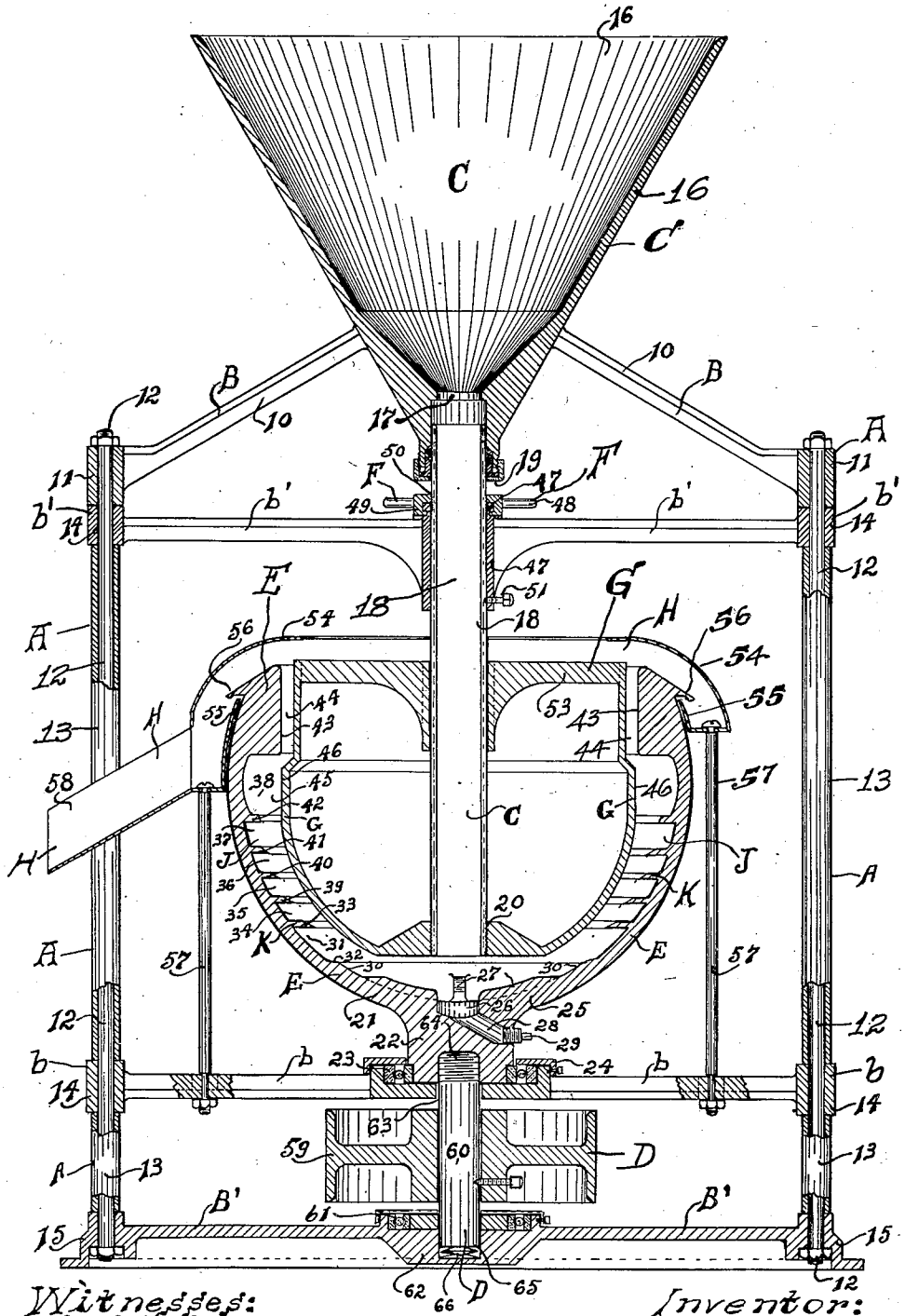
H. R. ZIMMER.

CENTRIFUGAL SEPARATOR AND AMALGAMATOR.

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1,220,051. Patented Mar. 20, 1917.



Witnesses:
John C. Walker.
Louis J. Lefebvre

Inventor:
Harry R. Zimmer;
By Wm. Francis Deemans
his Atty.

UNITED STATES PATENT OFFICE.

HARRY R. ZIMMER, OF LOS ANGELES, CALIFORNIA.

CENTRIFUGAL SEPARATOR AND AMALGAMATOR.

1,220,051. Specification of Letters Patent. Patented Mar. 20, 1917.

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To all whom it may concern:

Be it known that I, HARRY R. ZIMMER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Centrifugal Separators and Amalgamators, of which the following is a specification.

This invention relates to centrifugal and centripetal separators and amalgamators in general, particularly to that class and description of separating or amalgamating mechanisms applicable for the concentration of precious metals, but more especially to centrifugal separators, wherein mercury is employed.

The primary object of the invention is the provision of a mercurial mechanical separator and amalgamators of the above general relation, wherein new and novel rotary mechanism is provided and so arranged that the centrifugal and the centripetal forces of such rotary mechanism are productive of a highly efficient separation of metals or minerals of various specific gravities on or in a vertical plane.

One of the chief objects of the invention is the provision of a mechanical separator and amalgamators of the above general relation and of the stated character wherein the centrifugal and the centripetal forces are produced and thereafter controlled to act and re-act on the product being separated, with relation to the true specific gravities of the material for separation and the resultant separated values or products of the various specific gravities.

An object of the invention is the provision of mechanism and means of the character stated, wherein the velocity of rotation of certain of the parts is such that the mercury employed therein is made more dense as it is held in an operative vertical wall, which, in this instance, is very advantageous, in that the material to be separated and that is passed through the invention or any of the most minute particles thereof composed of substance lighter than the specific gravity of the mercury, is and are thereby prevented from entering said mass of mercury or dislodging any particles thereof, so that the usual mercurial losses in the operation of a machine of this character, are substantially *nil*.

Another object of the invention is the provision of mechanism and means of the character stated especially applicable to, and for the handling of various ores or metal bearing sands, which has a comparatively wider range of minimum and maximum utility, with relation to the use of water; the operative use of water ranging from 20 per cent. to 98 per cent., in connection or in combination with the products to be separated.

A further object of the invention is the provision of a combined separator and amalgamator of the stated character and possessed of the advantages above stated, wherein mercury is employed for attracting a greater per cent. of the "pay values" of the ores or precious metal bearing sands being treated.

A further object of the invention in the production of a precious metal separator is the provision of mechanical rotary means having suitable grooves and indentures for the impinging and deflection and thereby the retardation of the metals of various specific gravities as the ores or metal bearing sands are gradually moved in a vertical plane in such rotary means (either in combination with or without mercury); such grooves and indentures comprising a series of opposed angular surfaces of predetermined varying angularity.

A still further object of the invention is the provision of a mechanical separator of the stated character and of the above general relation, that is superior in points of relative simplicity and inexpensiveness of construction, positiveness in operation and applicability, and in point of labor economy and general efficiency, and serviceability.

With the above and other objects in view, the invention further consists in the new and novel provision, formation, construction, combination, and relative arrangement of parts, members and features, all as hereinafter more fully described, shown in the drawings, and finally pointed out in the claims annexed hereto at the end of this specification.

In the drawings:

The figure is a central vertical cross-sectional view of the various operative parts.

Like parts and combinations of parts are designated by like characters of reference throughout the several views of the drawings.

Referring to the drawings, the letter A broadly designate the frame posts of a ma-

chine constructed in accordance with the invention, and extending from the frame posts are the frame parts B and B′ for respectively supporting the hopper or feed means C and the transmission means D; there being the sub-frame *b* for supporting the rotary means or bell-shaped bowl E, and the like sub-frame *b′* for supporting the means F for raising and lowering the non-rotatable relatively bell-shaped bowl G, the latter of which is operatively suspended within the rotary bowl E in the more extensive use of the invention. The sub-frame *b* also supports the covering and discharge means H for controlling the discharge of the tailings of the product handled in the machine without the same.

Suitable grooves or indentures J are provided in the rotary means E, each of which is designed to contain a quantity of mercury for the separation or amalgamation of various ores when the machine is in operation; the mercury being forced upwardly from the bottom of the rotary means E and thereafter kept in the grooves by the centrifugal forces resultant from the rotation of the means E. Adjacent the grooves and indentures J there is a series of angularly inclined surfaces K for the impingement and the deflection of the product being handled in the invention.

Referring with particularity to the drawings, the frame B specifically comprises the centrally converging frame standards 10 extending from brackets 11 on the corner posts A, such standards 10 being preferably upwardly inclined for supporting the hopper C substantially as shown. The posts A comprise the bolts or the like 12 having a series of spacing-pipes 13 thereon for spacing the bracket ends 14 of the frame parts *b* and *b′* and the base brackets 15 of the frame part B′ at the base of the invention from each other a predetermined distance in conformity to the desired height of the invention. The frame parts B′, *b* and *b′* are each arranged directly under the frame B and converge centrally to support the various parts as hereinafter described.

The feed means C comprises the funnel shaped hopper 16 ranging in the center of the invention and having the ore exit 17 therein, there being a suitable conduit 18 movably fitted in said exit 17 and also the suitable stuffing-box 19 ranging in connection with the conduit and the hopper, so that the non-rotatable bowl G may be raised and lowered by the means F provided therefor, while the finest of crushed ores are prevented from leaking without said hopper or conduit.

The conduit 18 ranges downwardly and has on its lower end, fastened as at 20 in the non-rotatable bell-shaped bowl G, the general contour of which conforms to the general outline of curvature of the working surfaces of the rotary means E as hereinafter more fully described.

The rotary means or bell-shaped-bowl E specifically comprises the main bowl portion 21, the top of which is preferably flush with the top of the bowl G and the bottom of which is provided with the suitable pedestal 22 fitting in the annular bearing 23, the latter in turn are suitably arranged in the frame part *b* and having the cover 24 for effectually excluding all dust or grit therefrom. The base 25 of the rotary means is provided with the chamber 26 from which the ribs 27 extend as shown in the drawings, the chamber 26 having the drain conduit 28 extending therefrom, in the end of which the plug 29 is turned, provision being thereby made for the ready removal of the mercury or the mercurial product employed in the invention as may be from time to time desired in the extensive use of the invention. The working surface 30 extends upwardly to the first groove 31 of the series of grooves or indentures J, the groove 31 being preferably rounded as at 32; there being the relatively angularly inclined surface 33 of the series K above such groove 31, then another groove 34 above such surface 33. The grooves 35, 36, 37 and 38 are arranged one above the other and above the groove 34 and the similarly constructed inclined deflecting surfaces 39, 40, 41 and 42 are provided intermediate said grooves; the uppermost groove 38 being relatively larger than the various other grooves and ranging thereabove is the projecting wall 43, to provide the annular conduit 44 the latter ranging in communication with the annular conduit or chamber 45 which latter in turn ranges adjacent the wall 46 of the non-rotatable bowl G.

The means F for raising and lowering the non-rotatable bowl G consists in the bracket or sleeve 47 extending integrally with or suitably fitted in the center of the frame part *b′* such sleeve being arranged on the conduit 18 and having the rotatable handle or the like 48 thereon which in turn is provided with the threaded portion 49 which engages in the threads 50 provided on the conduit to thereby raise or lower the conduit and thereby the bowl G, when the set-screw 51 in the sleeve 47 is loosened from engagement with said conduit and said handle 48 is turned; the set-screw 51 being provided to engage the conduit against rotation or loosening while the invention is in use and to thereby hold the bowl G in the desired operative position. The spider-brace 53 is supplied in the upper portion of the bowl G for bracing the latter from the conduit 18.

The combined covering and discharge means H comprises the launder 54 having the inwardly bent portion 55 in connection therewith and fitting about the rotary bowl

E under the lug 56 substantially as shown in the drawings; there being the rods or bolts 57 extending from the launder to the subframe *b*, thereby providing means for supporting the same in operative position with the discharge chute 58 extending from said launder as shown to thereby discharge the tailings without the machine.

The transmission means D comprises the pulley 59 on the shaft 60, there being an annular bearing 61 arranged in the bracket 62 in the center of the frame standard B′, the upper end of said shaft being freely projected as at 63 through the frame standard *b* and fastened as at 64 in the pedestal 22 of the rotatable bowl E and the lower end 65 rests on the beveled steel disks or the like 66 arranged in said bracket 62, to thereby provide suitable thrust bearings for the vertical or end thrust of the rotary working parts.

A brief statement of the operation and of the advantages of the invention is as follows:

A quantity of mercury is placed in the chamber 26 of the rotary bowl E and as the latter is rotated the mercury is distributed in the various grooves J, the arrangement being such that the centrifugal forces resultant from the desirable predetermined speed of the bowl are the means of gradually distributing the desired working quantity of the mercury in each of the grooves 31, 34, 35, 36 and 37 and a relatively smaller quantity of mercury in the groove 38; it being obvious that the groove 31 must fill with mercury before the mercury can or does reach the groove 34, the latter groove in turn filling and then the additional mercury is raised and held in the other grooves 35, 36 and 37, the quantity of mercury employed in the invention being such that as above mentioned the groove 38 contains a minimum quantity of the mercury as the bowl E is rotated at the proper speed, the velocity of rotation being sufficient to raise the mercury and when the mercury is so raised or distributed additional or increased velocity of the bowl E tends to compress the mercury in a mass of greater or lesser density predetermined by the character of the material or product to be, or that is handled or treated in the invention and the true specific gravities of the metal, metals or concentrates, or metals and concentrates to be separated. As the separation of the metals or concentrates is effected as hereinafter more fully described and the separated particles of the metals or concentrates are forced or carried in and through the mercury in the various grooves 31, 34, 35, 36 and 37, a particle of mercury corresponding in volume with each of the particles of such metals or concentrates that enters the mercury in each of the grooves J being displaced without one of the grooves and thereafter raised to the groove next above is finally forced into the uppermost groove 38. As the various grooves fill with metals or concentrates, the quantity of mercury in each of the grooves is decreased until the upper groove 38 is filled with mercury and metals or concentrates, at which time the machine is stopped and the amalgamated product or metals or concentrates are removed as at the plug 29 from the machine, after which another predetermined operative quantity of mercury is placed in the chamber 26 and the machine then rotated at the proper velocity in accordance with the product or material being amalgamated or separated and in accordance with the true specific gravities thereof.

The ores, dehydrated or otherwise, or sands or the like to be treated are placed in the hopper C, thereafter being conveyed through the conduit 18 to the chamber 26, and the rotating ribs 27 tend to scatter the material as the same is moved upwardly by the centripetal and the centrifugal forces of the rotating bowl E, the material then proceeding upwardly in the annular chamber 45 and the angles of deflecting or angularly inclined surfaces K are the means for centripetally deflecting the material toward the surface of the wall 46 of the non-rotatable bowl G. When said deflected material contacts with said wall 46, the curvature of which is proportioned in operative accordance with the arrangement and the location as well as the degree of inclination of the surfaces K, as it is rotated at a rate of speed in accordance with the true specific gravities of the particular metallic or other values it is desired to save, such material is thereby impinged against the wall 46 and thereafter centrifugally carried across the chamber 45 as it is also being raised upwardly in the bowl E and thereafter comes in contact with some one of the surfaces K thereabove; the material being buffeted from side to side of the chamber 45 as it gradually travels upwardly and the values to be saved are thereby forced within the dense mass of the mercury in one of the grooves J, and the portion of the material that it is not desired to save is carried upwardly through the annular chamber 44 to pass into the launder 54 and thereafter discharged without the machine through the medium of the discharge chute 58.

The invention in operation is possessed of the distinct advantage, in direct contradistinction to all of the mechanisms of this character now in use, facilitating the operative retention of a vertical wall of mercury of predetermined quantity and of a greater or lesser operative density as is from time to time desired in the more extensive application of the invention and wherein the usual

losses of the mercury by its normal tendency to break up or "flour" are prevented by the increased density of the vertical wall of the same and its operative retention in the wall of the rotatable-bowl.

I do not desire to be understood as limiting myself to the specific provision, formation, construction, combination, organization, and relative arrangement, as herein shown and described, but reserve the right to vary the same within the scope of the invention, and within the terms of the following claims, in the more extensive utilization of the invention.

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

1. A separator comprising a rotatable bowl provided with a plurality of inwardly extending superposed annular shelves having upper and lower horizontal surfaces the inner edges of which are connected by downwardly and inwardly inclined surfaces forming sharp edges with the lower surfaces of the shelves, said rotatable bowl having an inwardly extending wall at the top forming with the uppermost shelf a pocket for receiving amalgam or mercury, a means forming an ore chute, a bowl stationarily mounted on said means, and in spaced relation to said rotatable bowl, said stationary bowl having a substantially vertical wall forming with the inwardly extending wall of said rotatable bowl a passageway, and means to operate said rotatable bowl.

2. A separator and amalgamator comprising a rotatable bowl provided with a plurality of superposed inwardly extending shelves having upper and lower surfaces, the inner edges of which are connected by downwardly and inwardly inclined surfaces forming sharp edges with the lower surfaces of the shelves, said bowl formed at the top with an inwardly extending substantially vertical wall the bottom of which forms with the uppermost shelf a receptacle for amalgam or mercury, an ore feed supported centrally of and extending to near the bottom of said rotatable bowl, a bowl stationarily mounted on said feed and in spaced and adjustable relation to said rotatable bowl, said stationary bowl having at its upper end a substantially vertical wall parallel with and spaced from the inwardly extending wall of said rotatable bowl to form a passageway, and means to operate said rotatable bowl.

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

HARRY R. ZIMMER.

Witnesses:
J. H. HOLLINGS,
WM. FRANCIS SEEMANN.