W. F. DEISTER.

APPARATUS FOR CONCENTRATING ORES.

APPLICATION FILED NOV. 13, 1913.

1,088,685.

Patented Mar. 3, 1914.

3 SHEETS—SHEET 1.

FIG. 1.

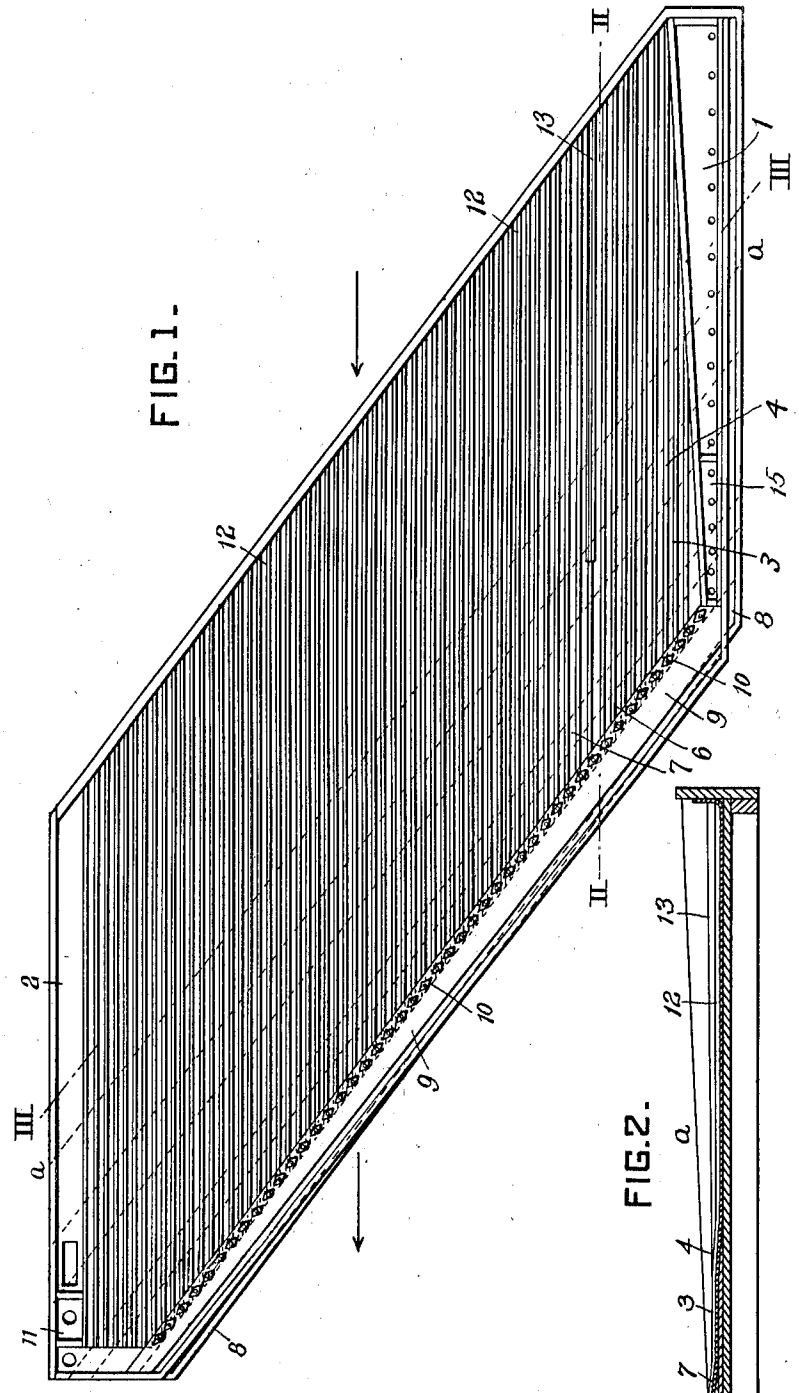
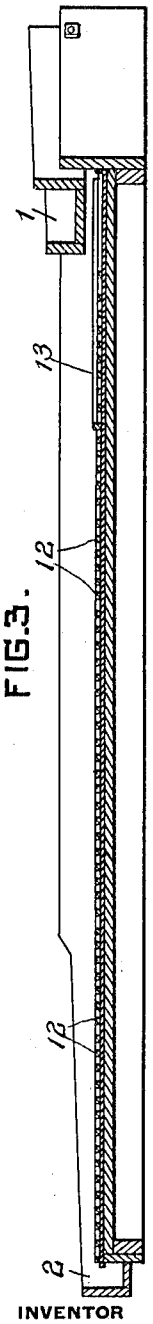



FIG. 2.




FIG. 3.




WITNESSES

J. Herbert Bradley

INVENTOR

William F. Deister

by Dennis B. Wolcott

Atty

W. F. DEISTER.

APPARATUS FOR CONCENTRATING ORES.

APPLICATION FILED NOV. 13, 1913.

1,088,685.

Patented Mar. 3, 1914.

3 SHEETS—SHEET 2.

FIG.5.




FIG.4.

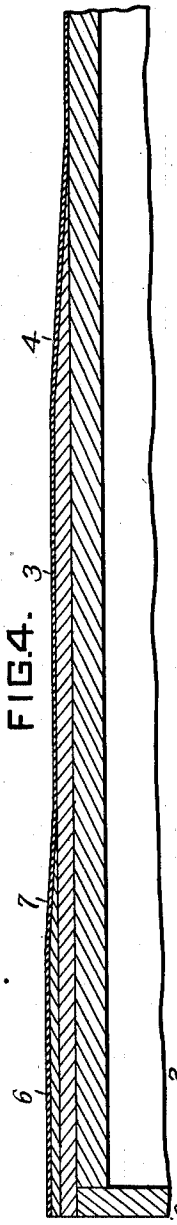
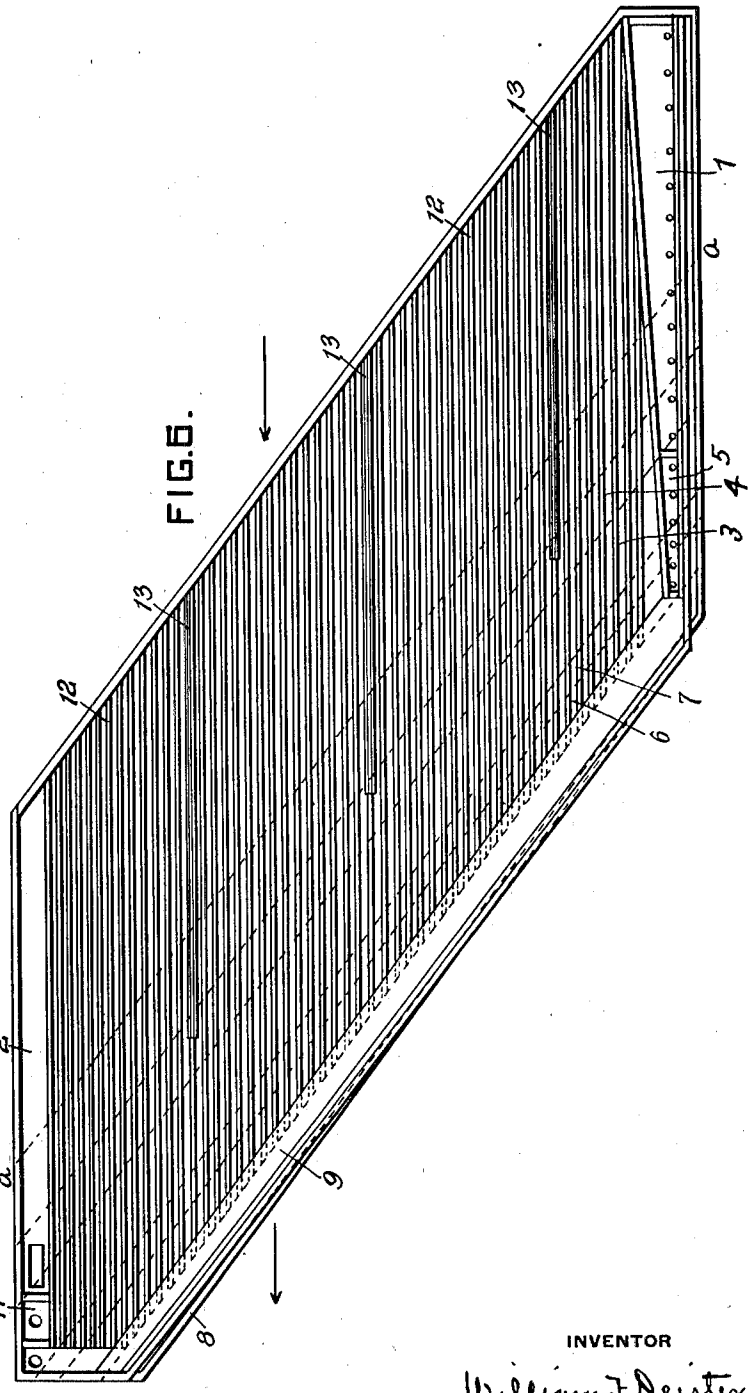



FIG.6.




WITNESSES

J. Herbert Bradley.

F. B. Joyce.

INVENTOR

William F. Deister

by Dennis S. Wolcott

Atty

W. F. DEISTER.

APPARATUS FOR CONCENTRATING ORES.

APPLICATION FILED NOV. 13, 1913.

1,088,685.

Patented Mar. 3, 1914.

3 SHEETS—SHEET 3.

FIG.7.

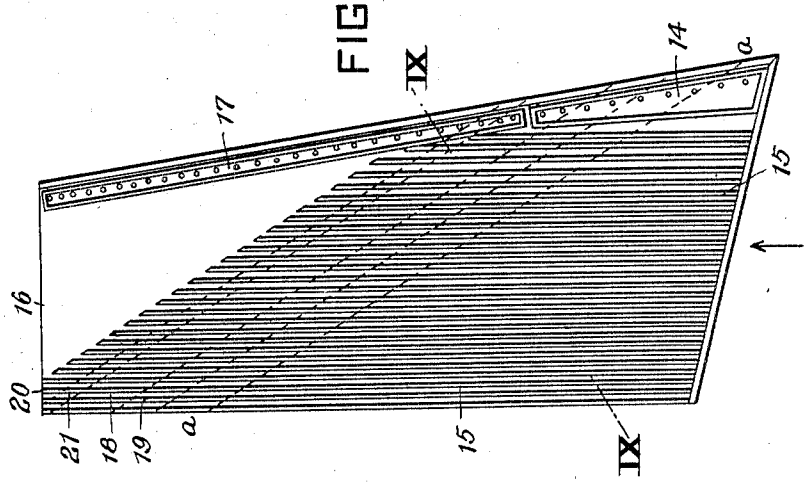



FIG.8.

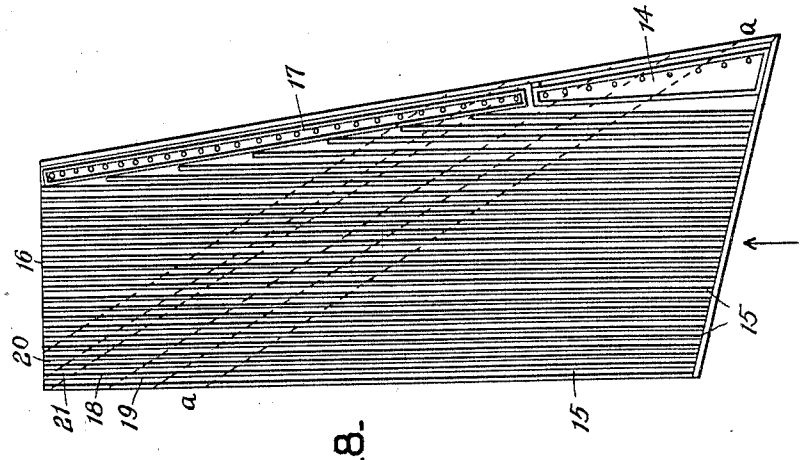
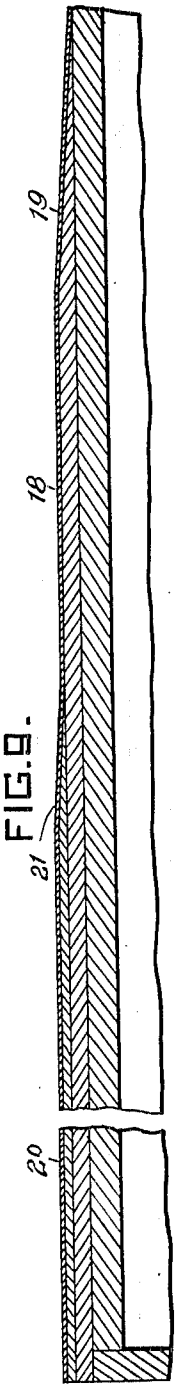



FIG.9.




WITNESSES

J. Herbert Bradley.

F. B. Joyce

INVENTOR

William F. Deister

by Dennis B. Wolcott

Atty

# UNITED STATES PATENT OFFICE.

WILLIAM F. DEISTER, OF FORT WAYNE, INDIANA, ASSIGNOR TO DEISTER MACHINE COMPANY, OF FORT WAYNE, INDIANA, A CORPORATION OF INDIANA.

## APPARATUS FOR CONCENTRATING ORES.

1,088,685. Specification of Letters Patent. Patented Mar. 3, 1914.

Application filed November 13, 1913. Serial No. 800,779.

*To all whom it may concern:*

Be it known that I, WILLIAM F. DEISTER, residing at Fort Wayne, in the county of Allen and State of Indiana, a citizen of the United States, have invented or discovered certain new and useful Improvements in Apparatus for Concentrating Ores, of which improvements the following is a specification.

In concentrating crushed ores on vibrating tables, the material in a pulverized condition is mingled with a sufficient quantity of water to form a freely flowing pulp, which is then fed onto a differentially vibrating table. While on the table opportunity must be afforded for a gravity separation or stratification of the constituents of the pulp in accordance with their relative specific gravities. After this gravity separation or stratification, the mineral or minerals which move down through pulp onto the surface of the table, are caused by the vibration of the table to move in a certain direction. By reason of the fact that the minerals are the heaviest constituents and are in contact with the vibrating surface they would, if the table were level move more rapidly in the direction of vibration than the overlying lighter constituents or gangue and would in time if the table were of sufficient dimensions pass entirely from under the gangue. But in order to lessen the travel of the materials and to establish a definite line of separation, the table is so inclined as to neutralize so far as the lighter materials or gangue are concerned the movement due to the vibratory action of the table. The stratification and separation by the vibratory action of the table occurs to a greater or less degree over the whole surface of the table which has a downward or feed inclination from the point of feed.

It is the general practice to so support the table that its surface is inclined sufficiently to neutralize the travel due to the vibrations. Of course this neutralizing inclination which is at an angle to the feed inclination, will also retard to a considerable extent the movement of the values by the vibrations. It will be understood, that while the minerals or values and gangue are mingled together, they will be influenced more by the inclination of the table than by the vibrations and hence will tend to move toward the rear of the table and that this movement of the minerals is checked and reversed when the minerals have settled down through the lighter materials toward or into contact with the table. Thus it will be seen that the neutralizing inclination of the whole surface of the table is objectionable, first because the pulp is caused to move toward the rear before stratification occurs, thus necessitating a greater travel of the minerals after stratification, and also because such inclination has a retarding influence on the movement of the minerals by the vibrations of the table.

The object of the invention described herein is to provide for the stratification of the pulp without subjecting it to any force or influence which will retard the separation of the stratified materials.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings forming a part of this specification, Figure 1 is a top plan view of my improved concentrating table; Figs. 2 and 3 are sectional views on planes indicated respectively by the lines II—II and III—III Fig. 1; Fig. 4 is a sectional view on an enlarged scale of the portion of the table where the separation of the stratified material is effected; Fig. 5 is a detail of one of the riffles; Fig. 6 is a top plan view of a modification of my improved table; Fig. 7 is a top plan view of the Wilfley type of table having my improvements applied thereto; Fig. 8 is a view similar to Fig. 7 and showing a modification of the construction shown in Fig. 7, and Fig. 9 is a transverse section on a plane indicated by the line IX—IX Fig. 7, the riffles and linoleum covering being removed.

In the practice of my invention the feed trough or launder 1 which is of the usual or any suitable construction is arranged along one side of the table, the latter being inclined downwardly from the feed side so that the material will flow slowly toward the gangue or tailings launder 2 secured to the opposite side of the table. As the table is preferably given little and in some cases no downward inclination from its front to its rear end or at an angle to the direction of feed, the pulp will flow in substantially straight lines from the feed trough across the table. During this movement of the pulp the mineral or minerals will settle down into contact with the surface of the

table, to which such a differential vibratory movement is imparted by a suitable mechanism, as to cause the minerals to move toward the front end of the table as indicated by the arrows. A plateau 3 is arranged on the table across the line of movement imparted to the minerals by the vibration of the table. The surface of the plateau is sufficiently higher than the surface over which the pulp flows and where the gravity separation or stratification of the constituents of the pulp takes place, so that portions of the material which have passed up into the plateau will be above the surface of material flowing over the rear portion of the table. In order to facilitate the movement of the minerals onto the plateau its rear edge portion 4 is beveled or inclined so as to merge into the surface where stratification occurs. The plateau is made of such a height that the rear portion 4 of the plateau may be given sufficient inclination to form an easy up grade for the minerals thus avoiding any material retardation of the movement of the minerals out of the gangue and onto the plateau.

It will be observed that as the surface of the table over which stratification occurs is preferably substantially level as above stated when treating fine sand, although it may be inclined when treating coarse sand as hereinafter explained there will be no retardation to the movement of the minerals by the vibratory movement of the table until the materials begin to move up the inclined surface 4. This portion 4 is made of such a width that the "grade" is low and therefore the onward movement of the minerals is but slightly retarded. Although this grade is low it is sufficient to prevent a large proportion of the gangue from moving up onto the plateau as the force tending to cause the gangue to move with the minerals is the frictional engagement of the gangue with the minerals. As is well known the gangue is so fluid and of such relatively low specific gravity as to be affected only to a slight degree by the vibrations of the table. During the stratification which takes place in the main portion of the table the fine sand will settle down onto the minerals and to a considerable extent be mingled therewith, and will be moved onto the plateau with the minerals. The materials which pass onto the plateau, which is substantially parallel with the main stratifying surface, are caused to travel across the plateau by the differential vibrations imparted to the table. While crossing this plateau opportunity is afforded for the mineral to settle down out of whatever fine sand or gangue is carried on to the plateau with the values. In other words, the first plateau forms a surface where a second and practically complete stratification of the materials will take place, and presents the minerals as a stratum to the second plateau. While moving across this plateau 3 the materials are also subjected to a washing action by water fed onto the plateau by the launder 5 arranged at the higher side of the table in line with the plateau 3 and with a second plateau 6 as shown in Fig. 1. This second plateau is arranged across the table parallel with the plateau 3 and its front edge forms the mineral discharge edge of the table. The height of this plateau above the surface of plateau 3 is preferably less than the height of the latter above the main or stratifying surface of the table as shown in Fig. 5 as the material passing over the first plateau is of less depth than that of the material on the main or first stratifying surface. This second plateau 6 is provided with a beveled portion 7 preferably of substantially the same "grade" as the portion 4 of the first plateau. As before stated the materials passing across the plateau 3 are subjected to stratification and also to a stream of water which will not only remove a considerable portion of the gangue, but will render the remainder quite fluid and therefore less liable to be carried along by the minerals and less affected by the vibrations of the table. By reason of the fluidity of the gangue any tendency to move up the inclined portion 7 with the minerals will be quickly checked, and the minerals when they reach the plateau 6 will be practically free from gangue. In order to effect a final washing and also to facilitate the movement of the minerals over the discharge edge and into the launder 8 a water trough or launder 9 having adjustable blocks 10 for regulating the distribution of the water on the plateau 6 is arranged across the front end of the table. As shown in Fig. 1 a middlings launder 11 is arranged on the lower side of the table and substantially in line with the plateau 3.

It is preferred that suitably spaced riffles 12 should extend the surfaces of the table from the rear to the front end, so as to catch the minerals as they settle onto the surface of the table and guide them in substantially straight lines as they move toward the mineral discharge edge. As before stated the inclined portion 4 of the plateau 3 will hold back the greater part of the gangue and as the minerals move up out of the gangue, there will be an accumulation of the latter in the rear of the plateau to a depth approximately equal to the height of the riffles at that point. In some cases a considerable depth of gangue immediately in the rear of the plateau may be objectionable and in such cases the riffles may be made tapering from points along the line *a* a short distance from the foot of the portion 4. This reduction in height of the riffles will permit of a freer flow of the gangue toward the lower side of

the table. From the points *a* or from the foot of the inclined surface 4 the riffles taper uniformly so that their heights above the surface of the plateaus gradually decrease.

It is preferred in order to insure a proper distribution of the pulp across the surface along which it flows to provide a pool a short distance below the upper side of the table. To this end a riffle 13 of considerable height say one and a quarter inches at its rear end and tapering to about one-half of an inch is arranged parallel with the riffles 12 and extends from the rear end of the table to and preferably slightly overlaps the portion 4 of the first plateau. As shown in Fig. 6, two, three or more of these relatively high riffles may be arranged at suitable intervals on the stratifying surface of the table.

As shown in Fig. 7 my inmprovement may be applied to what is known as the Wilfley type of table, having its riffles arranged to establish a definite diagonal line of separation between the values and gangue. The table is inclined downward from its upper side, so that the pulp will flow from the feed trough 14 across the riffles 15 toward the lower side or tailings discharge edge of the table. The riffles 15 which are tapering as described in connection with the construction shown in Fig. 1 are arranged on the surface of the table substantially parallel with the direction of vibration. The front ends of the riffles terminate in a line forming an acute angle with the direction of vibration of the table and define the line of separation of the values and gangue. The surface of the table intermediate the ends of the riffles and the mineral discharge edge 16 forms the washing surface and is supplied with water from the trough 17.

It is necessary in using the present form of Wilfley table to give it a downward inclination from the mineral discharge edge to prevent the gangue from moving toward such edge with the minerals or values. This inclination will have a retarding effect on the movement of the values, and as the entire table is so inclined the values are subjected during their entire travel over the table to such retarding or neutralizing action. By applying my improvement to the Wilfley table, the latter need not be inclined downwardly from the mineral discharge edge when treating fine sands, although it may be slightly inclined when treating coarse sands.

In applying my improvement to the Wilfley table the plateau 18 having an inclined or beveled rear portion 19 extends from side to side of the table at an acute angle to the direction of vibration of the table and at such a point along the length of the table that practically complete stratification has been effected by the time the material has reached the foot of the inclined portion 19. The plateau 18 onto which water is fed from the trough 17 is made of any suitable or desired width. The second plateau 20 having an inclined or beveled rear portion 21 is arranged diagonally across the table with its rear edge substantially parallel with the rear edge of the first plateau. The surface of this second plateau, which extends to the mineral discharge edge from the final washing surface of the table, is supplied with water from the trough 17. As in the construction shown in Fig. 1 the surfaces of the plateaus 18 and 20 are made substantially parallel with the main or stratifying surface of the table. The plateau 18 is made of such a height that its surface will be slightly above the surface of the material on the main surface of the table, and the surface of the plateau 20 is slightly above the surface of the material on the plateau 18, but as the depth of material on the latter is less than that of the material on the main surface, the height of plateau 20 above plateau 18 may be proportionally less than the height of the latter above the main surface.

It is preferred as described in connection with construction shown in Fig. 1 that the riffles 15 should begin to taper from points on line *a* a short distance in the rear of the edge of the inclined surface 19, so as to prevent the gangue from being dammed up against such surface and overflowing onto the plateau 18. It is also preferred that the riffles should extend a short distance onto the plateau 20, and if desired they may extend entirely across the plateau to the mineral discharge edge, as shown in Fig. 8.

When treating fine sand, the fine particles of values have less inertia and do not frictionally engage the surface of a table as effectively as coarser particles and are more readily retarded by a back flow of gangue due to the inclination of the table, and hence my improved table is especially effective in treating fine sand, as the surfaces over which the materials move are substantially level and there will be no neutralization of the vibrating effects. As the particles of values in coarse sand have considerable inertia and will effectively engage the surfaces of the table, and hence will not be materially retarded in their movements due to the vibration of the table by a slow backflow of the gangue, the table may be slightly inclined downwardly from the mineral discharge edge when treating coarse sand.

My improved table is particularly adapted to the treatment of ores having two or more mechanically combined minerals differing in specific gravity. As for instance in treating ores containing lead and zinc by properly proportioning the height of the first plateau both minerals will be separated

from the gangue as they pass up onto the first plateau, and by making the height of the second plateau such that with a given vibratory action, only the heavier of the two minerals will be caused to move up onto the second plateau, the zinc will remain on the first plateau and pass down into the launder 11.

Heretofore the separation of the values from the gangue has been effected by causing the former to move out from under the lighter and overlying gangue by imparting a differential movement to a table having a slight inclination rearwardly to prevent the gangue from following the values in their approximately horizontal movement. This horizontal separation involves the employment of a table having a comparatively large area, especially in the direction of travel of the values as the separation is gradual, the overlying strata becoming thinner and thinner until it entirely disappears. It has been attempted to effect a separation of the values from the gangue by interposing an upwardly inclined or wedge like surface in the line of travel of the values, such surface extending to the mineral discharge edge so that the values would be separated by a combined horizontal and vertical movement. In this construction the stratifying surface had a slight upward inclination so as to hold back a large part of the gangue, while the values moved to the foot of the incline which had a steeper inclination in order that the values might move up through and above the gangue at that point. It was found that the movement of the values up and across this steeper surface was greatly retarded, causing an accumulation or piling up of the minerals at the foot of the incline and that the movement across the incline was due very largely to this piling up and that unless the inclined surface was made quite short in the direction of travel of the values, a comparatively small percentage of the latter would reach the mineral discharge edge. And on the other hand, if the surface were made sufficiently short to permit of the values in practical quantities reaching the discharge edge the line of separation of the values from the gangue was so close to the discharge edge that values could not be properly washed and consequently a considerable percentage of gangue was carried over the discharge edge.

In the operation of my improved table having a plurality of plateaus the surfaces of which are substantially parallel with the main or stratifying surface of the table, the values will travel up the short beveled or inclined surfaces with but little diminution of their rate of movement, and as soon as they reach the plateau surfaces their rate of travel is accelerated and they are quickly moved out of the way of oncoming values. The surface of the first plateau is but slightly above the surface of the gangue on the main surface, and a percentage of gangue will be carried with the values onto the first plateau over which the values are moved by the differential movement of the table, the movement of the values being more rapid than that of the gangue. When the foot of the incline leading to the second plateau is reached, the depth of the overlying gangue is slight. The surface of the second plateau is as before stated only slightly higher than the surface of the material on the first plateau and as the inclined or beveled approach to the top of this plateau is short, there will be only a slight retardation in the movement of the values, and there will be an acceleration of the rate of movement as soon as the values reach the surface of the plateau.

It is characteristic of my improved table that the values move up step by step, and although there is probably a slight retardation of the rate of movement of values while moving up through the overlying gangue, there is an immediate restoration to normal rate of travel, so that values which have reached a plateau cannot retard or check the movement of other values moving up the inclined approaches.

In the form of tables having an inclined surface extending to the mineral discharge edge, the values, as they reach the foot of the incline operate to push ahead those that have previously arrived at that point as the movements of the latter are retarded. In my improved table, there is no such retardation as will give rise to any substantial accumulation or piling up of the values at the feet of the inclines.

I claim herein as my invention:

1. A concentrating table, having in combination therewith a plurality of plateaus arranged transverse of the lines of movement of the values toward the mineral discharge edge, and having their surfaces higher than that of the main or stratifying surface and the surface of each succeeding plateau being higher than that of the preceding plateau, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

2. A concentrating table, having in combination therewith a plurality of plateaus arranged transverse of the lines of movement of the values toward the mineral discharge edge, the surface of the first plateau being above the normal surface of the material on the main or stratifying surface of the table and the surface of each succeeding plateau being above the normal surface of

material on the preceding plateau, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

3. A concentrating table, having in combination therewith a plurality of plateaus arranged transverse of the lines of movement of the values toward the mineral discharge edge, the main or stratifying surface of the table and the surfaces of the plateaus being in different but parallel planes, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

4. A concentrating table, having in combination therewith a plurality of plateaus arranged transverse of the lines of movement of the values toward the mineral discharge edge, the main or stratifying surface of the table and the surfaces of the plateaus being in different but parallel planes and the rear edges of the plateaus being beveled or inclined to facilitate the upward and onward movements of the values, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

5. A concentrating table, having in combination therewith a plurality of plateaus arranged transverse of the lines of movement of the values toward the mineral discharge edge and having their surfaces higher than that of the main or stratifying surface, and the surface of each succeeding plateau being higher than that of the preceding plateau, and riffles arranged on the main or stratifying surface and extending onto the plateau next adjacent to the mineral discharge edge, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

6. A concentrating table, having in combination therewith a plurality of plateaus transverse of the lines of movement of the values toward the mineral discharge edge, and having their surfaces higher than that of the main or stratifying surface of the table and the surfaces of succeeding plateaus being higher than that of the next preceding plateau, and riffles arranged on the main or stratifying surface and extending onto the plateau next adjacent to the mineral discharge edge, said riffles being tapered from points in the rear of the first plateau, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

7. A concentrating table transversely inclined, in combination with a feed trough arranged at the higher side, a plurality of plateaus arranged transversely of the lines of movement of the values toward the mineral discharge edge, riffles arranged on the main or stratifying surface of the table and extending onto the plateau adjacent to the mineral discharge edge and a riffle substantially higher than the other riffles arranged transverse of the direction of flow of pulp across the table at a suitable point below the point of feed, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

8. A concentrating table transversely inclined, in combination with means for feeding material onto the table, a plurality of plateaus arranged transversely of the line of movement of the values toward the mineral discharge edge, riffles arranged on the main or stratifying surface and extending onto the plateau adjacent to the mineral discharge edge, and a riffle below the point of feed and extending from the rear end of the table onto the first plateau, said riffle being higher than the other riffles but tapering from its rear end, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

9. A concentrating table inclined transversely, in combination with means for feeding material onto the table, a plurality of plateaus arranged transversely of the lines of movement of the material toward the mineral discharge edge, riffles arranged on the main or stratifying surface and ex-

tending onto the plateau adjacent to the mineral discharge edge and a plurality of suitably spaced riffles below the point of feed and extending from the rear end of the table onto the first plateau, said riffles being higher than the other riffles but tapering from their rear ends, the front edge of the final plateau of the series forming the mineral discharge edge, and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

10. A concentrating table transversely inclined, in combination with a plurality of plateaus arranged transversely of the lines of movement of the values toward the mineral discharge edge, the surfaces of the plateaus and the main or stratifying surface of the table being in different but parallel planes, and receiving launders at the lower ends of the plateaus, the front edge of the final plateau of the series forming the mineral discharge edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

11. A concentrating table, having in combination therewith a plurality of plateaus arranged transversely of the line of movement of the values toward the mineral discharge edge, the surfaces of the plateaus being in different planes above the main or stratifying surface of the table but parallel therewith, and riffles extending from the rear end of the table to the mineral discharge edge, said riffles being tapered from points in the rear of but adjacent to the first plateau, the front edge of the final plateau of the series forming the mineral edge and a plateau or plateaus intermediate the main surface of the table and the last plateau being adapted to permit of a further stratification of the material and to deliver concentrates as a stratum to the plateau having the mineral discharge edge.

In testimony whereof, I have hereunto set my hand.

WILLIAM F. DEISTER.

Witnesses:
G. G. TRILL,
T. B. JOYCE.