G. W. BURNHART & A. KRIEG.

ORE CONCENTRATING MACHINE.

APPLICATION FILED MAY 8, 1911.

1,106,923. Patented Aug. 11, 1914.

5 SHEETS—SHEET 1.

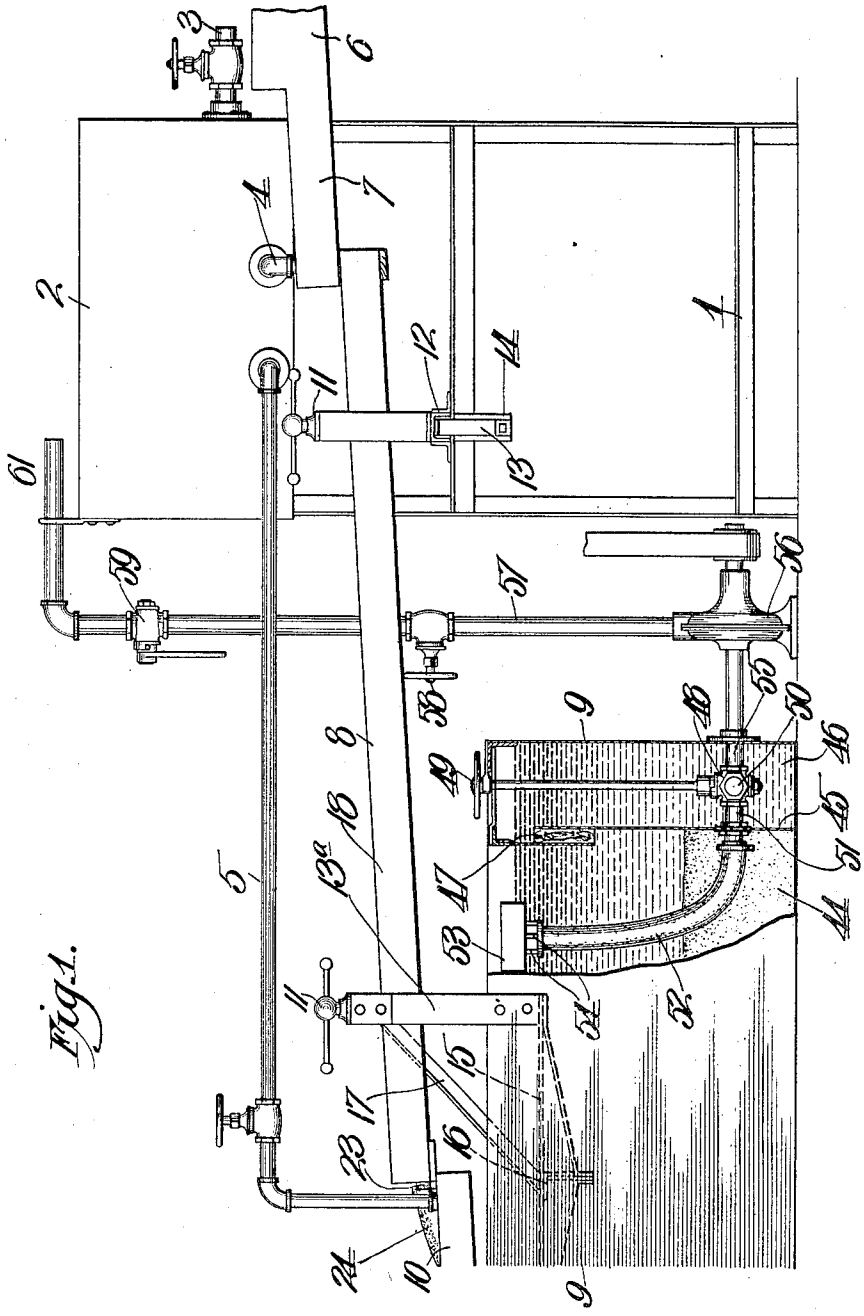

Fig. 1.

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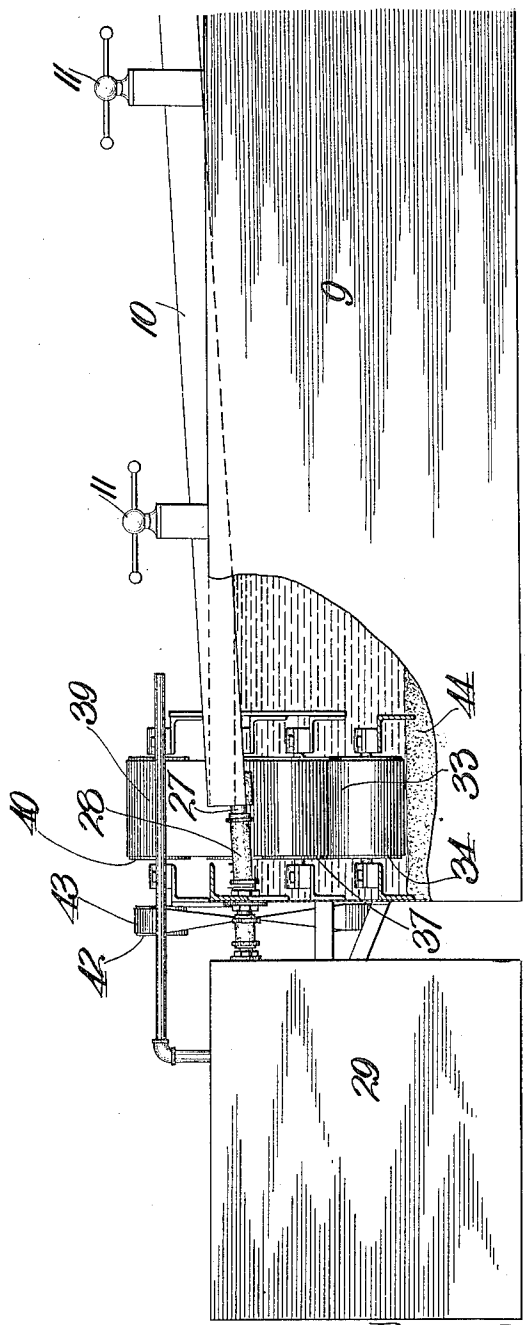
5 SHEETS-SHEET 2.

Fig. 2.



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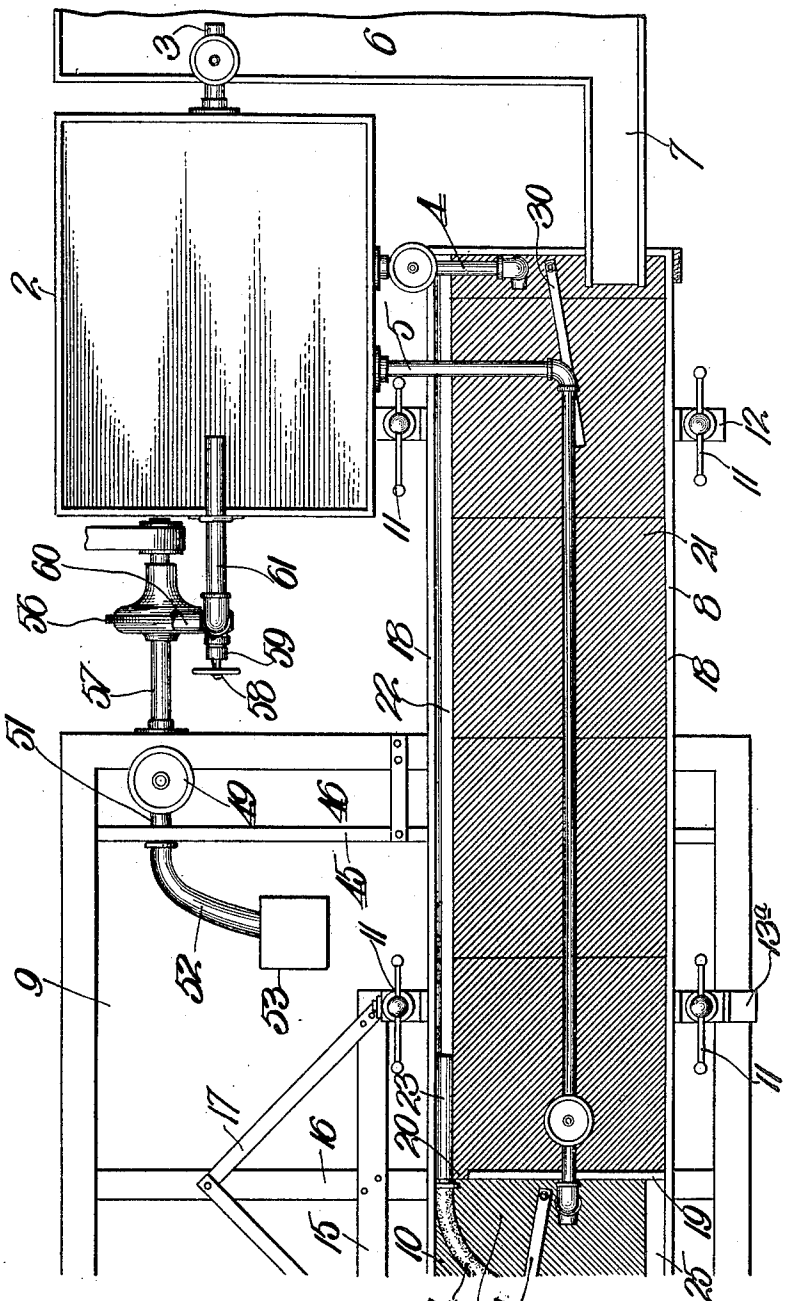
5 SHEETS—SHEET 3.

Fig. 3.



Witnesses

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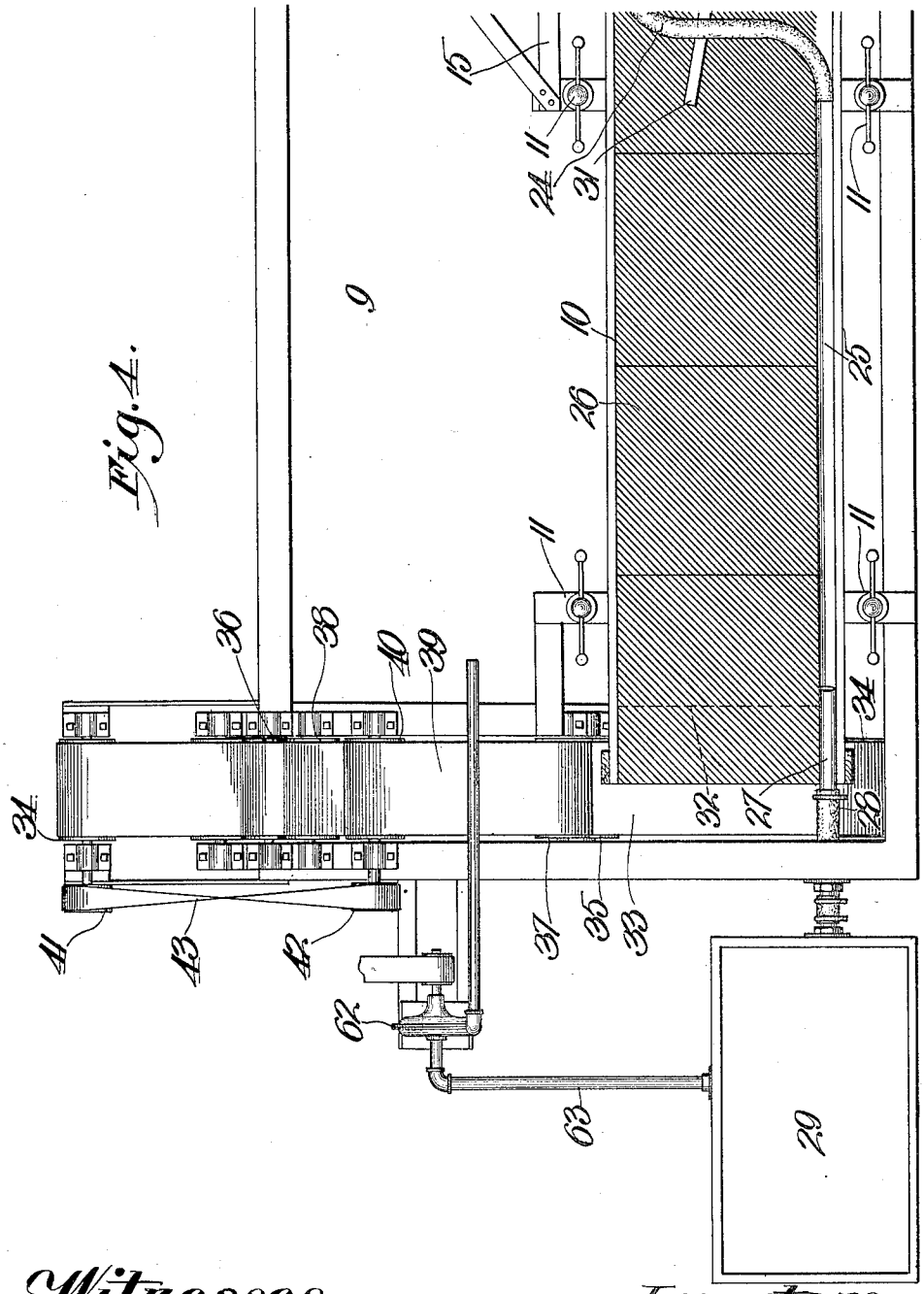
5 SHEETS—SHEET 4.

Fig. 4.



Witnesses

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5 SHEETS—SHEET 5.

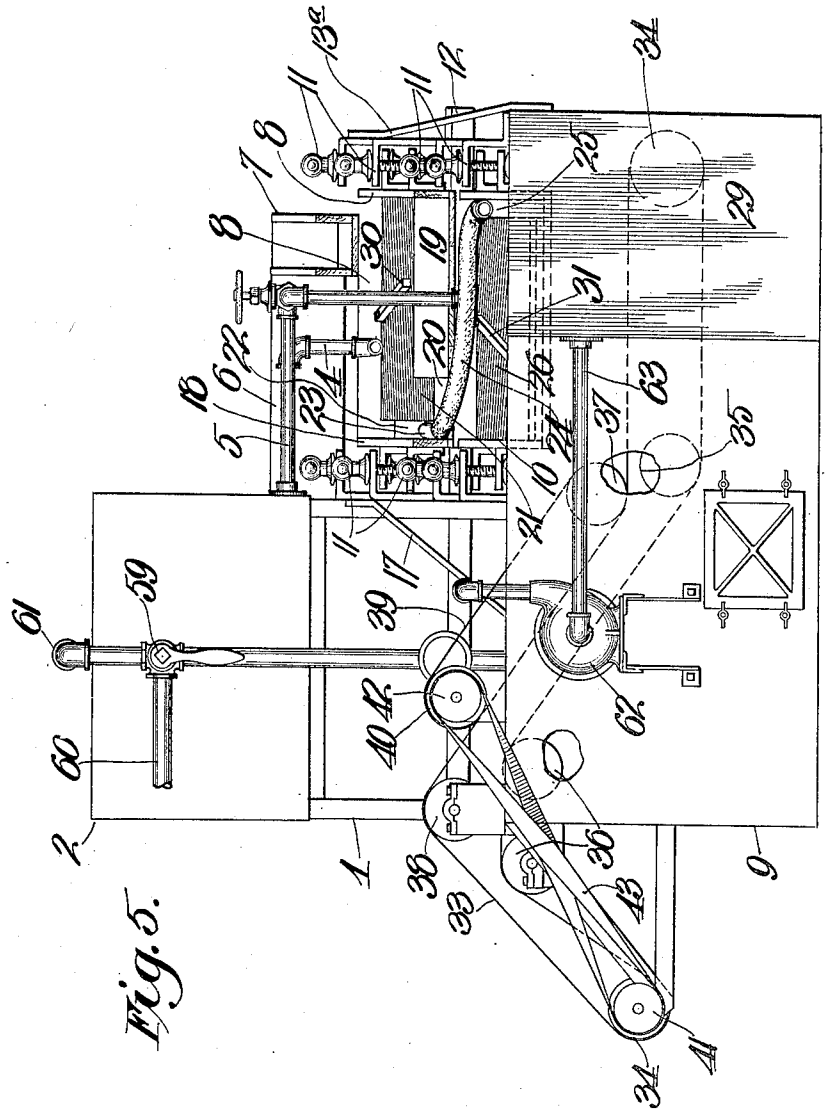

Fig. 5.

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UNITED STATES PATENT OFFICE.

GEORGE W. BURNHART, OF WARD, COLORADO, AND ALBERT KRIEG, OF KANSAS CITY, MISSOURI.

ORE-CONCENTRATING MACHINE.

1,106,923. Specification of Letters Patent. Patented Aug. 11, 1914.

Application filed May 8, 1911. Serial No. 625,884.

To all whom it may concern:

Be it known that we, GEORGE W. BURNHART and ALBERT KRIEG, citizens of the United States, residing, respectively, at Ward, in the county of Boulder and State of Colorado, and Kansas City, Jackson county, State of Missouri, have invented certain new and useful Improvements in Ore-Concentrating Machines, of which the following is a specification.

This invention relates to ore concentrators whereby the concentrates, tailings and slimes are separated and the water employed to effect such separation may be repeatedly used if desired, and our object is to produce apparatus of this character which will operate efficiently and reliably with crushed ore, gold bearing sand, or water containing fine particles of gold in suspension.

With this general object in view and others as hereinafter appear, the invention consists in certain novel and peculiar features of construction and organization as hereinafter described and claimed; and in order that it may be fully understood reference is to be had to the accompanying drawings, in which—

Figure 1, is a side elevation partly broken away of the front end of concentrating apparatus embodying our invention. Fig. 2, is a similar view of the rear half of the apparatus. Fig. 3, is a plan view of the half of the apparatus shown by Fig. 1. Fig. 4, is a plan view of the half of the apparatus shown by Fig. 2. Fig. 5, is a rear end view of the apparatus.

In the said drawings, 1 is a suitable frame supporting a water tank 2, at a suitable height, provided with valve controlled discharge pipes 3, 4, and 5, pipe 3 being adapted to discharge onto a table adapted to receive ore or its equivalent to be subjected to the concentrating operation, the said table being preferably inclined toward the rear and provided with a discharge chute 7, overlying the front end of a separating table 8, near the outer front corner of the same. The discharge end of said table overlies a relatively large tank 9, and a second or supplemental separating table 10, also overlying the tank and terminating short of the rear end of the latter.

The tables 8 and 10 incline downwardly toward their rear ends, the former being tilted or canted so that its outer front corner shall occupy a higher and its inner rear corner a lower plane than any other part of the table, and the table 10, is reversely tilted or canted, that is to say its inner front corner occupies a higher and its outer rear corner a lower plane than any other part of the table.

The tables are supported in any suitable manner upon screw jacks 11, in order that proper adjustment of the latter will give the tables more or less pitch or inclination, it being noted that the jacks at the front end of table 8 are mounted upon an inverted channel bar 12 extending outward from frame 1, and that the outer end of said bar 12 is braced by an inclined brace 13, secured at one end on the channel bar and at its opposite end to another bar 14 depending from frame 1. The remaining jacks are mounted upon U-shaped cross bars 13ª, each of which is suitably secured at its outer end upon one wall of tank 9 and at its inner end preferably upon a longitudinal bar 15 supported by a cross bar 16, and the rear end wall of the tank as shown most clearly in Figs. 3 and 4, any suitable bracing such as shown at 17 being employed to brace the upper ends of the jacks, it being understood however that the particular means for supporting the jacks is immaterial.

Both tables are provided with side walls 18 and table 8 with a rear end wall 19 which terminates short of the inner side wall, so as to provide a gate way 20, through which the tailings and most of the water and slimes may be discharged onto table 10. Table 8 is provided with a diagonally corrugated bottom 21 of glass or equivalent material, and the inner side of said corrugated bottom of the table is formed with a narrow longitudinally extending channel 22 adapted to discharge the concentrates entering the trough, into the mouth piece 23 of a curved and preferably flexible pipe 24 which extends transversely over the front end of table 10, and discharges into a longitudinal channel 25, provided adjacent to the outer side wall of table 10, the greater portion of table 10 being provided with a diagonally corrugated glass or equivalent bottom 26, the corrugations being reversed to the corrugations of bottom 21, for the purpose of guiding the concentrates from said table 10, into the said channel 25, and fitting in the rear end of channel 25 is a

mouth piece 27 for a flexible or equivalent piece of hose 28 which extends through the rear wall of tank 9, and into a concentrate tank or vessel 29.

Secured on the corrugated portion 21 of table 8 at a point between chute 7 and the discharge end of pipe 4, is a distributer 30, the same extending convergingly rearward with respect to the outer side wall of said table. This distributer is intended to insure the travel of the ore or its equivalent for some distance along the table near the outer wall thereof to give it an opportunity under the force of the water discharged with it from the chute, to become segregated or spread out and thus guard against it passing in a mass into the channel 22, it being understood that the diagonal corrugations tend to cause the ore to move rearwardly and inwardly and that the water flowing through the grooves will facilitate such movement and also tend to carry the concentrates into the channel 22, it being also noticed that the water discharged in a longitudinal direction from nozzle 4 onto the table will tend to facilitate the separation of the concentrates from the tailings and quickly carry the same into the channel 22, and through the latter into the mouth piece 23, and thence through tube 24 into channel 25 of table 10, from which the concentrates pass through tube 28 into the concentrate receptacle 29.

It will be understood that the current of water on the table discharged from the nozzle 4, travels at a much greater speed than that which passes with the ore from chute 7, and as a result it tends to thoroughly wash from the concentrates in the grooves in its path, the tailings which have started with such concentrates toward the channel 22, such tailings under the force of the faster current moving toward the discharge end of the table in a direction substantially parallel with the channel so as to eventually pass through the gateway 20. In practice the difference in the speed of the flowing water from the two sources of supply is so marked that apparently two distinct currents are traversing the table, the one from the chute apparently flowing diagonally toward the channel with the groves, and the one from pipe 4, apparently directly rearward on top of the water flowing through the grooves of the bottom, the cross currents very efficiently cleaning the concentrates and permitting them because of their greater specific gravity, to continue their movement through the grooves until they enter the channel. This cross current action also occurs on the table 10, and as a result practically all of the concentrates or most valuable constituents of the ore eventually enter the concentrate receptacle 29.

The tailings which pass through the gateway 20, fall on the table 10 at the inner side of a distributer 31 secured thereon and corresponding in function to distributer 30, distributer 31 extending convergingly rearward with respect to the inner wall of table 10 as shown clearly in Figs. 3 and 4 and in the last-named figure it will be noticed that the corrugated bottom is shown as made in sections in which form it will be more economical to make it.

The water discharged through the gateway with the tailings will tend to effect the rapid flow of the latter toward the rear end of table 10, and to effect separation therefrom of concentrates mixed therewith and to facilitate the passage of such concentrates over said table and to insure their arrival in channel 25, the valve controlled discharge pipe 5 is arranged to discharge water on table 10, at the outer side of the distributer 31, this discharge pipe 5 performing the same office for table 10 that discharge pipe 4 performs for table 8.

Most of the water with the slimes in suspension and the tailings fall from the rear end of the table 10 into water contained in tank 9, this water standing to about the level shown in Fig. 2, so that the depressed rear outer corner of such table 10 shall be partly submerged, the water standing over the depressed end of the table to the dotted lines 32 of Fig. 4, for the purpose of checking the rapidity of the discharge of the tailings and the flow of the water from said table in order that the former shall in effect drop vertically downward from the table.

33 is an endless belt or conveyer extending transversely of the tables and at one end underlying the discharge end of table 10 for the purpose of catching and retaining the tailings dropping therefrom, the distance between the table and the belt being sufficient to permit of the separation of the tailings and slimes held in suspension by the water, so that the slimes shall not accumulate on the belt. The other end of the belt is exterior to the tank 9, and the ends of the belt engage suitably supported pulleys 34, and between its ends the lower run of the belt passes under guide pulley 35 and over guide pulleys 36, one within and the other at the outer side of the tank, as shown clearly in Fig. 5. The upper run of the belt passes under a suitably supported pulley 37 and over a suitably supported pulley 38.

Overlying the upper run of belt 33 between pulleys 37 and 38 and mounted at one end on the former is a belt 39, the other end of the belt engaging a suitably supported pulley 40, the arrangement of the belt 39 being such that its lower run shall be in frictional contact normally with the underlying portion of the upper run of belt 33.

Rotatable with pulleys 34 and 40 respectively, are pulleys 41 and 42 and connecting the same is a crossed belt 43, and one of said pulleys is adapted to be driven by any suitable means, not shown, and thus impart simultaneous movement to the two belts and cause the underlying runs to travel upwardly and away from the tables so that the said overlying belt shall by pressure upon the tailings carried by belt 33, coöperate with the latter in the withdrawal of such tailings from the tank, as will be readily understood.

The slimes discharged into the tank from table 10 will through their specific gravity gradually collect upon the bottom of tank 9 as shown at 44, being prevented from reaching the front end of the tank by the vertical partition 45 therein. The partition terminates short of the top of the tank in order that the water when it accumulates therein to a predetermined depth will overflow into the chamber 46 formed by said partition, and arranged within the tank at the opposite side of the partition from chamber 46 and extending downward a substantial distance below the upper end of the partition, is a tubular filter 47, up through which the water must pass before entering chamber 46. By this arrangement the slimes are retained in the body of the tank and water in practically purified condition, enters chamber 46.

48 is a three-way valve in chamber 46, controllable by a handle 49. The valve is provided with an opening 50 to receive water from chamber 46, and with a short nozzle 51, extending into the body of tank 9 and provided with a flexible extension 52, equipped at its upper end with a float 53, the connection 54, between the float and the upper end of the tube being such that the water can enter the tube below the float.

55 is a pipe leading to a pump 56, and leading from the latter is a stand pipe 57 provided with a controlling valve 58. It is also provided with a three-way valve 59 above valve 58, and leading from valve 59 is a pair of nozzles 60 and 61, the latter being arranged to discharge into tank 2, nozzle 60 also leading to a suitable receptacle not shown. By proper adjustment of the three-way valves 58 and 59 the pump can be utilized to pump the purified water from chamber 46, into tank 2, from which it will be discharged through pipes 3, 4, and 5 as hereinbefore explained.

When it is desired to remove the slimes, from the body of the tank, the three-way valves are adjusted to establish communication between the flexible extension 52 and nozzle 60, so that when the pump is started up the water will be withdrawn from the body of the tank, it being understood that the float descends with the water and therefore keeps the upper end of the nozzle 52 submerged until practically all of the water has been withdrawn. In this connection it will be understood that when the water is pumped from the body of the tank, the valve 48 is not in communication with chamber 46, and that when the water is pumped from said chamber the passage of water through the extension 52 is cut off. After the water is practically all withdrawn from the body of the tank, the slimes may be shoveled or otherwise withdrawn therefrom and thus, if water is scarce, that which was pumped from the body of the tank is resupplied thereto as it is preferred that the water shall stand in the tank to the level hereinbefore indicated, before the concentrating operation begins.

The water which enters the concentrator tank 29 may be permitted to overflow the same or may be pumped by a pump 62 through a pipe 63 connected at one end to the concentrator tank and adapted to discharge at its opposite end into tank 9.

Under ordinary conditions the tables will be tilted as explained but when operating with placer material or extracting gold in suspension from the water, the tables will preferably be horizontal transversely and tilted only slightly in a longitudinal direction and for convenience the tables are shown as only tilted endwise.

From the above description it will be apparent that we have produced an ore concentrating machine possessing the features of advantage enumerated as desirable and we wish it to be understood that while we have illustrated and described the preferred embodiment of the invention we do not wish to be restricted to the exact details of construction shown and described, as obvious modifications will suggest themselves to one skilled in the art.

We claim:

1. In an ore concentrating apparatus, a tilted table having transverse diagonal grooves and a channel along one side, a wall across the lower end of said table provided with an opening at the lower end of said channel, means for delivering ore on to the upper end of said table at the side opposite the channel, and a nozzle for discharging a stream of water across the upper surface of the table adjacent the channel in approximately the direction of said end opening.

2. In an ore concentrating apparatus, a slightly tilted table having transverse diagonal grooves and a channel along one side, a wall across the lower end of said table provided with an opening at the lower end of said channel, a second tilted table having its receiving end beneath the lower end of the first table, and the rest of said second table extended away from and in the same general direction as the first table, said second table being grooved and channeled reversely to

the first table, means for delivering ore on to the upper end of the first table at the side opposite its channel, and means for directing a rapid stream of water across the side of said first table adjacent its channel and through its end opening on to the second table.

In testimony whereof we affix our signatures, in the presence of two witnesses.

GEORGE W. BURNHART.
ALBERT KRIEG.

Witnesses:
HELEN C. RODGERS,
G. Y. THORPE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."