

No. 682,749.

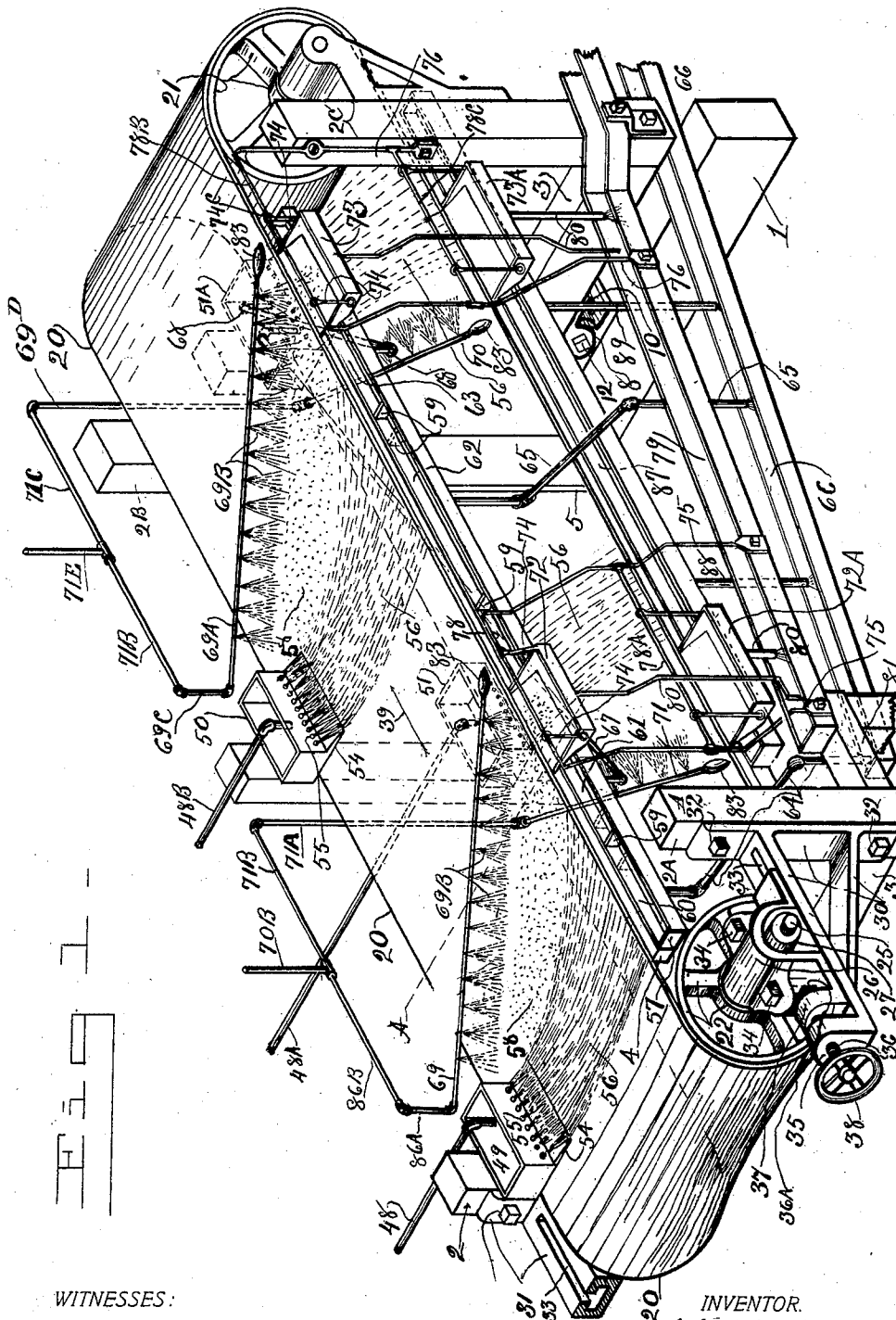
Patented Sept. 17, 1901.

J. G. ROBERTS.
ORE CONCENTRATOR.

(Application filed Apr. 15, 1901.)

(No Model.)

2 Sheets—Sheet 1.



WITNESSES:

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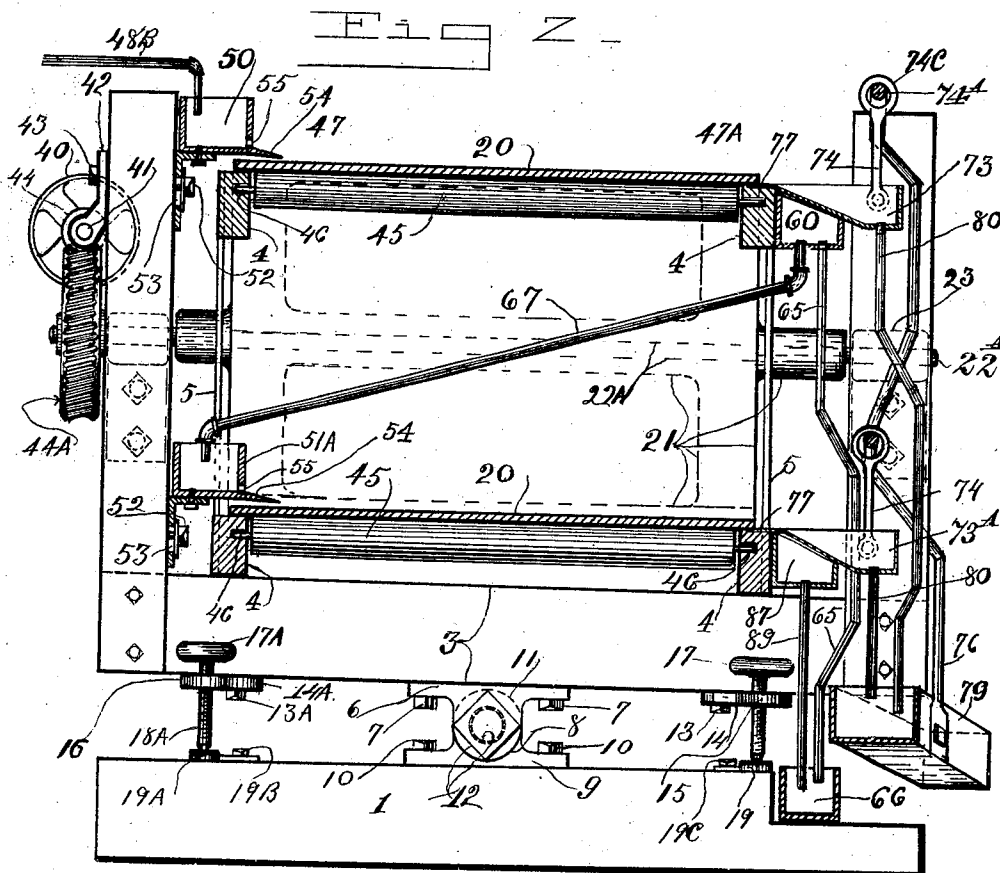
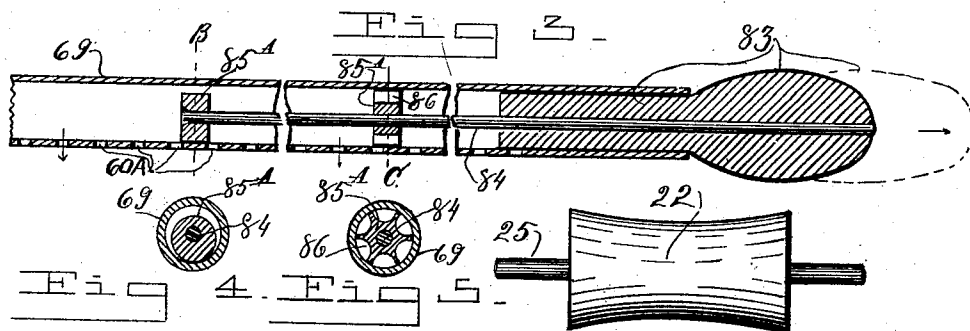
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2 Sheets—Sheet 2.



WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN G. ROBERTS, OF IDAHO SPRINGS, COLORADO.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 682,749, dated September 17, 1901.

Application filed April 15, 1901. Serial No. 55,972. (No model.)

To all whom it may concern:

Be it known that I, JOHN G. ROBERTS, a citizen of the United States of America, residing at Idaho Springs, in the county of Clear Creek and State of Colorado, have invented certain new and useful Improvements in Endless-Belt Ore-Concentrators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in endless-belt concentrators; and the objects of my invention are, first, to provide an endless-belt concentrator adapted to concentrate the slimes and ore from the different compartments of jigs at the same time; second, to provide an endless-belt concentrating-table adapted to concentrate ore from ore-pulp and slimes of stamp and other ore crushing and pulverizing machinery; third, to provide means for distributing an even supply of water transversely across the belt to wash the concentrates from its surface; fourth, to provide adjustable hoppers for catching the concentrates that can be moved and set at different positions along the discharge side edge of the concentrating-belt, and, fifth, to provide means for reconcentrating the middlings of the top portion of the belt. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of a concentrating-machine embodying my invention. Fig. 2 is an enlarged sectional view of the belt substantially on line A of Fig. 1 and is also a section of several other parts of the concentrator. Fig. 3 is a sectional fragmentary view of one of the water-distributing pipes. Fig. 4 is a cross-section on line B of Fig. 3. Fig. 5 is a cross-section on line C of Fig. 3, and Fig. 6 is an elevation of the adjustable pulley that supports one end of the concentrating-belt.

Similar figures of reference refer to similar parts throughout the several views.

Referring to the drawings, the numeral 1 designates the supporting foundation-timbers of my concentrator; 2 and 2^A and 2^B and 2^C,

vertical posts that support the boxes and brackets that support the concentrating-belt pulleys. 3 designates the base-timber, 4 the side rails, and 5 the vertical supports of the side rails. These several parts compose the foundation and the tilting frame that supports the endless belt of my concentrator. The parts of the tilting frame are shown in Fig. 3.

To the central portion of the timber 3 of the tilting frame I secure a plate 6 by bolts 7. This plate is provided with two depending lugs 8, which are spaced a short distance apart. A plate 9 is bolted by bolts 10 to the top of the bed-plate timbers 1, which is provided with an upwardly-projecting lug 11, that extends loosely between the lugs of the plate 6. The lugs are pivotally bolted together by a bolt 12, which passes centrally between them. To each of the opposite ends of the timber 3 I secure by bolts 13 and 13 plates 14 and 14^A, which are provided with lugs 15 and 16, that project beyond the sides of the timber far enough to allow hand-wheels 17 and 17^A, which are secured to the upper end of studs 18 and 18^A, to be turned. The studs 18 and 18^A are threaded to each of the lugs and extend through them, and their ends bear against plates 19 and 19^A, which are bolted to each corner of the timber 1 by the bolts 19^B and 19^C. By screwing up one of the studs and screwing down the other the tilting frame can be tipped and set at any desired angle relative to a horizontal plane it is desired to give the concentrating-belt 20. This concentrating-belt 20 consists of a plain endless belt of rubber, preferably about forty feet long. It is mounted on two pulleys 21 and 22. The pulley 21 is a straight crowned belt-pulley, but the pulley 22 is a concaved crowned pulley, as shown in Figs. 1 and 6. The pulley 21 is mounted on a shaft 22^A in stationary boxes 23, which are attached by a bracket portion to the posts 2. The pulley 22 is mounted on a shaft 25, which is supported in ball-and-socket pillow-blocks 26. These ball-and-socket pillow-blocks are in common use and consist of the box 27 and the pillow-block 26. The boxes are arranged to have a limited vertical and lateral pivotal movement in the pillow-block. The pillow-blocks, of which only one is shown in Fig. 1, are adjustably mounted on slotted brackets 30 and 31, which are se-

cured by bolts 3^A and 32 and 32^A to the posts 2 and 2^A. The pillow-blocks are slidably secured to the slots 33 of the brackets by the bolts 34. The ends of the brackets are provided with a lug 35, to which a screw 36 is threaded, one end of which passes freely through a lug 37, formed on the pillow-block, and the end of the screw 36 is secured rotatably in the lug by a nut 36^A, which is secured to its end. A hand-wheel 38 is secured to the outer end of the screw, by means of which it may be turned to draw the pillow-block toward the lug at the end of the bracket, and thereby tighten the belt, or push the pillow-block toward the posts, and thereby slacken the belt. After the belt is adjusted the pillow-block is bolted tight to the bracket by the bolts 34. The concentrating-belt moves very slowly in the direction of the arrow 39, it being driven by a pulley 40, that is mounted on a shaft 41, that is journaled in a suitable supporting-bearing 42, which is bolted to the post 2^B by the bolt 43. A worm-pinion 44 is also secured on the shaft 41, adjacent to the pulley, which meshes into a worm-gear 44^A, that is secured to the end of the shaft 21^A of the concentrating-belt's driving-pulley 21. This driving mechanism is shown only in Fig. 3.

The concentrating-belt while it moves very slowly has a tendency to creep toward the slack side of the adjusting-pulley 22, which is probably due to the slight transverse inclining position the belt runs in. Usually a belt runs to the highest or tightest side of a pulley; but it runs the reverse on these pulleys. To overcome this, I make the face of the adjusting-pulley 22 concaved, as shown in Figs. 1 and 6, which obviates this difficulty when either one or the other side of the belt is slightly tightened by the hand-screws. The belt is supported between its end pulleys on rollers 45, which are positioned at suitable distances apart to hold it up in substantially a level plane. These rollers are provided with trunnions 46, which fit loosely in holes formed in the sides of the side rails 4 of the tilting frame. The belt is positioned by tilting the tilting frame to stand at a slight downward inclination transversely, as shown in Fig. 3, the side 47 being the highest and the side 47^A the lowest. The highest side is the ore-pulp-feed side, and the lowest side is the tailings and middlings and concentrates discharge side. The ore-pulp flows through the pipes 48, 48^A, and 48^B from a source of supply and is fed onto the table through distributing-boxes 49, 50, 51, and 51^A. These boxes are secured to the posts by bolts 52 and are vertically adjustable on the posts by means of a slot 53, formed in each, through which the bolts pass. (See Fig. 3.) The distributing-boxes are provided with a distributing-apron 54, that inclines down toward the belt at its top side from the box. The boxes close to the upper edge of the aprons are provided with a row of small holes 55,

through which the pulp 56 flows from the boxes over the apron onto the upper or higher side of the belt, from which it flows, owing to the slight downward inclination of the belt, in a stream 56 to its opposite side, where the tailings and water discharge or flow from the belt into a discharge-trough 57. This trough is secured in any suitable manner to the adjacent side rail. The mineral in the pulp settles to the surface of the belt as the pulp flows over it, and as the belt moves slowly in the direction of the arrow the pulp is deflected, as shown, from a direct path across the table, and the clear clean concentrates 58 are carried by the belt away from the path of the flowing pulp. There is, however, a small portion of the mineral in the pulp that is disseminated throughout its edge from which the concentrates feed that are carried away with the tailings and discharge into the trough. This portion of the mineral and the pulp is called the "middlings," and one of the objects of my invention is to save and concentrate this portion of the pulp from the distributors of the top of the belt. In order to do this, I place an adjustable partition 59 in the trough to separate the middlings portion of the pulp from the tailings. This partition consists of a piece of any suitable material fitted tightly but removably between the sides and against the bottom of the trough in such a manner as to form in the trough the compartments 60 and 61, which are located in the trough transversely across the belt from the feed-box 49, and also the compartments 62 and 63, which are located transversely across the belt opposite the feed-box 50. In these compartments of the trough the tailings and middlings are separated from one another as they discharge from the concentrating-belt. These partitions are made adjustable, so that they can be moved and placed at any desired point in the middlings portions of the width of the pulp stream, as the point at which the middlings portions should be separated from the tailings varies in different ores. The tailings portion of the pulp is conveyed from compartments 60 and 62 through pipes 64 and 65, which are secured to their bottom portion to the discharge-chute 66, from which it runs to waste. The middlings portion is conveyed from the compartments 61 and 63 through the pipes 67 and 68, which are attached to the bottoms of these compartments, to the distributing-box 51^A, from which it flows across the top portion of the lower portion of the belt. The fine clear concentrates 58 from the pulp of the distributing-boxes as it travels along with the belt encounters streams of clear water 69^B, which are delivered on the belt from the pipes 69, 69^A, 70, and 71, which are arranged diagonally across the belt in a direction to wash the concentrates toward the lower and discharge side of the belt. These pipes are placed at any suitable distance from the distributing-boxes in the path of the

moving ore. They are provided with a row of small holes 60^A, which are positioned close enough together to discharge the clear wash-water onto the belt in a thin sheet or spray, that will extend uninterruptedly across the belt, so that no particles of ore will be carried by the belt past the pipes. The pipes are arranged diagonally across the belt, so that the water will engage the concentrates at the highest side of the belt first and they will be continuously washed to the lower and discharge edge of the belt by the diagonal position of the pipes and path of the discharging water. From the belt the concentrates discharge into adjustable hoppers 72, 73, 72^A, and 73^A, which are suspended by pivotal rods 74 from iron supporting-frames 75 and 76, that are secured in any suitable manner at the discharge side of the belt. These hoppers are preferably made of galvanized iron or tin and one side tapers up over the trough 57 to a lip portion 77, that rests on the top of the adjacent side rail and extends under the edge of the belt. (See Fig. 3.) The rods 74 are secured to the opposite ends of the hoppers and at their opposite ends eyes 74^A are formed, that surround loosely the horizontal rods 73, 78^A, 78^B, and 78^C of the supporting-frames 75 and 76. The frame 75 is shown secured at its ends to the concentrates-chute 79, and the frame 76 is shown secured at one end to the concentrates-chute 79 and at its opposite end to the post 2^C. My invention contemplates, however, any suitable support for these hopper-supporting frames. The hoppers are made wide enough to receive the full width of the stream of concentrates that is washed to them by the water from the diagonally-arranged pipes, and they are adjustable longitudinally of the belt by sliding them along on their horizontal rods. This adjustment is frequently made necessary by the action of the concentrates of ores of different characters, some being light and moving very freely over the belt before the washing action of the water, which drives them easily ahead and away from it, others being heavy or a mixture of light and heavy particles of mineral which are not so easily moved by the water and feed along where its pressure is the greatest, which necessitates a change in position of the hoppers. Then, again, a heavy ore might be feeding into one distributing-box and a light ore into another. Each one of the hoppers is provided with a discharge-pipe 80, which is secured to its bottom and conveys the concentrates and water that flows into them to the concentrating-chute 79. This chute is supported by the post 2^C and a projecting member 8^I of the frame of the machine or in any other suitable manner.

In order to be able to thoroughly wash the concentrates from the belt and from off the discharge end of the belt, it is necessary that an even pressure of water be maintained and constantly discharged evenly across the belt,

and as the water used flows almost always to the pipes by gravity it is necessary to employ some means to regulate the flow and pressure of the water throughout the length of the perforated section of pipe to satisfactorily wash the concentrates from the belt. I preferably carry out this feature of my invention in the following manner: In the end of each pipe I fit a handle 83, preferably making it of wood and arranging it to extend several inches into the pipe tight enough to prevent the water from leaking too freely by it when placed in the pipe at any portion of its length. To the handle I secure an iron rod 84, which extends from the handle about two-thirds of the length of the pipe, and on this rod I place two or more iron washers 85 and 85^A, placing them several inches or from twelve to eighteen inches apart, depending on the head and amount of water required on the belt. These washers are arranged to allow the water to flow by them and fill the pipe, thus insuring an even and constant supply. Yet at the same time they keep the greatest pressure and flow at the opposite end of the pipe from the handle or at the high side of the belt. In order to let the water flow freely by them, they may be made with a series of notches 86 cut in their peripheries, as shown at Fig. 5, or they may be made of smaller diameter than the pipe, as shown in Fig. 4. The clear-water-distributing pipes 69 and 71 connect to pipes 86^A and 86^B and 71^A and 71^B, respectively, all of which connect to a pipe 70^B, that leads to a source of supply. The pipes 69^A and 70 connect to pipes 69^C and 71^B and 69^D and 71^C, respectively, all of which connect to a pipe 71^E, that leads to a source of supply. The tailings from the distributing-boxes 51 and 51^A, which deliver pulp 56 to the lower portion of the belt, discharge into a chute 87, from which they discharge through pipes 88 and 89 into the discharge-chute 66. As the distributing-box 51^A redistributes over the lower portion of the belt only the middlings of the pulp flowing from the distributing-boxes 49 and 50 onto the upper portion of the belt, all of the tailings of the box 51^A run to waste. The distributing-box 51 is adapted more particularly to receive the fine concentrated pulp from hydraulic sizers. Consequently all its tailings are allowed to run to waste, and the boxes 49 and 50 receive the coarser concentrated pulp also from hydraulic sizers.

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

1. In an ore-concentrator, the combination of the endless belt having a concaved, adjustable pulley arranged to support one of its ends and a fixed pulley arranged to support its opposite end, a suitable frame pivotally mounted and arranged and adapted to operatively support said belt and its supporting-pulleys, means including screws for tilting and adjustably setting said frame at any desired transverse inclination to give said belt a side

or transverse pitch or inclination, means including a screw-controlled pillow-block and bearing, and a slotted bracket arranged to support said convex pulley for adjustably tightening said belt, one or more ore-pulp-receiving boxes arranged at the higher side of both the lower and upper portions of said belt, an apron portion on said pulp-boxes, a series of small pulp-discharging holes in said boxes above said apron arranged to discharge pulp over said apron onto said belt, means for conveying ore-pulp to said distributing-boxes, a trough arranged along the lower side of said belt adapted to catch the tailings of said pulp from said belt, a movable adjustable partition in said trough arranged to form two or more compartments and to separate and divide said pulp into tailings and middlings, a discharge-chute below said trough, pipes secured to the tailings-compartments of said trough and arranged to discharge into said discharge-trough, and a pipe leading from each of said middlings-compartments of said trough to one of the said distributing-boxes of said lower portion of said belt, and arranged to convey said middlings portion of said pulp to said distributing-box, and means including power-driven gearing for imparting a slow, longitudinal movement to said belt, substantially as described.

2. In an ore-concentrator the combination of the adjustable tilting frame, the endless rubber belt operatively mounted in an adjustable, transversely-inclined position, and having an adjustable, concave pulley at one end, distributing-boxes arranged and adapted to deliver ore-pulp onto the higher side of said belt, a trough arranged along the discharge side of said endless belt, movable partitions in said trough arranged to divide said pulp into tailings and middlings portions, means for conveying said tailings portion from said trough, means for conveying said middlings portion to a distributing-box on the lower portion of said belt, a clear-water-distributing pipe arranged diagonally across said belt adjacent to each of said distributing-boxes and arranged to diverge away from said distributing boxes, a row of water-discharging holes arranged along said pipe, an adjustable plug-handle in the end of said pipe a rod extending from said handle along said pipe and washers on said rod arranged to allow a portion of the water flowing into said pipe to flow past them and adapted to regulate the flow and pressure of the water in said pipe, and a hopper arranged along the lower edge of said belt adjacent to each of said clear-water-supply pipes, and provided with a lip arranged to extend under the edge of said belt and arranged and adapted to be adjustably

moved a predetermined distance along the edge of said belt, and power-driven means for imparting a slow, continuous, even traveling movement to said belt, substantially as described.

3. In an ore-concentrator, the combination of the supporting, tilting frame, the endless rubber belt operatively mounted thereon, with the pulp receiving and distributing boxes, the trough having the movable partitions, the hoppers arranged to be longitudinally adjusted along the discharge edge of said belt and the clear-water-distributing pipe, the adjustable handle in its end, the rod extending from said handle into said pipe and the washers on said rod arranged to control and to adapt the discharge of the water from said pipe to the conditions required, substantially as described.

4. In an ore-concentrator, the combination of a suitable, adjustable, tilting supporting-frame, the endless traveling belt operatively mounted on said frame and adapted to stand at a slight, transverse inclination, the pulp-distributing boxes and the clear-water-distributing pipe, with the adjustable hopper comprising the tapering pan having a lip portion extending underneath the edges of the belt, a frame arranged alongside the lower edge of said belt, a horizontal bar portion on said frame, rods loosely mounted at one end on said bar and depending from it and secured at their opposite ends to said hopper whereby said hoppers may be adjustable a predetermined distance along said belt, substantially as described.

5. In an ore-concentrator, the combination of the adjustable, transversely-inclined traveling endless, rubber concentrating-belt, the ore-pulp-distributing boxes, the ore-pulp tailings and middlings trough having adjustable partitions and arranged to catch and separate the tailings portion of the ore-pulp from the middlings, with means for discharging a sheet of water in a diagonal direction across the belt across the path of the concentrates and comprising a pipe having a long handle slidably fitting in the end of said pipe, a rod extending from said handle into said pipe, washers mounted on said rod and arranged to allow the water to flow by them, a plurality of small holes arranged in said pipes and adapted to discharge the water toward said pulp-distributing boxes and said hoppers, substantially as described.

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

JOHN G. ROBERTS.

Witnesses:

CLAUDE A. DUNN,
CLARA IRWIN.