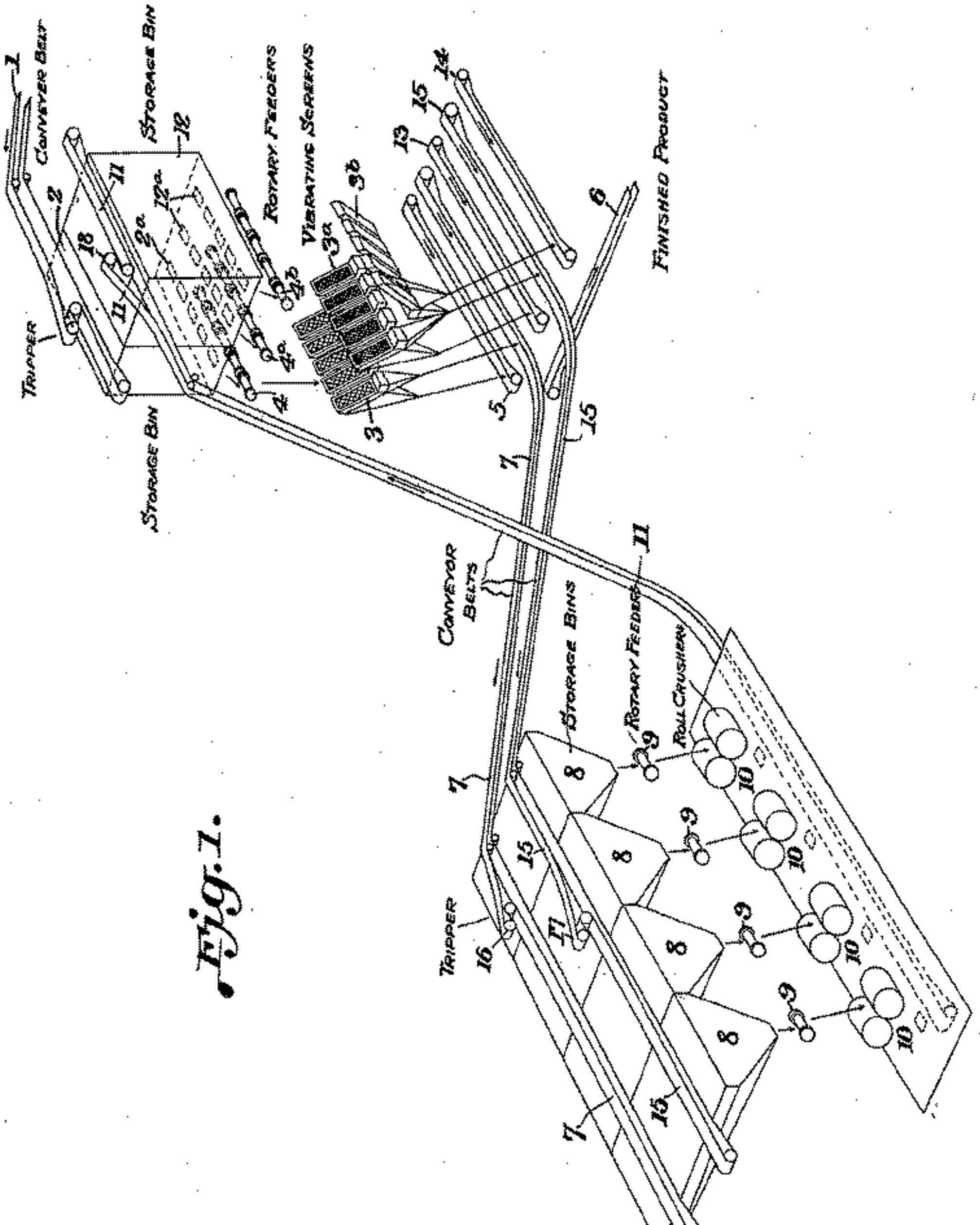


Fig. 1.

Inventor:
Alex. G. McGregor,

By Calvert Calvert,
Attorney

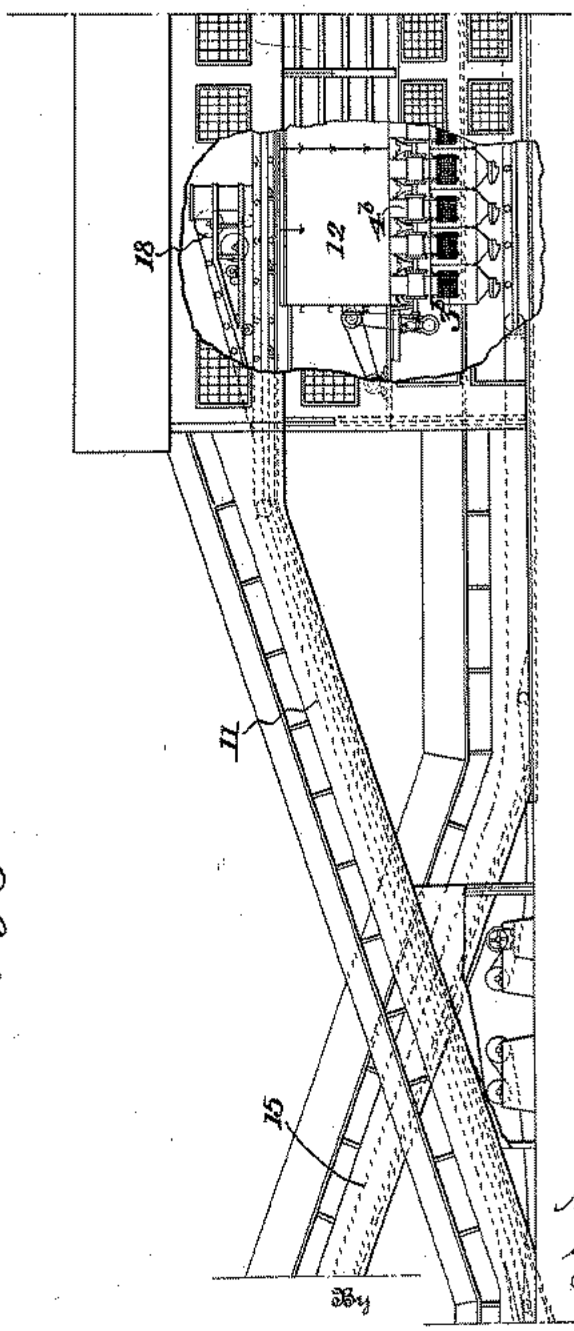
Jan. 20, 1925. 1,523,435

A. G. McGREGOR

CRUSHING AND SEPARATING PLANT

Filed May 1, 1923 3 Sheets-Sheet 2

Fig. 2.



Inventor:
Alex. G. McGregor
by Kalm & Kalm
Attorneys.

By

Jan. 20, 1925.

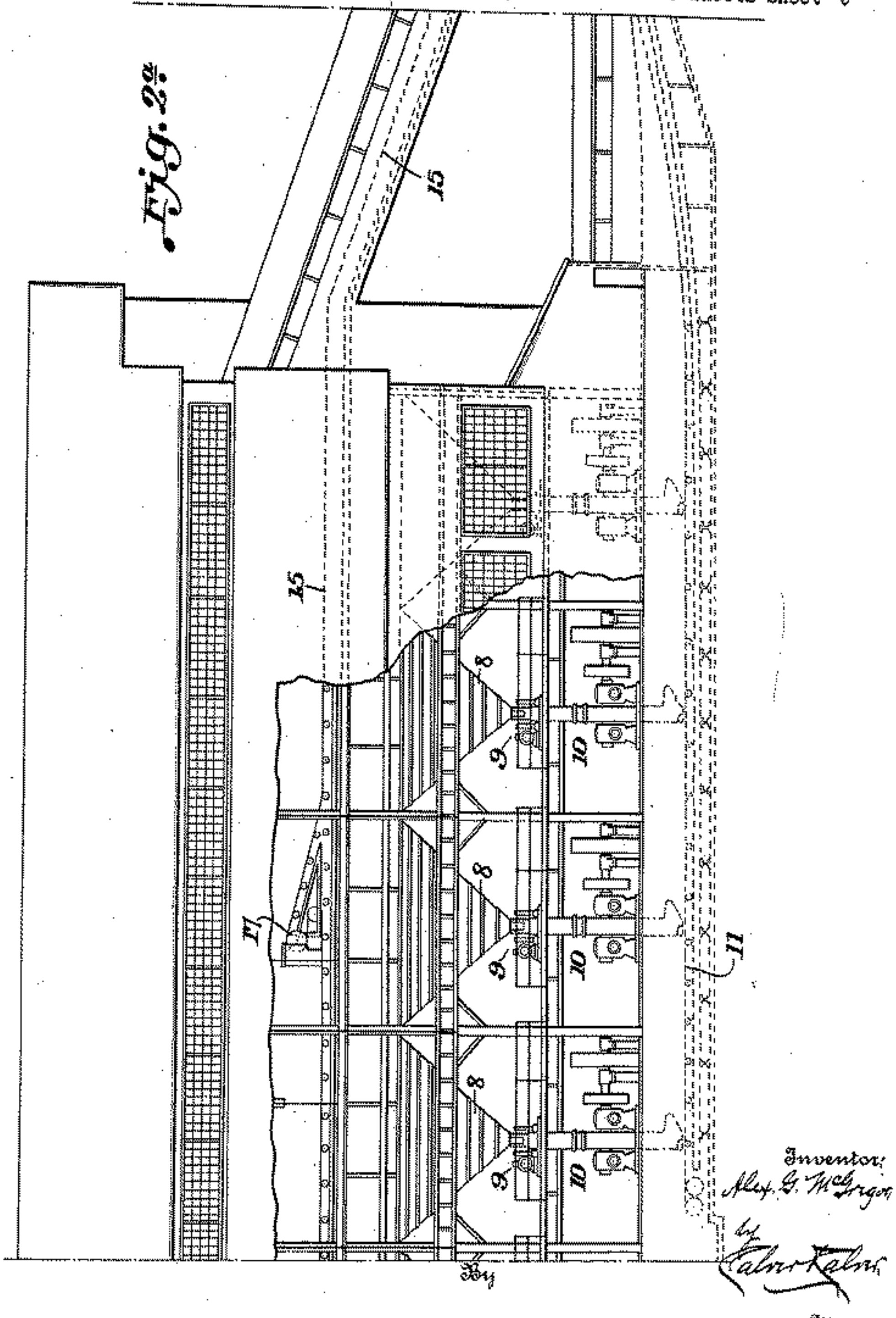
A. G. McGREGOR

1,523,435

CRUSHING AND SEPARATING PLANT

Filed May 1, 1923

3 Sheets-Sheet 3



Patented Jan. 20, 1925. **1,523,435**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

CRUSHING AND SEPARATING PLANT.

Application filed May 1, 1923. Serial No. 635,860.

To all whom it may concern:

Be it known that I, ALEXANDER GRANT McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Crushing and Separating Plants, of which the following is a specification, reference being had therein to the accompanying drawings.

In mills for crushing and separating ores or other similar hard materials, in pulverizing the same, and which employ roller crushing mills, it is common practice in reducing oversize to employ one mill for the first stage or coarse crushing of the oversize and another mill to which the finer oversize from the screens is fed for the second stage or finer crushing, the crushed material from the second mill being then returned to the screens for separation, in securing the finished product. In crushing very hard material the crushing rolls after a time become more or less indented or corrugated thus allowing more oversize to pass through them. For the finer crushing it is important that these corrugations or indentations be kept as small as possible. With the present improved system, when new shells have been placed on a set of rolls that set may be used for the finer crushing until the indentations or corrugations become excessive, when the feed of the material for the coarse crushing may be shifted to such set of rolls, thus allowing the shells of the rolls to be finally worn out in the coarse crushing service. In this way the rolls having the newer shells may be used for the finer crushing, and the rolls having the older shells may be used for the coarser crushing, where the indentations or corrugations are not as great a detriment.

The present invention has for its object to provide a crushing and separating plant or system employing two or more roller crushing mills with means whereby the crushing mills may be employed for one-stage crushing or for two-stage crushing, and when utilized for two-stage crushing either the coarser or finer oversize from the screens may be fed to any desired mill, so that such mill may be used either for the first or coarser crushing of the oversize, or for the second or finer crushing of the oversize, as may be desirable. Thus by means of the present invention the plant may be converted from a two-stage crushing plant to a one-stage crushing plant, and vice versa, with intermediate screening, or may be run as a one-stage crushing plant, without screening, as may be desired, according to the nature or condition of the ores being treated.

In the accompanying drawings Fig. 1 is a diagrammatic view of a crushing and separating system embodying the present invention. Figs. 2 and 2^a are illustrative, in elevation, of the invention.

The material to be reduced by the roller crushing mills is usually first coarsely crushed by jaw crushers or other forms of crushing mills, and such coarsely crushed material may be fed from the coarse crushers by a conveyor 1 to a storage bin 2 having openings 2^a in its bottom through which this crushed material may be fed to the screens or separators 3 by a set of rotary feeders 4 driven in any desired manner. The finer material passing through the screens 3 drops to a conveyor 5 discharging the fine finished product onto a conveyor 6. The oversize from the screens 3 is discharged onto a conveyor 7 by which it is carried to any desired one of several storage bins 8 beneath which are arranged rotary feeders 9 discharging to a set of roller crushing mills 10. The material from the said crushing mills 10 is discharged onto a conveyor 11 by which it is carried to a storage bin 12 having openings 12^a in its bottom for discharging the crushed material to rotary feeders 4^a and 4^b discharging onto screens 3^a and 3^b. The oversize from the screens 3^a and 3^b is discharged onto a conveyor 15 by which it is carried to one of the bins 8 and thence through a rotary feeder 9 to a crushing mill 10. The fine product passing through the screens 3^a falls onto a conveyor 13 and the finished product from the screens 3^b falls onto the conveyor 14, from which conveyors it is discharged onto the finished product conveyor 6. The conveyors referred to are all of the endless belt type.

It will be understood that the oversize from the screens 3 is much coarser than the oversize from the screens 3^a and 3^b. In Fig. 1, diagrammatically illustrating the invention, the coarser oversize material from the screens 3, and carried by the conveyor 7, is supposed to be discharged into the first of the bins 8 through the medium of a tripper 16, while the finer oversize material from the screens 3^a and 3^b, will be discharged onto the conveyor 15 which is shown as discharging into the second of the bins 8 by a tripper 17.

These discharging trippers are conventionally represented in Fig. 1, but are of well-known form now in use, and are mounted on wheels so that they may be moved to any desired position over any bin 8, as will be understood from Fig. 2^a in which the tripper 17 is somewhat diagrammatically illustrated, and in Fig. 2 where a tripper 18, discharging into the bin 12, is also shown. By the use of the system of conveyor belts above described and the movable or adjustable trippers 16 and 17, through which said belts run, it will be understood that the coarser oversize material, carried by the conveyor 7, may be discharged into any desired one of the bins 8 and may pass thence to any desired one of the roller crushing mills 10. Also the conveyor 15 may, by the use of a movable or adjustable tripper, as 17, be discharged into any one of the bins 8 and may pass thence to any desired one of the crushing mills 10.

Thus, in two-stage crushing, any one or more of said roller crushing mills in which the shells of the rollers are most worn may be utilized for crushing the coarser oversize material, and in which the corrugations or indentations of the worn shells are not seriously detrimental, while one or more of a set of roller crushing mills, having fresher or less worn shells on the crushing rolls, may be utilized for the finer crushing, as hereinbefore referred to. In other words, any one or more of a row or series of roller crushing mills may be used for the coarser or first crushing, and any one or more of such series of mills may be used for the second or finer crushing. It will thus be apparent that the shells or sleeves of the rolls may be finally worn out in the coarser crushing service, while the mills having the newer or less worn shells may always be utilized for the finer crushing.

In ore reducing plants as now generally arranged it is usual to arrange the roll crushing machines for the coarser material on a certain level or in a room by themselves, while the roll crushing machines for finer crushing are located on a lower level or in another room by themselves. My arrangement as herein shown permits the machines or rolls for coarse and fine crushing to be all arranged in a row side by side so that repairs, etc., may be effected by the assistance of one overhead crane. Also by putting these roll crushing machines all in one room side by side the attendance is much simpler than with the old arrangement.

As hereinbefore stated the present invention permits the plant to be converted from a two-stage crushing plant to a one stage crushing plant, and vice versa, according to the nature of the ores being treated. To convert the two-stage crushing plant herein shown, and operating as above described, into a one-stage crushing plant the movable trippers 16 and 17 may be arranged to discharge into any one of the bins 8 at the same time. In practice, however, in utilizing the plant for one-stage crushing, the said trippers 16 and 17 could be caused to travel automatically back and forth over the bins 8, thus discharging the oversize indiscriminately into said bins which would all contain the same kind of mixture to be fed to the roller mills 10. In one-stage crushing the return conveyor belt 11 will be dispensed with or arranged to discharge to a finished product receptacle or pile.

In handling certain ores which may be sticky and wet from exposure to rain or other causes, it is practically impossible to pass the same through screens and it is more expedient to pass them either once or twice through roller mills without being crushed down to the fixed maximum size. Thus in a known instance a mining company handles an oxide ore which, during the greater part of the year, gives no trouble in crushing and screening, but which, during the rainy season, becomes very sticky and is put through the crushing plant with much difficulty. In handling ores under such conditions the screens 3^a and 3^b, may be dispensed with and the crushed ore from bin 2 may be discharged into any or all of the bins 8 by means of the conveyor 7, the ore from the feeders 4 being discharged over screens 3 and onto the conveyor 7, the ore from bin 12 and feeders 4^a and 4^b being discharged onto conveyors 13 and 14.

From the foregoing it will be understood that the invention provides a flexible ore crushing plant which may be operated (*a*) either as a two-stage crushing plant, the final stage crushing mill or mills being in closed circuit with the screens 3^a and 3^b; or (*b*) as a one-stage crushing plant with the crushing mill or mills in closed circuit with the screens 3^a and 3^b; or (*c*) the plant may be operated as a one-stage crushing plant with none of the crushing mills in closed circuit with the screens.

The invention is not to be understood as being limited to any particular details of construction, or to any particular driving mechanism for the different elements and machines employed in this improved system of screens, conveyors, trippers, feeders and roller crushing mills, but the invention will be understood as residing in the novel arrangement of these elements and machines herein shown and described and by which the object of the invention is effected. The screens 3, 3^a and 3^b, diagrammatically shown in Fig. 1, are, of course, to be vibrating screens of well known form and will be operated in any suitable manner.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a crushing and separating plant, the combination with a plurality of sets of screens and a plurality of roller crushing mills, of adjustable means for supplying coarser or smaller oversize material to any desired one of said roller mills, in two-stage crushing, while enabling the plant to be converted into a one-stage plant, if desired.

2. In a crushing and screening plant, the combination of two or more sets of screens and two or more roller crushing mills, of adjustable means for supplying either coarser oversize material or smaller oversize material, or both coarser oversize material and smaller oversize material, to any desired one or more of the said roller crushing mills, thus enabling the plant to be run as a two-stage crushing plant or a one-stage crushing plant in closed circuit, or as a one-stage crushing plant in open circuit, as described, at the will of the operator.

3. In a crushing and separating plant, the combination with two or more sets of screens and two or more roller crushing mills, of adjustable means for supplying either coarser oversize material or smaller oversize material to any one or more of the said roller crushing mills, at the will of the operator.

4. In a crushing and separating plant, the combination with two or more sets of screens and two or more roller crushing mills, of adjustable means for supplying either coarser oversize material or smaller oversize material to any one or more of the said roller crushing mills, at the will of the operator, said supplying means comprising oversize-receiving bins above said mills, bins above said screens for holding coarsely crushed and returned oversize material, conveyors for taking oversize material from said screens to said first-named bins, a conveyor for taking the product from said mills to said oversize bin above the screens, and movable discharging means whereby the coarser or the smaller oversize material may be discharged into any one of the bins above said mills, to be fed to any desired mill or mills.

5. In a crushing and separating plant, the combination with one or more sets of screens and two or more roller crushing mills, of means for supplying either coarser oversize material or smaller oversize material, to any one or more of the said roller crushing mills, at the will of the operator, said supplying means comprising bins above said roller mills, feeders between said bins and mills, bins above said screens, feeders between said last-named bins and said screens, two belt conveyors for carrying the coarser and smaller oversize from said screens to said first-named bins, a belt conveyor for carrying the product discharged from said mills to a bin over said screens, and trippers for discharging the material from said belts into said bins, the trippers above the roller-mill bins being movable so that either the coarser or the smaller oversize material may be discharged into any one of the said bins and so be fed to any desired mill or mills.

6. In a roll crushing and screening plant, the combination with a plurality of sets of roll crushing machines in a row side by side, of adjustable means for supplying coarser or smaller oversize material to any desired machine in said row, accomplishing two stage crushing with rolls set in one row and on the same level.

7. In a roll crushing and screening plant, the combination with a plurality of sets of roll crushing machines in a row side by side, of adjustable means for supplying coarser or smaller oversize material to any desired machine in said row, so that any particular roll crushing machine may be fed with coarse oversize, or finer oversize, for two stage crushing, or any particular machine or machines in said row may be fed with both coarse oversize and fine oversize for one stage crushing.

8. In a roll crushing and screening plant, the combination with a plurality of sets of roll crushing machines in a row side by side, of adjustable means for supplying coarser or smaller oversize material to any desired machine in said row, so that the finer crushing may be done by the machine or machines in said row which are in better condition for the said finer crushing operation.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

April 28, 1925. 1,535,174

A. G. McGREGOR

ART OF FEEDING POWDERED COAL TO BLAST FURNACES

Filed Sept. 29, 1920 2 Sheets-Sheet 1

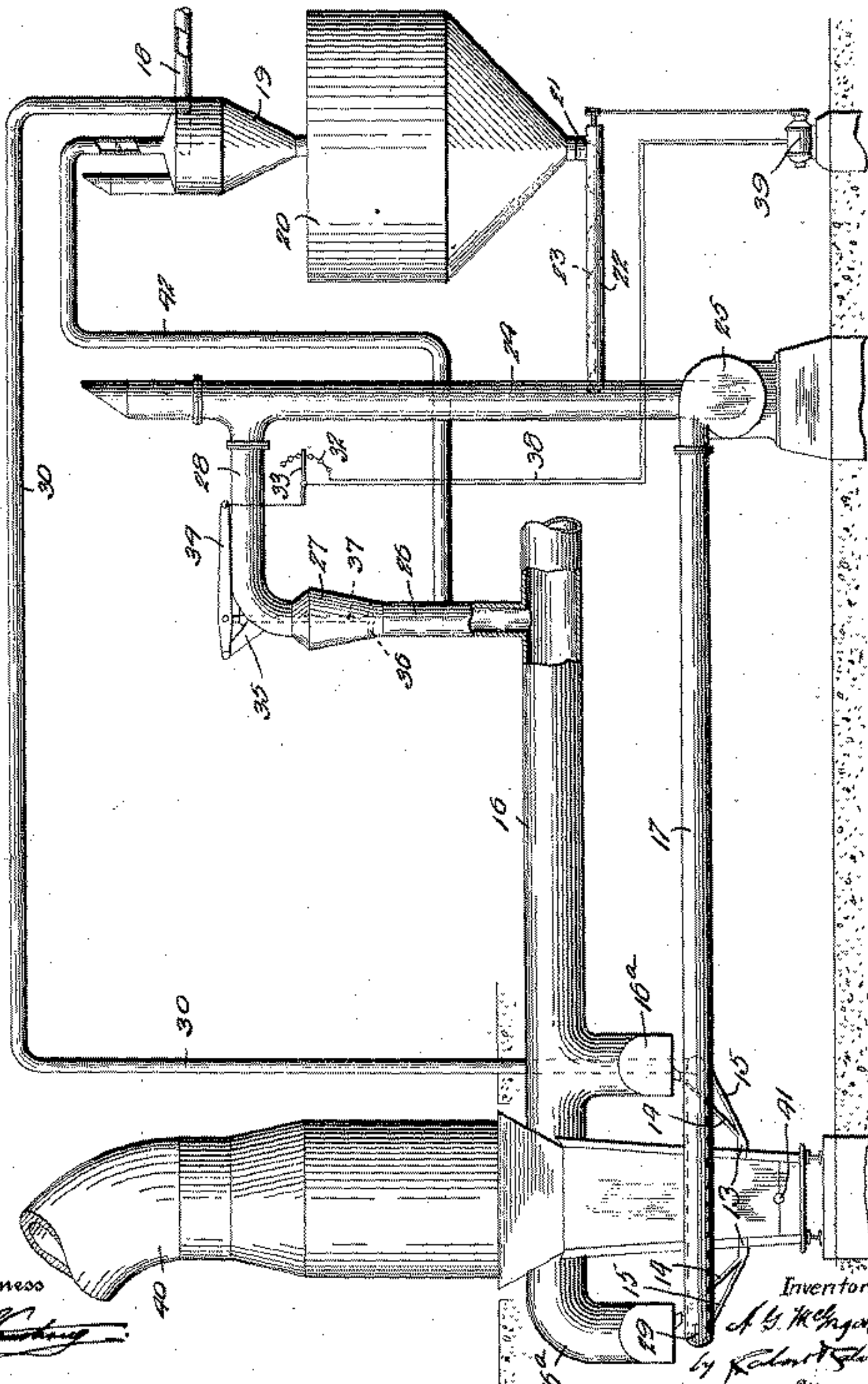


Fig. 1.

Witness

Inventor:

A. G. McGregor,

by

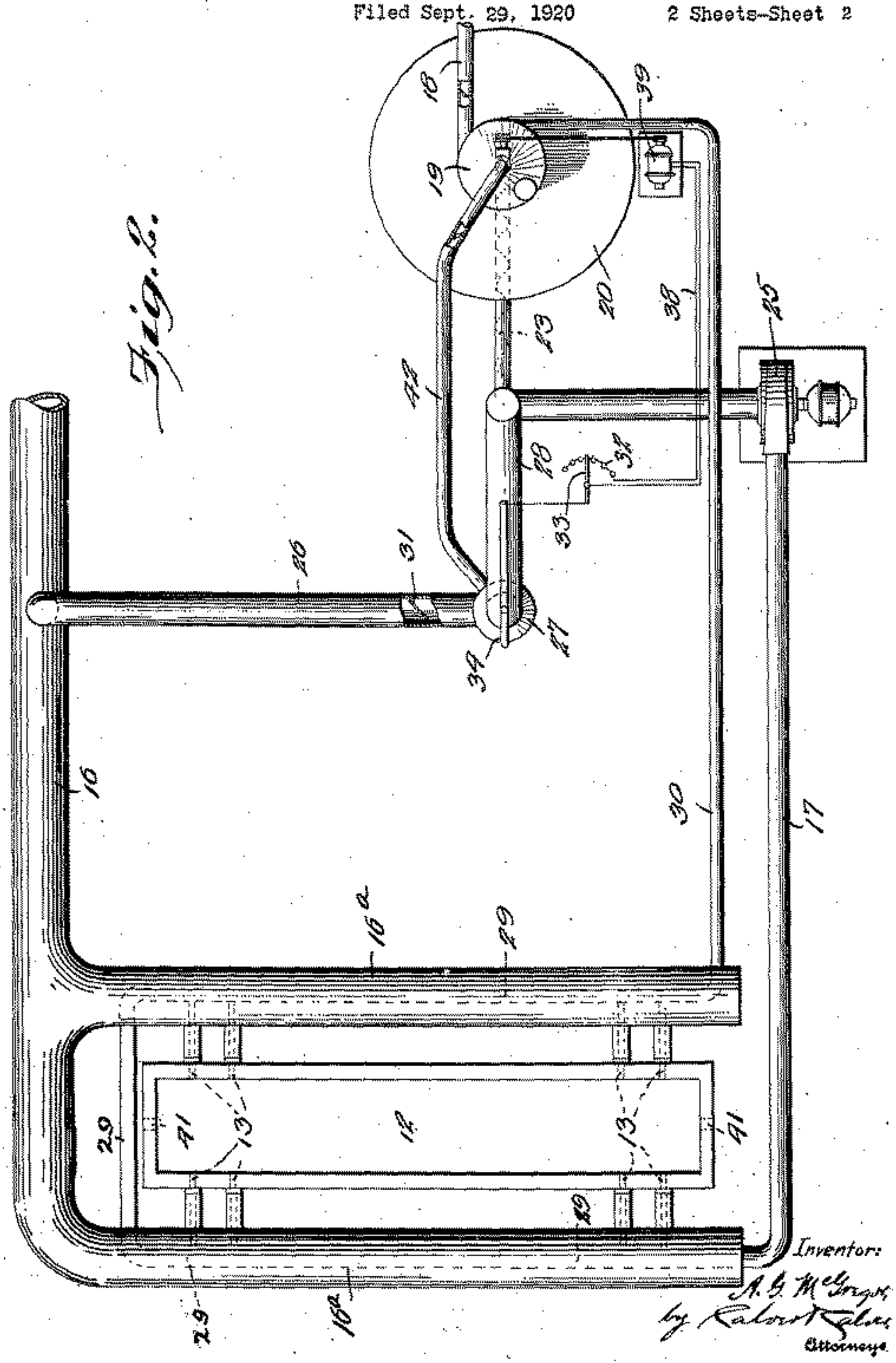
Attorneys

April 28, 1925. 1,535,174

A. G. McGREGOR

ART OF FEEDING POWDERED COAL TO BLAST FURNACES

Filed Sept. 29, 1920 2 Sheets-Sheet 2



Patented Apr. 28, 1925. **1,535,174**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

ART OF FEEDING POWDERED COAL TO BLAST FURNACES.

Application filed September 29, 1920. Serial No. 413,595.

To all whom it may concern:

Be it known that I, ALEXANDER G. McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in the Art of Feeding Powdered Coal to Blast Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improvement in the art of feeding powdered coal to blast furnaces, and has for its object a method which, as compared with the methods at present in use, will be more economical in the use of power, will require less space around the furnace, and be more readily installed, and which will provide a more flexible and reliable means for distributing the coal to each and every tuyère of the furnace than the method now in use.

The method at present most generally in use for feeding the coal into the tuyères of blast furnaces is by feeding the powdered coal from the supply hopper by a screw conveyor. This screw conveyor is arranged so as to distribute the coal into from one to six or eight individual pipes, each leading to an air injector. The air injector produces a suction, drawing the coal into it, and discharges the mixture of coal and air into the furnace tuyère.

As the pressure of the blast air entering the furnaces is from 2 to 3 pounds per square inch, it is usual, in practicing the present method, to use air at a pressure of some 10 pounds greater than the blast air at the furnaces, for operating the injector, and to provide this air at higher pressure considerable power is required.

As the usual blast furnace may have from 40 to 140 tuyères, a number of coal hoppers with their feed screws and injectors would be required, and would make a complicated and bothersome installation which must be placed as close to the furnace as possible where the space is limited, and where it would interfere more or less with the other equipment and operations about the furnace. Such systems are not always reliable in delivering the desired amount of coal to each tuyère.

In accordance with the present invention the powdered coal is delivered and distributed to each tuyère of a blast furnace by means of an air circulating and distributing system, similar to the systems which are now being used in plants where coal is distributed to a number of heating furnaces in the same building or plant. In practising the present invention powdered coal is fed into the suction air pipe of a centrifugal fan blower. In the fan the coal and air are intimately mixed and discharged, under a pressure of approximately 6 ozs. per square inch, the discharge being into a fuel pipe main which, through suitable branches, supplies a mixture of air and coal to the various furnace burners.

Sufficient velocity is maintained in the main to prevent the coal from settling and clogging it. To accomplish this, the main is preferably in the form of a loop communicating with a return pipe and carries more air and fuel than is delivered to the furnaces, so that a certain amount of the fuel-laden air in the main passes by all the branch pipes and is returned to the fuel and air supply for the fan.

Automatic means may be provided for regulating the amount of coal fed into the system, so that the proper mixture of powdered coal and air will be maintained in the main and its branches, regardless of the amount being actually consumed by the furnace. Such a means and system is described in U. S. Patent No. 1,206,112, issued to A. A. Holbeck, November 28, 1916.

In accordance with the present invention a fuel supply main, containing a mixture of coal and air under sufficient pressure, extends around on both sides of the blast furnace, similar to the bustle pipe which furnishes the air through the various short branches to the tuyères of the furnace. In the same way the mixture of coal and air is drawn from the fuel main through short pipes to the furnace tuyères in the practice of the present invention, and suitable valves may be provided in the short branch pipes so that the amount of the fuel mixture going to each tuyère may be regulated.

A coal distributing system, similar to those now in use, as described, could be used for delivering coal into the fuel mains through branch pipes, and into the tuyères of a blast furnace in the manner suggested. But as the pressure of the blast in the tuyères of a copper blast furnace, for instance, is usually maintained at some pressure between 24 ozs. and 40 ozs. per square inch, the fan which delivers the mixture of coal and air would have to maintain a pressure at least 6 ozs. higher than the blast pressure, so that the mixture of air and coal delivered by the fan would flow through the main and branches at a high velocity and into the tuyères against the furnace blast pressure.

To deliver the mixture of fuel and air against a pressure of say 30 ozs., the runner of the fan would necessarily have to operate at a very much higher velocity than is required for delivering at a pressure of only 6 ozs. per square inch. This would result in excessive wear of the fan, due to the particles of coal impinging against the interior parts of the fan at the high velocity.

In the present invention this difficulty is overcome by taking the suction air for the fan from the blast furnace main. In this way the fan is only required to boost the furnace main pressure about 6 ozs., and it will not be required to run any faster than fans are now running in connection with the ordinary low pressure air coal distributing systems, and the wear on the fan will be no greater.

In the accompanying drawings, which, it will be understood, are more or less diagrammatic, Fig. 1 is an elevation illustrating an apparatus by which the invention may be carried into effect, and Fig. 2 is a plan view of the same.

Referring to the drawings, 12 denotes a blast furnace having tuyères 13, through which the powdered coal is to be fed into the furnace by means of air under pressure passing through pipes 14, the outlets of which join the outlets of the fuel pipes 15, the air pipes 14 communicating with the main air blast pipe 16 through the bustle pipes 16[a], and the fuel pipes 15 communicating with the fuel feed pipe 17. The powdered fuel is discharged from the fuel inlet pipe 18 to a collector or separator 19 which empties into a bin 20 having at its bottom an outlet 21 through which the powdered coal is discharged into a pipe 22 in which is located a screw conveyor 23 which feeds the fuel into the pipe 24 communicating with a booster blower fan 25 which, in turn, communicates with the fuel feed pipe 17. The air and powdered coal are thoroughly mixed by the fan 25.

The main air blast pipe 16 is provided with a branch pipe 26 opening into an air flow meter 27 through which the air passes into a pipe 28 communicating with the pipe 24, so that air from the main air blast pipe 16 is delivered to the fan at a pressure of say 3 pounds to the square inch, or the blast furnace pressure; and this pressure is augmented by the fan 25 by only about 6 ounces to develop the necessary pressure for feeding the powdered fuel into the furnace through the fuel feed pipe 17.

Surrounding the furnace 12 is a looped fuel header pipe 29 into which the powdered fuel is discharged from the feed pipe 17, and with which the fuel pipes 15 communicate, the said header pipe being merely a continuation of said feed pipe. Preferably communicating with the said header pipe 29 is a return pipe 30 which communicates with the collector or separator 19 so that any surplus fuel not discharged into the furnaces through the tuyères is returned to the fuel supply and the surplus air is again returned to the fan.

The branch pipe 26 is preferably provided with a damper or valve 31 by which the air supply from the main air pipe may be cut off when desired.

The speed of motor 39 and screw feeder 23 which it drives is regulated by means of the rheostat 32, which is controlled by the piston 36 in the air flow meter 27, the said piston being connected by the rod 37 with the lever 34 pivoted on a support 35, said lever being in turn connected with the rheostat regulating lever 33; so that if the amount of fuel and air delivered to the furnace is increased more air will be drawn in through the flow meter and the speed of screw feeder will be automatically increased. In the same way, if the air and coal admitted to the furnace is reduced, the speed of the screw feeding the coal will be reduced, thus keeping the ratio of coal to air in the mixture constant. The motor 39 is electrically connected with the rheostat 32 by conductors 38.

From the foregoing it will be understood that the normal air pressure, when the fan 25 is not running, is practically the same in the fuel inlet pipe 17 as in the main air blast pipe 16, and that an increased pressure of only about 6 ozs. is required in the said fuel inlet pipe 17, to be developed by the fan 25, in order to properly feed the fuel into the furnace.

The coal will preferably be delivered to the bin 20 by an air transport system through the pipe 18 and collector 19 for the reason that the bin 20 will be under a pressure equal to the main air blast pressure, and to avoid interruption in the operation, the coal would have to be delivered against the bin pressure. The collector or separator 19 is vented to the pipe 26 through the pipe 42 which allows the air in the return pipe 30 to be delivered to pipe 26; and also allows whatever air is required in delivering the coal to the bin 20 by the air transport system, to be delivered to the fan. The additional air required by the fan is drawn from the main air blast pipe 16.

The furnace 12 may be provided with an outlet stack 40 and tap hole 41 at its bottom, etc., as usual.

It will be understood that, if thought desirable, check valves may be installed in the tuyère pipes between the tuyères and the bustle pipes to prevent the coal from being blown back into the bustle pipes in case the tuyères become clogged. It will also be understood that the powdered coal may be fed into the discharge of the fan 25 instead of into the suction, as indicated by the drawings.

It is preferred that the return pipe 30 discharge through the separator 19, so as to collect the surplus powdered fuel which is then discharged into the bin 20, although the surplus air could be discharged into the atmosphere; but by discharging the air in the return pipe into a pipe or chamber having connection with the blast main, or to the suction of the fan which has approximately the blast pressure in it, the air is again used and the power required to compress it up to the blast pressure originally is not wasted.

The invention is not to be understood as being limited to the details of the particular apparatus herein shown and described and which somewhat conventionally illustrates an apparatus by which the invention may be carried into effect, as the means by which the invention may be practiced may be varied widely, as will be understood by those skilled in the art.

Some of the advantages of the arrangement described may be mentioned as follows:

Much less power is required for forcing the fuel into the tuyères than is used in the injector scheme now in use for delivering powdered coal into blast furnace tuyères.

As a more efficient means than a centrifugal fan blower is generally used for delivering the blast air under pressure to blast furnaces, by providing a fan to boost this pressure, by only a few ounces, as described, less power on the whole will be required than if a fan were used to draw the coal and air in at atmospheric pressure and compress it up to 6 ozs. higher than the main air blast pressure. This would be similar to the systems now in use for heating furnaces except the fan would be called upon to develop much more pressure, and the wear of the fan on account of the higher velocity of the rotating part would be greater.

In practice, the blast air pressure varies from time to time, due to pulsation, variation in the speed of the prime mover, and a variation in the amount of air delivered to the furnace or furnaces, and if the compressed air for delivering the coal to the blast furnace tuyères is compressed by an independent means, there will also be variations in its pressure, due to variation in the speed of the motor driving it and due to variations in the amount of air being used.

By using a fan running at a constant speed, which receives its suction from the air blast main and merely boosts this pressure up a few ounces, to furnish the air for feeding the coal into the furnace tuyères, it will be apparent that a very simple means is provided in the present invention for maintaining a practically constant difference in pressure between the fuel air and the blast air.

In accordance with the present invention all moving mechanism may be remote from the furnace, where it will not be injured by, or be in the way of the operations about the furnace.

While the sketches and description herein relate more or less to copper blast furnaces, it will be understood that the invention is also applicable to lead and iron and other blast furnaces.

As hereinbefore stated, to prevent the powdered coal from settling in and thus clogging the fuel feed pipe 17, more air and coal are fed into said pipe than is delivered into the furnace and the surplus is returned to the separator 19 through the pipe 30.

Owing to the fact that the closed fuel bin 20 into which the fuel is fed through the pipe 18 by air pressure, is in communication with the main air blast pipe 16 through the pipes 26 and 42, a pressure higher than atmospheric pressure, and approximately equal to the pressure in said main blast pipe, will be maintained in said bin. Thus as no air pressure in the system will be vented to the atmosphere there is no loss of pressure which would have to be replaced by additional power.

Having thus described my invention I claim and desire to secure by Letters Patent:—

1. The herein-described method of delivering powdered fuel to a blast furnace, consisting in introducing the said fuel into the furnace through a fuel pipe or passageway communicating with the main air blast pipe or passageway, and increasing the air pressure in the said fuel pipe or passageway to a sufficient extent to enable the fuel to be forced into the furnace against the air pressure developed therein from the said main air blast pipe.

2. An apparatus for delivering powdered fuel to a blast furnace, comprising a main air blast pipe, a fuel feed pipe leading to the furnace, and a booster fan communicating with the said main air blast pipe and discharging into said fuel supply pipe.

3. An apparatus for delivering powdered fuel to a blast furnace, comprising the combination with a furnace provided with tuyères, of a main blast furnace pipe, branch air pipes communicating with said main blast pipe and leading to the furnace tuyères, a fuel supply pipe carrying a mixture of air and powdered fuel and also com-

municating with said tuyeres through branch pipes, and means for creating an air pressure in said fuel supply pipe higher than the blast pressure; whereby the fuel mixture may be discharged into said tuyères against the blast pressure of the furnace.

4. An apparatus for delivering powdered fuel to a blast furnace, comprising a main air blast pipe leading to the furnace, a fuel feed pipe communicating with the said main air blast pipe so as to receive air under pressure from said main air blast pipe, and a booster fan communicating with the said main air blast pipe and with the said fuel feed pipe and serving to increase the air pressure in said fuel feed above that received from said main air blast pipe.

5. An apparatus for delivering powdered fuel to a blast furnace, comprising a main air blast pipe leading to the furnace, a fuel feed pipe communicating with the said main air blast pipe so as to receive air under pressure from said main air blast pipe, a booster fan communicating with the said main air blast pipe and with the said fuel feed pipe, and serving to increase the air pressure in the said fuel feed above that received from said main air blast pipe, and a pipe for returning the surplus fuel from the pipes at the furnace to the fuel bin or the fuel entrance part of the apparatus.

6. An apparatus for delivering powdered coal to a blast furnace comprising a main air blast pipe, a fuel feed pipe, means for causing said fuel pipe to deliver fuel to a furnace under a pressure higher than the furnace blast pressure and adapted to carry more air and fuel than is discharged into the furnace, a closed fuel supply bin, means for creating a pressure in said bin higher than atmospheric pressure, and a return or circulating pipe communicating with said fuel feed pipe and said bin so that the surplus fuel may be returned to the source of supply.

7. An apparatus for delivering powdered coal to a blast furnace comprising a main air blast pipe, a fuel feed pipe, means for causing said fuel pipe to deliver fuel to a furnace under a pressure higher than the furnace blast pressure and adapted to carry more air and fuel than is discharged into the furnace, a closed fuel supply bin, means for connecting said bin with said main air blast pipe and thereby creating a pressure in said bin approximately equal to the pressure in said main air blast pipe, and a return or circulating pipe communicating with said fuel feed pipe and said bin so that the surplus fuel may be returned to the source of supply.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

June 2, 1925. 1,539,948

A. G. McGREGOR

DRIVING SYSTEM FOR ROLL CRUSHING MACHINES

Filed May 13, 1924 2 Sheets-Sheet 1

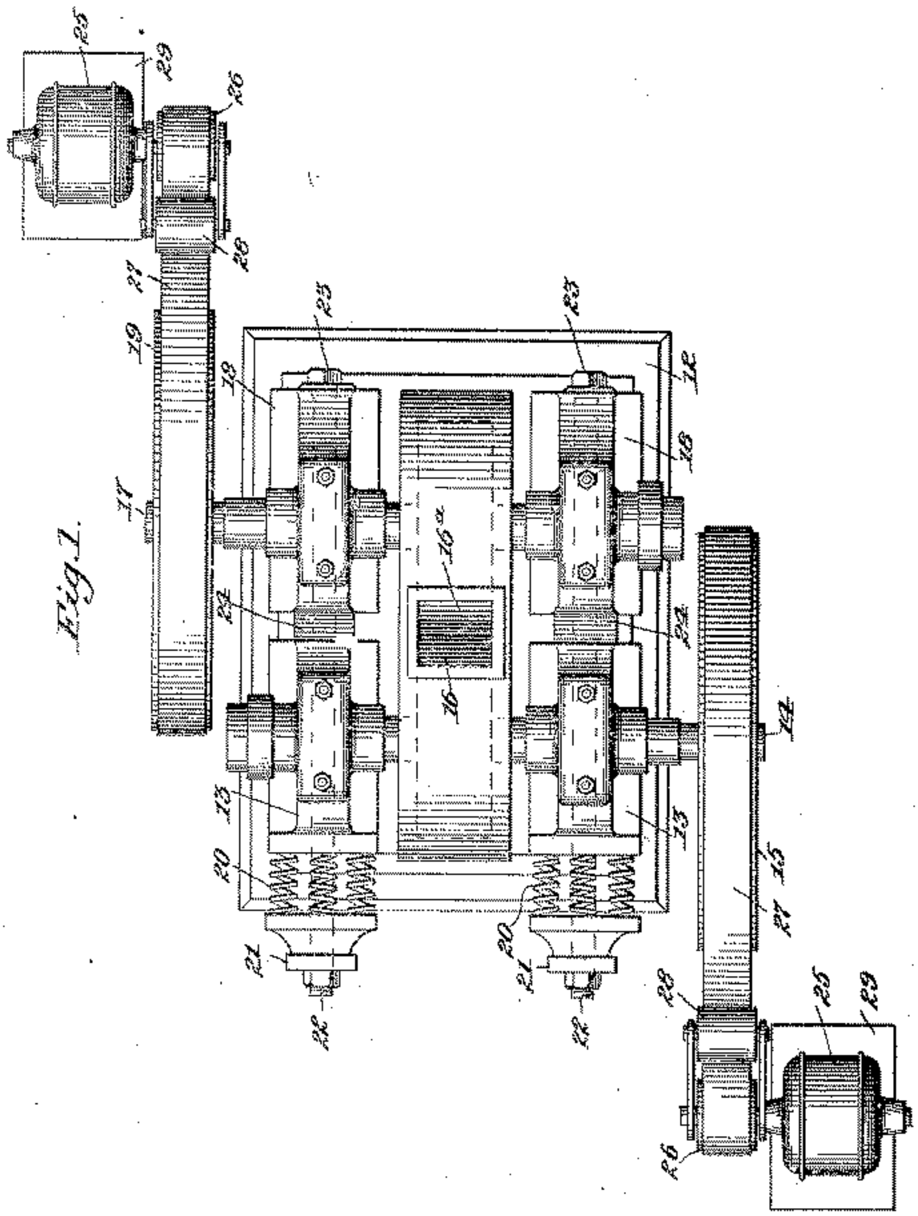


Fig. 1.

Inventor:
Alexander Grant McGregor,
by [illegible]
Att'ys.

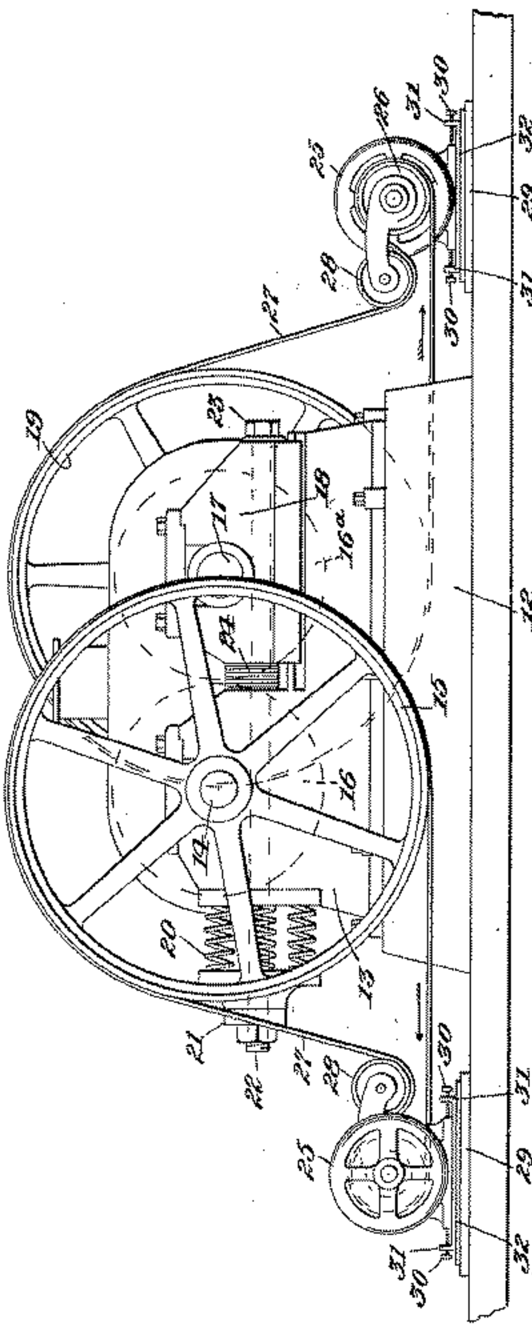
June 2, 1925. 1,539,948

A. G. McGREGOR

DRIVING SYSTEM FOR ROLL CRUSHING MACHINES

Filed May 13, 1924 2 Sheets-Sheet 2

Fig. 2.



Inventor:
Alexander Grant McGregor,
by Calver & Calver,
Att'ys

Patented June 2, 1925. **1,539,948**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

DRIVING SYSTEM FOR ROLL-CRUSHING MACHINES.

Application filed May 13, 1924. Serial No. 713,039.

To all whom it may concern:

Be it known that I, ALEXANDER GRANT McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Driving Systems for Roll-Crushing Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

In that class of power driven roller crushing machines in which the shaft for one roll is mounted in fixed bearings and the shaft for the other roll is mounted on yielding bearings, so that one of the crushing rolls can move away from the other when any unusually hard substance or article gets between said rolls, the two shafts have usually been driven by belts driven from pulleys on a power or "jack" shaft which is on that side of the machine at which the movable crushing roll is located, one of these belts being a crossed belt to give the proper direction of rotation to the shaft (usually the yieldingly mounted shaft) with which the said crossed belt is connected. The crossed belt running to the movably mounted roll pulley is generally somewhat slack so that most of the power is transmitted to the machine by the belt running to the pulley on the shaft which is journalled in fixed bearings. When the movably mounted roll is forced away from the other roll the tension on the belt of the movably mounted roll is relaxed so that still less power is transmitted to the said movably mounted roll. In thus driving the crushing rolls the tight side of the belt transmitting most of the power is on top. As the crushing rolls wear down, in use, the space between the crushing faces is maintained approximately constant by removing shims which permits the movable roll shaft to occupy a position closer to the fixed roll shaft and farther away from the jack shaft driving it. To accommodate the subsequent adjustments the belt driving the movable roll must be sufficiently slack in the first place.

Sometimes a belt drive for the movable roll is omitted altogether, said roll deriving its rotating motion indirectly from the "fixed" roll through the ribbon of material passing between the two roll faces.

The objections to these systems of driving are: (*a*) The tight side of the belt driving the pulley on the rigid roll is on top. This condition is bad for a belt drive, resulting in faster wear and requires that the belt be taken up oftener than would be necessary if the tight side were on the bottom. This also makes a bad condition for the bearings of the jack shaft causing extra pressure on them, requiring close attention on the part of the attendant, and resulting in more wear on the bearings. (*b*) As suggested, the belt driving the rigid roll must be fairly taut at all times. There is always a certain amount of slack in the bearings of the rigid roll so that when feed to the roll slacks off the drive belt tension tends to draw the rigid roll in toward the movable roll. Then when the feed comes on again the rigid roll shaft is forced back again against the back of its bearings with a slam. With an intermittent feed this condition causes a disagreeable and more or less harmful hammering.

(*c*) Practically all the power is delivered through the fixed roll with the result that the steel shell of this roll wears down faster than the shell on the movable roll. As it is more expeditious to make one repair job and change both shells at the same time, the shell on the movable roll, is often discarded before it is worn out.

These objections are overcome by an improved power driving system which is illustrated in the accompanying drawing in which Fig. 1 is a plan view and Fig. 2 a side view of a roll crushing machine and the improved driving system therefor.

Referring to the drawing, 12 denotes a base on which are mounted fixed bearings 13 for a shaft 14 to which is fixed a driving pulley 15 and a crushing roll 16. Coöperating with said crushing roll 16 is a companion crushing roll 16^a fixed to a shaft 17 mounted in yielding bearings 18 adapted to slide back and forth on a fixed support, said shaft 17 carrying a driving pulley 19. The crushing roll 16^a is forced toward its companion crushing roll 16 by springs 20 placed between the fixed bearings 13 and movable heads 21, said springs encircling bolts 22, the heads 23 of which bolts are in contact with the yielding bearings 18. Between the fixed and yielding bearings are interposed shims 24.

The driving pulleys 15 and 19 are preferably independently driven by motors 25 the shafts of which carry power pulleys 26 connected by belts 27 with the driving pulleys

15 and 19, the slack of said belts being taken up by belt tighteners 28. These driving belts are so arranged that the tight sides thereof are on the bottoms of the said pulleys, as indicated in Fig. 2, so that the slack of said belts increases their arc of contact on the driving and driven pulleys, which is the ideal condition sought for by those experienced in power transmission by belts. Also the pull on said belts is in opposite directions and tends to draw the yieldingly mounted roll away from the other roll and to hold the yieldingly mounted roll shaft back in its bearings regardless of whether the rolls are crushing anything or not.

With the power transmitted through the bottom runs of the belts, so that the arcs of contact of the belts with the driving pulleys 15 and 19 are larger than they otherwise would be, less tension on the belts is required. Thus the tensile strain on the belts will be less and their life lengthened, and the wear on the bearings for the shafts 14 and 15 will be less, in that they will not be crowded towards each other so much.

The motors 25 are mounted on base plates 29 and are held in any desired position on said base plates by screws 30 passing through lugs 31 on the bases 32 of the motors, so that the said motors may be adjusted toward and from the pulleys 15 and 19 for the purpose of allowing the belt tighteners 28 to operate always in a low position and thus maintain a maximum arc of contact by the belts on their pulleys even in the case of the movable roll when the roll shells are nearly worn out and all the shims are removed.

From the foregoing it will be understood that the crushing rolls are independently driven by separate motors arranged on opposite sides of the machine, so that equal power may be transmitted to the pulleys connected with the shafts on which the crushing rolls are mounted, and the wear on said crushing rolls will therefore be even, and the disadvantage of discarding shells that are not entirely worn out, hereinbefore referred to, will be avoided.

Although I prefer to drive the pulleys 15 and 19 by separate motors, as above described, this is not positively necessary as power pulleys located on opposite sides of the crushing machine as are the power pulleys 26 of the motors 25, but operated from a common source of power, might be employed without departing from my invention.

Also it will be apparent that by making the pulleys on the roll shafts smaller in diameter than those herein shown, and by making one shaft longer than the other, so that the driving pulleys on said shaft would be offset from each other, the two machine driving pulleys and their respective power pulleys or motors could be located at the same end of the machine. Such an arrangement would not, of course, depart from the spirit of my invention.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. In a roll crushing machine, the combination with two shafts each provided with a driving pulley and a crushing roll, one of said shafts being mounted in spring-pressed bearings, of two power pulleys located some distance apart and on opposite sides of the said machine and of said shafts, and driving belts connecting said power pulleys and driving pulleys and arranged to pull on one of said driving pulleys in opposition to the stress of the springs for said spring-pressed bearings.

2. In a roll crushing machine, the combination with two shafts each provided with a driving pulley and a crushing roll, one of said shafts being mounted in yielding bearings, of two power pulleys located some distance apart and on opposite sides of the said machine and of said shafts, and driving belts connecting said power pulleys and driving pulleys, each of said power pulleys being arranged to drive the driving pulley nearest to it, so that the tension on one of said belts will tend to draw the said rolls apart in opposition to the stress of the springs for the yielding bearings.

3. In a roll crushing machine, the combination with two shafts each provided with a driving pulley and a crushing roll, one of said shafts being mounted in spring-pressed bearings, of two power pulleys located some distance apart and on opposite sides of the said machine and of said shafts, and driving belts connecting said power pulleys and driving pulleys, each of said power pulleys being arranged to drive the driving pulley nearest to it, with its tension on one of said pulleys in opposition to the stress of the springs acting on said spring-pressed bearings, the direction of rotation of said power pulleys being such that the upper runs of said belts will be slack and the bottom runs tight, so as to transmit power through said bottom runs.

4. In a roll crushing machine, a system for driving the crushing rolls comprising two power pulleys, one each on opposite sides of the center line between the two shafts of said crushing rolls, one of said shafts being mounted in yielding bearings, driving pulleys on said shafts, the top sides of each of said driving pulleys turning inwardly, belts connecting said power pulleys and driving pulleys, each power pulley operating the driving pulley on the roll shaft nearest to each of said respective power pulleys, so that the top runs of said belts will be slack and the bottom runs will be

tight, and so that the power will be transmitted through the said bottom runs.

5. In a roll crushing machine, the combination with fixed and yielding bearings, of two shafts one of which is journalled in said fixed bearings and the other of which is journalled in said yielding bearings, a driving pulley and a crushing roll fixed to each of said shafts, two motors arranged on opposite sides of said machine and having power pulleys, and two driving belts independently connecting said power pulleys with said driving pulleys on the roll-carrying shafts, the tension on one of said belts being in opposition to the stress of the springs acting on said yielding bearing.

6. In a roll crushing machine, the combination with fixed and yielding bearings, of two shafts one of which is journalled in said fixed bearings and the other of which is journalled in said yielding bearings, a driving pulley and a crushing roll fixed to each of said shafts, two motors arranged on opposite sides of said machine and having power pulleys, two driving belts independently connecting said power pulleys with said driving pulleys on the roll-carrying shafts, the tension on one of said belts being in opposition to the stress of the springs acting on said yielding bearing, and a belt tightener for each of said belts.

7. In a roll crushing machine, the combination with fixed and yielding bearings, of two shafts one of which is journalled in said fixed bearings and the other of which is journalled in said yielding bearings, a driving pulley and a crushing roll fixed to each of said shafts, two motors arranged on opposite sides of said machine and having power pulleys and two driving belts connecting said power pulleys with said driving pulleys on the roll-carrying shafts, the direction of rotation of the motor shafts being such as to cause the tight sides of said belts to run from the bottoms of said last-named pulleys so that the power is transmitted by the bottom runs of said belts, and the tension on one of said belts being in opposition to the stress of the springs acting on said yielding bearing.

8. In a roll crushing machine, the combination with fixed and yielding bearings, of two shafts one of which is journalled in said fixed bearings and the other of which is journalled in said yielding bearings, a driving pulley and a crushing roll fixed to each of said shafts, two motors, having power pulleys, and two driving belts independently connecting said power pulleys with said driving pulleys on the roll-carrying shafts, said motors being adjustably mounted on their bases, so that their positions towards and from said machine may be varied to vary or take up the slack of said belts, and the tension on one of said belts being in opposition to the stress of the springs acting on said yielding bearings.

9. In a roll crushing machine, a system for driving crushing rolls consisting of two power pulleys arranged on opposite sides of the center line between the two shafts of said crushing rolls, driving pulleys on said shafts, the top side of each of said driving pulleys turning in an inward direction, each power pulley driving the belt pulley on the roll shaft nearest to each of said respective power pulleys, so that the top runs of both of said belts will be slack and the bottom runs will be tight, with the result that the belt tension of the two drives will tend to keep the rolls apart and the shafts back against their respective bearings.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

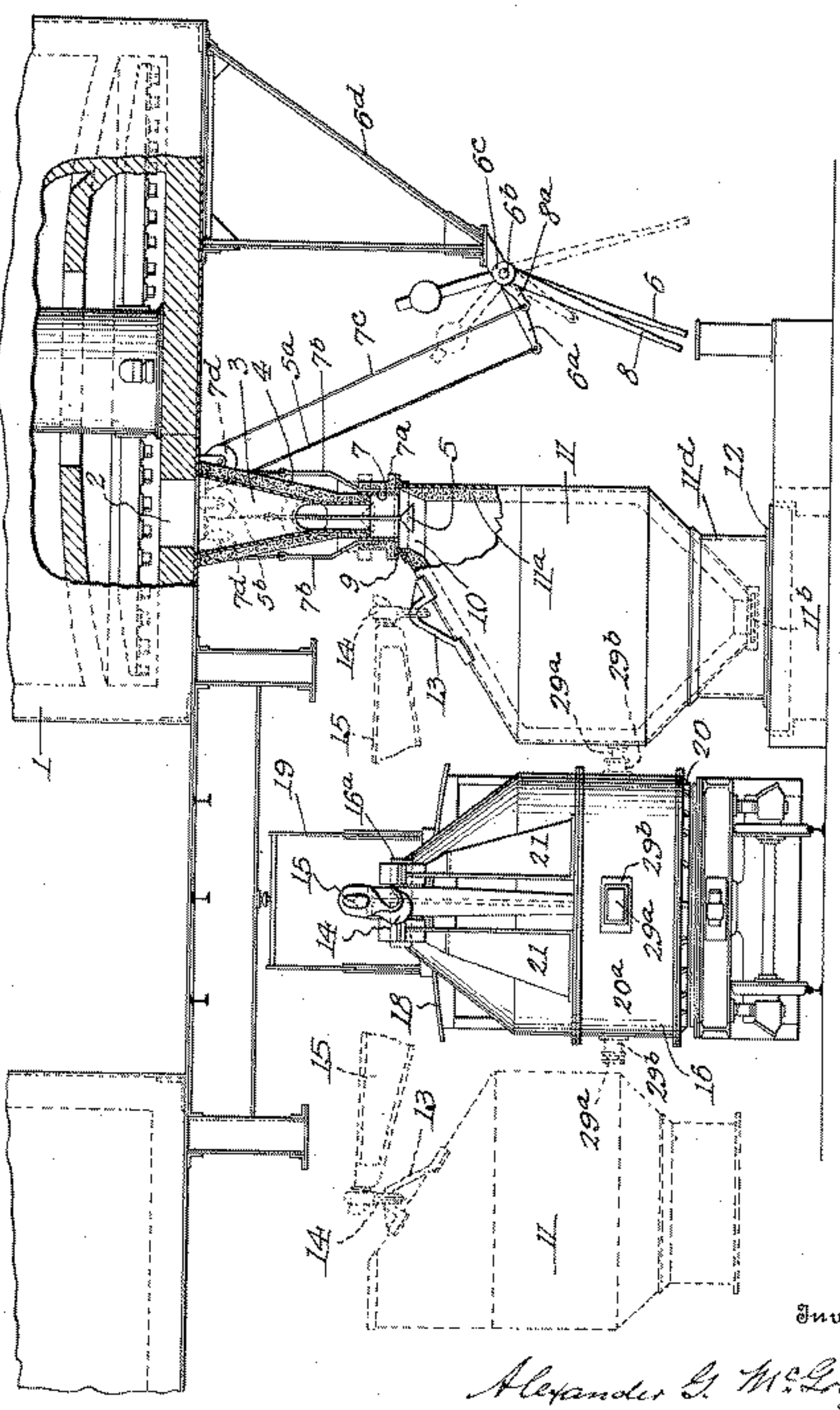
Aug. 11. 1925. **1,549,141**

A. G. McGREGOR

APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES AND CHARGING SAME INTO REVERBERATORY FURNACES

Filed April 7 1923 7 Sheets-Sheet 1

Fig. 1.



Inventor:

Alexander G. McGregor,

By [illegible]

Attorneys

Aug. 11, 1925. 1,549,141

A. G. McGREGOR
APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES
AND CHARGING SAME INTO REVERBERATORY FURNACES
Filed April 7, 1923 7 Sheets-Sheet 2

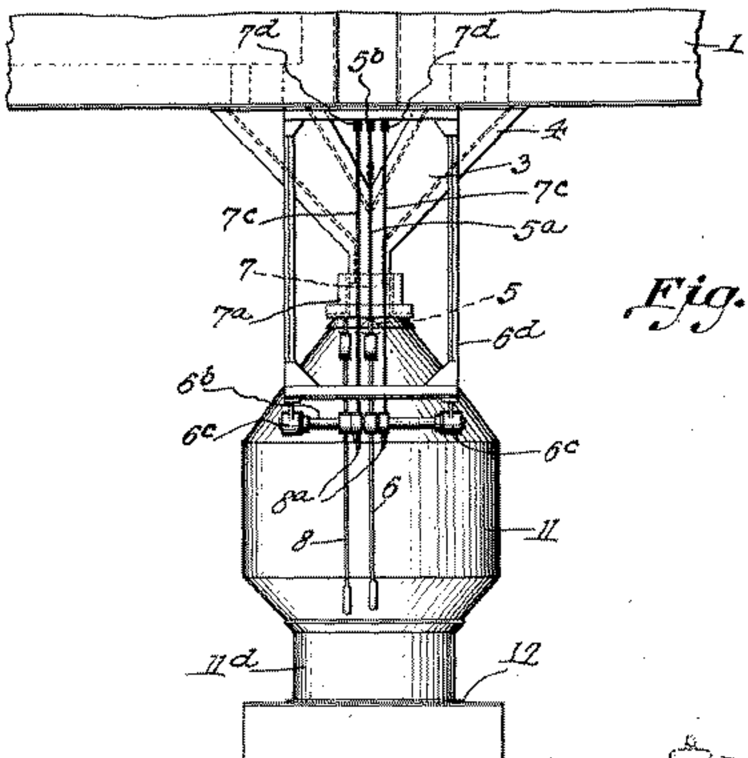


Fig. 2.

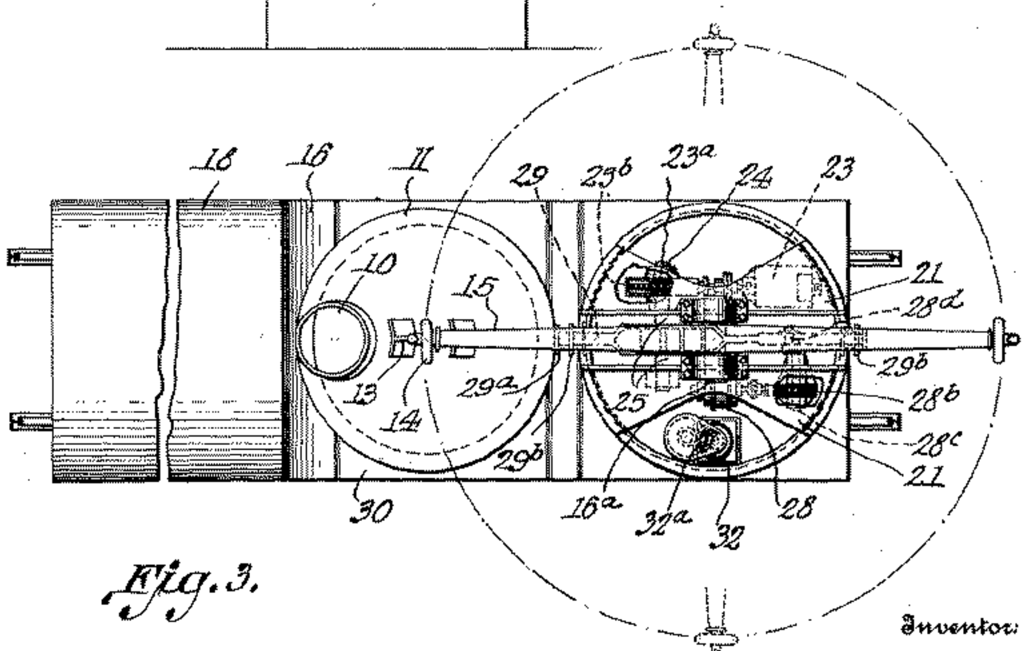


Fig. 3.

Inventor:
Alexander G. McGregor,
By Cahn & Kahn,
Attorneys.

Aug. 11, 1925. **1,549,141**

A. G. McGREGOR

APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES
AND CHARGING SAME INTO REVERBERATORY FURNACES

Filed April 7, 1923 7 Sheets-Sheet 3

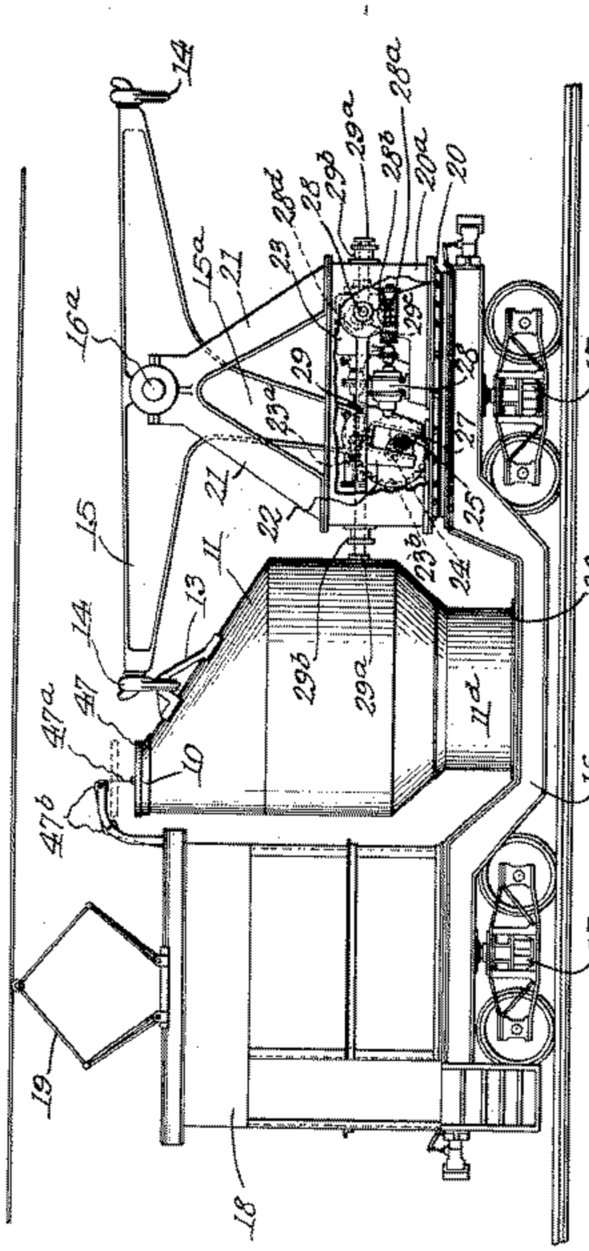


Fig. 4.

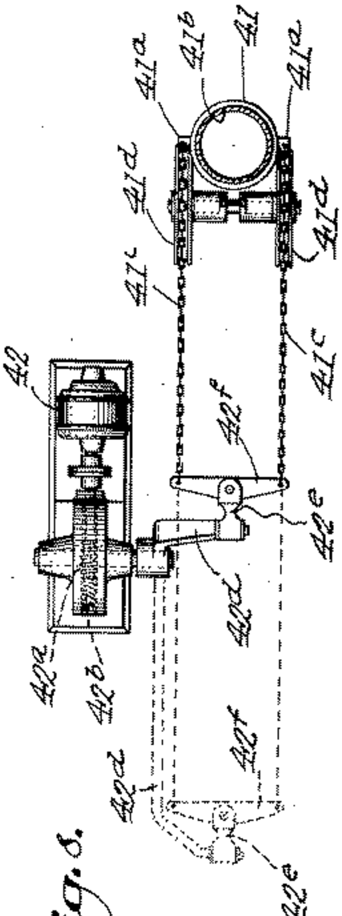


Fig. 8.

Inventor:

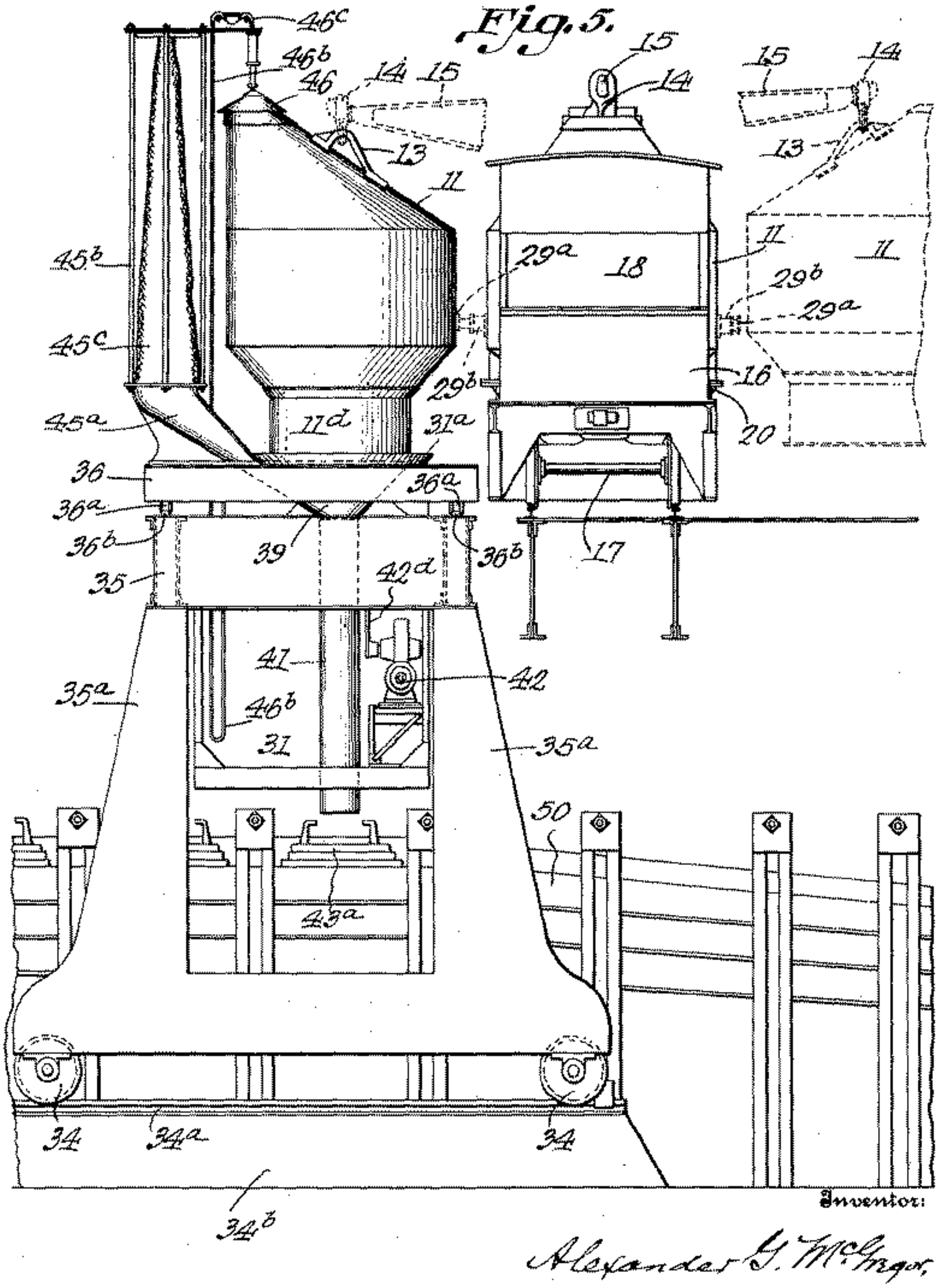
Alexander G. McGregor,

By Robert Kates,

Attorneys.

A. G. McGREGOR
APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES AND CHARGING SAME INTO REVERBERATORY FURNACES
Filed April 7 1923 7 Sheets-Sheet 4

Fig. 5.



Inventor:
Alexander G. McGregor,
By [signature]
Attorneys.

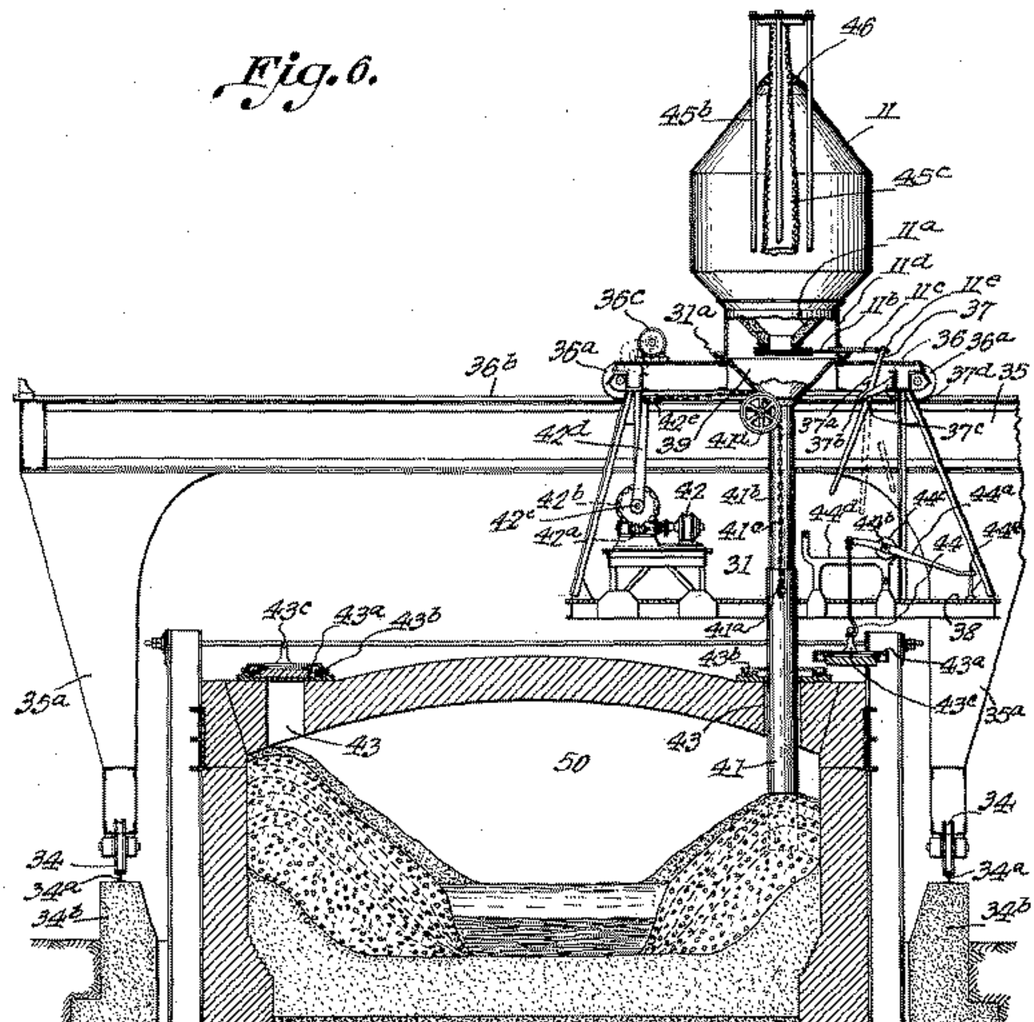
Aug. 11, 1925. 1,549,141

A. G. McGREGOR

APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES AND CHARGING SAME INTO REVERBERATORY FURNACES

Filed April 7, 1923 7 Sheets-Sheet 5

Fig. 6.



Inventor:
Alexander G. McGregor,
By Ratner Ratner,
Attorneys.

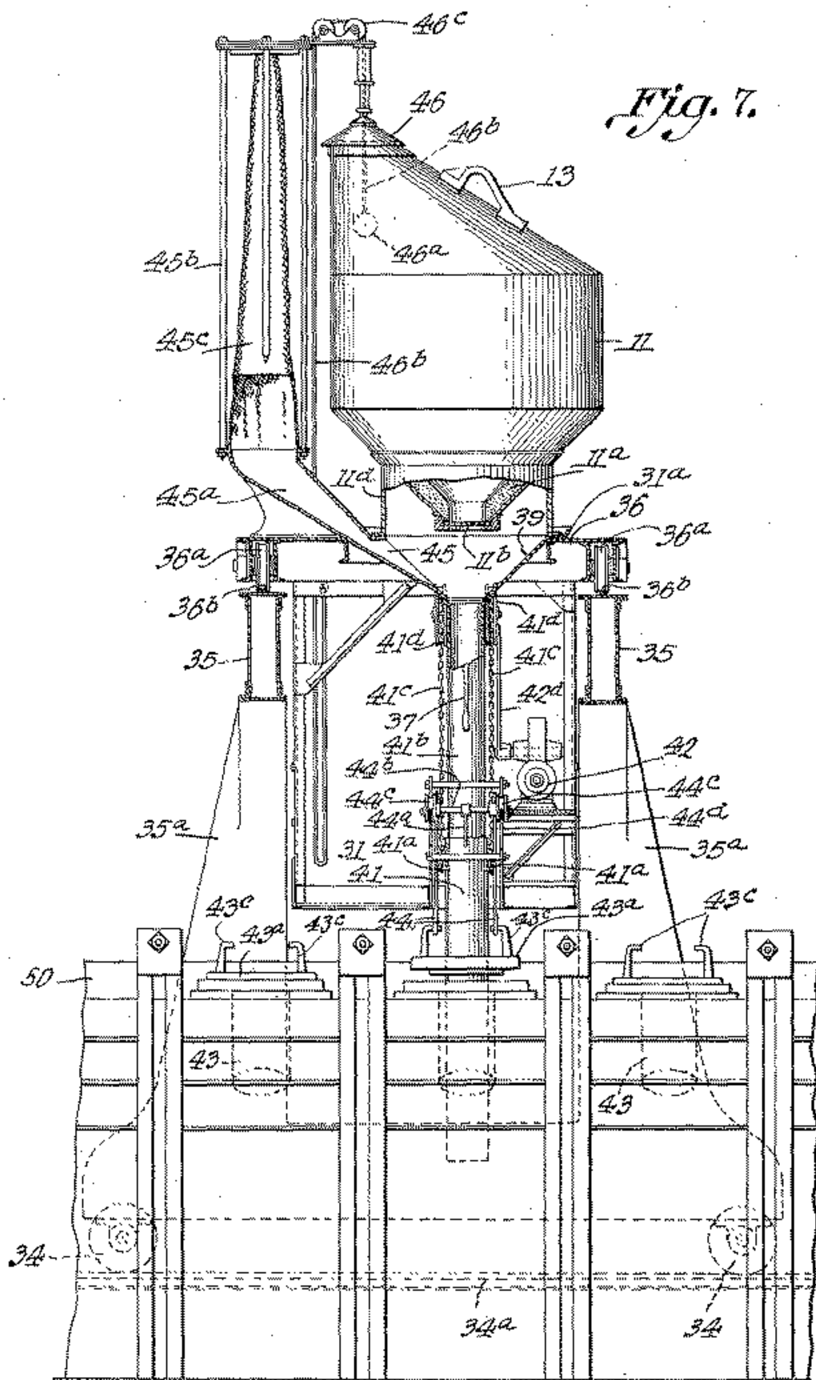
Aug. 11, 1925. 1,549,141

A. G. McGREGOR

APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES AND CHARGING SAME INTO REVERBERATORY FURNACES

Filed April 7, 1923 7 Sheets-Sheet 6

Fig. 7.



Inventor

Alexander G. McGregor,

By Rabner & Rabner,

Attorneys

Aug. 11, 1925. 1,549,141

A. G. McGREGOR

APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES AND CHARGING SAME INTO REVERBERATORY FURNACES

Filed April 7, 1923 7 Sheets-Sheet 7

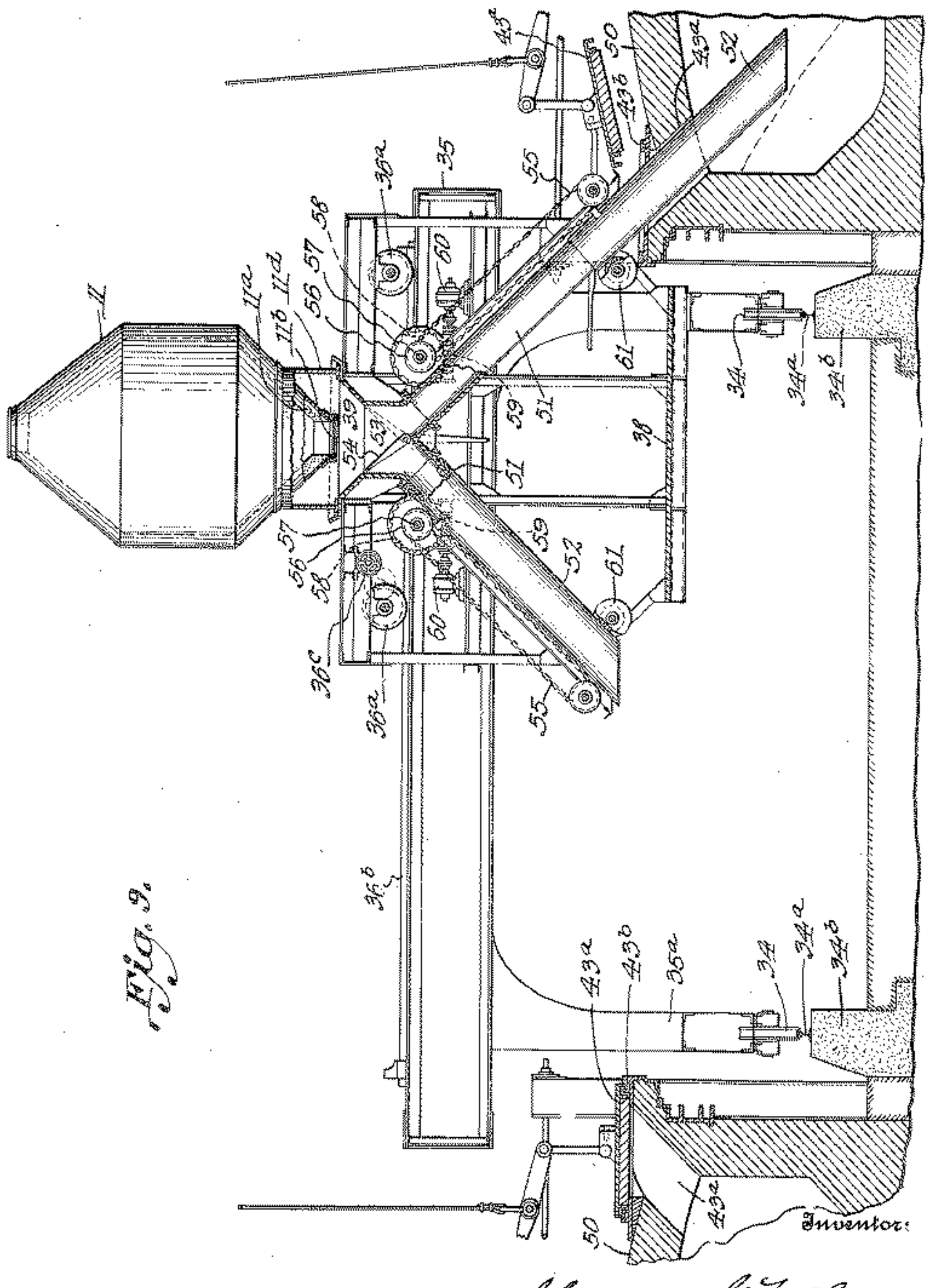


Fig. 9.

Inventor:

Alexander G. McGregor,

By Robert Calvert,

Attorneys.

Patented Aug. 11, 1925. **1,549,141**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

APPARATUS FOR TRANSPORTING CALCINE FROM ROASTER FURNACES AND CHARGING SAME INTO REVERBERATORY FURNACES.

Application filed April 7, 1923. Serial No. 630,589.

REISSUED

To all whom it may concern:

Be it known that I, ALEXANDER GRANT McGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Apparatus for Transporting Calcine from Roaster Furnaces and Charging Same into Reverberatory Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

In extracting copper from its sulphide ores in copper smelting works it is common practice to roast the crushed ores or concentrates in roaster furnaces having circular hearths superimposed one above another. These roaster furnaces discharge their product, commonly known as calcine, into hoppers underneath, each of these hoppers usually having a capacity for holding several hours' product of a furnace. The calcine hoppers are attached to the steel work supporting the roaster furnace, and the furnace and hopper or hoppers are placed high enough above the ground so that cars running on tracks on the ground below may be spotted under the gate or chute in the bottom of a hopper for receiving the calcine. The calcine is then transferred in these so-called calcine cars from the roaster furnace department to the reverberatory furnace department of the smelting works. In the transfer the cars and contents are usually weighed on a railroad scale.

A reverberatory furnace usually has a row of hoppers directly over each of its two long side walls. Railroad tracks are usually provided over these hoppers so that the contents of the calcine cars may be discharged into these reverberatory furnace hoppers and from these overhead hoppers the calcine passes down through pipes or tubes and through holes provided in the roof of the furnace. The pipes or tubes direct the charge in the holes in the furnace roof. From this point the charge has a free fall through the atmosphere of the furnace to the pile of charge in the furnace below. As the calcine is usually very dusty a certain amount is lost in the transfer from the roaster hopper to the calcine car, and from the calcine car into the reverberatory furnace hoppers.

The free fall through the atmosphere inside the furnace liberates a great deal of dust so that, at the time of charging, the furnace is filled with dust. The dust thus raised has a number of bad effects or disadvantages, as follows:

(*a*) The furnace roof is of silica brick and is maintained at a nearly fusing temperature inside the furnace. The dust from the charge, being basic, it fluxes the nearly fusing silica and thus greatly increases the erosion of the furnace roof which requires frequent renewals.

(*b*) The fine dust settles upon the blanket of slag in the furnace and often the proper fluxing element is not present for such dust particles, and they pass out of the furnace without giving up their precious metal value to the matter underneath the blanket of slag, and thus the dust raised inside the furnace increases the slag losses.

(*c*) A great deal of dust is carried along through the furnace by the strong draft of the furnace, settling down in the flue connection, and in the waste heat boilers beyond, and on the heating surface of said boilers. Extra labor is required to keep the flues and boilers cleaned out. Also there is excessive wear on the boiler tubes, especially the first row of tubes, due to the sand blast effect of the dust particles impinging upon them.

(*d*) Some of the dust raised in the furnace during the charging operation passes entirely beyond the flues and waste heat boilers and up through the stack and to the outside atmosphere, entailing further loss of valuable material.

By the system of calcine handling and furnace charging now practiced, the calcine leaving the last roaster hearth often has a temperature of over 1200° F., and often cools down to less than 700° F. before it is finally deposited inside the reverberatory furnace. As about three heat units in fuel are required to impart one heat unit to the charge in the furnace, it is apparent that if the temperature of the calcine leaving the roaster hearth be carefully conserved a considerable saving in reverberatory furnace fuel will result.

The present invention relates to an apparatus or system whereby calcine may be transferred from a roaster furnace to the inside of a reverberatory furnace in such a manner as to avoid the many disadvantages hereinbefore indicated incidental to the present practice.

In the accompanying drawings Fig. 1 is an elevation, partly in section, showing a transfer container located beneath a roasting furnace and adjacent a transfer car. Fig. 2 is an elevation of the same looking from the right in Fig. 1, with the transfer car omitted. Fig. 3 is a plan view of the transfer car with the container mounted thereon. Fig. 4 is an elevation of the same. Fig. 5 is an elevation showing a transfer car, and a charging machine with a container mounted thereon adjacent a reverberatory furnace. Fig. 6 is an elevation of a charging machine with a container mounted thereon over a reverberatory furnace. Fig. 7 is an elevation of the same looking from the right of Fig. 6. Fig. 8 is a detail plan view showing means for raising and lowering the sleeve of the telescoping charging tube. Fig. 9 is a sectional elevation illustrating a modified form of charging machine.

Referring to the drawings 1, denotes a roasting furnace or furnaces from which the hot roasted ores, in more or less comminuted form, are discharged, as through an opening 2, into a chute 3, having an insulated covering 4. The outlet from the chute 3 is controlled by a vertically movable valve or gate 5 joined, by a cable 5^a or other suitable flexible connection passing over a pulley 5^b, with an arm 6^a controlled by an operating handle 6, said arm and handle being preferably connected with a rock-shaft 6^b mounted in bearings 6^c sustained by a suitable frame 6^d suspended beneath the roasting furnace 1.

Mounted at the lower end of the chute 3 is a sliding sleeve 7 also preferably having an insulated covering 7^a, said sleeve being provided with upwardly extending arms 7^b to which are attached cables or other suitable connections 7^c passing over pulleys 7^d and running from said pulleys to an arm 8^a on the rock-shaft 6^b and to which rock-shaft is also attached an operating handle lever 8 by which and the connections referred to, the said sleeve may be raised and lowered. The sliding sleeve 7 is provided with a flange 9 fitting closely over the entrance mouth 10 of a container 11 when said container is located beneath said sleeve, as shown more clearly in Fig. 1. The container 11 is preferably provided with an insulating lining 11^a, although the said container may, if desired, have an insulating covering, as is shown on the chute 3 and sleeve 7, for the purpose of retaining the heat in the material discharged from the roasting furnace 1.

The container 11 is shown in Fig. 1 as resting on a scale platform 12, said container being provided with an eye 13 adapted to be engaged by a lifting hook 14 carried by an arm 15 of a three-armed walking-beam mounted on a transfer car 16. The said car is provided with suitable trucks 17 which, in practice, will be equipped with electric motors similar to the usual electric car trucks, for driving the car. Also the said car comprises an operator's cab 18 which, in practice, will be equipped with suitable electric controllers to enable the operator to manipulate the car and the parts mounted thereon by electric connections of well-known form, such connections receiving current from an overhead trolley wire through a collector 19.

Mounted on the transfer car 16 is a turn-table 20 supporting a turret 20^a on which are mounted suitable supports 21 for the gudgeons 16^a of the three-armed walking-beam which is to handle the containers 11. The depending arm 15^a of the said walking-beam is provided with a fork 22. Mounted on the turn-table 20 is an electric motor 23 the shaft of which carries a worm gear 23^a meshing with a worm wheel 23^b mounted on a shaft 24 provided with a crank 25 and which crank is preferably provided with a sliding shoe 27 working in the fork 22. By means of this mechanism rocking movements may be imparted, when desired, to the three-armed walking-beam, as will be understood, for the purpose of lifting or lowering the containers.

Also mounted on the turn-table 20 is an electric motor 28 the shaft of which carries a worm 28^a meshing with a worm gear 28^b on a shaft 28^c having a crank 28^d. Mounted to slide in bearings 29^b supported on the turret 20^a is a thrust-bar 29 an enlarged rear part of which is provided with a slot 29^c in which the crank 28^d works, the outer end 29^a of said thrust bar impinging against a container 11. The lifting eye 13 of the said container is so located that the container will hang slightly out of plumb, the lower end tending to swing in toward the turret 20^a, and the thrust bar 29 is provided to overcome this tendency when the container is being lowered onto a platform scale 12, or onto the platform 30 of a transfer car, or onto a platform of a charging machine 31.

Also mounted on the turn-table 20 is an electric motor 32 the shaft of which is connected by suitable gearing 32^a with the said turn-table, so that the latter, with the walking beam and other parts mounted on said turn-table, may be rotated when desired. The motors 23, 28 and 32 will have suitable electric connections, which it is not necessary to illustrate in detail, extending to the cab 18, and by means of which the driver of the car in said cab may cause these motors to be operated at proper times to perform their intended functions, as hereinbefore indicated.

The charging machine 31 is mounted on a bridge or travelling crane 35 the side legs or supports 35^a of which are provided with wheels 34 running on tracks 34^a on suitable ways 34^b extending lengthwise of the reverberatory furnace or furnaces 50, so that the said charging machine may be caused to travel back and forth over the furnace or furnaces. The charging machine is carried by a truck or trolley 36 provided with wheels 36^a running on tracks 36^b on the travelling bridge or crane 35, so that said charging machine may be caused to travel from one side to the other of the said travelling bridge or crane in charging the opposite sides of a furnace. To effect the travelling movements of the truck or trolley 36 on the tracks 36^b an electric motor 36^c suitably geared to the driving wheels of the said truck is preferably provided. In practice a travelling bridge or crane and a charging machine thereon will preferably be provided for each furnace.

The truck or trolley 36 is provided with a support 31^a adapted to receive a container 11, and said container is provided at its bottom with a sliding gate 11^b having an extension 11^c working through the side walls 11^d on said container, the said extension having an opening or eye 11^e at its outer end adapted to receive the upper end of an operating lever 37. The lever 37 is provided with hooks 37^a and 37^b to engage a fulcrum support 37^c afforded by a bracket 37^d mounted on the truck or trolley 36. When the said lever is suspended from the hook 37^b, as shown in Fig. 6, its upper end will be engaged in the eye portion 11^e of the operating extension 11^c of the sliding gate 11^b and will thus be in a position to move the said sliding gate in and out as may be desired; but when the said lever is not in use the hook 37^b will be disengaged from the fulcrum support 37^c and the hook 37^a then be engaged with said support, thus lowering said lever out of the way and disengaging it from the operating connection 11^c. The lever 37 may be manipulated by an operator standing on the platform 38.

Mounted on the truck or trolley 36 is a hopper 39 beneath the gate 11^b of the container 11, said hopper serving to guide the material discharged from said container to a charging tube consisting of a movable sleeve 41, and a fixed portion or tube part 41^b extending from the bottom of said hopper 39. The sleeve 41 is provided with ears 41^a to which are attached chains 41^c running over pulleys 41^d. Suitably supported on the charging machine is an electric motor 42 the shaft of which is provided with a worm 42^a geared to a worm wheel 42^b on a shaft 42^c carrying an upwardly extending arm 42^d with which is connected a link or clevis 42^e carrying an evener 42^f to which the ends of the chains 41^c are attached. By virtue of this construction the sleeve portion 41 of the telescoping charging tube may be raised and lowered through holes 43 in the top of the reverberatory furnace, as will be understood.

The furnace is provided at intervals near its side walls or at any other desired points with the charging holes 43, and these charging holes are furnished with easily removable covers 43^a fitting into sand lutes or seals 43^b, said covers being provided with lifting lugs 43^c. The covers 43^a may be removed from over the charging holes by means of hooks 44 the shanks of which are jointed at their upper ends to levers 44^a, the fulcrums 44^b of said levers being concentric with rollers 44^c adapted to be moved back and forth on tracks 44^d. When a cover is removed laterally as shown at the right in Fig. 6 the outer end of the lever carrying said hooks may be engaged with a hooked retaining standard 44^e of the platform 38.

The hopper 39 communicating with the charging tube 41^b is provided at one side with an opening communicating with the chamber 45 of a spout 45^a attached to the lower end of a frame 45^b which supports a fabric bag 45^c the open lower end or mouth of which communicates with the chamber of the said spout 45^a. The spout 45^a serves as an air and dust vent from the charging tube, and the fabric bag 45^c is of closely woven material which will permit the passage of air but will retain dust particles which may fall back into the spout 45^a and be returned to the hopper 39.

Supported from the top of the frame 45^b is a cover 46 fitting closely over the mouth 10 of the container 11, said cover being adapted to be raised and lowered by means of a float 46^a and a chain 46^b passing over pulleys 46^c supported by the said frame 45^b. The float 46^a may be used as a sounding device by the operator for ascertaining the approximate amount of charge in the container at any time. Supported from the top of the cab 18 of the transfer car is a cover 47 which may be fitted over the open mouth 10 of the container 11 when the container is being transferred from the roasting furnace to the reverberatory furnace, said cover being attached to a chain 47^a running over pulleys 47^b and downward to a point convenient for access by the operator.

It will be understood that by reason of the fact that the container 11 is provided with a heat insulating lining, and that the chute 3 and sleeve 7 are also provided with heat insulating coverings, the heat in the hot material discharged from the roasting furnace will be retained so that the roasted material may be delivered to the reverberatory furnace while still hot, thereby greatly economizing heat in the smelting operation, as hereinbefore indicated. Also the radiation of heat from the inside of the containers in being transferred from the roasting furnace to the reverberatory or smelting furnace will be prevented by the cover 47 on the transfer car and the cover 46 on the charging machine.

Fig. 9 illustrates a modified form of charging machine most of the parts of which are similar to those of the charging machine hereinbefore described, and are similarly indicated by reference characters, but in this modified form of charging machine two inclined charging tubes having fixed portions 51 and sliding sleeve portions 52 are provided, these inclined charging tubes communicating through a tubular portion 53 with the hopper 39 which receives the material from the container 11. A gate 54 is mounted in the sleeve portion 53 so that the material from the said hopper may be directed into either one of these inclined charging tubes which are arranged to extend through inclined openings 43^a in the reverberatory smelting furnaces 50. Connected with the sliding sleeves 52 are chains 55 running over pulleys 56 mounted on shafts 57 carrying worm wheels 58 meshing with worms 59 on the shafts of electric motors 60. These connections between the sliding sleeves 52 and the electric motors 60 enable the said sleeves to be moved up and down, as will be understood. The sliding sleeve portions 52 of the charging tubes rest on steadying wheels 61.

The operation of my system may be described as follows. The transfer car having an empty container supported by one arm of the walking-beam 15 is stopped opposite a filled container at the roaster plant. At this time the gate or valve 5 is closed and sleeve 7 is raised. With the empty container attached to one arm, the walking-beam is swung around and its other arm is engaged with a loaded container located beneath the chute 3. The loaded container is then raised slightly from the scale upon which it was resting and is swung around and set upon the platform 30 of the transfer car, the empty container at such time acting partly as a counterbalance for the loaded container. The hook 14 is then disengaged from the loaded container and the beam is swung around and the empty container is set upon the scale platform 12 just vacated by the loaded container. The sleeve 7 is now lowered to close the space between chute 3 and the mouth 10 of the container and the valve 5 is opened by being lowered. After the arm 15 of the walking-beam is disengaged from the empty container it is swung in a position nearly parallel with the axis of the car so as to reduce the clearance required for the car, but neither arm 15 of the walking-beam need engage the lifting eye of the loaded container.

The transfer car carrying the loaded container now proceeds to the reverberatory furnace plant and stops opposite a charging machine having an empty container resting upon it. The walking-beam is then swung around and one arm 15 engages the lifting eye of the empty container. The empty container is lifted and the beam is swung around and the other arm is engaged with the lifting eye of the loaded container. With the empty container assisting in counter-balancing the loaded container, the latter is lifted off the car and swung around to take the place on the charging machine just vacated by the empty container. After the beam is disengaged from the loaded container, the empty container is swung around over platform 30 of the car. The empty container may or may not be lowered to rest upon the platform, and the hook is not disengaged from it. The transfer car with the empty container is now ready to proceed back to the roaster plant, thus completing its cycle of operation.

The charging machine carrying a loaded container and with handle 37 engaged with gate 11^b is stopped with the sleeve 41 directly above a charge hole through which a charge is to be delivered. The charge hole cover 43^a is moved to one side by means of handle 44^a and hooks 44. The sleeve portion 41 of the charging tube is then lowered down so that its lower end rests upon, or nearly rests upon, the melting charge inside the furnace. The gate 11^b is now opened by means of handle 37 and the hot calcine from container 11 is allowed to run down through the charging tube 41^b and sleeve 41 and be deposited upon the melting charge already in the furnace. The sleeve 41 is then gradually raised slowly enough at all times so its lower end is kept filled up for some distance with the charge. The dusty charge will thus slide gently down the slopes of that which was first deposited; but in no event is the sleeve 41 to be raised fast enough so that the material issuing from its lower end will have a free fall through the furnace atmosphere and thus liberate a cloud of dust.

The bottom end of the sleeve 41 may thus be raised gradually up to the furnace arch leaving a somewhat conical shaped pile of charge beneath. If desired the sleeve may be pressed down again, crowding the charge just deposited sideways and out further into the furnace. The slow raising operation may be repeated and additional charge deposited. The downward thrusting and spreading of the charge and the slow raising may be repeated several times if desired. When sufficient charge has been deposited the gate 11^b is closed, the sleeve 41 is then entirely removed from the charge hole 43 of the furnace, and the cover 43^a replaced. The bridge or traveling crane 35 may then be moved along the furnace and stopped in proper position for lowering the sleeve 41 in the next hole 43 to be charged and so on.

When the container 11 is empty gate 11^b is closed and the lever 37 is shifted so that it will be supported by hook 37^a on fulcrum 37^F. In this way the upper end of lever 37 will be down in the clear so that the container 11 may be swung around without interfering with said lever 37. When the loaded container is again placed on the support 31 the upper end of lever 37 is moved up so as to enter the hole 11^e and thus engage the gate stem 11^c, and in this raised position the lever 37 will be supported by hook 37^b. In this position lever 37 can be used to open or close the gate 11^b at will.

It is to be understood that the foregoing description of the invention and the accompanying drawings are for illustrative purposes only, and that the mechanical details of the apparatus shown and described may be varied widely without departing from the spirit of the invention. For example, the container 11 may be placed upon another car at the right hand end of Fig. 4 instead of on the car carrying the revolving turret and lifting means, and rigid jibs or booms may be substituted for the walking-beam, each jib or boom having its own lifting or hoisting mechanism. Also the charging tube and sleeve projecting down inside of the furnace at the time of charging, for the purpose of preventing dust inside the furnace, might be employed in connection with a stationary hopper without departing from the spirit of my invention. Also the tube and telescopic sleeve might be used in connection with a movable charge car running on a track over the furnace.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. An apparatus for transferring hot ore product from a roasting furnace to a smelting furnace, comprising a container having a heat non-conducting or insulated outer wall, a filling opening at its top, a discharge opening at its bottom, and a gate for controlling said discharge opening, combined with means for transferring said container from beneath a roasting furnace when filled to a position over a smelting furnace into which its contents are to be discharged, said means comprising a transfer car provided with lifting and transporting means adapted to raise said container when filled and place it on said car and subsequently move said container from the car and place it over the smelting furnace.

2. An apparatus for transferring hot ore product from a roasting furnace to a smelting furnace, comprising a container having a filling opening at its top, a discharge opening at its bottom, and a gate for controlling said discharge opening, combined with means for transferring said container from beneath a roasting furnace when filled to a position over a smelting furnace into which its contents are to be discharged, said means comprising a transfer car provided with lifting and transporting means adapted to raise said container when filled and place it on said car and subsequently move said container from the car and place it over the smelting furnace.

3. An apparatus for transferring hot ore product from a roasting furnace to a smelting furnace, comprising a container having a filling opening at its top, a discharge opening at its bottom, and a gate for controlling said discharge opening, combined with means for transferring said container from beneath a roasting furnace when filled to a position over a smelting furnace into which its contents are to be discharged, said means comprising a transfer car having a turn-table, a three armed walking-beam mounted on said turn-table, and means for operating said turn-table and said walking-beam.

4. An apparatus for transferring hot ore product from a roasting furnace to a smelting furnace, comprising a container having a filling opening at its top, a discharge opening at its bottom, and a gate for controlling said discharge opening, combined with means for transferring said container from beneath a roasting furnace when filled to a position over a smelting furnace into which its contents are to be discharged, said means comprising a transfer car provided with lifting and transporting means adapted to raise said container when filled and place it on said car, a charging machine to which said container may be transferred from said car by said lifting and transporting means, said charging machine having an extensible charging tube, and means for moving said charging machine over the smelting furnace.

5. An apparatus for transferring hot ore product from a roasting furnace to a smelting furnace, comprising a container having a filling opening at its top, a discharge opening at its bottom, and a gate for controlling said discharge opening, combined with means for transferring said container from beneath a roasting furnace when filled to a position over a smelting furnace into which its contents are to be discharged, said means comprising a transfer car having a turn-table, a three-armed walking-beam mounted on said turn-table, and means for operating said turn-table and said walking-beam, a charging machine to which said container may be transferred from said car

by said lifting and transporting means, said charging machine having an extensible charging tube, and means for moving said charging machine over the smelting furnace.

6. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace.

7. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car and suitable means for moving said containers to and from said transfer car.

8. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having means for raising and lowering said containers.

9. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having means for raising and lowering said containers, and means for moving said containers horizontally.

10. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having suitable means for moving said containers to and from said car, said car having a platform upon which to rest said containers while they are being transferred from a roasting furnace to a smelting furnace.

11. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having propelling means, a revolving turret, and hoisting means on said revolving turret for lifting and lowering said containers.

12. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers, from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having propelling means, a revolving turret, hoisting means on said revolving turret for lifting and lowering said containers, and means for supporting said containers while they are moved from one furnace of the plant to another.

13. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said transfer means consisting of a transfer car having a revolving turret provided with hoisting means extending on two opposite sides, whereby an empty container on one side may be used to partly counterbalance a loaded container on the other side.

14. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having a revolving turret provided with hoisting means on two opposite sides, whereby an empty container on one side may be used to partly counterbalance a loaded container on the other side, and a support for a loaded container while the hoisting means on one side is swinging around to engage

an empty container that will serve as a counterbalance while swinging the loaded container off the transfer car to its support at a desired location.

15. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having propelling means, a revolving support, and a walking beam mounted on said support, said walking beam having means at its outer ends for engaging said containers, and means for causing the walking beam to oscillate up and down in raising or lowering the containers.

16. An apparatus for transferring hot ore product from a roasting furnace to a smelting furnace, comprising a container having a heat non-conducting or insulated outer wall, a filling opening at one side of its top, a lifting engagement device near the central part of said top and a discharge opening at its bottom, combined with a gate for controlling said discharge opening and with means for transferring said container from beneath a roasting furnace, when filled, to a position over a smelting furnace into which its contents are to be discharged, said means comprising a transfer car provided with lifting and transporting means adapted to engage said lifting device so as to raise said container when filled and place it on said car and subsequently move said container from the car and place it over the smelting furnace, the one-sided location of said filling opening permitting the container to be engaged by the lifting means without interference.

17. A transfer car having propelling means, a revolving support, a walking-beam mounted on said support, means, mounted upon the body of said car, for rotating said support, said walking beam having means at its outer ends for engaging loads, and means for causing the walking-beam to oscillate up and down in performing its function of raising and lowering the containers.

18. An apparatus for charging a reverberatory furnace with dusty material, comprising a tube with means for projecting it down into the said furnace at the time of charging so that its lower end may rest or nearly rest upon the surface of material already smelting in the furnace, the new dusty charge thus passing down into said furnace through said tube, means for gradually raising said tube allowing the charge to progressively build up and slope somewhat conically from the lower end of said tube, and means whereby said tube may be again forced down into said furnace, flattening out the charge material already in the furnace in such a way that the upper part of said pile of charge will be forced downwardly over the sloping part of said charge without any of said charge having a free fall through the atmosphere inside of said furnace, thus making room for more charge without the liberation of dust inside of said furnace.

19. A system for transferring calcine from a roaster furnace to a reverberatory furnace, consisting of portable closed containers adapted to be located under a roaster furnace, for receiving the product of said roaster furnace, means for transferring said containers to the reverberatory furnace, means for discharging the contents of said containers directly from said containers into said reverberatory furnace, and means for avoiding a free fall of said charge through the atmosphere inside of said last-named furnace.

20. A system for transferring calcine from a roaster furnace to a reverberatory furnace for the purpose of reducing temperature and dust losses, consisting of portable, heat-insulated, closed containers adapted to be placed under a roaster furnace, for receiving the product of said roaster furnace, means for transferring full containers from the roaster furnace to a reverberatory furnace, means for discharging the contents of said containers directly into said reverberatory furnace, and means for avoiding a free fall of the charge through the atmosphere of said last-named furnace.

21. A system for transferring calcine from a roaster furnce to a reverberatory furnace, consisting of portable closed containers adapted to be placed under the roaster furnace, for receiving the hot product of said roaster furnace, means for transferring said containers to the reverberatory furnace, means for discharging the contents of said containers directly from said containers into said reverberatory furnace, and means for avoiding a free fall of the charge through the atmosphere of said last-named furnace.

22. In a plan for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers, and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having means for raising and lowering said containers, and means for steadying the containers laterally when lifted.

23. In a plant for handling comminuted ores where the product of a roasting furnace

is to be transferred to a smelter, a system of portable closed containers, and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car haivng means for raising and lowering said containers, means for moving said containers horizontally, and means for steadying the containers laterally when lifted.

24. In a plant for handling comminuted ores where the product of a roasting furnace is to be transferred to a smelter, a system of portable closed containers, and transfer means for said containers whereby the full containers from a roasting furnace are replaced by empty containers from a smelter, and empty containers from a smelter are replaced by full containers from a roasting furnace, said means consisting of a transfer car having suitable means for lifting said containers and moving them onto and off from said car, said car having also means for steadying said containers laterally to hold them upright when lifted, and a platform upon which to rest said containers while they are being transferred from a roasting furnace to a smelting furnace.

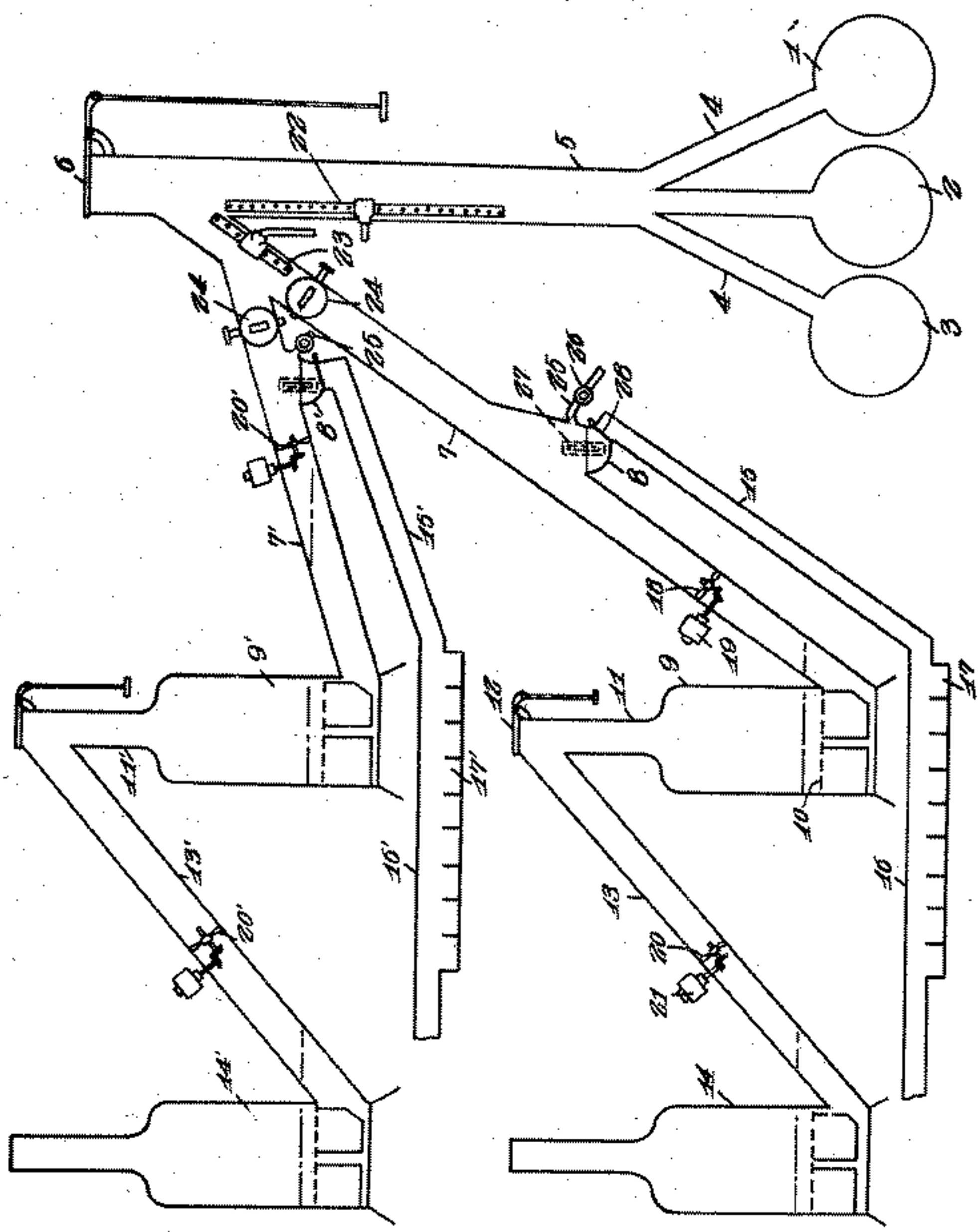
In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

Sept. 7, 1926. M. M. MEDIGOVICH **1,599,027**

APPARATUS FOR TREATING CORROSIVE GASEOUS FUMES

Filed May 26, 1924



M.M. Medigovich, Inventor

By C.A. Snow & Co.
Attorney

Patented Sept. 7, 1926. **1,599,027**

UNITED STATES PATENT OFFICE.

MITAR M. MEDIGOVICH, OF BISBEE, ARIZONA.

APPARATUS FOR TREATING CORROSIVE GASEOUS FUMES.

Application filed May 26, 1924. Serial No. 716,016.

This invention relates to apparatus for treating corrosive gaseous fumes such as are produced in the treatment of sulfid ores.

As is well known to those skilled in the art these fumes are highly destructive of vegetable and animal life and unless treated they become a menace in the territory adjoining the furnaces.

It is also well known that the fumes generated often contain valuable compounds which, if recovered, add materially to the profit resulting from the ore treatment.

It is an object of the present invention to provide apparatus which will act efficiently to recover values contained within the injurious fumes and the smoke or other gaseous products of a burner and at the same time neutralize the harmful gases or else prevent their escape into the surrounding atmosphere.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

In the accompanying drawing has been shown, more or less in diagram the apparatus constituting the present invention.

Referring to the drawing by characters of reference 1 and 2 designate the furnaces and 3 the converter of an ore treating apparatus, these structures being connected by flues 4 to a main stack 5 the outlet end of which is adapted to be closed by a damper 6. Extending downwardly from the upper portion of the stack 5 is a separating flue 7 provided, in its lower wall, with a pocket 8 for trapping solids. The lower portion of flue 7 opens into the bottom portion of a tank 9 provided, above the level of the lower end of the flue 7, with a perforated partition 10. A stack 11 projects upwardly from the flue 9 and is provided with a damper 12 and, if desired, another flue 13 can be extended downwardly from stack 11 into the bottom portion of a tank 14 similar to the tank 9. A pipe 15 extends downwardly from the bottom portion of the pocket 8 and opens into one end of a collecting trough 16, the bottom of which is divided into separate receptacles 17 or can be provided with separate containers.

A fan 18 is mounted for rotation within the flue 7 and can be driven by one or more motors 19 as shown. Another fan 20 can be located in the flue 13 and can be driven by one or more motors 21. A water spraying pipe 22 is located in the upper portion of the stack 5 and another water spraying pipe 23 is located in the upper portion of the flue 7. A damper 24 can be mounted in flue 7 for closing communication between the lower portion of this flue and the stack 5 when it is desired to clean out or repair said flue and the parts with which it communicates. Another flue 7′ can be extended from the flue 7 at a point above damper 24 and also be provided with a damper 24′. This flue 7′ can be provided with a fan 20′ and can open into a tank 9′ and thence through a stack 11′ into a flue 13′ having a fan 20′. In other words the stack 5 can communicate with either or both of two separating units which are of the same construction and either of these can be used while the other is being cleaned out or repaired. A water supply pipe 25 opens into each pocket 8 and 8′ and is provided with a valve 26. A gauge glass 27 or the like is also provided at each pocket 8 or 8′ so that the level of the liquid in the pocket can be determined readily at any time.

As before pointed out the apparatus herein described is particularly useful in treating the gaseous fumes from furnaces used in treating ores. In practice it is especially useful where copper is being treated. The fumes generated in the furnaces 1 and 2 and converter 3 will rise within the stack 5 and, being intensely hot, will convert into steam the jets of water sprayed into the stack from the pipe 22. The steam will combine with some of the gaseous products both in the stack 5 and in the upper portion of the flue 7 where the water is sprayed from pipe 23. The steam treated combustion products will be sucked downwardly within the flue 7 by the fan 18 and heavy solid particles contained within the mixture will be precipitated into the pocket 8. The remaining products will be forced into water which is contained within the lower portion of tank 9 and extends above partition 10. The pressure will be sufficient to force the fumes upwardly through the body of water and through the partition 10 so that they are then free to flow into the stack 11 if any gaseous portions are remaining after this treatment. From stack 11 this remaining portion of the fumes will be pulled downwardly by fan 20 and forced upwardly through another body of water contained in the lower portion of the tank 14 which tank is likewise provided with an apertured partition 10′ corresponding with the partition 10. It is not always necessary to use flue 13 and the parts with which it communicates because often all of the parts to be recovered are properly retained before the stack 11 is reached. Such being the case the damper 12 can be opened to permit air and any gases mixed therewith to flow into the atmosphere.

At desired intervals a valve 28 located in the bottom of the pocket 8 can be opened to allow the contents of the pocket to drain downwardly into the conduit 16. From this conduit the fluid can pass outwardly to a suitable receptacle while the solids will be deposited within the receptacle 17. After valve 28 has been closed pocket 8 can be refilled from the pipe 25.

It has been found in practice that by using apparatus such as described an efficient treatment of fumes can be effected and practically all values therein recovered.

What is claimed is:—

Apparatus of the class described including a stack for receiving fumes from furnaces or the like, a tank having an inlet at the bottom and an outlet at the top, said tank constituting means for holding water with its level above the inlet, a flue inclined downwardly from the upper portion of the stack to the inlet of the tank, a pocket between the ends of the flue in the lower wall of said flue for receiving solids gravitating within the flue, means for spraying water into the stack and flue, means for supplying water to the pocket to maintain a predetermined level therein, a separating trough, a pipe for establishing communication between the pocket and the trough, a valve normally closing communication between the pocket and pipe, and means within the flue for setting up a forced circulation of fumes downwardly within the flue and into the water contained within the tank.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

MITAR M. MEDIGOVICH.

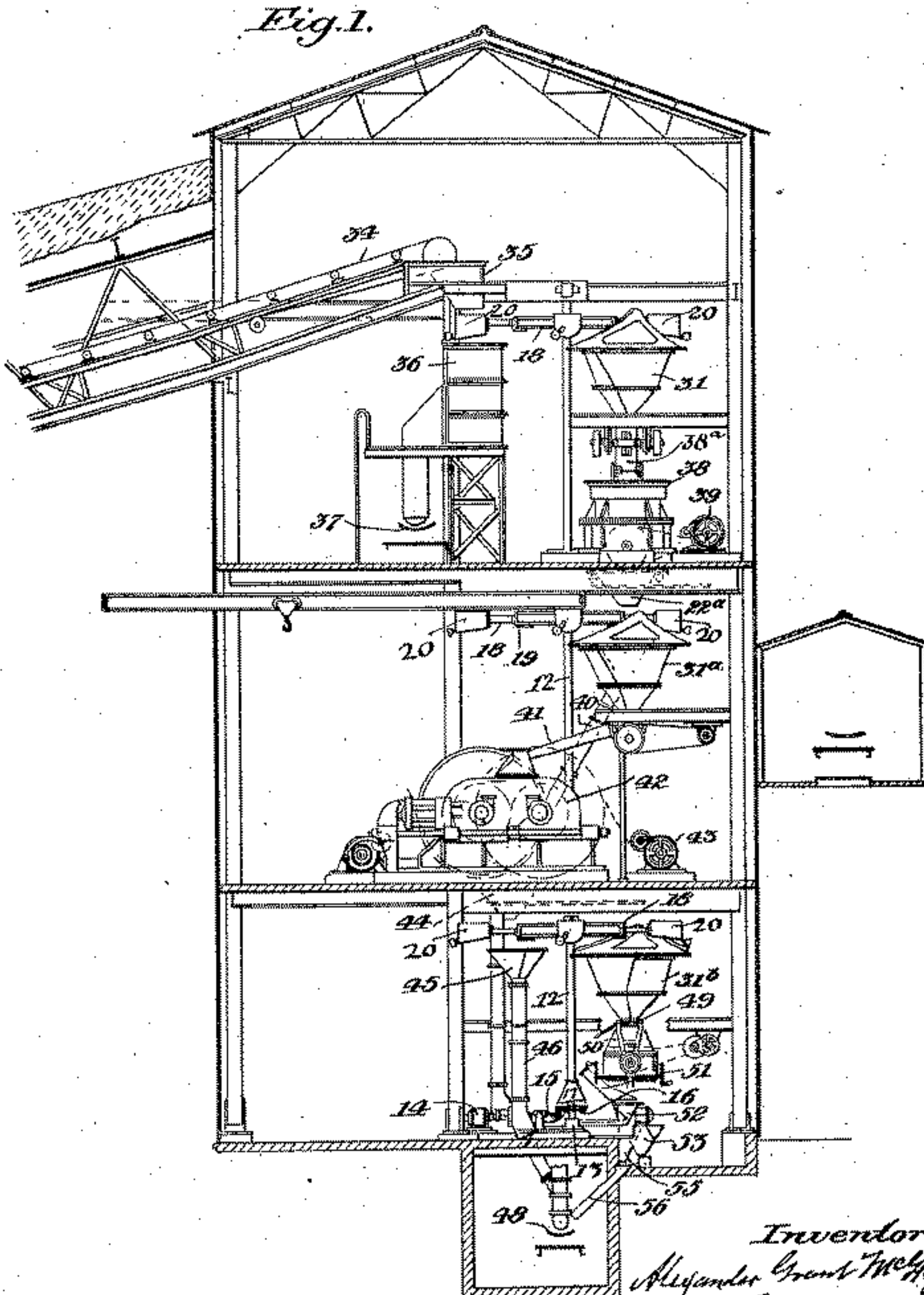
July 6, 1926. **1,591,092**

A. G. McGREGOR

SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 1

Fig. 1.



Inventor:
Alexander Grant McGregor,
by Kalver & Kalver,
Attys.

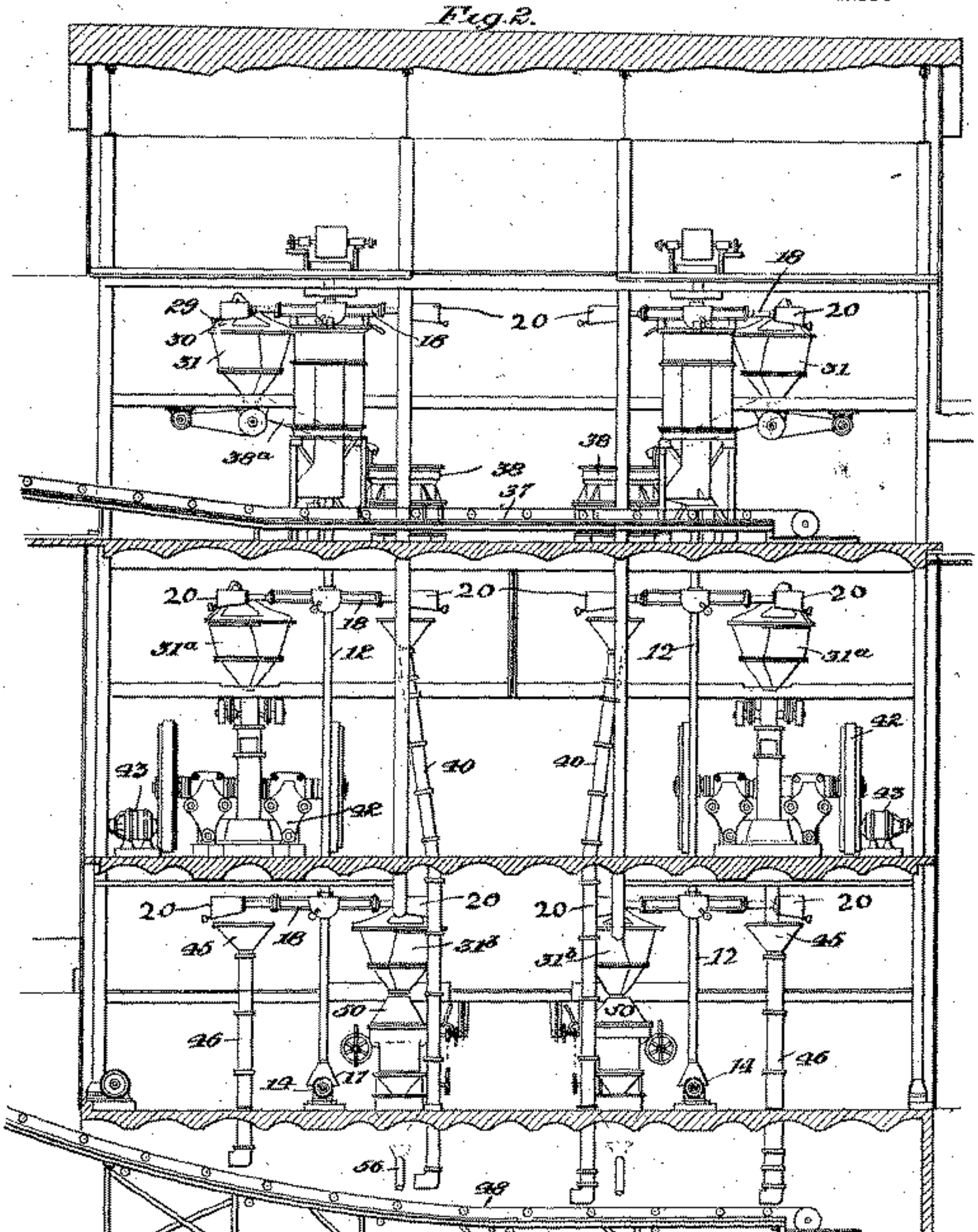
July 6, 1926. 1,591,092

A. G. McGREGOR

SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 2

Fig. 2.



Inventor:

Alexander Grant McGregor,

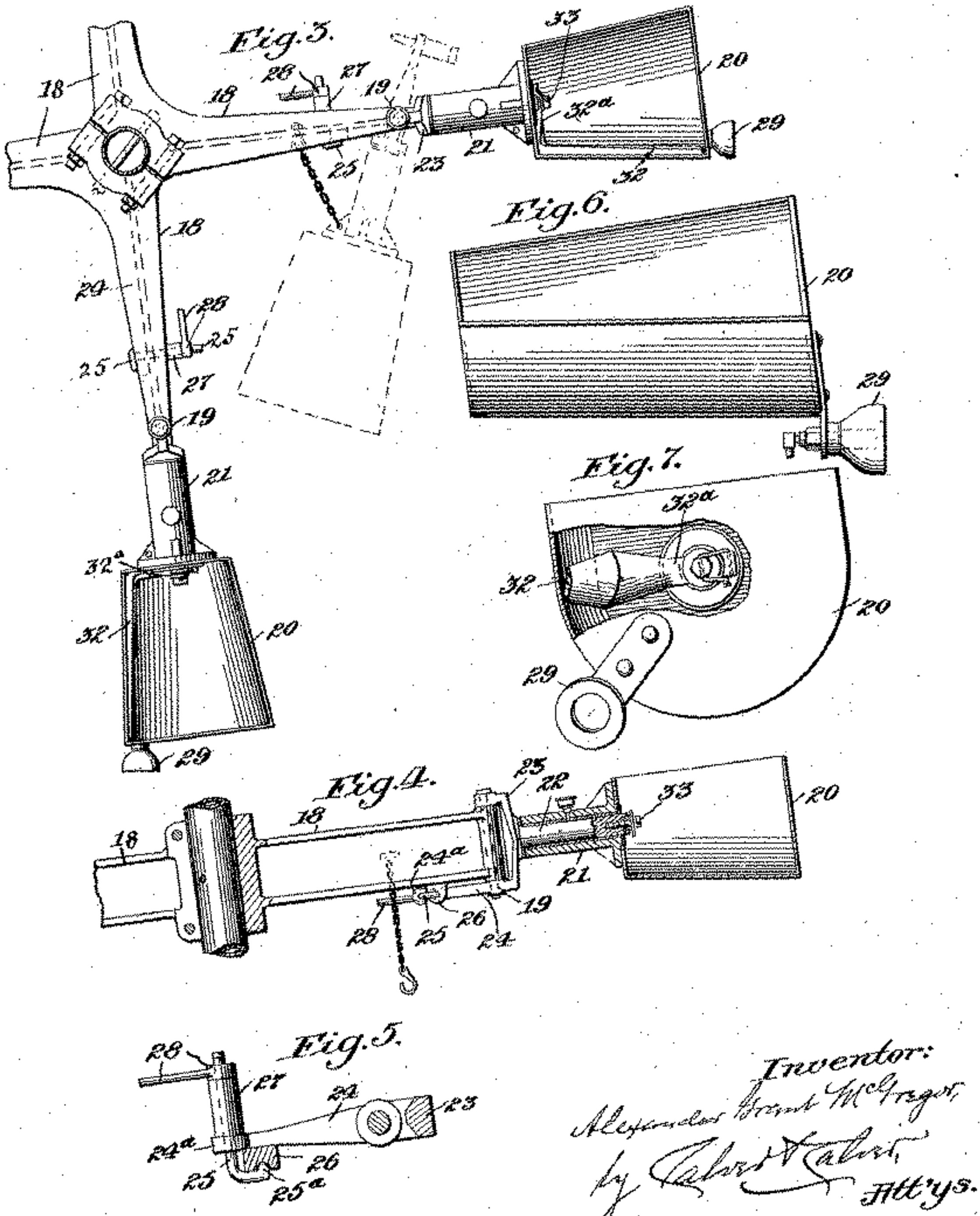
by Calver & Calver

Att'ys.

July 6, 1926. A. G. McGREGOR 1,591,092

SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 3



July 6, 1926.

A. G. McGREGOR

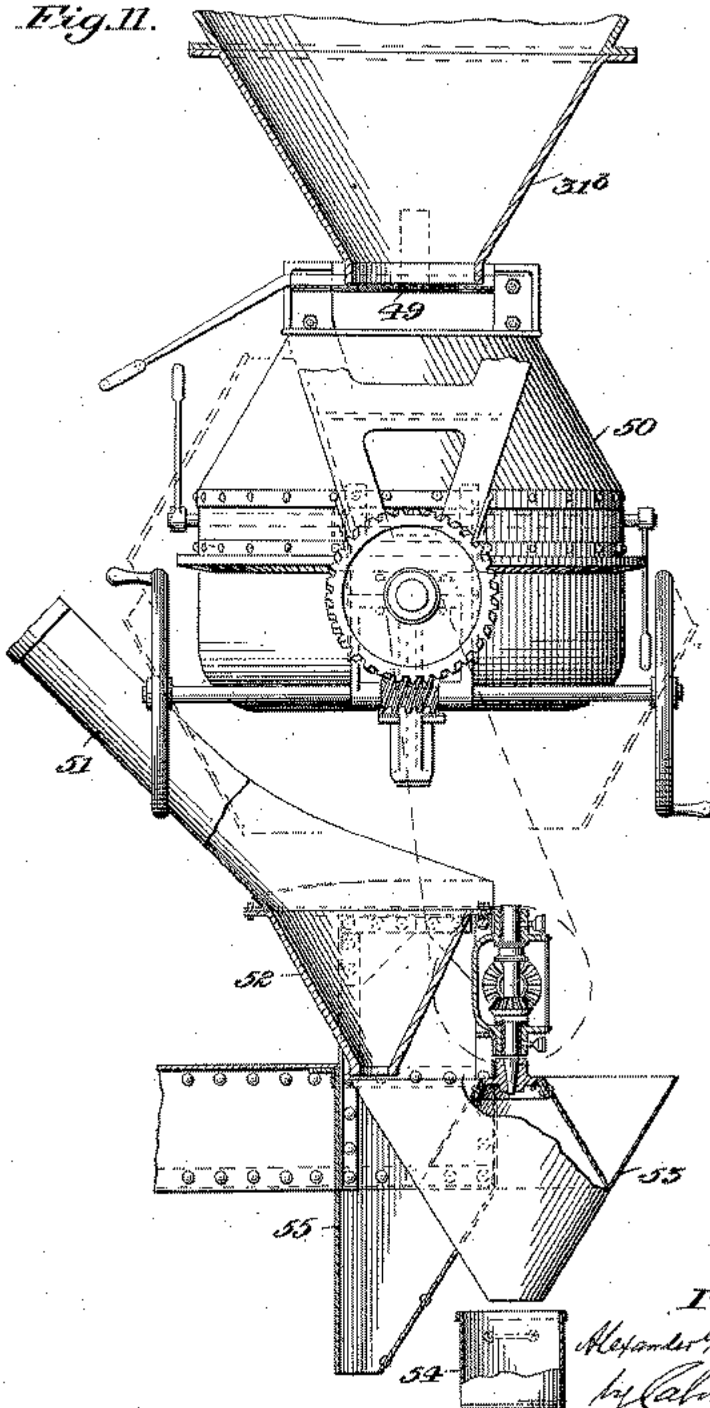
SAMPLING APPARATUS

Filed April 19, 1924

1,591,092

6 Sheets-Sheet 5

Fig. 11.



Inventor:
Alexander Grant McGregor,
by Cabot Eaton,
Att'ys.

July 6, 1926.

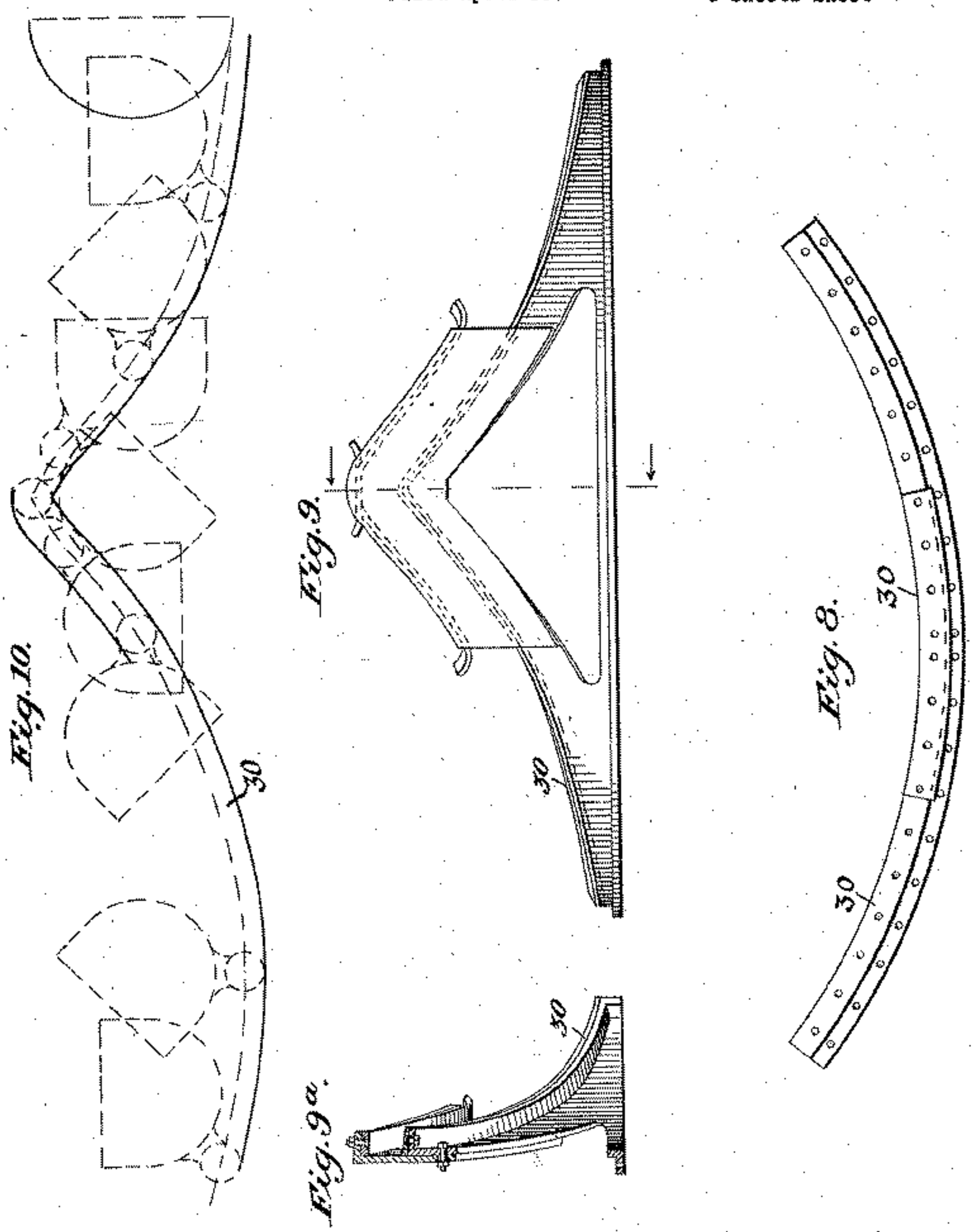
1,591,092

A. G. McGREGOR

SAMPLING APPARATUS

Filed April 19, 1924

6 Sheets-Sheet 4



Inventor:
Alexander Grant McGregor,

Att'ys.

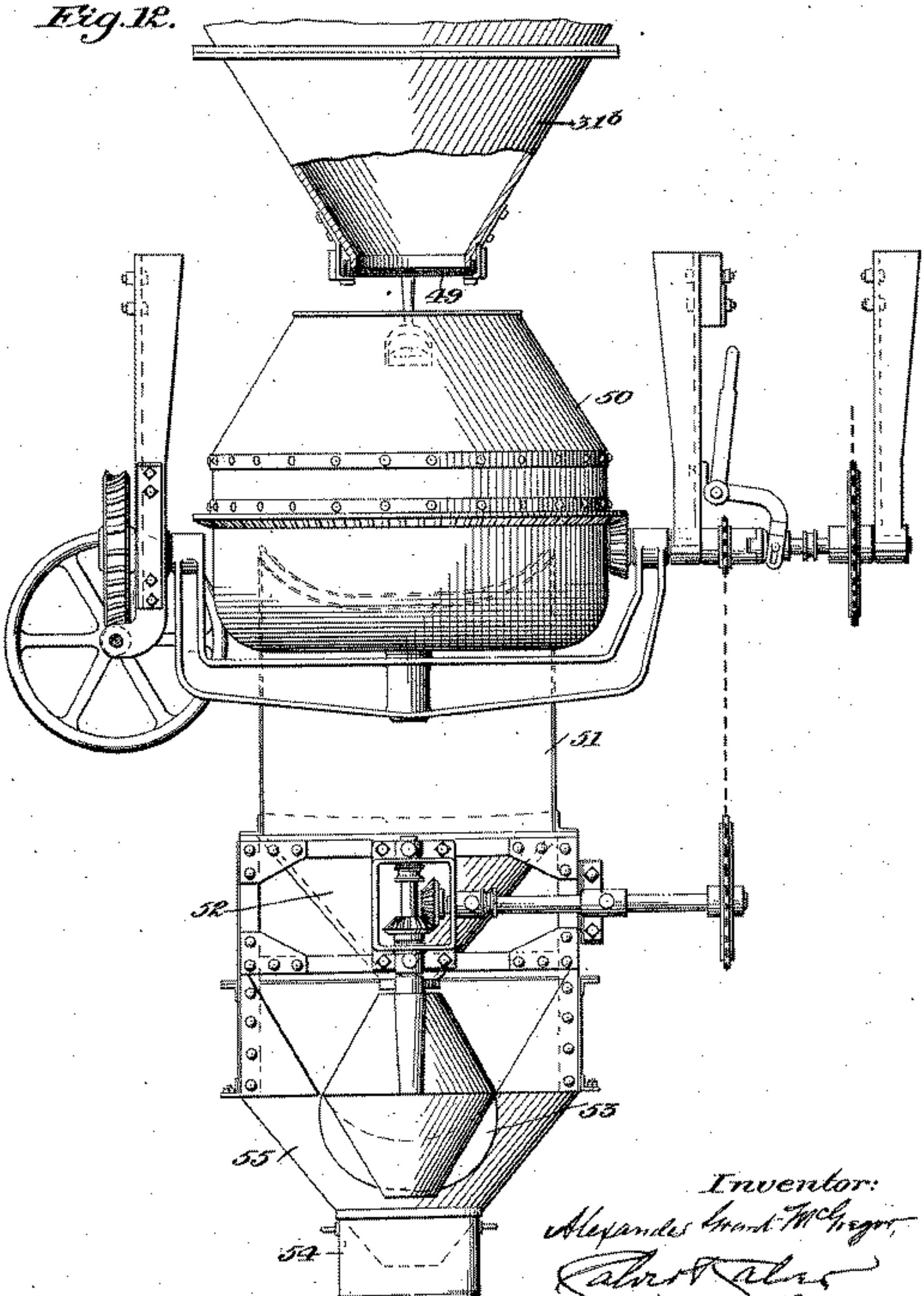
July 6, 1926. 1,591,092

A. G. McGREGOR

SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 6

Fig. 12.



Inventor:
Alexander Grant McGregor,
Atty's.

Patented July 6, 1926. **1,591,092**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

SAMPLING APPARATUS.

Application filed April 19, 1924. Serial No. 707,628.

This invention relates to an apparatus or machine for sampling ores, or the like, which will work more conveniently and to better advantage than the sampling machines at present in use in ore mills.

In an ordinary ore sampling mill, such as are now generally in use, a ten or twenty per cent sample of the coarse ore delivered to the mill is taken at the top of the mill in some such sampler as the Brunton, Vezin, Snider, etc. The ore is crushed in a subsequent crushing machine and another sample is taken of the ore discharged from the crushing machine. A second sample is further crushed by a second crushing machine. A third sample is taken of the ore discharged from the latter machine, and this is delivered to a third crushing machine. A sample is taken of the product from the third crushing machine and is usually delivered to a sample safe or hopper.

In such a mill each sampler cuts an approximately definite percentage of the material fed to it, and no change can be made in the percentage taken by the sampler without installing a different sampler, which is not practical in ordinary mill operation, and is not resorted to.

Such samplers as those suggested have slots or openings in the periphery of the sampler for collecting the sample. In order to get an accurate sample it is necessary that the sampler collect a uniform section through the stream of ore flowing to it, and this requires that the slots or openings in the sampler be large enough so that the coarsest material coming to it will not be prevented from passing through and so that a proper amount of coarse material will pass into the sampler. In usual practice the width of the sample opening must be several times the diameter of the coarsest ore fed to it. As the diameter of the usual sampler of the type suggested is not greater than about 60 inches, it results that, in order to get a proper opening for coarse ore, the width of the opening amounts to usually about ten per cent of the circumference described by the sample slot. Oftentimes it is twenty per cent. It is necessary to crush the sample finer before taking the next sample, and with large amounts of ore per lot, and with this large proportion of sample a great amount of crushing is required in the sampling mill.

Oftentimes in order to cut down the amount of crushing in the sampling mill, the sample opening is made narrower than it should be for accurate results and for getting a proper proportion of coarse ore. Very often the coarse ore will not analyze the same as the fine. In an ordinary sampling mill the several samplers require their own drives which increases the number of belts and pulleys on each floor. The present mechanical ore samplers in use, such as those mentioned, will not operate on sticky ores, such as flotation concentrates.

One purpose of my invention is to enable the percentage of sample to be varied from time to time. On large lots of ores it is not necessary to cut as big a percentage as on small lots. Another object is to get a small percentage sample of coarse ore and yet have sufficient width of bucket in order to get an accurate sample. I accomplish this by having a sample bucket with a comparatively wide open top, and which is caused to travel on a much larger circle than is common in samplers of the types hereinbefore referred to. A further object is to cut samples on the various floors of a sampling mill with a self-contained machine having only one drive.

In the accompanying drawings Fig. 1 is an endwise elevation of a sampling mill having several floors fitted with a preferred form of sampling and reducing apparatus. Fig. 2 is a sidewise elevation of the same, showing the sampling and reducing apparatus in duplicate. Figs. 3, 4, 5, 6 and 7 are detail views of sampling buckets, their carrying arms and attached parts. Fig. 8 is a detail plan view, and Fig. 9 a detail elevation of the bucket-turning cam-ridge. Fig. 10 is a diagrammatic view illustrating the turning movement of a sampling bucket. Figs. 11 and 12 are enlarged detail views of the Jaeger dumping mixer and the Vezin sampler shown in Figs. 1 and 2.

Referring to the drawings, 12 denotes a vertical shaft having a stepped bearing at 13 at its lower end and having suitable bearings in the several floors of the mill. The shaft 12 is driven from a motor 14, the motor shaft carrying a bevel pinion 15 meshing with a bevel gear 16 rigidly connected with the shaft 13 and protected by a safety housing 17.

In the preferred form of the invention illustrated in the drawings, the shaft 12 carries several sets of arms 18 to each of which is attached, preferably by a knuckle joint pivot 19, a rotatably mounted sampling bucket 20, each sampling bucket being connected with a sleeve 21 mounted on a journal rod 22 preferably formed integral with a yoke 23 forming part of the knuckle joint pivot 19. The yoke 23 has, integral therewith, an inwardly extending arm 24 through the inner end 24[a] of which passes a locking pin 25 having a bent-over end part 25[a] arranged to enter a recess in the outer face of a lug 26 on the arm 18, so as to hold the said arm in working position; but when it is desired to throw a bucket out of working position the locking pin 25, passing through a sleeve 27 on said arm, may, by a proper manipulation of a handled locking nut 28, be loosened and withdrawn so that the pivotally mounted bucket may be displaced from or moved out of working position, as shown in dotted lines in Fig. 3.

Each bucket 20 is provided with a cam roll 29 arranged to engage a curved cam ridge 30 mounted on a sample hopper 31, 31[a] and 31[b], so that as the shaft rotates, carrying the buckets 20 around with it, each bucket, when it arrives over a sample hopper, will, by engagement of the cam roll 29 with the said cam ridge 30, be turned upside down so as to empty its contents into a sample hopper.

To insure a proper discharge of the samples from the sampling buckets, particularly if the material being sampled is of a sticky nature, the sampling buckets are each furnished with a bayonet-shaped scraper or cutter 32, the inner portion of the shank 32[a] of said scraper or cutter being approximately at a right angle to the body 32. The shank 32[a] is secured by an attaching screw 33 to a journal rod 22 on which a sleeve 21, rigidly connected with a sampling bucket 20, is mounted for turning movements, and with which journal rod the scraper or cutter 32, 32[a] is rigidly connected, so that as the sampling bucket is turned upside down to discharge its contents the said scraper or cutter will remain stationary and will thus assist in clearing the said bucket of its contents.

The ore to be sampled is discharged from a conveyor 34 into a hopper or chute 35 at the top of the mill and beneath which hopper or chute the sampling buckets 20 are carried at intervals. In the form of the invention herein illustrated there are four arms 18 in each set, each arm carrying a sampling bucket 20, these sampling buckets cutting at intervals through the stream of material being discharged from the hopper or chute 35.

If, however, it be desired to take a lesser percentage of sample material from the stream of crushed ore or other material being discharged from the hopper or chute 35 than would be taken if all four of the sampling buckets of each set were in operation, one or more of said sampling buckets may be thrown out of operation by loosening it from its supporting attachment to an arm 18, and displacing it from working position, as indicated by dotted lines in Fig. 3.

That portion of the stream of material being discharged from the chute or hopper 35 which is not carried away by the sampling buckets 20, falls into a reject receptacle or chute 36 from which it may be discharged to a conveyor 37 and be carried away to any suitable place of deposit. The ore sample which has been segregated from the stream or mass of material discharged from the hopper 35 and dumped into the hopper 31 by the sampling buckets is conveyed by suitable means, as by a chute 38[a], to a crushing mill 38 which may be driven from a motor 39, and the product from said mill passes into a hopper 22[a] beneath which the sampling buckets of a second set pass at intervals, cutting through the stream of material discharged from said hopper 22[a]. The reject material not being taken by this second set of sampling buckets passes downward through a chute 40, while the sample material from this second set of sampling buckets is dumped into the hopper 31[a] and passes thence through a chute 41 to a roller crushing mill 42 for further reduction, said crushing mill being driven from a motor 43.

The products from the crushing mill 42 pass into a hopper 44 beneath which sampling buckets of a third set pass at intervals, said sampling buckets dumping their contents into the hopper 31[b], while the material discharged from the said hopper 44, not taken by said sampling buckets, passes into a reject hopper 45 and thence through a chute 46 which discharges onto a conveyor 48 which carries the reject material to any suitable place of deposit.

The sample safe or hopper 31[b] is provided at its bottom with a gate 49 which may be opened at intervals for permitting the contents of said hopper to be discharged into a dumping batch mixer 50 which will preferably be of the Jaeger type, such as shown in the Jaeger Patents Nos. 1,322,575 and 1,414,648, so that the sample material, now properly reduced, may be thoroughly mixed. The mixer is arranged to discharge into a trough or chute 51 which in turn discharges into a hopper 52 beneath which rotates a Vezin sampler hopper 53 of well known form, said sampler taking any desired proportion of the material discharged from the hopper 52 and discharging it into a sample bucket or receptacle 54. The material from the hopper 52, not taken by the rotating sampling hopper 53, is discharged into a reject chute 55 whence it passes into a chute 56 discharging onto the reject conveyor.

From the foregoing it will be apparent that the improved sampling apparatus provides means, by releasing one or more of the horizontally rotated open-topped sample buckets or receptacles and displacing it or them from working position, as indicated in dotted lines in Fig. 3, or otherwise, by which the percentage of sample material taken from a stream of material being delivered may be varied, as desired; and this feature of the invention may of course be utilized in connection with a single set of horizontally rotating sampling buckets or receptacles, as will be understood.

The operation of turning the open-topped sampling buckets or receptacles upside down for dumping will be readily understood from the diagrammatic view Fig. 10, which shows, in dotted lines, a sampling bucket in different progressive positions as it is turned for dumping, and then restored to receiving position, by reason of the contact of the cam roll 29 with the horizontally curved cam ridge 30 as the bucket is carried around horizontally.

Also the feature of providing a dumping mixer for thoroughly mixing the sample material which has been properly reduced, and thereby rendering the same practically homogeneous, may be used in connection with a single sampler, or a single set of sampling buckets or receptacles, as will be understood.

In the operation of the sampling apparatus arranged, as shown in Figs. 1 and 2 in a sampling mill having several floors, and in which the vertical shaft 12, having a single drive, carries several sets of horizontal arms 18 at different levels, and which arms are each provided with an open-topped sampling bucket or receptacle 20, arranged to be turned relative to said arms, the upper set of sampling buckets, as they are rotated horizontally, cut through the stream of material delivered from the hopper 35 to which hopper such material is delivered by the conveyor 34, and the sample material passing into said buckets or receptacles is dumped into the upper hopper 31 by virtue of the engagement of the cam rolls 29 on the buckets 20 with a cam ridge 30 on the hopper 31. The material from the hopper 31 is next delivered to the crushing mill 38 through which it passes to a hopper 22^a, and the stream of material from the said hopper 22^a is cut through by the sampling buckets 30 of the second set and the sample thus taken is dumped into the hopper 31^a. From said last-named hopper the material is fed to the roller crushing mill 42 from which it passes to the hopper 44 beneath which the third set of sampling buckets pass at intervals, taking samples from the stream of material from said hopper 44, and dumping it into the hopper 31^b. The rejected material passing from the uppermost hopper 35 to the receptacle 36, as also the rejected material from the hoppers 22^a and 44, is carried away through the chutes hereinbefore described. It will thus be understood that while a certain quantity of sample material is taken from the stream of material delivered from the upper hopper 35, this sample material is reduced in quantity by the second set of horizontally rotating sampling buckets, and the sample material before it reaches the hopper 31^b is again still further reduced by the third or lowermost set of sampling buckets or receptacles. Thus the quantity of sample material finally delivered to the hopper 31^b is small in quantity relative to the amount of sample material taken by the uppermost set of sampling buckets.

As ore sampling operations are at present practiced, the sample material collected in a sample safe or hopper sometimes amounts to several thousand pounds, and the operation of reducing this large quantity of sample material down to a sample of say fifty pounds, by coning or quartering, involves a great deal of labor and there is often considerable inaccuracy in the samples. By using a mixer as described the sample material is rendered practically homogeneous, as above referred to, and by using a Vezin sampler, as hereinbefore described, and which divides the reduced and well-mixed sample material into any desired reduced quantity, much labor will be avoided and more accurate results obtained than heretofore.

The invention is not to be understood as being limited to the details herein shown and described, as such details may be varied widely, within the province of mechanical skill, without departing from the essence or scope of the invention as the same is defined by the claims hereunto appended.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. In a sampling apparatus, the combination with a horizontally rotating open-topped sample receptacle having a curved bottom, and a vertical rotating shaft by which said receptacle is carried, of means for turning said receptacle upside down for dumping, and a cutter or scraper mounted within said receptacle and stationary relative thereto, so as to assist in clearing said receptacle when the latter is turned for dumping.

2. In a sampling apparatus, the combination with a vertical rotary shaft having a plurality of horizontal arms, sample receptacles each having a pivoted connection with one of said arms, releasable means for holding said receptacles rigid with said arms, but permitting any desired number of said recep-

tacles to be displaced from their working positions to vary the percentage of sample taken from a supply of descending material, and means for turning said sample receptacles for dumping.

3. In a sampling apparatus, the combination with a vertical rotary shaft having a plurality of horizontal arms, sample-receiving receptacles each having a pivoted connection with one of said arms, releasable means for holding said receptacle rigid with said arms, but permitting any desired number of said receptacles to be displaced from their working position to vary the percentage of sample taken from a supply of descending material, a sample receiving hopper, and means for emptying said receptacles as they pass over said hopper.

4. In a sampling apparatus, the combination with sampling means, of a mixer into which the segregated sample material is discharged, so that said material will be thoroughly mixed and thus be rendered practically homogeneous.

5. In a sampling apparatus, the combination with sampling means, of a crushing mill through which the segregated sample is passed, and a mixer into which the crushed sample is discharged, so that said sample will be thoroughly mixed and thus be rendered practically homogeneous

6. In a sampling apparatus, the combination with sampling means, of a crushing mill and a grinding mill through which the segregated sample material is passed, and a mixer into which the crushed and ground sample material is discharged, so that said sample material will be thoroughly mixed and thus be rendered practically homogeneous:

7. In a sampling plant having successive mechanical samplers and crushing machines at different levels, a sample safe or hopper containing the segregated sample cut from the lowermost crushing machine, in combination with a mechanically operated batch mixer for receiving and mixing the accumulated contents from said sample safe or hopper.

8. In a sampling plant having successive mechanical samplers and crushing machines at different levels, a sample safe or hopper containing the sample cut from the lowermost crushing machine, in combination with a mechanically operated batch mixer for receiving and thoroughly mixing the accumulated contents from said sample safe or hopper, so that each small quantity of the mixed material selected at random will be practically a true sample of the mixture.

9. In a sampling apparatus, the combination with sampling means, of a crushing mill and a grinding mill through which the sample material is passed, a batch mixer into which the crushed and ground sample material is discharged, so that said material will be thoroughly mixed and thus be rendered practically homogeneous, and a dividing sampler for reducing the quantity of the mixed material.

10. In a sampling mill, the combination with a vertical shaft, extending through several floors of said mill, and means for rotating said shaft, of a plurality of sets of horizontal arms fixed to said shaft at different levels, sampling buckets or receptacles carried by said arms, means for emptying said sampling buckets or receptacles as they are rotated horizontally, a sample-receiving hopper beneath each set of sampling buckets or receptacles, a crushing mill through which the sample material from the upper sample-receiving hopper is passed, a grinding mill through which the crushed sampled material from the next lower sample-receiving hopper is passed, and a dumping batch mixer into which crushed and ground sample material from the lowermost sample-receiving hopper is discharged.

11. In a sampling mill, the combination with a vertical shaft, extending through several floors of said mill, and means for rotating said shaft, of a plurality of sets of horizontal arms fixed to said shaft at different levels, sampling buckets or receptacles carried by said arms, means for emptying said sampling buckets or receptacles as they are rotated horizontally, a sample-receiving hopper beneath each set of sampling buckets or receptacles, a crushing mill through which the sample material from the upper sample-receiving hopper is passed, a grinding mill through which the crushed sample material from the next lower sample-receiving hopper is passed, a dumping batch mixer into which crushed and ground sample material from the lowermost sample-receiving hopper is discharged, and means for carrying away the rejected material from the points at which the several sets of sampling buckets or receptacles cut through the streams of material passing downward through the sampling mill.

12. In a sampling mill, the combination with a vertical shaft, extending through several floors of said mill, and means for rotating said shaft, of a plurality of sets of horizontal arms fixed to said shaft at different levels, sampling buckets or receptacles carried by said arms, means for emptying said sampling buckets as they are rotated horizontally, a sample-receiving hopper beneath each set of sampling buckets or receptacles, a crushing mill through which the sample material from the upper sample-receiving hopper is passed, a grinding mill through which the crushed sample material from the second sample-receiving hopper is passed, a dumping mixer into which crushed and ground sample material from the lowermost

sample-receiving hopper is discharged, and a dividing sampler for finally reducing the sampled material to a desired and relatively small quantity.

13. In a sampling mill having several floors, the combination with a vertical shaft extending through several floors, a plurality of sets of horizontally rotating, open-topped dumping sampling buckets connected with said shaft at different levels, co-operating means for diverting the material downward through the mill and feeding it to the different sets of sampling buckets, and a single motor or driving device for said shaft.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

June 21, 1927.

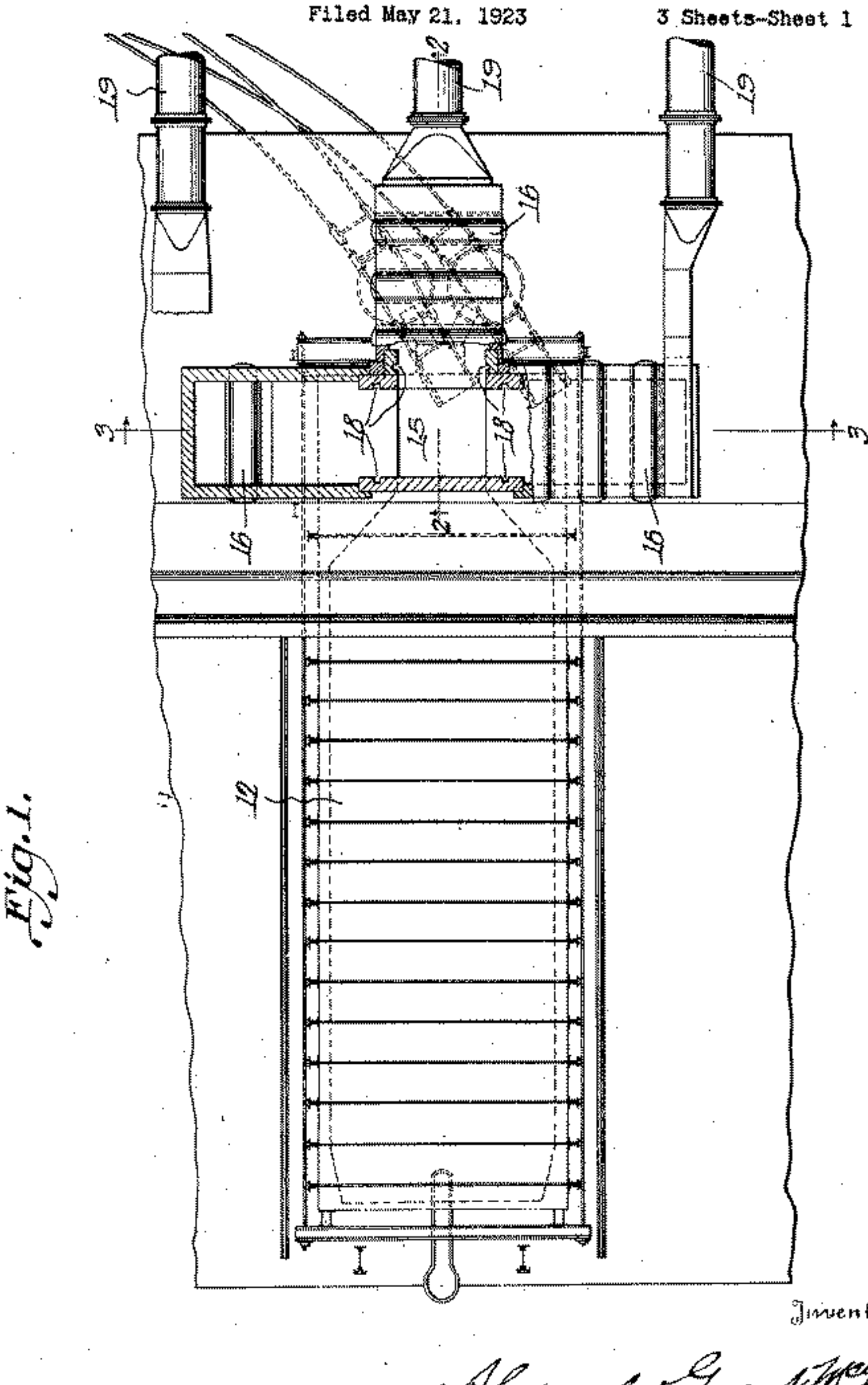
A. G. McGREGOR

1,632,844

REVERBERATORY FURNACE WASTE HEAT BOILER

Filed May 21, 1923

3 Sheets-Sheet 1



Inventor

Alexander Grant McGregor,

By Rabin Katius

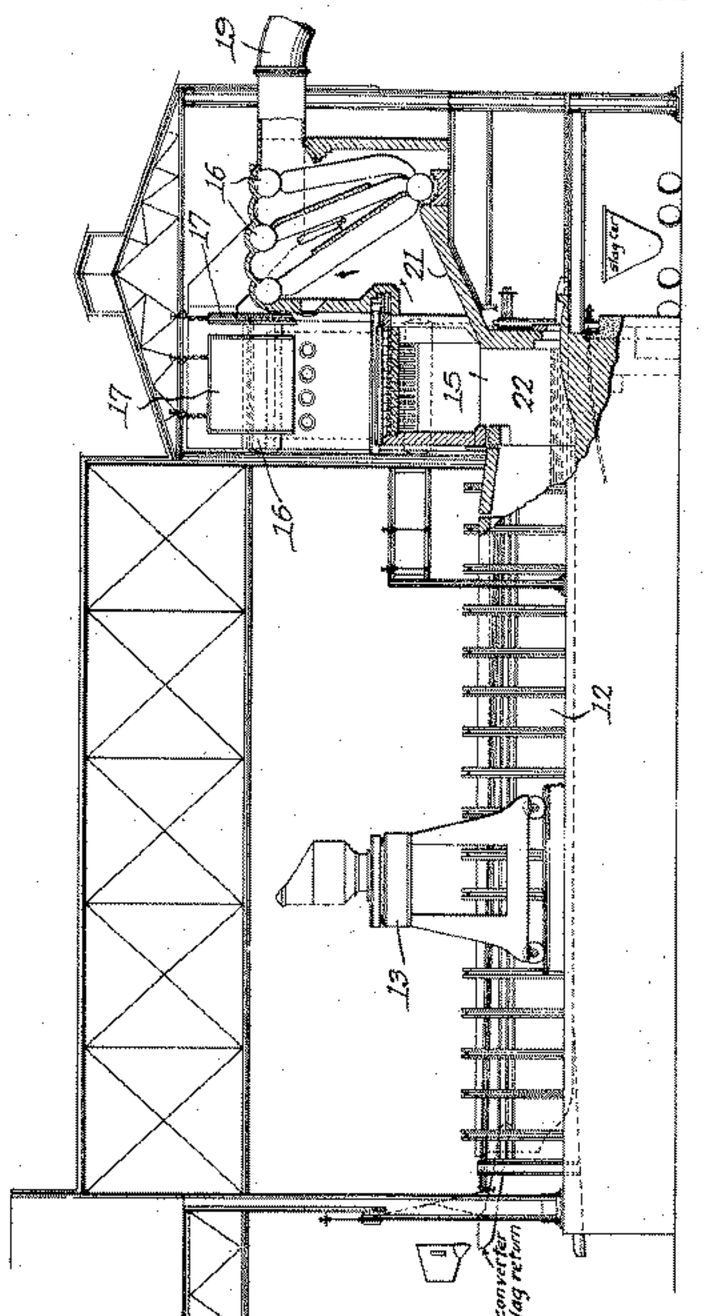
Attorneys

June 21, 1927. **A. G. McGREGOR** 1,632,844

REVERBERATORY FURNACE WASTE HEAT BOILER

Filed May 21, 1923 3 Sheets-Sheet 2

Fig. 2.



Inventor

Alexander Grant McGregor,

By Palmer Palmer,

Attorneys

June 21, 1927.

A. G. McGREGOR

1,632,844

REVERBERATORY FURNACE WASTE HEAT BOILER

Filed May 21, 1923

3 Sheets-Sheet 3

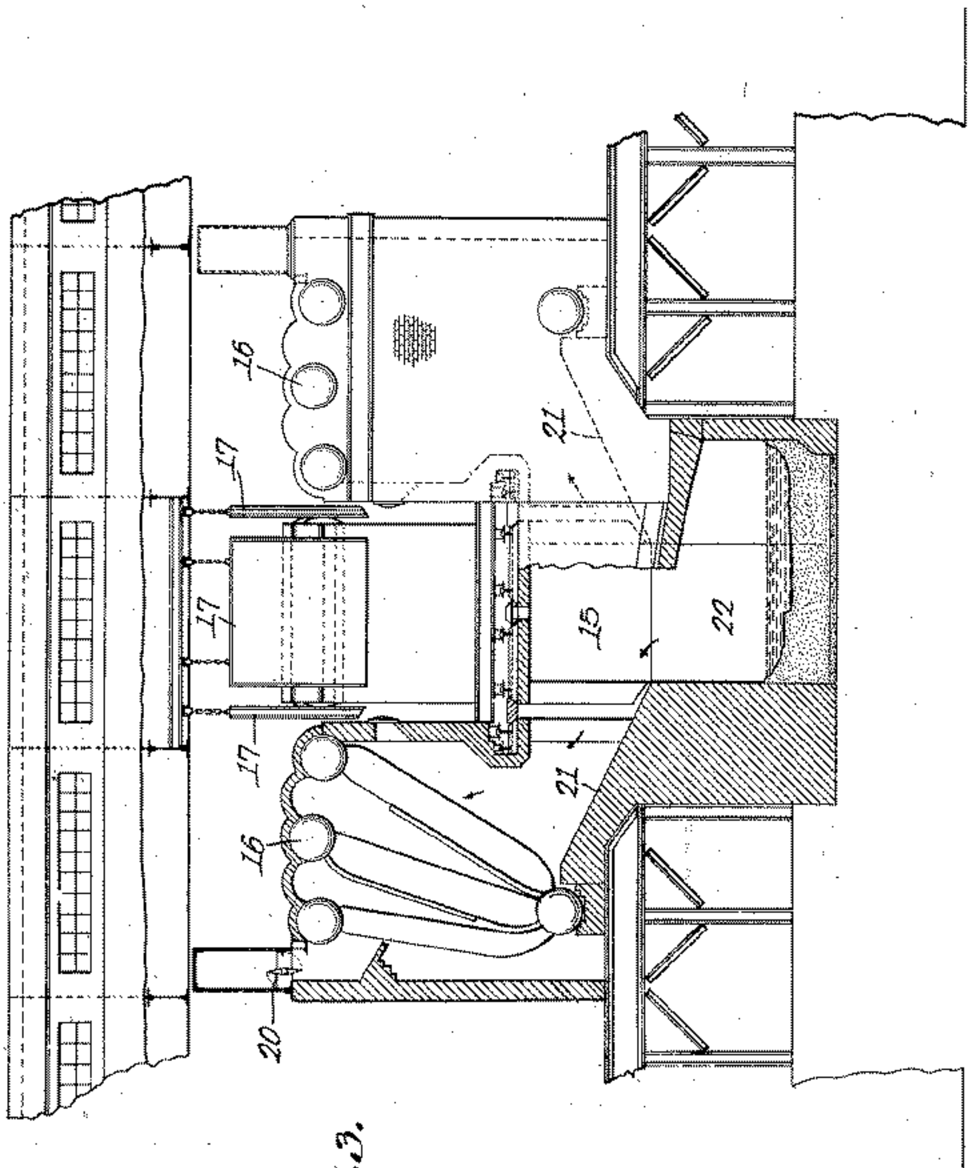


Fig. 3.

Inventor:

Alexander Grant McGregor,

By [illegible]

Attorneys.

Patented June 21, 1927. **1,632,844**

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

REVERBERATORY-FURNACE WASTE-HEAT BOILER.

Application filed May 21, 1923. Serial No. 640,409.

In connection with reverberatory furnaces, for the smelting of ores, it is customary practice to cause the gases, discharged from the furnace, to pass through boilers and thus utilize the waste heat from the furnaces. Such boilers are known as waste heat boilers. In the arrangement of these waste heat boilers now generally in use there is an up-take from the furnace which connects into a header flue. Branches are taken off the header flue leading to the boilers. With this arrangement there is a great deal of brick work between the discharge point of the furnace and the inlet point to the boilers.

Four serious objections may be mentioned to this arrangement: 1st. The brick work is subjected to intense heat and the maintenance and repairs on this amount of brick work are important items in the cost of operation. 2nd. The great amount of flue surface permits the infiltration of a great deal of cold air, reducing the efficiency of the waste heat boilers. 3rd. The large amount of surface of the connections between the furnace and boilers affords the radiation of much heat and reduces the boiler efficiency. 4th. The various turns and the length of the connections between furnaces and boilers afford lodgment places for the collection of molten dust particles. Much labor is required for the removal of the accretions thus built up, which become hard and have to be chiselled out, and this has to be done, in some instances, several times in one day. This feature is particularly troublesome when powdered coal is used as fuel for the furnaces.

The present invention has for its object to avoid the objections above referred to and provide a compact arrangement of reverberatory furnace waste heat boilers, such as will utilize the heat escaping from the furnaces to the best advantage. To this end the invention, in its preferred form, comprises a rectangular uptake from the furnace, with the boilers in boiler chambers arranged closely contiguous to three sides of this uptake, and dampers by which any one or more of the boilers may be shut off from the uptake, if desired. In this improved arrangement the bottoms of the floors of the chambers leading from the uptake to the boilers slope downwardly inwardly to the furnace, so that the molten flue dust and fusible ash coming from the furnace and lodging on these floors will drain back into the furnace, thereby avoiding the labor required in the present constructions and arrangements in removing the accretions in the connections between the furnace and boilers at present in use, as above referred to.

In the accompanying drawings Fig. 1 is a plan view, partly in horizontal section, showing the present improved arrangement of the waste heat boilers relative to a reverberatory furnace. Fig. 2 is a side elevation of the same, partly in vertical section on line 2—2, Fig. 1. Fig. 3 is an elevation, partly in section on line 3—3, Fig. 1.

Referring to the drawings, 12 denotes a reverberatory furnace of well-known or suitable construction to which the comminuted ore or flue dust may be fed by a charging machine 13 which may run on a track 14 at one side of the furnace. Communicating with the chamber of the furnace is a vertical uptake 15, preferably square or of rectangular form in cross section, and having a plurality of flat sides, as more clearly shown in Fig. 1. Arranged closely adjacent to the said uptake, and on three sides thereof, are the waste heat boilers 16, 16, 16. Dampers 17 are preferably arranged closely adjacent to the uptake 15 for controlling the passageways between the said uptake and the chambers in which the waste heat boilers are located, these dampers being vertically movable in slots 18 in the walls of these passageways. By means of these dampers any one or more of the boiler chambers may be shut off from the uptake, if desired. The chambers in which the waste heat boilers are arranged communicate with flues 19 through which the gases are discharged. These flues are preferably provided, adjacent the boiler chambers, with dampers 20 which may be closed when desired.

The floors 21 of the boiler chambers or passageways leading from the uptake 15 to the boilers are sloped downward inwardly toward the furnace, so that any molten material accumulating on these floors will drain back into the part 22 of the furnace chamber.

The circular dotted lines in Fig. 1 denote slag cars and the dotted and full lines denote the tracks on which these cars may run. This feature, however, is not a part of the present invention, and is not herein claimed.

From the foregoing it will be understood that the invention provides a compact arrangement of the waste heat boilers of reverberatory furnaces, so that loss of heat and other objections hereinbefore mentioned to the constructions and arrangements heretofore in use are avoided.

The invention is not to be understood as being limited to the details of construction hereinbefore described and illustrated in the accompanying drawings showing a preferred form of the invention, as such details may be varied widely, within the province of mechanical skill, without departing from the essence of the invention in arranging the waste heat boilers in chambers closely adjacent to and communicating directly with the chamber of an uptake which in turn communicates directly with the chamber of a reverberatory furnace.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. The combination with a reverberatory furnace, of an uptake opening at its bottom directly into the chamber of said furnace, said uptake having a plurality of side openings, a plurality of boiler chambers grouped about and closely adjacent to the sides of said uptake and each communicating directly with the chamber of said uptake through one of said openings, and waste heat boilers in said boiler chambers.

2. An uptake for a reverberatory furnace opening at its bottom directly into the chamber of said furnace and having a plurality of flat sides provided with openings, a plurality of boiler chambers grouped about and closely adjacent to the sides of said uptake and each communicating directly with the chamber of said uptake through one of said openings, combined with waste heat boilers in said boiler chambers, and flues for the discharge of gases from said boiler chambers.

3. The combination with a reverberatory furnace, of an uptake opening at its bottom directly into the chamber of said furnace, said uptake having three side openings, three boiler chambers grouped about and closely adjacent to the sides of said uptake and each communicating directly with the chamber of said uptake through one of said openings, and waste heat boilers in said boiler chambers.

4. The combination with a reverberatory furnace of an uptake opening at its bottom directly into the chamber of said furnace and having a plurality of side openings, a plurality of boiler chambers grouped about and closely adjacent to the sides of said uptake and each communicating directly with the chamber of said uptake through one of said openings and having inwardly and downwardly inclined floors adapted to drain into the furnace chamber through said uptake, and waste heat boilers in said boiler chambers.

5. An uptake for a reverberatory furnace rectangular in cross-section and opening at its bottom directly into the chamber of said furnace, said uptake having a plurality of flat sides provided with openings, a plurality of boiler chambers grouped about and closely adjacent to the sides of said uptake and each communicating directly with the chambers of said uptake through one of said openings and having inwardly and downwardly inclined floors adapted to drain into the furnace chamber through said uptake, combined with waste heat boilers in said boiler chambers, and flues for the discharge of gases from said boiler chambers.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.

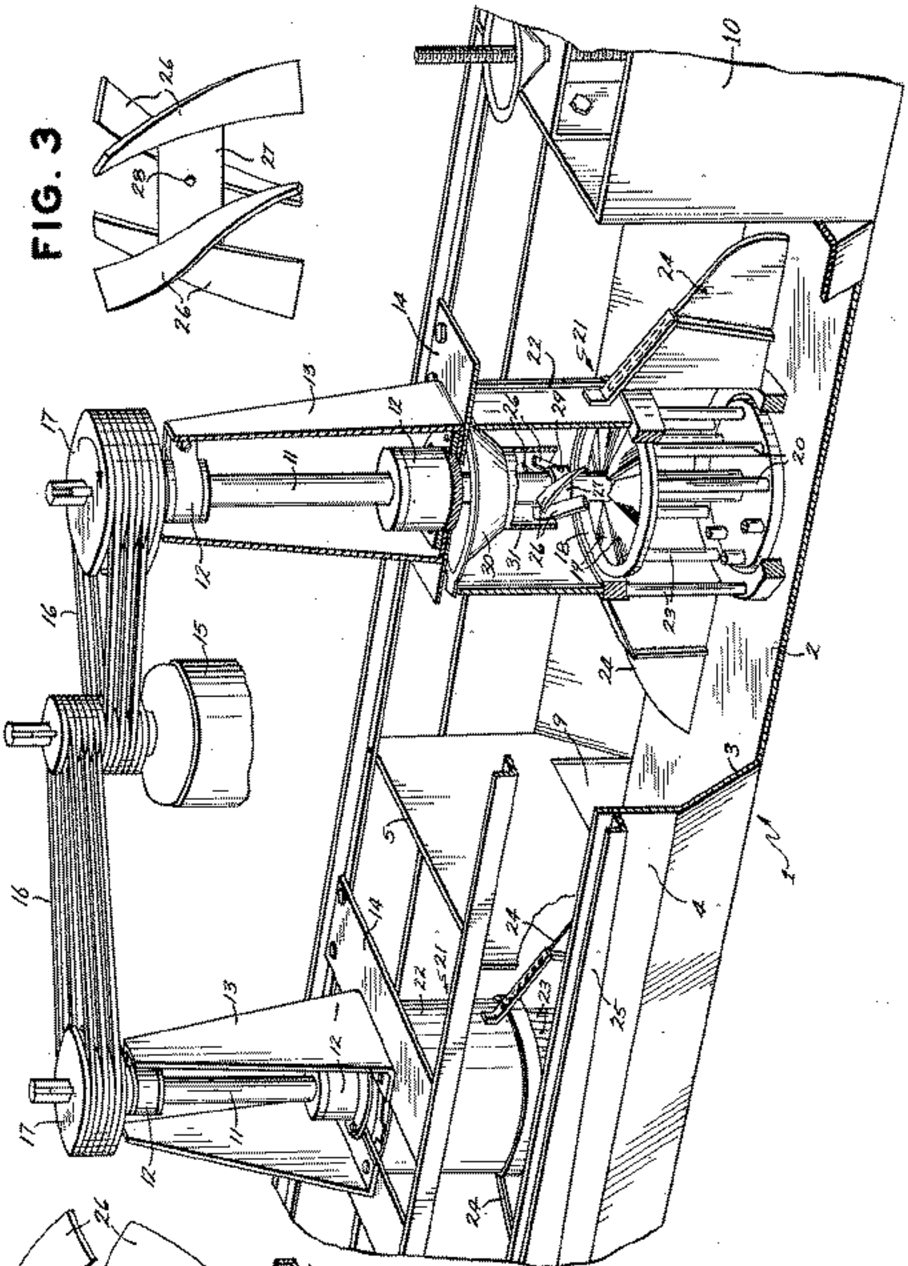
Oct. 30, 1951 W. A. WASLEY ET AL 2,573,521

FLOTATION APPARATUS

Filed Oct. 7, 1947

FIG. 3

FIG. 1



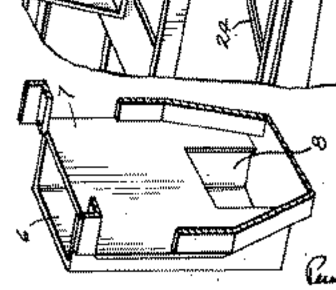
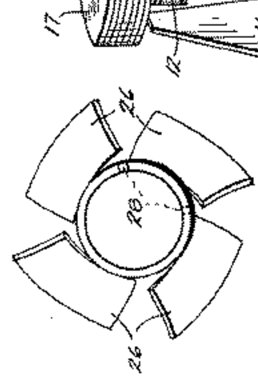


FIG. 2



INVENTORS
WILLIAM ARTHUR WASLEY
JOHN CLEMENT MACINTOSH
BY
Pennie Edmonds Morton & Barrows
ATTORNEYS

Patented Oct. 30, 1951

2,573,521

UNITED STATES PATENT OFFICE

2,573,521

FLOTATION APPARATUS

William Arthur Wasley, Cananea, Mexico, and John Clement MacIntosh, Bisbee, Ariz., assignors to The Cananea Consolidated Copper Company S. A., a Mexican corporation

Application October 7, 1947, Serial No. 778,436

2 Claims. (Cl. 261—93)

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This invention relates to flotation apparatus, and is particularly concerned with the provision of improvements in flotation machines having submerged air pumps (impellers) driven by a vertical shaft that extends downwardly from above the normal level of an ore pulp in the machine. The invention is especially adapted for use in connection with flotation machines of the Fagergren type. The principal feature of the present invention is the provision of a supplementary air screw comprising a plurality of vanes projecting laterally from the vertical air pump (or impeller) shaft adjacent the normal level of the ore pulp in the apparatus. The vanes are pitched at an angle to the vertical so as to cause them to force air downwardly when the shaft is rotated in its normal operating direction.

A typical Fagergren-type flotation machine of the character to which the invention may be applied with advantage (such, for example, as is shown and described in Taggart's Handbook of Mineral Dressing (1945 edition), section 12, pages 66 and 67) comprises a long trough-like chamber divided by transverse partitions into a plurality of cells. Each cell is provided with an air pump for aerating the pulp comprising a substantially vertical rotatable impeller shaft, with an impeller mounted on the shaft at its lower end beneath the normal level of pulp in the cell. A housing surrounds the impeller and shaft, and a splash cone generally is provided inside the housing adjacent the normal level of the pulp in the cell.

In apparatus of this character, the invention provides the improvement comprising a plurality of vanes projecting laterally from the impeller shaft adjacent the normal level of the pulp, said vanes being pitched at such an angle to the vertical as to force air downwardly toward the impeller during rotation of the impeller shaft in its normal operating direction. The vanes may be permanently mounted on a collar having the proper inside diameter to slide-fit on the impeller shaft. The collar then may be provided with a set screw for clamping it and the vanes at a desired position on the shaft. The splash cone itself advantageously is formed with a substantially vertical cylindrical portion at its lower end, which surrounds but is spaced from the impeller shaft adjacent the normal level of the pulp. The vanes, in such case, are secured to the impeller shaft inside this cylindrical lower extension of the splash cone.

The vanes referred to serve a dual purpose: They increase the amount of air which the air pump impeller delivers to the ore pulp; and they

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prevent accumulation of ore pulp mud in the splash cone around the impeller shaft, thereby insuring an open passage for air from the atmosphere to the impeller.

A preferred embodiment of the invention is shown in the accompanying drawings, in which

Fig. 1 shows in perspective (parts being broken away) a Fagergren-type flotation machine equipped in accordance with the present invention;

Fig. 2 is a plan of the air screw assembly of collar and vanes shown in Fig. 1; and

Fig. 3 is an elevation of the air screw assembly shown in Fig. 2.

The flotation machine shown in Fig. 1 comprises a long trough-like chamber 1 having a flat bottom 2, and side walls each having a lower portion 3 which slopes outwardly from the bottom and an upper portion 4 which is substantially vertical. The chamber is divided by a series of transverse partitions 5 into a plurality of individual cells (only two such cells are shown in full, in Fig. 1, but ordinarily the chamber 1 will be long enough to contain five or six similar cells).

A feed box 6 is provided at one end of the trough-like chamber 1. The end wall 7 of the chamber which separates the feed box 6 from the chamber itself is formed with an opening 8 near its bottom, so that an aqueous ore pulp introduced into the feed box may enter and flow lengthwise through the chamber. Openings 9 in the transverse partitions 5 enable the ore pulp to flow lengthwise from the feed box serially through the several cells to a tailing discharge box 10 at the opposite end of the chamber.

A vertical impeller shaft 11 is mounted substantially centrally in each cell, in bearings 12 supported on vertical and horizontal frame members 13 and 14. The impeller shafts are rotated in their bearings at fairly high speed by a motor 15 connected by V-belts 16 to pulleys 17 keyed to the upper ends of the shafts.

An impeller 18 is mounted at the lower end of each shaft beneath the normal level of the ore pulp in the cell. The impeller comprises fan-like blades 19 set at an angle such as to force air downwardly into the ore pulp when the impeller shaft is rotated in its normal operating direction (clockwise, as indicated by the arrow, in the apparatus shown in Fig. 1). The impeller also comprises a squirrel cage of vertical bars 20 which rotate with the blades 19. The impeller and impeller shaft are surrounded by a cylindrical housing 21, the upper portion 22 of which, above the impeller, is of solid wall construction, and the lower portion of which, immediately about the impeller, comprises a cage of vertical bars 23.

The apparatus of Fig. 1 is shown provided with a pair of vertical baffles 24 in each cell. The baffles are secured to the impeller housing and project radially therefrom in a direction lengthwise of the chamber 1 parallel to the flow of ore pulp through the apparatus from cell to cell. These baffles, which serve to prevent rotary motion of the pulp in each cell, are not a part of Fagergren-type flotation machines as heretofore known. They form the subject matter claimed in our copending application Serial No. 778,006, filed October 4, 1947, and are more fully described therein.

In the operation of the apparatus thus far described, an ore pulp to which suitable flotation reagents have been added is introduced into the feed box 6 and flows lengthwise through the chamber 1 from cell to cell. The impeller shafts are rotated at a fairly high speed by the motor 15, so that the impeller blades 19 suck air downwardly about the impeller shaft and deliver it radially outwardly through the rotating squirrel cage bars 20 and the stationary housing bars 23 into the body of the pulp. The air bubbles form a froth in the pulp, which rises to the surface carrying the mineral values of the ore with it and overflows into collecting launders 25 arranged alongside the upper edges of the vertical side members 4. The gangue component of the ore does not float, but flows with the main body of the pulp to the tailing discharge box 10, through which it is withdrawn.

It is, of course, important that an adequate amount of air be delivered to the pulp to insure formation of a large volume of froth. Otherwise deficient recovery of the mineral values in the concentrate may result. In accordance with the invention, the delivery of an adequate volume of air is insured by the provision of a plurality of vanes 26 secured to the impeller shaft 11 about at the normal surface level of the pulp in the cell. The vanes are pitched at such an angle to the vertical that when the impeller shaft rotates in its normal operating direction, they serve as fan or air screw blades to force air downwardly to the impeller.

The vanes can be welded or otherwise fastened directly to the impeller shaft 11, but preferably they are mounted on a collar 27, as by being welded thereto. The assembly of collar and vanes is shown on an enlarged scale in Figs. 2 and 3. The internal diameter of the collar is just enough larger than the diameter of the shaft to slidefit easily therein. The collar is formed with threaded radial holes 28 to receive set screws 29 by which the collar may be clamped at a chosen position on the impeller shaft.

It is customary to provide Fagergren type flotation machines with a splash cone 30. The purpose of this cone is to prevent ore pulp splashed by the rotating impeller from being recirculated thereby. It is of course recognized that to whatever extent the impeller serves merely to recirculate splashed ore pulp, its capacity to force air into the pulp is correspondingly diminished. In apparatus constructed in accordance with the invention, we prefer to provide the splash cone, at its lower end, with a downwardly extending cylindrical portion 31 which is concentric with but spaced from the impeller shaft. This lower cylindrical portion (or extension) of the splash cone is situated about at the normal level of pulp in the cell, and the air screw assembly of collar 27 and vanes 26 is mounted inside it. The inside diameter of the downward extension 31 of the splash cone should be only slightly greater than the diameter of the circular path described by the outer edges of the vanes as they rotate with the impeller shaft.

While splash cones generally have been found necessary in flotation machines of the type described to minimize recirculation of splashed ore pulp and froth, they have often been found to provide a focal point for the accumulation of ore pulp mud. An accumulation of mud in the splash cone reduces the cross-sectional area of the passage through the cone through which air must pass from the atmosphere to the impeller. An accumulation of mud therefore reduces the rate at which the impeller can deliver air to the pulp. We have found that the above-described air screw is extremely efficient in preventing any accumulation of ore pulp mud in the splash cone, especially when the splash cone is provided with the cylindrical downward extension 31 shown in the drawings, and when the inside diameter of this extension is not much larger than the overall diameter of the air screw. The action of the air screw in preventing any accumulation of ore pulp mud may be considered as a mechanical scraping action because as ore pulp mud tends to begin to accumulate in the opening of the cone, it is scraped off by the radially extending rotating vanes of the air screw.

It is apparent from the foregoing that the air screw vanes 26, rotating with the impeller shaft 11, insure delivery of an adequate volume of air to the pulp in two ways: first, by keeping the air passage through the splash cone free from any accumulation of ore pulp mud; and, second, by positively forcing air downwardly toward the impeller.

Tests have shown that the increased aeration of an ore pulp achieved by equipping Fagergren-type flotation machines with air screws of the character described results in improved recovery of mineral values in the concentrate, and reduced losses of the desired mineral values in the tailing. In a comparative test of Fagergren-type machines treating a pulp of sulphidic copper ore, in which some of the machines were equipped with air screws of the character described and with baffles 24, and in which the other machines were not so equipped, it was found that the copper content of the tailings from the machines not equipped in accordance with the invention averaged, over a considerable period of time, about 20% higher than the copper content of the tailings from the machines that were equipped in accordance with the invention.

In addition to leading to improved flotation concentrate recovery of mineral values, the air screws of the invention also reduce the difficulty of keeping the machines in good operating condition, by reducing the frequency with which it is necessary to clean mud from the splash cone and elsewhere in the immediate vicinity of the impeller shaft.

We claim:

1. In a flotation apparatus comprising a cell adapted to contain ore pulp and having therein means for aerating the pulp comprising a substantially vertical rotatable impeller shaft, an aerating impeller mounted on the shaft at the lower end thereof beneath the normal level of pulp in the cell, a housing surrounding the im-

peller shaft, said housing being continuous and imperforate from the aerating impeller upwardly to above the level of the pulp thereby defining an enclosed air admission space about the impeller shaft above said impeller, and a splash cone inside the housing adjacent the normal level of the pulp, said splash cone having its apex cut away to form a circular opening through which the impeller shaft passes, the improvement comprising a plurality of vanes pitched at an angle to the vertical and projecting laterally from the impeller shaft in the enclosed air admission space directly above the aerating impeller, said vanes being positioned directly in the circular opening of the splash cone and extending radially from the shaft almost to the inner edge of the splash cone defining said circular opening, the pitch of said vanes being such that during normal rotation of the impeller shaft the vanes force air downwardly through the opening of the splash cone toward the impeller and the radial extension of the vanes being such that accumulation of ore pulp mud in the opening of the splash cone is prevented by the mechanical scraping action of the rotating vanes.

2. In flotation apparatus comprising a cell adapted to contain a body of ore pulp and having therein means for aerating pulp comprising a substantially vertical rotatable impeller shaft, an aerating impeller mounted on the shaft at the lower end thereof beneath the normal level of pulp in the cell, and a housing surrounding the impeller and shaft, said housing being continuous and imperforate from the aerating impeller upwardly to above the level of the pulp thereby defining an enclosed air admission space about the impeller shaft above said impeller, the improvement comprising a splash cone inside the

housing above the impeller and terminating at its lower end in a substantially vertical cylindrical portion concentrically surrounding the impeller shaft adjacent the normal level of the pulp but spaced from said shaft to form an annular air passageway around said shaft, and a plurality of vanes secured to the shaft adjacent the normal pulp level inside said cylindrical portion of the splash cone, said vanes being pitched at an angle to the vertical and projecting radially from the impeller shaft almost to the inner surface of said cylindrical portion, the pitch of the vanes being such that during normal rotation of the impeller shaft the vanes force air downwardly through the cylindrical portion of the splash cone toward the aerating impeller and the radial extension of the vanes being sufficient to prevent accumulation of ore pulp mud in said cylindrical portion by mechanical scraping action when said shaft is rotated.

WILLIAM ARTHUR WASLEY.
JOHN CLEMENT MACINTOSH.

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Fig.4.