E. H. TATE.

AERO ORE CONCENTRATOR AND PLACER MACHINE.

APPLICATION FILED MAY 6, 1909.

984,866.

Patented Feb. 21, 1911.

2 SHEETS—SHEET 1.

Fig. 1

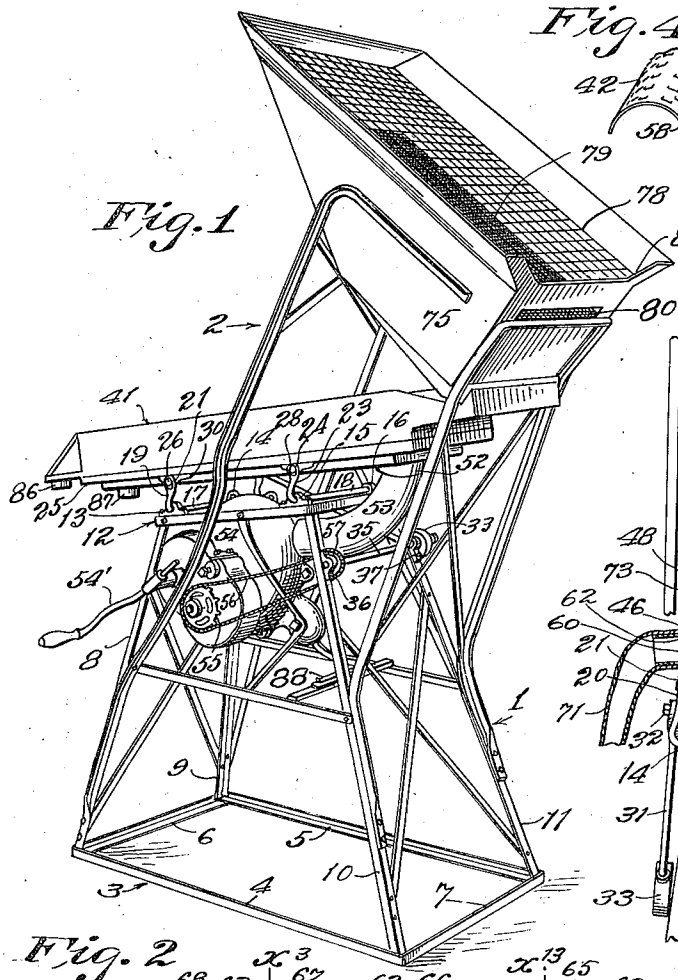


Fig. 4

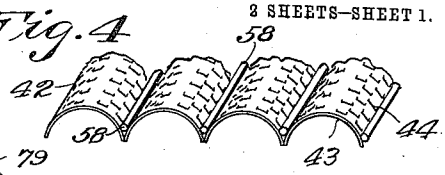


Fig. 3

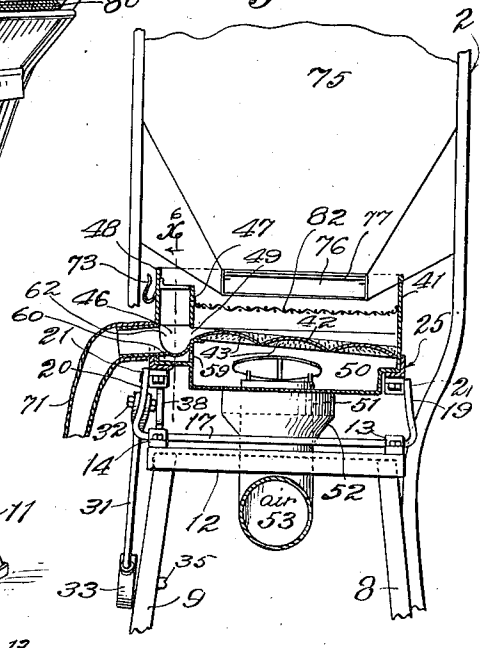
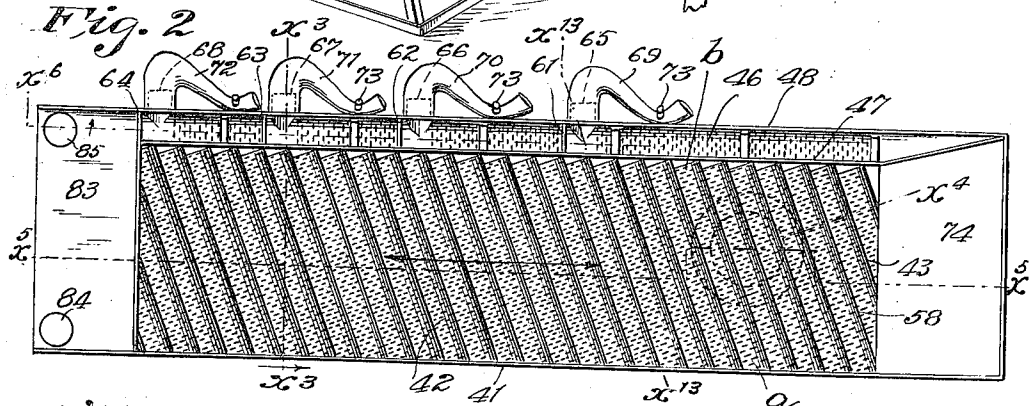


Fig. 2



Witnesses

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2 SHEETS—SHEET 2.

Fig. 5.

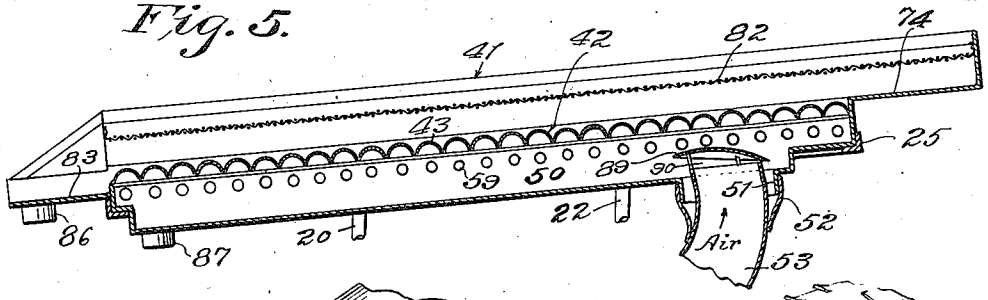


Fig. 7

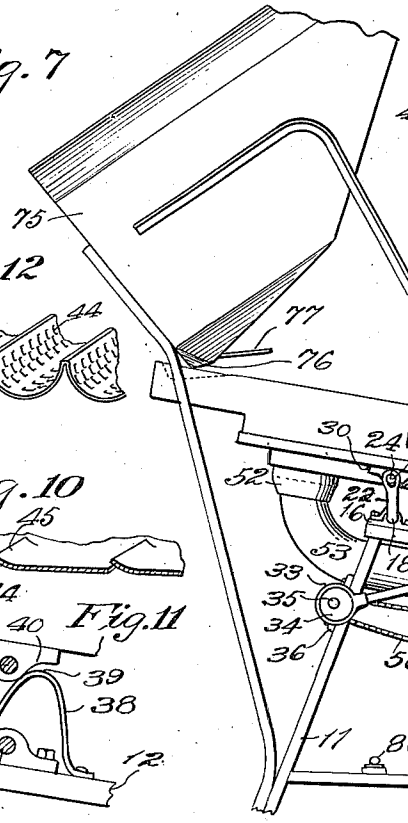


Fig. 8

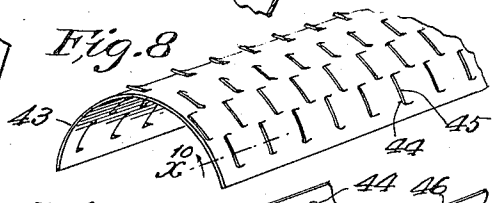


Fig. 9

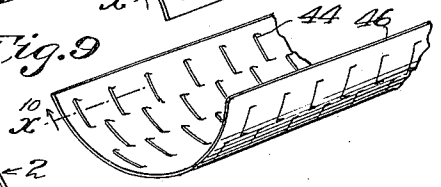
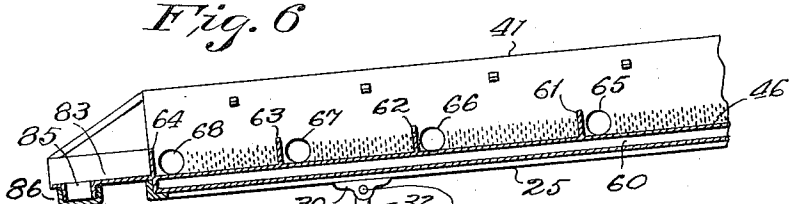


Fig. 12

Fig. 10

Fig. 11

Fig. 6



Witnesses

C. C. Holly

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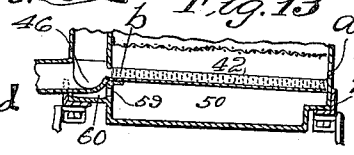
Fig. 13



Inventor

Earl H. Tate

by James R. Townsend

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UNITED STATES PATENT OFFICE.

EARL H. TATE, OF LOS ANGELES, CALIFORNIA.

AERO ORE-CONCENTRATOR AND PLACER-MACHINE.

984,866. Specification of Letters Patent. Patented Feb. 21, 1911.

Application filed May 6, 1909. Serial No. 494,469.

To all whom it may concern:

Be it known that I, EARL H. TATE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Aero Ore-Concentrator and Placer-Machine, of which the following is a specification.

The object of this invention is to provide light, readily portable, cheap, strong, and highly-effective means for separating minerals from the materials in which they occur.

This invention relates to the class of machines in which air is used to buoy up and carry off the waste materials while the valuable minerals and heavy concentrates separate from the gangue by gravity and are delivered to a suitable receptacle for reduction.

The machine is adapted for operation either manually or otherwise.

The accompanying drawings illustrate the invention.

Figure 1 is a perspective view of a manually-operable ore-concentrator constructed in accordance with this invention. Fig. 2 is a plan of the concentrating table detached. The flexible concentrate discharge-tubes are shown hung up. Fig. 3 is a fragmental view partly in cross-section on line indicated at x^3, Fig. 2, looking toward the right. A flexible concentrate discharge-tube is shown released to discharge the concentrates. Fig. 4 is a fragmental view of a plurality of the riffle-segments. Fig. 5 is a distorted view, partly in section, at right angles to the riffle-segments and partly in section lengthwise of the chamber underneath the riffle-sections. This view shows the air-inlet to said air-chamber and outlets to the concentrate-trough. Line x^5—x^5, Fig. 2, indicates the line of section. Fig. 6 is a section on line x^6, Fig. 2, looking up in the direction of the arrow. Fig. 7 is a side elevation of the machine from the back of Fig. 1 and the right-hand side of Fig. 3. Fig. 8 is a fragmental, perspective view of one of the segmental riffles. Fig. 9 is a sectional view of the segmental member forming the bottom of the concentrate-trough. Fig. 10 is a fragmental, sectional detail of one of the riffles. Fig. 11 is an enlarged detail of the bumping and lifting contrivance at the head of the table. Fig. 12 is a fragmental view showing an arrangement of the segmental riffles just the reverse of that shown in Fig. 5. Fig. 13 is a fragmental, sectional elevation on line x^{13}, Fig. 2, to show the upward inclination of the riffles from their heads to their discharge ends.

The frame of the machine is constructed of angle-iron, and comprises a base 1 of pyramidal form and an oblique extension 2 extending upwardly aslant from the base. The base comprises a bottom-piece 3 composed of a single length of angle-iron bent into the form of a parallelogram having two long sides 4, 5, and two short ends 6, 7. The recess of the angle-iron is directed inwardly and upwardly; and into said recess, at the four corners of the base, are seated four upwardly-converging standards 8, 9, 10, 11, which terminate at their upper ends at a distance apart and are fastened at the corners to the top-piece 12 which is made of a length of angle-iron bent into a parallelogram similar to but smaller than the bottom-piece 3. The tops of the standards fit and are fixed to the top-piece at the corners thereof. The standards 8, 9, at one end of the base are shorter than the standards 10, 11, at the other end of the base so that the top-piece 12 extends aslant relative to the bottom-piece 3 to form a support for bearings 13, 14, and 15, 16, in which are journaled rock-shafts 17, 18. The rock-shaft 17 is provided at one end with an upwardly-extending arm 19 and at the other end with an upwardly-extending arm 20, each of which arms is provided at its upper end with a circular eye 21. The rock-shaft 18 is provided at its ends with upwardly-extending rock-arms 22, 23, each of which is provided at its upper end with a vertically-elongate eye 24.

25 is a concentrating-table-frame, the same being formed of angle-iron bent into oblong shape and provided at its sides with cylindrical pivots 26, 27, 28, 29, that are journaled in the eyes 21 and 24; said pivots being provided with bases 30 by which they are fastened to the table-frame 25.

The arms of the rock-shafts are held upright by means of a pitman 31 that is pivoted by a wrist-pin 32 to the arm 20 of the tail-end rock-shaft 17 and connected by an eccentric-strap 33 with an eccentric cam 34 that is fastened to a shaft 35 which is mounted in bearings 36, 37, on the head standards

10, 11. The eccentric-cam is constructed to reciprocate the pitman with a slight throw, which in actual practice in the machine illustrated is ¼ inch in length. The concentrating-table 25 is thus reciprocated endwise in the direction of the large double-headed arrow in Fig. 2 whenever the pitman is operated by the cam. The rock-shaft arms which support the table-frame are approximately of the same length and each of the pivots moves in the arc of a circle almost directly over the center of the rock-shaft, so that the movement of the table-frame effected by the arms alone would be of a regular character; but there is provided a bumper 38 having an oblique face 39 arranged in the path of a bearing 40 on the table-frame nearly in line with the axis of the pivots, and this serves to lift the table-frame from the pivots in the elongated eyes at the close of each stroke of the table in the direction of the tail or lower end, and to allow the head of the table to lower at the beginning of each return stroke toward the upper end. The result of this action is to jar the table at every revolution of the cam as well as to reciprocate the table endwise, and the head end of the table is given an up-and-down movement greater than that of the tail of the table, all of which assists in moving forward the lighter material more rapidly than the heavier material, thus to assist in effecting the concentration.

The concentrating-table 41 has a concentrating surface 42 formed in ridges and valleys and constituting riffles that extend diagonally across the table, aslant upwardly from head to tail, and that are preferably formed by the conjunction of a series of foraminous, tubular, sheet-metal segments 43, having slot-like openings 44 therethrough which are produced by angular slits forming tongues 45 that are bent upwardly and that extend toward the concentrating-trough 46 of the table. The ridged concentrating surface formed by the foraminous sheet-metal tube-segments has openings through the opposite side walls of the valleys thereof so that when air under pressure is applied to the underside of said surface and hence to the inside of the tube-segments, air will issue from the side walls of the valleys in numerous streams, those from each of the side walls of any valley flowing toward and impinging upon streams from the opposite side wall of said valley so that in each valley the air-currents tend from the sides of the valley toward the midline of the valley and thence upwardly, flowing at the same time toward the concentrates side of the table by reason of the direction given the air by the form and arrangement of the slot-like openings particularly herein-described. Said trough is bounded at its sides by two walls 47, 48. Underneath the inner wall 47 are openings 49 into the trough from between the riffles. The riffles 43 are mounted on and form the top of an air-box 50 into the bottom of which at the head-end of the table opens an air-pipe collar 51 onto which a flexible air-pipe 52 is telescoped; the same being connected at its lower end with the blower-pipe 53 to direct air into the box 50 from the blower 54 which may be of any ordinary type operable by suitable means. In the drawings a crank 54′ is provided for this purpose. Said blower is provided with a driving sprocket-wheel 55 connected by a sprocket-chain 56 to a driven sprocket-wheel 57 on the cam-shaft 35 so that when the blower is operated the table will be reciprocated by the cam 34. The top of the air-box is formed by the segmental riffles 43 and wires 58 that are led along and are raised above the centers of the valleys midway between the crowns of the segments, as clearly shown in Fig. 4. The wires 58 constitute auxiliary riffles or air mixers which retard the air going through the side walls of the segmental foraminous riffles the tops of which riffles are provided with an imperforate portion 90 so that the top of the table is doubly riffled having foraminous riffles and between the same solid riffles. In the operation of the machine the solid wire riffles support and retard the middlings and allow the concentrates to move along the sides of the riffles; and by their cylindrical form shown, produce above the sheet metal surface, small ways along which concentrates may flow. Said solid riffles 58 may contact with the surface of the foraminous riffles and the concentrates may flow along both sides of the raised solid riffles 58. Ports 59 in one wall of the air-box 50 open into an air-pipe 60 underneath the concentrate-trough 46, which trough may be a sheet-metal segment provided with angular slits 44 corresponding to those of the segmental riffles 43. This trough serves as a conduit for the concentrates, and the operation of the air through the slits of the trough and through the slits of the riffles is practically the same upon the material in the trough and on the riffles, as the case may be, tending to move the lighter material on toward the tail of the machine.

The concentrate-trough is separated by transverse partitions 61, 62, 63, 64, into sections into which the concentrates discharge from the ends of the riffles 43. From the lower end of each of these sections the concentrate discharge-spouts 65, 66, 67, 68 open, and onto the same are telescoped the ends of flexible concentrate-pipes 69, 70, 71, 72, which may taper to a small diameter and may be hooked upon hooks 73 that are above the level of the spouts so that the concentrates will be retained in the flexible pipes until said pipes are released from the hooks and allowed to hang down as indicated in

Fig. 3. Then the concentrates will discharge.

At the upper end of the table there is a plain distributing-plate onto which the material may fall from a hopper 75 provided with an opening 76 which is elongated transversely of the table and delivers the material to be separated onto the top of the table. Said opening is controlled by a slide 77 by which it may be contracted or entirely closed. In the hopper there is provided a coarse screen 78 and a fine screen 79, the latter discharging the finer waste through a slot 80, and the former discharging the coarser waste through the opening 81. Over the top of the distributing-plate 74 and the riffles 43 is stretched a wire screen 82 to carry down any material that may have passed through the second screen 79. The first screen 78 may be inch mesh, the second screen 79, half-inch mesh, and the third screen 82, one-fourth inch mesh; so that only the material which is finer than would pass over the one-fourth inch mesh screen will reach the riffled-table.

83 is the tail-plate of the table provided with traps 84, 85, for any heavy values that may have passed the concentrating surfaces above. These traps may be provided with removable bottoms as the screw-caps 86 that may be removed, thus to recover the contents of the traps. A like trap with a removable bottom or cap 87 is provided at the tail of the air-box so that any finer values that may have passed through the concentrating surface can be collected.

The riffles and the valleys between them are arranged diagonally, their discharge-ends at the concentrating-trough 46 being nearer the tail-plate of the table than is the head-end of the riffle. The table is tilted transversely, and the riffles slant upwardly from their heads *a* to their tails or discharge-ends *b*, so that the concentrates that pass over the table must rise as they proceed to the discharge-end *b*. The frame of the table is provided with a spirit-level 88 so that the operator can set the frame in level position without difficulty, thus bringing the riffles to the appropriate slant.

Above the discharge-end of the air-pipe 52 is a deflector 89. The air-pipe 53 opens into the air-box 50 at the upper end thereof, and the deflector 89 is arranged aslant upwardly toward the lower or discharge end of the table and underneath the riffles; an open space 90 being provided all around the top of the pipe underneath the deflector so that the air escapes from the pipe 53 on all sides thereof and provides an even pressure upon the underside of the riffles through which the air flows to hold in suspension the lighter material, so that the same may be carried off thereby. By providing the angular slits which form tongues, the air issues around the sides of the tongues in streams and over the spaces between the slits, thus producing a peculiar action upon the material, tending to allow the heavy values to fall and move along the riffles, while the lighter material is held in suspension and thoroughly shaken and agitated by the varying pressures of air as it passes alternately over the slitted and the solid portions.

In practice, the apparatus will be set in position where the pay-dirt occurs or is available, care being taken that the table-top is given a considerable endwise slant downward toward the tail-end and a sidewise slant upward toward the discharge-side of the riffled surface. The endwise slant may be six inches in four feet, and the sidewise slant three-fourths of an inch in eighteen inches. The degree of slant may be varied within the judgment of the operator. Then the crank 54′ will be turned by one workman, thus operating the blower and shaking the table, while another workman shovels the pay-dirt into the hopper.

By reason of the segmental form of riffles the top riffles are concave as clearly seen in Fig. 4, thus being provided with gently sloping sides down which the material flows on its way to the solid riffles 58 and since such sides are foraminous by reason of the slits, the material as it passes thereover is effectively operated upon without violent action and the concentrates gradually find their way to engagement with the solid riffles down which they will pass on their way out of the machine.

I claim:—

1. The concentrator table having a surface formed in ridges and valleys the sides of which ridges and valleys are foraminous and the tops of which ridges are impervious to air; and means for supplying air pressure to the underside of said surface.

2. A concentrating table provided with a sheet-metal top that is formed with ridges and valleys, the side walls of the valleys being perforated by angular slits forming tongues which project toward one edge of the top, and means to supply air under pressure to the under-side of said top.

3. A concentrating table provided with a sheet-metal top that is formed with ridges and valleys and is perforated through the side walls of such valleys by angular slits forming tongues, and means to supply air under pressure to the under-side of said top.

4. A concentrating table provided with a top formed of segmental sheet metal tubes that are perforated to admit air through the sloping sides thereof and are imperforate at the top, and means to supply air under pressure to the under-side of said table top.

5. A concentrating table provided with a top formed of sheet-metal tube segments

forming curved faces that are perforated along their sides with angular slits forming tongues, said tongues being bent upward, and means to supply air under pressure to the under-side of said top.

6. A concentrating table provided with a top formed of sheet-metal tube segments having curved faces that are perforated along their sides with angular slits forming tongues, said tongues being bent upward and extending lengthwise of the segments, and means to supply air under pressure to the under-side of said top.

7. A concentrating table having a concentrating surface one end of which is higher than the other end and one side of which is higher than the other side, said surface being formed in ridges and valleys that extend diagonally across the table, the side walls of said valleys being foraminous, means to force air through said surface, and means to reciprocate the table.

8. A concentrating table having a concentrating surface formed in ridges and valleys and provided with openings directed along the ridges and toward one side of the table, means to force air through said openings, and means to shake the table; the side of the table toward which the openings are directed being higher than the other side and one end of the table being higher than the other end, and said ridges and valleys extending diagonally across the table, and the ends of such ridges and valleys at the high side of the table being higher than the ends of the ridges and valleys respectively at the other side.

9. A concentrating table having a concentrating surface formed by the conjunction of a series of foraminous sheet-metal tube segments forming curved faces, the openings through said faces being slot-like and consisting of angular slits forming tongues, said tongues being bent upwardly and all extending in the same general direction along the tube segments.

10. A concentrating table having a concentrating surface formed by the conjunction of a series of foraminous sheet-metal tube-segments forming curved faces; the openings through said segments being slot-like and consisting of angular slits forming tongues, said tongues being bent upwardly and all extending in the same general direction along said segments; means to force air through the openings, and means to shake the table.

11. An ore-concentrator comprising a table provided with a foraminous riffled top, a frame, rock-shafts journaled on said frame and provided with upwardly-extending arms having eyes, a table provided with pivots in said eyes, the eyes in the arms of one of the rock-shafts being vertically elongate; a pitman pivoted to one of said arms to shake the table, means on the frame to operate the pitman; a bearing on the table-frame, a bumper having an oblique face arranged in the path of such bearing and nearly in line with the axis of the pivots so that the bearing will ride upon the bumper at each stroke of the table in the direction of the tail or lower end of the table, and means to operate the pitman.

12. In an ore-concentrator, the combination with a foraminous riffled surface, of a trough to receive concentrates from such surface, said trough being provided with a slitted bottom, the slits being arranged to form tongues, and means to force air through the riffled surface and through the slitted bottom.

13. A concentrating table comprising an air-box, a trough alongside the air-box, the bottom of the trough being foraminous and the top of the box being formed with foraminous riffles to discharge material into the trough; means to supply air under pressure to the air-box, and means to shake the table.

14. A concentrating table comprising an air-box, a trough alongside the air-box, the bottom of the trough being foraminous and the top of the box being formed with foraminous riffles to discharge material into the trough; means to supply air under pressure to the air-box, means to shake the table, partitions separating the trough into sections, and means to discharge concentrates from the sections respectively.

15. A concentrating table comprising an air-box, a trough alongside the air-box, the bottom of the trough being slitted and the top of the box being formed with slitted riffles to discharge material into the trough, the slits of said trough being angular to form tongues; means to supply air under pressure to the air-box, means to shake the table, partitions separating the trough into tions, and means to discharge concentrates trates from the sections respectively.

16. A concentrating table having a sloping concentrating surface and a trough to receive concentrates from the table, said table being formed by the conjunction of a series of foraminous sheet metal tube segments provided with openings formed by angular slits that are directed toward the concentrating trough of the table, which tube segments form valleys; a series of solid wire air-riffles at the center of the valleys for the purpose of breaking the air pressure through the sloping sides of the tube segments; said wires being arranged stationary extending from the low side of the concentrating table to the trough that receives the concentrates and lying in their valleys parallel with the hollow segment tubes that

form riffles and extend diagonally across the surface of the table rising toward their discharge ends.

17. An ore-concentrator comprising a slanting hopper, superposed coarser and finer screens to discharge waste from the hopper, a concentrating table having a distributing-plate under the hopper to receive the screened material, said table being aslant and provided with slitted riffles, a screen over the riffles and plate, means to supply air under pressure to the riffles, and means to shake the table.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 29th day of April, 1909.

EARL H. TATE.

In presence of—
JAMES R. TOWNSEND,
M. BEULAH TOWNSEND.