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MACHINE FOR POLISHING MINERAL PARTICLES

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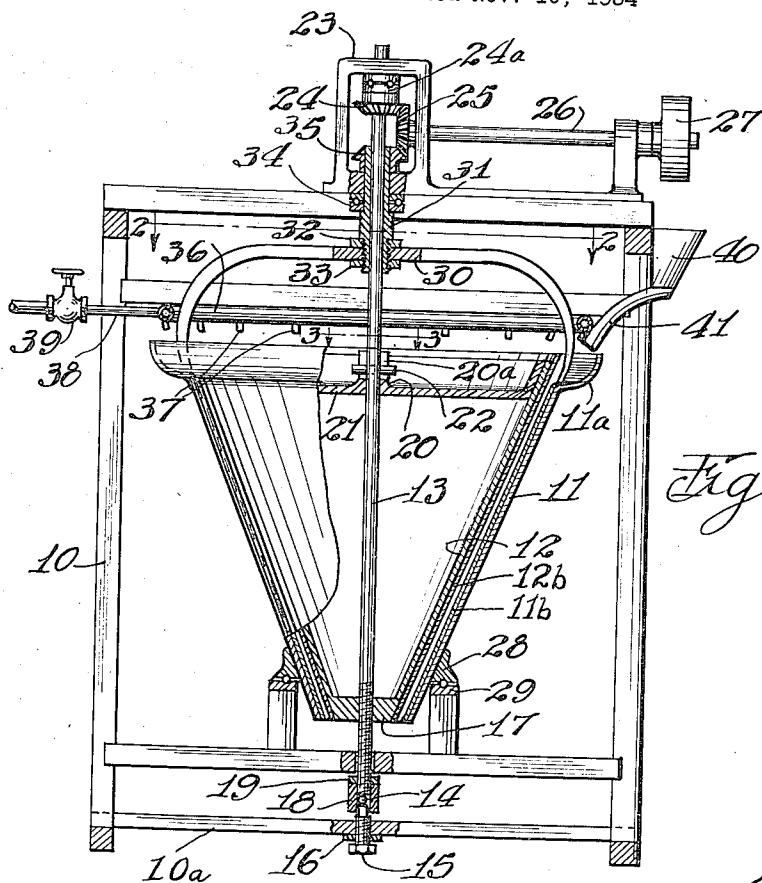


Fig. 1.

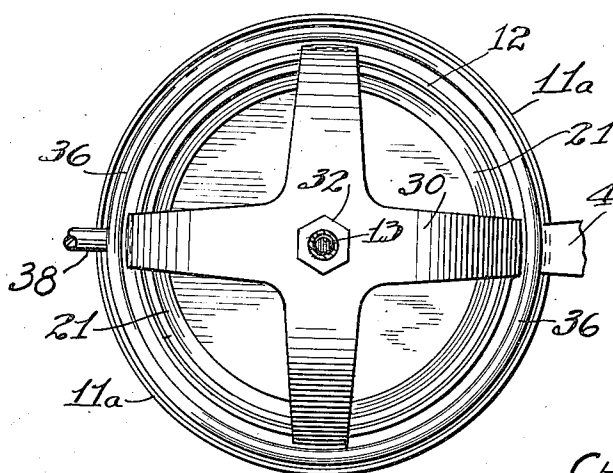


Fig. 2.

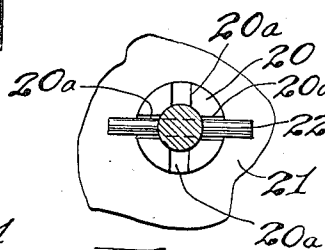


Fig. 3.

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MACHINE FOR POLISHING MINERAL PARTICLES

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13 Claims. (Cl. 51—26)

My invention relates to a machine for polishing mineral particles, by which the particles are rubbed against themselves to break down and remove the coating of foreign material which may be on them, my machine being particularly adapted to so treat particles of precious metal, for example, gold, to remove the gangue, oxide such as iron oxide, and other material which may have collected on said particles and with which they may be coated.

As illustrated herein, my machine consists of two similar conical drums mounted coaxially to rotate in opposite directions, with their adjacent surfaces spaced from each other an amount determined by the size of the particles to be treated, the axes of the drums being preferably vertical, with the larger ends of the drums uppermost. Means are provided for simultaneously rotating the drums in opposite directions and devices are employed for feeding water and the particles to be treated, to the upper end of the space between the drums, so that the rotation of the drums will rub the particles against each other and break up and remove the coating that may be on them, the water serving to feed the particles through the machine and separate the ground up coating material from said particles, leaving the latter in clean condition for any subsequent treatment it may be desired to give them, for example, amalgamation, where the particles are gold. I further provide means by which the amount of separation between the drums, may be changed as desired, to effectively treat mineral particles of different sizes.

More generically, my machine consists of members one within the other and having relative rotation, said members having spaced adjacent surfaces for rubbing the treated particles against each other, means for effecting said relative rotation, and means for changing the spacing of said adjacent surfaces, as desired.

My invention will be best understood, by reference to the accompanying drawing showing a preferred embodiment thereof, in which

Fig. 1 illustrates my machine in front elevation with the drums thereof shown partially in vertical, central sectional view,

Fig. 2 is a horizontal, sectional view of the structure shown in Fig. 1, taken along the line 2—2, with the framework removed, and

Fig. 3 is a horizontal, sectional view to an enlarged scale, of a part of the structure shown in Fig. 1, taken along the line 3—3.

Similar numerals refer to similar parts throughout the several views.

As shown in Figs. 1 and 2, my machine consists of a framework 10 supporting outer and inner conical drums 11 and 12 in coaxial relation, with their axes vertical and with a space between the outer surface of the inner drum 12 and the inner surface of the outer drum 11, the smaller ends of said drums being lowermost.

The drum 12 is supported on a vertical shaft 13 coaxially therewith, and said shaft is supported at its lower end on a thrust ball 14 carried on the upper end of a screw 15 threaded through the member 10a of the framework. The screw 15 carries a lock nut 16 to clamp the screw in any desired adjustment.

The shaft 13 is threaded at its lower end, and engages similar threads in the lower head 17 of the drum 12. The lower end of the shaft 13 has threaded thereon a sleeve 18 held in place by a lock nut 19, said sleeve extending downwardly beyond the ball 14 and around the upper end of the screw 15, to retain said ball in place and to protect said ball and the bearing surfaces engaged by it, from the water and mineral particles that are delivered from the machine and that may flow downwardly around said sleeve. The screw 15 is of reduced diameter at its upper end, to clear the lower end of the sleeve and bear against it if desired.

The upper part of the shaft 13 extends with a sliding fit through a central boss 20 extending upwardly from the upper head 21 of the drum 12, which boss is provided, as more clearly shown in Fig. 3, with keyways 20a for receiving a key 22 extending through the shaft 13, in which shaft the key is a tight fit. The keyways 20a are deeper axially of the boss than the depth of the key 22, so that the key engages only the sides of the keyways 20a. The key 22 constitutes the means for rotating the drum 12 when the shaft 13 is rotated.

The shaft 13 extends upward from the drum 12 through the framework 10 and through a bearing frame 23 supported on said framework, in which frame the upper end of the shaft is provided with a bearing. Just below its upper end bearing, the shaft 13 has secured thereto a bevel gear 24 meshing with a bevel gear 25 carried by one end of a horizontal driving shaft 26 supported in suitable bearings by the frame 23, said shaft 26 having secured to its other end a driving wheel 27 for operating the machine. A thrust ball bearing 24a is located between the bevel gear 24 and the frame 23 to take upward thrusts that may be exerted on the

drum 12 by the operation of the machine, and communicated thereby to the shaft 13.

The outer drum 11 carries near its lower end, a bearing ring 28 cooperating with a second and stationary bearing ring 29 supported by the framework 10. Bearing balls are disposed between the rings 28 and 29 to take the downward thrust of the drum 11 during its operation, and to reduce the friction of rotation to a minimum. At its upper end, the drum 11 is connected with the outer ends of a spider 30 through the central part of which, the lower end of an externally threaded sleeve 31 extends, said sleeve having a bore somewhat larger in diameter than the diameter of the shaft 13, said shaft extending through said bore coaxially with said sleeve and with the drum 11. The lower end of the sleeve 31 carries a collar 32 and a nut 33 clamping the spider 30 to said sleeve, and said sleeve above the collar 32, is provided with a shoulder engaging said collar. Above the collar 32, the sleeve 31 is provided with a second shoulder engaging the lower member of a ball bearing 34, the upper member of which rests against the bottom of the bearing frame 23 by which it is held stationary. The sleeve 31 extends above the bearing 34 and with a free turning fit through the lower part of the bearing frame 23, above which said sleeve has secured thereto, a bevel gear 35 meshing with the bottom part of the bevel gear 25. As a result, rotation of the shaft 26, rotates the drums 11 and 12 in opposite directions.

The drum 11 is provided around its upper edge, with an upwardly and outwardly flaring rim, forming an annular trough 11a for receiving water and the mineral particles to be polished. Above the trough 11a, an annular pipe 36 is supported by the framework 10, said pipe having downwardly extending nozzles 37 for discharging water from said pipe into said trough. A supply pipe 38 extends from the pipe 36 through a valve 39 to any suitable source of water under pressure, so that the rate of flow of water from said nozzles into said trough, may be controlled as desired.

The framework 10 supports a hopper 40 above the trough 11a, to receive the mineral particles to be polished, said hopper having at its lower end, a discharge spout 41 extending over said trough to deliver said mineral particles from said hopper into said trough.

The drums 11 and 12 are preferably provided on their adjacent surfaces, with coverings 11b and 12b of resilient material, for example rubber, which may be secured to said drums in any desired manner, for example by vulcanization or by cement. Said coverings are sufficiently soft to avoid undue abrasion and disintegration thereof by their engagement with the mineral particles, and yet hard enough to positively move the particles upon each other to abrade and remove the coating, such as gangue or oxide that may be on the particles.

In operating the machine, the spacing between the drums is first adjusted according to the size of the mineral particles to be cleaned and polished, by removing the key 22 and turning the drum 12 on the shaft 13, until the desired spacing between the drums is secured, and the key 22 is then placed in the shaft 13 and in the keyways 20a that are then in line with the keyway in said shaft. The mineral particles to be treated are placed in the hopper 40, either

in dry or wet condition as preferred, and fed through the spout 41 into the trough around the upper end of the drum 11, and at the same time water is supplied to said trough by the nozzles 37. Rotation of the drums 11 and 12 in opposite directions, rolls the mineral particles on the yielding adjacent surfaces of the drums, so that regardless of whether the mineral particles have appreciable rotary movement around the axis of the shaft 13, they trace spiral paths on the adjacent surfaces of the drums, constantly progressing downwardly due to the weight of the particles and the action of the water flowing downwardly around said particles, the pitch of said spiral paths being determined largely by the speed of rotation of the drums, and in turn determining the amount of treatment to which the particles are subjected. In their movement as described, the mineral particles rub and grind against each other to a greater or lesser degree, depending upon the rate of feeding the particles to the trough. As a result, the coatings on the particles are abraded and ground away, the more friable material of said coatings being disintegrated first, and washed away by the water, and then the harder and more obstinate materials of said coatings are similarly affected, until the mineral particles are cleaned and polished and ready for any subsequent treatment that may be given them, at which time the particles are delivered from the machine. The convergence downwardly of the surfaces operating on the particles, brings said particles more closely into association with each other progressively, as the particles pass downwardly through the machine, which correspondingly progressively increases the abrading and grinding action of the particles on each other and insures delivering the particles from the machine in clean and polished condition.

While I have shown my invention in the particular embodiment above described, it will be understood that I do not limit myself to this exact construction as I may employ equivalents known to the art at the time of the filing of this application without departing from the scope of the appended claims.

What I claim is:

1. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles to be polished, and means for supplying mineral particles and water to the upper portion of the space between said drums.

2. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft

and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles to be polished, said outer drum having a trough at its upper end surrounding the upper end of said inner drum, and means for supplying mineral particles and water to said trough.

3. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles to be polished, said outer drum having a trough at its upper end surrounding the upper end of said inner drum, an annular water supplying pipe above said trough, spaced nozzles extending from said pipe towards said trough for delivering water thereto, and means for supplying mineral particles to said trough.

4. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles to be polished, and means for supplying mineral particles and water to the upper portion of the space between said drums, said gearing comprising a driving shaft, a first bevel gear carried by said driving shaft, and second bevel gears carried by said drum shaft and said sleeve and meshing with opposite sides of said first bevel gear.

5. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles

to be polished, means for supplying mineral particles and water to the upper portion of the space between said drums, said inner drum having upper and lower heads, said drum shaft extending through said heads and having on its lower portion threads engaging corresponding threads in said lower head and extending with a sliding fit through said upper head, and releasable means for securing said drum shaft to said inner drum against rotation relatively to said inner drum, whereby with said shaft securing means released the space between said drums may be changed as desired by rotation of said inner drum relatively to said drum shaft.

6. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles to be polished, means for supplying mineral particles and water to the upper portion of the space between said drums, said inner drum having upper and lower heads, said drum shaft extending through said heads and having on its lower portion threads engaging corresponding threads in said lower head and extending with a sliding fit through said upper head, said upper head having a keyway in line with said drum shaft, a key in said keyway and extending into said drum shaft, and a bearing supporting the lower end of said drum shaft, whereby with said key removed rotation of said inner drum relatively to said drum shaft changes as desired the spacing between said drums and the insertion of said key into said keyway and said drum shaft effects a driving connection between said drum shaft and said inner drum.

7. In a machine of the class described, the combination of outer and inner drums mounted vertically for relative rotation with a space between them, gearing for imparting relative rotation to said drums, one of said drums having a trough at its supply end around the adjacent end of the other of said drums, an annular water supplying pipe above said trough, spaced nozzles extending from said pipe towards said trough for delivering water thereto, and means for supplying mineral particles to said trough.

8. In a machine of the class described, the combination of outer and inner concentric conical drums mounted vertically for relative rotation with a space between them, gearing for imparting relative rotation to said drums, one of said drums having a trough at its supply end around the adjacent end of the other of said drums, an annular water supplying pipe above said trough, spaced nozzles extending from said pipe towards said trough for delivering water thereto, and means for supplying mineral particles to said trough.

9. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes vertical and with their smaller ends lowermost, a drum shaft

extending upwardly from said inner drum, a sleeve extending upwardly from said outer drum around said shaft, gearing connecting said drum shaft and said sleeve to rotate said drums in opposite directions, a first thrust bearing connected with the lower portion of said outer drum to withstand downward thrusts of said outer drum, a second thrust bearing connected with the upper portion of said shaft to withstand upward thrusts of said inner drum, the adjacent surfaces of said drums being spaced from each other an amount determined by the size of the mineral particles to be polished, one of said drums having a trough at its supply end around the adjacent end of the other of said drums, and means for supplying mineral particles and water to said trough.

10. In a machine of the class described, the combination of two concentric conical drums mounted with their axes substantially vertical, a rotary drum shaft restrained against longitudinal movement relatively to a first one of said drums and extending from the other one of said drums to rotate the latter, said shaft having screw threads engaging said other drum for adjusting the spacing of the adjacent surfaces of said drums from each other, and releasable means for securing said shaft to said other drum against rotation relatively to said other drum, whereby with said shaft securing means released the space between said drums may be changed as desired by rotation of said other drum relatively to said shaft.

11. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes substantially vertical, a rotary drum shaft restrained against longitudinal movement relatively to said outer drum and extending from said inner drum to rotate the latter, said shaft having screw threads engaging said inner drum for adjusting the spacing of the adjacent surfaces of said drums from each other, and releasable means for securing said shaft to said inner drum against rotation relatively to said inner drum, whereby with said

shaft securing means released the space between said drums may be changed as desired by rotation of said inner drum relatively to said shaft.

12. In a machine of the class described, the combination of two concentric conical drums mounted with their axes substantially vertical, a rotary drum shaft restrained against longitudinal movement relatively to a first one of said drums and extending from the other one of said drums to rotate the latter, said shaft having screw threads engaging said other drum for adjusting the spacing of the adjacent surfaces of said drums from each other, and releasable means for securing said shaft to said other drum against rotation relatively to said other drum, whereby with said shaft securing means released the space between said drums may be changed as desired by rotation of said other drum relatively to said shaft, said releasable means comprising a removable key engaging said shaft and said other drum to rotate the latter and when removed freeing said shaft from said other drum for said adjusting purposes.

13. In a machine of the class described, the combination of outer and inner concentric conical drums mounted with their axes substantially vertical, a rotary drum shaft restrained against longitudinal movement relatively to said outer drum and extending from said inner drum to rotate the latter, said shaft having screw threads engaging said inner drum for adjusting the spacing of the adjacent surfaces of said drums from each other, and releasable means for securing said shaft to said inner drum against rotation relatively to said inner drum, whereby with said shaft securing means released the space between said drums may be changed as desired by rotation of said inner drum relatively to said shaft, said releasable means comprising a removable key engaging said shaft and said inner drum to rotate the latter and when removed freeing said shaft from said inner drum for said adjusting purposes.

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