(No Model.) 4 Sheets—Sheet 1.

J. M. SCHUTZ.

PULVERIZING APPARATUS.

No. 522,945. Patented July 10, 1894.

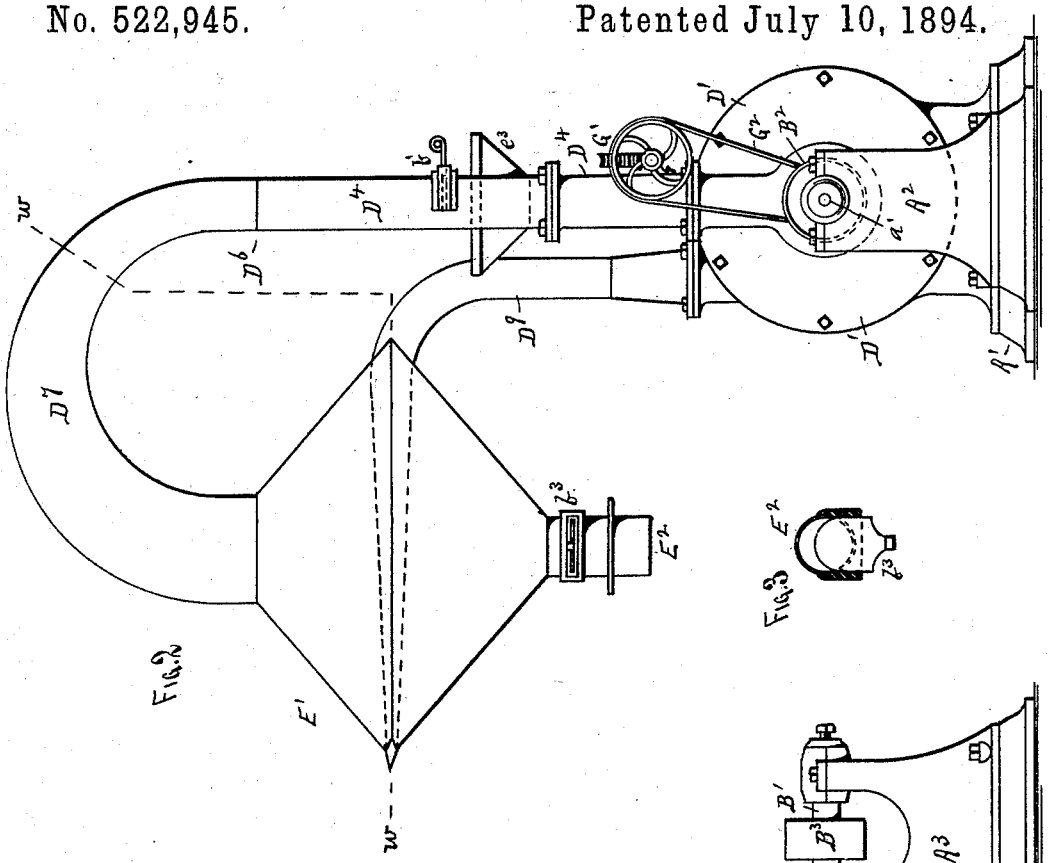

Fig. 2

Fig. 3

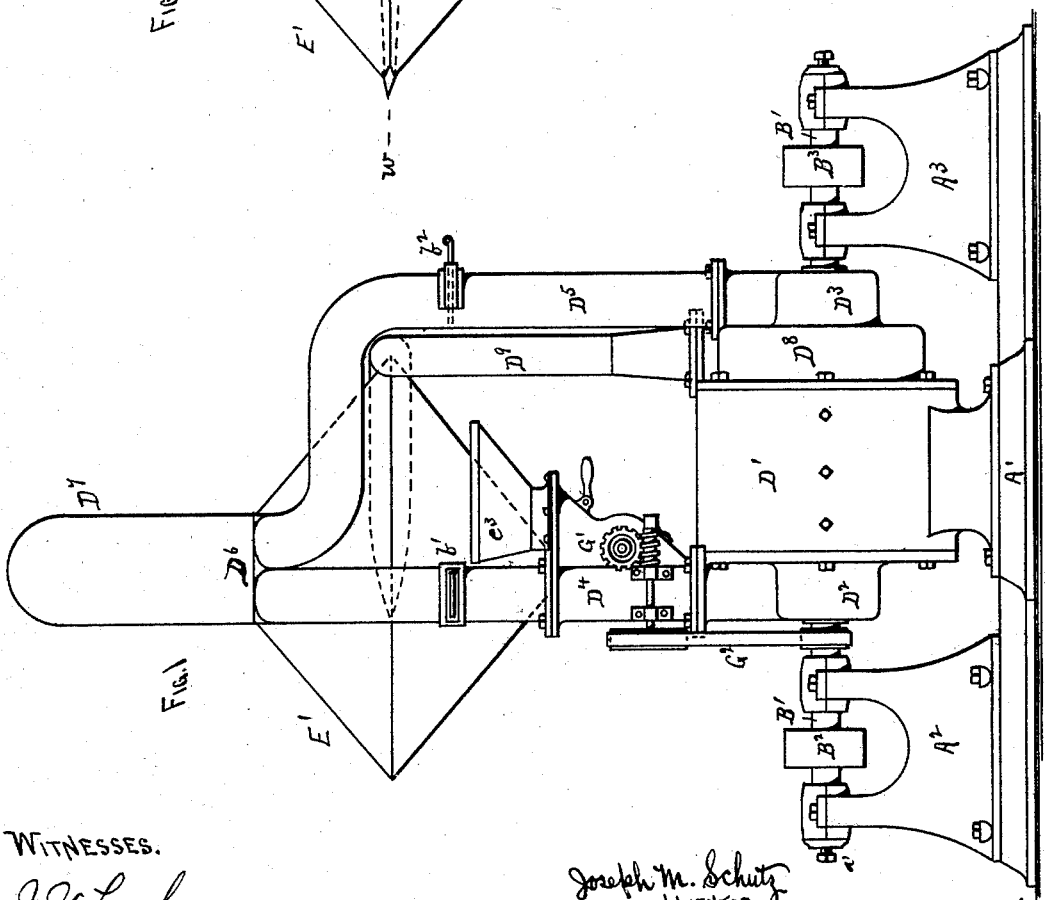

Fig. 1

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(No Model.) 4 Sheets—Sheet 2.

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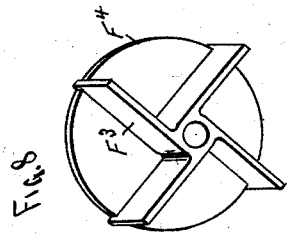

Fig. 8.

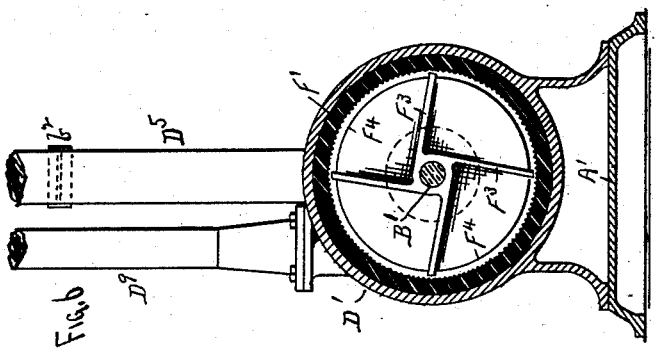

Fig. 6.

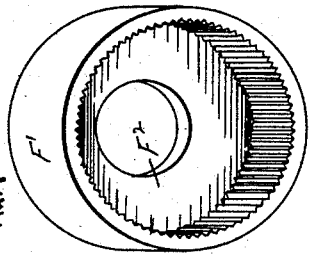

Fig. 7.

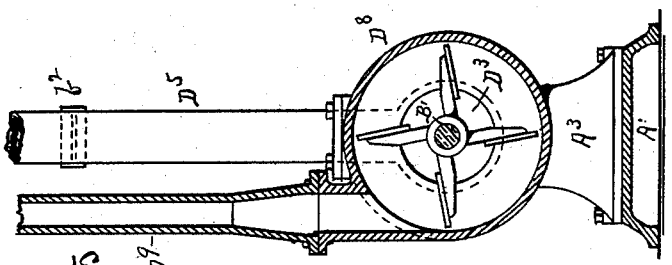

Fig. 5.

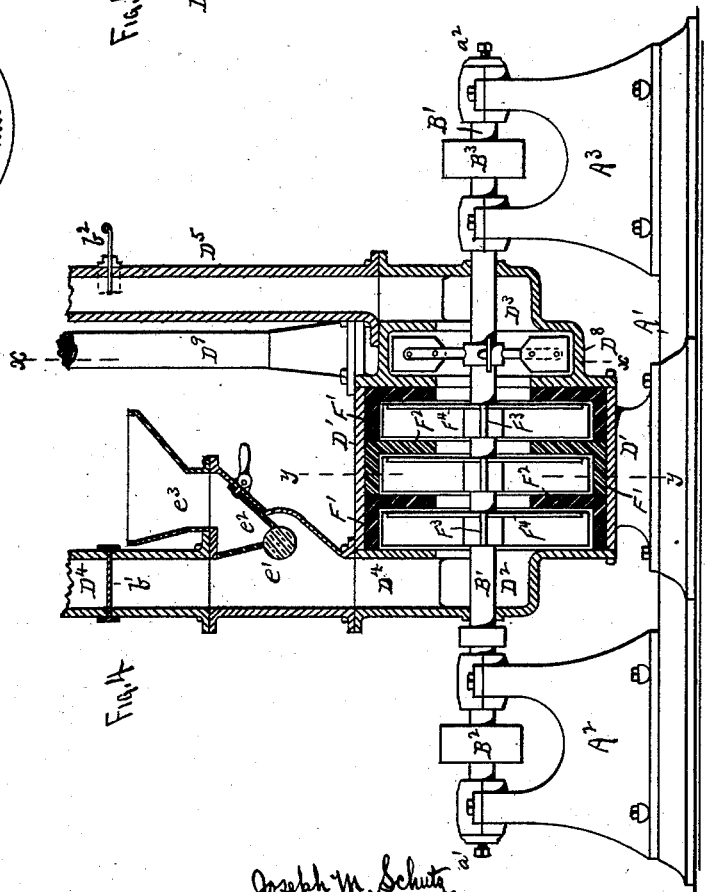

Fig. 4.

WITNESSES.

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(No Model.) 4 Sheets—Sheet 3.

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PULVERIZING APPARATUS.

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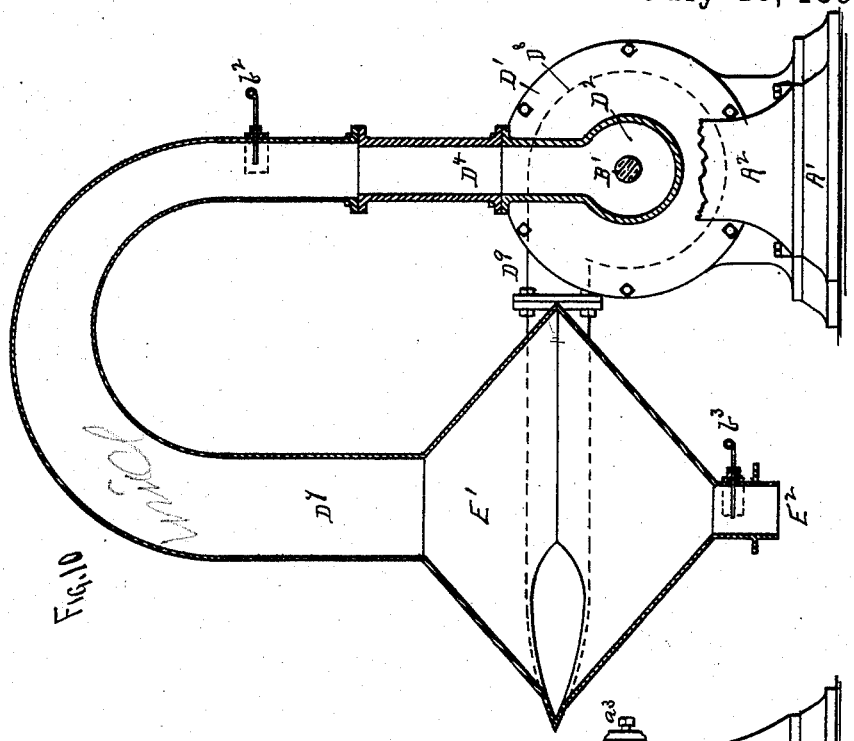

Fig. 10

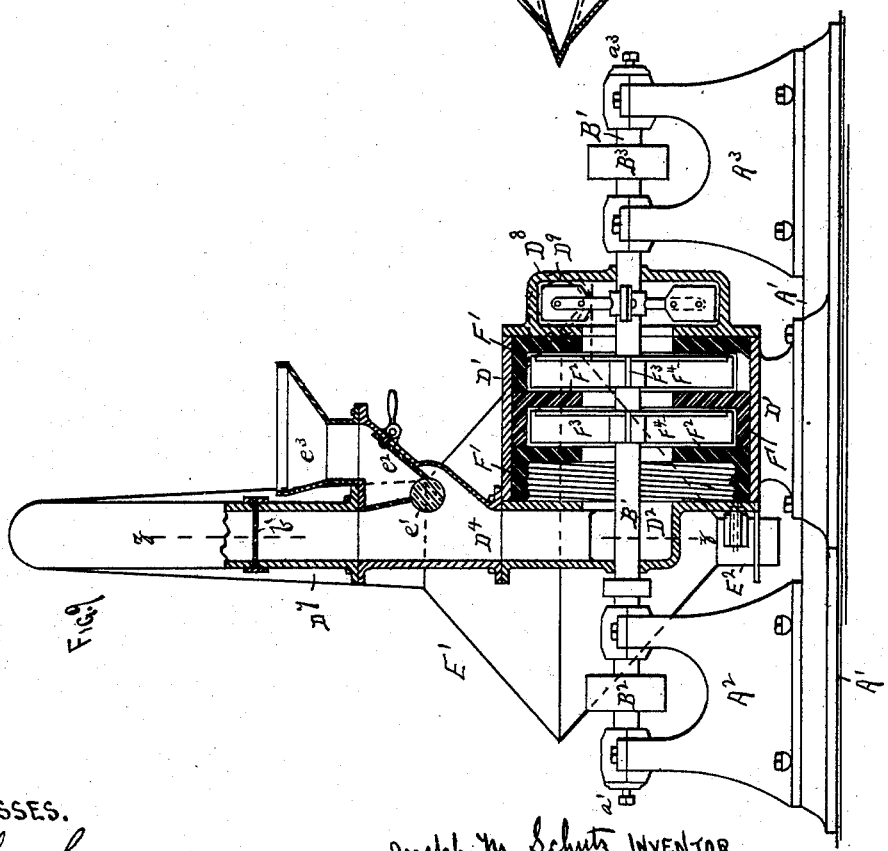

Fig. 9

WITNESSES.

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(No Model.) 4 Sheets—Sheet 4.

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PULVERIZING APPARATUS.

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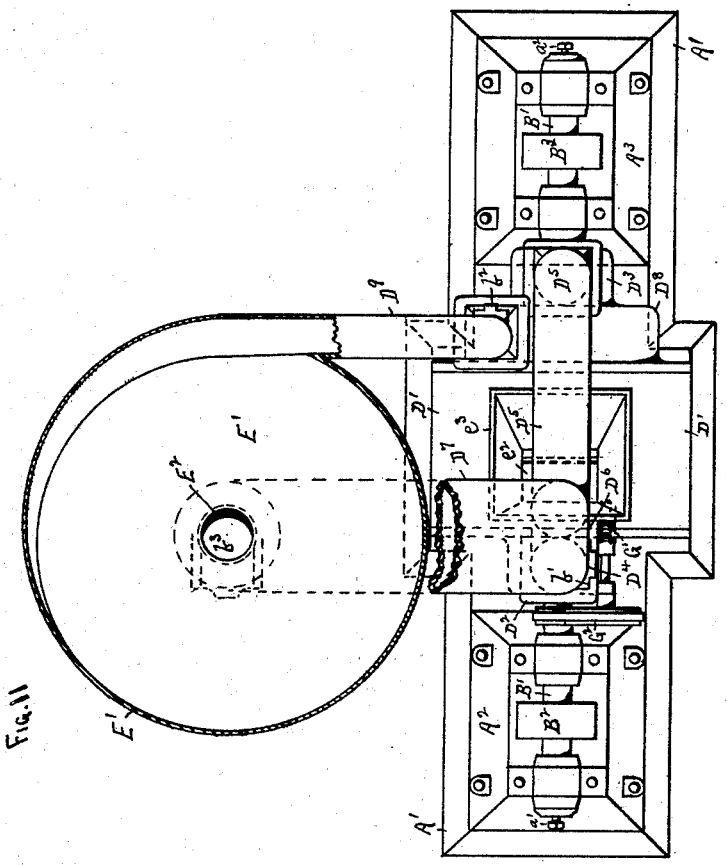

FIG. II

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UNITED STATES PATENT OFFICE.

JOSEPH M. SCHUTZ, OF MINNEAPOLIS, MINNESOTA.

PULVERIZING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 522,945, dated July 10, 1894.

Application filed August 4, 1893. Serial No. 482,353. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH M. SCHUTZ, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Pulverizing Apparatus, of which the following is a specification.

In the apparatus sought to be protected by these Letters Patent is comprised a pulverizer in which the material is reduced, a separating chamber in which the pulverized material is separated from the air and from which it flows continuously, an outlet tube from the pulverizer entering the separating chamber preferably at a tangent, a return tube leading from the separating chamber to the pulverizer, means for creating and maintaining suitable air currents throughout the apparatus, and a feed mechanism so arranged as to supply the material to be reduced to the pulverizer without permitting the entrance or escape of air, whereby the integrity of the circulation is insured, and continuous controllable air currents maintained throughout the apparatus, for collecting and delivering the pulverized material automatically, and without waste or loss of the pulverized material through the admission or discharge of air.

An apparatus that will successfully pulverize all kinds of material, without creating dust outside the apparatus by disturbing the surrounding atmosphere, has long been desired for pulverizing many kinds of material, and this machine fully meets that requirement, as the air used in the machine is confined entirely within the pulverizer and separating chamber, and the tubes connecting them, and circulates continuously throughout these parts.

In those forms of pulverizers and separators, in which fresh air is being constantly fed in from the outside, and passing through the apparatus, it carries with it the moisture and impurities of the atmosphere, which mingle with the finely pulverized material and cause it likewise to become moist and impure, which in the case of many kinds of material is very detrimental. In many cases it is impossible to use the ordinary pulverizer during damp weather, for reducing many substances, because of the dampness of the atmosphere being absorbed by the material being pulverized. In the construction shown however, the outside air being excluded, and only the air contained within the apparatus being used over and over again, it soon becomes very dry, so that the pulverized material absorbs no moisture therefrom, and will not "cake" after or during the pulverization.

Another advantage of this apparatus is that the material to be pulverized is fed to the apparatus continuously, and as before stated, without admitting air with it, and the pulverized material likewise discharged continuously, and without either admitting air or permitting any to escape. By this means the capacity of small apparatus constructed according to my invention is equal to other forms which are much larger and correspondingly more expensive.

In the drawings I have shown a preferred form of apparatus comprehending the mechanical features hereinafter claimed.

Figure 1 is a side elevation, and Fig. 2 is an end elevation, of the apparatus complete. Fig. 3 is a sectional detail of one of the air valves. Fig. 4 is a longitudinal sectional elevation. Fig. 5 is a cross sectional elevation on a line x—x passing through the axis of the fan and its discharge, looking toward the "tail" end of the apparatus. Fig. 6 is a cross sectional view on the line y y of Fig. 4. Fig. 7 is a perspective view of one of the pulverizing shells removed, and Fig. 8 is a perspective view of one of the pulverizing beaters, removed. Fig. 9 is a sectional side elevation, and Fig. 10 is a cross sectional elevation, on the line z z of Fig. 9, illustrating a slight modification in the construction. Fig. 11 is a plan view with the separating chamber in cross section, on the line w—w Fig. 2.

A′ is a base frame upon which is mounted by standard A^2 A^3, the main horizontal shaft B′, the shaft adapted to be adjusted laterally by set screws a' a^2, as shown, and with pulleys B^2 B^3 by which it may be driven.

D′ is a circular casing supported upon the base A′ and through the center of which the shaft B′ passes, as shown. On each end the casing D′ is provided with reduced chambers D^2 D^3, each chamber having a large tube D^4 D^5 rising therefrom, as shown, the two tubes united at D^6 into one trunk D^7 at some distance above the casing D′. Between the

chamber D^3 and the main portion of the casing D′ is arranged a fan D^8, opening both into the interior of the casing and also into the chamber D^3, and with its discharge pipe D^9 rising upward and ending in a separating chamber E′, as shown. The fan pipe enters the separating chamber E′ at tangent thereto, so that the air entering the casing is whirled around in volute like paths, as hereinafter more fully explained. The wind trunk D^7 is turned over and ends in the top of the upper end of the separating chamber E′, while the discharge to the chamber is at its bottom E^2.

Within the pipes D^4 D^5 and also within the discharge pipe E^2 of the separating chamber are arranged valves b' b^2 b^3, (being in the form of cut off slides, as shown,) the object to be hereinafter explained.

Arranged in one portion of the tube D^4 is a feed roll e' having an adjustable feed slide e^2, and a hopper e^3 by which the material to be pulverized may be fed to the chamber D^2 and from thence to the interior of the casing D′. By this means, an air tight feeding mechanism is provided which permits the material to be reduced, to be fed to the pulverizer, but which effectually prevents the entrance of any air from the outside.

Within the casing D′ is arranged a series of shells formed of circular plates or rims F′ touching at their edges so as to form a complete lining to the casing D′, and each rim provided with an annular ring F^2 projecting inward from one edge, thereby forming the interior of the casing into a series of compartments connected at their central portions.

Mounted upon the shaft B′ within each of the compartments formed by the rings F^2 is a "spider" or set of beaters consisting of arms F^3 and a disk F^4, see Figs. 4, 5 and 7. Neither the disks F^4 nor the edges and ends of the arms F^3 touch the shells F′ F^2, but spaces are left for the passage of the material being pulverized, which is thus caused to take a somewhat zigzag course through the machine. The feed roller is actuated by worm gear and belt mechanism G′ G^2 from the shaft B′, as shown in Figs. 1 and 2.

The machine being set in operation, and the material to be pulverized being supplied to the hopper e^3, is slowly and uniformly fed into the chamber D^2 in a thin uniform stream and passes thence into contact with the first set of the rapidly revolving beaters F^3, where the particles are soon reduced by being thrown violently against the interior of the shells F′ and the rings F^2. The fan D^8 at the same time creates and maintains a strong air current through the casing D′, which carries the particles, as soon as they are sufficiently reduced, into the next compartment, and so on throughout all the compartments and in contact with all the beaters. By adjusting the valves b' b^2 in the tubes D^4 D^5 the air currents may be completely controlled and their force increased or diminished to any desired extent. For instance, if a fine grade of material is required, then the valve b' is nearly closed, and the valve b^2 drawn wide open, so that the larger portions of the air will be drawn from the separator E′ directly to the fan, while only a small portion will pass through the pulverizer, the air currents naturally seeking the easiest and most direct course. This greatly reduces the force of the air currents, so that the material will not be drawn through the pulverizer so rapidly, but will remain longer in contact with the beaters, and will thereby be more finely pulverized. Moreover, the air currents being weak, the particles will not be carried thereby into the separator E′ until they are finely pulverized. By this means the material will be very finely pulverized. If, on the other hand a coarser grade of material is required, the valve b^2 is partially or wholly closed, to shut off the passage through the tube D^5, and the valve b' opened, so that a greater volume of the air is caused to pass through the pulverizer, thereby increasing the force of the currents therein and causing them to carry larger particles of the material into the separator. It will thus be readily understood that the force of the currents may be perfectly controlled, and by thus controlling them, the sizes of the particles carried by them from the pulverizer will be correspondingly regulated and controlled.

In apparatus where only one grade of material is required, the tube D^5 may be dispensed with, as shown in Figs. 9 and 10.

The interior of the shells F′ F^2 may be fluted, or formed with teeth of any desired form, as shown in Fig. 7, or left smooth, as the nature of the material to be reduced may require.

The material is carried by the air currents into the separating chamber on a tangent, at the center of the casing E′, or at the point of juncture of the two reverse cones, and is set into a whirling motion the moment it enters, and expands into the interior of the casing, so that the pulverized particles of the material are suddenly released and flow down around the interior of the casing in a volute like path and are discharged at the bottom at E^2, while the air currents flow upward and out into the wind trunk D^7 and thence back through the pulverizer and fan again. By this means a continuous air blast is created and maintained through the apparatus, none of the air flowing outward, but with the circulation entirely self contained. Thus no adverse currents occur to interfere with the perfect action of the apparatus or the perfect separation and reduction, and, as before stated, without permitting of the absorption of any moisture or impurities from the outside atmosphere.

Another important feature to be noticed is the fact that the pipe D^9 leading from the pulverizer to the separating chamber is of smaller area than the tube D^4 leading back again from the top of the separating casing to the pulverizer. By this means the air can

never be compressed or retarded in its return to the pulverizer, hence no back pressure will ever be created within the separating chamber to cause "blowing" from the bottom of the separating chamber, or otherwise interfere with the perfect action of the separator. By arranging the larger return pipe D^7 D^4 to leave the separating chamber from its top, the air currents will flow constantly upward from the point where the pipe D^9 enters, so that the air currents do not pass below the line of the entrance of pipe D^9, but rise constantly toward and through the return pipe D^7, D^4 this action effectually preventing the formation of any back pressure in the separating casing.

The separating chamber E′ is shown in the form of two reversed cones united at their bases and having a common axis perpendicular to the plane of their junction, and with the inlet pipe D^9 entering at a tangent at the center or point of juncture of the two cones, and with the outlet pipe D^4 D^7 at the apex of the upper cone. While this is the preferable form of the separating chamber, I do not claim it broadly, as it is not a novelty with me, *per se*.

The valve b^8 in the discharge E^2 of the separating chamber is an important feature of my invention, as it retards the outflowing material somewhat and prevents the formation of adverse whirling currents which would otherwise be liable to form in the lower portion of the chamber. By making the valves in the form of "slides," the material is discharged on one side of the tube E^2 and the small amount of air currents which may pass upward therethrough, will not be thrown into "whirls" or into circular motion, and thereby interfere with the perfect separating action of the apparatus.

Having thus described my invention, what I claim as new is—

1. In a pulverizing apparatus, a pulverizer, a separating chamber, an inlet air tube leading from one end of said pulverizer and entering said separating chamber at a tangent, an outlet air tube leading from said separating chamber to the opposite end of said pulverizer, a fan between said inlet tube and separating chamber, an auxiliary air tube connecting said outlet tube with the casing of said fan, and provided with a valve, whereby the force of the air currents may be regulated and controlled, substantially as and for the purpose set forth.

2. In a pulverizing apparatus, a pulverizer, a separating chamber, a tube D^9 leading into the separating chamber at a tangent, a tube D^4 leading from the top of the separating chamber to the pulverizer, and means for creating and maintaining air currents throughout said pulverizer, separating chamber and tubes, said tube D^9 being of smaller area than said tube D^4, whereby the formation of back pressure in the separating chamber is prevented, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOSEPH M. SCHUTZ.

Witnesses:
C. N. WOODWARD,
H. S. WEBSTER.