

Aug. 19, 1924.

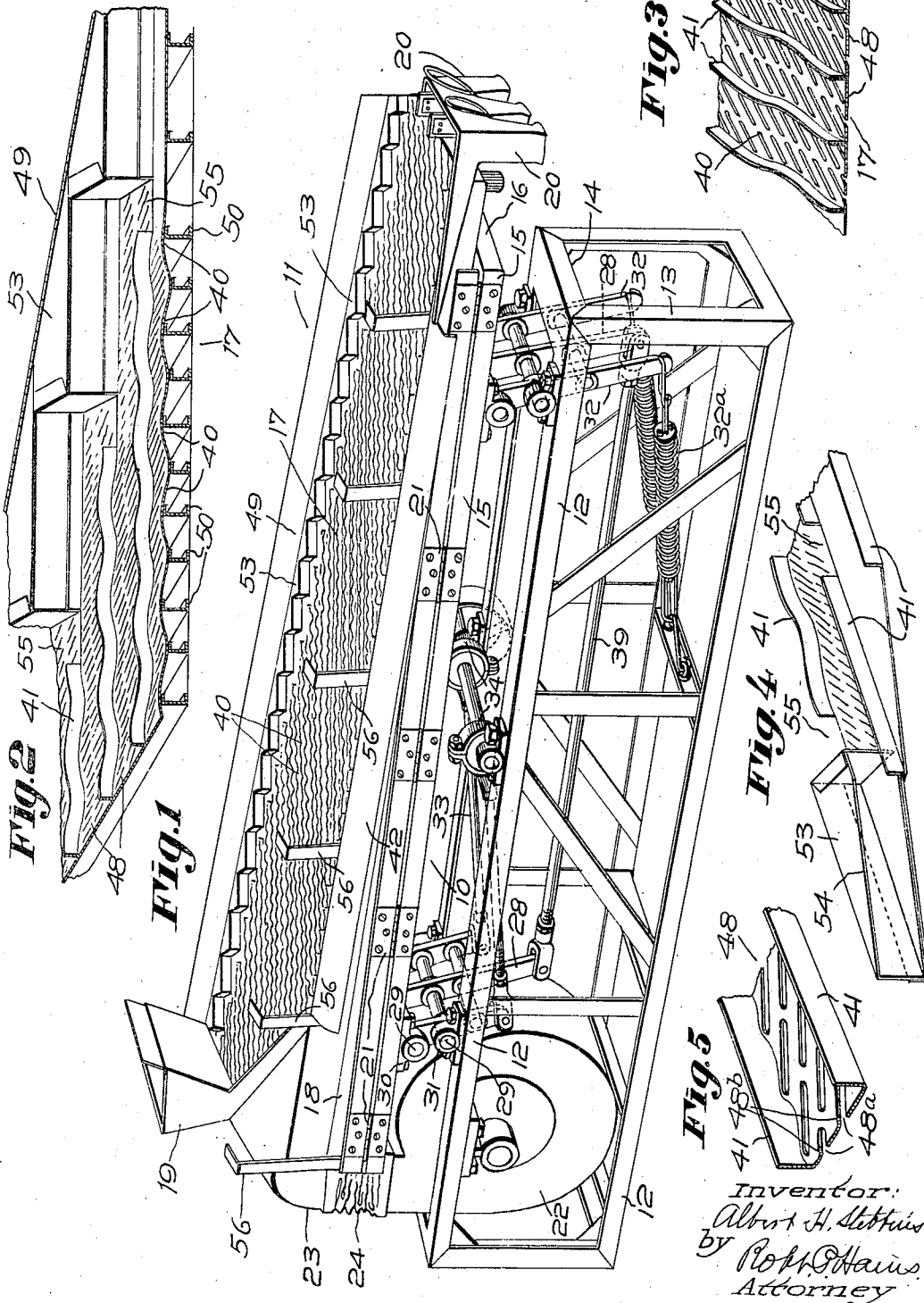
A. H. STEBBINS

1,505,735

TABLE CONCENTRATOR

Filed April 12, 1922

2 Sheets-Sheet 1



Inventor:
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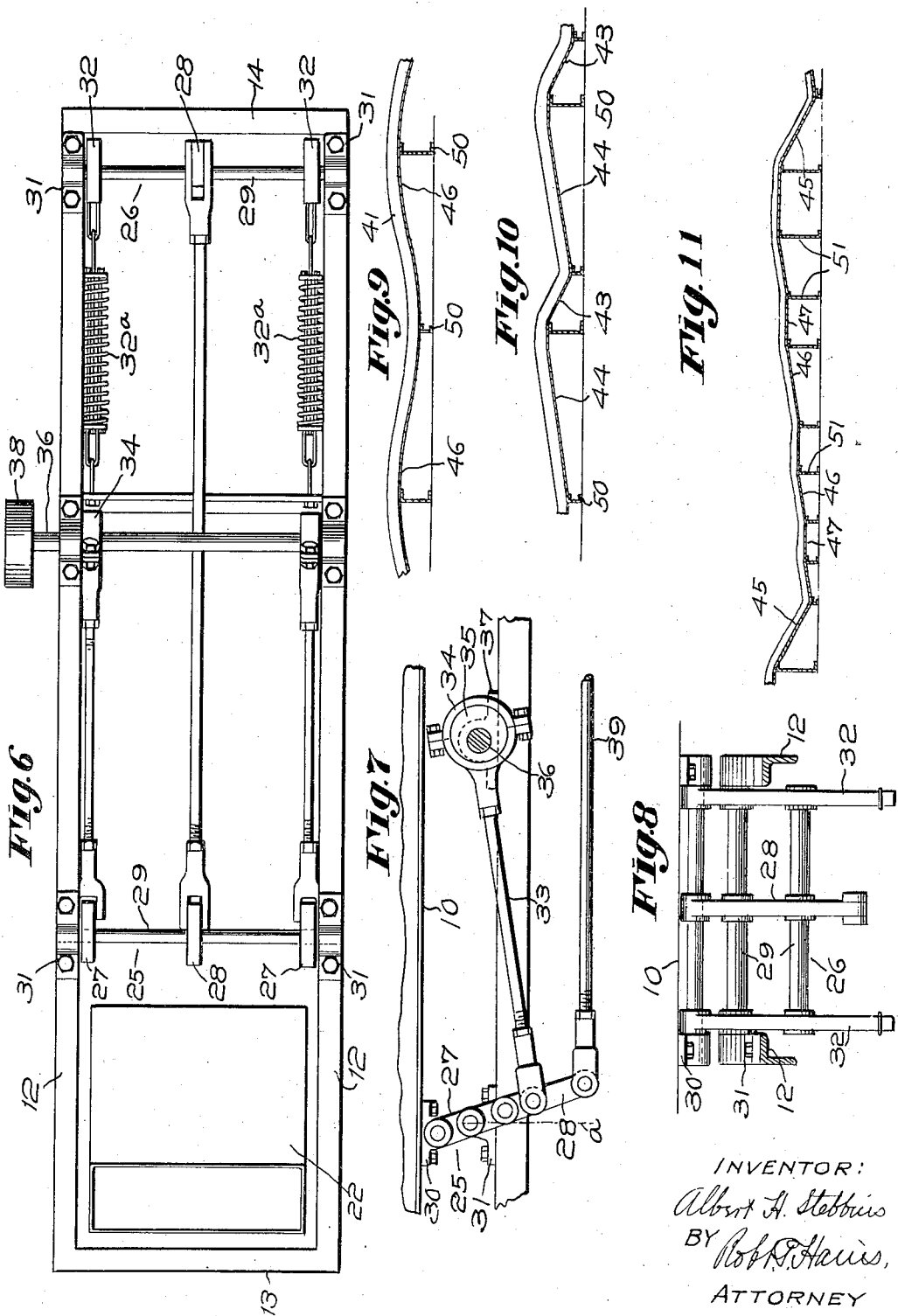
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A. H. STEBBINS

TABLE CONCENTRATOR

Filed April 12, 1922

2 Sheets-Sheet 2



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1,505,735

UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

TABLE CONCENTRATOR.

Application filed April 12, 1922. Serial No. 551,936.

To all whom it may concern:

Be it known that I, ALBERT H. STEBBINS, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented an Improvement in Table Concentrators, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to concentrators of the table type for the separation of ores and other materials in accordance with their differences in specific gravity.

Most metals or values have a higher specific gravity than the accompanying impurities, and the values are commonly distributed throughout a relatively large amount of impurities or foreign matter so that it is usually necessary to treat a large amount of materials as compared with the amount of values obtained therefrom.

The ores to be treated may vary in size from a fine pulverized material to large lumps or rocks, and in the dry concentration of ores, the large lumps or rocks are commonly crushed to a predetermined size and are then delivered to a concentrator table to separate the lighter materials or tailings from the heavier materials or values. All the values may not be released from the lumps of foreign matter at this stage so it may be desirable to recrush the tailings obtained from the first concentrator table and then pass them over a second concentrator table that is adjusted for finer work. The crushing and concentration of the materials may be carried through a number of successive steps, and some values are removed by each concentrator as the materials are reduced in size.

The concentrator table of the present invention is designed more particularly to perform the first several concentration operations above mentioned, and concentrators of this type are commonly provided with a deck having a deck surface over which the materials to be treated are passed. Riffles are commonly provided over the surface of the deck and they serve to direct the heavier materials that lie close to the deck surface in one direction while the lighter materials pass over the riffles in a different direction.

Movement of the materials over the surface of the deck may be obtained either by inclining the deck in the direction of its length

or by imparting a movement to the deck that will advance the materials over the same, and movement of the materials will be promoted by passing air upwardly through the deck surface.

It is important to produce a stratification of the materials upon the deck surface, and this is facilitated by passing air upwardly through the materials of sufficient strength to lift the lighter materials while permitting the heavier materials to move downward. As the materials are stratified it is desirable to cause the lighter materials to pass laterally over the top of the riffles while the heavier materials travel lengthwise of the riffles, and to this end the concentrator deck is usually supported at a transverse inclination which causes the lighter materials to move over the riffles in the direction in which the deck slopes.

In the operation of the concentration table it is desirable to produce a smooth flow of the materials along the riffles with a great number of small cross flows of the lighter materials over the riffles, and to this end, one important feature of the present invention resides in a deck surface having waves or other inclined surfaces in the path of the materials traveling lengthwise of the riffles to cause the materials to pile up at intervals lengthwise of the riffles. The piling up or bunching of the materials at intervals along the riffles should be sufficient to cause the lighter materials to escape over the riffles while the heavier particles should rise to a less extent.

In the present case movement of the materials lengthwise of the deck is promoted by imparting a back and forth movement to the deck, and another feature of the present invention resides in the mechanism for imparting movement to the deck.

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 one good practical form thereof.

In the drawings:

Fig. 1 is a perspective view of a concentrator table constructed in accordance with the present invention;

Figs. 2, 3 and 4 are perspective views of parts of the deck surface;

Fig. 5 is a perspective view of one of the surface channels of which the deck surface is formed;

Fig. 6 is a plan view of the supporting frame and deck operating mechanism;

Fig. 7 is a side view of parts shown in Fig. 6;

Fig. 8 is a front view of parts shown in Fig. 6; and,

Figs. 9, 10 and 11 are sectional views through differently constructed deck surfaces.

In Fig. 1 the concentrator table is shown as consisting of a supporting frame of a rectangular box-like construction having a carriage 10 movably supported thereby, and a deck 11 mounted on the carriage at a transverse inclination.

The supporting frame may be formed of longitudinally extending angle irons 12 connected by upright and transversely extending angle irons 13 and 14 respectively. The carriage may consist of side beams 15 and end beam 16 connected to form a rectangular frame of sufficient size and strength to carry the deck 11. The deck preferably is constructed in the form of an elongated hollow casing tapering from the material receiving end toward the material discharge end as shown, and has a deck surface 17 to be described, below which is provided a relatively large air chamber 18. At one end of the deck 11 is provided a hopper 19 for delivering the materials to be treated to the deck, and at the opposite end of the deck are provided a plurality of receptacles or hoppers 20 for receiving the materials discharged from the end of the deck.

The deck 11 preferably is supported to slope in a transverse direction as shown, and to this end one side of the deck is secured to the carriage 10 by hinges 21 so that the transverse inclination of the deck may be varied, and the upper side of the deck may be supported in spaced relation to the carriage by suitable means, not shown. Air may be forced into the chamber 18 below the deck surface by a fan 22 mounted upon the supporting frame, a wide hood 23 being provided at one end of the chamber 18 to direct air into the chamber, and since the deck moves relatively to the supporting frame, a flexible connection 24 is provided between the fan 22 and hood 23.

The construction so far described, for the most part may be similar to the concentrator table construction disclosed in my co-pending application Serial No. 551,935 filed April 12, 1922.

It is desirable to impart a movement to the deck that will cause the materials to travel lengthwise thereof, and novel means to this end will now be described. In the construction shown the carriage 10 is supported by a rocking frame 25 near one end thereof and a second rocking frame 26 near the other end thereof. These frames are pivotally mounted on the supporting frame

to swing in a vertical plane, and the frame 25 consists of spaced side levers 27 and an intermediate lever 28 connected by transversely extending bars or shafts 29. The ends of the upper shaft 29 are journaled in bearing blocks 30 secured to the carriage 10 and the ends of the middle shaft 29 are journaled in bearing blocks 31 upon the angle beams 12 of the supporting frame. The rocking frame 26 may be similar in construction to the frame 25 except that the side levers 32 are longer for a purpose to be described.

In the construction shown, rocking movement is imparted to the frame 25 by connecting rods 33 secured to the lower ends of the side levers 27, and the other ends of the rods 33 are secured to eccentric heads 34 embracing eccentrics 35 secured to a driving shaft 36 rotating in bearings 37, and the shaft 36 may be driven by a pulley 38. It is desirable to impart a similar rocking movement to the frame 26 without requiring this movement to be transmitted through the carriage 10, and to this end the intermediate lever 28 of the frame 25 has its lower end connected to the lower end of the corresponding lever of the frame 26 by a connecting rod 39. By connecting the rocking frames 25 and 26 by the rod 39 to impart movement from one to the other, a well balanced construction is obtained and the mechanism will operate more smoothly and with less wear than when the connecting rod 39 is omitted.

The angle through which the frames 25 and 26 are rocked serves to impart an "up-throw" to the materials upon the deck to advance the materials longitudinally thereof, and to this end each frame rocks toward the vertical position indicated by the line *a* in Fig. 7, but has its movement arrested before it reaches this position. This serves to toss the materials upward and lengthwise of the deck slightly to impart a successive advancing movement to the materials. Movement of the rocking frames 25 and 26 toward the vertical position may be assisted by springs 32^a secured to the levers 32.

As the materials advance along the deck a stratification is produced by the passage of air upwardly through the materials so that light materials will work upwardly while the heavy materials work downward toward the surface of the deck, and removal of the light materials from the heavy is effected by causing the lighter materials to flow laterally over riffles upon the deck surface while the heavier materials travel along the riffles.

The desideratum in table concentrators is to produce a smooth flow of the materials lengthwise of the riffles with a great number of small cross flows of the light materials over the riffles, and satisfactory means

to this end will now be described. The deck surface 17 in the embodiment of the invention illustrated is formed to provide a plurality of waves 40 extending diagonally across the deck so that the crest of the waves extend diagonally from one side wall of the deck to the other, and the riffles 41 extend over the deck surface at substantially right angles to the direction in which the waves extend and run in an inclined direction from the lower side wall of the deck toward the upper side wall. As a result of this construction the materials traveling lengthwise of the riffles will bunch or pile up against the upwardly inclined side of each wave, and this bunching of the materials will cause the lighter materials to flow laterally over the riffles toward the lower side of the deck. As these lighter materials reach the lower side of the deck they escape therefrom over the side plate 42.

The wavy construction given to the deck surface may be varied as desired and in Figs. 1, 2, 3 and 9 the opposite sides of each wave are symmetrical. In Fig. 10 the downwardly sloping side 43 of each wave is shown steeper than the upwardly inclined surface 44. This construction permits the number of waves within a given distance to be increased without changing the configuration of the upwardly inclined side of each wave.

Still a different construction of the deck surface is shown in Fig. 11 wherein the up-slope between two downwardly inclined slopes 45 is divided into a number of short runs alternately flat and inclined. The small up-slopes 46 effect bunching while the horizontal runs 47 promote stratification. The up-slopes also offer greater resistance to the travel of the materials over the surface and this in turn promotes stratification.

In the construction shown the deck surface 17 is constructed entirely of perforated surface channels 48 (see Fig. 5) having the sides bent up to form the riffles 41. The perforations 48^a of the surface channels preferably are provided with upwardly inclined lips 48^b that serve to prevent the materials from falling through the apertures. The lips also serve to direct the air currents as they leave the apertures. The channels 48 are arranged side by side to form the deck surface and preferably extend diagonally of the deck as best shown in Fig. 1, so that the materials that travel along the riffles will be directed toward the upper side 49 of the deck. The channels 48 may be supported by the channel bars 50 and the latter preferably vary in width so that one will support the crest of a wave while the next will support the trough, as clearly shown in Figs. 2, 9 and 10. The deck surface shown in Fig. 11 may be supported by channel bars 51.

It is desirable to cause the materials traveling along a riffle to pile up at the end thereof so that they will flow transversely over one or more riffles and be further concentrated as they travel along the new riffles. To this end buffer blocks 53 are provided along the upper side 49 of the deck and in spaced relation to the ends of the riffles. These blocks are conveniently constructed of sheet metal having the hollow construction shown in Fig. 4, and are cut on an inclination as indicated by 54 to rest against the upper side members 49. The blocks 53 preferably fit within the surface channels 48 between the riffles 41, and a notch 55 cut in the walls of the riffles adjacent each block, terminates the riffle in spaced relation to the block.

The materials delivered to the deck by the hopper 19 will spread out rapidly over the deck due to the air passing upwardly through the aperture in the deck, and due also to the transverse inclination of the deck and the movement imparted thereto. The heavier materials will be directed toward the upper side of the deck by the riffles 41 and will travel along the upper side 49 toward the receptacles 20 at the delivery end of the deck. The lighter materials traveling transversely of the deck will escape from the lower side thereof, and the deck preferably is enclosed by a cover, not shown, which rests on the upstanding brackets 56.

What is claimed is:

1. A concentrator comprising, in combination, a deck supported at a transverse inclination and having a deck surface constructed to form a series of waves extending in a transversely inclined direction across the deck, riffles extending over the wavy surface of the deck across the waves and in an inclined direction from one side of the deck to the other, means for delivering the materials to be treated to the deck surface, and means for moving the deck to impart movement to the materials along the inclined riffles so that they will be directed by the riffles over the waves and toward the upper side of the deck.

2. A concentrator comprising, in combination, a deck supported at a transverse inclination and having a perforated deck surface constructed to form a series of waves extending across the deck, riffles extending at a transverse inclination over the wavy surface of the deck across the waves and in an inclined direction from one side of the deck to the other, means for delivering the materials to be treated to the deck surface, means for advancing the materials lengthwise of the deck over the wavy surface so that they are guided toward the upper side of the deck by the riffles, and means for forcing air upwardly through the perforations of the deck surface.

3. A concentrator table comprising, in combination, a deck supported at a transverse inclination and having a deck surface constructed to form a series of waves extending diagonally across the deck, riffles extending over the wavy surface of the deck in an inclined direction toward the upper side of the deck and cross-wise of the waves, means for delivering the materials to be treated to the deck surface, and means for advancing the materials lengthwise of the deck over the wavy surface.

4. A table concentrator comprising, in combination, a deck supported at a transverse inclination and having a deck surface constructed to form a series of waves extending diagonally across the deck, means for delivering materials to be treated to the deck surface, means for imparting movement to the deck to advance materials lengthwise thereof over the wavy surface, and riffles extending in an inclined direction over the deck surface and crosswise of the waves to direct the heavier materials toward the upper side of the deck while the lighter materials pass over the riffles toward the lower side of the deck.

5. A concentrator comprising, in combination, a deck supported at a transverse inclination and having a deck surface formed of a multiplicity of surface channels arranged side by side diagonally of the deck, each channel being bent at intervals along its length to form a series of transverse waves lengthwise of each channel and the channels having upwardly bent side walls forming riffles for deflecting the heavier materials away from the lower side of the deck, and means for advancing the materials lengthwise of the deck.

6. A concentrator comprising, in combination, a deck supported at a transverse inclination and provided with a deck surface having a stepped construction consisting of alternate horizontal and upwardly inclined portions, means for delivering materials to be treated to the deck surface, means for imparting movement to the deck to advance materials lengthwise thereof over the deck surface, and riffles extending over the stepped construction of the deck surface to direct the heavier materials away from the lower side of the deck.

7. A concentrator table comprising, in combination, a deck having a perforated deck surface constructed to form a series of waves extending across the surface thereof, means for delivering materials to be treated to the deck surface, means for imparting movement to the materials to advance them lengthwise of the deck, means for passing air upwardly through the deck surface, and riffles extending diagonally of the deck to direct the heavier materials away from the lighter materials.

8. A deck for a concentrator, comprising, in combination, a deck surface formed of a multiplicity of surface channels arranged side by side and having upstanding sides forming riffles, separate blocks fitted within the different channels to close an end of the channels and disposed relative to each other to form a buffer wall extending along one side of the deck, and each riffle having a section cut therefrom adjacent its block to promote the flow of materials from one riffle to another.

9. A deck for a concentrator table, comprising in combination, a deck surface formed of a multiplicity of surface channels arranged side by side and having upstanding sides forming riffles, and each surface channel having waves formed transversely thereof at intervals throughout its length to produce troughs and crests lengthwise of the channels.

10. A deck for a concentrator table, comprising, in combination, a deck surface formed of a multiplicity of apertured surface channels arranged side by side and having upstanding sides forming riffles, each surface channel having waves formed transversely thereof at intervals throughout its length to produce troughs and crests lengthwise of the channels, and lips at said apertures for directing the air passing therethrough.

11. A deck for a concentrator table, comprising, in combination, a deck surface formed of a multiplicity of apertured surface-channels arranged side by side and having upstanding sides forming riffles, each surface-channel having waves at intervals throughout its length and forming troughs and crests extending across the channels, and lips extending in an inclined direction over said apertures to deflect materials therefrom.

12. In a concentrator, the combination of a deck supported at a transverse inclination and having a deck surface provided with perforations and formed with undulations or waves extending in an inclined direction across the deck, riffles extending crosswise of the waves or undulations and diagonally across the deck to direct materials toward the upper side of the deck, and means for moving the deck to impart progressive movements of the material crosswise of the waves or undulations that the heavier particles may assemble themselves in the hollows of the waves or undulations with the lighter particles above the heavier particles.

13. A concentrator table comprising, in combination, a deck having a deck surface supported at a transverse inclination, riffles extending diagonally over the deck surface, means for delivering materials to the deck and for vibrating the deck to promote

travel of the materials over its surface, and the deck surface being constructed to present troughs and crests extending transversely between the riffles to cause the materials to travel over successive waves or undulations in traveling lengthwise of a riffle.

14. A deck for a concentrator table, comprising, in combination, a composite deck surface formed of a multiplicity of trough-shaped surface-channels arranged side by side and having upstanding sides forming riffles, and separate blocks independently fitted within the different channels so that they fill the space between the riffles near an end thereof to form buffer blocks arranged in stepped relation to form a stepped buffer

wall against which the materials pile up at the end of the riffles.

15. A deck for a concentrator table, comprising, in combination, a composite deck surface formed of a multiplicity of trough-shaped surface-channels arranged side by side and having upstanding sides forming riffles, and separate blocks of folded sheet metal fitted within the different channels between the upstanding sides and near an end of the channels to form buffer blocks arranged in stepped relation to form a stepped buffer wall against which the materials pile up at the end of the riffles.

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

ALBERT H. STEBBINS.