No. 711,015. Patented Oct. 14, 1902.

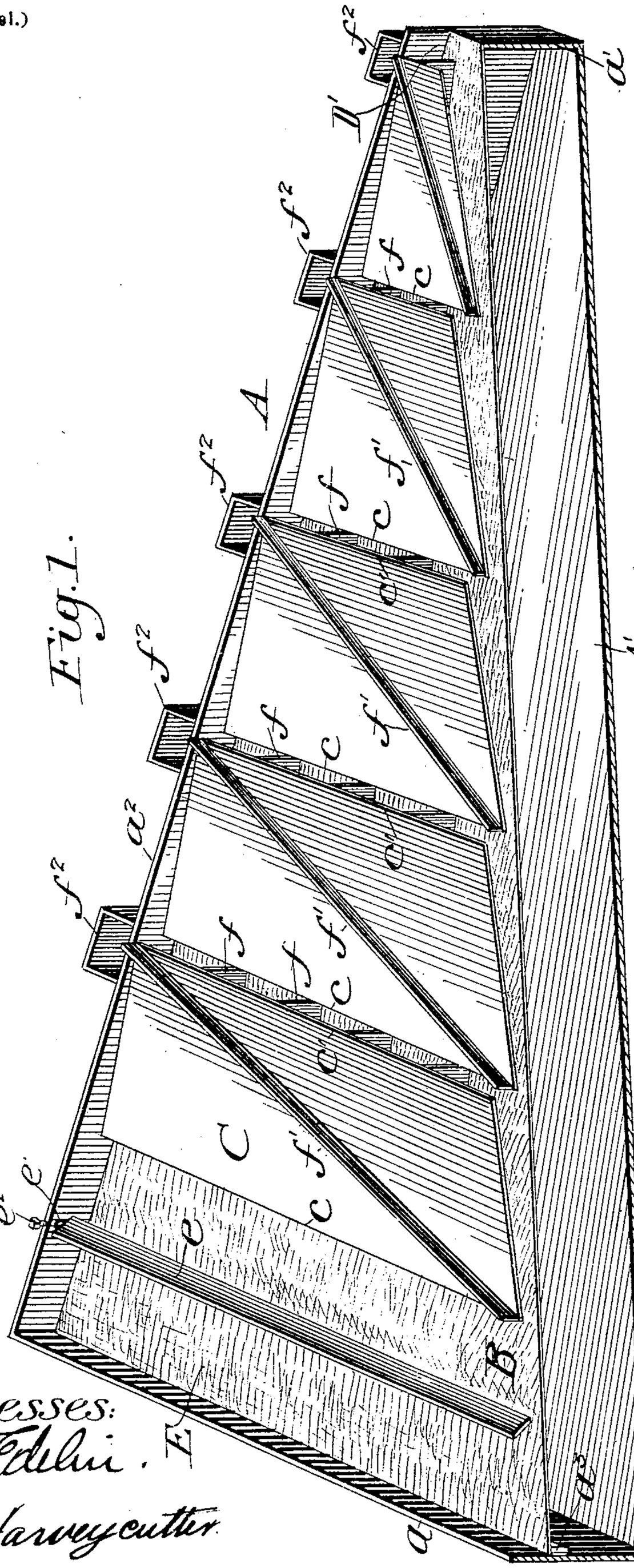
A. H. STEBBINS.

ORE SEPARATOR.

(Application filed July 1, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses:
D. W. Edelin.
A. Harveycutter.

Inventor.
Albert H. Stebbins.
By Bob & P. Hains
Atty

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(No Model.) 3 Sheets—Sheet 2.

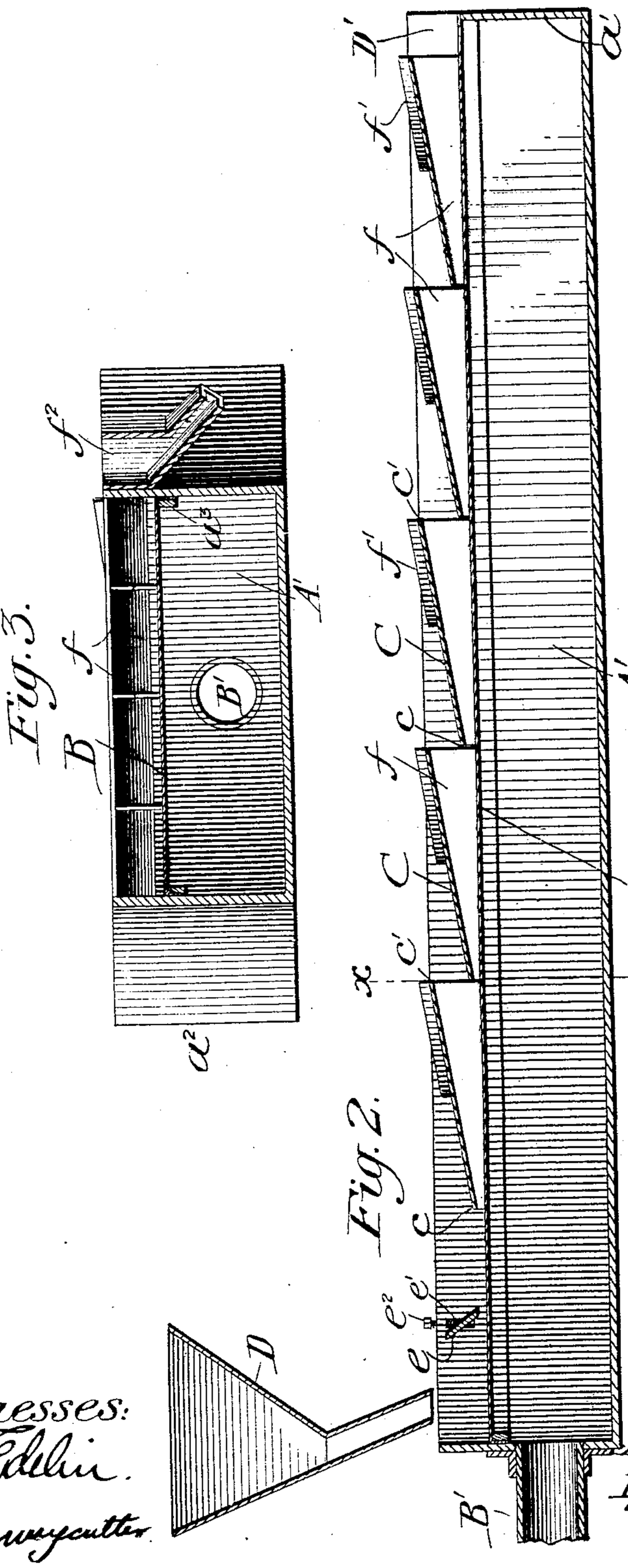

Fig. 3.

Fig. 2.

Witnesses:
D. W. Edelin.
A. Harrycutter.

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

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(No Model.) 3 Sheets—Sheet 3.

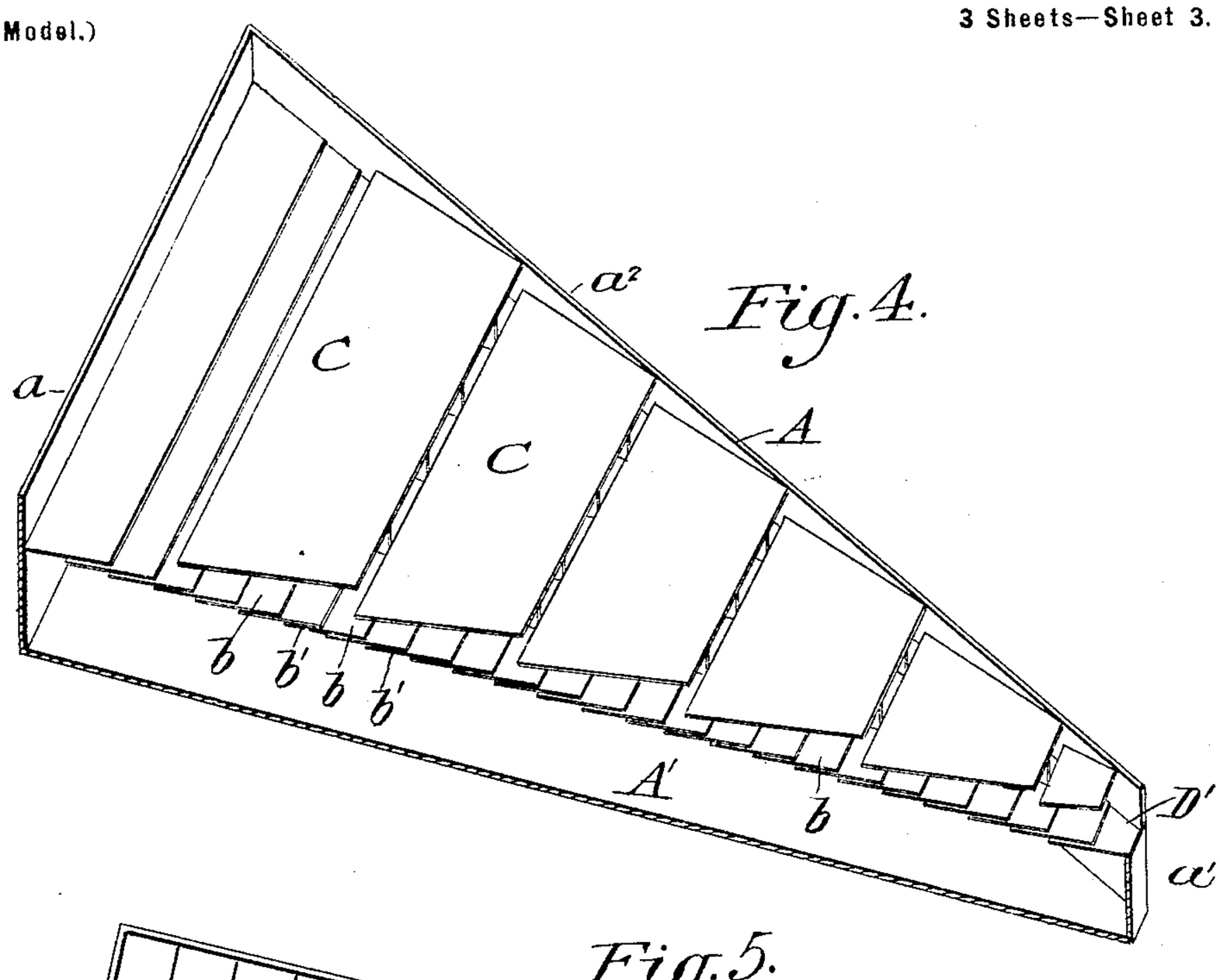

Fig. 4.

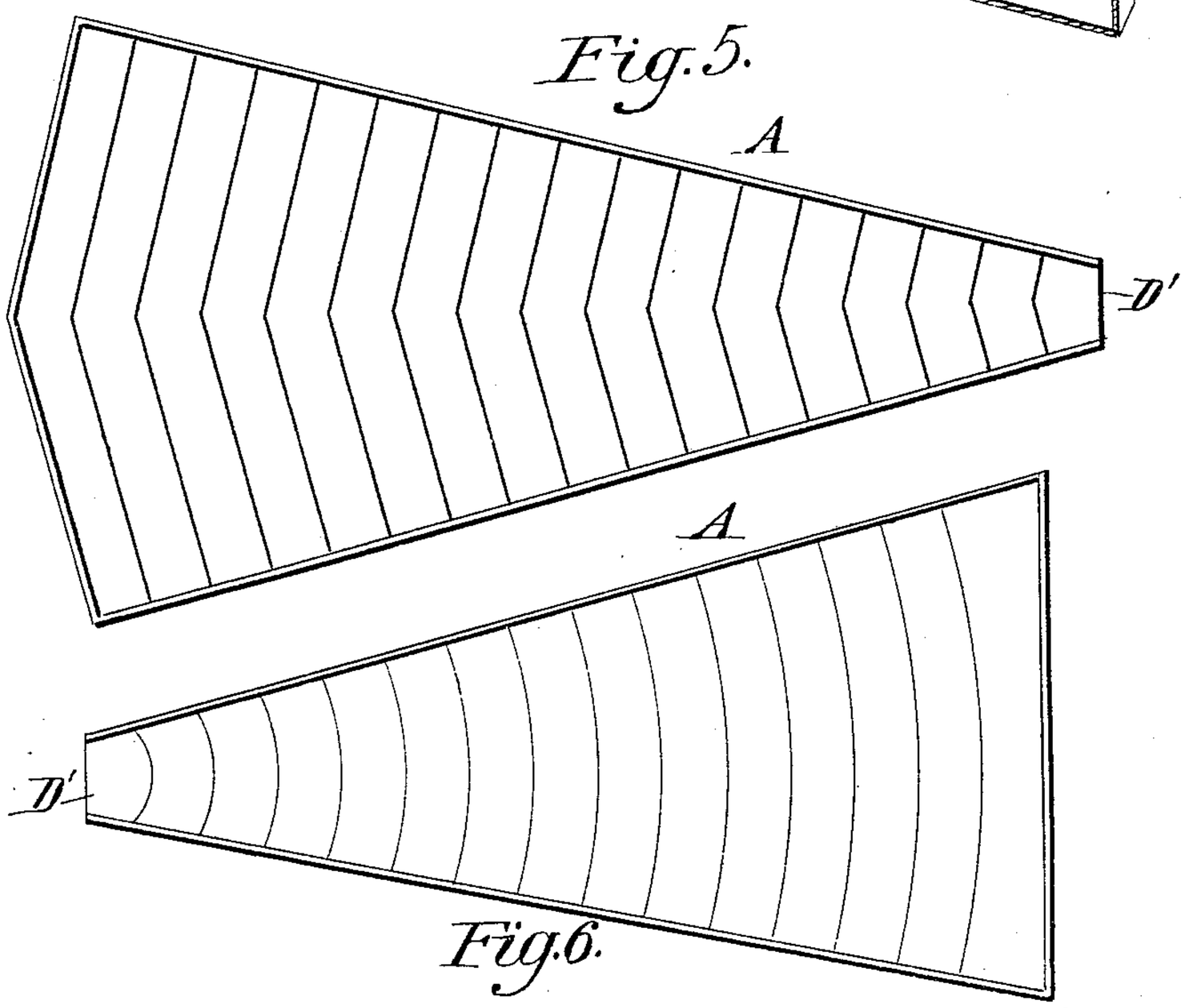

Fig. 5.

Fig. 6.

Witnesses:
D. W. Edelin.
A. Harveycutter.

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

UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LITTLE ROCK, ARKANSAS.

ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 711,015, dated October 14, 1902.

Application filed July 1, 1901. Serial No. 66,663. (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-Separators, of which the following is a full, clear, and exact description.

It is well known that finely-divided or comminuted ores, especially those containing the precious metals, are composed of particles of different sizes and shapes and of various specific gravities, and of these particles the values or those containing the metals to be secured are the heaviest. It follows from this relation of specific gravities or weights of the particles that if a blast of air be forced through a mass thereof from below of sufficient power to move or agitate the mass that the values or heavy particles will gravitate to the bottom of the mass, while the lighter particles, which usually represent the waste material, will be lifted to the top, the particles thus being stratified according to their specific gravities. If when the mass of comminuted material is thus stratified the top is removed, it will be evident that much of the waste material in the ore will be eliminated, and should this operation be repeated upon the same mass there will finally remain only the heaviest particles, which represent the values in the ore, and which can then be collected in a comparatively free state for further treatment. In my present invention I have taken advantage of this action of a finely-divided mass of ore-bearing material to eliminate the waste product and secure the values freed from their usual impurities and have devised means whereby the comminuted ore is fed to a surface provided with openings through which a continuous or intermittent blast of air or other fluid is made to pass to thereby stratify the material, and I have further provided means to successively cut from the said material the upper strata as they form during the passage of the material through the separator and discharge them, while the heavy values continue to travel over the perforated surface to be collected at a suitable discharge-chute, all as will hereinafter more fully appear and be definitely pointed out in the claims.

In the drawings, Figure 1 is a perspective view of one preferred form of my invention, a side thereof being removed to show the air-space below the separating-surface. Fig. 2 is a longitudinal central sectional view of the separator, showing the feed-hopper in position. Fig. 3 is a cross-section on line $x\,x$, Fig. 2. Fig. 4 is a perspective view similar to Fig. 1, showing a different form of separating-surface. Figs. 5 and 6 are diagrammatic views of still other forms of separating surfaces that may be advantageously used in my form of separator.

The body of the separator is preferably formed as a box-like frame A, gradually narrowing from one end to the other and comprising the solid bottom A′ and sides and ends $a\ a'\ a^2$. Secured to the sides and ends of the body and within the same at a distance below the upper edge thereof is the separating-surface B, formed with suitable openings for the passage of air or other fluid. The separating-surface B may be formed of cloth or other material, and if of sufficiently coarse mesh the openings between the threads composing the fabric will be sufficient to insure a proper passage therethrough of the air or other fluid blast; but if of fine mesh small openings may be made in the fabric to insure the passage of air or other fluid, as will be obvious. In case the separating-surface is formed of a fabric, as B, it is secured to the inside of the body of the separator, below the top thereof, by any suitable means, as the strips a^3, thus forming between the bottom A′ of the separator and the separating-surface an air-distributing space. To the larger end a of the separator is connected an air or fluid inlet B′, leading to the above-mentioned air-distributing space below the separating-surface, and as the body of the separator is practically air-tight it will be obvious that the entire blast of air or other fluid introduced through the inlet B′ must escape through the openings in the separating-surface. Disposed above the separating-surface are a series of cutting and conveying boards or knives C, having their cutting edges c arranged a short distance above the separating-surface and their discharge edges c' arranged at a greater distance above said surface and preferably in the plane of the upper edges of the sides

a^2 of the separator, thus presenting above the separating-surface inclines, on which material cut from the mass under treatment by the cutting edges *c* may move, and by virtue of the under inclined surfaces of which the air or fluid blast as it passes through the opening in the separating-surface may be directed lengthwise of the separator, to thereby assist in moving the material under treatment from one end of the separator toward the other, as will more fully appear. Material in a finely-divided condition is fed to the large end of the separator in a thin sheet extending entirely across the separator, as from a hopper D, (shown in Fig. 2 in cross-section, but omitted from Fig. 1 to more clearly disclose the other structural features,) and falls into the space E behind the leveling-board *e*, which may be provided to maintain a uniform thickness of material as it travels beneath the same to the cutting edge *c* of the first cutting and conveying board C, the said leveling-board being preferably inclined, as shown, and adjustably secured in the slots *e'* of the side pieces a^2 by any suitable means, as the clamping-bolts e^2. Since one of the essentials of a separator made in accordance with my invention is that the material shall be maintained uniformly distributed over the separating-surface, to thereby avoid thin places through which the air or fluid blast may escape without passing through and stratifying the mass of material under treatment, I provide the under surface of the cutting and conveying boards with a series of guides *f*, placed longitudinally of the separator, and I preferably stagger them, so that the guides on the under surface of one cutting and conveying board shall be opposite the opening between adjacent guides on the next preceding cutting and conveying board, and this disposition of guides I have found especially useful in a separator of the general triangular form shown by the drawings.

Upon the upper inclined surface of the cutting and conveying boards C, I preferably provide diagonal conveying-strips *f'*, which extend from a point near the cutting edge *c* at one side of the boards to a point at the discharge edge *c'* at the opposite side, where the said edges *c'* are in the plane of the top of the side piece a^2, and adjacent the said discharge edges I provide a suitable trough or receptacle f^2 for receiving and carrying off the waste material, as will be understood. It is not essential, of course, that each of the cutting and conveying boards C shall be provided with a conveying-strip, as just described, as it will be obvious in case one or more of these strips are omitted the waste material traveling up the inclined surface of one cutting and conveying board will discharge onto the cutting edge of the next succeeding board and be eventually discharged into a trough or receptacle f^2 by a conveying-strip *f'*.

The end wall at the small end of the separator does not extend above the separating-surface B, to thereby provide a discharge-opening D' for the heavy particles or values, where they may be collected in any suitable receptacle for further treatment.

In use the separator is set up so that the separating-surface slopes downward in the direction of the smaller or discharge end, and the incline is preferably such that the layer of material under treatment will almost slide over the separating-surface by virtue of its own weight.

From the construction thus described it will be evident that the material fed upon the separating-surface will in obedience to gravity and the action of the air or fluid blast move down the inclined separating-surface, and the air or fluid blast passing therethrough will lift the lighter of the ore-pulp to the top of the moving layer, thus stratifying the particles in accordance with their specific gravities, with the lighter on top, the heaviest on the bottom, and with, perhaps, more or less intermediary strata. The layer of moving ore-pulp meeting the cutting edge *c* of the first cutting and conveying board C will have removed therefrom the top strata of light or waste particles, which moving over the inclined surface of the board will be discharged into a trough or receptacle f^2, while the heavier particles continue on under the first cutting and conveying board C. At this point the blast of air or fluid passing through the separating-surface is given a direction of movement toward the discharge or smaller end of the separator by virtue of the inclined under surface of the cutting and conveying board, and the heavier particles of the mass under treatment are thus assisted in moving onward toward the discharge end of the separator. While passing beneath the boards the mass of material is kept evenly distributed in a uniform layer, both by the action of the air or fluid blast as it is directed by the inclined under surface of the boards and also by the guides *f f*, and being continuously subjected to the upward passage of the air or fluid blast the material is further stratified, with the lightest particles on top, as before described, which meeting the cutting edge *c* of the next cutting and conveying board the said strata of light waste material is removed and deposited in a receptacle f^2 to one side of the separator. This action continuing to the end of the separator the values or heavy particles are discharged through the contracted discharge-opening D'.

The constructions diagrammatically shown in Figs. 4, 5, and 6 are and may be in all respects the same as that above described, the said views being merely intended to show the various forms of separating-surfaces that may be advantageously employed with my separator. Fig. 4 shows the separating-surface $B^{\times}$ formed of a series of overlapping slats *b b*, having the air or fluid openings *b'* between their overlapping ends and directed toward the smaller or discharge end of the separator,

so that as the air or fluid passes through the material in thin sheets and over the separating-surface it serves to move the material onward toward the discharge end of the separator and at the same time acts to stratify the mass, coacting in the former action with the under inclined surfaces of the cutting and conveying boards, as already explained, although in a more marked and efficient degree than where the air or fluid passes directly upward through the separating-surface as described for the construction shown in Figs. 1 and 2. In Figs. 5 and 6 I have shown in diagrammatic form the overlapping slats as in Fig. 4, except that in Fig. 5 they are arranged to converge toward the center of the separator in straight lines, while in Fig. 6 they are arranged in curved form, whereby the sheets of air or fluid being introduced between the slats at intervals are directed toward the center and smaller or discharge end of the separator, to thereby act more efficiently in keeping an even distribution of the layer of material being treated and at the same time act to move the layer over the separating-surface. It is to be understood, of course, that the cutting and conveying boards, while not shown in the diagrammatic views of Figs. 5 and 6, are nevertheless to be used in connection therewith and that they act in coöperation with slats of the separating-surface, as indicated with respect to Figs. 1 and 2, to further direct the air or fluid blast toward and over the separating-surface toward the discharge end of the separator. It is evident also that the form of separator indicated as the present embodiment of my invention may be used with either a continuous or constant blast of air or other fluid or such blasts may be introduced intermittently.

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

1. In a separator, the combination of a box-like frame, a separating-surface having perforations and supported above the bottom of said box-like frame to provide a space between the said bottom and separating-surface, means for introducing a blast of air or other fluid into said space beneath the separating-surface to stratify material upon said separating-surface, cutting and conveying boards supported above the separating-surface to cut from the stratified material on the separating-surface the top portion or strata thereof and direct it out of the separator, the cutting and discharge edges of said boards being at different distances above the separating-surface.

2. In a separator, the combination of a box-like frame, a separating-surface having perforations and supported above the bottom of said box-like frame to provide a space between the said bottom and separating-surface, means for introducing a blast of air or other fluid into said space beneath the separating-surface to stratify material upon said separating-surface, cutting and conveying boards supported above the separating-surface to cut from the stratified material on the separating-surface the top portion or strata thereof and direct it out of the separator, the cutting and discharge edges of said boards being at different distances above the separating-surface, and the cutting edge of one board being adjacent and below the discharge edge of the next preceding cutting and conveying board.

3. In a separator, the combination of a box-like frame wider at one end than at the other, a separating-surface having perforations and supported above the bottom of said box-like frame to provide a space between said bottom and separating-surface, means for introducing a blast of air or other fluid into said space beneath the separating-surface to stratify material upon said separating-surface, cutting and conveying boards supported above the separating-surface to cut from the stratified material on the separating-surface the top portion or strata thereof and direct it out of the separator, the cutting and discharge edges of said boards being at different distances above the separating-surface.

4. In a separator of the class described, the combination of a box-like frame wider at one end than at the other, a separating-surface having perforations and supported above the bottom of the box-like frame to provide a space between said bottom and separating-surface, means for introducing a blast of air into said space beneath the separating-surface to stratify material upon said surface as the blast of air passes therethrough, a series of cutting and conveying boards each having a cutting edge and a discharge edge disposed over the separating-surface, the cutting edge of each board being nearer the separating-surface and wider edge of the box-like frame than the discharge edge to cut from the stratified material on the separating-surface the top portion thereof and direct it over the cutting and conveying boards out of the separator.

5. In a separator of the class described, the combination of a box-like frame wider at one end than the other, a separating-surface provided with openings and supported above the bottom of said box-like frame, a series of cutting and conveying boards each having a cutting edge and a discharge edge, the former being nearer the wider end of the separator than the latter and arranged nearer to the separating-surface, and a series of guides beneath the cutting and conveying boards and arranged longitudinally of the separator.

6. In a separator of the class described, the combination of a box-like frame wider at one end than the other, a separating-surface provided with openings and supported above the bottom of the box-like frame to provide an air-chamber beneath the separating-surface, means for directing blasts of air or other fluid into said chamber beneath the separating-surface to stratify material upon said separating-

surface, a series of inclined cutting and conveying boards arranged above the separating-surface with a cutting edge nearer to the said surface than the discharge edge, the latter being adapted to discharge material over the side of said frame, and conveying-strips arranged upon the upper surface of said cutting and conveying boards to direct the material on said boards over the side of the frame.

7. In a separator of the class described, the combination of a box-like frame, a separating-surface provided with air or fluid openings arranged within said box-like frame to provide an air-chamber beneath said separating-surface, means for directing a blast of air or fluid into said separator beneath the separating-surface to stratify material upon the separating-surface, a plurality of inclined cutting and conveying boards arranged with cutting and discharge edges above the separating-surface with the cutting edges nearer to the said surface than the discharge edges to cut from the material under treatment the top layers and by their under surfaces to direct the air or fluid blast over the separating-surface toward the discharge end of the separator, substantially as described.

8. In a separator of the class described, the combination of a box-like frame wider at the feed end than at the discharge end to maintain an even and uniform layer of material as the upper strata are removed, a separating-surface provided with air or fluid openings arranged within said box-like frame to provide an air-chamber beneath said separating-surface, means for directing a blast of air or fluid into said separator beneath the separating-surface to stratify material upon the separating-surface, a series of inclined cutting and conveying boards arranged entirely above the separating-surface with the cutting edges nearer to the said surface than the discharge edges to cut from the material under treatment the top layers and by their under surfaces to direct the air or fluid blast over the separating-surface toward the discharge end of the separator, substantially as described.

9. In a separator of the class described, the combination of a box-like frame, a separating-surface arranged within said frame and provided with a series of openings directed toward the discharge end of the separator, means for directing a blast of air or other fluid into said box-like frame beneath the separating-surface to stratify the material thereon, a series of cutting and conveying boards arranged above said separating-surface and inclined thereto with their cutting edges nearer to the said separating-surface than their discharge edges to thereby cut from the layer of material under treatment the top strata and to present above the separating-surface and inclined surface to direct the air or fluid blast toward the discharge end of the separator.

10. In a separator of the class described, the combination of a box-like frame wider at the feed end than the discharge end, a separating-surface arranged within said frame above the bottom thereof to provide an air-chamber beneath said surface, said separating-surface being provided with openings arranged at intervals to direct air or fluid blasts over the separating-surface and through the material being treated to thereby stratify the same according to specific gravities and move it toward the discharge end of the separator, a series of cutting and conveying boards having cutting and discharge edges arranged above the separating-surface and inclined thereto with their cutting edges nearer to said surfaces than the discharge edges to thereby cut the top strata from the material and remove the same from the separator, and means to direct a blast of air or other fluid into said chamber beneath the separating-surface.

11. In a separator of the class described, the combination of a box-like frame wider at the feed end than the discharge end, a separating-surface arranged within said frame above the bottom thereof to provide an air-chamber beneath said surface, said separating-surface being provided with openings arranged at intervals to direct air or fluid blasts over the separating-surface and through the material being treated to thereby stratify the same according to specific gravities and move it toward the discharge end of the separator, a series of cutting and conveying boards arranged above the separating-surface and inclined thereto with their cutting edges nearer to said surface than the discharge edges to thereby cut the top strata from the material and remove the same from the separator, guides arranged beneath the cutting and conveying boards longitudinally of the separator, and means to direct a blast of air or other fluid into said chamber beneath the separating-surface.

12. In a separator of the class described, the combination of a box-like frame wider at one end than the other, means to deliver material across the entire width of the separator at its widest part, a discharge-opening at the smaller end of the separator, a separating-surface arranged within said frame above the bottom thereof to provide an air-chamber beneath said surface, said separating-surface being provided with openings arranged at intervals and directed substantially in the plane of the said surface to discharge air or fluid blasts over the separating-surface and through the material being treated to thereby stratify the same according to specific gravities and move it toward the discharge end of the separator, a series of cutting and conveying boards arranged above the separating-surface and inclined thereto with their cutting edges nearer to said surfaces than the discharge edges to thereby cut the top strata from the material and remove the same from the separator, and means to direct a blast of air or other fluid

into said chamber beneath the separating-surface.

13. In a separator of the class described, the combination of a box-like frame, a separating-surface arranged with said frame above the bottom thereof to provide an air or fluid chamber beneath the concentrating-surface, said concentrating-surface being provided with perforations the walls of which are offset to direct air or fluid currents over or substantially parallel to the separating-surface, and a series of cutting and conveying boards arranged above the separating-surface and inclined thereto to successively cut from the material on said surface the top portion thereof and direct it out of the machine.

14. In an apparatus for separating the valuable from the waste portion of material by the action of air or fluid currents, a normally stationary box-like frame, a separating-surface arranged above the bottom of the box-like frame to provide an air or fluid chamber beneath, said concentrating-surface comprising a series of overlapping slats with a space between their overlapping edges to direct air or fluid currents over or substantially parallel to the concentrating-surface, and a series of cutting and conveying boards arranged above the concentrating-surface and inclined thereto to successively cut from the material on said surface the top portion thereof and remove it from the apparatus.

ALBERT H. STEBBINS.

In presence of—
J. E. LEAS,
ISAAC EMMICH.