No. 775,945. PATENTED NOV. 29, 1904.

A. H. STEBBINS.

ORE CONCENTRATOR.

APPLICATION FILED JULY 29, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 5.

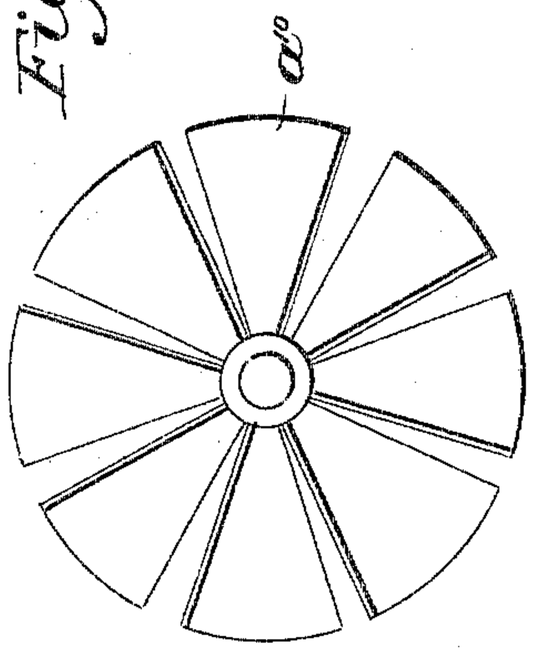

Fig. 1.

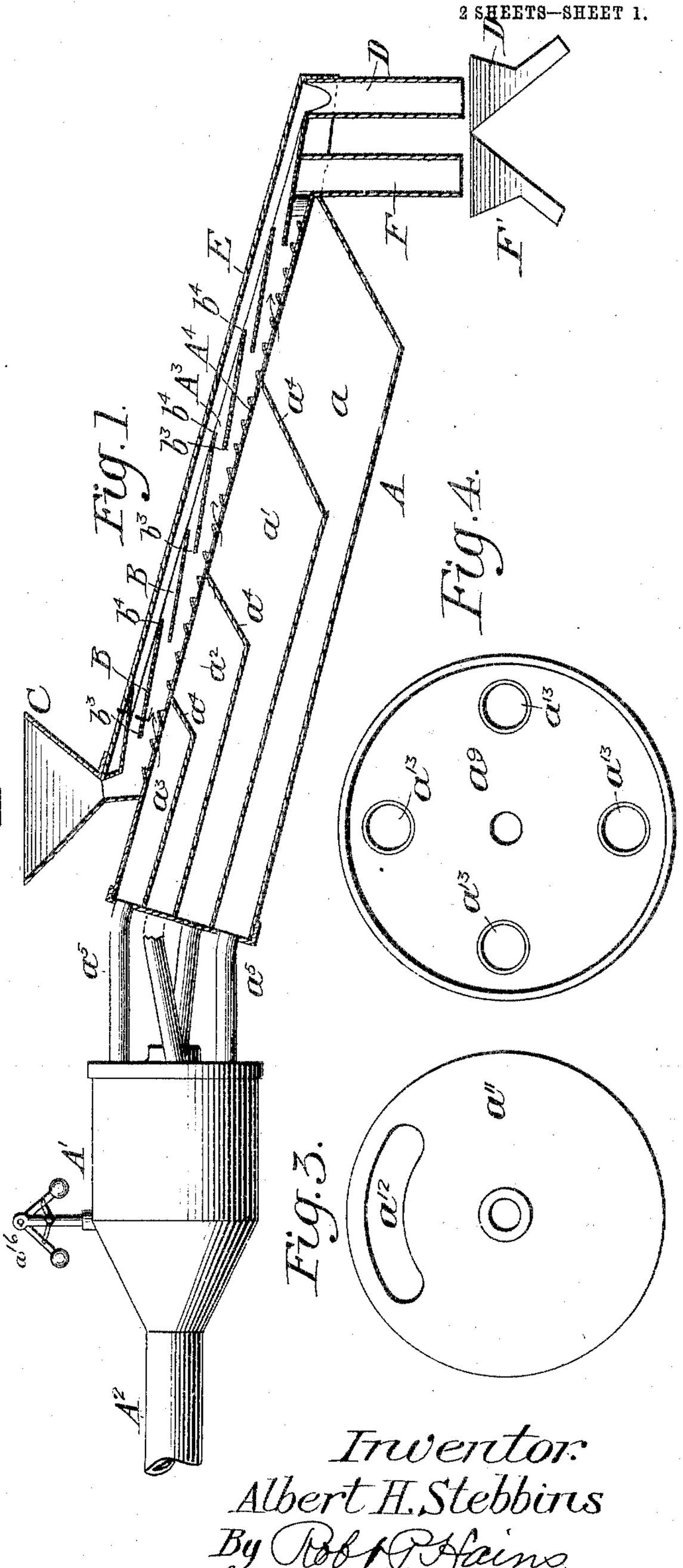

Fig. 4.

Fig. 2.

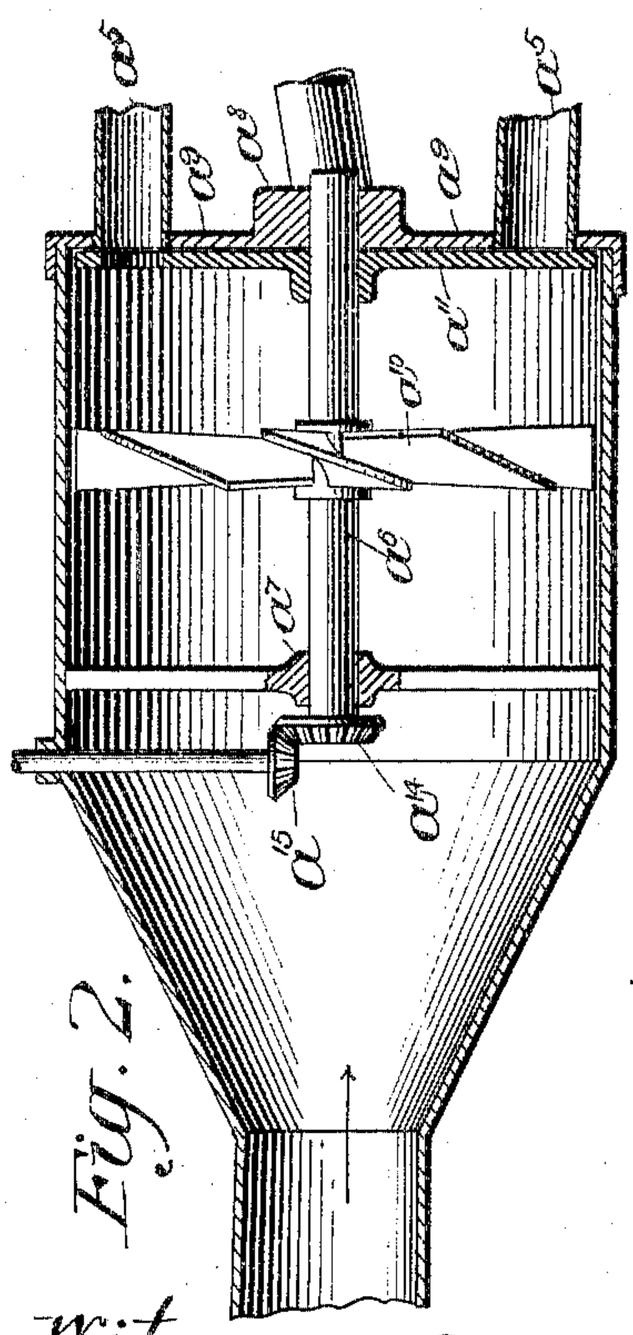

Fig. 3.

Witnesses:

D. W. Edelin.

A. Harveycutter.

Inventor:

Albert H. Stebbins

By Robt. P. Stearns,

Atty.

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NO MODEL. 2 SHEETS—SHEET 2.

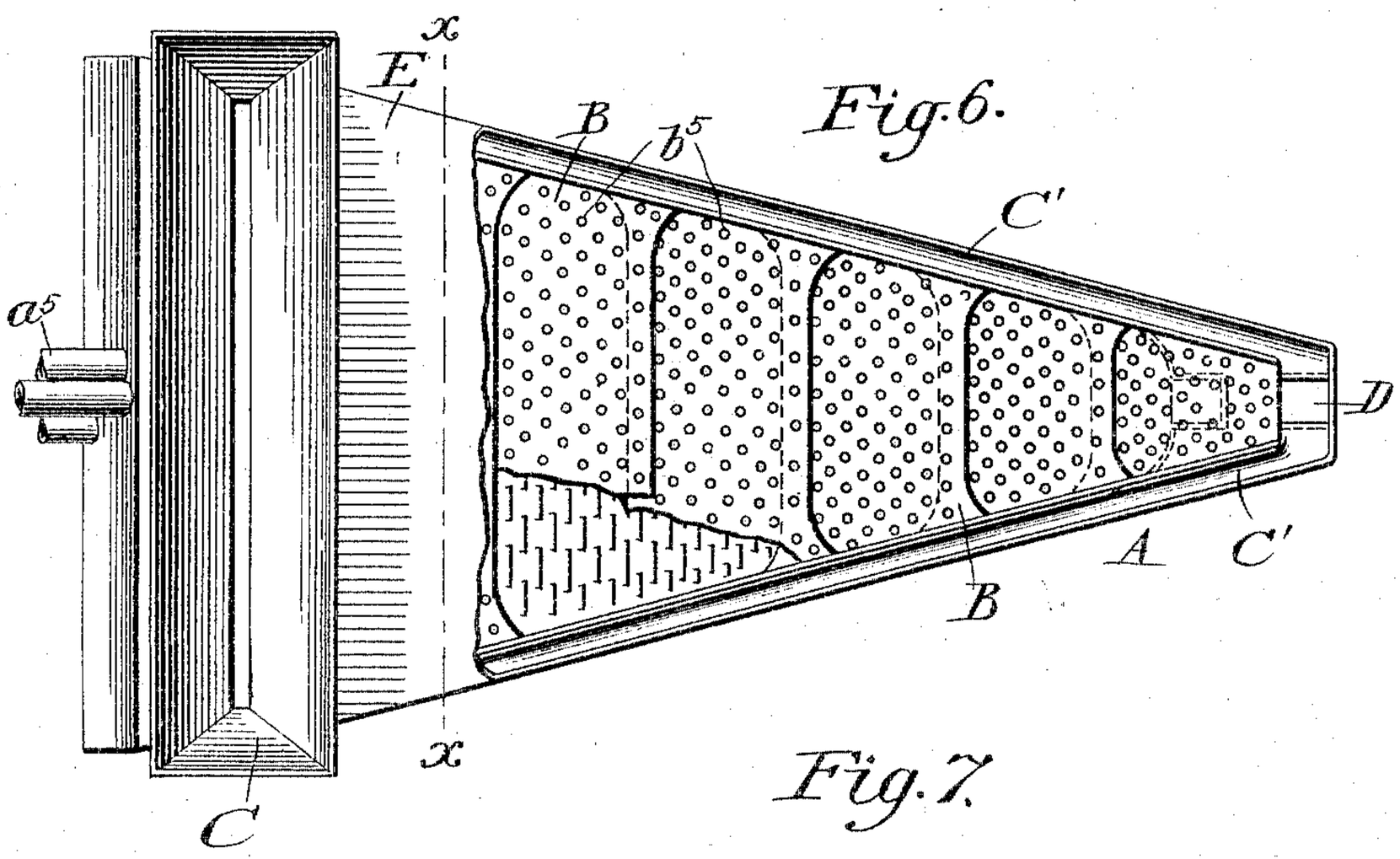


Fig. 6.

Fig. 7.

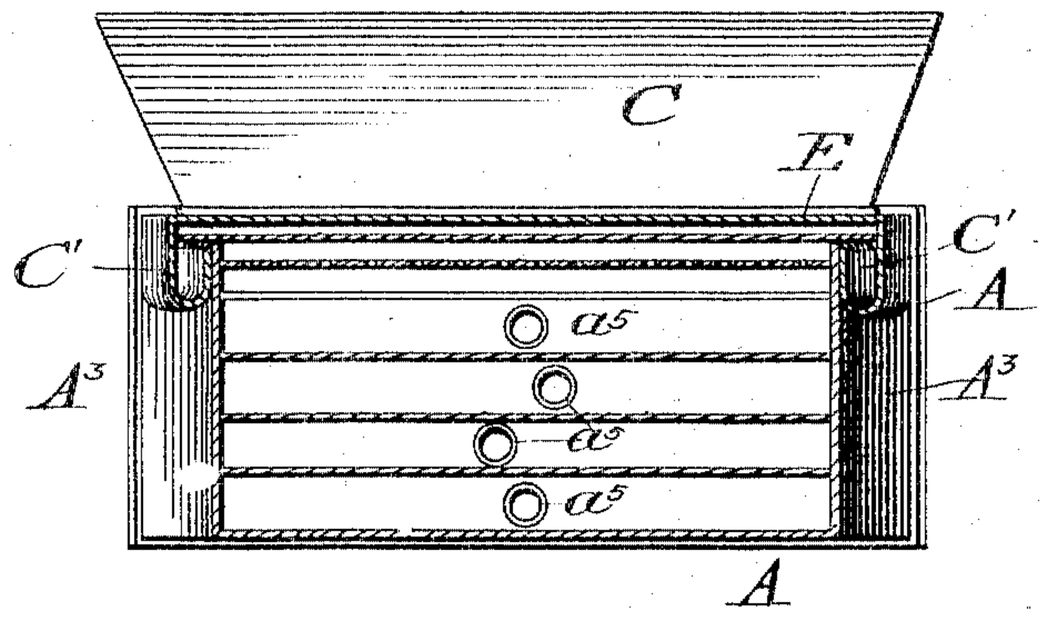


Fig. 8.

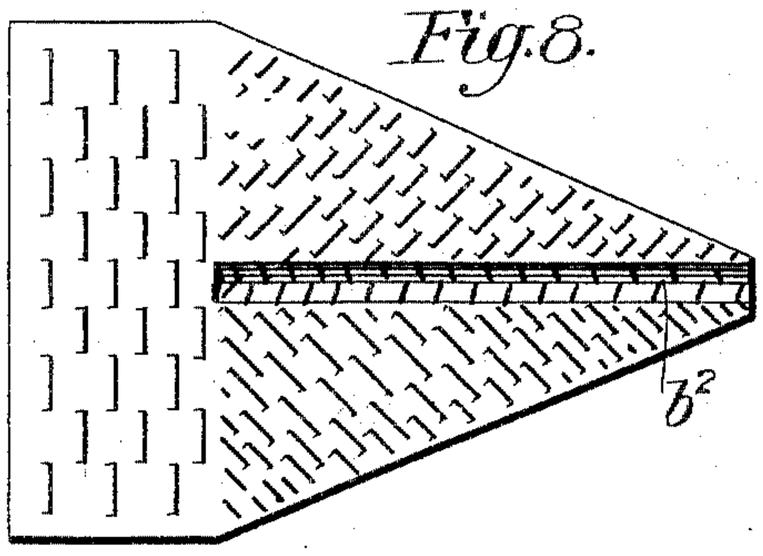
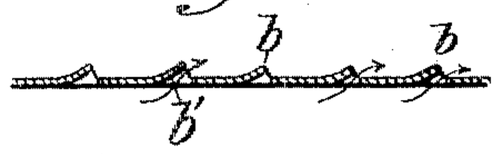


Fig. 9.



Witnesses:
D. W. Edelin.
A. Harveycutter

Inventor:
Albert H. Stebbins.
By Robt. P. Hains Atty.

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No. 775,945. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LITTLE ROCK, ARKANSAS.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 775,945, dated November 29, 1904.

Application filed July 29, 1901. Serial No. 70,135. (No model.)

To all whom it may concern:

Be it known that I, ALBERT H. STEBBINS, a citizen of the United States, residing at Little Rock, in the county of Pulaski and State of Arkansas, have invented certain new and useful Improvements in Ore-Concentrators, of which the following, taken in connection with the accompanying drawings, is a specification.

The invention to be hereinafter described relates to ore-concentrators for separating the valuable portion of ore-bearing material from the accompanying impurities, and more particularly to the form of such machines wherein a blast or blasts of air or other fluid or vapor are caused to pass through the material under treatment to eliminate therefrom the impurities, while the values remain to be collected for such further treatment as desired.

It is well known that the particles forming a mass of valuable ore-bearing material differ in specific gravity and that the valuable portion of such mass consists of particles of relatively greater specific gravity than the accompanying impurities, and I have taken advantage of these known facts to construct a device wherein such mass of material is subjected to the action of air, fluid, or vapor blasts in such manner that the particles composing the mass become stratified in accordance with their relative specific gravities, with the lighter particles on top, and wherein also after the stratification of the mass of material as specified the top or lighter particles or impurities are successively removed from the lower or heavier and valuable particles and carried away as waste product, while the heavy or valuable products are reclaimed free from impurities.

In the present embodiment of my invention I have provided a chamber with a perforated concentrating-surface upon which the material, preferably though not necessarily in a finely-comminuted condition, is fed, and above such concentrating-surface I provide a series of overlapping cutting and conveying boards which serve to cut off and carry away the top layers of waste material as the latter successively form under the action of a suitable blast or blasts of air, fluid, or vapor, and in order to secure the best results I have so constructed and disposed the above parts and provided the concentrating-surface and cutting and conveying boards with perforations as that the material will be caused to stratify more readily, while at the same time it is caused to move toward the discharge end of the machine, as will hereinafter appear.

With the above general objects in view the invention consists of the parts, improvements, and combinations, as will be fully described hereinafter and then definitely pointed out in the claims.

In the drawings, Figure 1 is a side elevation and part-sectional view of an ore-concentrator embodying my invention. Fig. 2 is a sectional detail of the intermittent-blast device. Figs. 3, 4, and 5 are elevational details of parts of the intermittent-blast device. Fig. 6 is a plan view of the apparatus, parts being broken away to show the construction beneath. Fig. 7 is a cross-section of the apparatus on line x x, Fig. 6. Fig. 8 is a detached view of one form of concentrating-surface, showing more especially the form and character of perforations. Fig. 9 is a detail view, on an enlarged scale, of a portion of the concentrating-surface with the perforations therein.

The chamber A, comprising a suitably-formed box-like structure, preferably larger at one end than at the other, as more clearly shown in plan view of Fig. 6, is divided into compartments a, a', a^2, and a^3 of any desired number by the dividing or partition walls a^4, and into each of said compartments leads a pipe a^5 from an intermittent-blast device A'. Such intermittent-blast device comprises a suitably-formed casing, in the present instance being cylindrical with a conically-formed end, which by means of a pipe or other flexible connection A^2 is in communication with some source of air, fluid, or vapor pressure device—as, for instance, a fan (not illustrated, as it forms no part of my present invention) and centrally within the casing is supported a shaft a^6, carried by suitable bearing-blocks a^7 a^8, the former being preferably within the casing, while the latter is secured to or formed in one with the end wall a^9 of the casing.

Mounted upon the shaft a^6 in close proximity to the end wall a^9 of the casing is a

disk a^{11}, provided with an elongated opening a^{12}, the said opening a^{12} being so disposed in the disk a^{11} that in the revolution of said disk it will register with and uncover successively the opening a^{13} in the end wall a^9 of the casing. Also fixed to the shaft a^6 is a fan a^{10}, whereby on the admission of a current of air, fluid, or vapor into the casing in the direction of the arrow, Fig. 2, the fan a^{10} will cause the shaft and disk a^{11} to rotate and bring the opening a^{12} of the disk successively over the opening a^{13} in the end wall a^9 of the casing, and said opening a^{13} being connected to the compartments a a' a^2 a^3 by the pipes a^5 a succession of blasts will be caused to enter the said compartments.

Different grades of material require different characters of treatment. Thus coarse material will require a more energetic action of the blasts in order to eliminate or stratify the particles than will more finely comminuted matter, and I have therefore devised a governor a^{16} to be connected to the fan-shaft a^6 by means of suitable gearing, as the bevel-gears a^{14} and a^{15}, whereby the action of the intermittent blasts may be adjusted and controlled, as will be evident.

Mounted above the compartments a a' a^2 a^3 and at a suitable distance below the top of the sides A^3 is the concentrating-surface A^4, which consists of a sheet of suitable material secured to the sides of the chamber A and extending over the entire area of said chamber. The concentrating-surface A^4 is provided with perforations, preferably in the form shown by Fig. 9, wherein the perforations are shown as being directed toward the exit or discharge end of the machine. These perforations in the concentrating-surface are formed by cutting a slit in the material forming said surface and bending and stretching the same on one side of the slit away from the surface, as at b, Fig. 9, thereby leaving a passage-way b', which will direct any air or fluid currents passing therethrough lengthwise of the concentrating-surface, and these perforations being directed toward the exit or discharge end of the machine will guide or direct currents of air over the concentrating-surface and assist by this means in movement of the material under treatment over the concentrating-surface.

In Fig. 8 I have shown a modified form of the concentrating-surface wherein the perforations instead of being directed lengthwise of the concentrating-surface are inclined in direction so as by their directing influence to cause the material to not only travel lengthwise of the said surface and toward the exit end, but also tends to move the material toward the center line of the concentrating-surface. This form is sometimes desirable, for the reason that where the intermittent blasts of air or other currents are employed in a concentrator or "dry washer," as it may be termed, which is wider at one end than at the other, as in the present instance of my invention, the force of the currents or blasts being introduced at the larger end becomes augmented or increased along the gradually-narrowing sides of the concentrator, where said currents are merely directed longitudinally of the concentrating-surface, as in Fig. 6. The oblique disposition of the openings in the concentrating-surface overcomes this objection where it is found to exist and may be advantageously employed in the treatment of light or very finely divided ore. As shown in Fig. 8, I provide the concentrating-surface therein with a central depression or gutter b^2, the walls of which are also perforated to direct the currents or blasts longitudinally of the gutter and concentrating-surface. The values or heavy particles will thus be gradually forced by the stratification, to be hereinafter more fully described, to the bottom of the material on the concentrating-surface, and the perforations therein when of the form shown by Fig. 8 will direct these valuable particles toward the center of the concentrating-surface and into the longitudinal gutter, after which they will be moved along said gutter by the blasts or currents directed longitudinally thereof and toward the exit end of the machine, the form of the perforations, as indicated in Fig. 9, preventing the material under treatment from falling into the chamber below.

Mounted in the side frames A^3 of the chamber and above the concentrating-surface A^4 are the series of cutting and conveying boards B, arranged on an inclination to the concentrating-surface A^4, as indicated in Fig. 1, and said cutting and conveying boards extend from side to side of the machine, as more clearly indicated in Fig. 6.

It will be noted by reference to Fig. 1 that one edge, b^3, of each cutting-board is close to the concentrating-surface A^4, while the other edge, b^4, thereof is preferably in the plane of the upper edge of the side A^3, and as the material passes over the inclined concentrating-surface A^4 it becomes stratified, as hereinbefore described, with the lighter particles on top, owing to the intermittent blasts which pass through the chambers a a' a^2 a^3, and being moved from the charging end of the device from the hopper C toward the discharge or smaller end of the machine the top layers of light particles as they are successively formed will meet the lower or cutting edge b^5 of the cutting and conveying boards and be cut thereby from the mass of material beneath, the said light particles then traveling over the cutting and conveying boards and part passing over the edge of the machine and into troughs C', arranged along the said edges, and the remainder passing over the edge b^4 of each cutting-board onto the next successive cutting and conveying board until it is discharged from the waste-chute D into any suitable receptacle D'.

It is a well-recognized fact that a fluid under pressure always seeks the point of least resistance for escape. Therefore with the cutting and conveying boards arranged with the lower edge—that is, the edge nearer the concentrating-surface—of one directly beneath the upper edge—that is, the edge more remote from the concentrating-surface—of the other the blasts or currents passing through the concentrating-surface would escape through the layer of material readily and pass through the opening between the upper and lower edges of the adjacent cutting and conveying boards, there being at this point only the resistance of the layer of material over the concentrating-surface. To obviate this, I have overlapped the cutting and conveying boards, as shown in Figs. 1 and 6, by extending the lower edge of one cutting and conveying board beneath and well under the upper edge of the next adjacent cutting and conveying board, from which construction it will be seen that the blasts or currents are not permitted to so readily escape directly through the material without performing the work required.

It is usually desirable to force an excess of air or other fluid currents through the concentrating-surface A^4 than can escape through the overlapping ends b^3 b^4 of the cutting and conveying boards, and to accommodate for the passage of this excess of current I preferably provide the cutting and conveying boards with perforations b^5, as more clearly shown in Fig. 6, so that the excess of air or other fluid will pass through the cutting or conveying board, and thereby also assist in moving the waste product on the cutting and conveying boards toward the discharge end of the machine.

Surmounting the chamber A and above the cutting and conveying boards B is a hood or cover E, the said hood or cover extending over the sides of the machine and the troughs C′, the effect of which is that as the air or other fluid currents pass between the edges of adjacent cutting and conveying boards and also through such boards the said hood directs the currents toward the discharge end of the machine, thereby carrying the lighter particles from one cutting and conveying board to the other until they are either discharged over the last cutting and conveying board into the waste-chute D or over the sides of the cutting and conveying boards into the troughs C′, wherein they collect and are moved under the air or fluid currents into the waste-chute D.

By reason of the gradual narrowing of the machine from the charging to the discharge end thereof a somewhat greater air or fluid pressure is created at the sides of the machine than in the center, and it follows from this that the waste material on the cutting and conveying boards near the sides of the machine is readily cleaned from the surface of the cutting and conveying boards, whereas the material near the center of the cutting and conveying boards being subject to less air or fluid pressure than at the sides is not so readily moved from one cutting and conveying board to the other, and I have found that by slightly increasing the width of the cutting and conveying boards at the sides thereof, as shown in Fig. 6, more resistance is offered to the air or fluid currents near the sides than where the cutting and conveying boards are of uniform width throughout and that it follows therefrom that a more equal distribution of the fluid or air current forces is secured over the entire surface of the cutting and conveying boards, whereby not only is the material that collects on the cutting and conveying boards near the sides thereof readily cleaned therefrom and forced over the edge into the side troughs C′, but the center portion of the cutting and conveying boards will likewise be subjected to substantially the same force of air or fluid currents as the sides thereof, whereby the waste product is readily moved over the surface of the cutting and conveying boards near the center of the same and toward the waste-discharge chute D.

At the smaller end of the machine and in direct communication with the concentrating-surface A^4 is the concentrate-discharge chute F, which leads to a suitable receptacle F′, wherein as the values move down the inclined surface A^4 they will be directed into the chute F, and the waste products by moving over the top of the cutting and conveying boards and along the troughs C′ will be discharged into the waste-chute D, and thus the values and waste products are separated and collected.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an ore-concentrator, the combination of a chamber, a perforated concentrating-surface arranged above said chamber, a series of cutting and conveying boards arranged at an incline to said concentrating-surface, the upper edge of one cutting and conveying board projecting above the lower edge of the next adjacent board, said boards being perforated, and means to produce an intermittent blast through the concentrating-surface and cutting and conveying boards.

2. In an ore-concentrator, the combination of a chamber, a perforated concentrating-surface arranged above said chamber, a series of cutting and conveying boards arranged at an incline to said concentrating-surface, the upper edge of one cutting and conveying board projecting above the lower edge of the next adjacent board, said boards being perforated, a hood or cover extending over and above the concentrating-surface and the said cutting and conveying boards, and means to produce an intermittent blast through the concentrating-surface and cutting and conveying boards.

3. In an ore-concentrator, the combination

of a chamber, a perforated concentrating-surface arranged above said chamber, a series of overlapping cutting and conveying boards arranged at an incline to said concentrating-surface and being wider at the ends than at the central portion thereof, the upper edge of one cutting and conveying board projecting above and over the lower edge of the next adjacent board, said boards being perforated, and means to produce an intermittent blast through the concentrating-surface and cutting and conveying boards.

4. In an ore-concentrator, the combination of a chamber wider at one end than at the other, a perforated concentrating-surface arranged above said chamber, a series of cutting and conveying boards above said concentrating-surface and having the end portions thereof wider than the central portion and arranged at an incline to said concentrating-surface with the upper edge of one board overlying the lower edge of the next adjacent board, and a hood or cover arranged above the concentrating-surface and cutting and conveying boards, and means for producing an intermittent blast of fluid through the concentrating-surface, whereby material fed to the concentrating-surface will be stratified and the upper strata removed or cut off and carried over the cutting and conveying boards by the air or fluid currents.

5. In an ore-concentrator, the combination of a chamber, a concentrating-surface arranged above the bottom wall of said chamber and provided with perforations the walls of which are offset and extended over the perforation to direct fluid-currents across the concentrating-surface to thereby stratify and move material upon said concentrating-surface while preventing particles of said material from passing or falling therethrough, means for introducing a fluid-blast into said chamber beneath the concentrating-surface, and means disposed above the concentrating-surface for removing the top portion of the material as the latter becomes stratified and is moved on the concentrating-surface, substantially as described.

6. In an ore-concentrator, the combination of a chamber, a concentrating-surface arranged above said chamber and provided with perforations the walls of which are offset and extended above the perforations to direct fluid-currents across the concentrating-surface to thereby move material along said surface while preventing the same passing therethrough, a series of cutting and conveying boards arranged at an incline to and above the concentrating-surface, and means for introducing a blast of fluid into said chamber and through the concentrating-surface to thereby stratify the material on the concentrating-surface and thereafter separate the stratified material.

7. In an ore-concentrator, the combination of a chamber, a concentrating-surface arranged above said chamber and provided with perforations the walls of which are offset to direct fluid-currents across the concentrating-surface to thereby move material along said surface while preventing the same passing therethrough, a series of perforated cutting and conveying boards arranged at an incline to and above the concentrating-surface, the upper edge of one board overlapping the lower end of the next adjacent board, and means for introducing a blast of fluid into said chamber and through the concentrating-surface.

8. In an ore-concentrator, the combination of a chamber, partitions therein dividing said chamber into a series of compartments, a perforated concentrating-surface arranged above said compartments, means for introducing blasts of fluid intermittently into each of said compartments to successively stratify material supported on the concentrating-surface above said compartments, and means disposed above and directly over the concentrating-surface to successively engage and lift the top portion from the stratified mass over said compartments as the mass of material moves under said means and upon the concentrating-surface.

9. In an ore-concentrator, the combination of a chamber, partitions therein dividing said chamber into a series of compartments, a concentrating-surface arranged above said compartments and means for successively introducing intermittent blasts of fluid through the concentrating-surface, said means comprising a casing having a separate connection to each of said compartments, and devices for successively opening and closing the connections to said different compartments.

10. In an ore-concentrator, the combination of a chamber, partitions therein dividing said chamber into a series of compartments, a concentrating-surface arranged above said compartments and means for introducing intermittent blasts of fluid into each of said compartments and through the concentrating-surface, said means comprising a casing having separate connections to each of said compartments, a perforated disk movable over the said connections to alternately open and close the same, and a fan operable under the action of the incoming blast of fluid to move said disk.

11. In an ore-concentrator, the combination of a normally stationary chamber, partitions therein dividing said chamber into a series of compartments, a concentrating-surface arranged above said compartments and means for introducing intermittent blasts of fluid into each of said compartments and through the concentrating-surface, and a governor connected to and operable from said means for regulating the intervals of the intermittent blasts.

12. In an ore-concentrator, the combination of a chamber wider at one end than the other

and having an overlying concentrating-surface, a feed-hopper at the larger end of the device, a series of overlapping cutting and conveying boards extending above the concentrating-surface, means for introducing intermittent blasts of fluid into said chamber, troughs arranged along the sides of the device to receive the waste material discharged over the ends of the cutting and conveying boards, a cover or hood extending over the concentrating-surface, a waste-discharge chute at the small end of the apparatus connected to the side troughs, and a concentrate-discharge chute also at the small end of the apparatus and in communication with the concentrating-surface.

13. In an ore-concentrator, the combination of a chamber, a concentrating-surface provided with perforations and arranged above the bottom of said chamber to provide a space for the introduction of fluid beneath the concentrating-surface, a series of overlapping cutting and conveying boards arranged at an incline to said concentrating-surface, the upper rearward edge of one cutting and conveying board projecting above and over the lower forward edge of the next adjacent cutting and conveying board, and means for introducing a blast of fluid into the space beneath the concentrating-surface to thereby stratify material thereon so that the upper portion of waste material may be cut off and removed by the overlapping cutting and conveying boards.

14. In an ore-concentrator, the combination of a chamber, a concentrating-surface provided with perforations and arranged above the bottom of said chamber to provide a space for the introduction of fluid beneath the concentrating-surface, a series of overlapping cutting and conveying boards arranged at an incline to said concentrating-surface, the upper rearward edge of one cutting and conveying board projecting above and over the lower forward edge of the next adjacent cutting and conveying board, a hood or cover extending over and above the concentrating-surface and said cutting and conveying boards, and means for introducing a blast of fluid into the space beneath the concentrating-surface to thereby stratify material thereon so that the upper portion of waste material may be cut off and removed by the overlapping cutting and conveying boards.

ALBERT H. STEBBINS.

Witnesses:
JOHN R. LASH,
JAMES M. PARK.