H. N. MIDDLETON.

PNEUMATIC SEPARATOR.

APPLICATION FILED FEB. 2, 1907.

940,469.

Patented Nov. 16, 1909

2 SHEETS—SHEET 1.

Fig. 1.

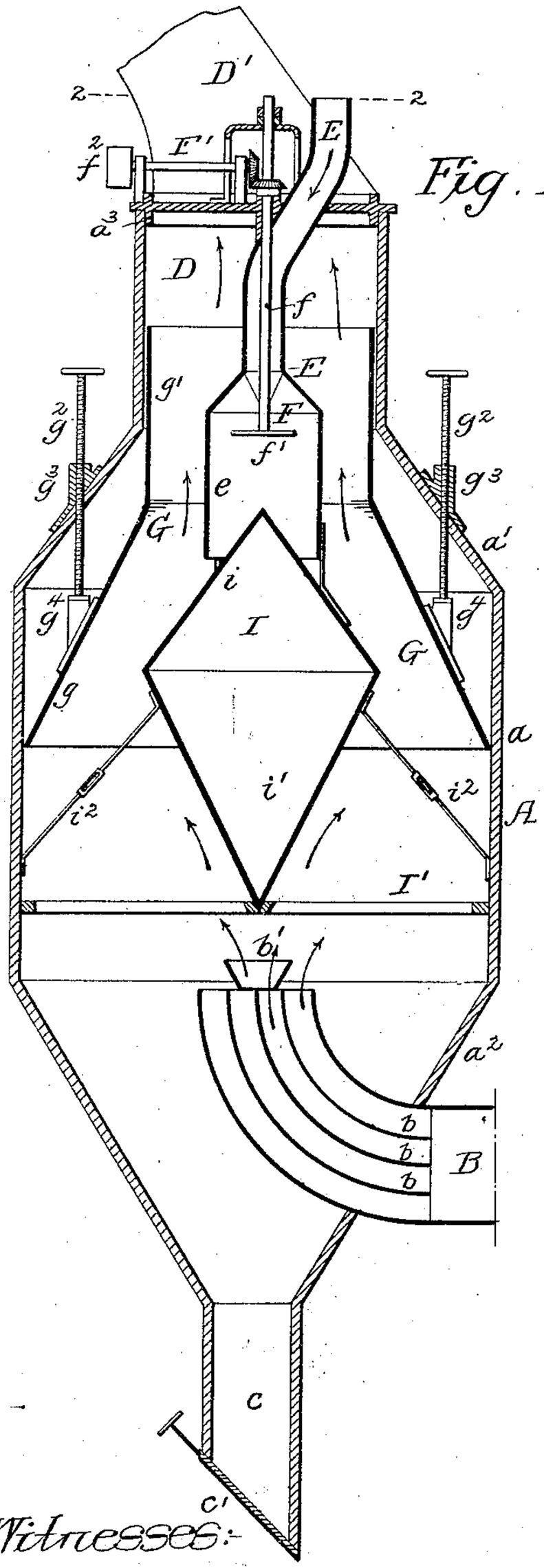
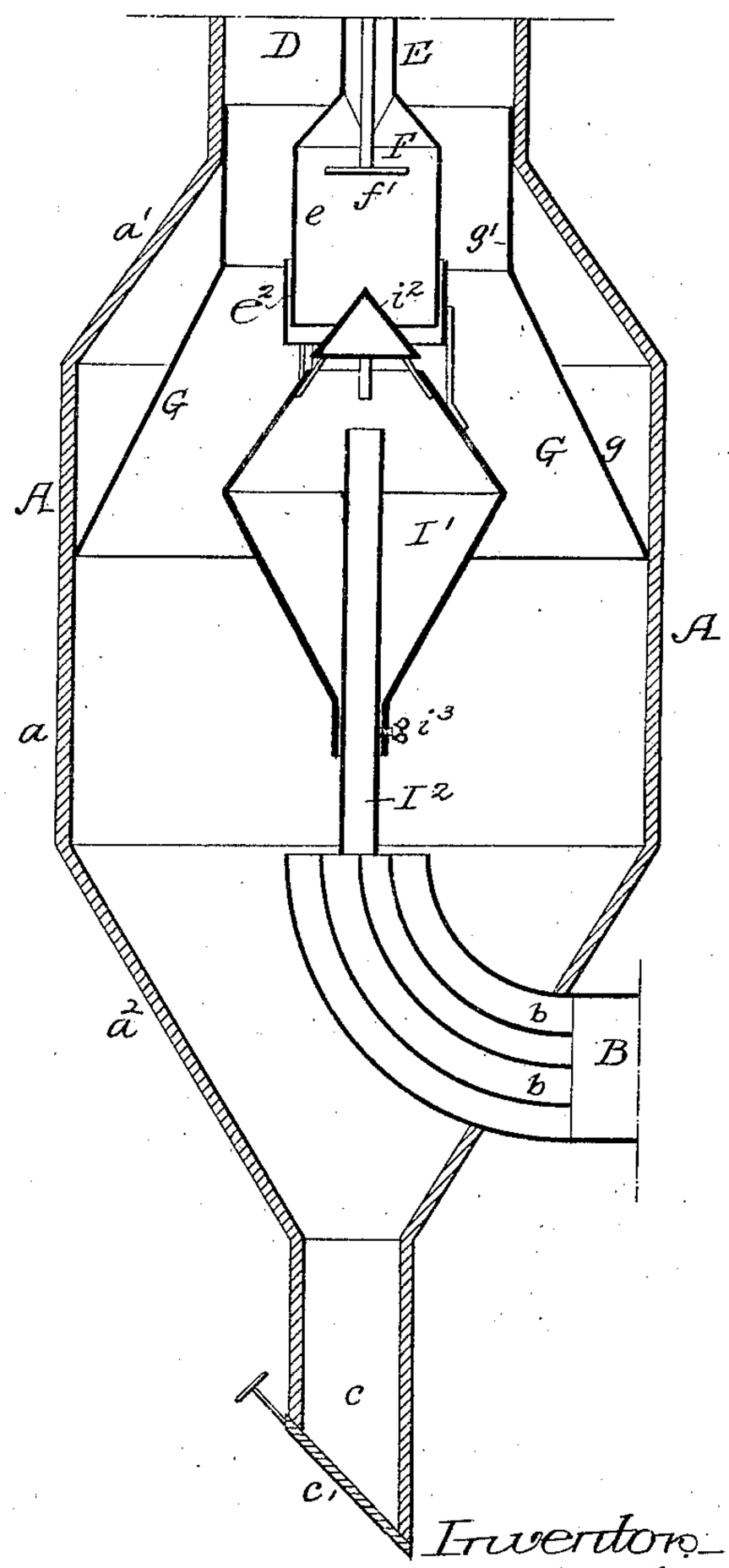


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 2.

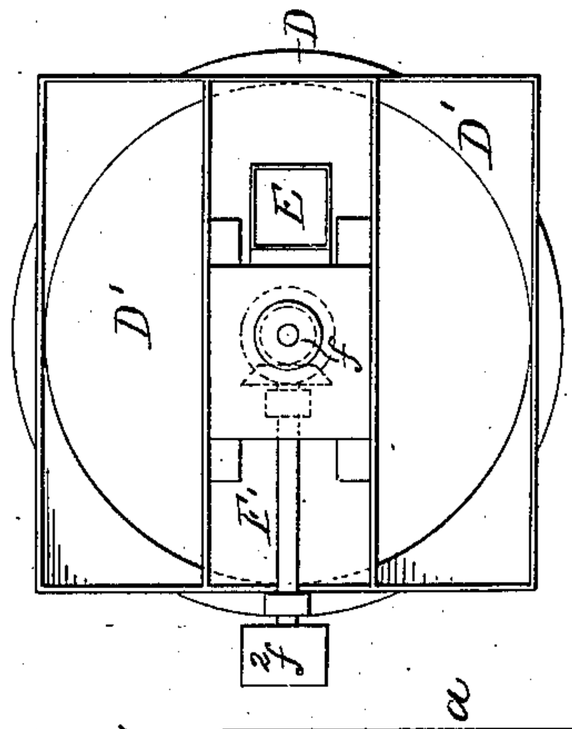


Fig. 3.

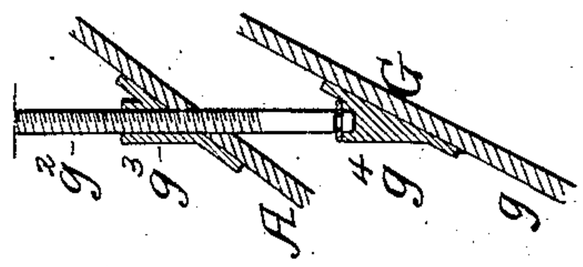


Fig. 1.

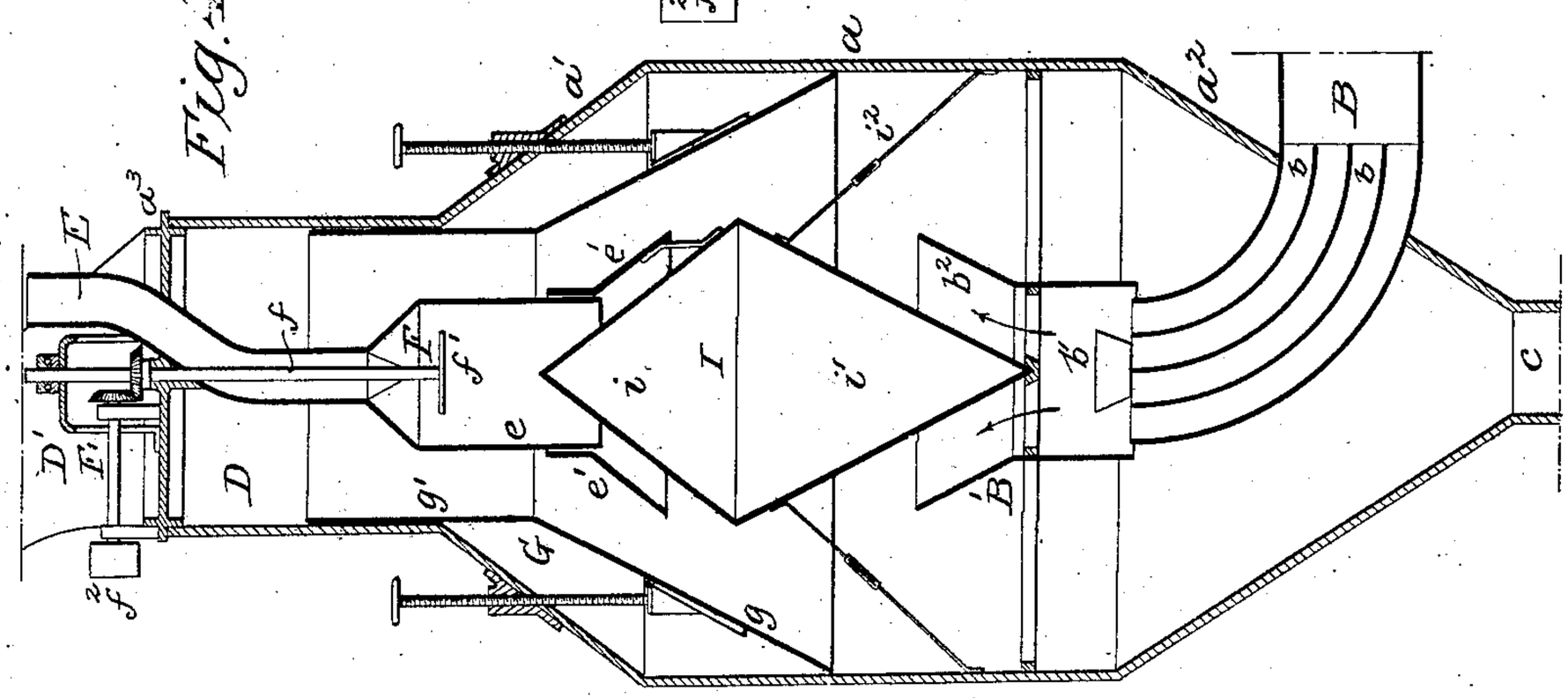
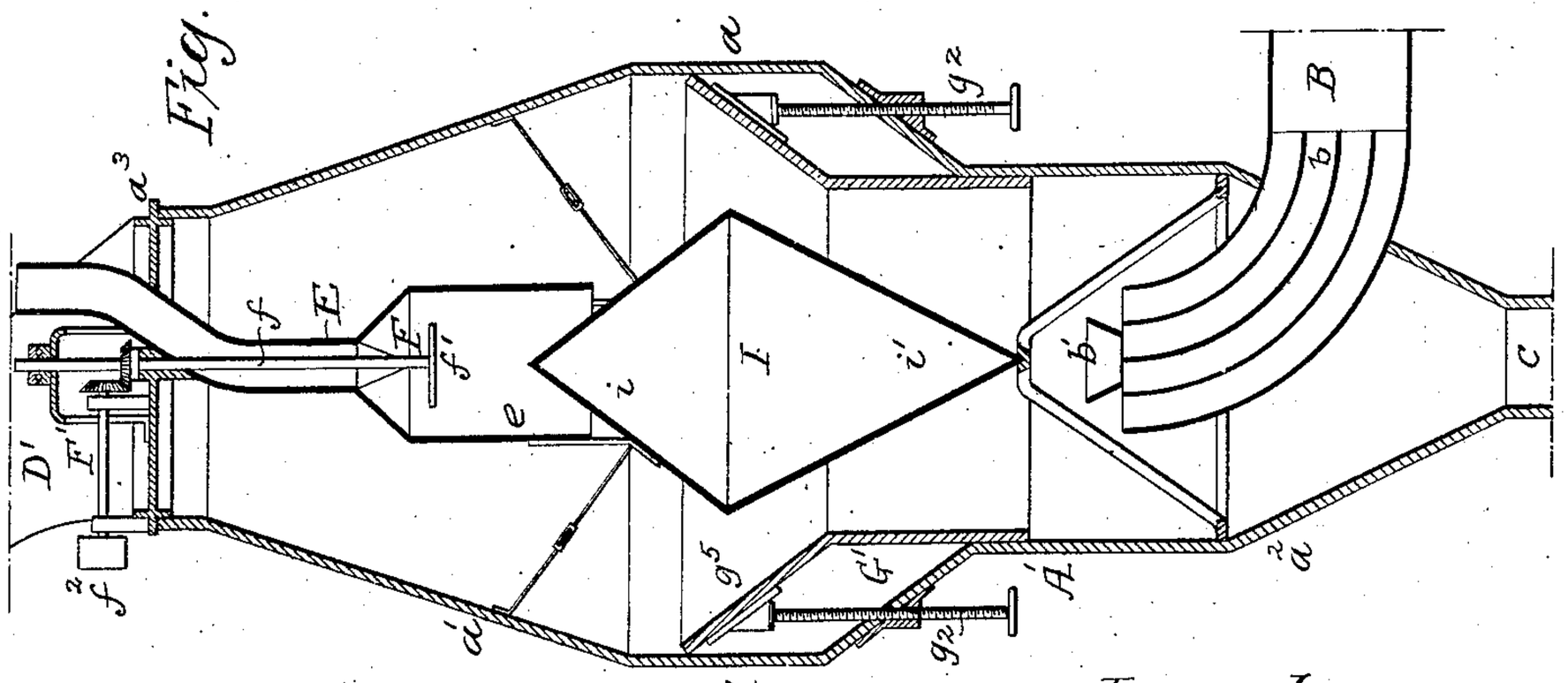


Fig. 5.



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UNITED STATES PATENT OFFICE.

HARRY N. MIDDLETON, OF WESTVILLE, NEW JERSEY.

PNEUMATIC SEPARATOR.

940,469. Specification of Letters Patent. Patented Nov. 16, 1909.

Application filed February 2, 1907. Serial No. 355,422.

To all whom it may concern:

Be it known that I, HARRY N. MIDDLETON, a citizen of the United States, residing in Westville, New Jersey, have invented certain Improvements in Pneumatic Separators, of which the following is a specification.

My invention relates to apparatus for separating light particles from heavier particles of material by the action of an air current.

The object of my invention is to so construct a pneumatic separator that it can be used either in connection with a suction blower or in connection with an air blast apparatus.

The invention relates also to means for regulating the blast so that the apparatus can be adjusted to properly act upon the particular material being separated.

In the accompanying drawings:—Figure 1, is a vertical sectional view of my improved pneumatic separator; Fig. 2, is a sectional plan view on the line 2—2, Fig. 1; Fig. 3, is a view of one of the regulating screws, and Figs. 4, 5 and 6, are views illustrating modifications of the invention.

A is the casing of the separator having a cylindrical portion a and tapered portions a'—a^2, although the form of the casing may be modified, as desired. In the bottom of the casing is a tailing spout c, having a gate c' for the discharge of coarse materials.

B is the air inlet pipe curved, as shown, so as to terminate at the center of the chamber formed by the casing A. This air inlet pipe has a series of curved diaphragms b for the purpose of dividing the air as it passes through the pipe. This air inlet pipe may connect with an air blast apparatus, or may simply open to the atmosphere if the separator is to be worked under partial vacuum.

Communicating with the casing A of the separator is the exhaust passage D. This passage may be connected with a suction fan, if it is desired to operate the apparatus under a partial vacuum. The passage D, in the present instance, is circular and connects with two pipes D', quadrangular in cross section as shown in Fig. 2, separated one from the other to allow for the placing of the driving gear described hereafter. E is a tube extending through the center of the passage D for the introduction of the material to be separated. As shown in Fig. 1, this tube is enlarged at e and within this enlargement of the tube is a spreader F consisting of a shaft f and a disk f'. The shaft extends through a bearing in a plate a^3 mounted in the upper end of the casing and has a bevel gear wheel which meshes with the bevel gear on a driving shaft F' mounted in bearings on the plate a^3 and having a driving pulley f^2. By this means the spreader is rotated so that when material drops thereon it is thrown out by centrifugal force against the inner surface of the enlarged portion e of the tube.

Mounted between the inlet tube E for the material and the air inlet pipe B is a double cone I. The upper portion i of the cone is, in the present instance, shorter than the lower portion i'. The cone is supported, in the present instance, on a spider I' secured to the casing and held in place by stay rods i^2, but the cone may be supported and held in place in any suitable manner without departing from the essential features of the invention.

The upper portion i of the cone preferably extends into the enlargement e of the tube E, as shown, insuring an even distribution of the material as it falls from the walls of the tube onto the surface of the cone and the air as it passes from the pipe B is preferably deflected by a conical ring b', which spreads a portion of the air so that some portion of the air will strike the cone, while the balance will be deflected and fill the space between the cone and the casing so that the air as it passes upward in the direction of the arrows will meet the down flowing material as it passes off the upper portion of the cone I and the light particles of material will be forced to travel with the air and away from the cone and through the outlet passage D, while the heavy particles will overcome the pressure of air and will flow into the lower portion of the separator and pass out the tailing spout c.

In order to adjust the apparatus so as to separate more or less of the particles of the material, I mount within the casing an adjustable shell G, having a conical portion g and a cylindrical portion g', this cylindrical portion is adapted to slide within the outlet passage D in the upper end of the casing. By raising or lowering this shell the passage surrounding the cone can be increased or diminished in area thus increasing or diminishing the force of the air blast pass-

ing around the cone, so that if the shell is lowered some of the heavy particles will be carried with the air through the outlet passage D, whereas, if it were raised, fewer of the heavy particles would be carried by the air. By this arrangement ready means is provided for regulating the separation of the particles of material. I have shown one method of adjusting this shell in Figs. 1 and 3, viz., by screw rods g^2, which pass through screw threaded lugs g^3 on the casing, and adapted to swivel in a block g^4 on the conical portion g of the shell so that by turning the screws the shell can be raised and lowered, but it will be understood that other means may be used without departing from the invention.

In Fig. 4, I have shown a modification of my invention, in which I mount a conical flange e' on the end of the enlargement e of the tube E, and I inclose the lower end of the cone I in a cylinder B′ having a conical section b^2 whose walls, in the present instance, are parallel with the walls of the cone. This cylinder is somewhat larger than the air inlet pipe B and this tends to concentrate the air around the lower walls of the cone and the hood e' tends to retain the particles on the cone so that separation would be at the greatest diameter of the double cone.

In Fig. 5, I have shown a movable shell G′, having a flared section g^2; the cylindrical portion of the shell fitting into the lower portion of the casing A′. Any suitable means may be devised for raising and lowering this shell, either extending below the shell, as in the drawing, or extending above the shell.

In Fig. 6, I have shown a modification in which the cone I′ is vertically adjustable, being mounted upon a tube I^2 attached in any suitable manner at the bottom to the inlet pipe B or other fixture. The cone is secured in position to which it is adjusted by a confining screw i^3 and is guided at the upper end by a sleeve e^2 arranged to slide upon the enlarged portion e of the tube E. The head i^2 of the cone is separated from the body to form an air outlet so that air entering the tube I^2 will flow out the slot under the head e^2 and aid in separating the particles. An adjustable shell G may be used as shown or may be dispensed with and all the adjustment made by shifting the cone.

The operation of the separator is as follows:—When it is worked under air pressure then the pipe B is connected to any suitable blower that will force air at the velocity desired into the casing A. The conical ring b' will spread the air as it leaves the pipe B and the lower portion of the double cone will still further spread the air. The material is fed through the tube E and as it falls upon the spreader, which is rotated, it is thrown against the walls of the enlarged portion e of the tube and falls onto the upper portion of the cone I. As the material meets the air in its downflow from the edge of the cone the lighter particles will be carried by the air to the outlet D, while the heavy particles will flow into the lower portion of the casing and be discharged through the tailing spout. The shell G is adjusted in the first place to a position to concentrate the air and to properly separate the material.

I claim:—

1. The combination of a casing, a double cone mounted within the casing, a tailing spout in the lower end of the casing, an exhaust pipe communicating with the upper end of the casing, an air inlet pipe opening into the casing directly under the cone, a material feed tube having an enlarged end and situated directly above the cone, a spreader, means for rotating the spreader, a shell having a cylindrical and a conical portion surrounding a part of the cone, and means for adjusting the shell so as to increase or diminish the space between the shell and the cone.

2. The combination of a casing, a double cone consisting of two conical structures united base to base within the casing, an air inlet pipe entering the lower portion of the casing and opening at a point directly under the cone, a tube placed to discharge material upon the cone and having an enlarged end portion inclosing the upper end thereof, a spreader within the enlarged end of the tube, and means for rotating the spreader so as to distribute the material evenly over the outside of the cone.

3. The combination of a casing, a double cone mounted within the casing, an air inlet pipe under the cone, an inlet tube for material, an outlet pipe for the air and finer particles of material, said outlet pipe having a tubular body portion connected with the casing, two quadrangular pipes connected to the tubular portion, with a spreader mounted in the material feed tube, and gearing for driving the spreader situated in the space between the two quadrangular pipes.

4. The combination of a casing having a cylindrical portion and conical extensions at each end, a tailing spout connected to the lower extension, an outlet pipe for air and light material connected to the upper extension, a double cone mounted within the casing, an air inlet pipe entering from the side of the casing and curved so as to discharge directly under the cone, a series of diaphragms in said pipe, a conical ring mounted above the opening in the pipe, an inlet tube for material having an enlarged end surrounding the upper portion of the

cone, a spreader within said enlarged portion of the tube, means for rotating the spreader, a shell having a cylindrical portion extending into the air outlet pipe and having a conical portion situated between the casing and the upper portion of the cone, with means for vertically adjusting said shell.

5. The combination in a separator, of a casing, a double cone mounted within the casing, an air inlet pipe directly under the cone and an inlet pipe for material directly above the cone, an exhaust pipe for the air and the lighter particles of material, a shell mounted between the casing and the cone, means for vertically adjusting the shell, and means for vertically adjusting the cone.

6. The combination in a separator, of a casing, a double cone mounted within the casing, an air inlet pipe directly under the cone, an inlet pipe for material directly above the cone, and an exhaust pipe for air and the lighter particles of material, said cone having an annular opening near its upper end communicating with the air inlet pipe and vertically adjustable.

7. The combination of a casing, a double cone mounted in the casing, an air inlet pipe communicating with the casing under the cone and arranged to discharge air against the lower conical surface thereof, a cylinder having an upwardly flared end inclosing the lower portion of the cone, a feed tube for material situated directly above the cone and discharging upon its conical surface, said feed tube having an enlarged end inclosing a portion of the cone, an air outlet pipe for the fine particles of material, and a conical downwardly flaring shell within the casing outside of the end of the feed tube and surrounding a portion of the cone.

8. The combination of a casing, a double cone, an air inlet pipe communicating with the casing directly under the cone, an inlet pipe for material above the cone and discharging directly onto the cone, an air outlet pipe for the fine particles of material communicating with the upper portion of the casing, a conical shell mounted within the casing and surrounding a portion of the cone, screw rods connected to the shell, and threaded bearings on the casing through which the screw rods pass so that on turning said screw rods the shell can be raised or lowered.

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

HARRY N. MIDDLETON.

Witnesses:
E. R. Loughery,
Wm. A. Barr.