O. H. KING.

ORE CONCENTRATING MACHINE.

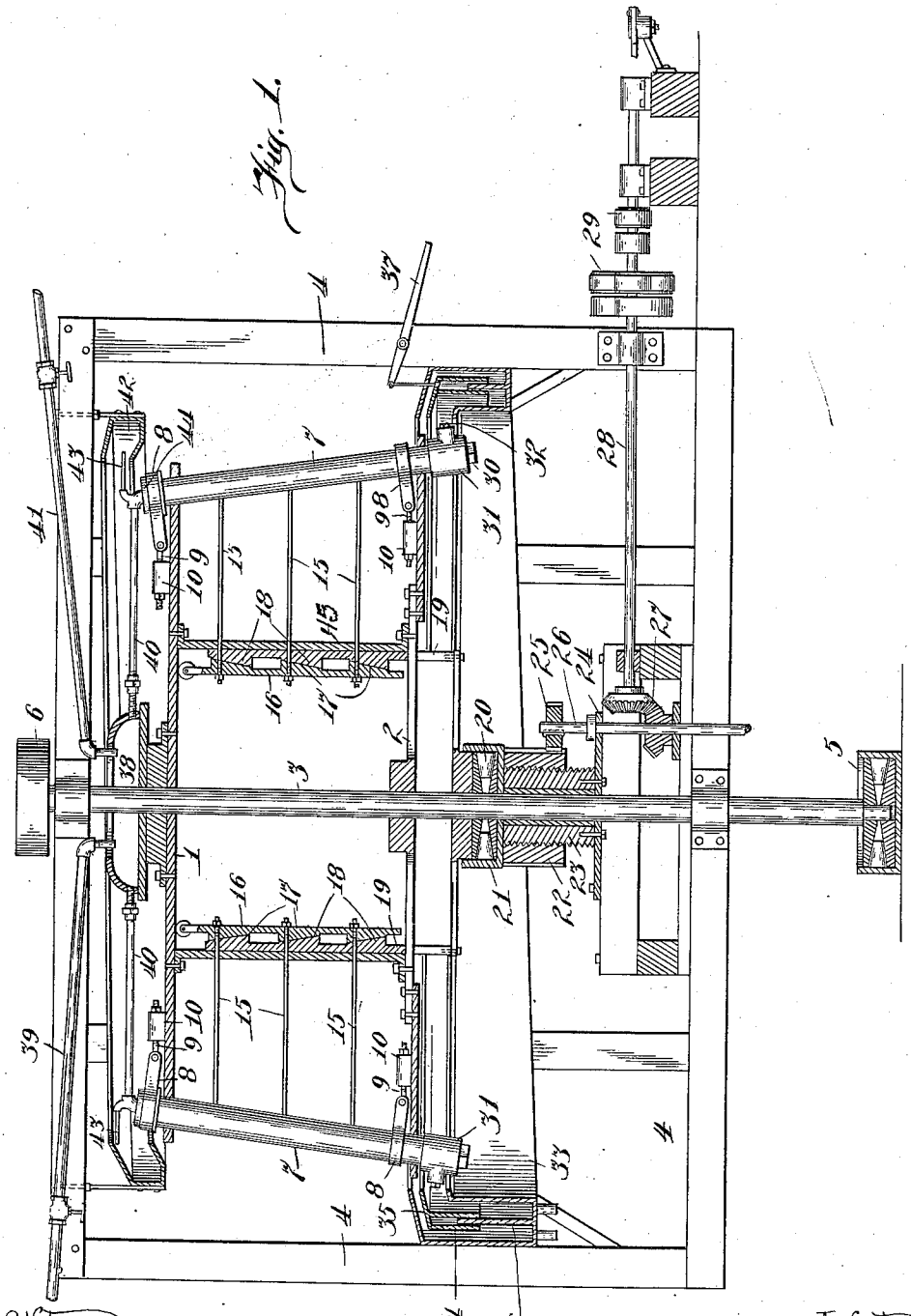
APPLICATION FILED JUNE 8, 1910.

1,014,827.

Patented Jan. 16, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



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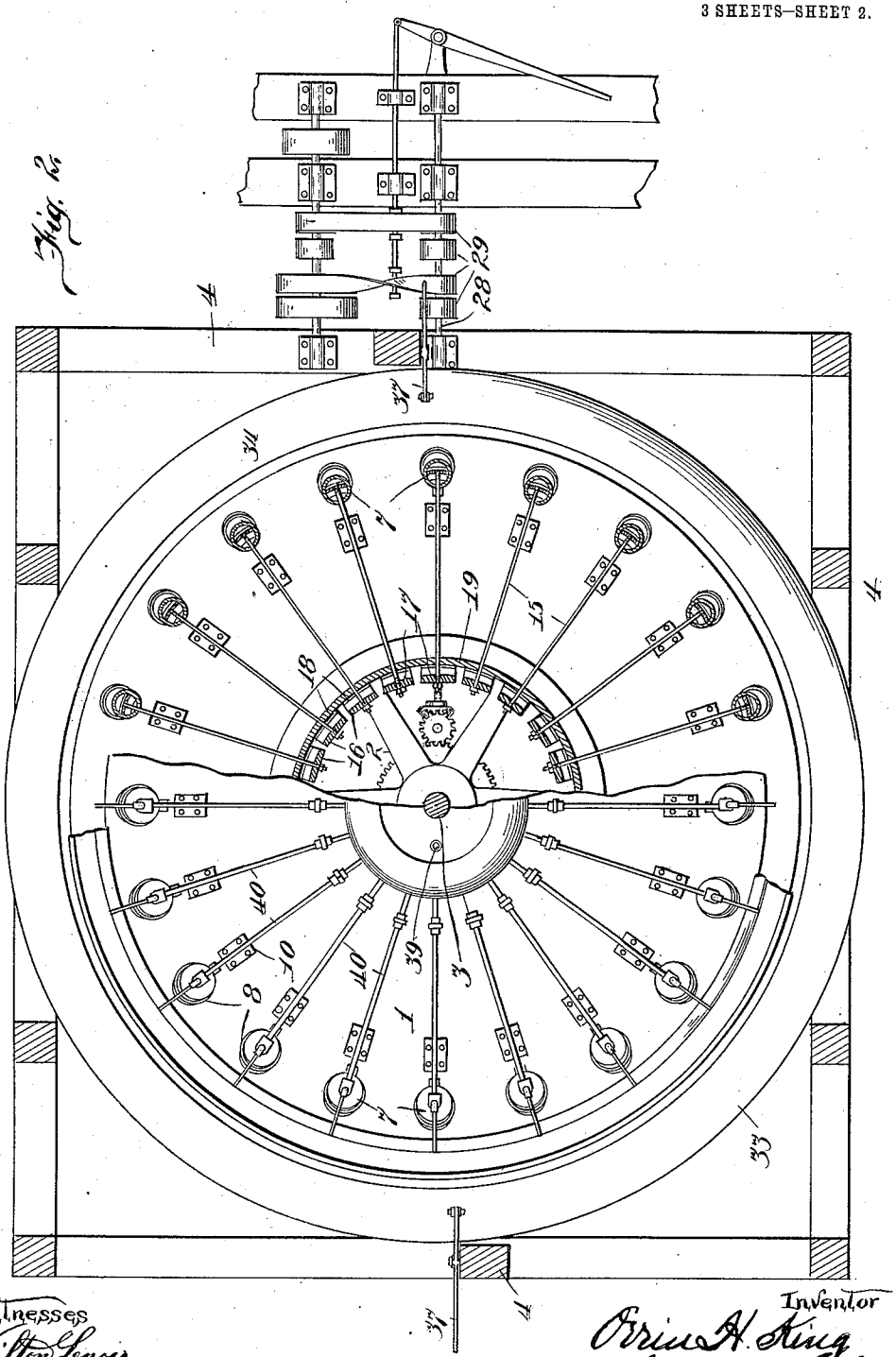
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

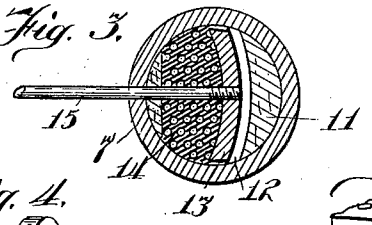


Fig. 4.

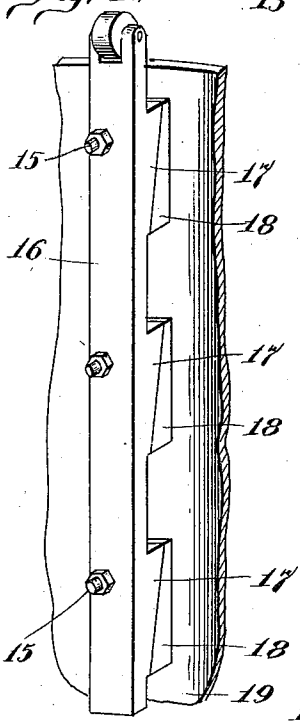


Fig. 5

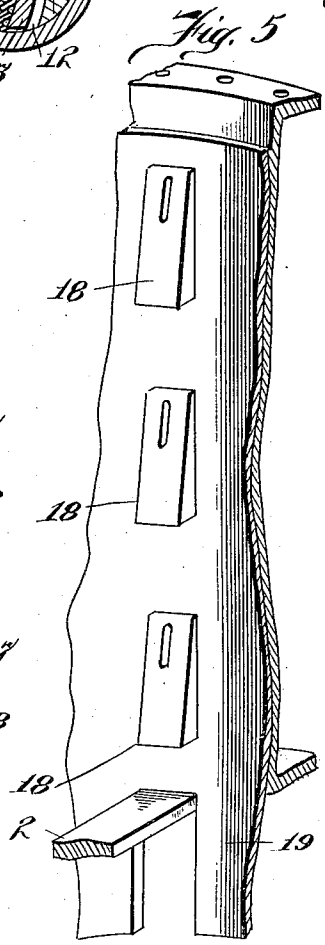


Fig. 6.

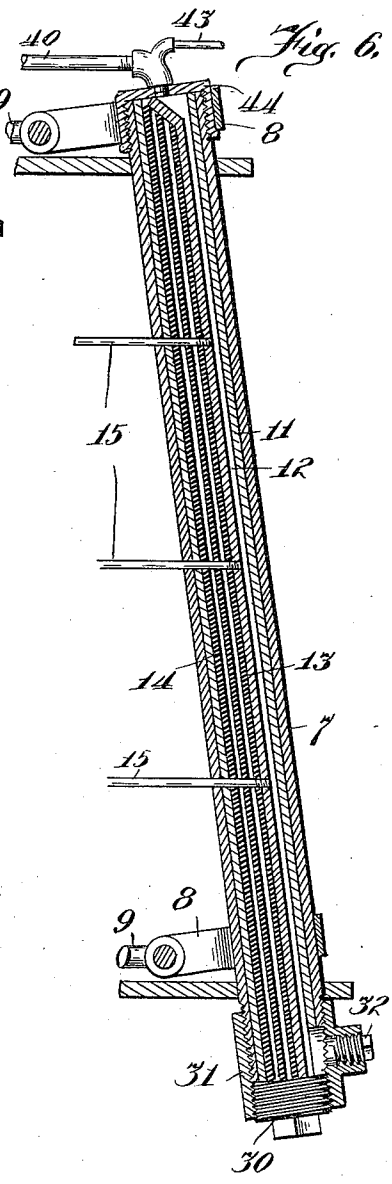
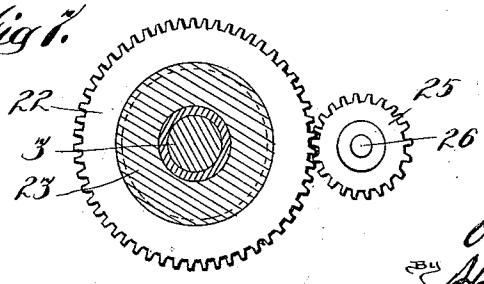


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ORE-CONCENTRATING MACHINE.

1,014,827. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed June 8, 1910. Serial No. 565,677.

To all whom it may concern:

Be it known that I, ORRIN H. KING, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Ore-Concentrating Machines, of which the following is a description, reference being had to the accompanying drawings, which form a part of my specification.

My invention relates to a concentrator or separator especially adapted for the treatment of ore, slime, tailings, and the like, and more especially wherein centrifugal force is employed to separate the ores or other similar materials which have previously been pulverized and mixed with water; the object of the invention being to provide a machine that will permit of a thorough separation of the materials of different degrees of specific gravity, as will more fully appear from the following detailed description of the accompanying drawings.

In the drawings:—Figure 1 is a vertical central sectional view of my improved machine. Fig. 2 is a top plan view of one half of the machine, while the other half is a horizontal sectional view. Fig. 3 is a detail of one of the concentrating or separating channels in cross-section. Fig. 4 is a detail view of a portion of the separating-channel expanding mechanism shown in perspective; while Fig. 5 is a similar view of a portion of the expanding mechanism. Fig. 6 is a longitudinal sectional view of one of the separating channels or tubes. Fig. 7 is a detail view of the mechanism employed for operating the separating-channel expanding means.

The machine shown in the drawings as an exemplification of my invention comprises the upper and lower annular plates or spider 1 and 2, which are of suitable material and construction and secured to the rotatable shaft 3. This shaft is vertically supported by suitable frame-work 4, and has bearing on the antifriction cone or roller bearing 5; while the other or upper end of the shaft is provided with a driving pulley 6. The two plates 1 and 2 have their peripheries cut away so as to form sockets to receive the tubes 7, of which there are any desirable number as shown for example in Fig. 2. These tubes 7 may be held in the sockets of the plates 1 and 2 by any suitable mechanism as for example by the bands 8, provided with the threaded pins or bolts 9 taking through the lugs or blocks 10 secured on the plates 1 and 2. By employing this method of fastening, it is evident that each tube 7 is independently secured in place to be readily removed for repairs without disturbing the remaining channels whereby the ore separation may be continued. These tubes 7 are preferably of metal and of sufficient length to permit of their being arranged circumferentially about the plates 1 and 2 and preferably in the sloping manner indicated in Fig. 1. Each tube contains a filler or block of wood 11, (see Fig. 3) extending throughout the length of the tube. The filler or block 11 merely fills a small portion of the tubes or pipes 7 as clearly shown in Figs. 3 and 6, so as to leave a channel 12 between said filler 11 and the metallic plate or deflector 13. The block or filler 11 and the metallic plate or deflector 13 are preferably concaved and convexed respectively as shown in Fig. 3, so as to leave a channel 12 of equal width throughout. The space between plate 13 and the wall of the tube 7, is provided with an elastic filler or cushion 14 which is preferably provided with the longitudinally extending holes therethrough as shown in Figs. 3 and 6 so as to allow for the contraction of the cushion 14 when it is desired to increase the size of the treating channel. Taking into the tubes 7 and through the filler or cushion 14 and screwing into the metallic deflector or plates 13, are the rods 15 whose free ends are properly secured to the vertically arranged plates or portion of the expanding means 16. There are preferably as many plates or members 16 as there are tubes 7; and the upper ends of these members 16 may be provided with rollers as shown; to take against the top plate 1 and prevent upward movement of said member 16 during the operation of the expanding mechanism; the rollers permitting the members 16 to move horizontally. All of the plates or members 16 are provided on one face with the inclined surfaces or wedge-blocks 17,—of which there are a suitable number. These inclined surfaces or wedge-blocks 17 correspond with and take against the oppositely inclined surfaces or wedge-blocks 18, secured on the inner surface of the cylindrical member 19, which has its bearing on the

vertically movable antifriction bearing 20. This bearing is mounted in the cup-shape member 21, which latter is secured to the gear 22. This gear 22 is threaded on its inner circumference to take onto the threaded sleeve 23, which is secured on a suitable frame-work 24. The gear 22 is driven by a pinion 25 mounted on the shaft 26, which is revolved by the bevel gearing 27 which is operated by shaft 28. This shaft 28 is operated by any suitable driving mechanism as at 29, the latter being arranged to be reversed in its operation when desired.

In order to support or brace the upwardly extending portion of member 19 against the lateral pressure encountered during the operation of the wedge-blocks 17 and 18 and at the same time secure top and bottom plates 1 and 2 together, I provide the drum or cylindrical member 45, against which the upwardly extending portion of member 19 takes as shown in Fig. 1.

The lower ends of the tubes 7 are closed by a plug or cap 30 which may screw into the tubes; while a T-shaped coupling 31 screws onto the end of each tube 7 as more clearly shown in Fig. 6. These couplings 31 are provided with discharge openings which are reduced by the discharge plugs 32; the discharge openings in the couplings being made to register with an opening in the lower ends of each tube to allow the material to pass out of the separating channel in the tubes.

Taking about the lower portion of the machine and immediately opposite the discharge plugs or openings in the bottom ends of the tubes 7, is a circular trough 33, which is made of greater depth at one side of the machine or made to slope so as to cause the discharged material to flow toward the lowest side or discharge portion of the trough as clearly shown in Fig. 1. This trough is provided with the vertical movable gate or bifurcated member 34, the top of which is made with the sloping surface 35, extending toward the discharge openings or plugs 32, so that the material discharged from the plugs 32 will either flow over the top of the surface 35 of the gate 34 and pass to the outer chamber of the trough as is clearly evident from the construction shown when the gate has been lowered from the position shown in Fig. 1 or it will pass beneath the surface 35 when the gate is raised as shown in Fig. 1. The lower portion of the gate is preferably made bifurcated as shown to take over a rib or partition 36 arranged within the trough so as to divide it into two compartments. This circular partition will hold the gate firmly in position against lateral movement; while any suitable mechanism, such as the lever 37, which may be pivoted on the frame-work 4, may be provided to raise and lower the gate. This gate of course extends about the entire circumferential trough, and with the partition 36 divides the trough into two separate compartments. With the gate in its raised position as shown in Fig. 1, it will be seen that the material will flow into the inner chamber or compartment of the trough, while the lowering of the gate will compel the material to flow across the sloping surface 35 of the gate 34 into the outer compartment of the trough. From this construction it is apparent that the water and undesirable matter may be discharged into one of the compartments and from there discharged to any suitable point through suitable outlets in the trough; while the separated or desirable matter may be discharged into the other compartment and discharged from there into any suitable receptacles not shown.

The top plate 1 is provided with a chamber 38 into which the slime or pulverized ore mixed with water is discharged by pipe 39. Leading from this chamber 38 are a series of pipes or conduits 40 which conduct the material to be treated to the separating tubes 7, see Figs. 1 and 2. The chamber 38 also has a pipe 41 leading thereto, whereby water may be fed to the chamber and from there through the different separating tubes or channels by means of the pipes 40. Extending about the upper part of the machine, is an overflow trough 42, which may be suspended from the frame-work above in any suitable manner. This trough 42 has an open side as clearly shown in Fig. 1, into which the overflow spouts or short pipes 43 extend; an overflow spout or pipe being employed for each separating tube. The trough 42 is arranged at an incline as shown in Fig. 1, so that the material discharged into the trough will flow to one side from where it may be fed back to the pump by a suitable conduit. The supply and overflow pipes or conduits 40 and 43 may be held in place by a suitable cap 44 which is screwed onto the upper end of the tubes 7 as shown in Fig. 6.

The operation of the machine is as follows—The material to be acted upon is fed through pipe 39 to the chamber 38, from where it flows through the series of pipes 40 into all of the concentrating tubes 7, while the entire machine is being rotated through the action of shaft 3 which is driven by a belt taking about pulley 6. While the material is being fed to the tubes 7 and during the rotation of the machine, shaft 28 is rotated, thereby operating bevel-gearing 27 which revolves pinion 25 meshing with gear 22. The rotation of gear 22, will cause the latter to ride upward on the threaded sleeve 23, thereby forcing member 19 with its wedging surfaces or blocks 18 upward. These blocks 18 taking against the blocks 17

will force the different plates or members 16 toward the center of the machine, moving said members in a radial manner, and causing the plates 13 in all the tubes 7 to compress the cushion of resilient material, thereby enlarging the separating channels 12 in every tube 7. This enlarging of the channel allows all the material of greatest specific gravity to adhere to surface of filler or block 11 while the water and undesirable material flow out of the discharge end of the tubes. As soon as the limit of upward movement of the member 19 has been reached, and therefore the limit of expansion of the channels 12, the speed of shaft 3 is slackened or stopped, while the gearing 27 is reversed and feed-pipe 39 closed; the reversal of the gearing 27 causes gear 22 to travel downwardly on the sleeve 23, thereby bringing member 19 back to its normal position, which in turn allows the wedges 16 and 17 to slide down into or back to the position shown in Fig. 1, permitting the separating channels 12 to contract, which will be done through the action of the resilient cushion 14 which tends to press the plates 13 13 back to normal position as shown in Fig. 3. While this reversal of the gearing 27 takes place and the speed of shaft and members 7 reduced or stopped, water is allowed to flow into the machine through pipe 41 and the concentrates washed out of the tubes 7 into the proper compartment of the trough 33, from where it is allowed to flow to suitable receptacles.

During the concentrating period in the operation of the machine to wit—while the material is being fed into the tubes or members 7, the gate 35 may, for example, be raised as shown in Fig. 1, so that the light or waste material may be discharged into one compartment of trough 33—namely in this case, the inner compartment, from where it may be led away to any suitable point. After the channels or chambers have been expanded to their fullest extent and the feeding of material through pipe 39 has been stopped and the speed of the machine having been reduced and the operation of gear 27 reversed, the gate 35 is lowered so as to bring its sloping top beneath the discharge plugs in members 7, thereby compelling the discharged material to flow into the outer compartment of trough 33, from where it may be discharged into any suitable receptacle or reservoir.

If the machine is being fed faster than it is possible to handle the material and the tubes 7 have become completely filled, the material will crowd about the top or feed-end of the concentrating tubes and overflow through the spouts or tubes 43 whereby the material is discharged into trough 42, from where it is fed back into the machine until it has been acted on. This overflow will be readily detected, when of course the further feeding of the machine will be temporarily shut off until the difficulty has been overcome.

I have shown and described what I believe to be the simplest form of my invention, but it is evident that a number of alterations may be made in a number of details without departing from the spirit of my invention, and I do not wish to be understood as limiting myself to the exact construction shown and described, but—

What I claim and wish to secure by Letters Patent, is:—

1. In an ore concentrating machine, a series of tubular members provided with concentrating channels within, means located within the tubular members and forming one wall of the concentrating channel, mechanism common to the series of tubular members whereby said means may be moved in a transverse direction within said tubular members, and resilient means intermediate of the first-mentioned means and the wall of the tubular members whereby the first mentioned means will be restored to normal position.

2. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubular members having concentrating channels within, said members being provided with inlet and outlet ports at their tops and bottoms, respectively, mechanism extending from end to end in said members and yieldingly held in close proximity to one side of said members to form a wall of the concentrating channels in said members, and means common to the series of tubular members whereby the mechanism in said members may be moved in a transverse direction within the members to expand the concentrating channels.

3. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubes arranged vertically in a circular manner about the shaft and connected therewith, said tubes being provided with concentrating channels and inlet ports at their upper ends and outlet ports at their lower ends, the lower ends of the tubes being so arranged as to describe a larger circle than the upper ends, mechanism extending from end to end in said tubes and yieldingly held in close proximity to one side of the tubes to form a wall of the concentrating channels, and means common to the series of tubes whereby said mechanism may be moved in a transverse direction within the tubes to expand the concentrating channels.

4. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubes arranged vertically in a circular manner about said shaft and operatively connected therewith, the tubes being

provided with concentrating channels and inlet and outlet ports at their upper and lower ends respectively, mechanism extending from end to end in said tubes to form one wall of the concentrating channels within said tubes, resilient means whereby said mechanism is yieldingly held in normal position, and means common to the series of tubes whereby said mechanism may be moved in a transverse direction within the tubes and against the action of said means.

5. An ore concentrating machine comprising a vertically arranged shaft, a series of tubes arranged vertically in a circular manner about the shaft and operatively connected therewith, said tubes being provided with concentrating channels and inlet and outlet ports at their upper and lower ends respectively, the lower ends of the tubes being arranged to describe a larger circle than that described by the upper ends, yieldingly held mechanism extending from end to end in said tubes and normally in close proximity to one side of said tubes to form a wall of the concentrating channels within the tubes, and means common to the series of tubes whereby said mechanism may be moved in a transverse direction within the tubes to expand the concentrating channels.

6. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubular members arranged vertically in a circular manner about said shaft, said members being provided with concentrating channels and inlet and outlet ports at their tops and bottoms respectively, yieldingly held plates within said members extending from end to end and adapted to form one wall of the concentrating channel within said members, and mechanism whereby the plates in all of said members may be simultaneously moved in a transverse direction within the members to vary the width of the concentrating channels.

7. An ore concentrating machine comprising a rotatable shaft, a series of tubular members having concentrating channels extending longitudinally therethrough, one of the walls of each of the concentrating channels being yieldingly held in normal position, and means common to the series of tubular members whereby said yieldingly held walls may be simultaneously moved in a transverse direction to vary the width of the concentrating channels.

8. An ore concentrating machine comprising a vertically arranged rotatable shaft, members arranged in a circular manner about the shaft and adapted to form a series of longitudinally extending concentrating channels, one of the walls of each of the concentrating channels being yieldingly held in normal position, and means operatively connected in common with the yieldingly held walls of all of said members whereby said walls are moved away from the opposing walls of the members to expand the concentrating channels.

9. An ore concentrating machine comprising a vertically arranged rotatable shaft, members arranged about the shaft to rotate therewith and adapted to form a series of longitudinally extending concentrating channels, one of the walls of each of the concentrating channels being loosely held in place, yielding mechanism whereby the loosely mounted walls are held in normal position, and means common to all of said members whereby the loosely held walls are moved against the action of said yielding mechanism.

10. An ore concentrating machine comprising a vertically arranged rotatable shaft, tubes arranged in a vertical manner and operatively secured to said shaft and provided with channels, said tubes being provided with inlet and outlet ports at their upper and lower ends respectively, loosely held members extending longitudinally in said tubes and adapted to form one wall of the concentrating channels, yielding mechanism intermediate of the one side of the said members and the inner wall of the tubes, and means common to all of the tubes whereby said members are moved against the action of said mechanism to increase the width of the concentrating channels.

11. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubular members operatively secured to said shaft, each member being provided with a concentrating channel extending lengthwise of the member with inlet and outlet openings at opposite ends thereof, mechanism extending from end to end in said members and yieldingly held in normal position, and means common to the series of members whereby the mechanism may be moved in a transverse direction within the members to vary the width of the concentrating channels.

12. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubular members arranged in a vertical manner about said shaft and providing separate concentrating channels, said members being provided with inlet and outlet ports at opposite ends, means located within said members and adapted to form one wall of the concentrating channel, and mechanism common to the series of members whereby said means may be moved in a transverse direction within said members to vary the width of the concentrating channels, in combination with a launder circularly arranged about the outlet ports of said members.

13. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of tubular members arranged

in a vertical manner about said shaft and operatively connected therewith and having a concentrating channel in all of said members, said members being provided with inlet and outlet ports at their upper and lower ends respectively, mechanism yieldingly held in said tubular members and extending from end to end thereof to form one wall of each of the concentrating channels, a series of wedging members common to said series of tubular members having operative connection with said mechanism whereby the latter is moved in a transverse direction within the tubular members to vary the width of the concentrating members.

14. An ore concentrating machine comprising a vertically arranged rotatable shaft, a series of vertically arranged tubes provided with inlet and outlet openings at their tops and bottoms respectively and constituting separate concentrating channels, a longitudinally arranged plate in all of said tubes and forming one wall of the concentrating channels, means for yieldingly holding said plates in place, wedging members common to the series of tubes operatively connected with said plates whereby the latter are made to move in a transverse direction within the tubes and vary the width of the concentrating channels, in combination with a pair of troughs arranged about the upper and lower ends of said tubes and adapted to receive the material discharged from said tubes.

15. An ore concentrating machine comprising a series of vertically arranged tubular members formed to provide concentrating channels therein, a yieldingly held member in each of said tubular members adapted to form one wall of the concentrating channels, mechanism common to the series of tubular members operatively connected with said yieldingly held members whereby the latter may be moved in a transverse direction within the tubular members and the width of the concentrating channels varied, means whereby the material to be operated on will be fed to the upper ends of the tubular members, and mechanism whereby said tubular members may be moved about a vertical axis.

16. An ore concentrating machine comprising a series of vertically arranged tubular members having concentrating channels extending longitudinally there-through, a portion of the walls of the tubular members being yieldingly held in normal position, means common to the series of tubular members whereby said yieldingly held portion may be moved in a transverse direction to vary the width of the concentrating channels, a feed chamber communicating with the upper ends of the tubular members, and mechanism whereby the tubular members may be moved about a vertical axis.

17. An ore concentrating machine comprising a series of tubes having concentrating channels and provided with inlet and outlet ports at their upper and lower ends respectively, a yieldingly held member in all of said tubes and extending in a longitudinal manner therein, said yielding member constituting one wall of the concentrating channel extending through said tubes, mechanism common to the series of tubes operatively connected with the yieldingly held member in all of said tubes and adapted to move said member in a transverse direction within the tubes to vary the width of the concentrating channel within, a feed chamber having communication with the inlet ports of said tubes, and means whereby all of said tubes are moved in a circle about a common axis.

18. An ore concentrating machine comprising a series of tubular members arranged in a circular manner about and secured to a rotatable shaft, mechanism for feeding the material to be treated to the upper ends of said tubular members, means whereby the width of the passages through said members may be regulated, and mechanism common to the series of tubular members having controlling connection with said means whereby the latter may be controlled during the rotation of the machine.

19. An ore concentrating machine comprising a series of tubular members having concentrating channels and arranged in a circular manner about a rotatable shaft and controlled thereby, mechanism within each of said members whereby the channels in said members may be expanded and contracted, means for delivering the material to be treated to the upper ends of said members, and means common to the series of tubular members operatively connected with said mechanisms whereby the channels in the tubular members are expanded during the feeding of the material to said members and allowed to contract when the concentrates are discharged.

20. An ore concentrating machine comprising a series of substantially perpendicular tubular members arranged about a rotatable shaft adapted to rotate therewith and having channels through which the material to be operated on is fed, means located in all of said members whereby the channels through said members may be expanded or contracted, said members being provided with inlets at the top and outlets at the bottom, mechanism for feeding the material to said tubular members during the revolution of the machine, and means common to the series of tubular members whereby the means in all of said members may be controlled and the channels through all of the tubes simultaneously expanded.

21. In a machine of the class described, a

series of members adapted to form separate concentrating channels, deflectors longitudinally arranged in said members, resilient means intermediate of one side of the deflectors and the walls of the members whereby the deflectors are yieldingly held in normal position, and mechanism whereby the deflectors in all of said members may simultaneously be moved against the action of said intermediate means and the concentrating channels expanded.

22. In an ore concentrating machine, a tubular member provided with a concentrating channel, a deflector arranged in said member, resilient means intermediate of said deflector and one wall of said tubular member and external of the concentrating channel for yieldingly holding the deflector in normal position, and mechanism connected with the deflector and adapted to move the latter against the action of said resilient means to expand the concentrating channel.

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