C. O. MICHAELSEN.

MINERAL CONCENTRATOR.

APPLICATION FILED AUG. 9, 1910.

1,027,349.

Patented May 21, 1912.

4 SHEETS—SHEET 1.

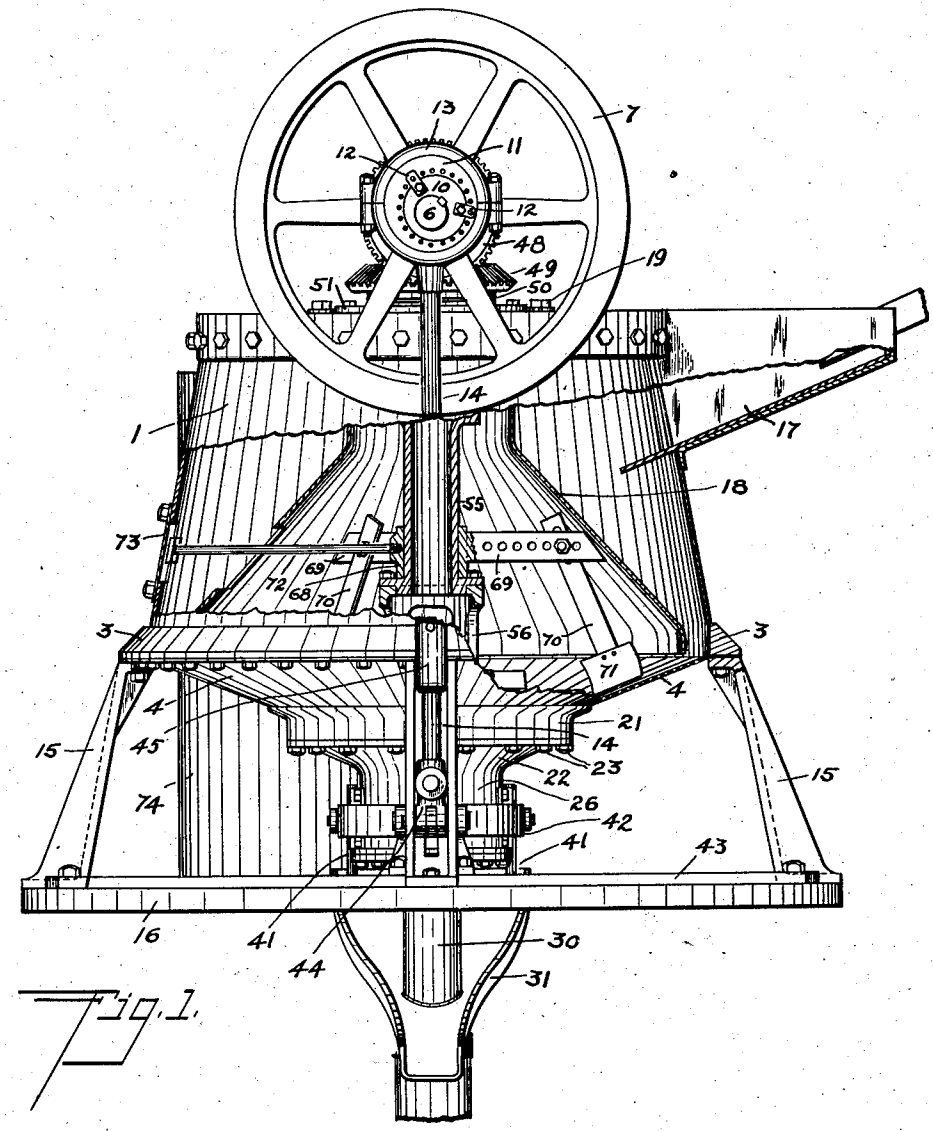

Fig. 1.

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Witnesses

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W. Haudschild

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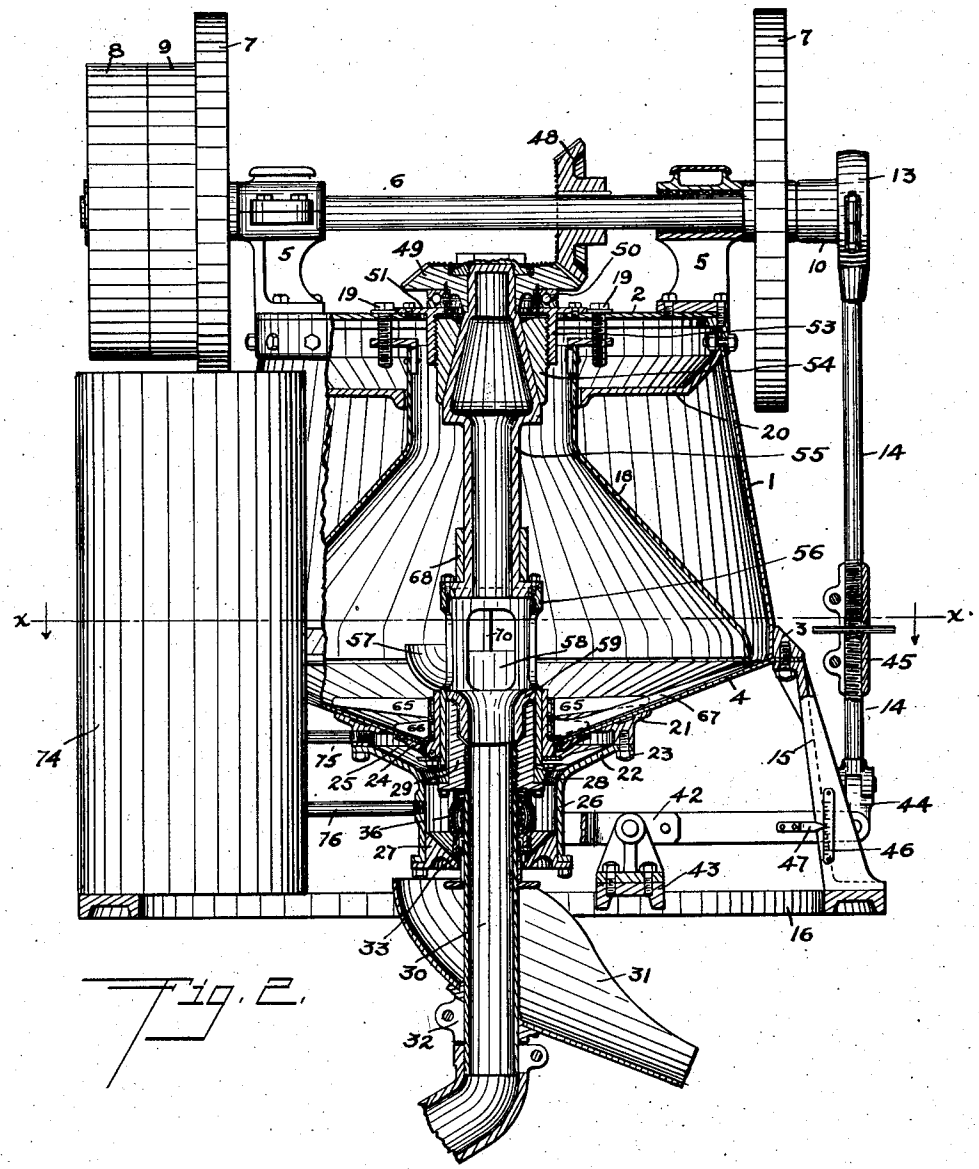

Fig. 2.

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4 SHEETS—SHEET 3.

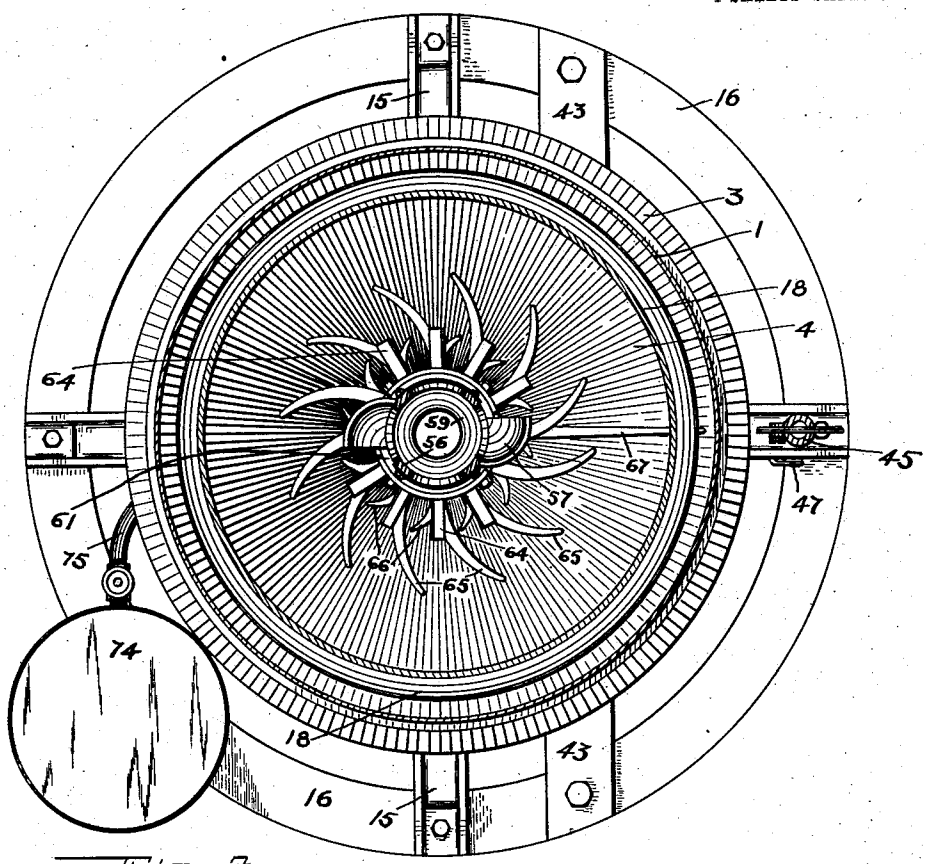

Fig. 3.

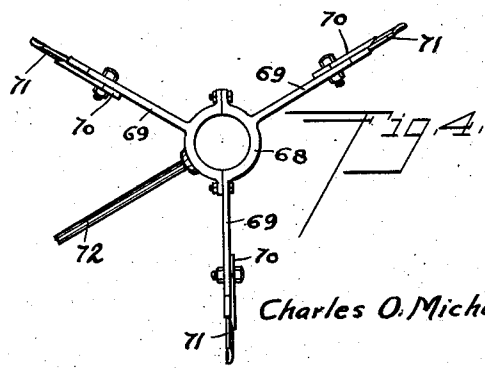

Fig. 4.

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C. O. MICHAELSEN.

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4 SHEETS—SHEET 4.

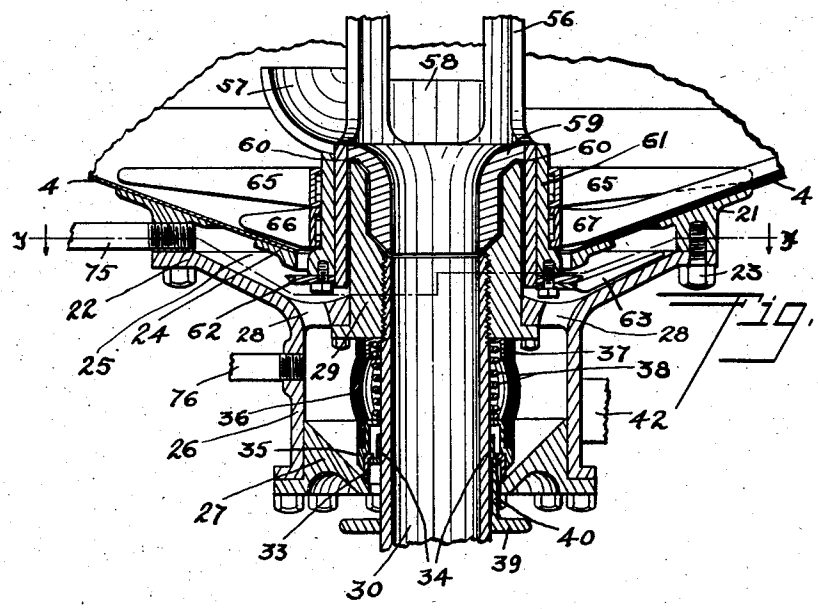

Fig. 5.

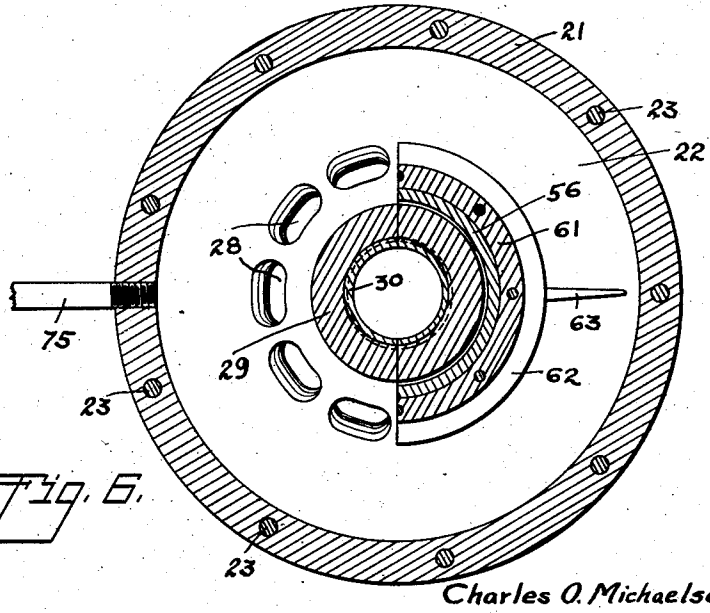

Fig. 6.

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UNITED STATES PATENT OFFICE.

CHARLES O. MICHAELSEN, OF OMAHA, NEBRASKA.

MINERAL-CONCENTRATOR.

1,027,349. Specification of Letters Patent. Patented May 21, 1912.

Application filed August 9, 1910. Serial No. 576,409.

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 of the class used in the treatment of crushed, pulverized and granular ores, in which the lighter portions of the ore are separated from the heavier portions by a washing and decanting operation.

It is the object of my invention to provide in a machine of this class certain specific improvements in the structural details thereof, as will be fully described and claimed hereinafter.

Constructions embodying my invention are illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation, partly broken away to show the inclosed parts in vertical transverse section, Fig. 2 is mainly a vertical sectional view taken through the axis of the main driving shaft, Fig. 3 is a horizontal sectional view taken on the plane of the line *x*—*x* of Fig. 2. Fig. 4 is a detail plan view of the frame which carries the check-paddles, Fig. 5 is a detail, drawn to a larger scale, of a portion of the mechanism shown in Fig. 2, and Fig. 6 is a horizontal sectional view taken on the plane of the line *y*—*y* of Fig. 5.

In carrying out my invention I provide a main casing comprising a shell 1 of frusto-conical form, at the upper end of which is secured a flat cover-plate 2, and at the lower end of which is a reinforcing ring 3 to which is secured the conical, or downwardly and inwardly inclined, bottom-plate 4. At the sides of the cover-plate 2 the bearing standards 5 are secured thereon, and in the upper portions thereof is journaled the main driving shaft 6. The said shaft, outside the bearings, carries fly-wheels 7, and adjoining one of said fly-wheels are arranged the tight and loose pulleys 8 and 9. On the shaft 6 adjoining the other fly-wheel is secured an eccentric body 10 around which is disposed a second eccentric body 11, the bore of which is eccentric to its periphery by an amount the same as that of the eccentric body 10 to the driving shaft. Adjoining the bore of the eccentric body 11 a series of holes are made in the side thereof, and said holes are adapted to receive pins carried on the outer ends of blocks 12 which are secured on the eccentric body 10, as shown in Fig. 1. By means of said blocks the two eccentric bodies 10 and 11 may be connected at various relations to each other so that the throw of the entire body inclosed by the eccentric-strap 13 may be varied from zero to a maximum of the sum of the eccentricity of the two bodies 10 and 11, or, as the eccentricity of said bodies is equal, to a maximum throw of twice that of either of the bodies alone. By means of the adjustable eccentric thus formed by the said bodies 10 and 11, the stroke of the eccentric-rod 14 may be varied through a considerable range.

The main casing is supported by suitable legs 15 which are connected to the reinforcing ring 3 and extend down to the base ring 16, as shown. At one side of the shell 1, near the upper end thereof, is arranged a feed-chute 17 of which the bottom-plate extends into the casing as shown so as to direct the materials from the chute onto the upper part of the distributer 18. The said distributer is made in the form of a hollow conical body of which the lower or outer edge adjoining the bottom-plate 4 is curved downwardly, and the upper end merges into a cylindrical portion which extends up adjacent to the cover-plate 2. On the said upper portion of the distributer body are outwardly extending lugs, and through said lugs are passed the adjusting screws 19 of which the upper ends extend through the cover-plate 2 so that the distributer is supported thereby. By means of said adjusting screws the distributer may be adjusted as to vertical position, and may also if desired be slightly tilted so that the opening between the lower edge thereof and the bottom-plate 4 may be made wider at one side than at the other. A partition-plate 20 is arranged in the upper part of the casing as shown, and serves to prevent any of the materials entering through the feed-chute from splashing into the opening at the top of the distributer.

Upon the portion of the bottom-plate 4 intermediate between its outer edge and center is secured the flanged ring 21 to which the pan 22 is removably connected by means of the screws 23. In the central part of the bottom-plate is a circular opening, and around said opening below the plate is se-

cured a reinforcing-ring 24. A shallow annular chamber 25 is formed between the said central portion of the bottom-plate and the pan 22. Integral with the pan 22 and extending downwardly therefrom is a cylindrical shell 26, and within the lower end of said shell is secured the valve-seat ring 27. A number of openings 28 are made in the bottom of the pan 22 to connect the chamber 25 and the valve-chamber formed within the shell 26. In the center of the pan 22 is an opening through which is passed the bushing 29 of which the lower end is outwardly flanged and secured to the bottom of the pan within the valve-chamber. Into the bore of said bushing 29 is screwed the drain pipe 30 which extends downwardly through the valve chamber, serving as a guide for the discharge-valve and as a support for the discharge-chute 31 which is carried thereon above the clamp-ring 32. The discharge-valve 33 is in the form of a ring having a conical end-face resting normally on the seat-ring 27. A guide-ring 34, disposed inside the valve-ring, fits slidably upon the pipe 30, and a second guide-ring 35, shouldered to fit over the upper end of the valve-ring, has a portion turned inwardly to engage the pipe 30 and an outer portion over which is fitted the lower end of the spring-casing sleeve 36. The said sleeve 36 is made of flexible resilient material and the upper end thereof fits around a ring 37 which rests against the lower end of the bushing 29. The coil spring 38 which normally holds the discharge-valve upon its seat is arranged around the pipe 30 between the rings 35 and 37. The discharge-valve is intermittently lifted from its seat by the following means: Around the pipe 30 below the valve is disposed a plate 39 upon the upper side of which are fingers 40 which extend up through the valve-seat ring and engage the ring 34, as shown in Fig. 5. The said plate 39 has laterally extending portions which are connected with the rods 41 which are vertically slidable in suitable guides arranged upon the sides of the shell 26. A forked lever 42 is fulcrumed on a cross-bar 43 arranged upon the base-ring 16, and the forked end of the lever is connected with the vertically slidable rods 41 which support the plate 39. The outer end of the lever 42 passes through a slot in one of the legs 15 and is connected by means of a link 44 with the lower end of the eccentric-rod 14. The said rod 14 is provided in its central part with a turn-buckle 45 by which its length may be adjusted, and the turn-buckle is slotted at one side and provided with clamping-screws, as indicated in Fig. 2, for securing it in adjusted positions. For convenience in adjusting the valve movements a scale 46 is arranged upon the leg 15 through which the lever passes, and a pointer 47 secured on the side of the lever extends to a point adjoining the scale, so that movement of the lever is indicated by said pointer.

Upon the central part of the driving-shaft 6 is mounted a bevel gear 48 which meshes with a similar gear 49 arranged to revolve on a vertical axis concentric with the main casing. The said gear 49 is supported upon a ball bearing 50 which is, in turn, arranged upon a plate 51 removably secured upon the central part of the cover-plate 2. The plate 51 has on the lower side thereof a tubular internally threaded sleeve 53 which extends down through the cover-plate, and into which is screwed the bearing-block 54. Said block 54 has a conical bore which fits around a similarly formed portion of the hollow vertical driving-shaft 55 of which the upper end is connected with the gear 49. The lower portion of the shaft 55 is outwardly flanged and has secured thereon the tubular body 56 which forms, in effect, a continuation of the shaft and which extends down over the bushing 29 to a point adjoining the bottom of the pan 22, as shown clearly in Fig. 5. In the sides of the upper part of the body 56 are formed a number of ports, and adjoining one or more of said ports are arranged the skimming-cups 57. Plates 58 are disposed over the lower portions of some of the ports, and said plates may be removed if it is desired to increase the port area. Below the ports and inside of the body 56 is secured the funnel-ring 59 which extends down inside the bushing 29, as shown. At the upper end of the said bushing between the same and the funnel-ring is arranged a packing ring 60 which serves to prevent leakage through the clearance space between the bushing and the revoluble parts carried by the vertical driving shaft. Upon the outside of the body 56 below the ports therein is secured a sleeve 61 which extends down through the central opening in the bottom plate past the reinforcing-ring 24 and into the chamber 25 so that a narrow annular opening is formed between said sleeve and the ring 24. Upon the lower end of the sleeve 61 is secured the flange-ring 62 which extends outward below the lip of the ring 24, as shown in Fig. 5. At one side of the flange-ring is connected the radially extending agitating finger 63 which is inclined slightly upward so as to move around within the chamber 25 adjoining the bottom of the pan 22. At the upper end of the sleeve 61 between the skimming-cups 57 are the radially extending blades 64 which are inclined so as to direct upwardly the materials engaged thereby. Below the skimming-cups is arranged a series of curved arms 65 of which the direction of curvature is such that the arms will direct inwardly the materials engaged

thereby. Below the said arms 65 is arranged a series of shorter curved arms 66 which move adjacent to the bottom-plate 4 and of which the direction of curvature is such as to direct outwardly the materials engaged thereby. In the latter series of arms, one or more of the same is displaced by a longer arm 67 which is inclined upwardly so as to sweep over the surface of the bottom-plate 4, and of which the outer end extends through the space between the bottom-plate and the lower edge of the distributer 18. A split collar 68 is fitted loosely around the vertical driving shaft 55 just above the outwardly flanged lower end thereof, so as to be supported thereon. On said collar are a number of radially extending arms 69, each of which has a number of holes made therein, as shown, to adapt it for adjustable connection with one of the bars 70 which carry the check-paddles 71. The bars 70 and arms 69 are connected by bolts, as shown, and it will be obvious that the paddles may be set to various positions by adjusting the said bolted connection. The collar 68 is held stationary by means of the rod 72 which extends therefrom through an opening made in the side of the distributer opposite the feed-chute and is connected with the main casing adjoining an opening in the side thereof similar to the opening in the side of the distributer. A removable plate 73 is disposed over the said opening in the side of the main casing. A water supply tank 74 is arranged upon the base-ring near the main casing, as shown, and from said tank pipes 75 and 76 extend respectively to the chamber 25 and the valve-chamber. Suitable valves may be arranged to control the flow of water through said pipes to the chambers.

In the operation of the machine, power is applied to drive the main shaft 6 at a suitable speed, and the material upon which it is desired to operate is supplied at the feed chute 17 together with a sufficient quantity of water to cause the same to move and flow freely. Water is also supplied to the valve chamber through the pipe 76 and to the chamber 25 through the pipe 75, and the quantity of water supplied through said pipes may be made to vary the action of the machine as will be hereinafter noted. The water and crushed material which enter at the fed chute impinge upon the distributer 18 near the upper end of the conical portion thereof and thence flow down over the conical surface in spiral streams, so that upon reaching the lower edge of the distributer the material is spread with comparative uniformity around the outer edge of the bottom-plate 4. By a suitable adjustment of the height of the distributer above the bottom-plate, the effectiveness of the distribution may be increased. As the materials pass inwardly over the bottom-plate they are further distributed by the spreading-arm 67 which sweeps the bottom-plate as before described and which also serves to prevent any clogging of the material at the narrow opening below the edge of the conical distributer. The normal water level maintained within the casing is slightly above the lower edge of the ports in the body 56, and the lighter non-metalliferous materials, or gangue, in passing inward over the bottom-plate are sufficiently agitated and stirred up by the arms 65 and 66 and the inclined blades 64 as to remain suspended in the water so as to be caught by the skimming-cups and directed through the ports in the body 56, from whence said materials are washed down through the funnel ring to the drain pipe 30 by which they are directed to any desired location. The check-paddles 71 are so arranged as to break up or materially reduce the tendency of the agitating arms to set up a whirling motion of the materials around the center of the casing. The heavier materials, remaining close to the bottom-plate, pass inwardly over the same and descend through the annular opening between the inner edge of the plate and the sleeve 61 into the chamber 25. From said chamber the materials descend through the openings 28 into the valve chamber within the shell 26 from which they are intermittently released and discharged into the chute 31 by the opening of the valve. The extent and relative time of opening of the valve is varied to meet the operating conditions, by suitable adjustments of the driving eccentric formed by the bodies 10 and 11, to vary the travel of the eccentric-rod, and also by adjustments of the length of the eccentric-rod by means of the turn-buckle 45. The making of adjustments of the valve is facilitated by reading the indications on the scale 46 of the pointer 47 carried by the valve-lever 42. By varying the supply of water through the pipes 75 and 76 it is possible to establish what may be termed "neutral zones" either at the openings 28, or at the annular opening between the ring 24 and sleeve 61. For example, if the quantity of water supplied through both of the pipes 75 and 76 is greater than is lost through the discharge-valve, then there will be an upward current passing through the annular opening into the main chamber from the chamber 25. If the quantity of water supplied through both pipes is less than that lost through the discharge-valve, then there will be a downward current through both the annular opening and the openings 28. If the quantity of water supplied through both pipes is substantially equal to the amount lost through the discharge-valve, then there will be established at the annular opening a neutral

zone, or a space through which there is no appreciable current of water, while there will be a downward current through the openings 28 of the water supplied by the pipe 75. If the water supplied by the pipe 76 is alone sufficient to compensate for that lost through the discharge valve then there will be a neutral zone established at the openings 28 and an upward current through the annular opening of the water supplied from the pipe 75. All of these various attainable actions may be taken advantage of in the treatment of materials of varying characteristics, and their advantageous utilization is dependent upon the skill and experience of the operator of the machine.

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 having a centrally inclined bottom, a drain pipe arranged centrally thereto, a vertical driving shaft, a feed chute, means for distributing materials from the feed chute around the outer edge of the inclined bottom, means carried by the vertical driving shaft for agitating the materials adjoining the inclined bottom, check-paddles arranged to retard whirling motion of the materials,, a frame supported on the driving shaft and carrying said paddles, and means for holding said frame stationary.

2. In a machine of the class described, a casing having a centrally inclined bottom, a drain pipe arranged at the central part thereof, a vertical driving shaft, a feed chute, means for distributing materials from the feed chute around the outer edge of the inclined bottom, means carried by the vertical driving shaft for agitating the materials adjacent to the inclined bottom, a frame supported by the driving shaft, means for holding said frame stationary, arms adjustably connected with said frame, and paddles carried by said arms and adapted to retard whirling movements of the materials caused by the agitating means.

3. In a machine of the class described, a casing having a centrally inclined bottom, a drain pipe arranged at the central part thereof, a vertical driving shaft, means for feeding materials into the casing, means for distributing said materials around the outer edge of the inclined bottom, agitating devices carried by the vertical driving shaft and arranged to move adjacent to the inclined bottom, stationary adjustably supported check-paddles arranged to retard whirling motion of the materials, and skimming-cups carried by the vertical driving shaft adjoining and extending above the opening to the drain pipe so as to positively direct material toward said opening.

4. In a machine of the class described, a casing having a centrally inclined bottom, means for feeding materials into the upper part of the casing, a conical distributer onto which said materials impinge and which is adapted to spread the materials around the outer portion of the inclined bottom, means for varying the relation of said distributer and the bottom of the casing, a vertical tubular driving shaft, a drain pipe axially alined therewith, the driving shaft having ports therein above the level of the inclined bottom to form a passage from the main chamber to the drain pipe, agitating arms carried by the said driving shaft and moving adjacent to the inclined bottom, skimming-cups carried by the driving shaft and adapted to direct a portion of the materials into the ports, stationary adjustably supported check-paddles arranged to retard whirling motion of the materials, means forming a receiving chamber below the inclined bottom and communicating with the main chamber by means of an opening through the bottom plate thereof, a discharge valve controlling an outlet to said chamber, and adjustable means for intermittently opening the valve.

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

CHARLES O. MICHAELSEN.

Witnesses:

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ROY G. KRATZ.