No. 656,674. Patented Aug. 28, 1900.

A. H. STEBBINS.

ORE CONCENTRATING AGITATOR.

(Application filed Oct. 2, 1899.)

(No Model.) 2 Sheets—Sheet 1.

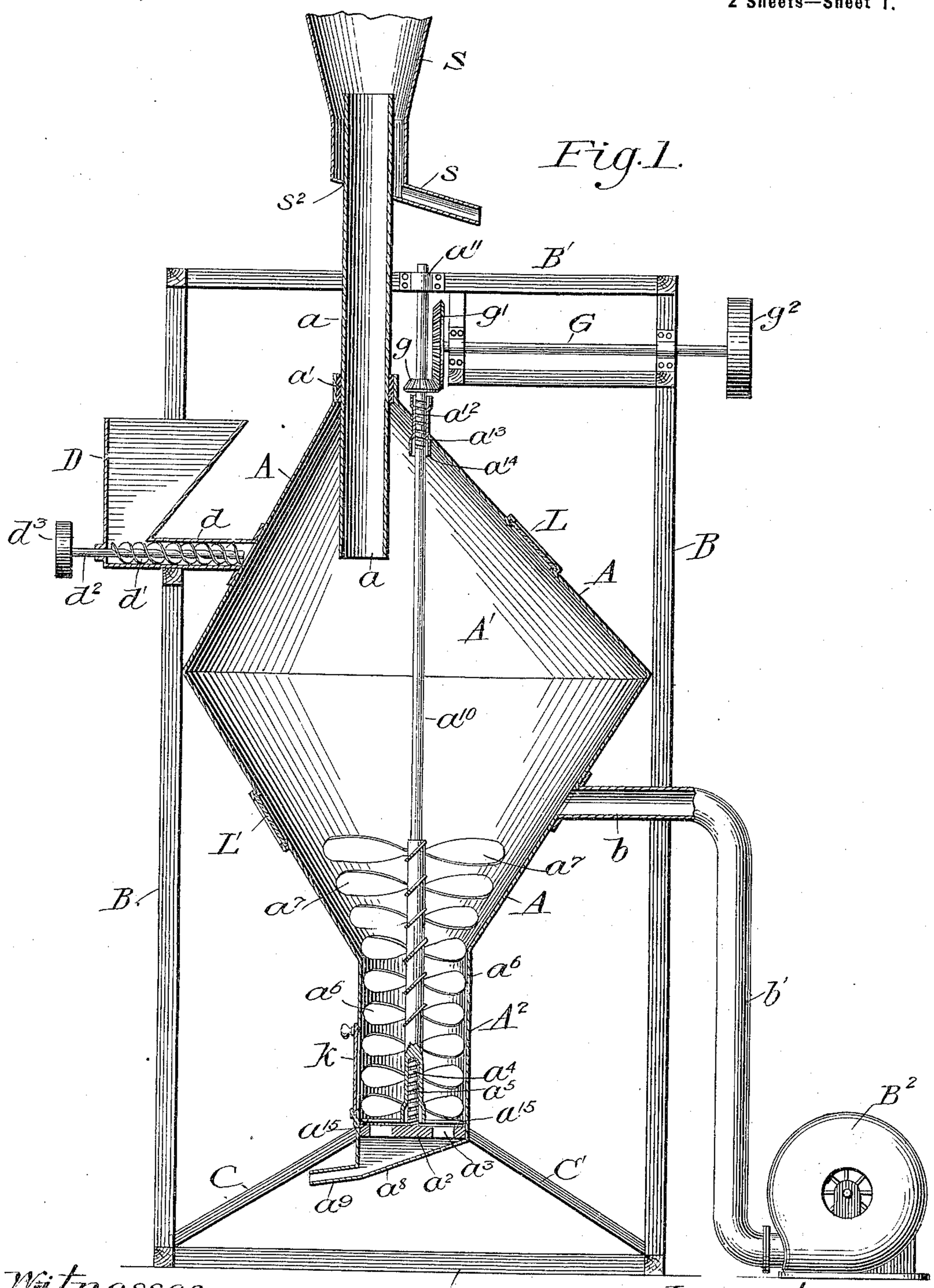

Fig. 1.

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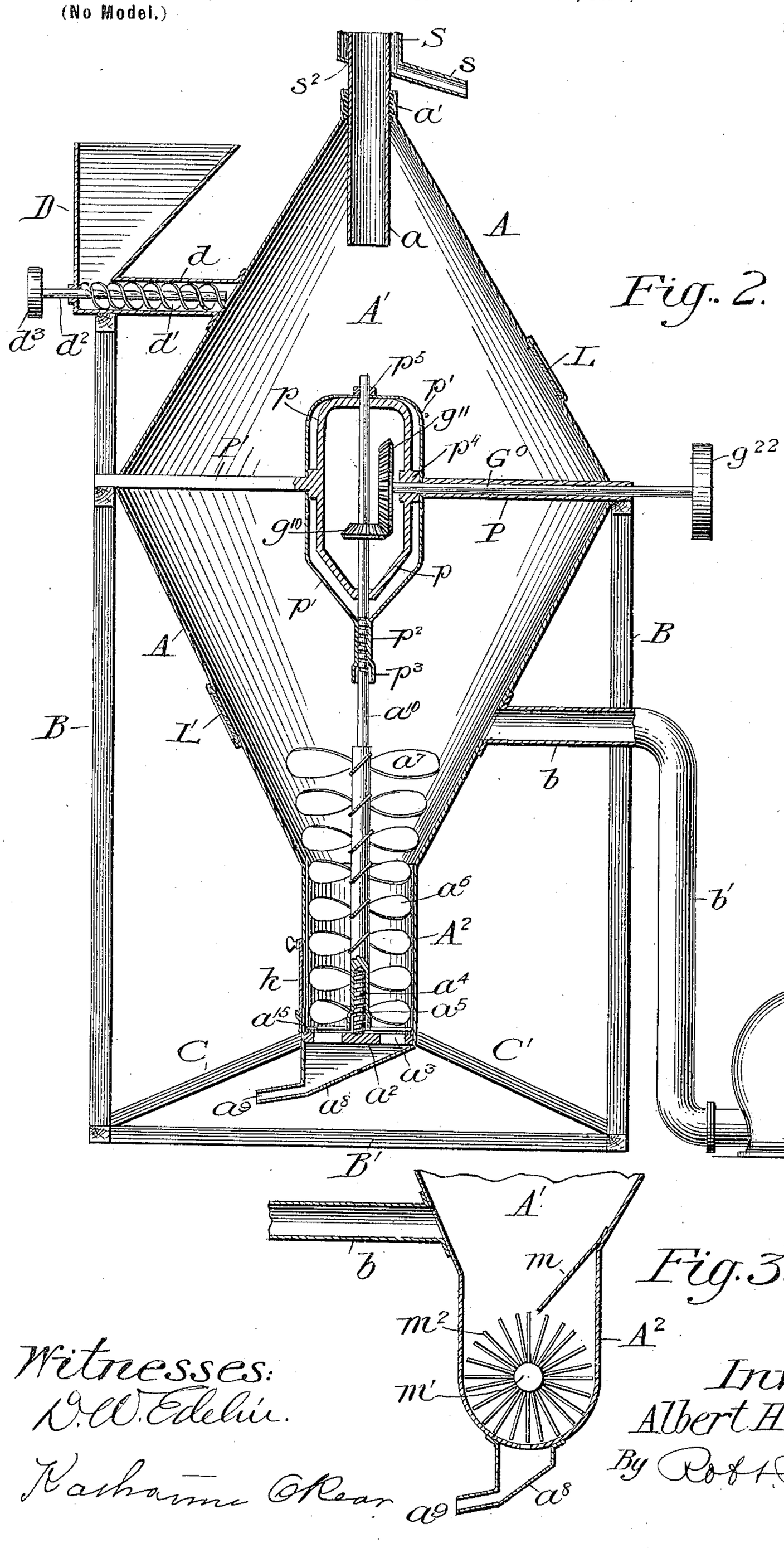

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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ORE-CONCENTRATING AGITATOR.

SPECIFICATION forming part of Letters Patent No. 656,674, dated August 28, 1900.

Application filed October 2, 1899. Serial No. 732,320. (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, county of Pulaski, State of Arkansas, have invented certain new and useful Improvements in Ore-Concentrating Agitators, of which the following is a specification.

My invention relates to ore-concentrating agitators in which finely divided or comminuted ore is subjected to the action of an air-blast to partly separate the heavy from the light particles and to carry the remainder into a settling-chamber, where the air-currents, being reduced, allow the heavy particles to settle under the action of gravity and fall into appropriate chutes, while the lighter waste material is continued onward by the reduced air-currents and carried out of the machine. It is necessary in this character of machine to make it of practical value that it shall be of large capacity—that is, it must efficiently separate a large quantity of ore or metal from its accompanying impurities—and this is particularly so when dealing with the less rich ores. In order to secure this efficiency, it is not sufficient to merely increase the air-blast alone as the greater quantity of material is fed to the machine, as this results in carrying the mass bodily into the separating-chamber above, destroying the character of the currents therein necessary for the settling process, and carrying much of the valuable heavy particles through the exit-opening out of the machine, where they are lost.

It is the object of my invention to increase the efficiency, so as to make the machine of practical utility and at the same time avoid the objections above pointed out; also, to perform a part of the concentration in the agitating-chamber. These objects I accomplish by providing an agitating-chamber with means whereby as the finely-divided ore is fed thereto the mass of material is continually thrown upward in a separated state, so that the air-blast can exercise its force thereupon and start it up into the settling-chamber above, where the concentrates readily settle under action of reduced air-currents and the lighter particles are carried off. By thus continually agitating and throwing up the finely-divided ore I am enabled to use less forcible blasts of air to carry the mass into the settling-chamber above and I also secure a partial separation of the heavy particles from the light in the agitating-chamber itself, such heavy particles finding their way to the bottom of the agitating-chamber, where they are conducted off into a chute. The construction whereby these results are secured will be more fully set forth hereinafter and then definitely pointed out in the claims.

In the drawings, Figure 1 is a sectional view of a machine embodying my invention, some of the parts being shown in elevation. Fig. 2 is a similar view showing a modification wherein the throwing-blades are driven from the side of the agitator, and Fig. 3 is a detail section of a modified form of throwing-blades.

The agitator-casing A, which may be of any desired form, but preferably shown as two frusto-conical portions united at their bases, is suitably supported on any usual or preferred framework B B′ C C′. This casing forms an agitating-chamber A′, enlarged at or near its central portion to permit a proper circulation of air-currents therein prior to their passage into the exit-pipe *a*, which leads from said chamber into the settling-chamber S above, wherein the heavy particles are less influenced by the reduced air-currents, owing to the enlarged character of the settling-chamber, and fall into the chute *s*, and thence from the machine. I have not deemed it necessary to further illustrate the settling-chamber S, as it forms no part of my present invention and is fully described in my pending application, Serial No. 730,841, filed September 18, 1899.

It will be noted that the exit-pipe *a* extends through the casing A and well into the agitating-chamber. This is for the purpose of preventing a direct passage of the air-currents from inlet *b* to and through the exit-pipe *a*, which would be the case if said pipe led direct from the top of the casing A. Moreover, by extending the pipe well into the agitating-chamber the end of the pipe is carried to a portion of the agitating-chamber where a zone of decreased air-pressure and circulating air-currents exists, which allow the heavy particles an opportunity to fall under the action of gravity and gradually work to the bottom of the chamber, where they pass from

the machine. I have found in practice that the pipe a should extend from six inches to six feet into the agitating-chamber, according to the character of ore being treated, and in order that the device may be adapted for various kinds of ores I secure the exit-pipe a in the casing A by a sliding fit at a', and am thus able to adjust said pipe to different positions in the casing. The exit-pipe may also, if desired, have a sliding fit in the bottom of the settling-chamber S, as at s^2.

Near the side of the casing A is suitably supported a feed-hopper D, which communicates with the chamber A′ by means of a feed-conduit d, in which works a feeding device, preferably in the form of a screw d', secured to or formed as part of a shaft d^2, which may be driven by any suitable means through the pulley d^3. While any other form of feeding device may be used, I prefer the feed-screw working in and fitting the conduit d, for the reason that it effectually prevents the exit of any air from the chamber even under high pressures.

Below the feeding device and preferably in the side of the casing opposite thereto is the air-inlet pipe b, communicating by suitable connections b' with any usual source of air-blast—as the fan B^2, for instance. It will be noticed that the air-blast inlet b is located below the feeding device and for the reason that the blast of air is thus conducted to the chamber A′ at a point most effective in exerting its lifting effect upon the ore as it is fed to the machine.

The lower part of the casing A terminates in a reduced portion A^2, extending some distance below the agitating-chamber A′. This extension or reduced portion A^2 may be made in any suitable form; but I preferably make it cylindrical in order to more easily adapt the throwing-blades a^6 therein, as will presently appear. The bottom of the reduced portion A^2 is closed by a wall a^2, having several slots a^3 therein, and below the said bottom is the chute a^8, terminating in a discharge-spout a^9.

Extending upward from the bottom wall a^2 is the stud or pin a^4, upon which the shaft a^{10} is supported. This shaft also finds a suitable bearing at its upper end at a^{11} on the frame B′ and carries at its lower part the throwing-blades a^6 a^7. These blades may be of any usual or desired form, so as by their revolution they will throw the material upward, and they may be of the same or different size; but I prefer to make them as illustrated in Figs. 1 and 2—that is, the blades a^6, that are within the reduced portion A^2, are made to fit such portion, and those a^7, above and extending into the agitating-chamber A′, are made larger in order to throw the material upward with increased force as the lower blades lift it from the reduced portion. I have found this form to give excellent results, and by extending the upper blades into the agitating-chamber I secure a thorough agitation of the comminuted ore and secure a complete disintegration of any mass that may become packed or caked together, while at the same time the material is thrown with such force that the incoming blast of air is enabled to lift the particles in its passage through the exit-pipe into the settling-chamber S.

The stud or pin a^4 is provided with a spiral groove a^5, and the shaft preferably has its lower end recessed to receive said stud or pin, by which it is supported. The grooves a^5 serve to keep the bearing between the shaft and pin or stud free from particles of sand and grit by working said particles down the spiral grooves and out of the bearing. A like provision is made near the upper end of the shaft a^{10}, where it passes through the casing A. At this point an elongated sleeve a^{12}, having flaring ends a^{14}, is provided, and the shaft a^{10} has formed thereon a spiral groove a^{13}, which by the turning of the shaft keeps sand and grit from injuring or cutting the bearing-surface between the sleeve a^{12} and the shaft a^{10}. The sleeve a^{12} is preferably formed of light metal, and the ends thereof are flared outward from the shaft, so that the end within the casing will act to catch a certain amount of the moving air-currents, which will act as a cushion to prevent binding of the sleeve upon the shaft under the pressure of air in the agitating-chamber, which is the case when the sleeve is made to closely fit around the shaft. If desired, both ends of the sleeve may be made alike, so that it can be reversed, though this is not essential. Below the lower blades on the shaft are a series of scrapers or arms a^{15}, which are located just above the bottom a^2 of the casing, and these arms serve to sweep any particles of heavy material that fall to the bottom of the reduced portion A^2 into the openings a^3, leading to the chute a^8.

The shaft a^{10} is provided at or near its upper end with a bevel-gear g, which, meshing with the bevel-gear g', carried by the shaft G and driven by the pulley g^2 from any source of power, transmits motion of rotation to the shaft a^{10}.

At one side of the reduced portion A^2 a sliding door is provided at k, which permits access to the interior of the reduced portion when it becomes desirable.

In opposite walls of the casing A are the observation-windows L, through which the operative can view the internal workings of the machine and regulate the feed of material thereto accordingly.

In Fig. 2 I have shown a modified form of means for driving the shaft a^{10}, which consists of the horizontal shaft G^0, inclosed in a tubular brace P and extending from the side of the casing into the agitating-chamber A′. The braces P and P′ serve to support a yoke p, in which the shafts G^0 and a^{10} have bearings at p^4 and p^5, respectively. On the outer end of shaft G^0 is the pulley g^{22}, through

which motion is imparted to said shaft and transmitted therefrom through the bevel-gears g^{11} and g^{10} to the shaft a^{10}, as will be obvious. It is necessary when this form of driving mechanism is employed to prevent the gears and bearings from becoming injuriously clogged by fine particles of ore-sand, and to this end I employ the hood p', preferably formed of sheet metal and completely housing the yoke p, and the gears and bearings. This hood is provided at its portion that encircles the shaft a^{10} with an elongated bearing p^2, having the end thereof at p^3 flared to form an air-cushion and prevent binding of the yielding metal of the hood against the shaft. The shaft at the part that passes through the bearing p^2 has a spiral groove p^6, which prevents any dirt or grit from finding access to the interior of the hood, the grooves serving to work all such matter outward as it revolves.

In Fig. 3 I have shown a modified form of throwing device wherein the horizontal shaft m' carries a series of fan-blades m^2, working with a close fit in the reduced portion a^2 of the casing. Below the throwing device is the opening $a^\times$ for the exit of any heavy particles that find their way past the throwing-blades m^2, and extending from the casing is the chute a^8 and exit-spout a^9. When this form of throwing device is employed, it is necessary to provide a deflector m to direct material to the rising or throwing portion of the device.

In general the dimension of parts will be such that the diameter of the agitator at its greatest width will be from six to twenty times the diameter of the exit-pipe and its height from six to forty times the diameter of said pipe. These proportions may vary, of course, as may also the relative sizes of the throwing-blades.

The operation of the device is as follows: The finely ground or powdered ore is fed into the hopper D and transmitted to the agitating-chamber by the feed-screw. As it falls the air-blast passes through it, carrying away some of the lighter particles through the exit-pipe a into the settling-chamber S. As the mass falls it is acted on by the throwing-blades, which separate and scatter the mass and throw it upward, where the blast acts to carry it into and through the exit-pipe. The air-blast entering the agitator does not pass direct to the exit-pipe a, but circulates around in currents, partly due to the fact that the air-blast enters the chamber at an angle to the exit and that the exit-pipe extends well into the agitating-chamber. The circulation of these currents affords opportunity for the heavier particles to fall, and some of them pass out through the slots in the bottom of the reduced portion A^2 of the agitator, while others, with the light material, are carried into the settling-chamber S, where the heavy and valuable portions of the mass entering the settling-chamber fall, owing to the reduced air-currents, and are conducted out of the machine by the chute s.

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

1. In an ore-concentrating agitator, the combination of a casing forming an agitating-chamber, a throwing device mounted in the lower part of said chamber, the latter being enlarged above the throwing device, an exit-pipe leading from said chamber, a feeding device, an air-inlet for conducting a blast of air into said chamber below the feeding device and above the throwing device.

2. In an ore-concentrating agitator, the combination of a casing forming an agitating-chamber, a throwing device mounted in the lower part of said chamber, the latter being enlarged above the throwing device, an exit-pipe leading from the chamber and extending thereinto, means for feeding ore to said chamber, and an air-inlet for conducting a blast of air into said chamber below the feeding means, and below the lower end of the exit-opening.

3. In an ore-concentrating agitator, the combination of a casing having an enlarged central portion forming an agitating-chamber, a throwing device mounted in the lower part of said chamber for throwing material upward, an exit-pipe for the lighter particles of ore leading from and extending into said chamber, means for feeding ore to said chamber, means for creating an air-blast and an inlet for conducting the blast of air into said chamber below the feeding means.

4. In an ore-concentrating agitator, the combination of a casing having an enlarged central portion forming an agitating-chamber, a throwing device mounted in the lower part of said chamber for throwing material upward, a discharge-chute below said throwing device, and forming practically a closed bottom for the casing, an exit-pipe leading from and extending into said chamber opposite the said throwing device, a feeder and an air-inlet for conducting a blast of air into said chamber below the feeder.

5. In an ore-concentrating agitator, the combination of a casing having an enlarged portion forming an agitating-chamber and provided with a reduced and practically-closed lower portion, a throwing device comprising a series of revolving blades practically occupying the cross-area of the lower portion, an exit-pipe leading from said chamber, a feeder and an air-inlet for conducting a blast of air into said chamber below the feeder.

6. The combination of a casing forming an agitating-chamber, having an enlarged central portion and a reduced bottom portion, a throwing device comprising a revolving shaft having a series of blades occupying said reduced portion and extending upward into the

enlarged portion, an exit-pipe for the light material, a feeder and an air-blast inlet below the exit-opening.

7. A casing having an enlarged central portion and a reduced lower portion constituting a chamber for the rarefaction and recondensation of the ascending air-currents, an exit in the upper part of the chamber for the lighter particles of ore, an air-blast inlet leading into the chamber below the exit-opening, a feeder above the air-blast inlet, and a revolving shaft with agitating-blades located in the reduced lower portion of the chamber and extending up into the enlarged central portion thereof, said blades in the central portion being of increased length.

8. In an ore-concentrating agitator, the combination of a casing having an enlarged central portion constituting an agitating-chamber, an exit-pipe leading from said chamber and extending thereinto, a throwing device in the lower part of said chamber, a feeder, an air-inlet for conducting a blast of air into said chamber below the feeder and above the throwing device and a door in the lower part of the casing opposite the throwing device.

9. In an ore-concentrating agitator, the combination of a casing forming an agitating-chamber, and having a reduced lower portion, a stud projecting upward from the bottom of the said lower portion, a shaft seated on said stud, and carrying throwing-blades fitted to the said reduced lower portion, and other throwing-blades of larger size above the reduced lower portion, a feeding device, an air-inlet, an exit-pipe leading from and extending into the agitating-chamber and means for operating the said shaft.

10. In an ore-concentrating agitator, the combination of a casing forming an agitating-chamber, a feeding device, an air-blast inlet leading to said chamber from the side thereof and below the feeding device to produce a circulation of air-currents in the agitating-chamber, and an exit-pipe fitted adjustably into the casing whereby it may be extended more or less into the said agitating-chamber.

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