No. 696,605.

Patented Apr. 1, 1902.

A. H. STEBBINS.

ORE CONCENTRATOR.

(Application filed July 14, 1900.)

(No Model.)

2 Sheets—Sheet 1.

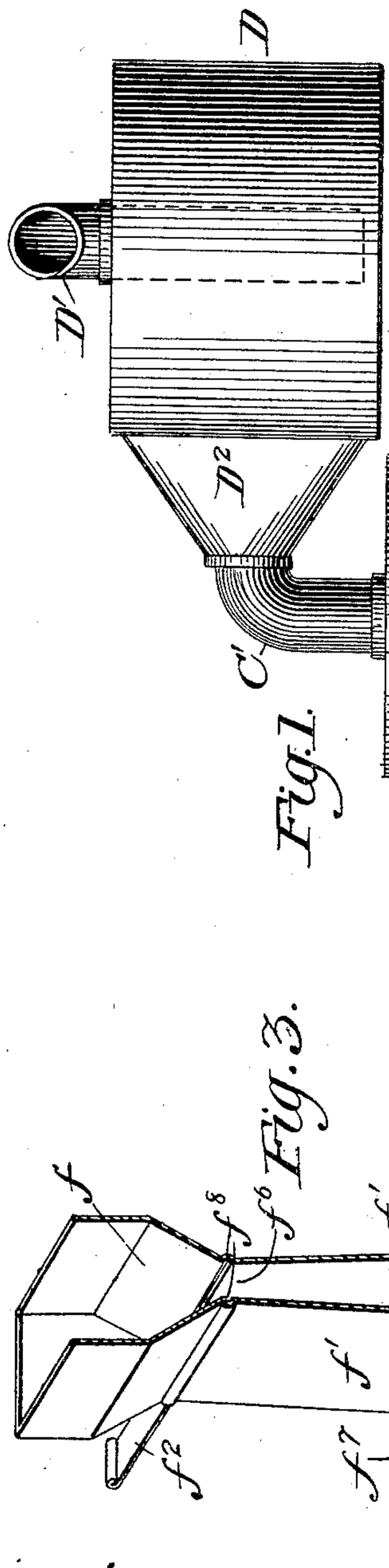

Fig. 1.

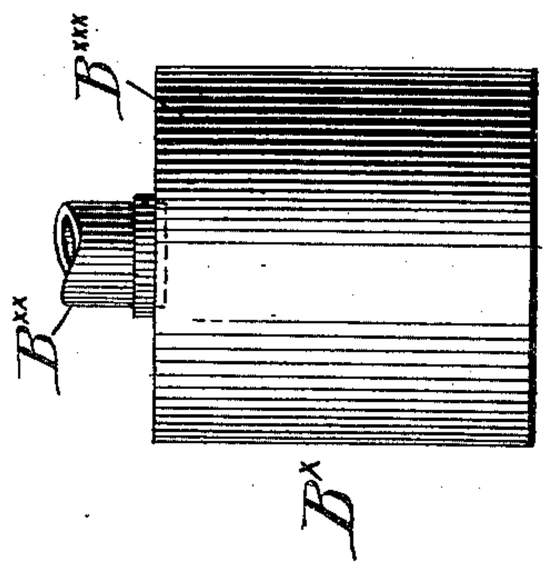

Fig. 4.

Fig. 3.

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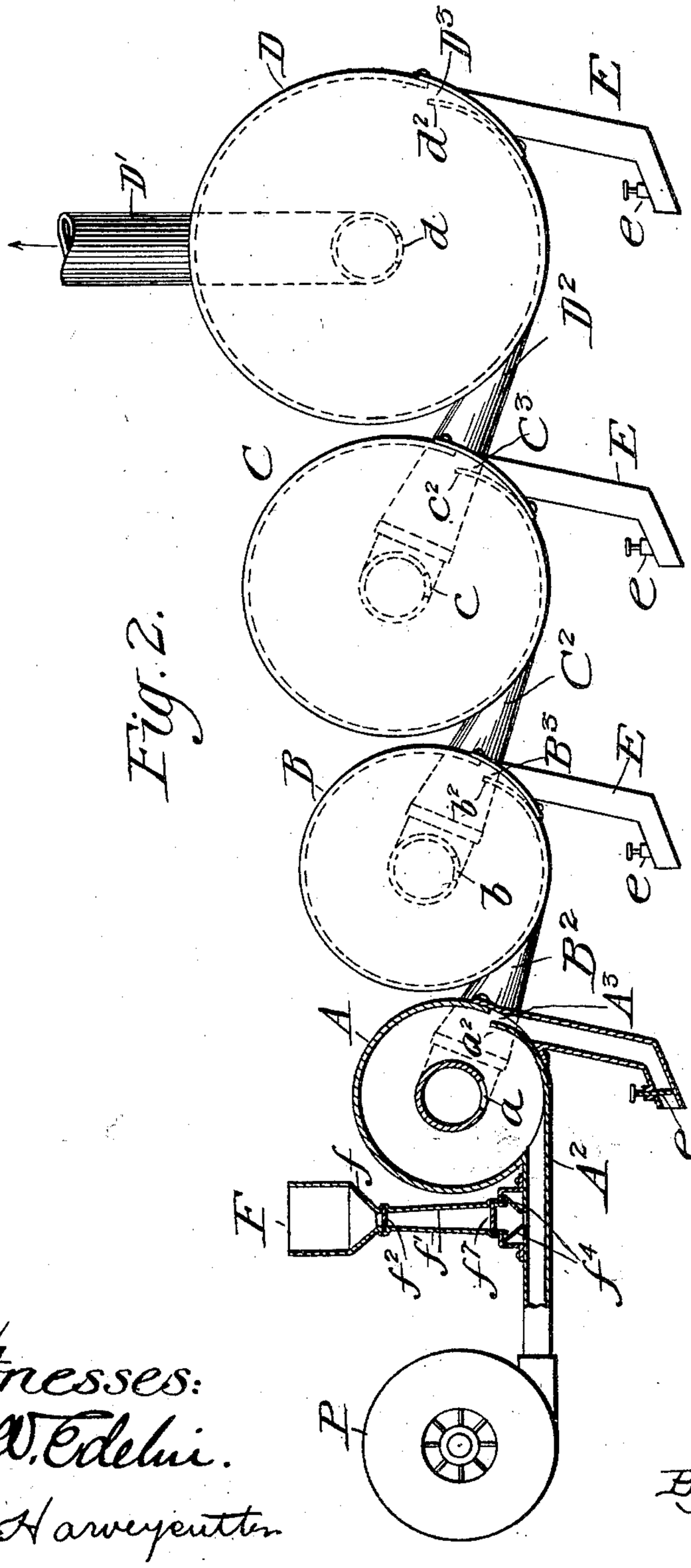

Fig. 2.

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UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LITTLE ROCK, ARKANSAS.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 696,605, dated April 1, 1902.

Application filed July 14, 1900. Serial No. 23,621. (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, State of Arkansas, have invented certain new and useful Improvements in Ore-Concentrators, as set forth in the annexed specification.

The invention to be hereinafter described relates to ore-concentrators for effecting a separation of the valuable particles of ore from their adhering impurities, and more particularly to that type of such machine wherein the valuable particles or portions of ore are not only separated from the accompanying sand, dirt, or other impurities which are eliminated during operation of the machine, but the valuable particles are themselves separated according to their size or relative specific gravities and collected for subsequent treatment.

The machine which forms the subject of my present invention is primarily designed for the treatment of ground or finely-divided ores or like materials, but may be applicable for treatment of materials in other conditions, and while I describe the device as employing blasts of air for effecting the separation it is obvious that any fluid may be used with advantage, according to the character of the material being treated.

It is a well-known fact that the particles of comminuted or finely-ground ores may vary in size and shape and often in specific gravities, and to facilitate the subsequent treatment of such particles it is desirable that those of similar size and like specific gravities shall be collected and separated from those of different size and unlike specific gravities and that impurities be eliminated from all the groups thus separated. With these and other objects in view I have invented a form of concentrator having several communicating compartments in which the material is successively subjected to the action of air or other fluid-currents, which currents in the successive compartments permit concentrates or the valuable particles of ore to settle in each compartment, according to their size and specific gravities, and in connection with such compartments I have devised a novel form of feed hopper or chute.

My invention, as above generally indicated, consists of the parts and combination, as will hereinafter be more particularly described, and definitely pointed out in the claims.

In the drawings, Figure 1 is a plan view of a concentrator comprising a series of compartments and embodying my invention. Fig. 2 is a central vertical sectional elevation on line *x x*, Fig. 1. Fig. 3 is a view of the feed-hopper. Fig. 4 is a detail of a modification.

In the present embodiment of my invention the several connected compartments are represented by substantially cylindrical drums A B C D, arranged in series and preferably varying in size from one end of the series to the other, yet the particular form of said drums or compartments is not material. The compartments or drums are arranged in series—that is, each is connected with its succeeding drum—and discharges into said succeeding drum the particles that do not settle. In thus connecting the drums or compartments in series I have found it preferable to arrange the same in echelon formation, as shown by Fig. 1, so that the discharge-pipes A′, B′, and C′, respectively, coming from the drums, may convey the material directly and with the least possible turns and angles into the feed-opening of the next succeeding drum, although such formation, being simply one of the forms of arrangement, is not essential, as the drums can be arranged in line as desired, it being only necessary that the drums shall be so related to each other as that the discharge-opening of one drum shall connect with the inlet-opening of the next succeeding drum. Each drum is provided with an inlet-opening, as A^2, B^2, C^2, and D^2, respectively, by which the blast of air or other fluid carrying the finely-divided ore is introduced into the drums. The inlet-opening of the first drum A of the series is preferably connected with a motor, such as P, shown as a fan in the present instance, whereby the air or other fluid may be introduced into the drum, and the inlet-opening A^2 is preferably arranged at the lower portion of the drum and tangential thereto and also extending, preferably, throughout the length of the drum. It is not always necessary, of course, that the inlet-openings shall extend throughout the length of the drums, as they may vary in this respect somewhat. The finely-divided ore or parti-

cles may be introduced into the first drum of the series in any approved manner; but I have shown in the present instance a feed-hopper F, interposed between the fan P and the first drum A and connected with the inlet-opening A^2 of the first drum, whereby the finely-divided ore may be fed through the hopper and be carried into the first drum of the series by the moving air or other fluid. Similarly, the inlet-openings of the other drums are arranged, preferably, tangential thereto and extend throughout the length of the drums, as indicated at B^2, C^2, and D^2, the blast of air or other fluid as it enters such elongated tangential opening being thus given a whirling or circular movement in the interior of the drum. The discharge-outlets A′, B′, C′, and D′ for the drums may consist simply of a pipe passing through the center of the drum and extending more or less the length of said drum, as clearly indicated in Fig. 1. Each of said discharge-outlet pipes is preferably provided in its under wall with an opening, as *a*, *b*, *c*, and *d*, by which the material which fails to settle in any drum is carried to the discharge-outlet pipe. It is not always necessary that the discharge-outlet pipes shall extend through the entire center of the drums; but they might be connected thereto throughout merely at the end, as shown in the slight modification to Fig. 4, wherein the pipe $B^{\times\times}$ extends only through an opening in the head $B^{\times\times\times}$ of the drum $B^{\times}$.

Near the bottom of each drum is provided an opening, as A^3, B^3, C^3, and D^3, for the discharge of such particles of ore or other material as fail to be carried in suspension by the currents of air or other fluid maintained in the respective drums. These discharge-openings are preferably formed as an opening extending the length of the drum and are formed by the walls of the respective drums being discontinued at the points A^3, B^3, C^3, and D^3 and the edge of the lower portion being bent slightly inward to form an inwardly-projecting lip providing the necessary space between it and the walls of the drum for such particles or values to escape as are not held in suspension by the air or fluid currents in any particular drum.

Below the discharge-openings A^3, B^3, C^3, and D^3, respectively, are the concentrate-boxes E, connected to the drums to cover the discharge-openings and each provided at its lower portion with a valve or gate *e*, by which the concentrates or values which collect within the concentrate-boxes may be discharged therefrom.

From the construction thus far described it will be noted that the finely-ground or other material is fed to the smallest drum A of the series through the feed-opening A^2, leading tangentially into said drum and preferably directing a blast of air or other fluid directly over the inturned lip or projection a^2 of the discharge-opening, means for introducing such blast of air or other fluid in the present instance of my invention being in the form of a fan P, the ore or other particles being fed to the inlet-opening A^2 through the feed-hopper F, as will hereinafter appear. By reason of the size of the drum A the whirling or circling action of the air or fluid currents passing thereinto carries the ground ore or other material with great force in a circular path. Many of the particles, however, of high specific gravity or being large in size are simply carried past the inturned lip or projection a^2 and by the centrifugal action of said particles as they pass said lip they are carried toward the wall of the drum above the lip, where meeting with less resistance from the circular currents in the comparatively quiet space over the discharge-opening they fall into the concentrate-box E. The remaining particles of ore and impurities held in suspension by the moving air-currents pass in circular currents around the interior of the drum A and finally make their exit from the opening *a* in the outlet-pipe A′ of the first drum A, which outlet-pipe leads to the feed-opening B^2, tangentially arranged and extending longitudinally of the second drum B. By reason of the increased size of the drum B the force and carrying capacity of the air or fluid currents coming thereinto from the first cylinder A is reduced, so that some of the particles which were carried in suspension by the force of the air or fluid currents in the small drum A are in the drum B permitted to settle in the manner as explained for the heaviest particles in the drum A—that is, the air or fluid currents entering the tangential opening B^2 in the drum B sweep the particles of ground material over the bottom of the said drum and pass the inwardly-projecting lip b^2 of the opening B^3, and as the particles thus forcibly carried around in the drum B by the decreased air or fluid currents pass the lip b^2 they pass toward the upper wall of the drum above the opening B^3 and in the quiet space comparatively free from air-currents above the opening they are enabled to gravitate into said opening and fall into the concentrate-box below. The particles of ground material still held in suspension are carried around in circular paths and finally pass into the exit-opening *b* of the exit-pipe B′ into the next larger drum C, where the action already described is repeated. It will be noticed from the construction set forth that the incoming air or fluid currents sweep with their greatest force over the bottom portion of the drum and past the projecting lip of the discharge-opening, thus preventing any amount of settlement of material in the bottom portion of the drum and carrying also the heaviest material up over the inwardly-projecting lip into the discharge-opening leading to the concentrate-box. It will be noticed also that the series of drums being of gradually-increasing size from the first to the end of the series that the force and carrying capacity of the

air or fluid currents in the respective drums vary, being greatest in the drum A of the series and least in the last drum D, where they pass into the outlet-pipe D′ and carry the impurities from the machine.

It is to be understood, of course, that while I show only four drums of the series that any number of such devices can be used, and that while a fan P is designated as a means for producing air or fluid currents throughout the series of drums, yet any suitable means may be employed.

In the present embodiment of my machine I have illustrated a hopper F, connected to the feed-opening of the first or smallest drum A; but it is to be understood that such hopper might be connected in any appropriate manner or position in connection with the first drum of the series without departing from the spirit of my invention. In the particular form of hopper illustrated it consists of an open-mouth upper portion f, having projecting therefrom the two divergent walls f' f', whereby a larger opening is provided at the lower end of said walls than at the upper. At the lower end of said walls I provide what may be termed a "regulating" device, which consists, preferably, of a box-like construction F′, into which the walls f' f' are fitted and over the upper wall f^3 of which they project, extending some distance below said upper wall. The box-like construction of the regulating device is secured by an air-tight connection to the inlet-opening A^2 of the first drum of the series and has projecting inwardly and downwardly from its side walls two wings f^4 f^4, providing a passage f^5 between their lower edges of less width than the opening f^6 at the upper part of the hopper. From this construction it will be noted that the opening f^5 being smaller than the opening f^6 provision is made for always securing a supply of material resting on the wings f^4 f^4 as long as material is fed into the upper part of the hopper, thus preventing the air or fluid pressure from forcing the material upward in the hopper, and, if desired, to further secure this end the wings f^4 f^4 may be made yielding to some extent, as by hinge $f^\times$, so as to be acted on by the air or fluid pressure from beneath to further contract or close the opening f^5 should the feed of material be interrupted.

By forming the walls f' f' divergent from their upper ends all clogging or choking up of the hopper is prevented. When for any purpose it is desired to stop the feed of material, sliding gates f^2 f^7 are provided, the former sliding in the ways f^8 at the upper end of the diverging walls f', and the latter, f^7, sliding in the ways f^9 at the upper edge of the regulating device.

From the construction as above described it will be noted that not only are the impurities carried from the ore and separated therefrom, but that the ore itself is graded or separated according to the size of particles thereof and their specific gravities and that by the form of feed-hopper I am enabled to use considerable pressure of air or fluid currents without danger of said currents blowing material from said hopper.

If desired, I may provide the feed-chute or the walls of the feed-regulating device, as shown in Fig. 3, with an adjusting device, as a screw f^{20}, which bearing against the wings f^4 serves to adjust them, so that the opening between their lower ends may be regulated at will.

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 plurality of independent compartments similarly arranged in series, an inlet and central outlet for each of said compartments, a discharge-opening for the concentrates near the bottom of each compartment and a concentrate-box in communication with said discharge-opening, means for introducing a blast of air or other fluid through the inlet of the first compartment of the series and tangential thereto, the inlet of each of the remaining compartments being tangentially arranged and in communication with the central outlet of the next preceding compartment.

2. In an ore-concentrator, the combination of a plurality of drums similarly arranged in series, means for introducing a blast of air or other fluid into the first drum of the series, a tangential inlet and a central outlet for each of said drums to cause the particles to travel in circular paths and the heavier particles to be thus thrown or separated from the lighter particles, which latter pass into the central outlet, the central outlet of each of said drums being connected to the tangential inlet of the next succeeding drum of the series.

3. In an ore-concentrator, the combination of a plurality of drums similarly arranged in series, means for introducing a blast of air or other fluid into the first drum of the series, a central outlet for each of said drums, a tangential inlet extending substantially the length of and for each of said drums to cause the particles to travel in circular paths and the heavier particles to be separated or thrown from the lighter particles which latter pass through the central outlet, the central outlet of said drums being in communication with the tangential inlet of the next succeeding drum of the series.

4. In an ore-concentrator, the combination of a plurality of drums similarly arranged in series and progressively varying in size from one end of the series to the other, an outlet and an air or fluid tangential inlet for each of said drums, means for introducing a blast of air or fluid into the first drum of the series to cause the particles to travel in circular paths and the heavier to be separated or thrown from the lighter particles which latter pass to the central outlet, and connections between the drums to successively carry the

said blast of air or fluid from the first drum tangentially into the succeeding larger drums and a discharge-opening for the concentrates in the bottom of said drums.

5. In an ore-concentrator, a plurality of independent drums similarly arranged in series, said drums gradually increasing in size from the beginning to the end of the series, a feed-hopper connected to the first drum of the series, means for introducing a blast of air or other fluid into said first drum of the series to cause the particles to travel in circular paths, and connections between the drums for discharging the air or fluid currents and the particles carried thereby directly from each drum tangentially into the next succeeding larger drum.

6. In an ore-concentrator, a series of drums, an air-inlet for directing a blast into the first drum of the series, a feed-hopper for said series of drums connected to said blast-inlet, said hopper comprising an open-mouth upper portion, and downwardly-divergent walls to prevent choking of the hopper, a regulating device to which said walls are connected, and wings projecting from the walls of said device toward each other to partially close the opening between the lower ends of the said divergent walls.

7. In an ore-concentrator, the combination of a plurality of drums of different sizes arranged in series, an inlet for directing a blast of air tangentially into the first drum of the series, a feed-hopper for said series of drums connected to said blast-inlet, the same comprising an open-mouth portion and downwardly-divergent walls, a regulating device into which said walls project, wings projecting from the sides of said device toward each other to partially close the opening between the divergent walls, and slides fitted to the upper and near the lower ends of said divergent walls to regulate the material passing.

8. In an ore-concentrator, a plurality of drums arranged in series, a tangential inlet, a central outlet, and discharge-opening for each of said drums, the central outlet of each drum being connected to the tangential inlet of the next succeeding drum of the series to direct a current of air or other fluid over the discharge-opening in the wall of said drums to thereby carry material seeking to settle on said wall above and over the discharge-opening, and means to introduce a blast of air or other fluid into the first drum of the series.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALBERT H. STEBBINS.

Witnesses:
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W. E. LENON.