C. O. MICHAELSEN.

MINERAL CONCENTRATOR.

APPLICATION FILED MAR. 17, 1908.

917,337.

Patented Apr. 6, 1909.

4 SHEETS—SHEET 1.

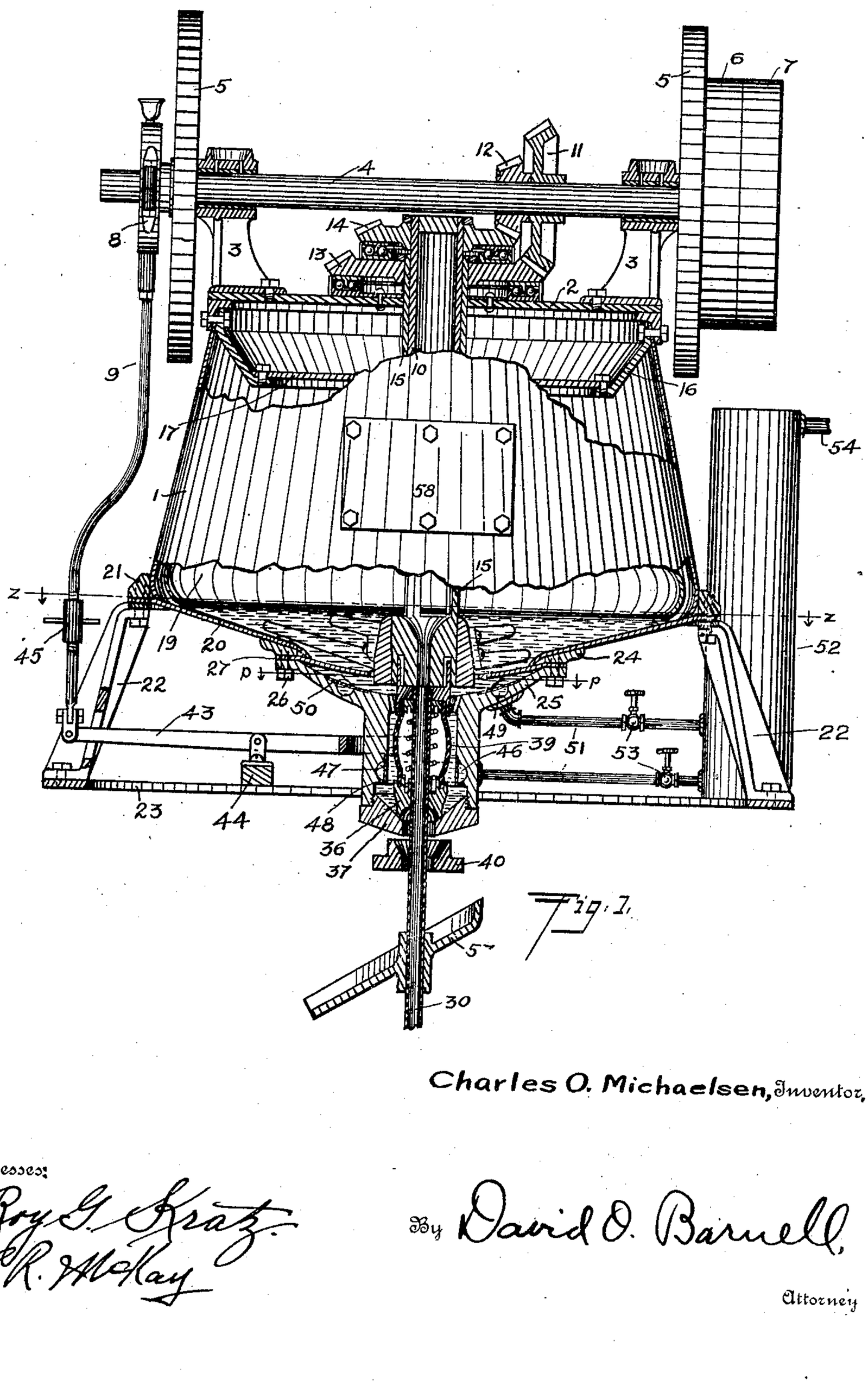

Fig. 1.

Witnesses:

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E. R. McKay

Charles O. Michaelsen, Inventor.

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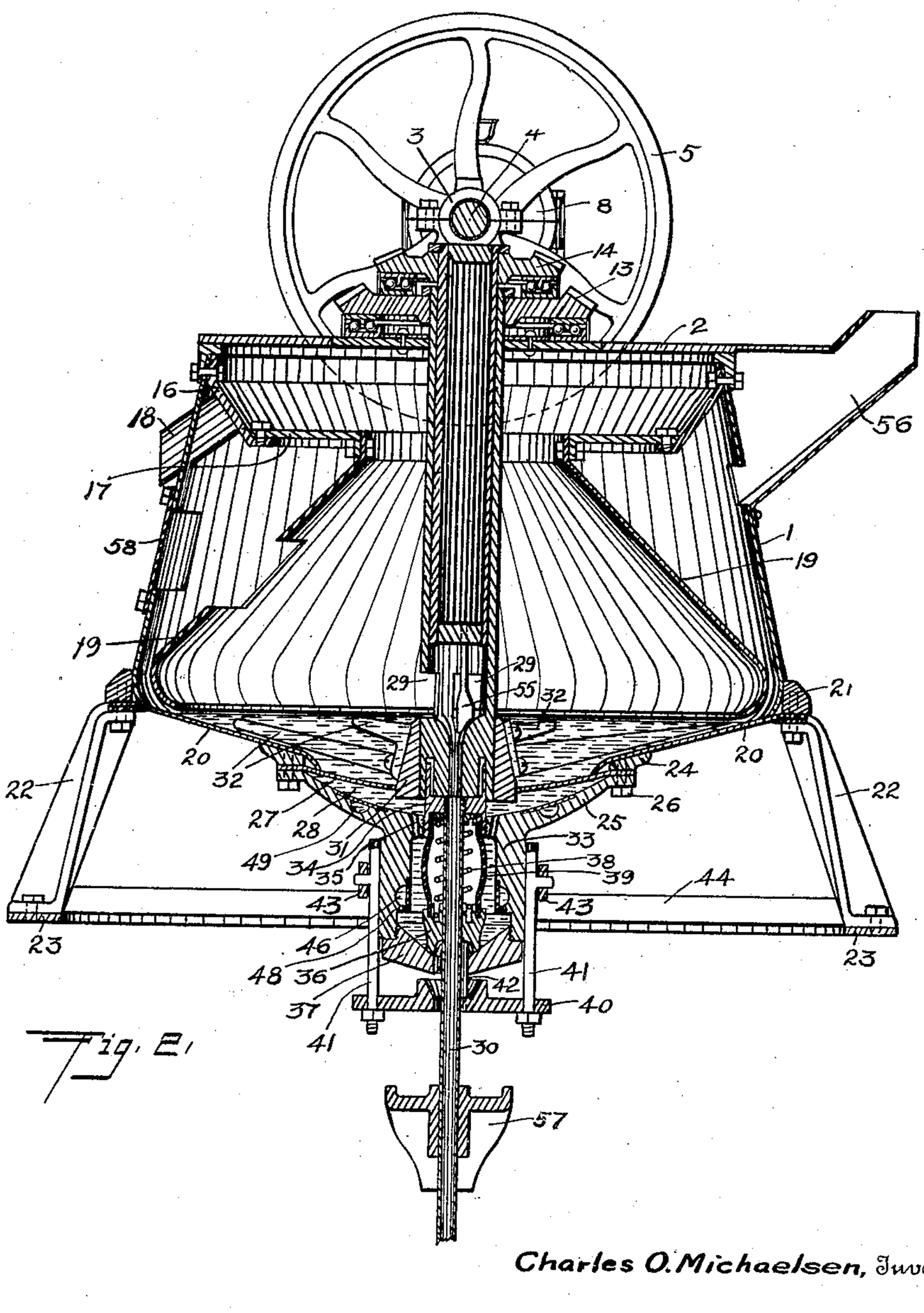

Fig. 2.

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4 SHEETS—SHEET 3.

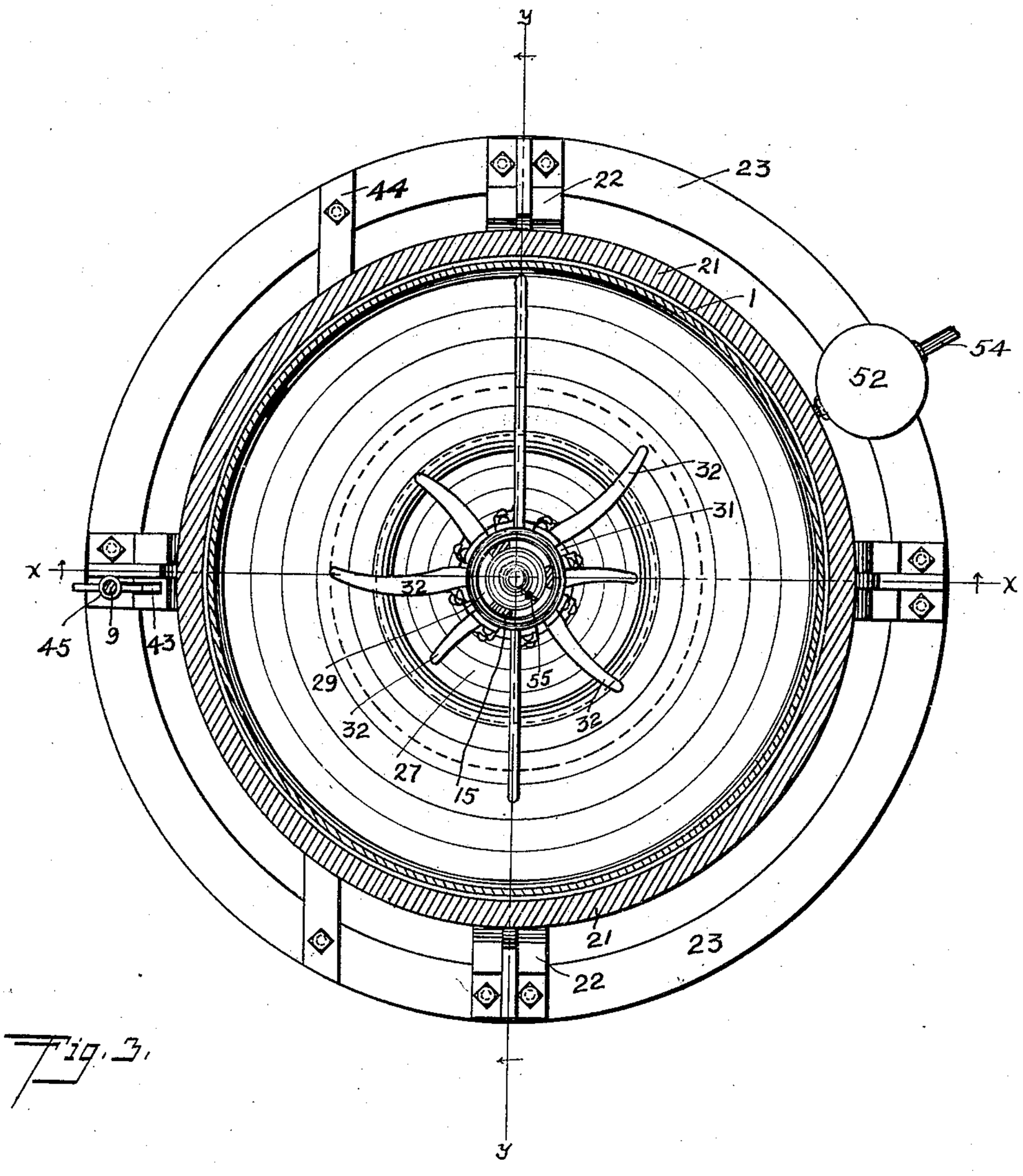

Fig. 3.

Witnesses:

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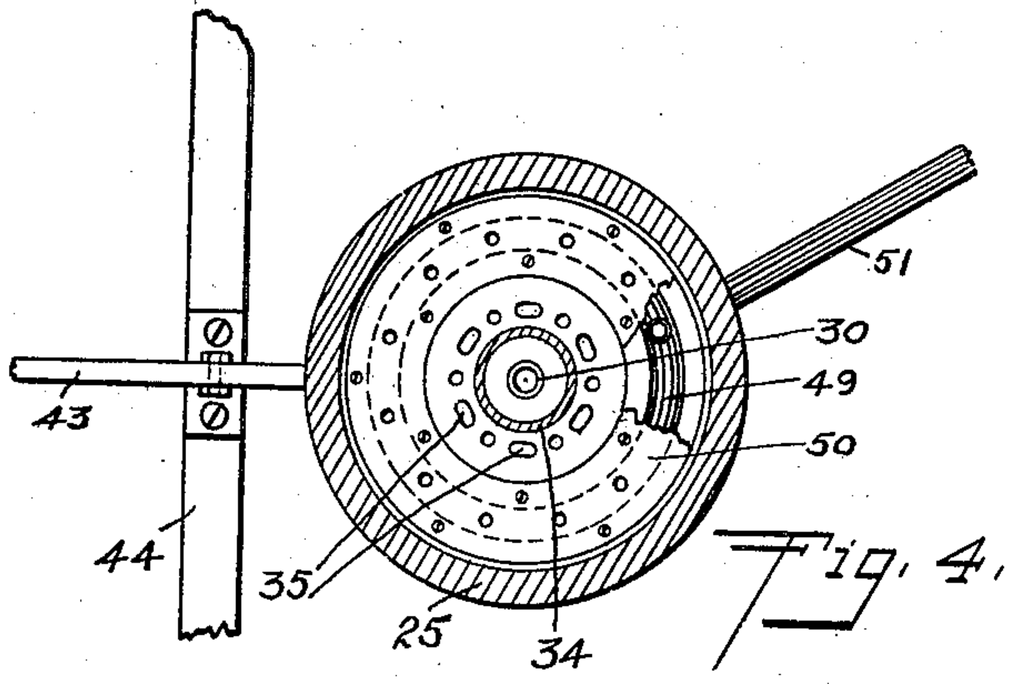

Fig. 4.

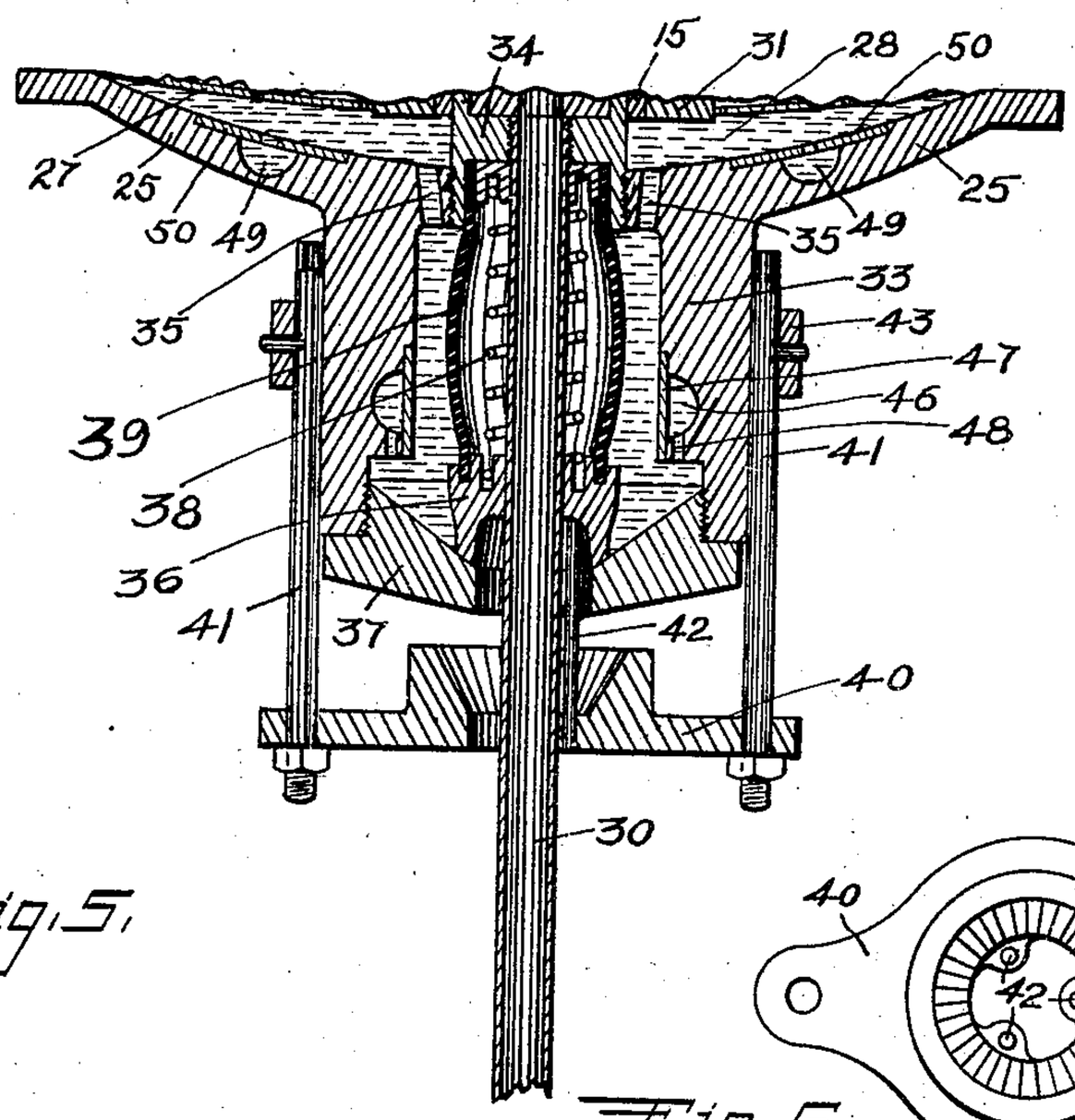

Fig. 5.

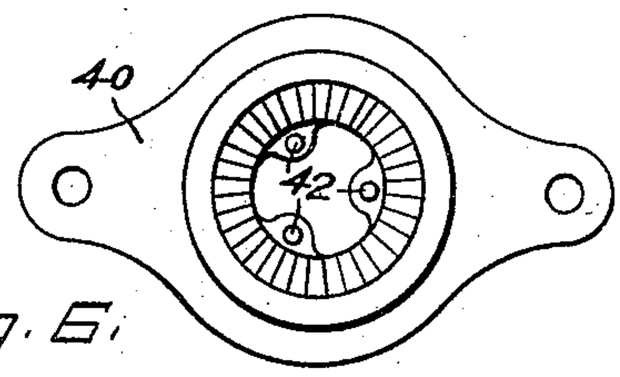

Fig. 6.

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UNITED STATES PATENT OFFICE.

CHARLES O. MICHAELSEN, OF OMAHA, NEBRASKA.

MINERAL-CONCENTRATOR.

No. 917,337. Specification of Letters Patent. Patented April 6, 1909.

Application filed March 17, 1908. Serial No. 421,712.

To all whom it may concern:

Be it known that I, CHARLES O. MICHAELSEN, a citizen of the United States, residing at Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Mineral-Concentrators, of which the following is a specification.

My invention relates to mineral concentrators or separators for treatment of crushed, pulverized or granular ores, and of the type shown in United States Letters Patent No. 880,808, issued to me March 3, 1908.

It is the object of my invention to provide in a machine of this class a simple and efficient valve for automatically discharging the concentrates, means for adjusting said discharging valve, means for preventing abrasion of contacting surfaces of the moving parts by portions of the ore working thereinto, to provide a means for preventing clogging of the gangue discharge opening, and to provide means for effecting an even and efficient distribution of water for flushing the discharge valve and for assisting in the separation of the gangue from the concentrates.

A machine embodying my invention is shown in the accompanying drawings in which—

Figure 1 is a side elevation, partly in section on the plane indicated by the line *x*—*x* of Fig. 3, Fig. 2 is a vertical section on the plane indicated by the line *y*—*y* of Fig. 3, Fig. 3 is a plan section on the plane indicated by the line *z*—*z* of Fig. 1, Fig. 4 is a section on the plane indicated by the line *p*—*p* of Fig. 1, Fig. 5 is an enlarged detail of the automatic discharge valve mechanism, and Fig. 6 is a detail plan view of the discharge-valve trip-plate.

In the construction shown I provide a casing 1 having the general form of a truncated cone. Said casing 1 is provided with a cover 2 on which are secured the bearings 3 in which is journaled the driving-shaft 4. On said shaft outside the bearings are secured the fly-wheels 5, and at one end, outside of the fly-wheel, are carried the tight and loose pulleys 6 and 7. At the opposite end of the shaft is an eccentric 8 which is adapted to impart a reciprocating motion to the rod 9. On the shaft 4 between the bearing-standards 3 are secured the bevel gears 11 and 12 which mesh, respectively, with the bevel gears 13 and 14. The gear 13 is supported by a ball-bearing on top of the casing cover 2 and is connected with a tubular shaft 15 extending downwardly into the casing. The gear 14 is supported by a ball-bearing arranged on top of the gear 13 and is connected with the tubular shaft 10 which extends down inside the shaft 15. The speed ratios between the gears 11 and 13, and the gears 12 and 14 is such that the shaft 10 is driven at a speed slower than that of the shaft 15.

Inside the casing 1, below the cover 2 is disposed a ring 16 which supports the partition-plate 17. At one side of the ring 16 is connected an overflow pipe 18, as shown in Fig. 2. In the partition-plate 17 is a large central opening, adjoining which the conical distributer 19 is secured to the plate and hangs therefrom. The said distributer extends from its support outwardly and downwardly to a point adjoining the lower edge of the casing 1 and then curves inwardly, terminating near the annular bottom-plate 20, as shown. The said bottom plate 20 is inclined toward the center thereof and the outer edge thereof is secured to a ring 21 held at the lower edge of the casing 1. Below the ring 21 are secured legs 22, the lower ends of which are, in turn, fastened to a larger ring 23 which forms the base of the machine. At the inner edge of the annular bottom-plate is a ring 24 to which the pan 25 is removably secured by screws 26. Between the pan and the said ring 24 are held the edges of a thin annular plate or diaphragm 27. Both the pan and the diaphragm are of concave form, the concavity of the pan being greater than that of the diaphragm so that a flat chamber 28 is formed between the same.

Near the lower end of the tubular shaft 15 a number of rectangular openings 29 are made through the wall thereof, the lower ends of said openings being about on a level with the lower edge of the distributer 19. Below said openings 29 is formed a funnel-shaped opening which extends downward to the bottom of the shaft and communicates with the discharge pipe 30. The lower end of the shaft 10 terminates just above the openings 29 and carries a blade or scraper 55 of which the lower part fits the contour of the funnel opening through the bottom of the shaft 15. As the shafts 10 and 15 are driven at different speeds said blade or scraper moves around the opening

keeping the same cleared and preventing any possibility of the same clogging. On the shaft 15 below the openings 29 is secured a block 31 on which are fastened a number of arms 32 which extend out over the diaphragm 27 and the bottom-plate 20. Some of the said arms are curved, as shown in Fig. 3, so that when the shaft 15 rotates said arms tend to direct materials engaged thereby outwardly from the shaft, while other of the arms are so curved as to direct materials in toward the shaft. The block 31 extends through the central opening of the diaphragm 27 into the chamber 28, and a narrow annular opening is left between the block and the diaphragm. From the central part of the pan 25 a hollow cylindrical shell 33 extends downwardly, said shell being integral with the pan. At the center of the pan a cup 34 is screwed therein and extends upwardly into a circular groove formed in the lower end of the shaft 15, as shown in Fig. 5. Into the bottom of said cup is screwed the pipe 30 which extends downwardly therefrom through the shell 33. Around the cup 34 a number of openings 35 are made in the bottom of the pan, connecting the chamber 28 with the chamber formed by the shell 33.

The discharge valve 36 surrounds the drain pipe 30, being vertically slidable thereon, and normally resting upon the inclined seat formed on the upper side of the ring 37 which is screwed in the lower end of the shell 33. A coil spring 38 holds the valve firmly in engagement with its seat, and said spring is inclosed and protected by a rubber tube or cylinder 39 of which the lower end fits in a groove in the upper side of the valve 36, and the upper end is held in the lower part of the cup 34. The rubber tube 39 is sufficiently elastic that when the valve is raised to open the same the movement may be accommodated by outward bulging of the walls of the tube.

The discharge valve is intermittently opened by the following means: A plate 40, of the form shown in Figs. 5 and 6, is supported below the ring 37 by the rods 41 which are vertically slidable in suitable guides formed on the outside of the shell 33. At the center of said plate 40 is formed a funnel-shaped opening, the mouth of which is larger than the opening through the ring 37, and into said opening in the plate 40 are extended three or more small lugs in which are held pins 42 adapted to extend up through the discharge opening to engage the valve and raise the same off of its seat. The rods 41 are connected with the forked end of the rocking-lever 43 which is pivoted on the cross-bar 44 carried by the base-ring 23. The outer end of the rocking-lever is connected with the eccentric-rod 9, and said rod is provided with a turn-buckle 45 by which the length thereof may be adjusted in order to change the relative position of the plate 40 and vary the height to which the discharge valve will be lifted thereby.

On the inside of the shell 33 just above the discharge-valve seat an annular groove 46 is made in the shell and the inner side of said groove is closed by a plate 47. From the said groove a number of holes 48 extend downwardly, opening just above the inclined valve-seat. In the bottom of the pan 25 is formed an annular groove 49 which is covered by a perforated plate 50. Water is supplied to the grooves 46 and 49 by pipes 51 which connect the same with a tank 52, the flow therefrom being regulated by valves 53. The tank 52 may be supplied from any suitable source through the pipe 54.

In the operation of the machine the driving-shaft 4 is actuated by means of a belt applied to the pulley 6. The ore to be treated is introduced through the chute 56 together with a sufficient quantity of water to cause the ore to move and flow freely, and water is admitted to the annular distributing grooves 46 and 49 through the pipes 51. The stream of ore and water from the chute 56 strikes the distributer 19 and in flowing down over the same a portion of the material moves around the same in a spiral path, so that on reaching the outer edge of the bottom-plate 20 the materials are spread with comparative uniformity around the entire periphery thereof. The materials moving inwardly over the bottom-plate 20 and the diaphragm 27 are gently agitated and are alternately drawn in toward the center and again thrown outwardly by the oppositely curved arms 32. The overflow of water constantly passes through the openings 29 and thence down through the discharge pipe 30. The water supplied to the chamber 28 through the distributing-groove 49, and a portion of that from the groove 46, passes up through the openings 35 and the annular opening between the diaphragm 27 and the block 31. The flow of water, together with the mechanical agitation, causes a separation of the heavier and lighter particles of the ore, the latter being decanted and flowing off through the discharge-pipe while the former continue to settle downward, passing first into the chamber 28 and thence down through the openings 35 to the inside of the shell 33 from which they are intermittently discharged by the opening of the valve 36, as described. The materials discharged from the valve 36 pass through the funnel-shaped opening in the plate 40 and are then caught and directed to any suitable receiving apparatus by the inclined pan 57 which is secured upon the discharge pipe 30 below the plate 40, as shown.

To enable observation of the interior of the machine, an opening is made in the cas-

ing 1 on the side opposite the chute 56, said opening being normally closed by a plate 58, as shown in Figs. 1 and 2. A similar opening is made in the distributer 19, adjacent to the opening in the casing 1, and, as the stream of materials coming from the chute 56 passes below said opening, the same need not be closed.

Now, having described my invention, what I claim and desire to secure by Letters Patent is:

1. In a machine of the class described, a casing, a chute leading thereinto, a fixed conical body suspended within the casing in such position that materials from the chute will strike one side of and flow around the same, a centrally-inclined bottom-plate disposed below said conical body, a drain-pipe disposed centrally to the casing, the opening to the drain-pipe being above the central part of the said bottom-plate, an intermittently actuated discharge-valve disposed around said drain-pipe, and arms rotatable within the casing adjacent to said inclined bottom-plate, some of said arms being arranged to direct materials toward the opening of the drain-pipe and other of the arms being arranged to direct materials away from the opening to the drain-pipe.

2. In a machine of the class described, the combination with a casing having a centrally inclined bottom, a chute connecting with said casing, distributing and agitating devices arranged within the casing, a drain-pipe arranged centrally to the casing, and means for supplying and distributing water within the lower part of the casing, of a shell disposed below the inclined bottom of the casing, the chamber formed therein communicating with the interior of the casing, an inclined valve seat arranged at the bottom of said shell, a valve surrounding the drain-pipe and vertically slidable thereon, a spring normally holding said valve upon the seat, a flexible tube inclosing said spring, and means for intermittently raising said valve from the seat.

3. In a machine of the class described, the combination with a casing having a centrally-depressed or pan-shaped bottom, of means for distributing a mixture of ore and water over the said bottom, a drain-pipe disposed centrally to the casing and arranged to permit an overflow therefrom when the water-level therein reaches a predetermined height, means forming two superposed chambers below the centrally-depressed bottom of the casing, said chambers communicating with each other and with the interior of the casing, an intermittently actuated discharge-valve arranged at the bottom of the lower chamber, and means for supplying water to each of said superposed chambers and distributing the same uniformly around said chambers.

4. In a machine of the class described, the combination with a casing, distributing devices, agitating devices, and a drain-pipe for carrying off waste materials, of means forming a chamber to receive the concentrates, an inclined valve-seat formed at the bottom of said chamber, a valve normally resting on said seat and closing the outlet to said chamber, a spring for holding said valve upon the seat, means for intermittently raising the valve from its seat, means for adjusting the height to which the valve will be raised, and means for supplying water to flush the valve-seat when the valve is raised.

In testimony whereof I have hereunto subscribed my name in the presence of two witnesses.

CHARLES O. MICHAELSEN.

Witnesses:

D. O. BARNELL,

ROY G. KRATZ.