Dec. 11, 1923. 1,476,808

A. FERGUSON

AMALGAMATOR

Filed June 20, 1922 2 Sheets-Sheet 1

Fig. 1

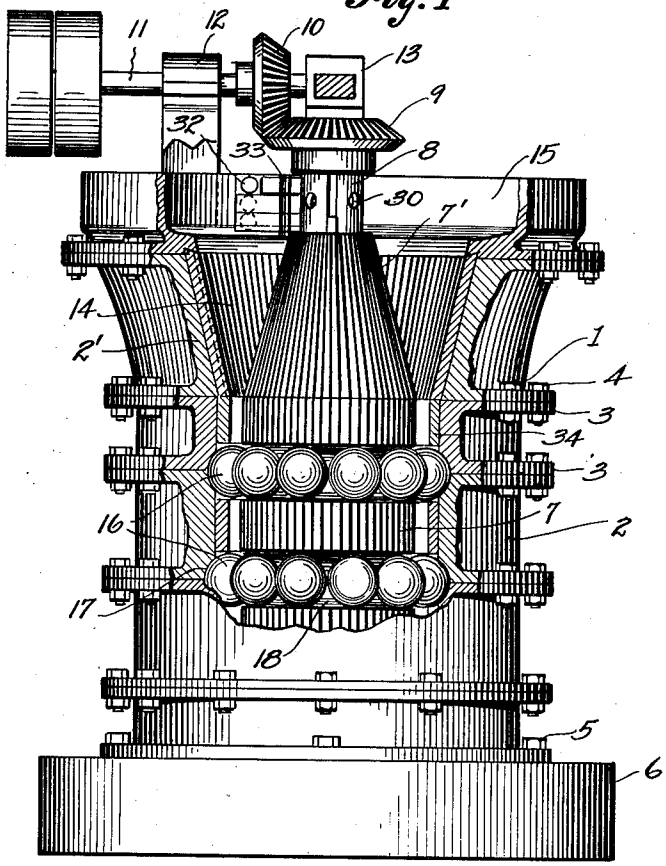
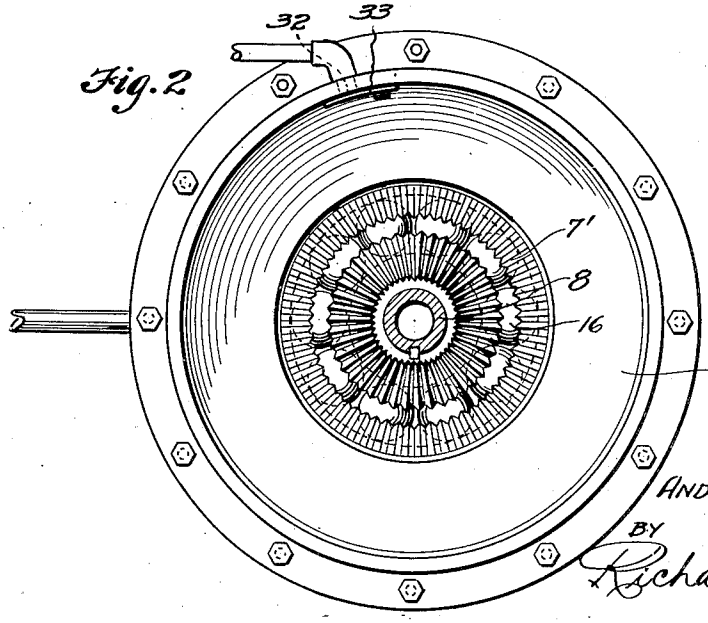


Fig. 2



Inventor
ANDREW FERGUSON
BY
Richard Cook
ATTORNEY

Dec. 11, 1923. 1,476,808

A. FERGUSON

AMALGAMATOR

Filed June 20, 1922 2 Sheets-Sheet 2

Fig. 3

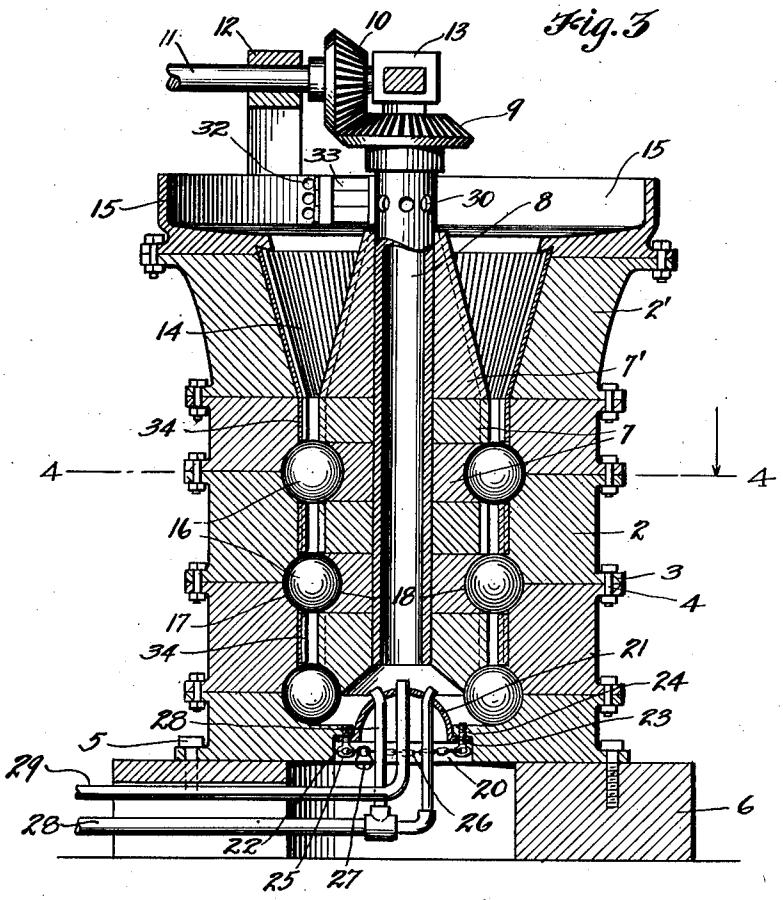
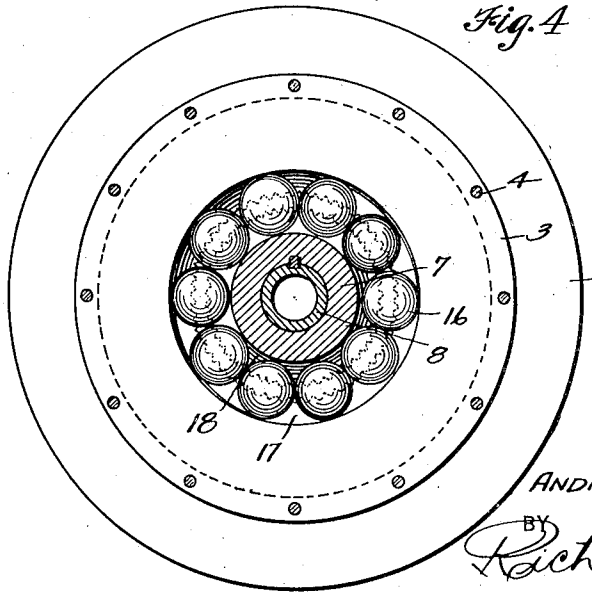


Fig. 4



INVENTOR
ANDREW FERGUSON
BY
Richard Hook
ATTORNEY

Patented Dec. 11, 1923. 1,476,808

UNITED STATES PATENT OFFICE.

ANDREW FERGUSON, OF SEATTLE, WASHINGTON.

AMALGAMATOR.

Application filed June 20, 1922. Serial No. 569,632.

To all whom it may concern:

Be it known that I, ANDREW FERGUSON, a subject of the King of England, and a resident of Seattle, county of King, and State of Washington, have invented certain new and useful Improvements in Amalgamators, of which the following is a specification.

This invention relates to amalgamators, and more particularly to improvements in machines of that type wherein the metal is separated from the ore by a rolling process as distinguished from machines wherein the separation is effected by pounding.

It is the object of this invention to provide an amalgamating machine of the above character, comprising a fixed cylindrical outer casing and a concentrically arranged, revoluble inner roller that is of a smaller diameter than the interior of the casing; both the casing and the roller having corrugated adjacent surfaces between which the ore, which may be delivered into the casing at the top, is ground and crushed.

A further object of the invention is to provide the above machine with a plurality of series of balls that are mounted loosely to travel in horizontal, cooperatively arranged raceways formed within the outer casing and the roller, whereby the ore, after being crushed, is rolled to a powdery form.

Another object of the invention resides in the provision of means for effecting a circulation of water upwardly through the central roller and downwardly along the outer side thereof whereby the coarse material is returned to the machine for further grinding.

Other objects of the invention reside in the means provided in connection with the water circulating system for drawing off the tailings at different levels.

Other objects of the invention reside in the details of construction of the parts embodied in the invention, and in their mode of operation.

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Figure 1 is a side view of an amalgamating machine constructed in accordance with the present invention, a part of the outer casing being broken away in order to illustrate interior mechanism.

Figure 2 is a plan view of the machine.

Figure 3 is a central, vertical section of the machine, particularly illustrating the disposition of the balls and the water circulating system.

Figure 4 is a horizontal section through the machine, taken on the line 4—4 in Figure 3.

Referring more in detail to the drawings—

1 designates, in its entirety, an amalgamating machine constructed in accordance with the present invention, comprising a cylindrical outer casing, here shown to be made up of five superimposed ring-like sections 2, each provided at its edges with extended circumferential flanges 3 through which bolts 4 are extended to securely join the sections together. The lower section of the casing is fixed by anchor bolts 5 to a foundation block 6 so that the machine is thereby held rigid and against rotation.

Supported rotatably and concentrically within the casing is a crushing roller consisting of a plurality of circular sections 7 of smaller diameter than the interior diameter of the casing and arranged one upon the other and keyed to a central, vertical pipe 8 which extends above the machine where it is equipped with a gear 9 that operates in mesh with a driving gear 10 on a line shaft 11; the latter being supported in bearings 12 and 13 at opposite sides of the gear 10.

The upper section 7′ of the roller is conically tapered toward its upper end, and the upper section 2′ of the casing is tapered outwardly so as to provide a hopper 14 into which the ore to be crushed is fed from a basin, or pan, 15 that is secured upon the section 2′ which forms a part of the machine.

The crushing roller is supported rotatably within the casing by means of three series of balls 16 which are mounted freely to roll within cooperating raceways 17 and 18 formed in the casing and roller respectively. These balls are arranged in close relation and are adapted to roll the ore as it is fed downwardly past them through the annular passage between the casing and roller.

It is preferred to provide the raceways in the roller within each alternate section 7, as shown in Figure 3, and to provide the raceways in the casing in the adjacent edges of the sections 2.

At the bottom of the casing is a central opening 20 which is concentrically alined with the pipe 8, and removably fitted within this opening is a dome shaped closure 21 which is secured in place by means of two bolts 22 which are threaded upwardly through a flange 23 on the closure and a peripheral shoulder 24 formed within the opening. Each bolt is provided with an eyelet 25 and a chain 26 is extended through these and secured by a padlock 27 as a means of preventing unauthorized removal of the closure whereby the amalgam is retained within the machine.

Leading upwardly through the opening 20 and closure 21 are water pipes 28 and an air, or steam, pipe 29; whereby water and air may be delivered, under pressure, into the machine. In this case the water will be forced upwardly through the pipe 8 and then discharged through openings 30 at its upper end, into the basin 15, and it will then circulate downwardly along the outer side of the roller to be again carried upwardly through the pipe. With the water circulating in this manner, it is apparent that the particles of ore will be forced from the lower part of the machine, upwardly through the pipe and the heavier will fall into the hopper to again pass the balls for finer rolling, while the smaller will float into the cleanout basin 15 which is provided at different levels with outlets, as at 32, whereby the slimes may be drawn off. These outlets are equipped with closure slides 33 mounted on the wall of the basin, whereby they may be closed or opened as desired.

An important feature of construction resides in the corrugating of the interior surface of the casing and the exterior of the central roller. By reference to Figure 3, it will be seen that the casing is fitted with vertically corrugated bands, or plates, 34 between the ball races, and the sections of the roller, between the ball races, are vertically corrugated as is best shown in Figure 1. Likewise, the walls of the parts forming the hopper 14 are vertically corrugated so that the ore delivered into the hopper can not possibly remain in a clogged condition but will be broken, or crushed and will work its way downwardly.

Assuming that the parts of the machine are so constructed and assembled, its operation would be as follows:

The ore is delivered into the hopper 14 and, on driving the central roller, it is crushed between the conically tapered surfaces of the hopper and gradually works its way downwardly through the annular passage between the casing and roller, past the three series of balls, and finally is delivered into the lower end of the machine. An amalgam is retained within the lower end of the machine, beneath the roller, by means of the closure 21, and gold that is separated from the ore by the rolling action is taken up by the amalgam, while the powdered ore is carried upwardly through the pipe 8 due to the forced circulation of water from the pipes entering through the lower end of the machine. The heavier particles of ore, after being delivered from the openings 30 in the upper end of the pipe 8, will fall into the hopper while the lighter particles will float into the basin and may be drawn off through the side openings 32. The different levels at which the openings are located in the basin provides that the tailings may be drawn off at desired degrees of fineness.

It is apparent that in this type of machine there is a maximum crushing surface whereby the ore is reduced to a certain degree of fineness and it is rolled between the balls which break up any coating that may be around the particles of gold and rub off any superficial deposit, and thus bring the gold into contact with the amalgam to make it amalgamate.

It is further apparent that the center tube 8 provides a most efficient hydraulic classifier for the separation of coarse sands from fine; the coarse sand in this case being returned to the rollers by the water circuit and the fine sand discharged into the basin to be drawn off.

It is also noted that with this type of machine, no amalgam gold or mercury can escape with the tailings.

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

1. An amalgamator comprising a cylindrical casing having an interior grinding surface, a roller arranged within the casing longitudinally thereof and providing a vertical passage between them; said roller having a central channel opening into upper and lower ends of the casing, ore rolling balls mounted between the casing and roller and supporting the latter and means for delivering water under pressure into the lower end of the casing to effect an upward circulation through the roller passage and a downward circulation about the roller.

2. An amalgamator, comprising a cylindrical casing having a longitudinally corrugated interior surface, a revolubly driven roller arranged concentrically within the casing and forming an annular passage between the same and having a central channel opening at opposite ends of the roller into the casing, raceways formed within the casing and rollers and balls mounted in close relation in said raceways and supporting the roller, and means for delivering water, under pressure, into the lower end of the casing.

3. An amalgamator, comprising a cylin-

drical casing with a longitudinally corrugated, interior surface, a revolubly driven roller arranged concentrically within the casing and forming an annular passage; the said roller and casing being provided with cooperating raceways, balls mounted in said raceways in close relation and supporting the roller, the upper ends of the casing and roller being conically tapered to provide a circular hopper leading into the annular passage, a pipe extending centrally through the roller opening to the lower end thereof into the casing and having lateral openings at its upper end, and water pipes leading into the lower end of the casing to discharge into the pipe, and drainage openings in the upper end of the casing.

4. An amalgamator, comprising a cylindrical casing with a longitudinally corrugated, interior surface and a lower end opening, a removable closure for the said opening, a roller arranged concentrically within the casing and forming an annular passage between them; the said roller and casing being provided with cooperating raceways, balls freely mounted in said raceways in close relation and supporting the roller, the upper ends of the casing and roller being conically tapered to provide a circular hopper that leads into the annular passage, a pipe extending centrally through the roller opening to the lower end thereof into the casing and having lateral openings at its upper end, means for delivering water into the lower end of the casing to create an upward circulation within the pipe and downward circulation about the roller, and the roller being equipped with a driving gear at its upper end.

5. An amalgamator, comprising a cylindrical casing having a longitudinally corrugated interior surface, and a lower end opening, a dome shaped closure removably mounted within said opening, a roller supported within the casing having a corrugated surface spaced from the casing surface to provide an annular passage between them, a tube centrally through the roller opening to the lower end of the casing and having lateral opening at the upper end thereof, raceways provided in the casing and roller, balls mounted in said raceways to support the roller from the casing; said casing and roller being conically tapered at the upper ends to provide an annular hopper leading into the annular passage, a basin formed about the hopper, outlets at different levels of the basin, and pipes for delivering air and water into the lower end of the casing through the lower end closure to effect an upward movement of water through the pipe.

Signed at Seattle, Washington, this 15th day of June, 1922.

ANDREW FERGUSON.