(No Model.) 3 Sheets—Sheet 1.

C. E. SEYMOUR.

SYSTEM FOR CONCENTRATION OF ORES.

No. 510,051. Patented Dec. 5, 1893.

Fig. 1.

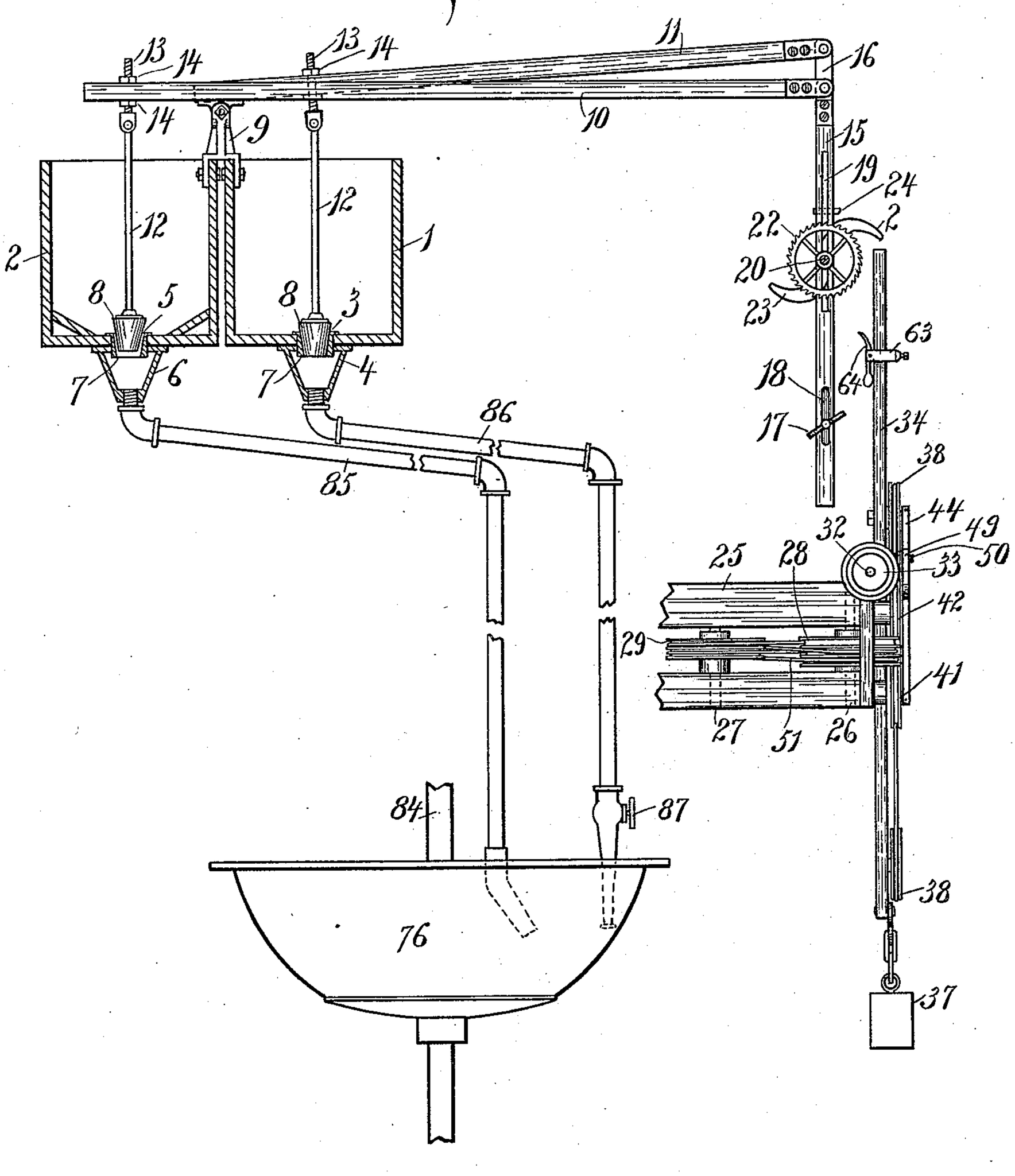

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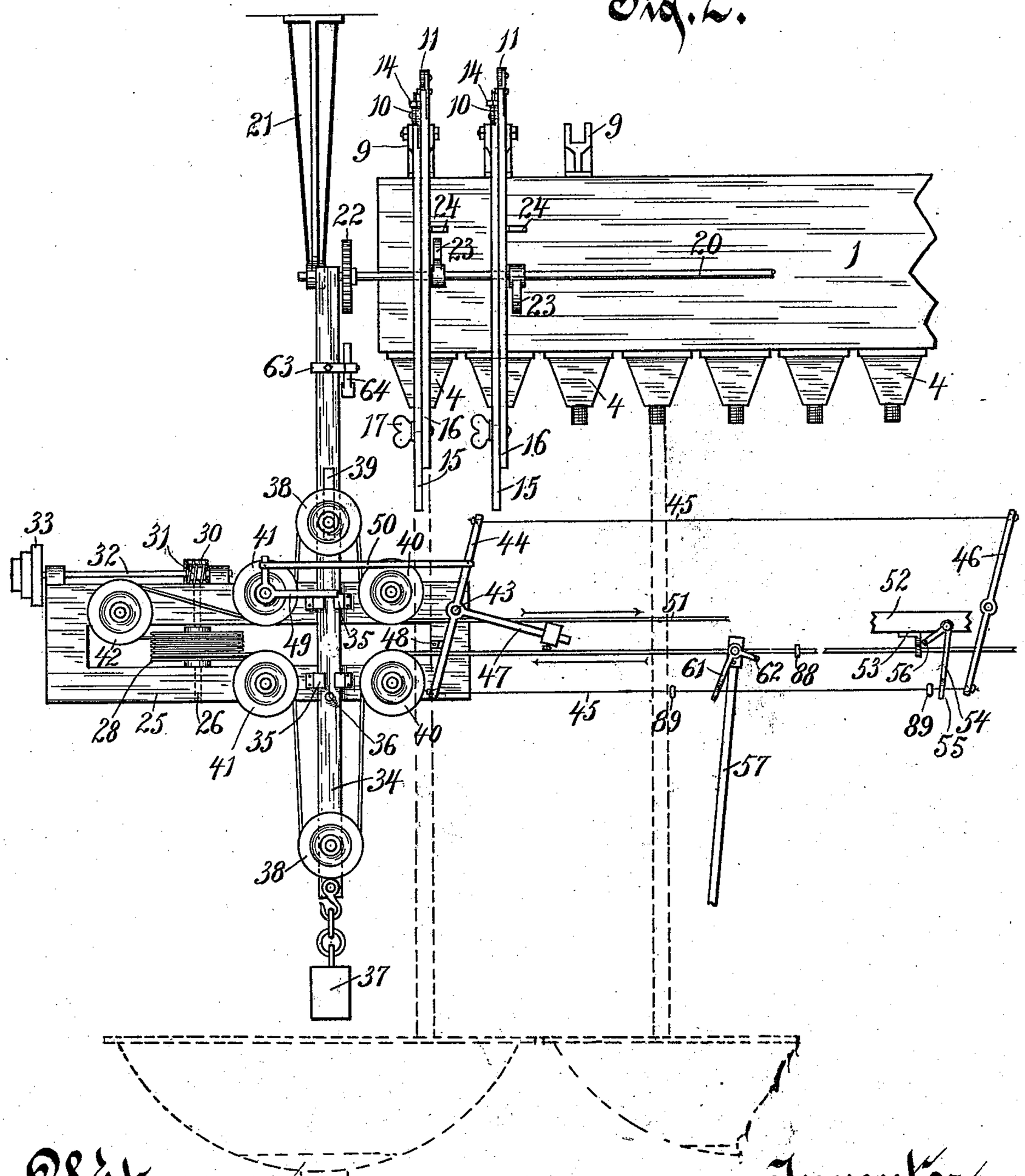
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 3.

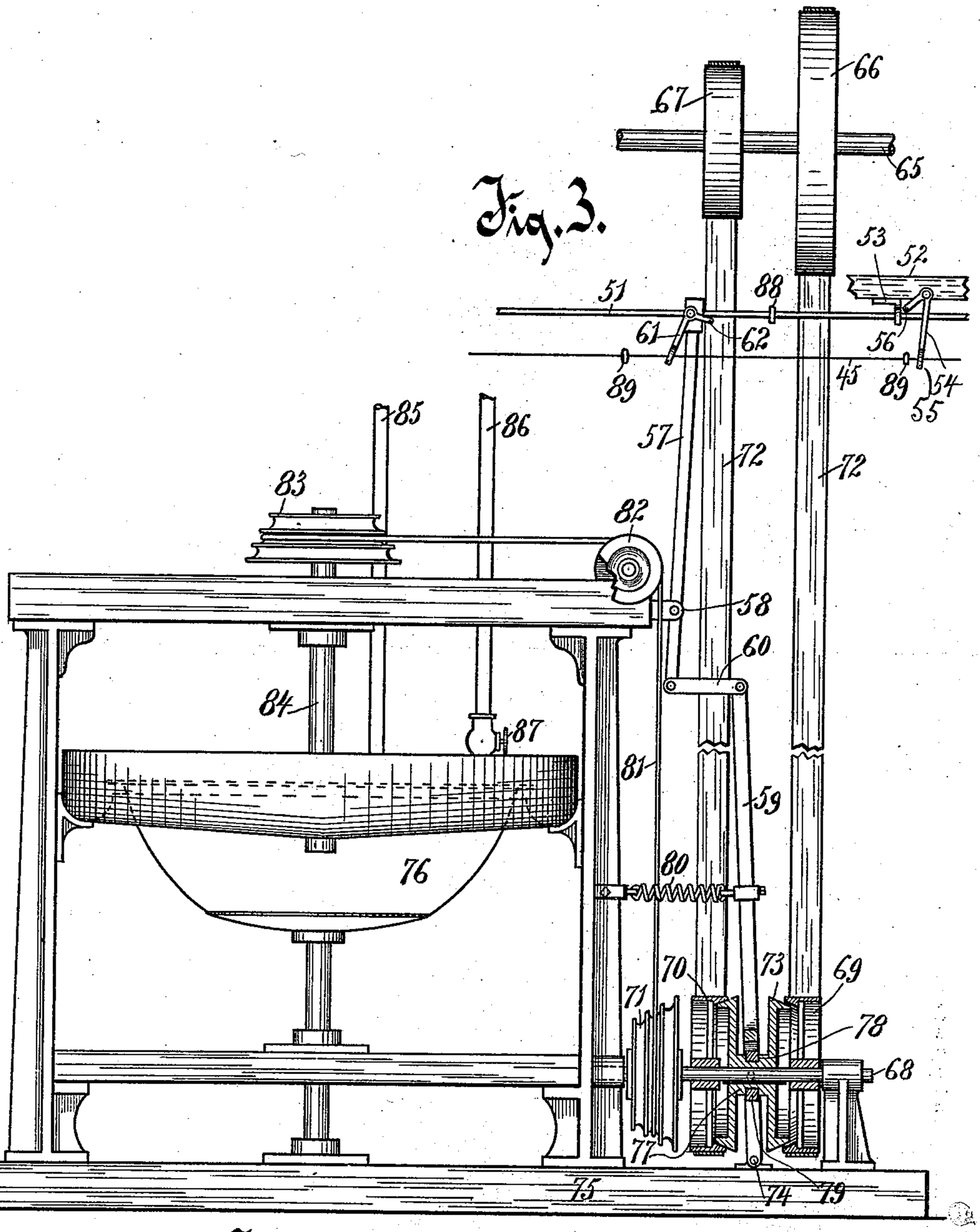


Fig. 4.

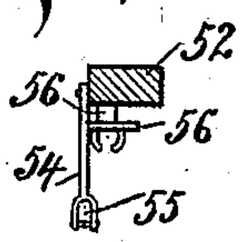
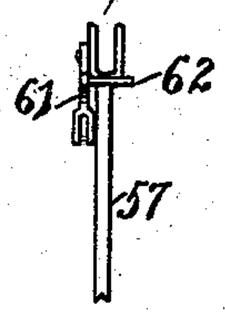


Fig. 5.



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UNITED STATES PATENT OFFICE.

CHARLES E. SEYMOUR, OF LAKE GENEVA, WISCONSIN.

SYSTEM FOR CONCENTRATION OF ORES.

SPECIFICATION forming part of Letters Patent No. 510,051, dated December 5, 1893.

Application filed November 25, 1892. Serial No. 453,024. (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 Systems for Concentration of Ores, 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 to an improved system for concentration of ores. It is more particularly adapted to be used in connection with, and operated by, the tripping mechanism described and claimed in my pending application for patent for improvements in ore concentrators, filed July 21, 1892, Serial No. 440,830. It may also be used to advantage in connection with the device described and claimed in my pending application for patent for improvements in devices for operating ore concentrators and allied machines, filed September 19, 1892, Serial No. 406,183, allowed February 26, 1892, and also in connection with my improved centrifugal amalgamator, filed November 30, 1891, Serial No. 413,457, allowed June 14, 1892. In fact its use may be extended to any or all concentrators and separators which discharge the product through the bottom of the pan or over the top centrifugally; and to many systems where pans are used for the treatment of pulverized or finely divided material.

It is necessary in the treatment of ores for concentration and separation to discharge the contents of the bowl or pan when a sufficient amount of the valuable part of the material has accumulated in the pan. A cleaner product is produced if clear water is allowed to pass through the pan and contents before and during the discharge of the product of separation and after the feed or flow of pulverized ore or material is cut off, as it tends to wash away any light material remaining in the pan prior to discharge.

It is one of the objects of my invention to provide a device of a construction capable of effecting the desirable end pointed out, either in a single machine or a series of machines. In operating most concentrating and separating machinery it is necessary, at certain intervals, to stop the feed on to or into the machine, and consequently it is also necessary to stop the machinery that produces the pulp, as otherwise said pulp runs to waste. The employment of a plurality of machines for treating the pulp, operated in accordance with my improved system, provides for the continual, as nearly as possible, working of the pulverizer, from the fact that all the pulp is delivered into one tank, so that when one machine is idle the pulp it should operate upon is evenly distributed among the remaining machines of the series that are working, and consequently it is not necessary to close down the pulverizing machinery while the machines are being cleaned. It also provides for a more uniform distribution of the material to be treated.

With the above objects and others in view the invention consists in the improved construction hereinafter more fully set forth.

In the accompanying drawings, Figure 1, is a side elevation of the apparatus with parts in section, also illustrating the vertical sliding rod, and a fragment of the mechanism for operating the same. Fig. 2, is a front elevation showing fully the means for operating the sliding rod and showing the manner in which my system can be used in connection with a plurality of machines adapted for treating ore for separation, only two sets of the depending arms and two of the cams, however, being shown. Fig. 3, is an elevation of a concentrator bowl and its frame in connection with the tripping mechanism for operating the levers controlling the valves of the tanks, and also showing said tripping mechanism arranged to effect variations in the speed of the pan or bowl. Fig. 4, is a face view of the stop and one of the tripping devices, and Fig. 5, is a similar view of a fragment of the lever carrying the other tripping device.

Like numerals of reference indicate like parts throughout the several views of the drawings.

Referring to the drawings, the numeral 1 indicates the water tank and 2 the pulp tank, the former provided with a series of outlet openings 3, beneath each of which is a registering hopper 4, and the latter with similar openings 5, having beneath the same registering hoppers 6. The outlet openings in both tanks have fitted therein gaskets or

washers 7, of soft material, preferably rubber, to form a water tight seat for valves, 8. These valves are provided for each outlet opening in both tanks. The inner side of each tank, as will be seen lie in close proximity, and have secured thereto and projecting upward therefrom a series of standards 9, each forming fulcra for a pair of levers 10 and 11.

The valves 8 are provided with valve rods 12, which are jointed at their upper ends to threaded rods 13. The rods 13 connected to the valve rods in the pulp tank pass through lever 10, and receive thereon above and below the lever nuts 14, 14, while the threaded rods connected to the valve rod in the water tank pass through lever 11, and receive thereon above and below said lever nuts, designated by the same reference numerals. This provides for the adjustment of the valves toward and from their seats. Jointed to the forward end of each lever composing a set are depending arms 15 and 16, normally held together by means of a set screw 17, passing through an elongated slot 18 in arm 15, and entering arm 16. In this manner, the relative positions of the two arms can be readily adjusted. Each depending arm is provided, near its upper end, with an elongated slot 19, said slots registering and receiving through the same a shaft 20, having its journals in suitable brackets similar to 21. Mounted upon this shaft is a ratchet wheel 22 and also a series of cams 23, arranged at different points of the length of the shaft and radiating therefrom at different angles as clearly shown in Fig. 2, one of these cams being provided for each set of operating levers 10 and 11 and adapted to operate upon tappets 24, carried by the depending arms 16, of said levers, in the manner hereinafter more fully explained.

The tripping mechanism which I employ for the purpose of operating the parts previously described, is shown fully in Figs. 1 and 2. In these figures the numeral 25 indicates a frame suitable for supporting the driving mechanism. In this frame are journaled, upon vertical shafts 26 and 27, multiple sheaves 28 and 29 respectively. Shaft 26 is provided at its upper end with a pinion 30, which meshes with a worm 31 upon a horizontal shaft 32, carrying upon its outer end a cone pulley 33, a corresponding pulley being provided upon a line shaft not shown.

The numeral 34 indicates a vertical rod which is free to slide in guide-ways formed by angle brackets 35, 35, upon the frame, said rod being provided medially with a projecting pin 36. Upon the lower end of this rod is suspended a weight 37, while at different points thereon are located sheaves 38, 38, the axis of the upper one being adjustable in an elongated slot 39. Upon the right hand side of rod 34 are two sheaves 40, 40, arranged in a vertical line, and upon the left hand side are also two sheaves 41, 41, similarly arranged, while another sheave 42 is located to the left of multiple sheave 28, all of said several sheaves being quartered with reference to the multiple sheaves.

Turning in the frame, 25, is a horizontal rock-shaft 43, having a bar or rod 44 secured to its end at right angles thereto. This bar or rod is apertured at opposite ends to permit wires 45, 45, to be passed through the same, said wires being held in place by knotting the ends thereof. The opposite ends of the wires are extended and attached to the extremities of a medially pivoted lever 46. The rocking shaft 43, has also extending therefrom an arm, 47, provided with an adjustable weight, which holds rods or arms 44, normally in contact with a stop 48. The axis of the upper of the sheaves, 41, has secured thereto a bell-crank lever 49, the short arm thereof connected with the bar or rod 44 by means of a link 50. The numeral 51 indicates a fragment of an endless rope or cable, the arrangement of which being shown fully in Fig. 2. This cable first passes over lower sheave 40, down and around sheave 38 at the lower end of rod 34 up and over lower sheave 41, thence extended back and forth over multiple sheaves 28 and 29, leaving the former and passing around sheave 42, and finally under upper sheave 41, over sheave 38 at the upper end of rod 34, and under upper sheave 40.

The numeral 52 indicates a fragment of a rigid frame from which depends a stop 53. In advance of this stop is pivoted a tripping device, 54, of bell-crank form, the long and short arms thereof, respectively, being provided with an eye 55, and laterally extending finger 56.

Located intermediate of the tripping device 54 and the sheave-carrying frame is a lever 57, pivoted to an arm 58, extending laterally from the frame of the machine, as shown in Fig. 3. The upper end of this lever is bifurcated or forked to receive the cable, and its lower end is connected with the upper end of a pivoted lever 59, shown in Fig. 3, by a link 60.

The upper end of lever 57, has pivoted thereto a tripping device 61, also of bell-crank form, and provided with a laterally extending finger 62. The long arm of this trip is acted upon so as to force the short arm thereof upwardly and release the cable, instead of downwardly as in the case of tripping device 54.

Adjustably secured near the upper end of vertical rod 34 is a collar 63, said collar carrying a pawl 64. This pawl is arranged in line with the teeth of the ratchet 22, so that when the vertical rod is moved upwardly said pawl will engage the teeth and move the ratchet a desired distance.

The numeral 65 indicates a fragment of a main driving shaft, driven from any suitable source of power, and having mounted thereon large and small pulley wheels 66 and 67 respectively. Some distance below the driving shaft is a countershaft 68, having loosely mounted

thereon two pulleys 69 and 70, and also toward its inner end a cone pulley 71. These pulleys 69 and 70 are connected, respectively, to the pulleys 66 and 67 by belts 72, 72. The inner surfaces of the rims of pulleys 69 and 70 are beveled inwardly, as clearly shown in the drawings. Feathered or splined on the countershaft, intermediate of the two pulleys, is a double friction clutch wheel 73, having two disks the peripheries of which are beveled to enter the pulleys 69 and 70 and register with the corresponding bevels thereof. A rod or pin 74 secured in the frame 75 of the concentrator pan 76 forms a pivot for the forked or bifurcated lower end of the shifting lever 59, said forked portion straddling a central connecting collar 77 of the double friction clutch. This central connecting collar is provided with an annular recess 78, which receives an annulus or ring 79. 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 move longitudinally upon its countershaft. After the clutch has been moved to the right of Fig. 3 to engage with pulley 69, it is subsequently brought back into engagement with pulley 70 by a recoil spring 80. A belt 81 runs around cone pulley 71, and thence upwardly over two quartered pulleys 82, one of which only being shown, mounted in the frame, and thence around a cone pulley 83 at the upper end of a bowl shaft 84, whereby when motion is imparted to the countershaft, rotation is communicated to shaft 84 and its bowl.

The pulp is conveyed from the pulp tank by means of pipes 85, each of which is coupled at its upper end to one of the hoppers 6 and has its lower end entering the pan or bowl and extending to within a short distance of the bottom of the pan. The water is conveyed from the water tank by means of pipes 86, which are coupled to the hoppers beneath the bottom of said tank and also extend into the pan or bowl, terminating at a point slightly above the bottom of said pan or bowl, and near the side thereof. Each of the water pipes is provided with a stop cock 87 for regulating the flow of water. It will be understood that a set of these pipes is provided for each machine in the series.

In the operation of feeding from the pulp tank 2, while the machines are receiving pulp one of the valves 8 of said pulp tank is raised or held open by the gravity or weight of the levers 10 and 11 until the time arrives for discharging the pan. This discharge is accomplished by the tripping mechanism, the operation of which will now be described.

It will be observed that the weighted arm 47 holds rock-shaft 43 and bar or rod 44 normally in the position shown in Fig. 2, said rod 44 bearing against the stop 48. The endless cable is moved by the sheave 28 in the direction indicated by the arrows, and as the button 83, carried by the cable, reaches the stop, 53, its travel is of course arrested. As this takes place, the strain or pull of the cable directed against the lower sheave 38, of rod 34, causes the raising of said rod. When the rod has been raised a certain distance the pawl 64 engages with the ratchet wheel 22, and turns it until the same passes beyond the line of the pawl, whereby the latter is disengaged. As the ratchet is thus turned shaft 20 is likewise rotated a sufficient distance to bring the first of the series of cams into engagement with the tappet 24 upon the first set of depending arms 15 and 16, whereby said arms are raised, and consequently the levers 10 and 11 turned upon their fulcra thereby closing the pulp valves and opening the water valve leading to the first machine of the series. As the vertical rod 34 continues to move upward the pin 36, projecting therefrom, comes in contact with and raises the bell-crank lever, 49, which, through the connecting link 50, draws back the upper end and carries forward the lower end of bar or rod 44. The lower wire, 45, it will be noticed, carries two buttons 89, 89. The moment therefore, the lower end of rod 44 moves forward, the lower wire is moved in the same direction, and the button 89, nearest the outer end thereof will strike the depending arm of tripping device, 54, and throw the short arm thereof downwardly forcing the rope or cable which previously had been held taut by the button being in contact with the stop free from said stop. The cable being now free, the weight upon the end of sliding rod 34 will return the same to its original position, and the cable will resume its motion with considerable impetus, and engaging the top of lever 57 will bring said lever rearwardly with a jerk to an approximately vertical position. As lever 57 is thus operated shifting lever 59, is also turned upon its pivot, thereby throwing the double friction clutch, 73, from the position shown in Fig. 3, that is, in engagement with the pulley giving slow speed, to the pulley imparting fast speed to the concentrator pan and its shaft. When the movements just described take place, the button of the cable is in engagement with the lever 57, and of course the progress of said cable is again arrested, with the result that the sliding rod, 34, is once more raised, and as before, the pawl 64 engages the ratchet 22, and carries said ratchet, shaft and cam farther around, so that said cam passes away from the tappet 24, and allows the levers 10 and 11 to drop, thereby closing the clear water valve and opening the pulp valve. This change is accomplished by the gravity of the levers and depending arms, and almost at the same time this occurs the speed changes to a concentrating speed, that is to say, by the release of the button carried by the endless cable 51 from the lever 57, by reason of the pin 36 again contacting with bell-crank lever 49. It is obvious that the moment this contact oc-

curs lever 57 is released, and the recoil spring 80 acting upon shifting lever 59 returns the double friction clutch to its normal position in engagement with the pulley giving slow speed. After this, the button on the cable passes to the next machine, and exactly the same operation takes place, and so on through the series.

It will be seen that the valves in the respective tanks are connected to independent levers. These levers are made to work in unison by the tightening of the set screw 17, passing into the elongated slot 18. It is obvious, however, that this construction also provides for the independent working of the arm, all that is necessary being to unloosen the set screw so as to disconnect the depending arms. The independent working of the levers is sometimes desirable when it becomes necessary to close both valves in order to stop off the flow of pulp from tank 2 and also the flow of water from tank 1. When the two depending arms are thus disconnected lever 10 is pushed up at one end so as to force down the opposite end carrying the valve rod, thereby firmly seating said valve. The water valve being already closed, as shown in Fig. 1, the two depending arms are again secured together by tightening the set screw, and the gravity or weight of the levers and depending arms firmly retain both valves in their closed position.

In regard to the cams 23, it is to be stated that the same may be constructed so as to adapt them by their length and position to raise the valves any desired height.

In the present illustration, I have shown my improved system in connection with a concentrating machine rotating at variable speed, that is to say, a machine having an ore receiving pan adapted to be revolved at a uniform rate of speed until it is loaded and then at an increased rate of speed for discharging the contents centrifugally. It is obvious, however, that my invention is not necessarily dependent for successful operation upon its connection with a machine of that character, and consequently I do not wish to be understood as limiting myself to such adaptation, as the lever 57 alone might be employed in connection with the cable system, irrespective of the connection of such lever with the shifting lever, and the pulp and water discharged into a pan or bowl of a concentrator of any ordinary form. Or, in fact, merely a duplicate or stop 53 might be substituted for the lever, as the function of the part in case of its not being used in connection with the shifting lever is simply to arrest the progress of the cable a second time. Attention is also directed to the fact that the locking of the two depending arms 15 and 16 practically forms one lever, and the only reason two are shown in the present illustration is for the purpose of disclosing clearly the manner in which the independent adjustment already described may be secured. I do not therefore, desire to be understood as limiting myself to two levers and their depending arms as shown in the drawings. Furthermore, while I have shown the invention as applied to a series of concentrating machines, it is obvious that its utility is not confined alone to operating a plurality of machines, as it is equally well adapted for operation in connection with one machine only. In that case, however, the several cams are not distributed along the shaft, but instead are formed into one cam ring comprising a series of radiating arms, of the form shown.

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

1. The process of concentration of ores, which consists, first, of feeding pulp to a revoluble vessel and subjecting the same therein to centrifugal force by rotation at a slow or uniform rate of speed, secondly, stopping the flow of pulp and forcing a jet or stream of water through the product of separation while the machine is still running at a slow rate of speed, thirdly, increasing the rate of speed, and continuing the flow of water continuously with the fast rate of speed for the purpose of washing away any light material remaining in the pan prior to discharge, until the discharge is effected, and, fourthly, cutting off the flow of water and resuming the feed of pulp, and at the same time changing the speed back to a uniform or slow rate, substantially as set forth.

2. The process of concentration of ores which consists, first, in feeding pulp to a revoluble vessel and subjecting the same therein to centrifugal force by rotation at a slow or uniform rate of speed, secondly, stopping the flow of pulp and forcing a jet or stream of water through the product of separation, thirdly, increasing the rate of speed for the purpose of centrifugally discharging the contents, substantially as set forth.

3. In a system for concentration of ores, the combination, of a concentrator pan or bowl, means for revolving said pan or bowl at a certain rate of speed for concentrating purposes, and subsequently changing said rate of speed, water and pulp receptacles provided with discharge openings, valves controlling the discharge openings, and mechanism for controlling the valves, said mechanism constructed to automatically retain the pulp valve in its open position and the water valve in its closed position during the concentrating period and to cause the reversal of the positions of these valves and after the reversal, the change of speed to a faster rate, substantially as set forth.

4. In a system for concentration of ores, the combination, of a series of concentrator pans or bowls, water and pulp receptacles each provided with a series of discharge orifices, valves controlling the discharge orifices, conduits leading from said discharge orifices to the respective pans or bowls, valve control-

ling devices, and mechanism constructed to act consecutively on the several valve controlling devices to automatically alternately effect the closing and opening of the pulp and water valves, respectively, throughout the series, substantially as set forth.

5. In a system for concentration of ores, the combination, of a concentrator pan or bowl, water and pulp receptacles provided with discharge openings, conduits leading from the discharge openings and conducting the water and pulp to the concentrator pan, valves controlling the discharge openings provided with upward-extending stems, a horizontal lever connected with the stems of the valves, and having its fulcrum point intermediate of the respective valves, and means for turning said lever upon its fulcrum point, whereby one of the valves is lowered and the other raised, substantially as set forth.

6. In a system for concentration of ores, the combination, of a concentrator pan or bowl, water and pulp receptacles provided with discharge openings, conduits leading from the discharge openings and conducting the water and pulp to the concentrator pan, valves controlling the discharge openings provided with upward-extending stems, horizontal levers connected with the stems of the valves, and having their fulcra intermediate of the respective valves, arms depending from the horizontal levers, one of said arms provided with an elongated slot, and a thumb screw passing through said slot and impinging against the other arm, substantially as set forth.

7. In a system for concentration of ores, the combination of a concentrator pan or bowl, water and pulp receptacles provided with discharge openings, conduits leading from the discharge openings and conducting water and pulp to the concentrator pan, valves controlling the discharge openings, a pivoted lever connected with the rods of the valves, said lever having its pivotal point intermediate of the respective valves, a rod pivotally connected at its upper end to the upper end of the lever, said rod provided with an elongated slot and with a tappet, a shaft passing through said slot and carrying a ratchet wheel and a series of cam fingers, and a vertically moving rod carrying a pawl constructed to engage the ratchet wheel and partially rotate the same to bring one of the cams into engagement with the tappet, substantially as set forth.

8. In a system for concentration of ores, the combination, of a pan or bowl, pulp and water receptacles discharging therein, valves controlling the discharge openings, a rod acting to alternately open and close the valves, said rod provided with an elongated slot and with a tappet, an endless moving cable carrying a button, stops with which said button contacts, a sliding weighted arm carrying a pawl, said rod engaged by the cable and constructed to be forced upward thereby when the movement of the cable is arrested by contact of the button thereof with the first stop, so as to cause the pawl of the sliding rod to engage the ratchet and throw one of the cams into engagement with the tappet carried by the actuating rod, and when said button contacts with the next stop to again raise the sliding rod to cause the release of the cam from the tappet and the return of the actuating rod to its normal position, and bring the next cam into position for engagement with the tappet, and a tripping device constructed to successively release the button from the stops, substantially as set forth.

9. In a system for concentration of ores, the combination of a pan or bowl, pulp and water receptacles discharging therein, valves controlling the discharge openings, a rod acting to alternately open and close the valves, said rod provided with an elongated slot and with a tappet, an endless moving cable carrying a button, a stop with which said button contacts, a pivoted lever with which the button subsequently contacts, a weighted rod carrying a pawl said rod engaged by the cable and constructed to be moved upward thereby when the movement of the cable is arrested by contact of the button with the stop, thereby causing the pawl of the sliding rod to engage the ratchet and throw one of the cams into engagement with the tappet carried by the actuating rod, and when said button contacts with the pivoted lever to tilt said lever and again raise the sliding rod to cause the release of the cam from the tappet and the return of the actuating rod to its normal position, and bring the next cam into position for engagement with the tappet, tripping devices constructed to successively release the button from the stop and pivoted lever, means for revolving the pan or bowl, and connections between the tilting lever and said mechanism whereby when the lever is tilted by contact of the button the speed of the machine is automatically changed, substantially as set forth.

10. In a system for concentration of ores, the combination, of a pan or bowl, pulp and water receptacles discharging therein, valves controlling the discharge openings, a rod acting to alternately open and close the valves, said rod provided with an elongated slot and with a tappet, an endless moving cable carrying a button, stops with which said button successively contacts, a weighted rod carrying a pawl, said rod engaged by the cable and constructed to be moved upward thereby when the movement of the cable is arrested by contact of the button with the first stop, thereby causing the pawl of the sliding rod to engage the ratchet and throw one of the cams into engagement with the tappet carried by the actuating rod, and when said button contacts with the second stop to tilt the lever and again raise the sliding rod to cause the release of the cam from the tappet and the return of the actuat-

ing rod to its normal position, and bring the next cam into position for engagement with the tappet, tripping devices constructed to successively release the button from the stops, means for revolving the pan or bowl, and connections between the tilting lever and said mechanism whereby, when the lever is tilted by contact of the button, the speed of the machine is automatically changed, substantially as set forth.

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

CHARLES E. SEYMOUR.

Witnesses:

JOHN B. SIMMONS,

BEN O. STURGES.