A. R. WILFLEY.

CONCENTRATOR.

APPLICATION FILED NOV. 5, 1910.

1,043,280.

Patented Nov. 5, 1912.

4 SHEETS—SHEET 1.

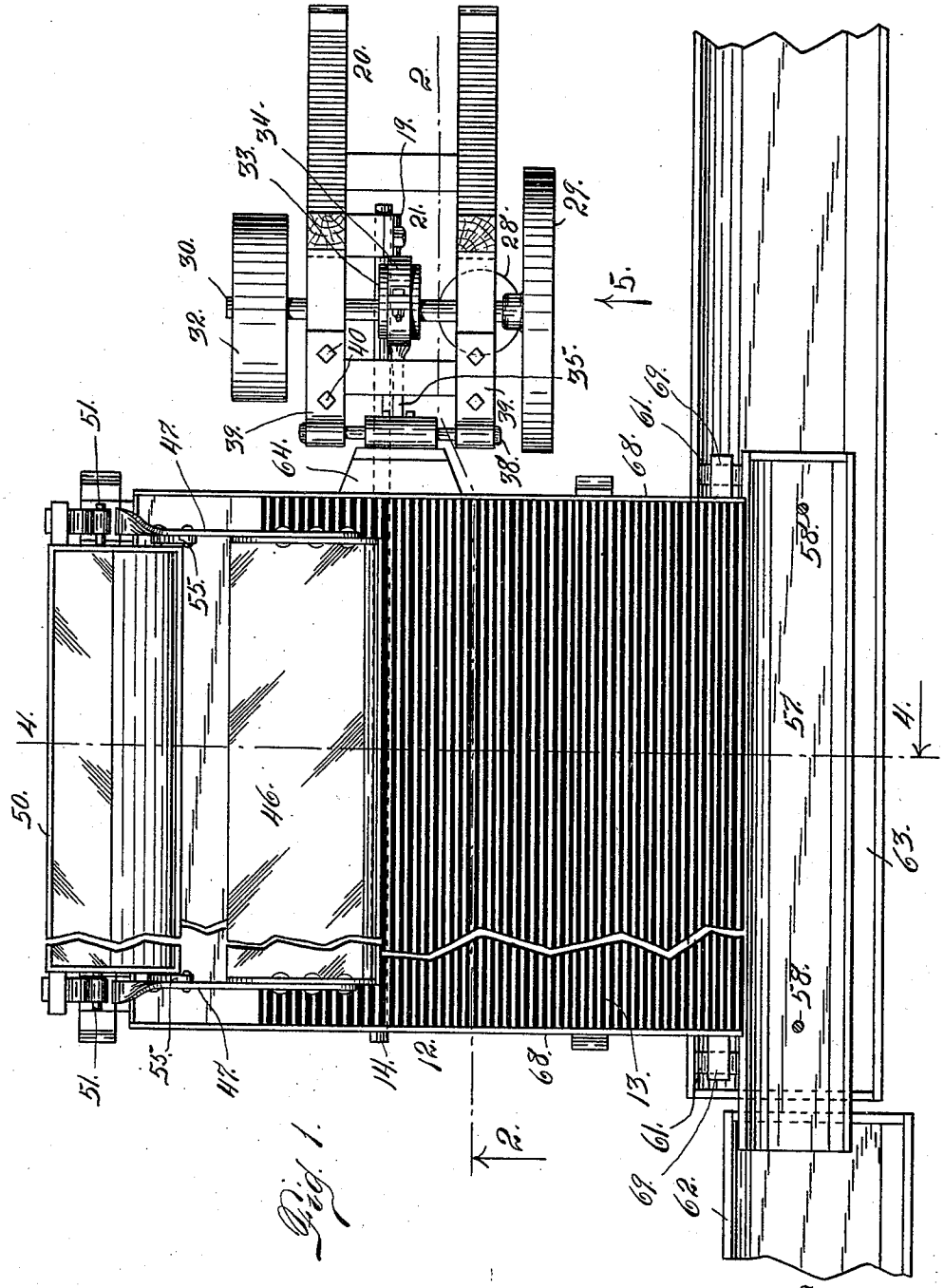

Fig. 1.

Witnesses

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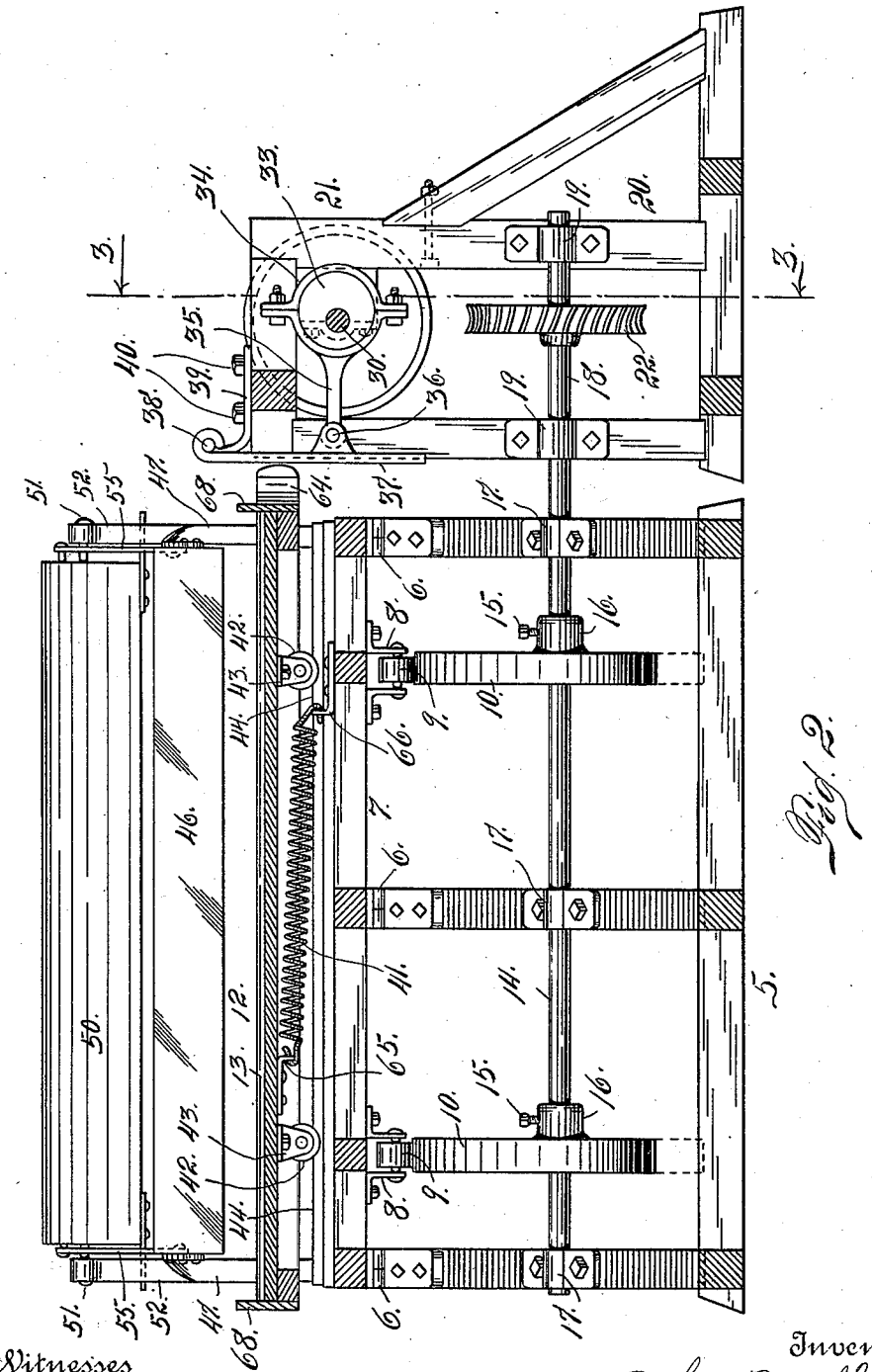

Fig. 2.

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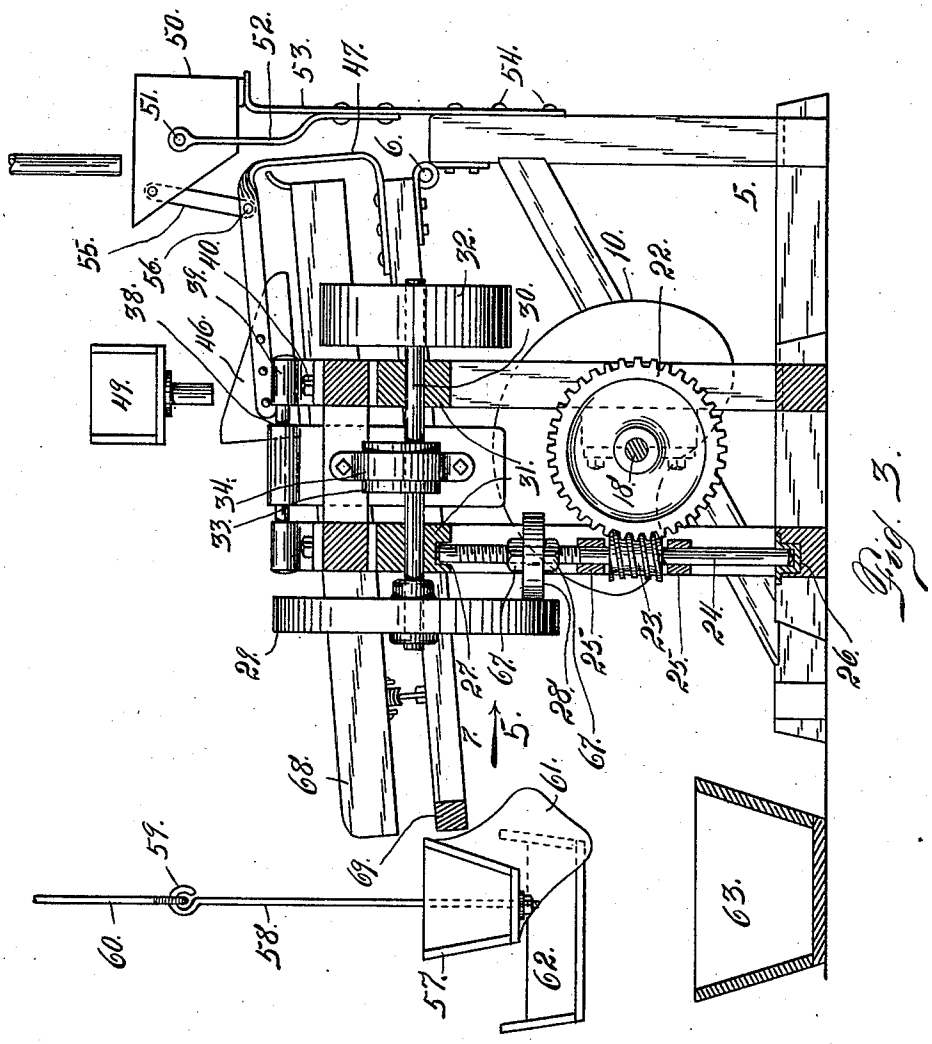

Fig. 3.

Witnesses

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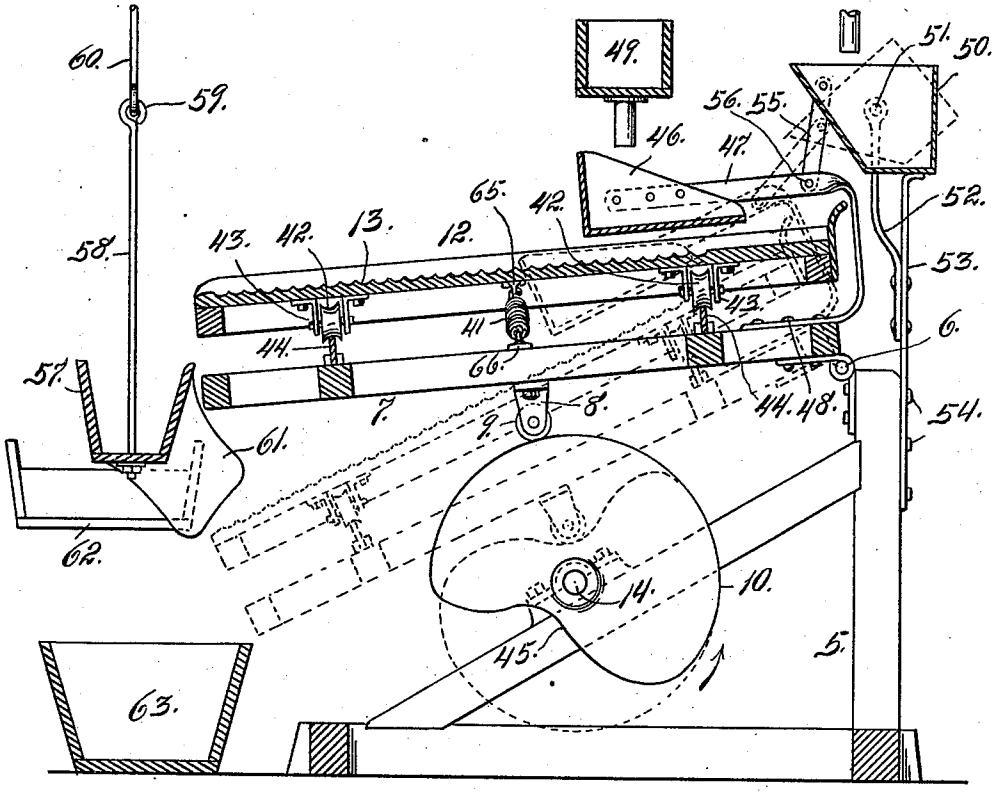

Fig. 4.

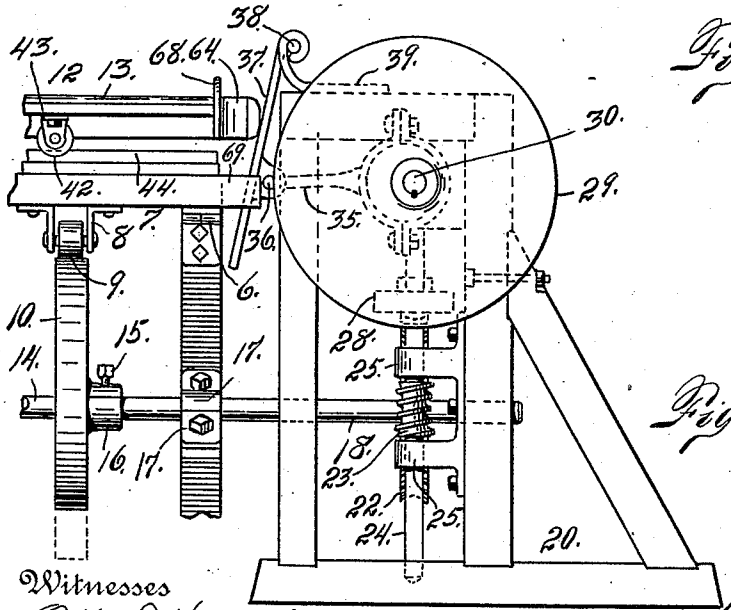

Fig. 5.

Witnesses

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UNITED STATES PATENT OFFICE.

ARTHUR R. WILFLEY, OF DENVER, COLORADO.

CONCENTRATOR.

1,043,280. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed November 5, 1910. Serial No. 590,910.

To all whom it may concern:

Be it known that I, ARTHUR R. WILFLEY, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in 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 characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in concentrators of that class of machines adapted to separate the metallic values from gangue or worthless material whether found in pulverized rock or placer dirt. My present construction, however, is more especially intended for saving the finer metallic values or those most difficult to save because of the fact that their specific gravity quite closely approaches that of the gangue with which they are found mingled, this slight differential rendering ores of this character most difficult to treat, as aforesaid, on ordinary concentrators. Hence my present improvement is designed to prevent the escape of the lighter metallic values until a quantity of these values has accumulated upon the table, provision being made for an intermittent discharge of the concentrates by changing the transverse inclination of the table at predetermined intervals for the discharge of the concentrates which have accumulated thereon. Hence the normal position of the table is such that its transverse inclination is slight, being only such as to permit the escape of the gangue, the concentrates being caught behind longitudinally disposed riffles or in grooves extending longitudinally across the table, and preferably at right angles to the transverse inclination of the latter. The depth of these riffles or grooves is such as to prevent the concentrates from escaping in a transverse direction and as the table has no longitudinal inclination there is no tendency for them to escape in a longitudinal direction. The table is given a longitudinal reciprocating movement or vibratory action of such a nature as to stratify the material on the table according to its specific gravity, the gangue being allowed to escape constantly from the concentrating surface of the table, while the values are retained until such a quantity has accumulated thereon that it is desirable to discharge them, and for this purpose the table is automatically and intermittently given a comparatively sudden drop or increased transverse inclination of such degree as to quickly discharge the concentrates from the grooves or riffles in a direction transverse to the longitudinal reciprocation of the table, and transverse to the direction of the grooves or riffles. Provision is also made for automatically stopping the feed of material to the table during the concentrates-discharging act and also to supply the table with an increased amount of wash water to facilitate the removal of the concentrates.

Having briefly outlined my improved construction, I will proceed to describe the same in detail, reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing: Figure 1 is a top plan view of my improved construction, the concentrating table proper being broken away, whereby its relative length as shown in the drawing is less than its width, for lack of room on the sheet for illustrating the other parts connected with the table. Fig. 2 is a longitudinal section of the table taken on the line 2—2, Fig. 1. Fig. 3 is a section taken on the line 3—3, Fig. 2, looking toward the left. Fig. 4 is a cross section of the table taken on the line 4—4, Fig. 1, looking toward the left. Fig. 5 is a fragmentary view looking in the direction of arrow 5, Figs. 1 and 3.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable supporting frame upon which is hinged, as shown at 6, a transversely tiltable member 7 having depending brackets 8 carrying rollers 9 adapted to engage cams 10 located underneath the table and so constructed that during a greater part of the revolution the concentrating structure is held in such position as to retain the concentrates upon the table 12 of the structure, the latter being equipped with longitudinally disposed grooves or riffles 13.

The cams are fast upon a shaft 14 parallel with the longitudinal direction of the table, the cams 10 being adjustable on the shaft by means of setbolts 15 passed through collars 16 formed integral with the cam members. The said shaft is journaled in

boxes 17 formed on the framework underneath the table structure. This shaft also extends beyond the table structure proper, having an extension 18 journaled in boxes 19 mounted on an auxiliary frame 20 upon which the head motion 21 is mounted. This extension 18 of the shaft 14 is provided with a worm wheel 22 which is operated from a worm 23 mounted on a vertically disposed shaft 24 journaled in bearings 25 mounted on the head motion frame, the opposite extremities of the shaft protruding into sockets 26 and 27. This worm shaft 24 also carries a friction wheel 28 which engages the flat surface of a fly wheel 29 fast on a power shaft 30 journaled in bearings 31 of the head motion frame. This shaft 30 is equipped with a pulley 32 which may be connected with any suitable motor or source of power for operating the machine. Upon the power shaft is also mounted an eccentric disk 33 whose strap 34 is provided with an arm 35 connected, as shown at 36, with an actuating plate 37 pivotally connected as shown at 38 with a stationary member 39 secured to the top of the head motion frame as shown at 40. As this plate 37 is oscillated due to the action of the eccentric, the concentrating table 12 is given a longitudinal reciprocating movement, the plate 37 serving to impart movement in one direction, while a spiral spring 41 which is placed under tension during the rearward travel of the table, serves by its recoil action to impart the return movement as soon as the actuating plate 37 ceases to act or is drawn forwardly during the regular action of the eccentric. This plate acts upon a shoe 64 on the table.

The concentrating table 12 is provided on its under surface with wheels 42 mounted in brackets 43, the said wheels being grooved to engage longitudinally disposed tracks 44 mounted on the lower member 7 of the structure.

From the foregoing description it will be understood that a longitudinal reciprocation or vibratory movement is constantly imparted to the table 12, while the bottom member 7 remains stationary, having no longitudinal movement. The transverse inclination of the table 12, however, is controlled by the member 7, the transverse inclination of the latter being regulated by the cams 10, as heretofore explained. These cams 10 have a relatively slow rotary movement due to the fact that the shaft 14 is actuated by a worm gear, as heretofore explained, during the operation of the structure. Each cam, however, is provided with an inwardly curved peripheral portion 45 which approaches quite close to the axis of the cam or the shaft 14 upon which it is mounted. Hence when this side of the cams is uppermost as indicated by dotted lines in Fig. 4, the rollers 9 will approach the shaft 14 sufficiently to give the table a relatively steep transverse inclination, as also indicated by dotted lines in the same figure, and while the table is in this position, the accumulated concentrates will be discharged in a transverse direction from the lower longitudinal edge of the table.

A feed box 46 is mounted above the table 12 and arranged to discharge upon its upper longitudinal portion when the table is in the position shown in full lines in Fig. 4. This feed box is supported upon a bent arm 47, to one extremity of which the box is attached, while the opposite extremity of the said arm is secured to the member 7 as shown at 48. By virtue of the feed box being supported from the table member 7 and further by virtue of the fact that its discharge edge is uppermost with reference to the transverse inclination of the table, as the transverse inclination of the latter is increased, the said box is tilted to cut off the feed from the table, during the time that the concentrates are being discharged therefrom. The relative position of the feed box when the table is at its limit of transverse inclination, is indicated by dotted lines in Fig. 4. In this case the feed box is transformed into a pocket for retaining the material which is constantly delivered thereto from a supply trough 49.

A wash water trough 50 is pivotally connected or trunnioned as shown at 51 on arms 52 secured to upright bars 53, the latter being in turn secured to the stationary structure 5 as shown at 54. The portion of the trough 50 nearer the concentrating table is connected by means of links 55 with the arms 47 as shown at 56. Hence as the table tilts to the position indicated by dotted lines in Fig. 4, a corresponding inclination is imparted to the arms 47, whereby the wash water trough 50 is tilted to occupy the position shown by dotted lines in Fig. 4, with the result that a relatively large quantity of water is suddenly discharged upon the table for the purpose of facilitating the removal of the concentrates therefrom. When the table is in the position indicated by full lines in Fig. 4 the gangue is constantly discharged therefrom into a trough arranged below its lower longitudinal edge and movably suspended by means of rods 58 connected as shown at 59 with other supporting rods 60, which it may be assumed are connected at their upper extremities with a suitable stationary support not shown. This trough 57 is provided on its side adjacent the table with cam projections 61 which lie in the path of the table member 7 during its movement from the full line to the dotted line position in Fig. 4. Hence as the table moves downwardly, the trough 57 is automatically moved out of the way by virtue of the engagement of the table member 7 with

the cam 61; while as soon as the table is returned to its upward limit of movement the trough swings into its normal position for the reception of the gangue. The gangue trough or chute 57 discharges its contents from one extremity thereof into another trough 62.

Below the gangue trough 57 is a concentrates receiving box or trough 63 adapted to receive the concentrates discharged from the table when the latter is at its lowest limit of movement. (See the dotted line position of the table in Fig. 4.)

From the foregoing description the use and operation of my improved concentrator will be readily understood. It must be assumed at the beginning of the operation that the table is at its upward limit of transverse movement (see the full line position in Fig. 4). In this event the material to be treated is delivered to the feed box 46 from the supply trough 49 and passes from the feed box to the upper longitudinal portion of the table and gradually moves transversely downwardly thereon, the material being stratified due to the difference in specific gravity, this stratification being greatly facilitated by the longitudinal vibration of the table. The material fed to the table is in the form of pulp, sufficient water being mixed with the pulverized quartz or other material to form a pulp of suitable consistency for the purpose. The transverse arrangement of the table is intended to be such that normally, or when the table is at its upward limit of transverse movement, no concentrates will leave the table, the metallic values being caught in the grooves or riffles and held thereon for a predetermined length of time. The gangue, however, or the lighter worthless material, floats above the grooves or riffles and passes transversely downwardly, being constantly discharged from the lower longitudinal edge of the table. During this time the peripheral portions of the cams 10 farthest from their axis are in engagement with the rollers 9 of the concentrating structure. As the travel of these cams is relatively slow, a charge of concentrates will accumulate upon the table before the grooved or cut away portions 45 of the cams will be in position to allow the table structure to drop to the dotted line position in Fig. 4. When, however, this occurs the feed from the box 46 is cut off and the wash water trough 50 tilted to suddenly discharge a considerable quantity of water upon the steeply inclined table, the water being discharged upon its upper longitudinal portion and passing transversely downwardly, facilitating the discharge of the concentrates from the lower longitudinal edge of the table into the trough 63. As soon as this discharge is accomplished, the cams 10 will be turned into such a position as to raise the table to its upward limit of transverse inclination, in which event the material which has accumulated in the trough 46 during the steep inclination of the table, is suddenly discharged upon the concentrating surface of the table which is then ready to receive a relatively large quantity of material, since its concentrating surface has been completely cleaned of all the material thereon. When the table is returned to its upward limit of movement the water trough 50 is also restored to its normal position and the discharge of wash water to the table consequently cut off.

The friction wheel 28 is longitudinally adjustable upon the shaft 24 for the purpose of regulating the speed of the shaft's travel. It is evident that the farther from the axis of the fly wheel 29 the friction wheel 28 is located, the more rapid will be its travel. For this reason the friction wheel is made adjustable by means of nuts 67 which are threaded on the shaft on opposite sides of the friction wheel. This wheel is fastened to the shaft by the use of these nuts.

The spring 41 is connected at one extremity with the table 12 as shown at 65, while its opposite extremity is connected with the member 7 as shown at 66.

Attention is called to the fact that the longitudinal reciprocation of the table 7 is for the purpose of stratifying the material thereon only and is not of such character as to cause the material to travel longitudinally thereon, as is the case with the ordinary differential head motions. In order to prevent any discharge from the grooves or riffles of the table at either extremity thereof, its opposite extremities are provided with plates 68 which extend above the concentrating surface a sufficient distance to prevent any discharge at the extremities of the riffles.

The cams 61 carried by the gangue trough 57 are located outside the path of the body portion of the table and its member 7 during their downward travel in assuming the relatively steep transverse inclination (see Fig. 1) indicated by dotted lines in Fig. 4. Hence the member 7 is equipped with end projections 69 adapted to directly engage the said cams during both the downward and upward transverse travel of the table and its said member.

Attention is called to the fact that when the table assumes its relatively steep transverse inclination as shown by dotted lines in Fig. 4, the actuating plate 37 imparts thereto a relatively long stroke, since the shoe 64 then engages the said plate considerably farther below the pivot 38 of the latter than when the table is in its normal position as shown by full lines in Fig. 4. This relatively long longitudinal stroke imparted to the table facilitates the discharge of the ma-

terial from the table. This is an important feature, since after the table has assumed its greatest degree of transverse inclination, it is important that the material accumulated thereon shall be removed therefrom within the shortest possible time. This increased stroke by virtue of the change of relation between the shoe on the table and the actuating plate, coöperates with the discharge of wash water upon the table from the trough 50 in quickly removing the concentrates from the grooved or riffled surface of the table.

Having thus described my invention, what I claim is:

1. The combination with a riffled concentrating table, of means for reciprocating the same, whereby the concentrates are separated from the gangue and caught by the riffles, means for automatically tilting the table in a direction at an angle to the direction of the riffles, whereby the contents of the table are removed, and means for automatically cutting off the feed from the table when the latter has reached its relatively steep inclination, comprising a feed-trough rigidly connected with the table and having its discharge extremity directed toward the upper longitudinal edge of the table.

2. The combination with a riffled concentrating table normally occupying an inclined position, of means for imparting a reciprocating movement thereto for the purpose of separating the gangue from the concentrates and discharging the gangue from the table, means for automatically tilting the table from its normal inclination, in a direction at an angle to the riffles and to an inclination sufficiently steep to tip the concentrate contents of the table out of the riffles, and means for automatically cutting off the feed from the table simultaneously with its downward movement from the one inclined position to another, comprising a feed-trough rigidly connected with the table, the bottom of the trough being parallel with the plane of the table and having its discharge extremity directed toward the upper edge of the table.

3. The combination with a riffled concentrating table normally inclined to a predetermined degree, of means for reciprocating the table for the purpose of separating the concentrates from the gangue and discharging the latter from the table, means for feeding to the table the material to be treated, means for automatically tilting the table at predetermined intervals in a direction forming an angle to the direction of the riffles, to a position of sufficient inclination to tip the material out of the riffles, whereby the concentrate contents of the table are discharged, and means for automatically cutting off the feed from the table simultaneously with the downward movement of the latter, comprising a feed-trough secured to the table whereby the bottom of the trough is constantly maintained parallel with the plane of the table, the discharge extremity of the trough being directed toward the upper edge of the table.

4. The combination with a riffled concentrating table, of means for reciprocating the latter, means for automatically tilting the table from one inclination to another, and in a direction at right angles to the riffles, the last named inclination being of such degree as to remove the concentrate contents of the table by tipping it out of the riffles, a feed trough rigidly connected with the table and so arranged that when the table has reached an inclination sufficient to discharge its contents the trough will be correspondingly and automatically actuated to cut off the feed from the table.

5. The combination with a riffled concentrating table normally occupying an inclined position, of means for imparting a reciprocating movement thereto for the purpose of separating the gangue from the concentrates and discharging the gangue from the table, means for automatically tilting the table in a direction at an angle to the riffles, from its normal inclination to an inclination sufficiently steep to discharge the concentrate contents of the table by tipping it out of the riffles, a feed trough, and a rigid connection between the feed trough and the table, whereby the feed is automatically cut off from the table simultaneously with the downward movement from the one inclined position to another.

6. The combination with a riffled concentrating table normally occupying an inclined position, of means for imparting a reciprocating movement thereto for the purpose of separating the gangue from the concentrates and discharging the gangue from the table, means for automatically tilting the table in a direction forming an angle to the riffles, from its normal inclination to an inclination sufficiently steep to discharge the concentrate contents of the table by tipping it out of the riffles, and a feed trough rigidly connected with the table and arranged to tilt therewith as the table assumes its relatively steep inclination, whereby the feed is cut off from the table, substantially as described.

7. The combination with a riffled concentrating table, of means for imparting a reciprocating movement thereto for the purpose of separating the gangue from the concentrates and discharging the gangue from the table, means for automatically tilting the table in a direction forming an angle to the direction of the riffles, from its normal position to an inclination sufficiently steep to discharge the concentrate contents of the table, a feed trough, and a direct rigid con-

nection between said trough and the table, whereby as the latter is tilted to discharge the concentrates, the feed trough is actuated to cut off the feed from the table, substantially as described.

8. The combination with a riffled concentrating table normally occupying a predetermined position, whereby the gangue is discharged therefrom and the concentrates retained thereon, of means for imparting a reciprocating movement to the table for the purpose of separating the gangue from the concentrates, means for automatically tilting the table in a direction forming an angle to the riffles, from its gangue-discharge position to a position to discharge its concentrate contents, and a feed trough rigidly connected with the table to supply the latter with pulp when the table is in its normal position, but arranged to be actuated to cut off the feed from the table simultaneously with the downward movement of the latter from its normal position to its position for discharging the concentrates.

9. In a concentrator, the combination with a table, of means for imparting a reciprocating movement thereto for the purpose of separating the gangue from the concentrates and discharging the gangue from the table, means for automatically tilting the table from its normal position to an inclination sufficiently steep to discharge the concentrate contents of the table, a feed trough, a connection between said trough and the table whereby as the latter is tilted to discharge the concentrates, the feed trough is automatically actuated to cut off the feed from the table, means for supplying wash water to the table, a trough movably mounted and normally located adjacent the lower edge of the table, means for automatically thrusting the said trough away from the table during the tilting travel of the latter in either direction, and a second receptacle arranged to receive the discharge from the table when at its downward limit of movement.

10. The combination with a longitudinally-reciprocable transversely-tiltable concentrating table, of means for automatically increasing the transverse inclination of the table at predetermined intervals, and means for automatically increasing the length of the table-stroke during its longitudinal reciprocation as it moves downwardly to its limit of transverse inclination.

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

ARTHUR R. WILFLEY.

Witnesses:
A. J. O'BRIEN,
F. E. BOWEN.