Oct. 11, 1927. 1,644,753

A. H. STEBBINS

CONCENTRATOR TABLE

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Fig. 1

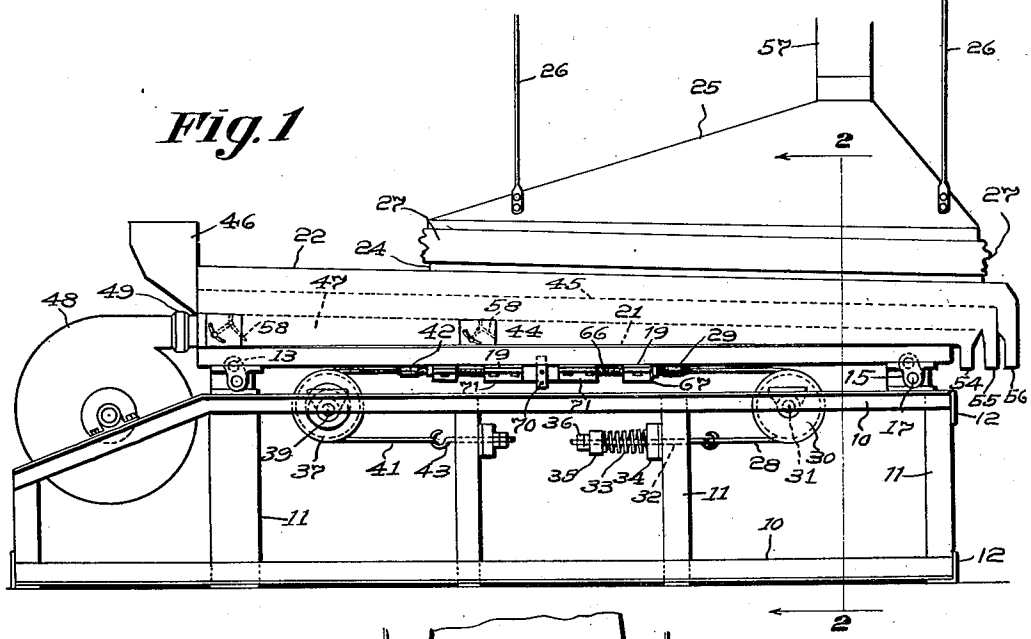


Fig. 2

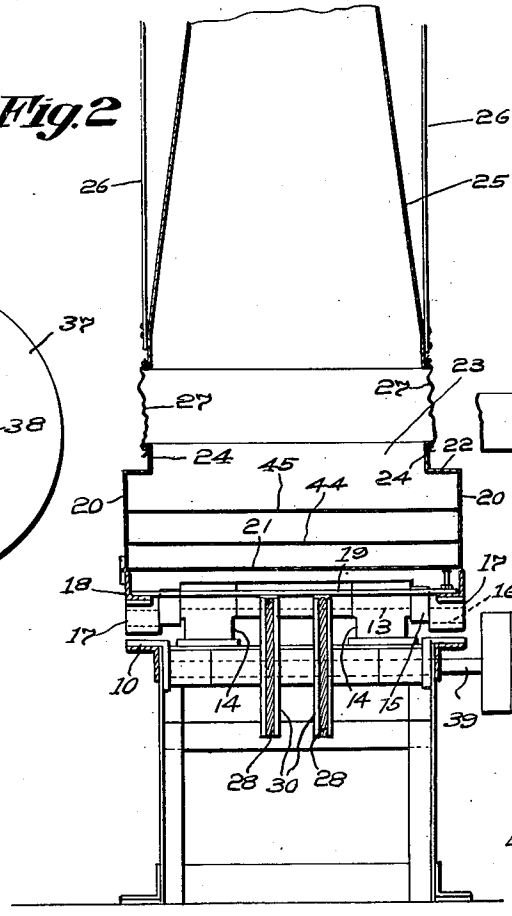


Fig. 3

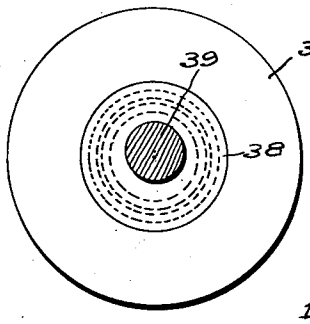
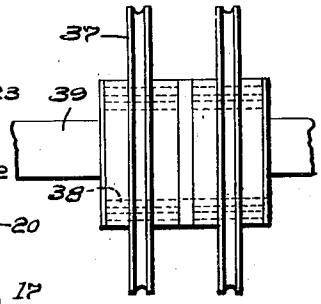


Fig. 4



INVENTOR
Albert H. Stebbins
BY Robert S. Harris
ATTORNEY

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A. H. STEBBINS

CONCENTRATOR TABLE

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Fig. 5

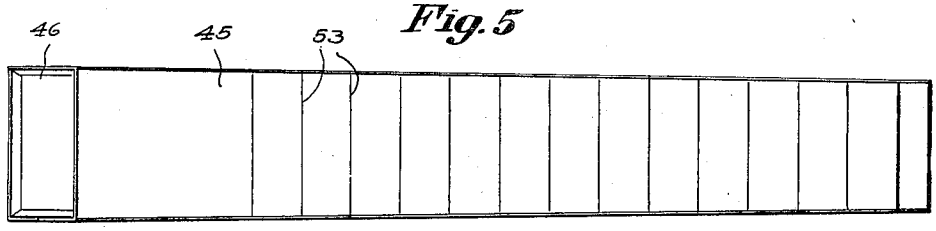


Fig. 6

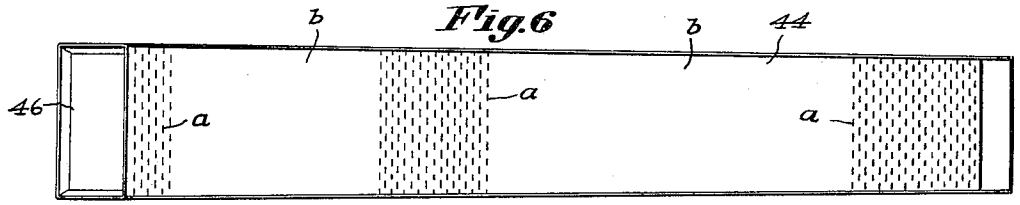


Fig. 7

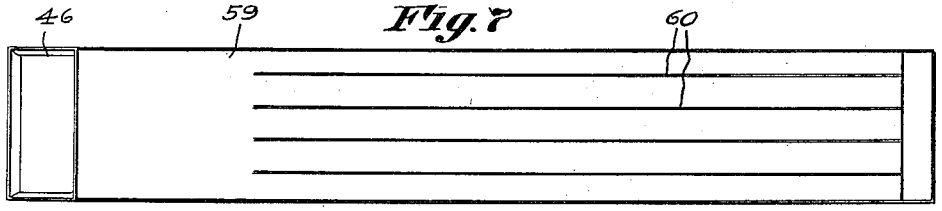


Fig. 8

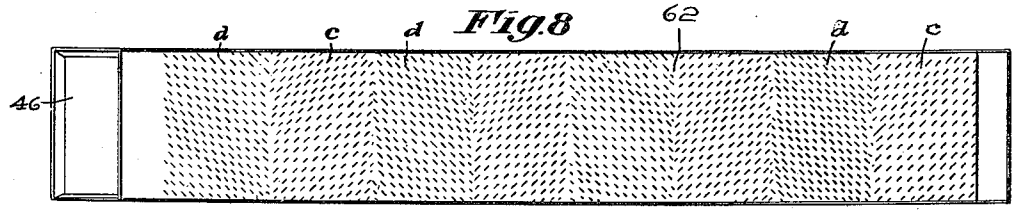


Fig. 9

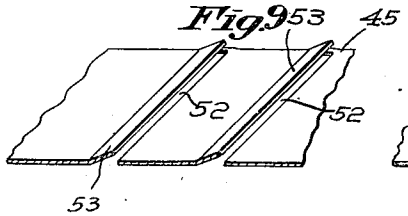


Fig. 10

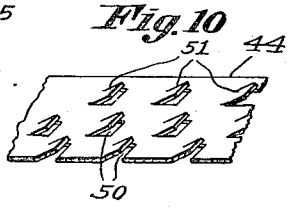


Fig. 11

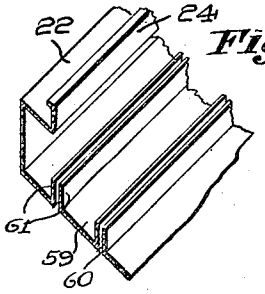
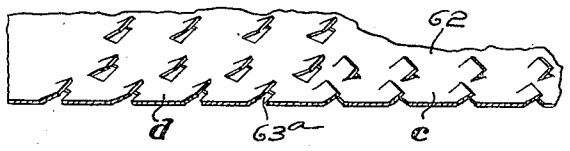


Fig. 12



INVENTOR:
Albert H. Stebbins
BY Robt. O. Harris.
ATTORNEY

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A. H. STEBBINS

CONCENTRATOR TABLE

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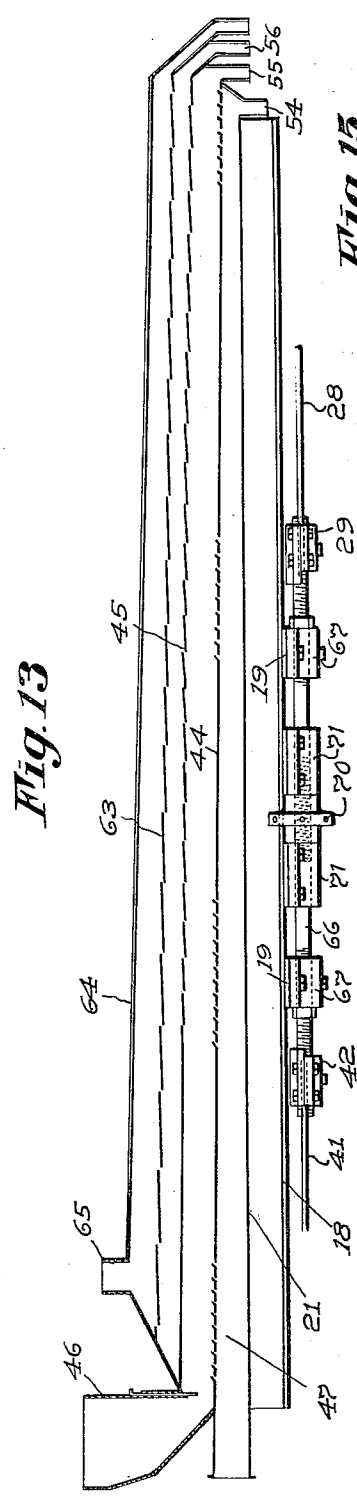


Fig. 13

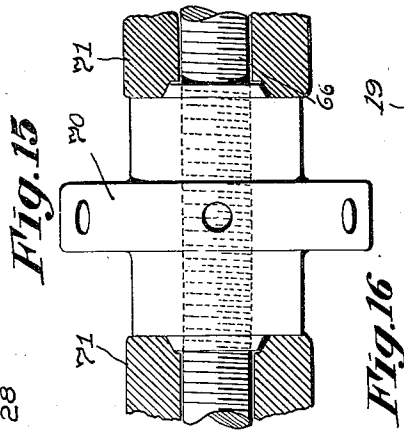


Fig. 15

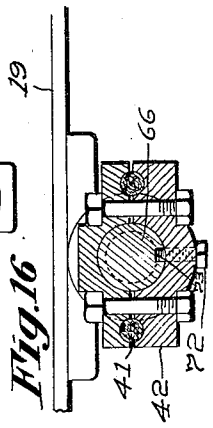


Fig. 16

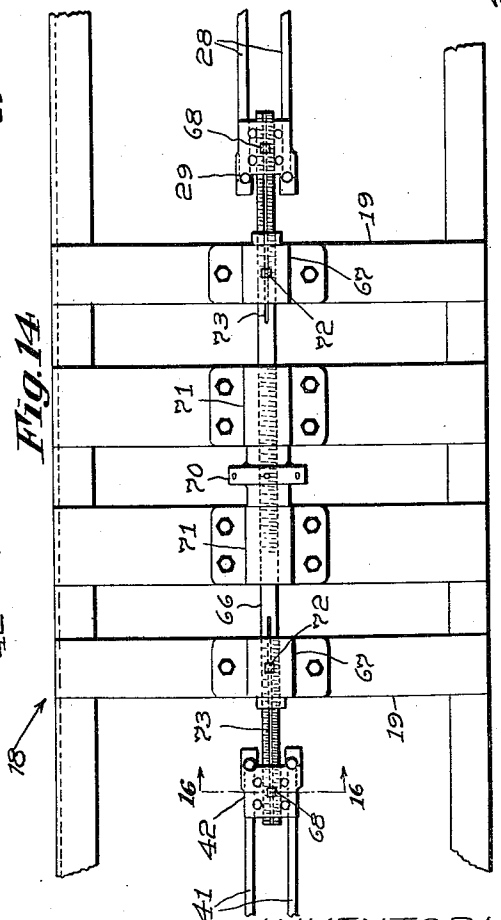


Fig. 14

INVENTOR:
Albert H. Stebbins
BY Robt. S. Harris
ATTORNEY

Patented Oct. 11, 1927. 1,644,753

UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

CONCENTRATOR TABLE.

Application filed November 10, 1924. Serial No. 748,903.

This invention relates to dry concentrator tables, and more particularly to a novel deck construction for treating ores and other mine products.

Dry concentrator tables are commonly provided with a transversely inclined deck surface having riffles which direct the concentrates in a general direction lengthwise of the deck surface, while the tailings flow laterally over the riffles toward the lower side of the inclined deck surface. This type of concentrator has a large range of use, and by varying the strength of the air employed and the movement imparted to the deck, may be used to treat different grades of materials ranging in size from about 8 mesh to 200 mesh or finer, but much care is required in treating the fine materials upon this commonly used type of deck to prevent the fine values from being carried off with the tailings.

Since it is difficult to treat very fine materials on the above mentioned type of deck employing an inclined deck surface and riffles, the present invention is directed to a new type of deck in which the back and forth or progressive movement imparted to the deck is used to a substantial degree to cause the fine, heavy values or concentrates to work downwardly under the tailings, and these values are permitted to escape through apertures in the deck surface while air passes upwardly through these apertures to prevent the tailings from passing through the same.

The deck of the present invention is well adapted to treat materials that are too fine to be satisfactorily treated upon the riffle type of deck above mentioned, but it is not necessarily limited in scope to very fine materials.

One important feature of the invention resides in a deck provided with an apertured deck surface which is constructed so that the concentrates or heavier particles which work downwardly under the progressive movement imparted to the deck may escape through the apertures while air passes upwardly through these apertures to prevent the tailings or lighter particles from passing through the same.

A further feature of the invention resides in a deck surface in which the apertures are formed in sections extending across the deck surface, and the sections are separated by smooth, stratifying or unapertured sections. The arrangement is such that the concentrates will work down beneath the tailings under the action of the deck movement while traveling over a smooth, unapertured section, and upon reaching an apertured section will pass downwardly through the apertures in opposition to the lifting action of the air passing up through the apertures.

Another important feature of the invention resides in a second deck surface supported above the first and provided with openings through which the lighter materials may be lifted by the rising air, the arrangement being such that these lighter materials are deposited by the air upon the upper deck surface thus effecting a further separation of the materials. The openings or slots in the upper deck surface are preferably constructed so that the materials deposited upon this surface may travel lengthwise thereof without falling through the openings or slots.

Other features of the invention and novel combination of parts in addition to the above will be hereinafter described in connection with the accompanying drawings, which illustrate good, practical forms thereof.

In the drawings:—

Fig. 1 is a side elevation of a concentrator table provided with a deck constructed in accordance with the present invention.

Fig. 2 is an enlarged sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged sectional view through the operating shaft and showing an eccentric and a sheave upon the eccentric.

Fig. 4 is an enlarged view of the pair of eccentric operated sheaves.

Fig. 5 is a plan view of the upper deck surface of Fig. 1.

Fig. 6 is a plan view of the lower deck surface of Fig. 1.

Fig. 7 is a plan view of a modified type of upper deck surface.

Fig. 8 is a plan view of a modified construction of the lower deck surface;

Fig. 9 is a perspective view of a portion of the deck surface of Fig. 5;

Fig. 10 is a perspective view of a portion of the deck surface of Fig. 6;

Fig. 11 is a perspective view of a portion of the deck surface of Fig. 7;

Fig. 12 is a perspective view of a portion of the deck surface of Fig. 8;

Fig. 13 is a longitudinal sectional view through a modified type of deck;

Fig. 14 is a plan view of a portion of the deck carriage.

Fig. 15 on an enlarged scale, is a sectional view showing the shaft adjusting wheel and associated parts; and

Fig. 16 is a sectional view taken on line 16—16 of Fig. 14.

Various types of means may be provided for supporting the deck of the present invention for back and forth movement and for imparting the desired progressive movement to the deck. In the construction shown, the deck is provided with a supporting frame consisting of longitudinally extending rails 10 supported in spaced relation by the uprights 11 and the opposite sides of the frame are connected by transversely extending braces 12. The means shown for supporting the deck upon the frame for back and forth movement consist of transversely extending shafts 13 located near the opposite ends of the deck and supported by bearing blocks 14 rigidly secured to the supporting frame. The opposite ends of the shafts 13 are provided with downwardly extending arms 15 having near their lower ends laterally extending stub shafts 16, which shafts are journaled in bearing blocks 17 secured to the under face of the deck supporting carriage 18, the arrangement being such that as the deck moves back and forth, the arms 15 will swing back and forth about the axis of the shaft 13 so that the deck will rise and fall slightly as it moves back and forth, and the rising and falling or upthrow movement may be varied as desired by adjusting the deck lengthwise of the supporting frame.

The carriage 18 may consist of longitudinally extending side rails connected by transversely extending bars 19 and the deck mounted upon this carriage comprises a closed receptacle having the side walls 20 and floor 21. The deck has a cover 22 in which is formed a large opening 23 surrounded by upstanding walls 24. Above the opening 23, in the construction shown in Figs. 1 and 2, is mounted a hood 25 which may be supported independently of the deck so that the hood does not partake of the back and forth movement given to the deck. To this end the hood 25 is supported in spaced relation to the deck by the suspension rods 26 and a flexible cover 27 serves to connect the lower end of the hood 25 with the deck cover, as best shown in Fig. 2. The hood construction just described is desirable in some constructions in that it reduces the mechanism which is moved back and forth with the deck, but, if desired, the hood may be directly secured to the deck and supported thereby, as shown in Fig. 13.

Various means may be provided for imparting a progressive back and forth movement to the deck, and the means shown consists of cables 28, each having one end secured to a head 29 which is adjustably secured to the deck carriage in a manner to be described. These cables, two being shown, pass about grooved idle sheaves 30 mounted upon the transversely extending shaft 31, the ends of which are mounted in brackets secured to the supporting frame. The opposite end of each cable 28 is yieldingly secured to the main supporting frame by means of a bolt 32 provided with a coiled spring 33, one end of which rests against a cup or plate 34, supported by the main frame and the opposite end rests against a cup 35 upon the bolt 32 and is held in adjusted position thereupon by the nuts 36. The arrangement is such that the cables 28, under the action of the springs 33, continuously urge the deck in a right-hand direction, and the tension of the springs may be adjusted by adjusting the nuts 36.

The means shown for forcing the deck in a left-hand direction and then releasing it to move in a right-hand direction, under the action of the cables 28, consists of grooved sheaves 37 mounted upon and actuated by eccentrics 38 upon the operating shaft 39. The shaft 39 may be driven by a pulley 40 and the arrangement preferably is such that the eccentrics 38, which are rigidly secured to or formed integral with the shaft 39, rotate in a central bore of the sheaves 37, so that these sheaves are moved back and forth without rotating with the eccentrics. The movement of the sheaves 37 is imparted to the deck by cables 41, each of which has one end secured to a head 42 similar to the head 29, and the opposite end of each cable is anchored to the supporting frame at 43. As a result of this construction the sheaves act upon the cables 41 to pull the deck in a left-hand direction and then release it to move in the opposite direction under the action of the compressed springs 33, and the operating parts are so constructed that the deck is moved more energetically in one direction than the other to impart a progressive movement to the materials that causes them to travel lengthwise of the deck.

As stated, the deck of the present invention is designed more particularly for treating materials in which very fine concentrates or values are to be separated from the tailings, and to this end the air pressure employed must be relatively low, to prevent the air from carrying off the values. The separation of the materials is brought about to a large degree by movement alone, whereby the small concentrates of relatively high specific gravity are caused to work down and wedge under the tailings having a lower specific gravity. In this manner the movement causes the concentrates to accumulate next the deck surface below the tailings,

and, in accordance with the present invention, these concentrates may escape from the deck surface by passing downwardly through apertures. A flow of air upward through these apertures is maintained to prevent the tailings or lighter particles from passing through the same.

It is often desirable to separate the materials being treated into several different classes and this is accomplished in accordance with the present invention by providing a second deck surface above the first so that the lighter materials picked up by the air passing through the lower deck surface may be deposited upon this upper deck surface. The deck shown is therefore provided with a lower deck surface 44 and an upper deck surface 45 and materials to be treated are delivered to the lower deck surface by a hopper 46. As stated the progressive movement imparted to the deck is relied upon to a substantial degree to produce a stratification of the materials being treated and, as best shown in Fig. 6, the deck surface 44 is provided with apertured sections *a* which are separated by unapertured or smooth stratifying sections *b*. Air is forced into the chamber 47 below the surface 44 by a fan 48 connected to the deck by a flexible connection 49 and as the air passes upwardly thru the apertured sections *a* it will lift the lighter particles while it will permit the heavier particles or concentrates to fall thru the apertures upon the floor 21 of the deck. The unapertured sections *b* of Fig. 6 provide a smooth surface upon which the materials may readily shift back and forth to promote settling of the concentrates below the tailings so that when an apertured section *a* is reached, these concentrates lie close to the deck surface so that they may readily escape thru the apertures in opposition to the air being forced up thru the apertures to carry off the lighter materials.

The apertures 50 of the deck surface 44 are preferably provided with inclined lips 51 which extend more or less in the direction in which the materials flow, and are constructed so that the lighter materials or tailings will pass over the apertures while the concentrates may work back thru the apertures.

The upper deck surface 45 is provided with openings thru which the rising air may pass to deposit the lighter materials upon the upper deck surface. These openings may be variously constructed and are shown in Figs. 5 and 9 as comprising transversely extending slots 52 preferably provided with inclined lips 53 which extend over the slots so that the materials traveling lengthwise of the upper deck surface in a right hand direction may pass over the slots without falling thru them.

From the construction so far described, it will be seen that four separations of the materials are obtained. The concentrates which pass thru the apertures in the lower deck surface 44 fall upon the floor 21 of the deck and travel lengthwise thereof to escape thru the discharge spout 54. The materials which remain upon the lower deck surface 44 discharge from its right-hand end thru the spout 55, and the materials that travel along the upper deck surface 45 are discharged thru the spout 56. The extremely light materials which do not settle upon the upper deck surface pass up into the hood 25 and escape thru a pipe 57 which may lead to the suction side of a fan.

It is desirable to reduce the strength of the air to which the materials are subjected as they advance along the lower deck surface and to this end, as shown in Figs. 5 and 6, the deck surfaces may be tapered somewhat so that they are wider at the material receiving end than they are at the discharge end. The strength of air which passes up thru the apertures in the lower deck may be further controlled by providing the air chamber 47 with one or more dampers 58, which may be adjusted to various positions to check the flow of air lengthwise of this passage.

Both the upper and lower deck surfaces may be variously constructed and in Fig. 7 a modified construction is shown in which the upper deck surface 59 is provided with longitudinally extending slots 60 thru which the air carrying the lighter materials may rise, and the slots 60 are provided with upstanding walls 61 which prevent the materials deposited upon the upper deck surface from entering these slots. The construction shown in Fig. 7 has the advantage that the materials deposited upon the deck surface may pass freely along the same without being disturbed by transversely extending slots such as shown in Fig. 5.

Altho the construction of the lower deck surface shown in Fig. 6 as provided with apertured sections separated by unapertured sections is highly desirable in many cases, this construction is not essential in all embodiments of the invention, and in Fig. 8 the lower deck surface 62 is shown as having apertures formed in its entire surface. It may be desirable in some cases to promote travel of the materials being treated transversely of the deck surface in a back and forth manner, as this will give the air passing upwardly through the apertures a better chance to remove the dust and small particles that tend to cling to the concentrates. To this end the apertures of Fig. 8 are shown as provided with lips 63ª which are arranged in adjacent rows inclined in opposite directions; the arrangement being such that one section *c* will direct the materials

toward one side of the deck and the next section *d* will direct the materials towards the opposite side of the deck. As above pointed out, both the upper and lower deck surface may be variously constructed in accordance with the present invention, but in the various constructions the area of the slot openings in the two decks should be approximately the same.

In some cases it may be desirable to provide the concentrator deck with more than one deck surface upon which the lighter particles may be deposited by the air, and to this end the deck shown in Fig. 13 has a third deck surface 63 which may be provided with slots or openings similar to the deck surface 45. In this construction the operation is substantially the same as in Fig. 1 except that the provision of the third deck surface 63 helps to remove the lighter particles from the rising air. In the construction shown in Fig. 13 the hood 64 is secured to and is supported by the deck, and the hood preferably slopes upwardly, as shown, toward the hopper end of the deck. A conduit 65 leads from the hood at a point near the material receiving end of the deck, and serves to draw the air off at the head of the deck. This is desirable because the flow of air lengthwise of the hood toward the material receiving end of the deck serves to pick-up the dust that may have settled upon the upper deck surface.

In treating different materials it may be desirable to vary the up-throw movement imparted to the deck, and in accordance with the present invention, this may be readily done during the operation of the concentrator so that the effect of different adjustments upon the materials may be noted. In the construction shown the cable engaging heads 29 and 42 are secured to the opposite ends of a longitudinally extending shaft 66 slidably secured to the frame 18 by brackets 67. The heads 29 and 42 may have threaded engagement with the opposite ends of the shaft 66 and may be locked in their adjusted position by set screws 68.

The movement imparted to the deck may be varied by adjusting the deck relatively to the shaft 66 which has its opposite ends secured to the operating cable. To this end the shaft has a threaded portion upon which the internally threaded wheel 70 is mounted and the hub of this wheel is journaled between the brackets 71. This arrangement is such that the wheel may be rotated to move the shaft 66 in the direction of its length, but the wheel is prevented from moving lengthwise of the carriage 18. As the wheel 70 is rotated it will force the deck in a lengthwise direction, thus changing the location of the arc through which the deck supporting arms 15 swing, and this varies the up-throw movement imparted to the deck. The shaft 66 is prevented from rotating with the wheel 70 by keys or bolts 72, extending into the slots 73.

What is claimed is:—

1. A concentrator table comprising, in combination, a supporting frame, a deck supported by the frame for back and forth movement and constructed to subject the materials being treated alternately to the action of movement alone and the action of air and movement, means for supplying air under pressure to the deck, a deck surface supported by the deck and provided with apertured sections separated by unapertured sections disposed so that the concentrates will settle while moving along the unapertured sections and upon reaching an apertured section pass downwardly thru the apertures, each apertured section having a number of apertures thru which the concentrates escape in opposition to the lifting action of the air passing up thru the apertures, and lips at the apertures to prevent the tailings from entering the apertures and extending in a direction to promote travel of the lighter materials over the apertures while permitting the concentrates to work back under the lips.

2. A concentrator table, comprising in combination, a supporting frame, a closed deck casing mounted upon the frame for vibratory movement in the direction of its length, means for forcing air into the chamber below the deck surface to pass upwardly thru the apertures of the deck surface, a deck surface provided with apertures thru which the concentrates pass downwardly in opposition to the rising air and constructed and actuated to stratify the materials, inclined lips at said apertures and arranged to promote travel of the lighter materials over the apertures while permitting passage of the concentrates thru the apertures, deck surfaces mounted above the first deck surface one above the other in spaced relation and each provided with slots thru which the lighter particles are carried by the rising air currents to settle upon the deck surfaces, and each of the upper deck surfaces having the slots formed so that the materials settling upon said surfaces may slide along the same under the deck movement without falling thru the slots.

3. A concentrator table comprising, in combination, a supporting frame, a closed deck casing mounted upon the frame for vibratory movement in the direction of its length, means for forcing air into the chamber below the deck surface to pass upwardly thru the apertures of the deck surface, a deck surface provided with apertures thru which the concentrates pass downwardly in opposition to the lifting action of the air passing up thru the apertures, a second deck surface supported above and in spaced rela-

tion to the first deck surface and provided with openings thru which the lighter particles are carried by the rising air currents to settle upon the second deck surface, and lips at the apertures of the lower deck surface and extending in a direction to promote travel of the lighter materials over the apertures while permitting the concentrates to work back under the lips.

4. A concentrator table for treating comminuted ores, comprising in combination, a a supporting frame, a deck supported by the frame for vibratory movement and provided with a deck surface that is constructed to effect separation of the materials by subjecting them alternately to the action of movement alone to effect settling of the heavier particles and to the action of air and movement to facilitate the removal of the heavier from the finer particles, said deck surface comprising a strip of sheet metal supported in a stretched condition by the deck structure and provided with apertured sections separated by relatively large unapertured sections and each apertured section having a width to extend entirely across said surface and being provided with a multiplicity of small apertures, means for delivering air under pressure to the under side of said surface to produce air jets passing upwardly through said apertures, and means for vibrating the deck to promote settling of the heavier particles and to work them through the apertures while the lighter particles that tend to pass through the apertures are carried upwardly by the air jets.

5. A concentrator table for treating comminuted ores, comprising in combination, a supporting frame, a deck supported by the frame for vibratory movement and provided with a deck surface that is constructed to effect separation of the materials by subjecting them to the action of movement alone as they move over a sufficiently large portion of the surface to produce settling of the heavier particles and then subject them to the action of air and movement as they move over another portion of the surface, said deck surface comprising a strip of sheet metal supported in a stretched condition by the deck structure and having relatively large apertured sections that extend across the deck and which are separated by relatively large unapertured sections and each apertured section being provided with a multiplicity of small apertures, means for delivering air under pressure to the under side of said surface to produce air jets passing upwardly through said apertures, and means for vibrating the deck to promote settling of the heavier particles and to work them through the apertures in opposition to the rising air currents.

In testimony whereof, I have signed my name to this specification.

ALBERT H. STEBBINS.