

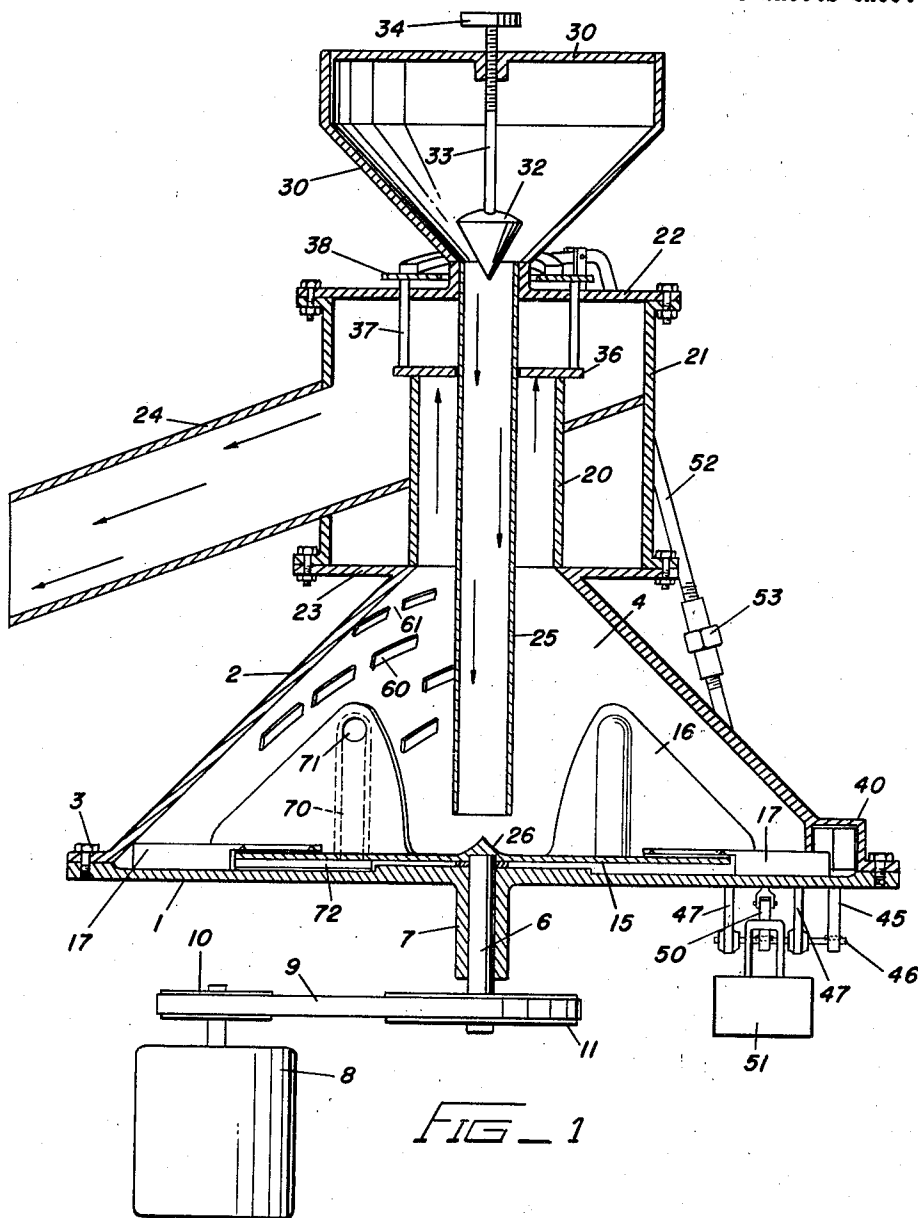
May 22, 1951

W. N. T. MORTON
ORE CONCENTRATOR

2,554,480

Filed Jan. 8, 1948

3 Sheets-Sheet 1



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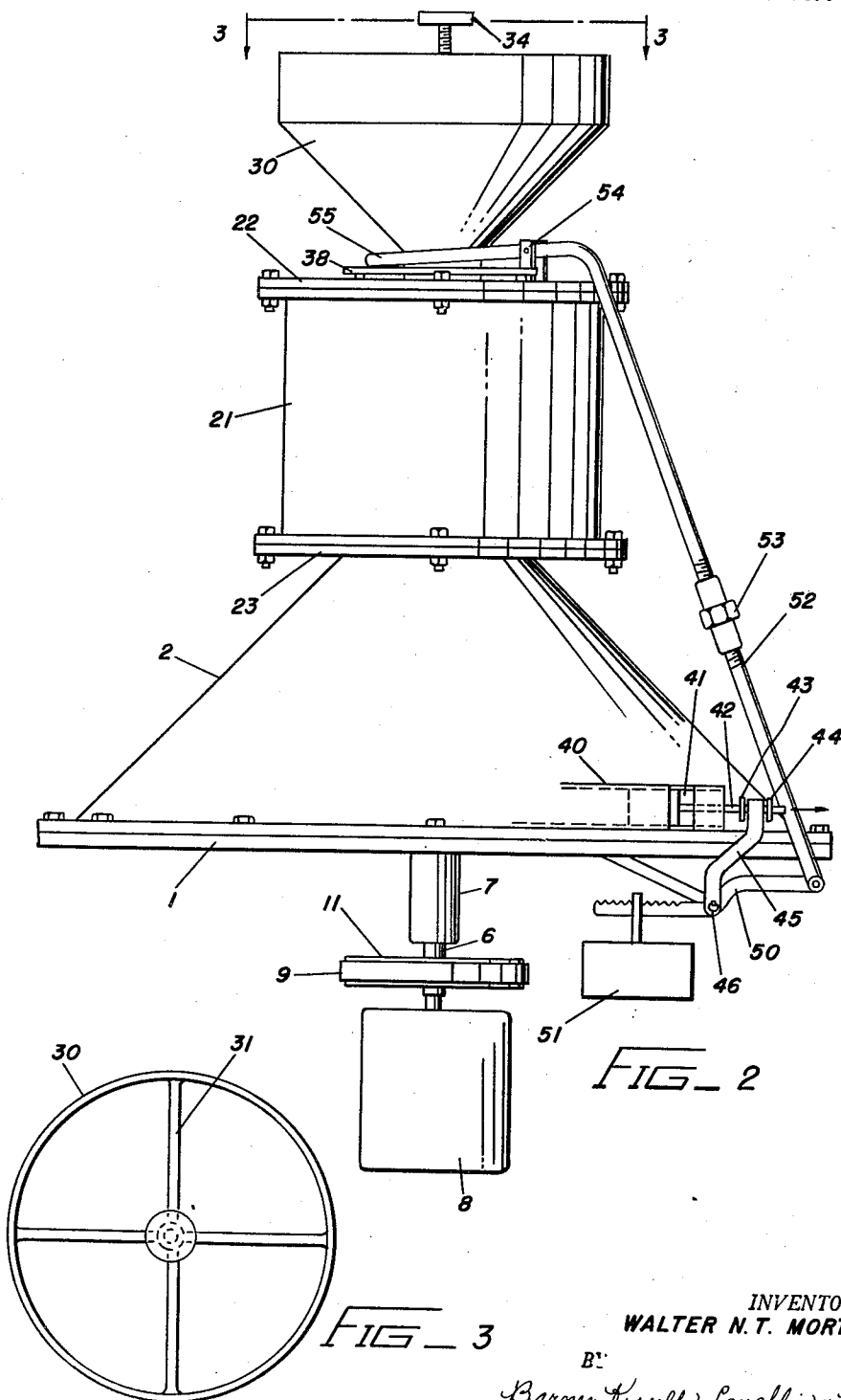


FIG. 2

FIG. 3

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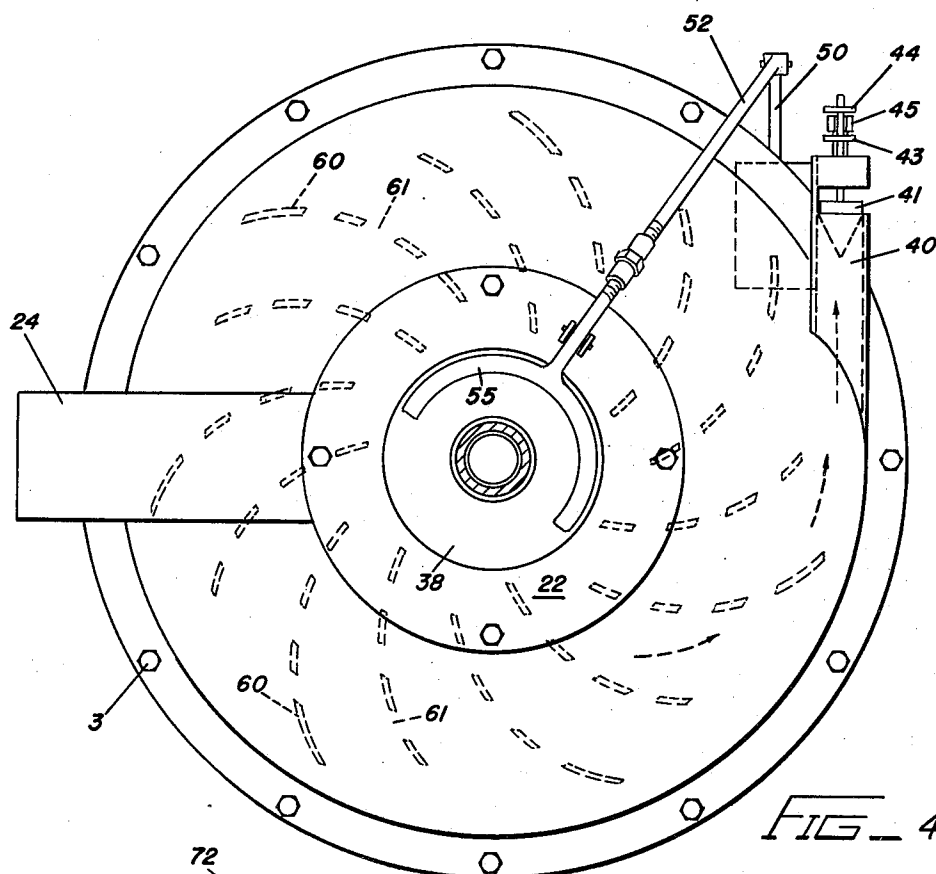


FIG. 4

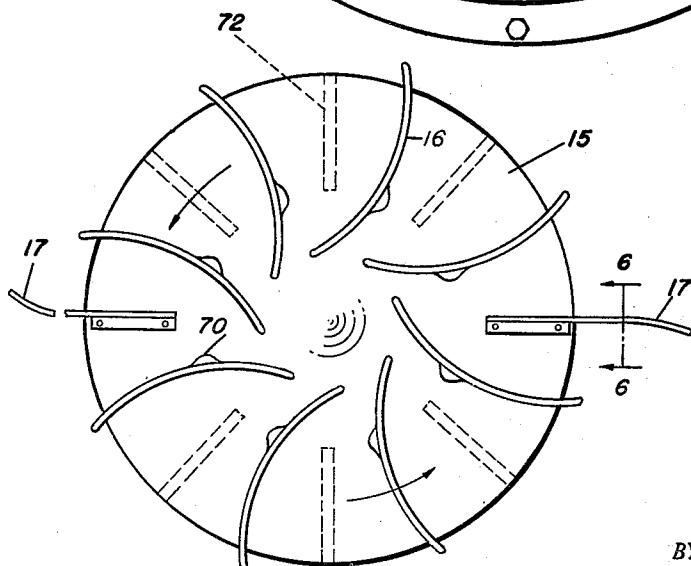


FIG. 5

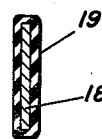


FIG. 6

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UNITED STATES PATENT OFFICE

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ORE CONCENTRATOR

Walter N. T. Morton, Windsor, Ontario, Canada

Application January 8, 1948, Serial No. 1,127

8 Claims. (Cl. 209—211)

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This invention relates to an ore concentrator and has to do particularly with a concentrator or separator of the centrifugal type wherein the rotating parts are reduced to a minimum thereby simplifying balancing problems and wherein the major portions of the separator are stationary and are of simple rugged construction.

An object of the invention is to provide an ore concentrator of improved efficiency and capable of adjustment for handling ores of different types and grades. For example, a concentrator constructed in accordance with this invention can very easily be set up and adjusted to handle rich or lean ores.

In accordance with the invention the concentrator has an exterior shell or body providing an interior chamber and within the container is a rotary impeller. The pulp, that is, ground or crushed ore in water is introduced into the chamber and subjected to the action of the impeller. The heavy concentrates and the gangue are separated largely by centrifugal force as the pulp is caused to flow or move in the chamber because of the action of the impeller. Due to the interior construction and formation of the chamber the heavy concentrates and the gangue are caused to flow into different portions of the chamber and discharge means is provided for both.

Other objects will become apparent as the following detailed description is followed in conjunction with the accompanying drawings which show one form of concentrator constructed in accordance with the invention.

Fig. 1 is a general cross sectional view showing a concentrator constructed in accordance with the invention.

Fig. 2 is a general view showing the concentrator in side elevation.

Fig. 3 is a view showing the top of the pulp vessel looking substantially on line 3—3 of Fig. 2.

Fig. 4 is a view in the nature of a plan view of the apparatus with the top funnel removed showing structure in dotted lines and illustrating by arrows the flow of concentrates.

Fig. 5 is a plan view of the impeller.

Fig. 6 is an enlarged cross sectional view showing a wiper blade and taken substantially on line 6—6 of Fig. 5.

The mechanism embodies a separating chamber provided with a bottom 1 and with walls extending upwardly therefrom which advantageously and preferably are of conical shape as illustrated at 2. The conical wall is preferably flanged at its lower edge so as to rest upon and be secured to the bottom by cap screws or bolts

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3. This provides a separating chamber 4. There is an impeller in the chamber carried by and operated by a shaft 6 suitably journaled as at 7 and which may be rotated by any suitable means, such as an electric motor 8 operating through a belt or the like 9 which, in turn, runs over pulleys 10 and 11. This impeller has a plate-like body 15 with blades 16 thereon and the impeller is arranged to rotate counter-clockwise as Fig. 5 is viewed. The impeller sits close to the bottom panel 1 and it may be provided with one or more wiper blades 17 extending therefrom which may project into the space adjacent the intersection of the side and bottom walls, as shown in Fig. 1. The wiper blades are preferably flexible comprised of a flexible piece of steel 18 and preferably provided with a rubber or plastic coating 19.

The top of the cone shaped chamber is provided with an extension 20 surrounding which is a chamber 21 closed at the top and bottom as at 22 and 23 and having an outlet or discharge pipe 24. Attached to the top closure 22 is an inlet tube 25 which extends downwardly through the extension 20 and terminates adjacent the center of the impeller. In this connection, the impeller preferably has a central conical extension 26. A suitable vessel, which may be of funnel shape, is illustrated at 30, the same communicating with the inlet pipe 25 and it may have a spider formation 31 for supporting a valve 32 having a screw threaded stem 33 threaded in the spider and a suitable controlling handle 34.

A valve in the form of a plate 36 cooperates with the upper end of the extension 20 and rods 37 secured to the valve plate slide through the cover plate 22 and their upper ends are engaged by a ring or plate 38.

The chamber 4 has an outlet for the concentrate, this outlet being preferably substantially tangentially located as shown at 40, and located in the lower portion of the chamber adjacent the intersection of the bottom wall 1 and the conical wall 2. A suitable valve 41 is associated with this outlet, the same being slidably mounted and having a rod 42 with an element thereon having an abutment 43 and an abutment 44. A shifter element 45 having a yoke portion between the two abutments is keyed to a rock shaft 46 held by brackets 47 so that oscillation of the shaft moves the valve member 41 into and out of position for closing an opening the outlet 40. This valve is preferably automatically acting by the condition of the gangue. A construction for so operating the valve resides in a lever 50 keyed

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to the shaft 46 and having an extending arm for receiving, in an adjustable position, a suitable weight 51. The other end of the lever is connected to a rod 52 preferably provided with a turnbuckle 53. This rod is pivotally mounted as at 54 and has a forked end 55 for resting on the plate 38.

The interior of the chamber is preferably provided with riffles or abutments on the interior surfaces of the conical wall 2. There are a series of these riffles or abutments as shown in Fig. 4, and each is disposed in an angular manner so that it extends along the inner surface of the member 2 substantially from the bottom to the top thereof. The abutments or riffles are preferably broken, there being alternate openings and abutment portions, the openings being illustrated at 61, and these openings are preferably offset from each other. That is to say, the opening in one riffle is in alignment with the abutment of the next adjacent riffle.

In the operation of the apparatus, the pulp which, aforesaid, is ground and screened ore carried in water is introduced into the funnel or vessel 30. The pulp flows downwardly through the inlet pipe 25 in a controlled manner as regulated by the valve 32. The pulp passes from the pipe 25 and engages the impeller. Due to the central protuberance 26 the pulp is more or less spread or divided so that it flows outwardly in all directions. The pulp thus discharged from the inlet pipe falls upon the plate body of the impeller and rotation is imparted thereto. The speed of rotation of the impeller is such as to cause the substance to flow outwardly by centrifugal force and the substance engages the walls of the conical chamber 4. Accordingly, a charge of substance in the chamber is whirled rapidly and as the substance moves over the inner surface of the chamber it engages the riffles. The lighter substances work upwardly under the centrifugal force while the heavy concentrates work downwardly. The heavy concentrates strike the abutments or riffles and more or less pile up or accumulate thereon, but the continuing forces are such that the substances piled up against the riffles are urged in a downward direction. This is because of the downward inclination of the riffles. Of course, as some of the substance accumulated on an abutment portion of the riffle reaches an opening 61 therein, that accumulation passes therethrough and onto the next riffle. Ultimately, however, the heavy concentrates are separated from the gangue and are accumulated in the outer regions of the chamber while the gangue, comprising the water and other lighter materials, is forced upwardly through the extension 20. The pressure of the gangue serves to elevate the valve plate 36 for the discharge of the gangue through the discharge pipe 24. The elevating of the valve plate 36 actuates the rod 52, and as will be appreciated by reference to Fig. 2, the valve 41 is shifted to the right, as Fig. 2 is viewed, thus opening the outlet 40 for the heavy concentrates.

Accordingly, a continuous operation may be had with the valve 32 being adjusted for the entrance of pulp with sufficient rapidity to satisfy the requirements of the machine in separating the heavy concentrates from the gangue. It will be noted that the escape of the gangue actuates the valve control for opening the discharge valve for the concentrates. With the arrangement as shown, if there is no discharge of gangue the valve for the concentrates is closed. The weight

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51 serves to close the valve against centrifugal force and the pressure of the concentrates thereon, and this can be adjusted as required. The valving arrangements can be adjusted for lean or rich ores. For example, in the case of a lean ore, in which there is more gangue, the turnbuckle 53 may be adjusted so as to require a greater movement of the valve plate 30 in order to open the concentrate valve 41.

The heavy concentrates more or less accumulate as above mentioned, in the lower outer regions of the chamber and, if desired, the outlet valve therefor can be opened at intervals. The wiper blades 17 serve to move the concentrates and to wipe the lower outer regions of the chamber relatively free thereof although the wiper blades may be dispensed with.

In order to prevent the accumulation of concentrates in the outer regions of the chamber so dry that the same will not readily flow some of the water introduced with the pulp may be caused to flow or pumped to the outer regions of the chamber. One way of accomplishing this is to form the blades 16 with hollow passages 70 which have forwardly facing openings 71 (Fig. 1). These passages extend downwardly through the body plate 15 of the impeller and into the space between the body 15 and the bottom panel 1. The impeller has suitable blades 72 on its under surface. In the operation of the impeller liquid is picked up by the opening 71 and pumped downwardly and outwardly by the blades 72 into the outer regions of the chamber. The solids of the gangue being heavier than water are thrown outwardly so that at the locations of the opening 71 the liquid is picked up with a minimum of solids of the gangue.

I claim:

1. An ore concentrator comprising, a stationary bottom wall, walls extending upwardly therefrom, said walls defining a separating chamber, an impeller in the chamber located adjacent the bottom wall, and disposed in a plane substantially parallel to the wall, means for operating the impeller, an inlet pipe for pulp passing into the chamber and arranged to discharge pulp to the impeller, the impeller having blades for engaging the pulp to impart rotary motion thereto and throw the pulp outwardly by centrifugal force, the inner surfaces of the upwardly extending walls having riffles thereon which are inclined so as to extend in an upwardly and downwardly direction for the collection of heavy concentrates thereon and for urging the concentrates into the lower outer regions of the chamber, an outlet pipe for gangue connecting into the upper regions of the chamber, outlet means in the lower outer portion of the chamber for heavy concentrates, a valve for the outlet pipe for the gangue operated to open position by the pressure of the gangue thereon, a valve for controlling the outlet means for the heavy concentrates and connections between said valves so that the operation of the outlet valve for the gangue operates the valve for the heavy concentrates.

2. An ore concentrator comprising, a stationary bottom member positioned substantially horizontally, side walls connected to the bottom member and extending upwardly in converging manner to form a separating chamber substantially of conical shape, an impeller in the chamber positioned adjacent the bottom member and substantially parallel thereto, an inlet pipe for pulp extending downwardly into the chamber and

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having its lower end arranged to discharge pulp to the center part of the impeller, said impeller having blades for imparting rotary motion to the pulp to throw the same outwardly by centrifugal force against the inclined walls, passage means for gangue surrounding the inlet pipe and extending upwardly from the top of the conical chamber, an outlet pipe for gangue, outlet means positioned substantially at the intersection of the bottom member and the upwardly extending walls, said outlet means being for heavy concentrates, a valve between the said passage means and the outlet pipe for the gangue arranged to be operated by the pressure of the gangue thereon, a valve for controlling the outlet means for the heavy concentrates and means interconnecting the valves whereby operation of the valve for the gangue operates the valve for the heavy concentrates.

3. An ore concentrator comprising, a stationary bottom member positioned substantially horizontally, side walls connected to the bottom member and extending upwardly in converging manner to form a separating chamber substantially of conical shape, an impeller in the chamber positioned adjacent the bottom member and substantially parallel thereto, an inlet pipe for pulp extending downwardly into the chamber and having its lower end arranged to discharge pulp to the center part of the impeller, said impeller having blades for imparting rotary motion to the pulp to throw the same outwardly by centrifugal force against the inclined walls, passage means for gangue surrounding the inlet pipe and extending upwardly from the top of the conical chamber, an outlet pipe for gangue, outlet means positioned substantially at the intersection of the bottom member and the upwardly extending walls, said outlet means being for heavy concentrates, and flexible wiper blades secured to the impeller for actuation in and for wiping the heavy concentrates in the zone adjacent the intersection of the bottom member and the upwardly extending walls.

4. An ore concentrator comprising, stationary bottom and upper walls forming a separating chamber, a rotary impeller in the chamber located adjacent the bottom wall, means operating the impeller, an inlet pipe for crushed ore carried in water passing into the chamber for discharging the crushed ore and water to the impeller, the impeller serving to engage the crushed ore and water to impart rotary motion thereto and throw the same outwardly by centrifugal force, an outlet pipe for gangue connecting into the upper region of the chamber, outlet means in the lower regions of the chamber for heavy concentrates, and means including passages in the impeller for recirculating some of the liquid into the outer regions of the chamber to wet the heavy concentrates.

5. An ore concentrator comprising, stationary bottom and upper walls forming a separating chamber, a rotary impeller in the chamber located adjacent the bottom wall, means operating the impeller, an inlet pipe for crushed ore carried in water passing into the chamber for discharging the crushed ore and water to the impeller, the impeller serving to engage the crushed ore and water to impart rotary motion thereto and throw the same outwardly by centrifugal force, an outlet pipe for gangue connecting into the upper region of the chamber, outlet means in the lower regions of the chamber for heavy concentrates, and including passages in the im-

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PELLER means for pumping some of the water from the inner regions of the chamber into the outer zone for wetting the heavy concentrates.

6. An ore concentrator comprising, a stationary bottom wall, walls extending upwardly therefrom, said walls defining a separating chamber, an impeller in the chamber located adjacent the bottom wall, and disposed in a plane substantially parallel to the wall, means for operating the impeller, an inlet pipe for pulp passing into the chamber and arranged to discharge pulp to the impeller, the impeller having blades for engaging the pulp to impart rotary motion thereto and throw the pulp outwardly by centrifugal force, whereby the gangue is forced upwardly in the chamber with the heavy concentrates collecting in the lower outer regions in the chamber, an outlet pipe for gangue connected into the upper regions of the chamber and outlet means in the lower outer region of the chamber for the heavy concentrates, the blades of the impeller having passages therein leading to the space between the impeller body and the bottom wall, and blades on the underside of the impeller for pumping water of the pulp into the outer regions of the chamber to wet the heavy concentrates.

7. An ore concentrator comprising, a chamber constituted by a substantially flat horizontally disposed bottom wall and a circular wall extending upwardly therefrom of conical form, an impeller in the chamber having a plate like body positioned adjacent the bottom wall and substantially parallel thereto, said impeller having blades on its upper surface, the outer portions of the impeller being spaced from the intersection of the bottom wall with the upper extending circular wall, a conduit extending downwardly into the chamber and substantially centrally thereof and into close proximity to the impeller for discharging pulp to the center part of the impeller, means for rotating the impeller whereby the same throws the pulp outwardly toward the space beyond the impeller, and for forcing the pulp upwardly along the inside surfaces of the conical wall, spaced riffles on the inner surface of the conical wall for engaging the pulp and tending to urge the heavy concentrates downwardly into the space adjacent the bottom wall and outwardly of the impeller, an outlet for gangue leading from the top of the chamber and surrounding the said conduit, and outlet means tangentially arranged and located substantially at the intersection of the bottom wall and said conical wall for the outlet of the concentrates from said space.

8. An ore concentrator comprising, a chamber constituted by a substantially flat horizontally disposed bottom wall and a circular wall extending upwardly therefrom of conical form, an impeller in the chamber having a plate like body positioned adjacent the bottom wall and substantially parallel thereto, said impeller having blades on its upper surface, the outer portions of the impeller being spaced from the intersection of the bottom wall with the upper extending circular wall, a conduit extending downwardly into the chamber and substantially centrally thereof and into close proximity to the impeller for discharging pulp to the center part of the impeller, means for rotating the impeller whereby the same throws the pulp outwardly toward the space beyond the impeller, and for forcing the pulp upwardly along the inside surfaces of the conical wall, spaced riffles on the inner surface of

the conical wall for engaging the pulp and tending to urge the heavy concentrates downwardly into the space adjacent the bottom wall and outwardly of the impeller, an outlet for gangue leading from the top of the chamber and surrounding the said conduit, outlet means tangentially arranged and located substantially at the intersection of the bottom wall and said conical wall for the outlet of the concentrates from said space, and interconnected valves for the outlet of the gangue and the outlet of the concentrates.

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