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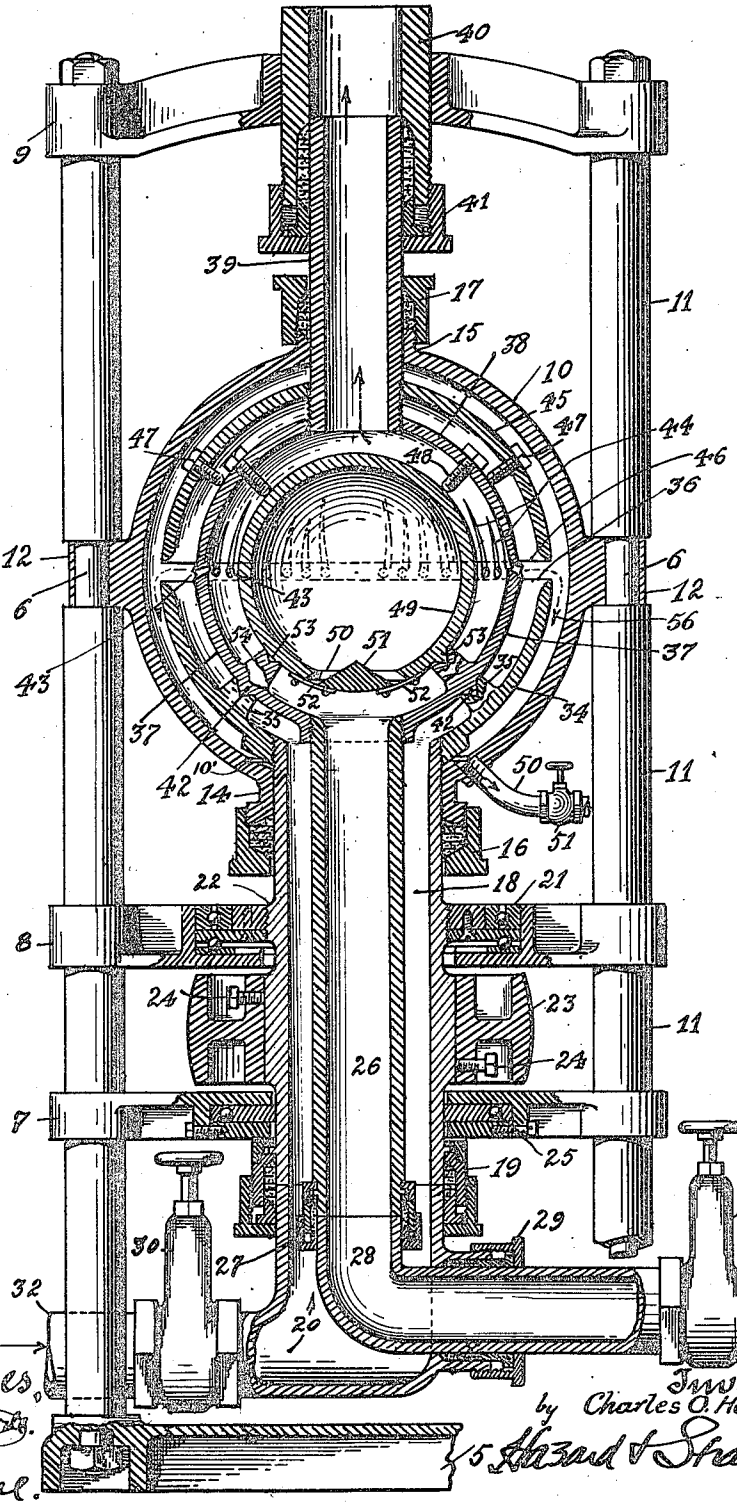
METAL SEPARATING APPARATUS.

APPLICATION FILED JAN. 13, 1913. RENEWED JAN. 11, 1915.

1,148,771. Patented Aug. 3, 1915.

2 SHEETS—SHEET 1.

Fig. 1.



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[illegible]
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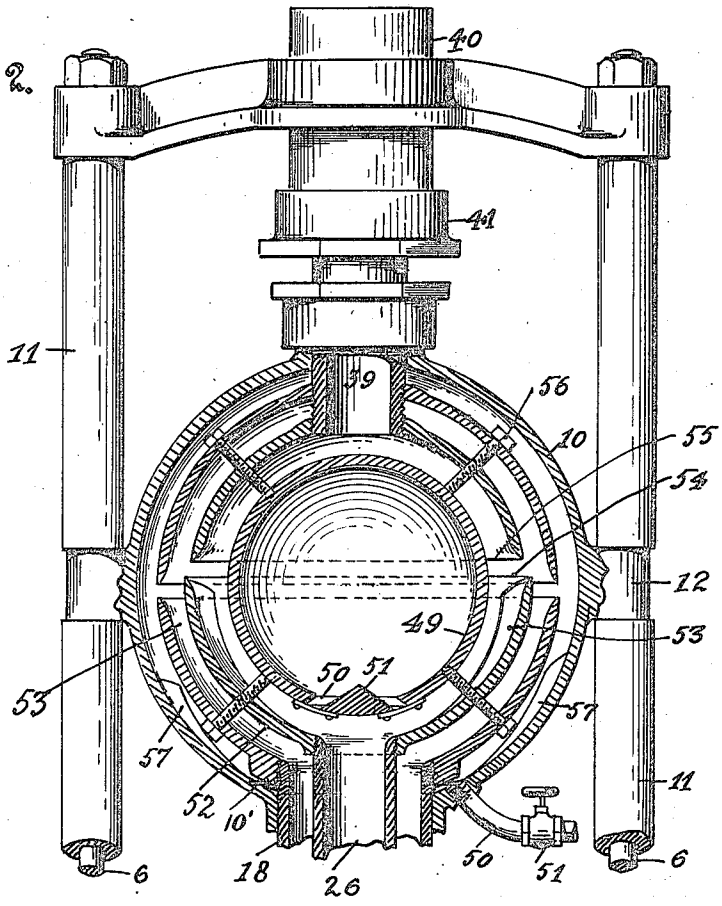
METAL SEPARATING APPARATUS.

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2 SHEETS—SHEET 2.

Fig. 2.



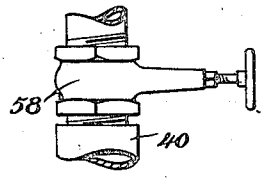


Fig. 4.

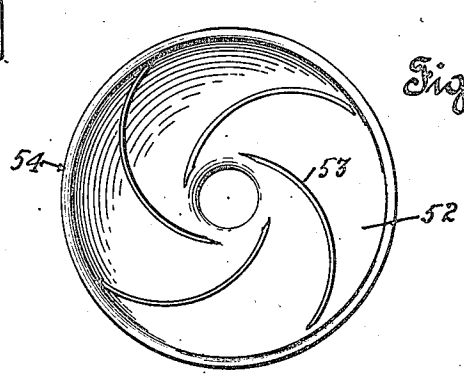


Fig. 3.

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UNITED STATES PATENT OFFICE.

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METAL-SEPARATING APPARATUS.

1,148,771. Specification of Letters Patent. Patented Aug. 3, 1915.

Application filed January 13, 1913, Serial No. 741,756. Renewed January 11, 1915. Serial No. 1,716.

To all whom it may concern:

Be it known that I, CHARLES O. HASKELL, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Metal-Separating Apparatus, of which the following is a specification.

This invention relates to separators and especially to the type of centrifugal separators, and the principal object is to provide a separator in which the pulp is admitted under pressure and meets in its path a stream of water at the point where the greatest effect of the centrifugal action is exerted.

It is a further object to provide means for introducing the pulp into a centrifugal chamber which is surrounded with an approximately concentric water carrying chamber, these chambers communicating with a third chamber of substantially the same form in which the separated material or metal is caught and removed.

In the drawings accompanying this specification Figure 1 is a central vertical section through a separator embodying the preferred form of the invention. Fig. 2 is a central vertical section of the centrifugal chambers of a modification, and Fig. 3 is a plan view of the lower pulp carrying hemisphere of Fig. 2, showing the position of the vanes or fans mounted therein. Fig. 4 is a detail in elevation of the pressure controlling gate valve mounted on the outlet side of the apparatus.

In the drawings accompanying this specification numerals are used to designate the parts, 5 designating the base of the apparatus on which are secured the vertical rods 6, the various cross frames 7, 8, and 9, and the spherical chamber 10, these being separated by spacers or sleeves 11 of suitable lengths so that the parts are quickly assembled and form rigid bearings and supports for the revolving members.

The spherical chamber 10 forming a casing for the revolving spherical members is simply formed or cast in two parts secured by suitable means, not shown, and provided with the lugs 12 through which are carried in suitable bores the rods 6 forming the supporting columns. The top and bottom bores through the spherical chamber 10 are provided with the flanges 14 and 15 on which are mounted suitable packing rings held by the sleeves 16 and 17, respectively, the lower bore being of larger diameter than the upper one, and of such dimensions that the cylindrical tubular shaft 18 freely revolves therein and is so supported that its upper threaded end projects the proper distance within the casing and is inclosed thereby, the lower end of the shaft being carried below the cross frame 7 where it is in turn provided with a suitable packing box 19 which surrounds and incloses the joint formed by the shaft registering with the upper limb of the T fixture 20, suitably supported and rigidly secured to the base 5. This shaft is provided with suitable thrust bearings 21 which are preferably threaded onto the flange 22 formed on the tubular shaft and secured in any suitable manner, ball bearings being shown as forming the thrust and ball bearings for its lateral support, these latter being incased in a suitable recess in the cross frame 8. A wider flange located below the flange 22 is adapted to receive the driving pulley 23 which is rigidly secured thereto by means of the locking bolts 24, the space between the two cross frames 7 and 8 being of sufficient width to provide for the free movement of the pulley and its driving belt, and the ball bearings 25 are preferably supplied which are mounted in a suitable recess in the lower cross frame 7 so that there is little friction, and a simple support for the shaft 18 is provided.

Mounted within the shaft 18 is a second tubular shaft 26 rigidly secured therein, its upper end terminating preferably a short distance above the upper end of the shaft 18, and its lower end provided with a suitable flange to which the packing box 27 is secured to form a tight joint at its registering point with the upper limb of the elbow 28 which is rigidly secured in one of the horizontal limbs of the T 20, a suitable box 29 is provided to form a tight joint at the junction of the T and the lower limb of the elbow 28, this lower limb being shown connected with a regulating gate valve 30. The oppositely disposed limb of the T 20 is joined to a regulating gate valve 31, these gate valves being in turn connected to the pipes 32 and 33, respectively, which lead to sources of supply of the fluid and pulp

under pressure. The shafts 18 and 26 are each connected by their threaded external peripheral ends to hemispherical structures, the shaft 18 to the hemisphere 34 which is provided with the internally formed lugs 35 suitably spaced within the hemisphere, the upper portion terminating in an outwardly turned edge forming a horizontal lip 36 which is preferably just below the equatorial plane of the surrounding concentric casing and those spherical structures inclosed within and supported upon this hemisphere.

The shaft 26 is connected with and forms communication with the interior of the spherical structure 37, this sphere being preferably formed in two parts separated into two hemispheres at the equatorial plane and joined by suitable means, not shown, the upper portion of hemisphere 38 being provided with an axial bore which is threaded and engages with the threaded periphery of the tubular shaft 39 which is of sufficient length to extend in a vertical line axially disposed with the lower shafts and through the bore forming a bearing in the casing 10 to the bearing 40 supported in the cross frame or head 9, a suitable packing box 41 being provided to form a tight joint between the lower end of the bearing 40 and the shaft 39, this packing box 41 being adjacent the packing box 17 at the upper point of the casing 10. The hemisphere 37 is provided with conically formed lugs 42 which register with and are seated within the conical depressions in the lugs 35 supporting the hemisphere in such position that a concentric chamber is formed between the two hemispheres 34 and 37 for the passage of fluid between the two latter. In the point of juncture in the equatorial plane of the sphere a plurality of openings 43 are provided, these openings being preferably circular in cross section and preferably inclined to the equatorial plane in a downward and outward direction so that the exits are located directly in this plane and are preferably provided with slight lips as clearly shown in Fig. 1. Extending from the internal openings of these bores upwardly are the grooves 44 cut with decreasing depth in an upward direction so that they terminate at a point about mid-way between the equatorial plane and the axial opening in the sphere. To support this hemisphere it is threaded upon a shaft 39, as stated, this shaft in turn carrying the hemisphere 45 which is preferably intermediate of the hemisphere 38 and the casing 10, its diameter corresponding with the hemisphere 34 and its terminal lip 46 being similarly formed with an outwardly turned edge and spaced the same distance from the equatorial plane as the lip 36. The screws 47 carried through this hemisphere 45 engage with the hemisphere 38, and suitable screws 48 carried through the walls of the hemisphere 38 engage with the spherical member 49 which is preferably hollow and forms an equalizing chamber, it being inclosed by the inner and outer hemispherical members and the casing previously described.

The spherical member 49 is provided with a dependent circular opening 50 of a diameter preferably greater than the internal diameter of the shaft 26, and this latter opening is partly closed by the conically formed member 51, supported concentrically within the opening 50 by means of the straps 52. Suitable conical lugs 53 formed on the lower external periphery of the sphere 49 are seated in conical depressions in the lugs 54 suitably spaced on the hemisphere 37 so that the chambers surrounding the sphere 49 and inclosed by the hemisphere 37 are concentric.

The casing 10 is shown as provided with an annular groove 10′ concentric with the external lower bore therethrough in which the shaft 18 is journaled, and connected with this groove is the outlet pipe 50, the exit being controlled by the valve 51.

In Fig. 2 a modification has been shown in which the primary separating bowl 52 is connected to the tubular shaft 26 and preferably formed so that its inner peripheral wall is eccentric to the central sphere forming the equalizing chamber, and this spherical bore is preferably provided with the curved vanes 53 so that the centrifugal action is accelerated, and the heavier particles are carried up over the lip 54 outside of the lip 55 of the inverted hemisphere forming the cooperative member of this sphere and so placed that its inner periphery is concentric with the sphere 49.

A different manner of supporting the equalizing chamber is shown, a plurality of bolts 56 extending through the two parallel hemispheres and bearing directly upon the central sphere 49. The lower portion or hemisphere of the casing 10 in the modification is also preferably supplied with vanes or deflectors 57, these vanes being turned in the reverse direction so that the current set up within this lower portion will be inhibited or restricted in its movement and throw metallic portions more quickly into the annular grooves 10′ placed near the bore in the bottom being carried off through the pipes 50 under the control of the valve 51.

The operation of the device will now be described. The pulp of any suitable consistency or the finely divided ore in the dry state is pumped under pressure from a suitable source and carried by the pipe 33 through the control valve 31 into the tubular shaft 26 and is distributed around the central opening forming the equalizing chamber, the shaft 26 and its spherical member

and the shaft 18 being revolved at a speed great enough to provide a sufficient number of revolutions, about 400 per minute being the usual number for a ten inch sphere. The water or other medium, as air, used to antagonize the flow of the centrifugally operated particles of metal or material of greater specific gravity than the water is introduced under suitable pressure to the pipe 32, the amount being controlled by the valve 30 and passing up through the annular passage in the shaft 18, enters the hemispherical chamber connected therewith and impinges against the centrifugally affected material escaping through the orifices 43. Small particles not having great weight are caught in the grooves 44 and are carried down eventually and tend to escape also through the orifices 43, the natural tendency being for the heavier particles to pass straight outward in the path outlined by the arrow 56, where they strike the inner walls of the casing 10 and are carried downward until they meet in the groove 10 where the quiet water contained therein eventually carries them to the opening controlled by the pipe 50, from whence the metallic particles are carried outward and discharged.

The object of the stream of water is to separate such particles as sand from the heavier particles of the metal so that they are separated in the openings 43 and carried away with the balance of the debris. The chamber above the equatorial plane and above the lips act in conjunction with the air in the equalizing chamber inclosed by the sphere 49 to balance the pressure between the streams, and the conical plate 31 is provided so that particles of metal or other material carried with the pulp stream up within the chamber readily gravitate when the pressure is relieved and fall out of the sphere.

A suitable gate valve 58 in preferably inserted in the connections of the outlet through the tubular bearing 40 as shown in Fig. 4 so that the pressure can be readily controlled within the structure, and in the operation it has been found that the best results are obtained with the pressure one-fourth to one-half greater in the outer chamber than in the inner chamber supplied through the passage-way in the shaft 26. The valve 51 is opened only a slight amount, and the area and capacity of the exit being greater so as to afford relief to the pressure than the combined inlet openings, as a very slight amount of water is carried out through the pipes 50, it being only enough to keep the metallic particles in movement so that they do not extend too high up in the casing 10 to interfere with the efficient operation of the apparatus.

This apparatus is particularly adapted to separating low grade ores of copper and other baser metals, and where the quantity of water is small, air can be used as the ore carrying and pressure mediums. The pressures can be readily regulated so that metals of different specific gravity can be separated.

What I claim is:

1. A separating apparatus, comprising a stationary spherical member and a plurality of revoluble spherical members mounted therein and in operative relation to each other, said revoluble members having a plurality of fluid inlets and an outlet for the passage of pulp and fluid and arranged to commingle the fluid and pulp passing therethrough, an equalizing chamber inclosed in the innermost spherical member, and means to rotate said revoluble members.

2. A separating apparatus, comprising a plurality of revoluble spherical members communicating with each other by means of openings, each of said members having a separate fluid inlet leading thereto and a discharge outlet, one of said inlets carrying pulp and the other of said inlets carrying water, said inlet carrying water being under greater pressure than the pulp inlet, whereby during the operation of the apparatus the materials of low specific gravity will be forced upwardly through the discharge outlet and the materials of higher specific gravity will pass through the openings between said revoluble members, an equalizing chamber arranged within one of the revoluble spherical members, means to rotate said members, and valve means to control the inlets and outlet.

3. A separating apparatus, comprising a substantially spherical revoluble hollow member forming an equalizing chamber, a plurality of revoluble members surrounding said spherical equalizing member and spaced apart to form chambers, a stationary casing inclosing said equalizing sphere and members, means for revolving said sphere and members, a tubular shaft for the passage of a fluid containing separable elements into said chamber formed by the equalizing sphere and the member immediately inclosing the same, means for introducing a separating fluid into the next adjacent chamber, said members having openings for affording communication between said fluids, and a tubular shaft providing fluid outlet from said chamber.

4. A separator apparatus, comprising a stationary spherical casing having a valve controlled outlet, a plurality of spherical members revolubly mounted therein, having a plurality of fluid entrances and a common fluid outlet, means for revolving said members, tubular shafting to deliver a fluid to said chamber separated by said spherical members, said spherical members having openings adapted to impinge one of said

fluids across the path of the other of said fluids delivered into said chambers, an equalizing sphere arranged in the innermost revoluble spherical member and means to control the outlet of metallic particles escaping into said casing against the pressure of said stream of fluid.

5. A separator apparatus, comprising a hollow casing provided with bearings for shafting mounted therein, tubular shafting mounted therein, a plurality of spherical members provided with openings interposed between the ends of the shafting mounted in said casing and secured thereto, an equalizing sphere supported intermediate of said spherical members, and capable of revolving therewith, one portion of said shafting providing means to introduce a plurality of fluids into the lower portion of said spherical members, and the other portion of said shafting providing means to withdraw fluid from one of said spherical members, the openings between said spherical members providing means to permit the co-mingling of the plurality of fluid intermediate said sphere and its adjacent spherical members.

6. A separator apparatus, comprising a casing of substantially spherical form provided with bearings, an upper and a lower section of tubular shafting mounted in said bearings and terminating in said casing, said lower section providing two channels, a hollow spherical member connected with said upper section and one of said channels in said lower shaft, providing inlet and outlet therefor, said sphere having a plurality of openings arranged in the plane of greatest centrifugal action, a hemispherical member spaced parallel with and secured to said upper shafting, a hemispherical member secured to the lower section of shafting to afford an entrance to the other of said channels, the interval between said hemispheres permitting the escape of centrifugal metals to said casing, valve controlled connections to said channels in said lower section of shafting, whereby the pressure may be regulated to cause the fluid carried in the chamber formed by said hemispheres to oppose the exit of materials of light specific gravity through said openings against the centrifugal action and to mingle with the ore carrying fluid of lower pressure and make its exit through said upper section of said tubular shafting, and valve controlled means for withdrawing the centrifuged metal from said casing.

7. A separating apparatus, comprising revoluble nested members spaced apart to form chambers, said chambers communicating with each other by means of openings, a fluid inlet and a pulp inlet leading to each chamber respectively, the fluid being forced through said fluid inlet under greater pressure than the pulp through its inlet, whereby the materials of lower specific gravity will be washed away, while the materials of higher specific gravity will be forced outwardly through said openings between said members and saved, the centrifugal force generated by the revoluble members being sufficient to overcome the fluid pressure in the fluid inlet, and an air containing equalizing chamber arranged within the innermost revoluble nested chamber and spaced therefrom.

In witness that I claim the foregoing I have hereunto subscribed my name this Dec. 28, 1912.

CHARLES O. HASKELL.

Witnesses:
EDMUND A. STRAUSE,
M. BATTEY.