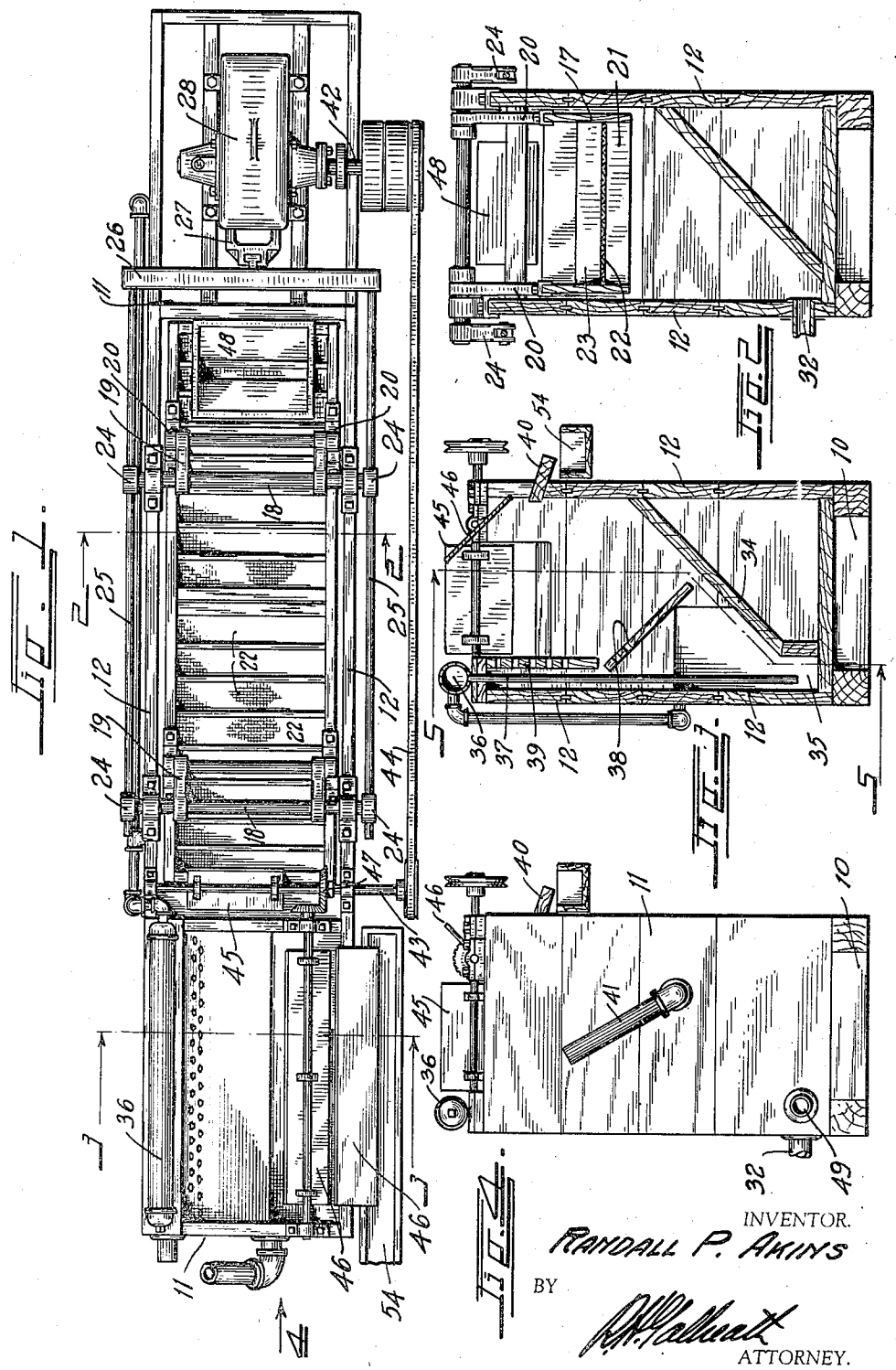
Jan. 25, 1938. R. P. AKINS 2,106,290

ORE CONCENTRATOR

Filed Sept. 3, 1935 3 Sheets-Sheet 1



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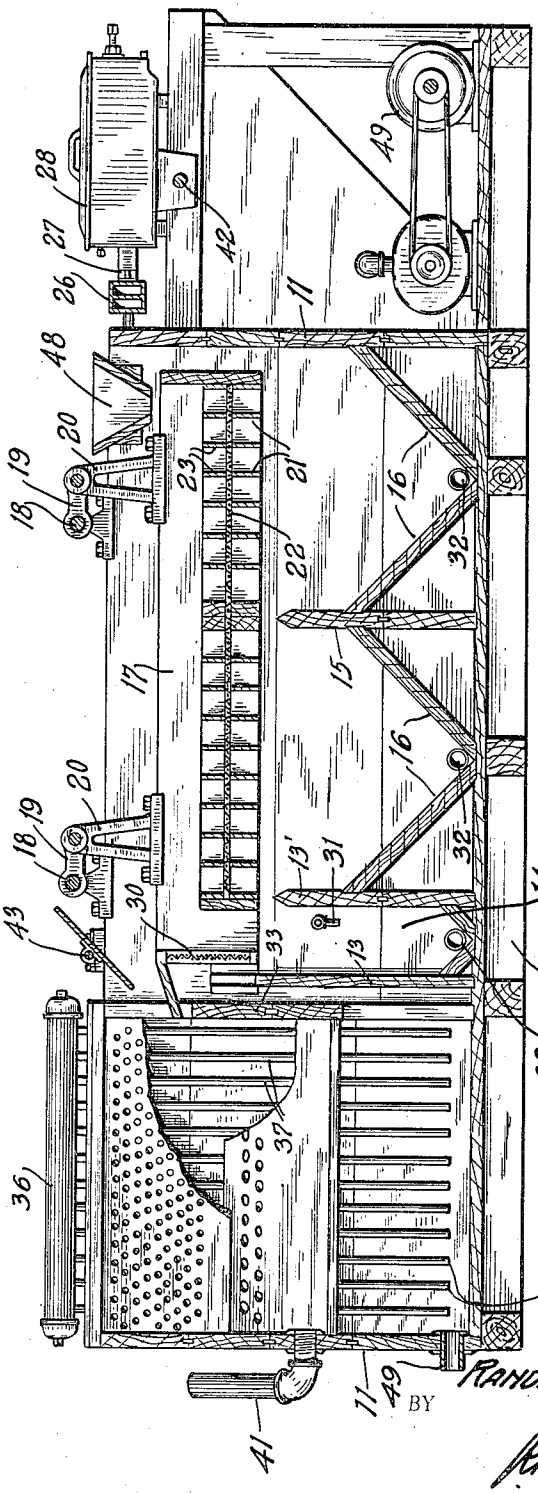


FIG. 5.

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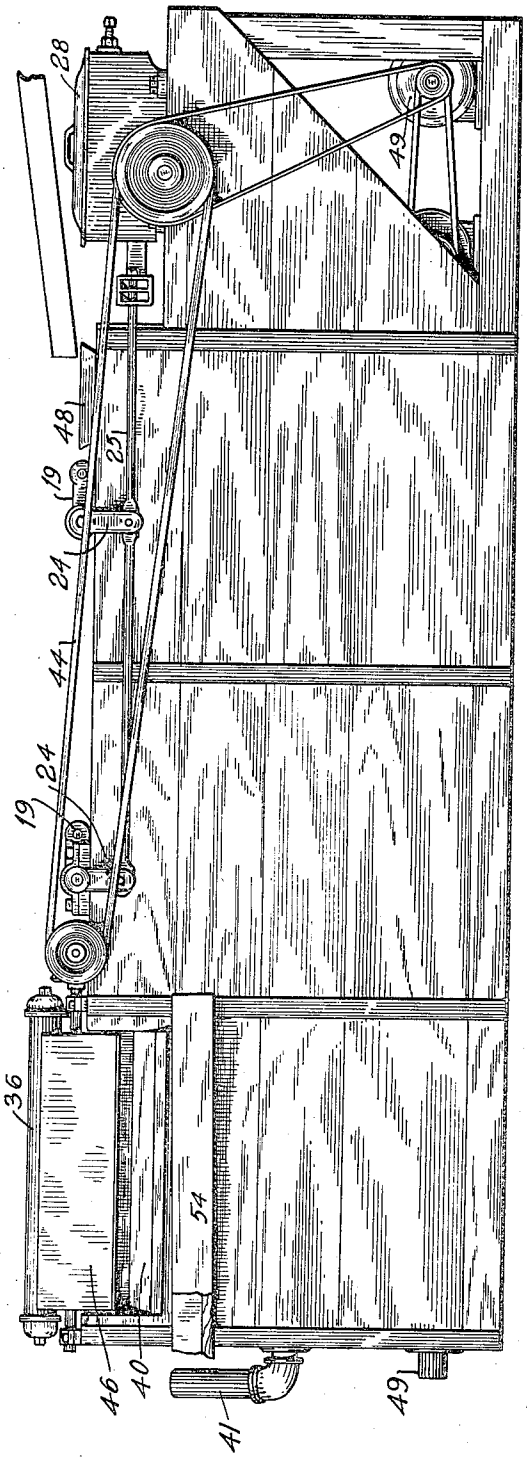


Fig. 6.

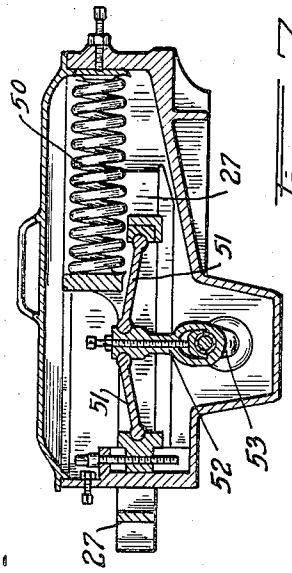


Fig. 7.

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ORE CONCENTRATOR

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Application September 3, 1935, Serial No. 38,937

2 Claims. (Cl. 209—425)

This invention relates to an ore concentrating machine and has for its principal object the provision of a device of this character which will combine the coarse concentrating action of a jig with the "fine" recovery of a flotation unit so as to eliminate loss of the mineral fines and yet to not require the capacity of the jig portion of the device to be reduced by attempting to recover the "fines" therein.

Another object of the invention is to provide a device of this character which will give a complete controllable classification and recovery in a single machine, that is, the fine values will be immediately separated from the coarse values and recovered; the medium values will be separated from the coarse and fine; and recovered, and the coarser values will be individually collected all in a single operation and in a single machine.

Another object of the invention is to provide a jiggling motion in which a very minute adjustment of the direction and intensity of movement can be had to obtain close classification and maximum capacity.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:—

Fig. 1 is a plan view of the complete machine.

Fig. 2 is a cross section through the jig portion, taken on the line 2—2, Fig. 1.

Fig. 3 is a cross section through the flotation portion, taken on the line 3—3, Fig. 2.

Fig. 4 is an end view looking in the direction of the arrow "4" Fig. 1.

Fig. 5 is a longitudinal section of the complete machine.

Fig. 6 is a side elevation thereof, looking toward the "left" side.

Fig. 7 is a detail, longitudinal section of the vibrating mechanism employed for vibrating the jig screen.

The invention comprises a supporting frame 10 supporting a relatively long tank. The tank terminates in two end walls 11 and is closed at its sides by two side walls 12. A pair of partition walls 13 and 13' divide the tank into a jigging compartment and a flotation compartment. Between the walls 13 and 13' is a preliminary flotation compartment 14.

The jigging compartment is divided by means of lateral partitions 15, below the solution line, into a series of hutches having inclined bottoms 16. A jig frame 17 is supported over the hutches of the jig compartment from a pair of laterally extending shafts 18. The shafts 18 carry relatively short horizontally positioned cranks 19 from which the jig frame 17 is suspended upon suitable hangers 20. The jig frame is divided into a series of screen compartments by means of lateral partitions 21 which support a jigging screen 22. Compartment boxes 23 rest upon the screens 22 to divide the space above the screen into sections or boxes.

The screen portion of the jig frame terminates in an end partition having a screen 30. The side members of the jig frame extend rearwardly to support the vertical end screen 30. The rearward partition 13' terminates immediately below the screen 30 so that the solution from the jigging portion may flow thereover into the flotation portion.

On the exterior of the tank, the transversely extending shafts 18 terminate in cranks 24 which extend downwardly therefrom. The cranks 24 at the two sides of the tank are connected by means of longitudinally extending connecting rods 25 which terminate in a cross head 26 adjacent the feed extremity of the machine. The cross head 26 is connected at its middle to the vibrating bar 27 of a vibrating mechanism designated in its entirety by the numeral 28.

An air pipe 31 is positioned in the preliminary flotation compartment. The latter compartment together with the hutches of the jig portion are provided with discharge outlets 32.

A lateral wall 33 forms the front end of the flotation portion. Wall 33 terminates above the bottom to allow the pulp from the jigging portion to enter at the bottom. The flotation portion is shown in section in Fig. 3 and consists of an inclined bottom 34 which directs settling material toward the back to a relatively narrow collection box 35 that extends longitudinally of the tank adjacent the rear wall 12.

An air manifold 36 is supported above the tank and provided with a series of downwardly extending air pipes 37 which terminate above the bottom of the collection box 35. An inclined froth baffle board 38 is positioned above the box 35 to direct rising material toward the rear wall. A perforated froth screen 39 extends upwardly therefrom parallel to the rear wall 12. The for-

ward wall 12 is provided with a froth overflow apron 40. The depth of the solution in the tank is regulated by means of a swinging discharge pipe 41.

The vibrating mechanism 28 is provided with a drive shaft 42 which may be driven from a motor 49 or in any other suitable manner. A shaft 43 extends transversely across the tank above the screen 30 and drives by means of suitable miter gears 47 another shaft that extends at right angles thereto and carries the paddle 46. The material to be treated is fed to the machine through a feed hopper 48.

The vibratory mechanism 28 is of a type to give a sudden forward stroke and a comparatively gradual rearward stroke.

The detail construction of the vibrator is illustrated in Fig. 7. The vibrating member 27 slides within a supporting housing. A compression spring 50 constantly urges the member 27 outward. Two toggle arms 51 push the member 27 inward. The arms 51 act against a pitman 52 which connects with a crank 53 on the shaft 42. As the pitman starts down the toggle arms are at their greatest angle so that a rapid movement is imparted to the member 27. As the pitman starts upward the toggle arms are in substantial alignment so that a slow movement is imparted to the member 27. This acts through the cranks 24 to give the jig frame 17 a sudden downward movement and a gradual upward movement.

In use the tank is filled with water to a point above the screen 22, the height being determined by the height of the overflow pipe 41. The material to be treated is fed with water into the hopper 48 and falls upon the screen 22. The jigging motion of the screen together with the solution flow travel across the boxes 23 toward the discharge extremity of the machine produces a classification of the material. The medium sized heavy material will work its way through the bed of sand on the jig screens and drop onto the hutch bottoms 16. The coarser particles dropping onto the first hutch bottoms and the finer particles onto the succeeding hutch bottoms. This will continue for as many cells as are provided. The tailings, the "fines" and the flour gold will pass over the discharge extremity of the screen frame into the preliminary flotation cell 14. Here, it will be met by rising bubbles of air from the pipe 31. These bubbles will attach themselves to some of the metal particles, and will act to create an upward current to raise the remainder of the particles so that they may flow over the partition 13. The particles which are attached to the froth will rise to the surface and be scraped over the partition by the scraper 45. Any remaining metallic particles will meet the rising air from the pipes 27 and flow through the froth screen 39 with the froth.

The tailings will settle to the bottom of the compartment 14 from whence they can be discharged through the discharge 32.

The screen 30 is constantly vibrated, since it is attached to the screen frame 17, so that it assists in keeping a vibration in the solution at this point to prevent settling of the "fine" values and to constantly maintain the screen in a clean condition.

The "fines" which were not floated in the chamber 14 flow into the bottom of the flotation portion and settle toward the collection box 35 where they meet the bubbles from the pipes 37 to which they attach themselves and rise through the froth screen 39 to the surface. The accumulated surface bubbles from the flotation portion and from the scraper 45 are scraped from the surface by the scraper 46 into a suitable receiving launder 54.

The exceedingly fine tailings will collect in the bottom of the flotation portion from which they may be discharged through an outlet 49. The coarse values are recovered through the discharge 32 from the first hutch. The medium values are recovered through the discharge 32 from the second hutch and the fine values from the launder 54.

The screen is vibrated with a combined vertical and horizontal movement. The horizontal movement is very slight and is determined by the arc of swing of the cranks 19. The forward movement can be adjusted to suit the operator and the material by positioning the cranks 19 at an inclined angle.

The quick downward movement allows the current to carry the pulp rearward and separate the heavier values which settle through the jig screen onto the hutch bottoms 16.

It is desired to call particular attention to the action of the cranks 19. The angle of the cranks may be changed, when desired, by adjusting the connecting rods 25 in the cross head 26, so that the cranks will approach either a horizontal or vertical position. When in a substantially horizontal position, very little horizontal movement will be communicated to the jig frame 17 during the jigging vibration and consequently there will be very little if any forward travel of the material along the jig frame. With the cranks in the vertical position, very little vertical movement will be imparted to the frame, and a maximum horizontal movement will be imparted thereto so that the material will travel rapidly along the jig frame.

It can be readily seen that from the above that by adjusting the cranks 19 to a position intermediate the two above extremes any desired speed of travel of the material may be obtained to suit the characteristics of the particular ore being treated. It is, of course, understood that the vibrating mechanism 21 is of the type to give a slow forward stroke and a relatively rapid return stroke so as to facilitate the travelling motion of the pulp.

The entire device may be carried upon a unitary supporting frame 10 so that it is comparatively easily portable which facilitates its use in temporary or experimental installations.

The above described machine has many uses and places but it is particularly valuable when installed in a mill circuit after the coarse crushing equipment and ahead of the fine grinding equipment. In this position it immediately eliminates a large proportion of the worthless tailings that would otherwise pass to the grinding mills. This of course increases the value of the flow to the subsequent treatments and the output of the mill. In addition to this, it recovers a marketable concentrate both in the froth launder and in the first cells or hutch bottoms which can be immediately removed from the mill circuit. This still further reduces the load on the subsequent grinding and milling equipment and increases the capacity of the mill without increasing the investment in subsequent treatment devices.

Another use for the invention would be to concentrate low grade ores such as found in mine dumps to an extent to make it practical to ship to mills for retreatment. All the equipment

needed would be a rough crusher and the above machine. The high concentrates could be saved, the light tailings discarded and the middlings shipped for treatment.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:—

1. A jig structure comprising: a longitudinally extending tank; a pair of shafts extending transversely over the top of said tank and beyond the sides thereof; bearings on the side walls of said tank supporting said shafts; a crank extending downwardly from each extremity of each shaft on the exterior of said tank; a connecting rod extending along each side of said tank connected to and supported by said depending cranks and extending beyond one extremity of said tank; a cross head extending across the latter extremity of said tank between said connecting rods; a differential vibrating mechanism attached to the middle of said cross head to impart a reciprocal vibration to said two connecting rods; a pair of horizontally extending cranks secured to each shaft intermediate its bearings and adjacent the latter, all of said latter cranks extending in a common direction; a bracket member depending from the free extremity of each of said latter cranks within said tank; a longitudinally extending jig frame within said tank having side frame members attached to said bracket members so that said jig frame will be supported from said horizontally extending cranks; a series of transversely extending partitions across the bottom of said jig frame; a screen supported upon said partitions; a series of compartments on said screen, said compartments being positioned below the top of said jig frame; and means for feeding ore into said jig frame.

2. A jig structure comprising: a longitudinally extending tank; a pair of shafts extending transversely over the top of said tank and beyond the sides thereof; bearings on the side walls of said tank supporting said shafts; cranks extending downwardly from each extremity of each shaft on the exterior of said tank; a connecting rod extending along each side of said tank connecting to and supported by said depending cranks and extending beyond one extremity of said tank; a cross head extending across the latter extremity of said tank between said connecting rods; a differential vibrating mechanism attached to the middle of said cross head to impart a reciprocal vibration to said two connecting rods; a pair of horizontally extending cranks secured to each shaft intermediate its bearings and adjacent the latter, all of said latter cranks extending in a common direction; a bracket member depending from the free extremity of each of said latter cranks within said tank; a longitudinally extending jig frame within said tank having side frame members attached to said bracket members so that said jig frame will be supported from said horizontally extending cranks; a series of transversely extending partitions across the bottom of said jig frame; a screen supported upon said partitions; a series of compartments on said screen, said compartments being positioned below the top of said jig frame; and means for feeding ore into said jig frame, all of said horizontally extending cranks being projected toward said cross head and said feeding means being positioned at the extremity of said jig frame nearest said cross head.

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