

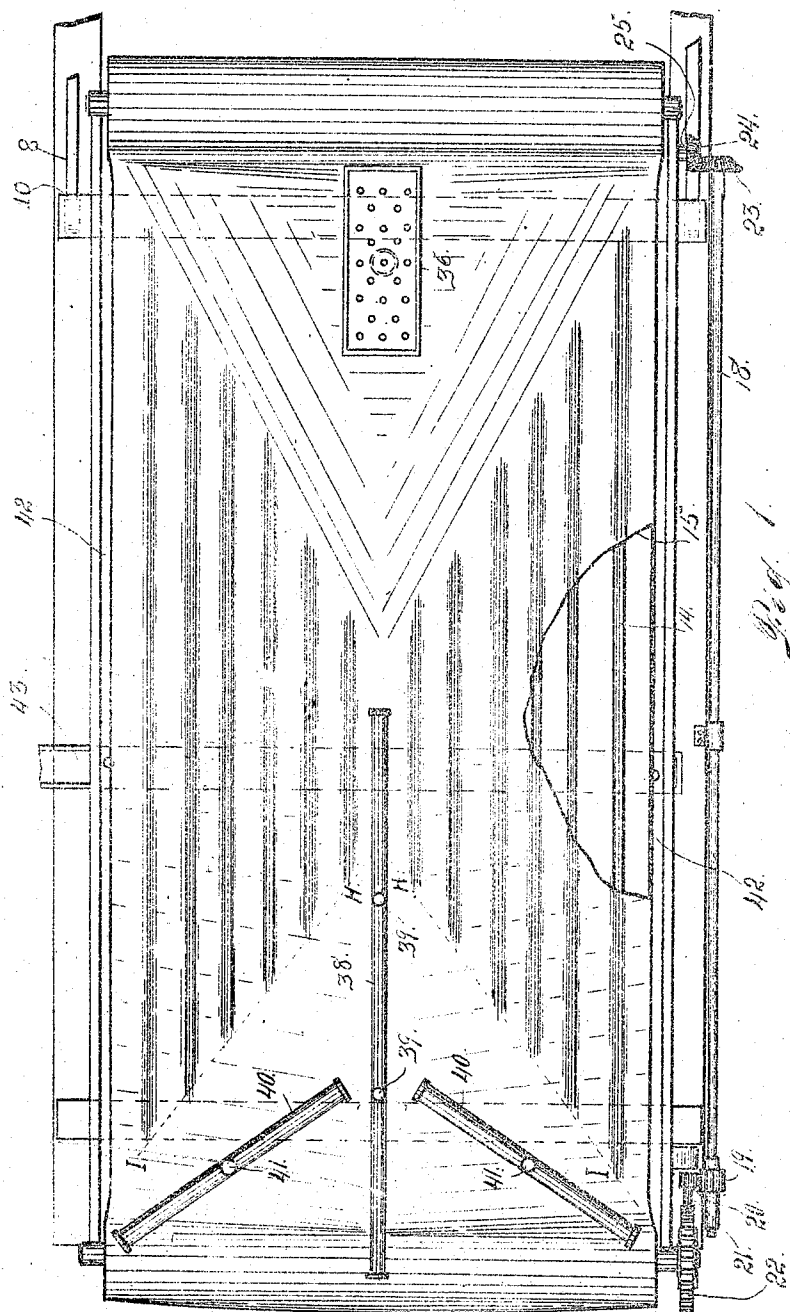
No. 885,692.

PATENTED APR. 21, 1908.

J. P. EVANS & R. P. AKINS.
CONCENTRATING APPARATUS.

APPLICATION FILED JAN. 21, 1907.

4 SHEETS—SHEET 1.



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Dena Nelson.

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By *Attorney*

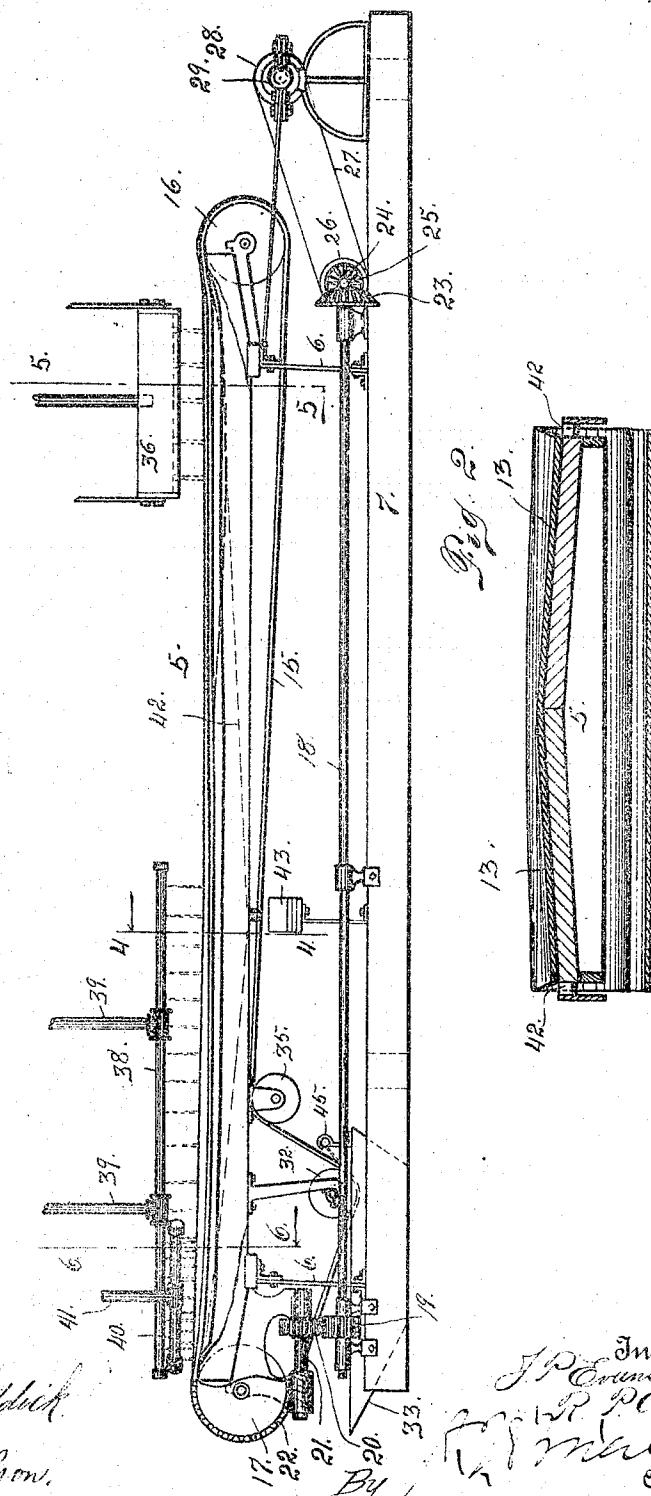
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4 SHEETS—SHEET 2.



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48. EETS—SHEET 3.

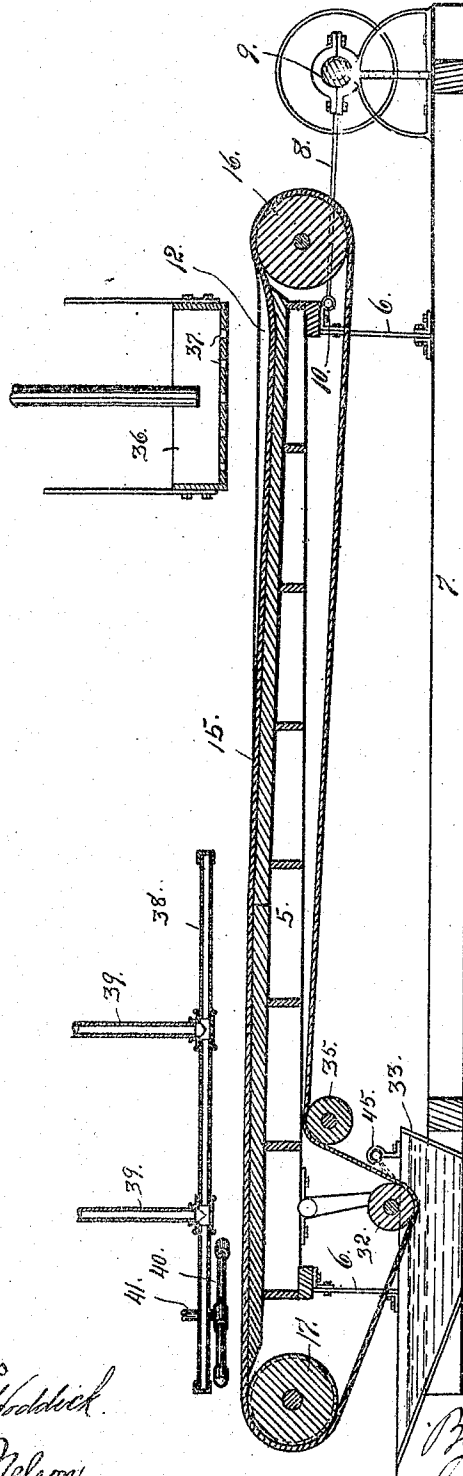


Fig. 3

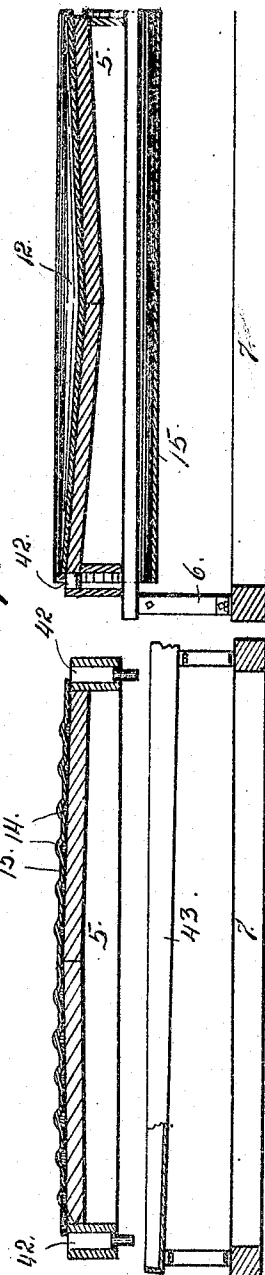


Fig. 5

Fig. 4

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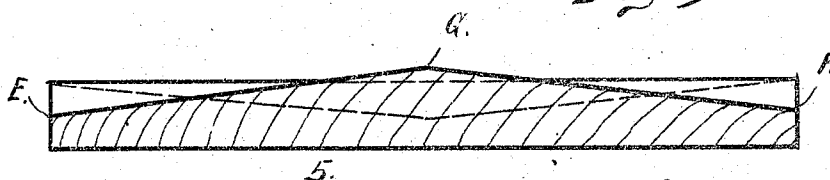
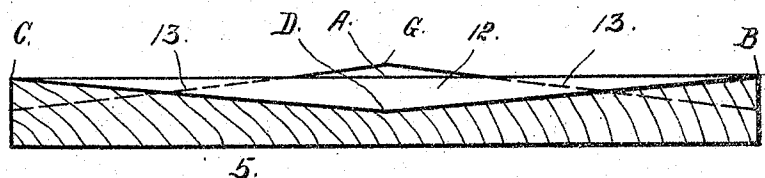
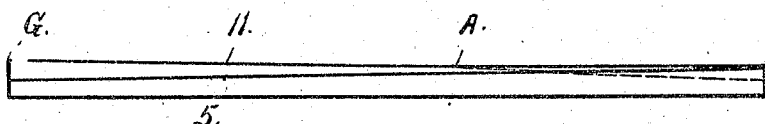
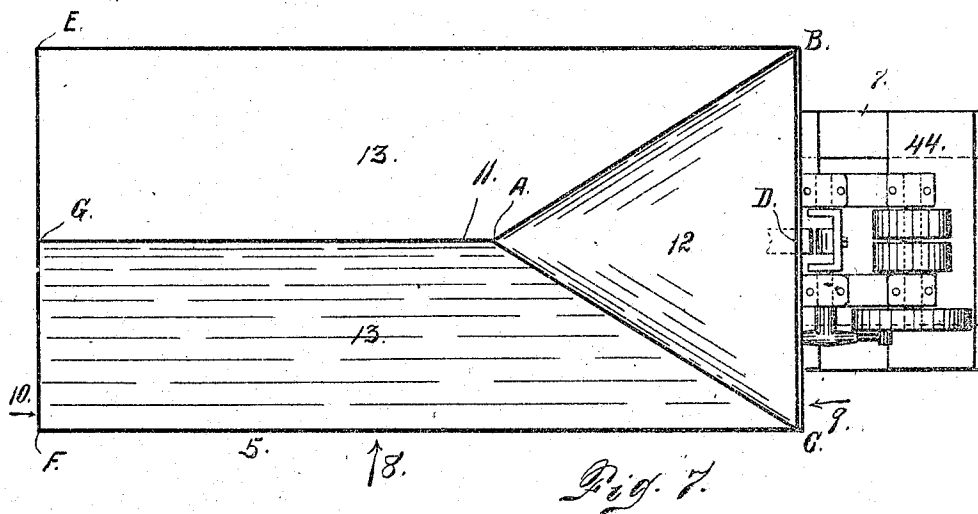
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

JAMES P. EVANS AND RANDALL P. AKINS, OF DENVER, COLORADO, ASSIGNORS OF ONE-FIFTH
TO ISABEL NESMITH EVANS, OF DENVER, COLORADO.

CONCENTRATING APPARATUS.

No. 885,892.

Specification of Letters Patent.

Patented April 21, 1908.

Application filed January 21, 1907. Serial No 353,245.

To all whom it may concern:

Be it known that we, JAMES P. EVANS and RANDALL P. AKINS, both citizens of the United States, residing at the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Concentrating Apparatus; and we 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 letters and figures of reference marked thereon, which form a part of this specification.

Our invention relates to improvements in concentrators or means for separating the values from the gangue with which they are found mingled.

Our improved apparatus is more especially intended for treating pulverized ore. It may, however, be employed in treating what is ordinarily known as placer material. In other words the apparatus is of general use in carrying out the process of concentration or the saving of the metallic values by stratification whereby the values are caused to settle or assume the lowermost position, while the gangue occupies a more elevated position, making it practicable to separate the worthless material usually termed "gangue" from the valuable portion generally termed "concentrates."

Our improved construction includes as a basic element or member, a table or bed of special construction upon which the material may be treated, by the use of a differential motion or a motion imparting a vibratory movement to the table of such character that the concentrates are caused to travel forwardly on the table, while the gangue is discharged from the opposite edges thereof, the table being transversely inclined in opposite directions from its central portion. The rear extremity of the table or that upon which the material to be treated is first discharged, is provided with a depression in which the original stratification of the material takes place. A traveling belt may be used in connection with this table for the purpose of removing the concentrates. In this case an ordinary shaking or vibratory movement is imparted to the table of such char-

acter as to produce the necessary stratification. The differential movement is not in this case necessary since the traveling belt performs the function of carrying the concentrates forwardly and removing them from the table. The surface of the table may be either riffled or plain as may be desired.

Having briefly outlined our improved construction we 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 a concentrating table embodying our invention. In this case the table is shown in connection with a traveling belt which is partly broken away. Fig. 2 is a side elevation of the same. Fig. 3 is a central longitudinal section taken through the apparatus. Figs. 4, 5 and 6 are sections taken on the lines 4-4, 5-5 and 6-6 respectively, of Fig. 2. Fig. 7 is a top view of a table shown in connection with mechanism for producing differential motion. Fig. 8 is a side elevation with the operating mechanism removed. This is a view looking in the direction of arrow 8 Fig. 7. Fig. 9 is an end elevation looking in the direction of arrow 9 Fig. 7 with the end strip removed, the table being shown on a larger scale. Fig. 10 is an end elevation looking in the direction of arrow 10, Fig. 7. In Figs. 8, 9 and 10, no supporting mechanism is employed, since the only novel feature lies in connection with the table top or bed containing the concentrating surface.

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

Let the numeral 5 designate a table mounted on spring supports 6 whereby the table is permitted to have an oscillating or vibratory movement in the direction of its length. The springs 6 are secured to a base 7. As shown in the drawing the necessary vibratory movement may be imparted to the table by a pitman 8 connected at one extremity with an eccentric 9, and at the opposite extremity with the front end of the table as shown at 10. This forward end of the table is provided with a depression 12 which as shown in the drawing has the shape approximately of an equilateral triangle sloping from all sides toward a point located in a line of the longi-

tudinal center of the table and near the forward extremity thereof which is the lowest point of the table. It must be understood that in this description we are not limited to mathematical accuracy in the use of terms. We simply describe one embodiment of the construction being that shown in the drawing, but do not intend to limit ourselves to any precise boundaries except so far as may be necessary in view of the state of the art and the scope of the appended claims.

The rear extremity of the triangular space 12 is located at the forward end of a central line 11 passing longitudinally through the table. This point may be designated A and the forward corners of the table as B. and C. The rearward corners of the table will be designated E and F respectively, for convenience of description. We will also designate the rear extremity of the line 11 by the reference letter G and the point midway between the lines B and C, as D. The sides A, B and A, C of the triangular space are substantially level or horizontal when the table is in use. These lines, however, may be elevated more or less at points B and C, as may be found expedient in practice. From points B and C to E and F respectively, the lines may slope downwardly or they may be level or upwardly inclined slightly from points near E and F (see Fig. 2). From points B and C to D the table may be downwardly inclined or level as may be found necessary or desirable in practice. The central line A, G of the table top may be termed the apex of the table, and from this apex as well as from the lines A, B and A, C, the table is laterally inclined, whereby the gangue is discharged over the opposite side edges of the table when the apparatus is in use. The sloping sides of the table may be designated by the numeral 13. These sides may be provided with parallel longitudinally disposed riffles extending rearwardly from the lines A, B, and terminating in diagonal lines H and I on the rear portion of the table (see Fig. 1). In Fig. 7 of the drawing the riffles are not shown.

The table with or without the riffles may be used in connection with an endless traveling belt or apron 15 composed of canvas or other suitable flexible material adapted when traveling over the table top, to conform to the contour or configuration of the latter. This feature is best illustrated in Fig. 1. The belt or apron 15 engages end drums 16 and 17. Motion is imparted to these drums from a shaft 18 extending parallel with the longitudinal direction of the table. Motion may be communicated to this shaft from any suitable source of power. As shown in the drawing the shaft 18 is provided with a gear 19 meshing with a gear 20 fast on a worm shaft 21 whose worm portion engages a worm wheel 22 fast on the journal of the rearwardly

located drum 17. When the shaft 18 is rotated it is evident that the drum 17 will be actuated and the endless apron caused to travel.

When the apron is employed, a shaking movement is imparted to the table as heretofore explained. This movement may be obtained from the shaft 18 which is provided with a bevel gear 23 meshing with a gear 24 fast on a shaft 25 journaled in the frame work of the machine. On this shaft 25 is made fast a pulley 26 from which leads a belt 27 to a pulley 28 fast on the shaft 29 located forward of the forward extremity of the table. From the eccentric 9 on the last named shaft, leads the pitman 8 to the frame work of the table, connection being made at a point 10 underneath the forward extremity of the latter. By means of this construction the necessary shaking or vibratory movement for the purpose of stratifying the material upon the belt may be satisfactorily obtained. In addition to engaging the end drums, the belt at the rear extremity of the table, after leaving the drum passes downwardly under a roller 32 into the water of a tank 33 and thence upwardly over a roller 35 journaled in the frame work of the table but located underneath the latter.

Mounted above the forward extremity of the table and centrally located with reference to the triangular feed space 12, is a feed trough or receptacle 36 having a perforated bottom 37 through which the pulp or material mixed with water, passes to the space 12. Above the longitudinal center of the table beginning at a point a short distance in the rear of the point A, extends a wash water pipe 38 perforated on its under side and connected with supply pipes 39 which also form means for supporting the pipe 38. Also mounted above the rear portion of the table and on opposite sides of the wash water pipe 38, are two pipes 40 which as shown in the drawing extend rearwardly and outwardly from the pipe 38. The pipes 40 are supplied with feed pipes 41 which also form their support, the pipes 40 being perforated on the under side to allow the water to pass freely to the table. These wash water pipes may be arranged in any desired manner, in order to supply the necessary wash water to effect the separation between the concentrates and the gangue. It must therefore be understood that we are not limited to the specific construction and arrangement of wash water means employed. This is also true with reference to the means for feeding the pulp to the table.

Arranged on opposite sides of the table, are longitudinally disposed troughs 42 adapted to receive the gangue as it is desired from the opposite sides of the table. These troughs slope from the forward and rearward extremities of the table toward a transversely disposed trough 43 adapted to receive the

gangue. This trough may carry the gangue or tailings to any desired point.

From the foregoing description the use and operation of our improved concentrating apparatus will be readily understood. The material to be treated is delivered by the feed trough 36, to the central part of the triangular feed space 12. Now if the table is used alone without the endless traveling belt, suitable mechanism 44 may be connected to its forward or head extremity for the purpose of imparting thereto the necessary differential motion whereby the concentrates are first stratified or settled in the feed space 12, and then caused to travel rearwardly and longitudinally of the table, being finally discharged at the rear extremity thereof while the gangue is carried transversely downwardly from the center of the table and discharged at the opposite sides of the latter. The motion imparted to the table must therefore be of such a nature as to produce the aforesaid result. In other words the movement is what is ordinarily termed the differential movement or motion. Any suitable mechanism adapted to produce this kind or quality of movement may be employed in connection with our improved apparatus.

Again assuming that the endless traveling belt is employed as shown in Figs. 1 to 4 inclusive, a simple shaking or vibratory movement for stratifying purposes, is all that need be employed, this mechanism being differentially illustrated in Figs. 2 and 3 of the drawing. In this case the endless traveling belt or apron, conforms to the shape of the top or concentrating surface of the table while traveling over the latter; and the material to be treated is discharged upon the portion of the belt covering the triangular feed space 12. The concentrates are carried rearwardly with the belt, these values being caused to settle upon the belt or occupy the lowest position thereon under the influence of the shaking or vibratory action heretofore described. As the belt is traveling over the table top, the wash water acting on the gangue or lighter portion of the material, carries the latter transversely downwardly on the opposite sides of the belt. This gangue passes into the troughs at the opposite sides of the table as heretofore described. The concentrates which cling to the belt as heretofore explained, are carried over the rear extremity of the table and down into the water of a tank 33 where the concentrates are removed therefrom. The removal of the concentrates from the exterior surface of the belt, is facilitated by the employment of a perforated water pipe 45, located just forward of the roller 32. Any material that is not removed from the belt while passing through the water tank, will be washed therefrom by the water issuing from the perforated pipe 45.

Having thus described our invention, what we claim is:

1. A concentrator comprising a table or concentrating surface having a forwardly and centrally located depressed feed space, a centrally located longitudinally disposed apex extending rearwardly from the feed space, the top of the table being transversely inclined on opposite sides of the apex, said sides being provided with longitudinally disposed riffles arranged parallel to the apex suitable means for feeding the material to be treated, to the forward portion thereof, and suitable means for supplying the table with wash water, substantially as described.
2. A concentrator provided with a concentrating surface or top, comprising a forwardly located depressed feed space, an apex extending longitudinally between and parallel with the side lines of the said top, the latter being transversely inclined from the said apex, and provided with riffles arranged parallel to said apex, substantially as described.
3. A concentrator comprising a concentrating surface or top having a forwardly and centrally located triangular depressed feed space, a longitudinally disposed apex located between the side lines of the top and extending parallel with the length of the table, the latter being transversely inclined from the apex downwardly in opposite directions, said table being provided with longitudinally disposed riffles arranged parallel to the apex and suitable means for imparting a longitudinal vibration to the said top, substantially as described.
4. A concentrating apparatus comprising a top having a forwardly located depressed feed space, a centrally located longitudinally disposed apex, the top being transversely inclined downwardly from the said apex, the said top being provided with longitudinally disposed riffles arranged parallel to the apex and extending rearwardly from the feed space.
5. A concentrator comprising a top and a forwardly located depressed feed space, a centrally located longitudinally disposed apex from which the sides of the table slope transversely downwardly in opposite directions, the sloping sides of the table being provided with longitudinally disposed riffles arranged parallel to the apex.
6. A concentrator comprising a top having a forwardly located depressed feed space, an apex extending longitudinally of the said top between the side lines thereof, the top sloping downwardly therefrom transversely in opposite directions, the said transversely sloping portions being provided with longitudinally disposed riffles, arranged parallel to the apex.
7. A concentrator comprising a top having a centrally and forwardly located depression forming a feed space, a longitudinally dis-

posed apex located between the side lines of the top, the latter sloping downwardly therefrom transversely in opposite directions, the sloping sides of the table rearwardly of the feed space, being provided with longitudinally disposed parallel riffles whose rear extremities terminate in diagonal lines extending from the longitudinal center of the table, rearwardly and outwardly.

8. A concentrator comprising a top having a forwardly and centrally located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions said feed space provided with walls which slope toward a point located in the line of the longitudinal center, an endless traveling belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the top, conforms to the contour or shape of the latter and means for moving said belt over the top, substantially as described.

9. A concentrator comprising a top having a centrally and forwardly located feed and settling space, a centrally located apex extending rearwardly from the feed space, the top having sides sloping downwardly from the apex, longitudinally disposed parallel riffles extending rearwardly from the feed space and terminating in diagonal lines extending from the longitudinal center of the table rearwardly and outwardly, an endless traveling belt or apron engaging the said top and composed of such material as to cause it to conform to the shape of said top while traveling thereover and means for moving said belt over the top, substantially as described.

10. A concentrator comprising a top having a forwardly located depressed feed and settling space, a longitudinally disposed apex extending forwardly from the feed space, from which apex the sides of the top slope transversely downwardly equally in opposite directions, and an endless traveling belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the top conforms to the shape of the latter, and means for moving said belt over the top, substantially as described.

11. A concentrator comprising a top having a forwardly located depressed feed space, a longitudinally disposed apex extending forwardly from the feed space, from which apex the sides of the top slope transversely downwardly in opposite directions, an endless traveling belt or apron mounted on the said top, means for moving said belt over the top, and means for imparting a vibratory movement to the structure, substantially as described.

12. A top or surface for concentrators having a centrally and forwardly located de-

pressed feed space triangular in shape; a longitudinally disposed apex extending rearwardly from the feed space and parallel with the side lines of said surface, the top or surface except the feed space being transversely inclined downwardly on opposite sides of said apex, toward the side lines, the said inclined surface being provided with longitudinally disposed riffles extending rearwardly from said feed space.

13. A top or surface for concentrators having a centrally and forwardly located depressed feed space triangular in shape; a longitudinally disposed apex extending rearwardly from the feed space and parallel with the side lines of said surface, the top or surface except the feed space being transversely inclined downwardly on opposite sides of said apex, toward the side lines, the said inclined surface being provided with longitudinally disposed parallel riffles whose rearward extremities terminate in diagonal lines extending from the longitudinal center of the table rearwardly and outwardly.

14. A top or surface for concentrators having a centrally and forwardly located depressed feed space triangular in shape; a longitudinally disposed apex extending rearwardly from the feed space and parallel with the side lines of said surface, the top or surface except the feed space being transversely inclined downwardly on opposite sides of said apex, toward the side lines, the said inclined surface being provided with longitudinally disposed parallel riffles whose rearward extremities terminate in diagonal lines extending from the longitudinal center of the table rearwardly and outwardly, and suitable means for imparting a reciprocating or vibratory movement to said top, substantially as described.

15. A concentrator comprising a top having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, an endless traveling belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the top conforms to the contour or shape of the latter, and means for moving said belt over the top, substantially as described.

16. A transversely inclined concentrating table having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, an endless traveling belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the table conforms to the contour or shape of the latter, and means for moving said belt over the top, substantially as described.

17. A concentrator comprising a top having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly equally in opposite directions, an endless traveling belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the top conforms to the contour or shape of the latter, and means for moving said belt over the top, substantially as described.
18. A concentrator comprising a top having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly equally in opposite directions, an endless traveling belt or apron mounted on said top and composed of flexible material, whereby the apron in passing over the top conforms to the contour or shape of the latter, and means for moving said belt over the top, substantially as described.
19. A concentrating table having a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, said sides being provided with longitudinally disposed riffles arranged parallel with said apex, and a forwardly located feed space whose walls slope toward a point located in the line of the longitudinal center of said top, substantially as described.
20. A concentrator comprising the top having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, said sides being provided with longitudinally disposed riffles arranged parallel to the apex of said top, substantially as described.
21. A concentrating table provided with riffles having a forwardly located unriffled depressed feed space, the centrally located and longitudinally disposed apex from which the sides of the top slope downwardly equally in opposite directions, an endless traveling belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the top conforms to the contour or shape of the latter, and means for moving said belt over the top, substantially as described.
22. A concentrator comprising the top having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, said sides being provided with longitudinally disposed riffles arranged parallel to the said apex, an endless belt or apron mounted on the said top and composed of flexible material whereby the apron in passing over the top conforms to the contour or shape of the latter, and means for moving said belt over the top, substantially as described.
23. A transversely inclined concentrating table having a forwardly located depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, the said sides being provided with longitudinally disposed riffles arranged parallel to the said apex, said riffles extending to the walls of the depressed feed space, substantially as described.
24. A transversely inclined concentrating table having a forwardly located unriffled depressed feed space, a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, the said sides being provided with longitudinally disposed riffles arranged parallel to the said apex, and said riffles extending to the walls of the depressed feed space, substantially as described.
25. A concentrating table provided with a forwardly depressed feed space, whose walls all slope toward a point located in the line of the longitudinal center of said table, suitable means for feeding the material to be treated to said feed space, and suitable means for supplying the table with wash water, substantially as described.
26. A transversely inclined concentrating table having a forwardly located triangular depressed feed space, whose walls all slope toward a point located in the line of the longitudinal center of said table, suitable means for feeding the material to be treated to said feed space, and suitable means for supplying the table with wash water, substantially as described.
27. A concentrating table provided with a forwardly located depressed feed space, and a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, substantially as described.
28. A concentrating table provided with a forwardly located depressed feed space, and a centrally located and longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, suitable means for feeding the material to be treated to said feed space, and suitable means for supplying the table with wash water, substantially as described.
29. A transversely inclined concentrating table having a triangular depressed feed space, and a longitudinally disposed apex from which the sides of the top slope downwardly in opposite directions, suitable means for feeding the material to be treated to said feed space, and suitable means for supplying the table with wash water, substantially as described.
30. A concentrating apparatus comprising

a surface having a forwardly located depressed triangular stratifying and feed section, a centrally located longitudinal apex and
ruffled sections sloping laterally downward
5 from said apex and each adapted to receive
pulp from the stratifying and feed section,
and means for supplying water to said surface.

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

JAMES P. EVANS.
RANDALL P. AKINS.

Witnesses:

A. J. O'BRIEN,
DENA NELSON.