No. 654,290. Patented July 24, 1900.

A. H. STEBBINS.

ORE CONCENTRATOR.

(Application filed Sept. 18, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

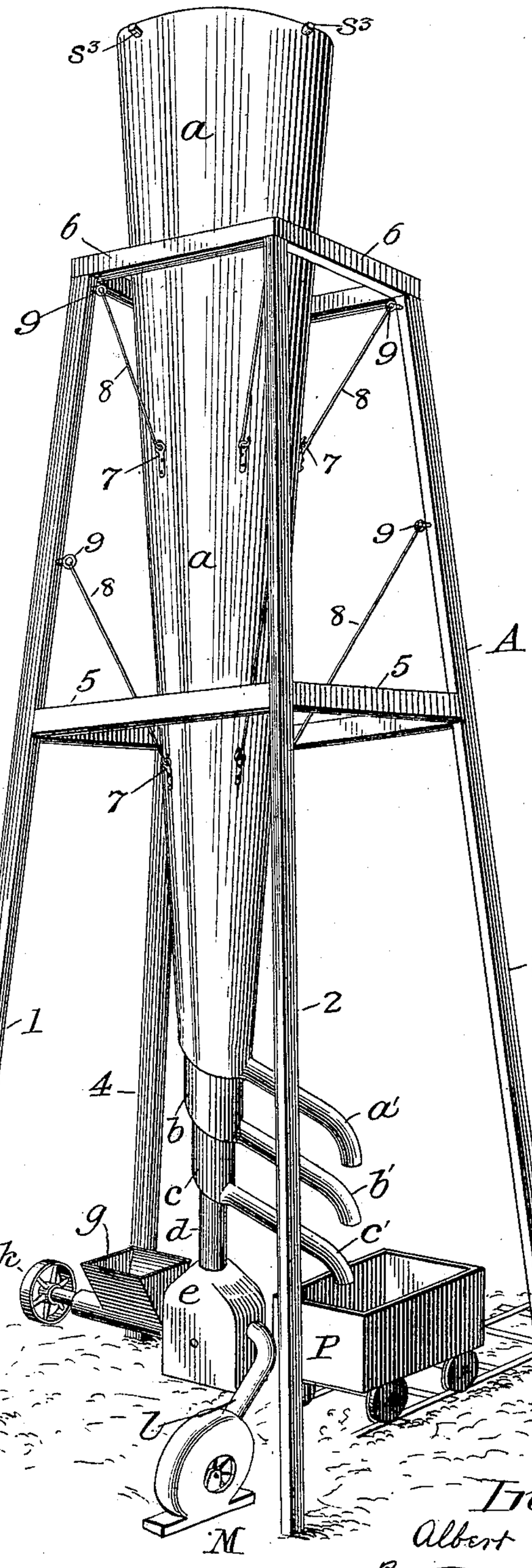

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Fig. 2.

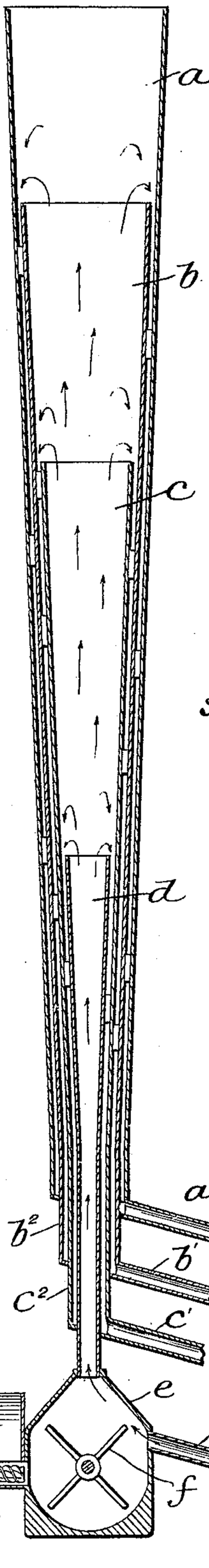


Fig. 3.

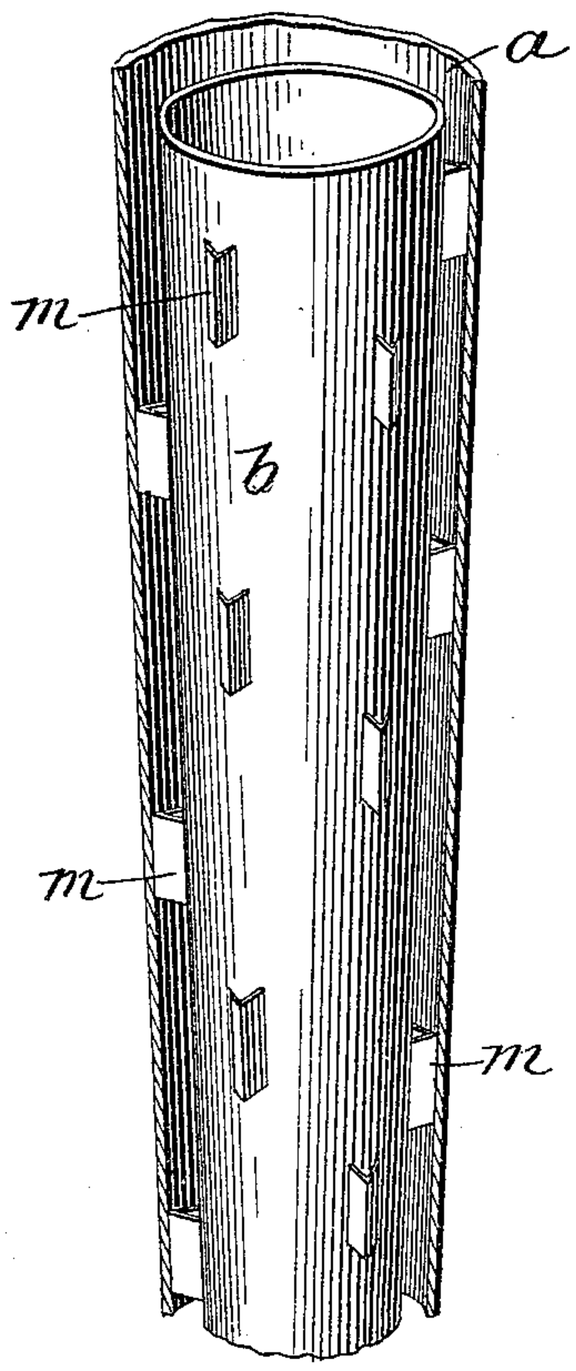
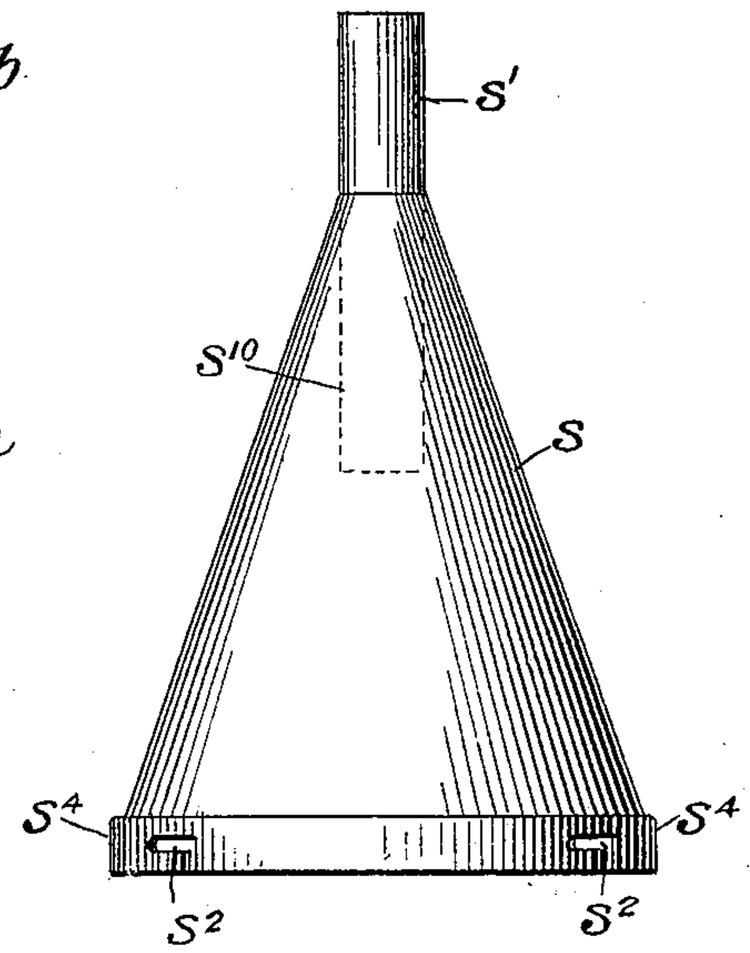


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

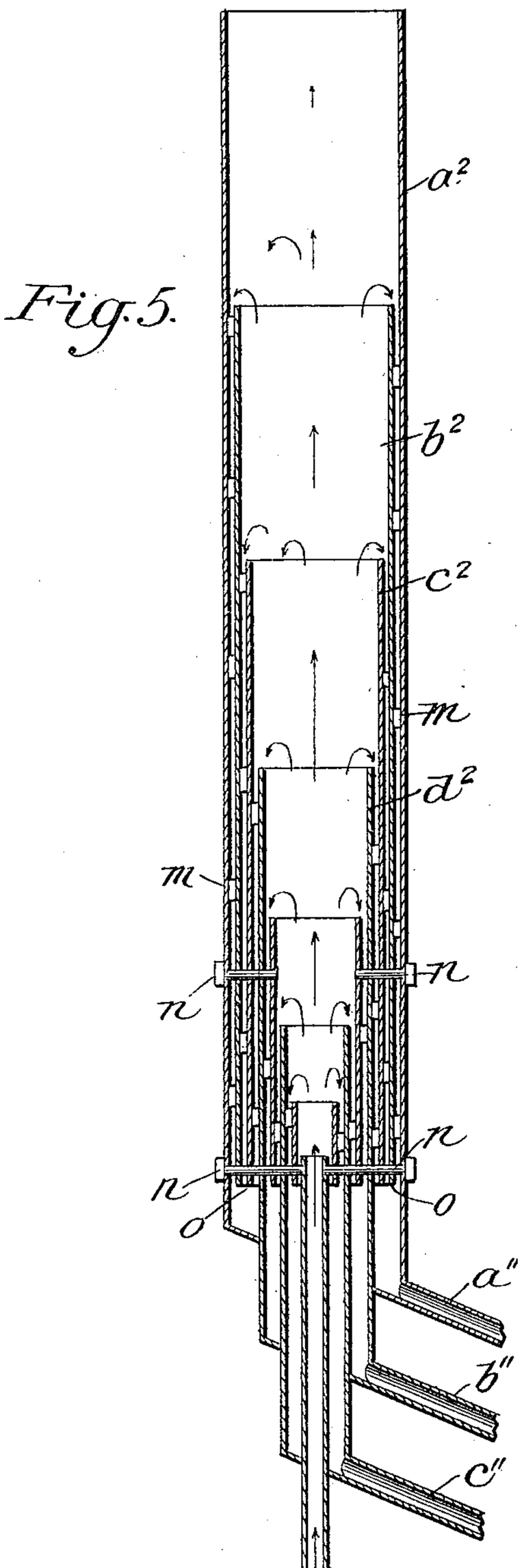

Fig. 5.

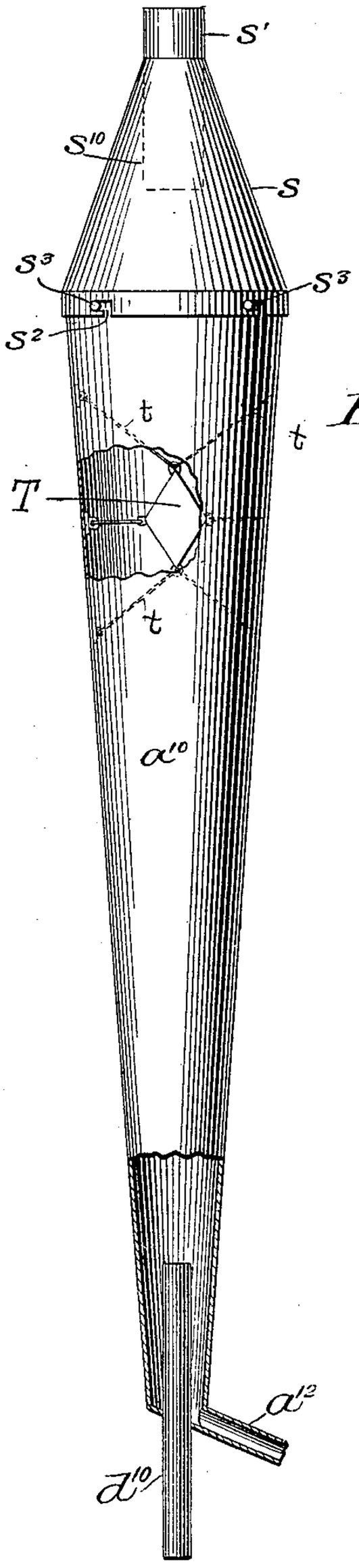

Fig. 6.

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UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LITTLE ROCK, ARKANSAS.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 654,290, dated July 24, 1900.

Application filed September 18, 1899. Serial No. 730,841. (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, of which the following is a specification.

My invention relates to ore-concentrators wherein the valuable portions of ore after being reduced to small particles are separated from the waste materials with which they are mixed; and the objects of my invention are to effect such separation in a thorough and efficient manner and on a scale to be practically and commercially valuable.

It is well known that of a mass of particles in motion those of high specific gravity are less influenced by air-currents than similar-sized particles of less specific gravity, and I have made use of this known fact to devise means whereby mixed particles of dirt, dust, and ores may be separated in such manner that the heavy particles or those containing valuable metals may be permitted to settle under the action of gravity, while the lighter particles are carried off by air-currents, which gradually diminish in force.

In carrying out my invention I feed the finely-divided ore-bearing earth to the action of a blast of air which is of such strength as to carry the entire mixture with it into settling-pipes the air-space in which gradually increases to form a settling-chamber, wherein the force of the air-blast is sufficiently reduced to permit the heavy particles to settle under the action of gravity, while the undesirable portions of the mixture are continued onward by the diminished air-currents and finally carried out of the machine.

My invention will best be understood from the following description in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of my device, showing also a car or receptacle into which the concentrates are discharged. Fig. 2 is a cross-section of the device with the supporting-framework removed. Fig. 3 shows in detail the means for holding the settling-pipes spaced apart. Fig. 4 shows in side elevation a reducer adapted to be placed on the top of the settling-pipe. Fig. 5 shows in section a modification of my device wherein the settling-pipes are cylindrical in cross-section. Fig. 6 shows the reducer in place on the top of a settling-pipe.

Referring to the drawings, A represents the supporting-framework of any suitable construction, but preferably formed of the four uprights 1, 2, 3, and 4, connected by any usual bracing, such as the tie-pieces 5 and 6. Connected to the framework, as by the braces or hangers 8, secured to eyebolts 9 at one end and to the eyes 7 at the other end, is the settling stand-pipe a, which is open at the top and preferably formed as a conical tube, gradually enlarging from its lower end to the top, as clearly represented in Fig. 2. At its lower end this settling-pipe is provided with a discharge-spout a'. Within the settling-pipe a and concentric therewith is a correspondingly-shaped pipe b of less length than pipe a, the lower end of which is extended at b^2 beyond the lower closed end of pipe a and terminates in a discharge-spout b'. Likewise within pipe b and concentric therewith is a correspondingly-shaped pipe c of less length than pipe b, the lower end of which is extended at c^2 beyond the lower closed end of pipe b and terminates in a discharge-pipe c'. Any number of these pipes may be employed to form at their enlarged portions a settling-chamber, and while I have shown them of conical shape they may be of any other preferred form. The last of the series of pipes, as d, is likewise made concentric with pipe c; but instead of terminating in a discharge-spout, as in the case of the other pipes, it is continued down beyond the lower end of pipe c and connects with an agitator e, in which are located the stirring-blades f, revolved by any usual mechanism not necessary to illustrate. Connected to the agitator by a feed-passage h is a hopper g, into which the crushed or ground ore is dumped, and working in said feed-passage h is any usual form of feeding device, (shown in the present instance as a screw i,) which receives motion from any usual source of power through a pulley k. Connected to the agitator, preferably on the side opposite the feed-screw, is the air-blast flue or conduit l, by which a strong current of air is introduced into the agitator from a suitable blower or air-supply M, and finding no other escape passes as a

strong blast up the pipe *d*. The stirring-blades *f* in the agitator serve to lift the material as it enters from the feed-chute *h*, so that the full blast of air is exerted upon the entire mass of crushed material, including the light and heavy particles, to force it under great velocity up the pipe *d*.

The series of concentric pipes are spaced apart, so as to form a receiving-chute between the pipes for the heavy particles as they seek to fall under the action of gravity after they have reached that enlarged section of pipes or settling-chamber where the force of the air-currents ceases to act sufficiently upon them to continue to propel them upward. Any suitable means, such as blocks, may be employed to space the pipes apart; but in the present instance I have shown V-shaped pieces *m*, of sheet metal, secured to the outer surface of the inner pipes, which bear upon the inner conical surface of the next adjacent exterior pipe. Not only do these pieces *m* serve to space the pipes apart the required distance to form a space between the walls of adjacent pipes, but by the conical formation of the pipes these pieces serve to support the pipes one within the other, as will be obvious.

In Fig. 5 I have shown a modification of my invention wherein the settling-chamber is formed of pipes which are made cylindrical. In this case the spacing-blocks *m* serve to hold the settling-pipes apart, as in the construction above described; but to support the pipes in their proper relative position I secure them together by suitable supporting-means, such as the bolts *n*. It will be noted in this construction I have shown some of the pipes, as b^2 c^2, terminating short of the discharge-spouts a'' b'' c'', so that two or more of the chutes between the pipes lead to the same discharge-spout, and it will be obvious that this same expedient may be employed with respect to the conical or any other form of pipes, it being necessary only to terminate some of the pipes short of the discharge-spout, as indicated at *o o*, Fig. 5. Moreover, the discharge-spouts may all lead to a common receptacle, as P, which in this instance is shown as a hand-car, movable on suitable ways *p p*, or each spout may, if desired, be led to different receptacles when it is desired to keep the various grades of material separated, as will be obvious.

The essential feature of my device is the separation of the heavier from the lighter particles of crushed or ground ore by lifting the entire mass of material with considerable velocity into an enlarged settling-chamber by means of a blast of air and then by gradually reducing the effective lifting force of the blast as it passes into the greater space near the tops of the settling-pipes to allow the heavier particles of ore to pass from the control of the air-currents and under the influence of gravity to settle and fall into the chute between the pipes, while the lighter particles are carried away by the reduced air-currents, which are still sufficient to propel them.

In order to insure sufficient current to carry away the lighter particles, I may employ on the top of the settling-pipe a reducer of the form shown in Fig. 4. This reducer consists of a conical piece *s*, having an enlarged flanged base s^4, adapted to fit over the top of settling-pipe *a*, being provided with bayonet-slots s^2, which engage pins s^3 on the pipe *a*. At its top the reducer terminates in a pipe s' of small sectional area, the effect of which is that the volume of air within the pipe in its endeavor to escape through the small opening afforded by pipe s' is again increased in velocity, and thereby the lighter particles floating around in the enlarged upper part of the settling-pipe are taken up and carried out of the machine. The reducer is particularly applicable when only one settling-pipe a^{10} is employed to form a settling-chamber, as represented in Fig. 6; but it may be used with great advantage on the outer pipe in the construction shown by the remaining figures. In said Fig. 6, a^{12} represents the discharge-chute and d^{10} the air-blast pipe leading from the agitator, not necessary to illustrate, as it is the same, or may be, as that of Fig. 2.

It will be noted that in the form of concentrator described the air-currents do not separate the lighter particles from the heavier ones by simply blowing the former away from the latter; but the air-blast lifts the entire mass of particles, and then the reduced force of the air-currents in the upper part of the pipes allows the heavier particles to settle under the action of gravity and be carried out of the machine through the side chutes. I have found in practice very good results are secured by making the height of the pipes about forty to sixty times the diameter of the pipe that brings the material from the agitator and the diameter at the top about six to twelve times the diameter of said pipe leading from the agitator; but these proportions may be varied.

By reference to Figs. 4 and 6 it will be noted that the outlet-pipe s' of the reducer extends well down into the reducer, as at s^{10}. In fact, it may extend nearly or quite to the bottom of the reducer. The effect of this is to create a comparatively-dead air-chamber in the upper portion of the reducer, where any heavy particles that might reach this height would begin to descend and gain velocity in their descent to carry them into the chute and out of the machine.

It is sometimes desirable that the air-currents, especially when very forcible, shall be separated and deflected from the center of the settling-chamber, and for this purpose I may support in the chamber, as illustrated in Fig. 6, a double-ended conical deflector T, supported by suitable detachable braces *t* from the inner surface of one of the pipes.

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

1. In an ore-concentrator, a supporting-framework, a settling-chamber, supporting devices connecting the framework and settling-chamber, the latter comprising a plurality of similarly-shaped separate pipes, and having a gradually-increasing cross-sectional area from bottom to top, each pipe extending into and part-way up its next exterior pipe and below the bottom thereof, an agitator directly below the settling-chamber and communicating with the central pipe of the series, means for feeding ores into said agitator, and devices for forcing a blast of air into and through said agitator to lift the entire mass of ores directly upward through the central pipe into the settling-chamber.

2. An ore-concentrator comprising a settling-chamber formed of a series of concentric pipes and having an increasing cross-sectional area from its bottom to its top, an agitator directly below and in communication with the central pipe of the series, means for feeding ores to said agitator, air-blast forcing means in communication with the agitator to lift the entire mass of ore with a gradually-reducing force directly upward through the central pipe of the series into said settling-chamber, and a reducer of frusto-conical form detachably connected to the top of the chamber.

3. An ore-concentrator comprising a settling-chamber formed of a series of conical pipes concentrically arranged, and blocks secured to the outer surface of the interior pipes, and adapted to bear upon the inner surface of the next adjacent exterior pipe, said blocks being spaced apart.

4. An ore-concentrator comprising a settling-chamber formed of a series of separate conical pipes each pipe extending into and part way up its next exterior pipe, the central pipe of the series being extended below the bottoms of the other pipes of the series, an agitator below the central pipe and in direct communication therewith, means for feeding ores to the agitator and device for forcing a blast of air upward through the agitator and central pipe of the series to carry the mass of ore upward through the central pipe into the settling-chamber and a supporting-framework for said concentrator.

5. An ore-concentrator comprising a settling-chamber formed of a series of conical pipes arranged one within the other, separating-blocks secured to the outer surfaces of the interior pipes and bearing upon the inner surfaces of the next adjacent exterior pipe to detachably support the interior pipes in position and means for forcing a blast of air upward into the settling-chamber.

6. An ore-concentrator comprising a settling-chamber formed of a series of relatively-long pipes concentrically arranged, the interior pipes extending into and part way up the exterior pipes and below the bottoms thereof, blocks interposed between the surfaces of adjacent pipes for spacing them apart, an agitator beneath the series of pipes, means for feeding ores to said agitator, and devices for forcing a blast of air through said agitator upward through the central pipe of the series into the settling-chamber.

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