(No Model.) 2 Sheets—Sheet 1.

C. E. SEYMOUR.

ORE CONCENTRATOR.

No. 513,832. Patented Jan. 30, 1894.

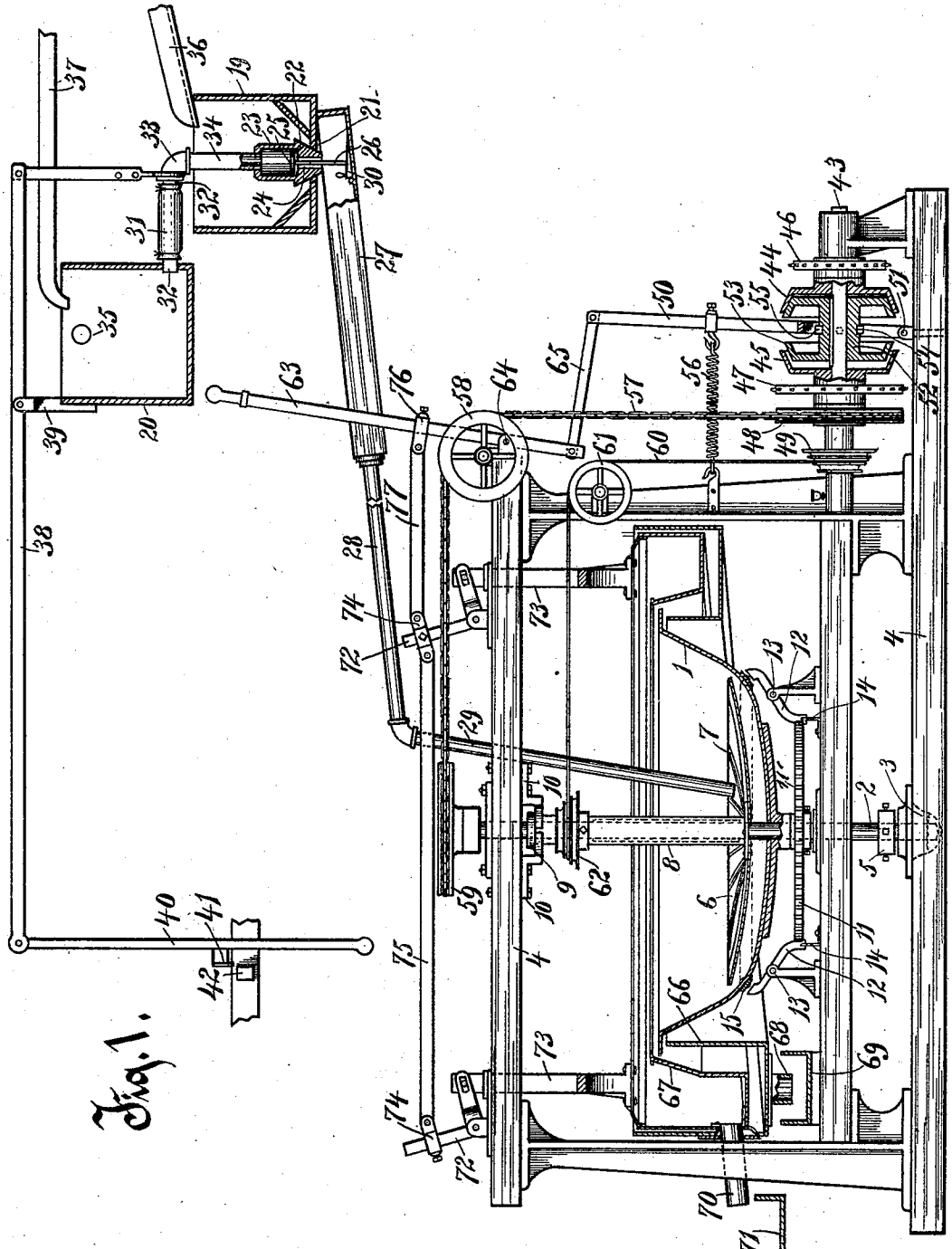

Fig. 1.

Witnesses.
O. N. Keeney.
Anna C. Faust.

Inventor.
Charles E. Seymour,
By Benedict & Morsell.
Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

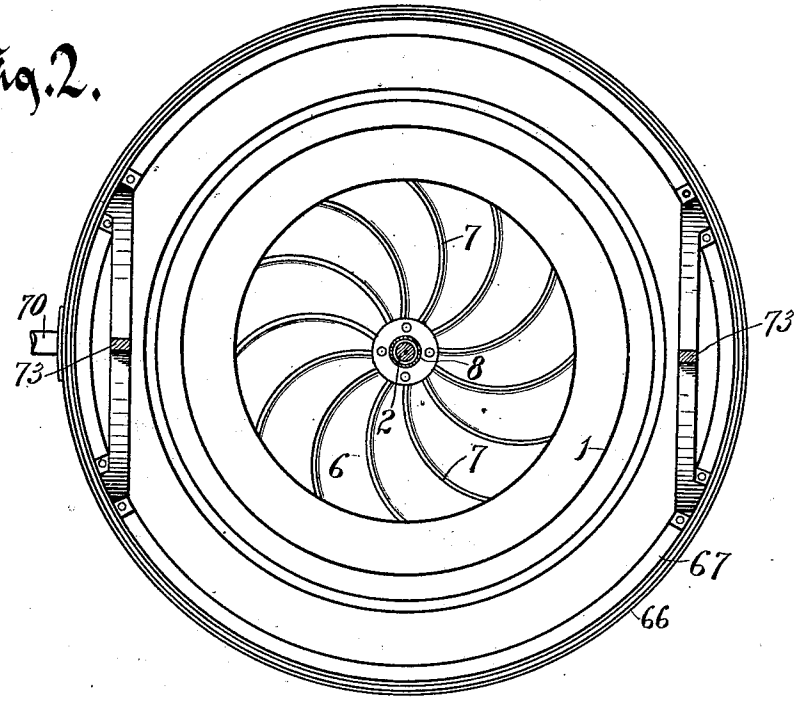
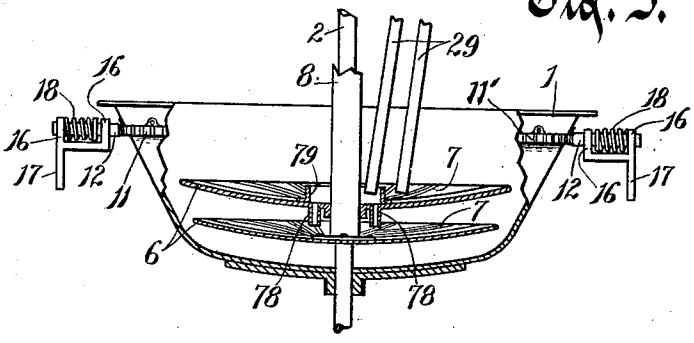


Fig. 3.



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A. V. Keeney,

Anna V. Faust.

Inventor.

Charles E. Seymour,

By

Benedict and Morsell

Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES E. SEYMOUR, OF LAKE GENEVA, WISCONSIN.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 513,832, dated January 30, 1894.

Application filed January 16, 1893. Serial No. 458,439. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SEYMOUR, of Lake Geneva, in the county of Walworth and State of Wisconsin, have invented a new and useful Improvement in Ore-Concentrators, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention has relation more particularly to improvements in ore concentrators or separators wherein the particles of greater specific gravity are separated from those of less specific gravity by the aid of centrifugal force, and the invention consists in the improved construction and combination of parts as hereinafter more fully set forth.

In the accompanying drawings, Figure 1, is a side elevation of the invention, certain parts being in section to more clearly illustrate the construction. Fig. 2, is a plan view of the concentrator pan or bowl, the disk, and the trough surrounding the pan, and, Fig. 3, is a partly sectional view of a pan or bowl involving certain modifications.

Like numerals of reference denote like parts throughout the several views.

Referring to the drawings, the numeral 1 indicates a concentrator pan or bowl, which is, preferably, slightly flattened at the bottom. This pan is supported on a shaft 2, which is stepped in a bearing, 3, and also has bearings in the cross beams 4, 4, of the frame. Above the step bearing 3, the shaft carries adjustably a collar 5, which relieves the step bearing and assists in supporting the shaft and its bowl.

The numeral 6 indicates a concave disk raised above the bottom of the pan, said disk provided with ribs 7, curved away from the line of motion as shown in Fig. 2, which ribs assist in the delivery of the material on to the wall of the pan with greater force and with more rapidity.

A tubular shaft 8 surrounds shaft 2, and has its lower flanged end secured to the disk 6. The upper end of the tubular shaft is provided with a collar 9, fitted upon and supported revolubly by the supporting plates 10, 10, secured to the upper cross beam 4. This shaft bears directly against shaft 2 only at two points, while for a greater portion of its length a space is left between the same and the shaft 2 so as to create as little friction as possible.

Fixed on shaft 2, and revoluble therewith, is a wheel 11 provided on its periphery with a series of projections 11′. Adapted to bear against this wheel at different points of its circumference are medially pivoted hammers 12, fulcrumed or pivoted at 13. The lower ends of these hammers bear against the cam wheel and are held normally in such position by springs 14, 14, while the upper striking ends or heads thereof are adapted to be brought into contact with an annulus or ring 15, secured to the pan or bowl, for preventing wear directly on said pan or bowl. As the shaft and cam wheel 11, revolve, the lower end of each hammer is successively acted upon by the cams on the wheel, throwing the upper striking end of said hammer in forcible contact with the annulus or ring, against the action of the spring 14, thus causing a continuous tremulous or vibrating movement of the pan and its contents. While in the drawings I have only shown two of these hammers, it is obvious that this number may be increased, as they must or should be adjusted to the susceptibility of vibration of the receptacle, and also to the centrifugal force developed by the revolution of the pan.

In Fig. 3, is shown a modified structure for imparting the tremulous or vibrating motion to the pan, and it is obvious that this knocking or bumping action can be accomplished in a variety of ways. In the modification I have shown the cam wheel 11, fixed directly to the pan or bowl. The hammers 12 acting against this wheel pass through eyed arms, 16, 16, forming part of a vertical arm 17. A coiled compression spring 18 encircles each hammer and is confined between the two arms 16, 16. As the cams or projections of the wheel pass by the hammer, the latter is thrust against the ring by the action of the coiled compression spring.

In my application for Letters Patent filed December 14, 1892, Serial No. 455,160, for improvements in ore concentrators, I have described in connection with the machine a thin sheet metal pan or bowl particularly adapted

to be used, although not necessarily, in connection with a concentrator running at a proper concentrating speed to retain the heavier particles, or those of greater specific gravity, in the pan and discharge the lighter particles, or particles of less specific gravity, over the top of the pan, in connection with means for imparting a jarring movement to the pan, whereby the maximum degree of success is attained in an operation of that character by reason of the trembling motion transmitted to the material to prevent packing and to assist in separation. So, in the present case, I desire to employ a pan, composed of vibratory material, more particularly in a concentrator constructed to be revolved at a high rate of speed for the purpose of discharging the lighter particles, or particles of less specific gravity, over the top of the pan; or in a concentrator constructed to be revolved horizontally to impart centrifugal force to the material being treated. I have found by practical experiments that besides pans constructed of thin sheet metal, composition pressed paper pans, or rubber pans, may be used to advantage, and, therefore, in the present application I describe a pan constructed of either of these materials subjected to the action of a stroke or jar to cause the tremulous movement of the particles.

By reference to Fig. 1, of the drawings, it will be seen that I provide a pulp tank 19, and a clear water tank 20. The pulp tank is provided in its bottom with an opening 21, fitted with a plug valve 22, said valve provided with an upper valve chamber, 23, with an opening or passage 24, smaller in diameter than the valve chamber, and leading from said chamber through the valve. A valve 25, is seated on the bottom of valve chamber 23, and normally closes the opening or passage 24, the stem 26, of said valve projecting through the passage or opening.

The outer end of a launder or conductor 27, passes beneath the pulp tank, and to the inner end of this launder is connected a pipe 28, having a branch 29 leading to the disk 6. Within the launder, directly under the passage 24, is movably placed a wedge 30, with which the valve stem, 26, contacts.

The numeral 31 indicates a flexible tube preferably rubber or canvas hose provided on opposite ends with nipples 32, 32, one passing into the water tank near the bottom thereof, and the other connected with an elbow 33. Extending down from this elbow is a pipe 34, communicating with the valve chamber 23. An overflow pipe 35 is arranged in the water tank, and, if desired, a similar one may be arranged in the pulp tank, to prevent water or pulp from being discharged over the top of the tanks in case of accident or stoppage of the concentrators. Pulp is fed to tank 19 through the trough 36 and water to the water tank 20, through pipe 37. A lever 38, is fulcrumed at 39 and is provided with a depending arm, 40, having a projecting lug 41, which is adapted to engage a catch 42, in order to retain the depending arm in a normal position to keep valve 22 closed.

The numeral 43 indicates a countershaft, having loosely mounted thereon two wheels 44 and 45, said wheels having their peripheries beveled. The hubs of these wheels have formed integral therewith sprocket wheels 46 and 47 the former, or outer sprocket, being of less diameter than the latter. The hub of wheel 45 has also formed upon its extremity a sprocket wheel 48, while the countershaft is provided near its inner extremity with a cone pulley 49. The countershaft derives its rotation by means of sprocket chains, not shown, which pass around sprocket wheels 46 and 47, and derive their motion from any suitable source of power.

A shifting lever 50, pivoted at 51, is provided with a forked or bifurcated lower end, which straddles a central connecting collar 52, of a double friction clutch, 53, splined upon the countershaft, and arranged intermediate the two wheels 44 and 45. This central connecting collar is provided with an annular recess 54, which receives an annulus or ring 55. The furcate arms of the shifting lever are connected to this ring by means of screws or equivalent devices, not shown, so that when movement is imparted to the lever the clutch will be caused to be moved longitudinally upon its countershaft. After the clutch has been moved to the right of Fig. 1 to engage with wheel 44, as shown in Fig. 1, it is subsequently brought into engagement with wheel 45 by a recoil spring 56.

A sprocket chain 57 runs around sprocket 48, and thence upward over two sprockets 58, one of which only being shown, mounted in the frame, then around a sprocket wheel 59, at the upper end of the bowl shaft 2, whereby when motion is imparted to the countershaft rotation is communicated to said shaft 2, and the bowl carried thereby.

Rotation is imparted to the tubular shaft 8, by means of an endless pulley belt or cord, 60, which runs around cone pulley 49, thence upwardly over two quartered pulleys 61, one of which only being shown, and finally around a cone pulley 62, mounted upon the tubular shaft. It will thus be seen that the bowl shaft 2, and the tubular shaft 6, are operated from the same driving shaft. It is intended, however, to run the tubular shaft at a greater rate of speed than the bowl shaft, and this is accomplished by an appropriate use of the cone pulleys 49 and 62.

The shifting lever 50, is operated by means of a handle or lever 63, fulcrumed at 64, and connected to the upper end of the shifting lever by means of a link 65.

The concentrator pan or bowl is surrounded by two troughs 66 and 67, the latter arranged within the former. Trough 66 has its outlet through 68 to a receptacle 69, while trough 67 has its outlet through a pipe 70, fixed rigidly thereto, said pipe passing through a slightly

elongated slot in the outer trough to allow for the raising and lowering of said inner trough. This outlet also leads to a suitable receptacle 71. These troughs are similar to the troughs shown and described by me in my application for Letters Patent for improvements in amalgamators, filed November 30, 1891, Serial No. 413,457, and allowed June 14, 1892, excepting the means which will now be described for raising and lowering the inner trough above and below the line of discharge from the concentrator pan, whereby, by a movement not greater than an inch, the discharge from the pan is changed from one trough to the other, and instead of discharging the product of concentration into the inside trough, as in the case referred to, I discharge it into the outside trough 66, and the tailings into the inside trough 67. This raising and lowering of the inside trough is accomplished by means of connections between the operating lever and said trough. To the top cross beam of the frame are pivoted, at opposite extremities thereof, bell crank levers 72, 72, and connected to each of these is an arm, 73, which extends down and is provided with branches or extensions connnecting with the edge of the inside trough. Upon the longer arm of each bell crank is a block 74, 74. These blocks are pivotally connected by means of a link 75. Block 74 on the bell crank on the right of Fig. 1, is also pivotally connected with a block 76, on the operating lever or handle 63, by means of a link 77.

I do not wish to confine myself to one of the disks 6, but in some instances may use a series of the same. In Fig. 3, of the drawings, I have shown two of these disks arranged within the pan, the upper one provided with ports 78, 78, leading to the lower disk, with a ring or casing 79, in the bottom thereof surrounding the tubular shaft and the depending ports. When a plurality of disks are employed it becomes necessary to provide a delivery pipe 29, and its connections for each disk used, so that in Fig. 2, two of these pipes are shown one leading directly to the upper disk, and the other leading to the ring or casing 79, so as to feed through the ports 78, to the lower disk.

In the adjustment of clutch 53, shown in Fig. 1, the countershaft derives its motion from the smaller sprocket 46, and consequently the shaft is running at fast speed, which is imparted to the pan or bowl, as well as to the disk, 6, although the latter always runs faster than the pan or bowl, through an appropriate use of the cone pulleys 49 and 62 no matter what may be the adjustment of the clutch. This speed is maintained as long as the operating handle or lever 63 is held in the position shown. The moment it is released, however, the recoil spring 56, acts upon the shifting lever, and throws the clutch into the wheel 45, and consequently the countershaft derives its motion through the large sprocket 47, and a slower speed is imparted to the countershaft and to the bowl and disk.

With the adjustment of the operating handle to the position shown in Fig. 1, that is, so as to give fast speed, the short arms of the bell crank levers 72, 72, are raised, which in turn raise the arms 73, and cause the elevation of trough 67, and consequently the concentrates are discharged into the outer trough, 66. When the lever or handle is released, however, the speed is changed to a slow rate, and at the same time the inner trough 67, drops below the line of discharge from the pan and the particles thrown off of less specific gravity are caught in the trough 67, and discharged from the same through the outlet 70, into the receptacle 71.

While I have shown in the drawings a hand operating lever 63, it is to be understood that, if preferred, this lever may be arranged to be acted upon intermittently to cause the automatic operation of the shifting lever and the raising and lowering of the inner trough.

In Fig. 1, of the drawings the pulp plug valve 22, is shown as closed and the water valve 25 open. In order to reverse this arrangement, or in other words, open the pulp valve and close the water valve, all that is necessary is to lower the depending arm 40 which will close the water valve, and as the pulp valve raises, the valve 25 is brought to its seat, and the stem 26 is raised off the wedge 30, which will of course close the water valve 25. This construction therefore provides for the alternate feed of pulp and water to the disk 6. It is designed that the pulp valve should remain open during the time the machine is running at a slower or concentrating speed, whereas when the speed is changed to a more rapid rate, the pulp valve is closed and the water valve opened by raising depending arm 40. When it is desired to keep the pulp valve closed for a certain length of time, and the water valve open, the depending arm may be held in a raised position by engaging the projecting lug 41 with the catch 42. It will be understood that the flow of pulp to the disk is intended to be continuous until the wall of the separating surface has collected a sufficient amount of the heavier particles, or particles of greater specific gravity. It is then that the valve delivering pulp is closed and simultaneously the water feed opened, and the speed increased to discharge the accumulated contents.

The most important feature of this case is the disk 6, with means for revolving it in the same line and direction as the receptacle and independently or at a different number of revolutions. The object of this is to cause it to impart to the material in the pan, particularly the material nearest the center of axis, a whirling motion, or centrifugal force, to assist in the discharge of the lighter particles over the top of the pan, and to provide means

whereby the inner wall of material receives a force to cause it to revolve, aside from the force which is transmitted from the revolving pan by contact, and thereby admit of a slower rate of speed in the pan, with better results in percentage of value, saved, and with increased capacity. This revolving of the disk 6, at a greater rate of speed than the pan or bowl also imparts a circular movement to the material on the wall of the pan, from which good results ensue. These distributing disks are particularly adapted to concentrators with an agitating centrifugal vibrating separating surface, but can be used with good results in any separater employing centrifugal force as a separating force. In a vibrating receptacle, however, the advantages of the delivery disk are superior to that class of concentrators employing only centrifugal force, for the reasons, that in a vibrating centrifugal separating surface, the continuous vibrations destroy to some extent, the cohesion or contact with the surface, and consequently reduce the capacity of the separator, yet there is no more tremulousness than is essential to good results and perfect separation. With my improved system there is a continuous force, "centrifugal," produced by the delivery of the material from the disk or disks 6, regardless of the vibrations of the collecting receptacle, and these disks can be so adjusted that they will produce a good result without revolving the receptacle, simply by giving it a knocking or tremulous vibrating action, the discharge from the disk 6, causing the centrifugal force.

It follows from the above that I do not wish to be understood as confining myself to the use of the independently revolving disks within a pan or bowl of the particular construction shown and described, nor do I wish to confine myself to the particular mechanism for revolving the pan and giving it the vibrating tremulous action; but I desire to use it in connection with any form of concentrator pan to which it may be found adapted.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an ore concentrator, the combination, with a rotatable receptacle, of one or more distributing disks rotating within the receptacle, for depositing the material on to the wall of said receptacle, and to give to the material nearest the center of axis a whirling motion independent of the force transmitted from the revolving receptacle, substantially as set forth.

2. In an ore concentrator, the combination, with a vibrating receptacle into which the material is delivered, of a rotatable distributing disk or disks, within the receptacle for depositing the material on the separating surface of the receptacle, and to give to the material nearest the center of axis a whirling motion, substantially as set forth.

3. In an ore concentrator, the combination, with a revoluble vibrating receptacle into which the material is delivered of a revoluble distributing disk within the receptacle for depositing the material on the separating surface of said receptacle, and for giving to the material nearest the center of axis a whirling motion independent of the force transmitted from the revolving receptacle, substantially as set forth.

4. In an ore concentrator, the combination, of a rotatable receptacle, a rotatable distributing disk within the receptacle for depositing the material on to the wall of the receptacle, and for giving to the material nearest the center of axis a whirling motion independent of the force transmitted from the revolving pan, and means for rotating the disk at a greater rate of speed than the receptacle, whereby a circular movement is also imparted to the material on the wall of the receptacle, substantially as set forth.

5. In an ore concentrator, the combination, of a revoluble receptacle, adapted to have a variable rate of speed, a revoluble disk within the receptacle, adapted to be rotated at a faster rate of speed than said receptacle, a double trough about the periphery of the pan, and means for alternately feeding pulp and water to the revoluble disk, the former during the slow speed of the receptacle, and the latter during the fast speed thereof, substantially as set forth.

6. In an ore concentrator, the combination, with a revoluble receptacle, of a revoluble disk within the receptacle, for depositing the material on to the separating surface of said receptacle, and for giving to the material nearest the center of axis a whirling motion independent of the force transmitted from the revolving receptacle, said disk provided with ribs or riffles to assist in the delivery of the material on to the wall of the receptacle with greater force and more rapidity, substantially as set forth.

7. In an ore concentrator, the combination of a pan or bowl adapted to have a variable rate of speed imparted thereto, disks revolving within the pan or bowl, and adapted to rotate at faster rates of speed than said pan or bowl, said disks arranged to deposit the material on to the separating surface of the pan or bowl, and to give to the material nearest the center of axis a whirling motion independent of the force transmitted from the revolving pan, the upper of said disks provided with a ring or casing and also with ports leading from said ring or casing to the lower disk, and feed pipes one leading directly to the upper disk, and the other to the ring or casing for feeding through the ports or openings to the lower disk, said feed pipes each adapted to feed alternately pulp and water to the respective revoluble disks, the former during the slow speed of the receptacle and the latter during the fast speed thereof, substantially as set forth.

8. In an ore concentrator, the combination, of a revoluble material receiving pan, a revoluble disk within the pan, a double trough about the periphery of the pan, one arranged within the other, and means consisting of an operating lever and connections between the same and the inner trough for raising and lowering said inner trough above and below the line of discharge from the material receiving pan, to change the discharge of the pan from one trough to the other, substantially as set forth.

9. In an ore concentrator, the combination, of a pan or bowl, a disk therein, an operating lever, means for independently revolving the pan or bowl and the disk, and connections between the operating lever and said revolving mechanism whereby, when the lever is adjusted to one position, the pan and disk will be rotated at a fast rate of speed, and when adjusted to the reverse position, said pan or bowl and the disk will be rotated at a slower rate of speed, substantially as set forth.

10. In an ore concentrator, the combination, of a pan or bowl, a double trough about the periphery of the pan, one arranged within the other, an operating lever, connections for independently revolving the pan or bowl and the disk, connections between the operating lever and said revolving mechanism, and connections between the operating lever and the inner trough, whereby, when said operating lever is adjusted to one position, the pan or bowl and disk will be rotated at a fast rate of speed and the inner trough elevated, and when, adjusted to the reverse position, said pan or bowl and the disk will be rotated at a slower rate of speed, and the inner trough lowered beyond the line of discharge from the pan or bowl, substantially as set forth.

11. In an ore concentrator, the combination, of a tank provided with a valve opening, a conductor from the tank to the pan or receptacle to be supplied, a valve controlling the opening of the tank, said valve provided with a valve chamber and with a passage from said chamber through the valve, a valve within the valve chamber having a stem passing through the opening and resting upon the conductor, a pipe connected to the valve chamber, and means for raising and lowering said pipe together with the valve, substantially as set forth.

12. In an ore concentrator, the combination, of a feeding tank, provided with a valve opening, a conductor leading from the tank to the receptacle to be supplied, a wedge within the conductor beneath the valve opening, a valve controlling the opening of the tank, said valve provided with a valve chamber and with a passage from said chamber through the valve, a valve within the chamber having a stem passing through the opening with its lower end engaged by the wedge, a pipe connected to the valve chamber, and means for raising and lowering said pipe together with the valve, substantially as set forth.

13. In an ore concentrator, the combination of feeding tanks, one of said tanks provided with a valve opening, a conductor from one of the tanks to the receptacle to be supplied, a valve controlling the opening of the tank, said valve provided with a valve chamber and with a passage from said chamber through the valve, a valve within the chamber having a stem passing through the opening and resting upon the conductor, a pipe connected with the valve chamber, a flexible tubing connecting the pipe with the other tank, and a pivoted lever having link connection with the pipe leading to the valve chamber, whereby said pipe and the valve may be raised and lowered, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES E. SEYMOUR.

Witnesses:
C. T. BENEDICT,
C. H. KEENEY.