

June 12, 1934.

H. S. MONTGOMERY

1,962,455

AIR SEPARATOR

Filed Jan. 30, 1931

4 Sheets-Sheet 1

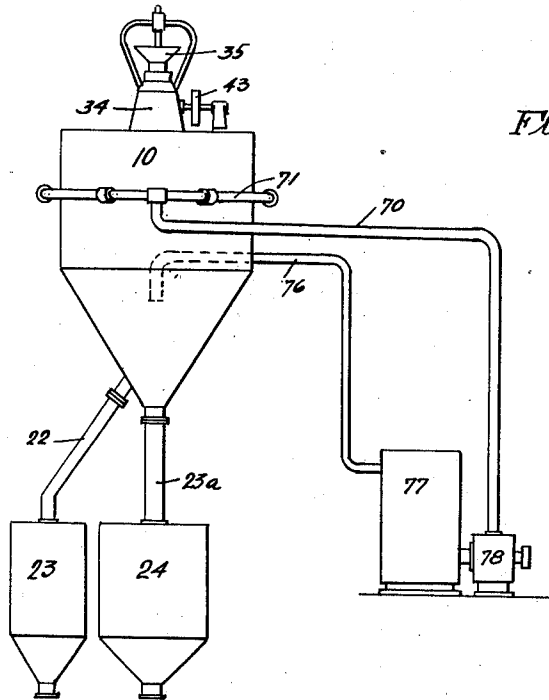


Fig. 1.

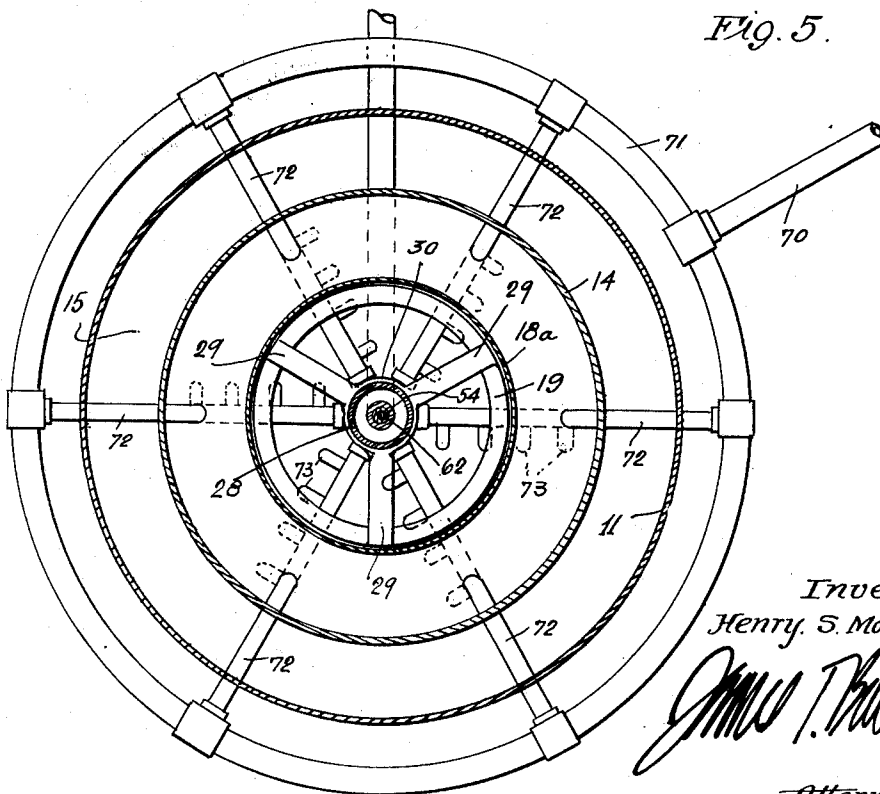


Fig. 5.

Inventor.
Henry S. Montgomery

James T. Hughes

Attorney.

June 12, 1934.

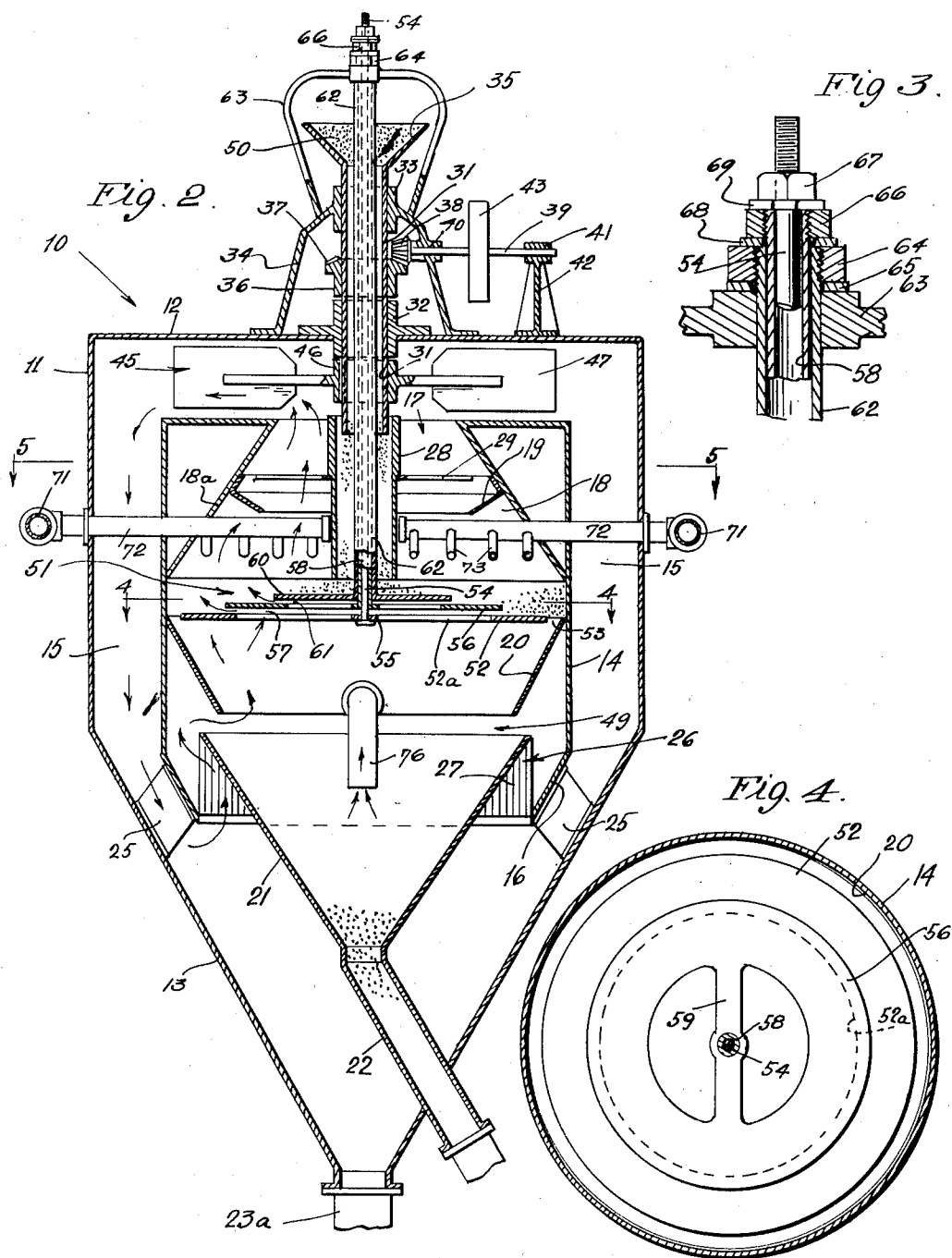
H. S. MONTGOMERY

1,962,455

AIR SEPARATOR

Filed Jan. 30, 1931

4 Sheets-Sheet 2



Inventor
Henry S. Montgomery.
James T. Paulsen
Attorney.

June 12, 1934.

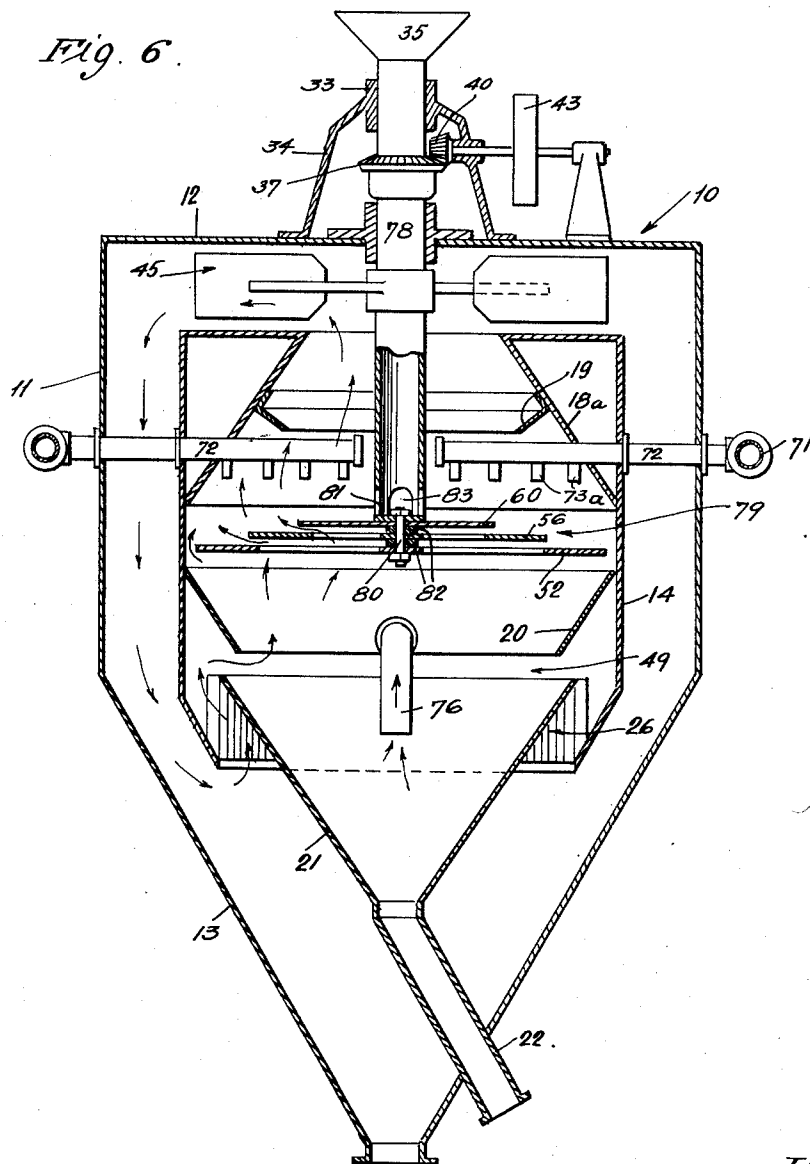
H. S. MONTGOMERY

1,962,455

AIR SEPARATOR

Filed Jan. 30, 1931

4 Sheets-Sheet 3



Inventor
Henry S. Montgomery

James T. Threlkeld

Attorney

June 12, 1934.

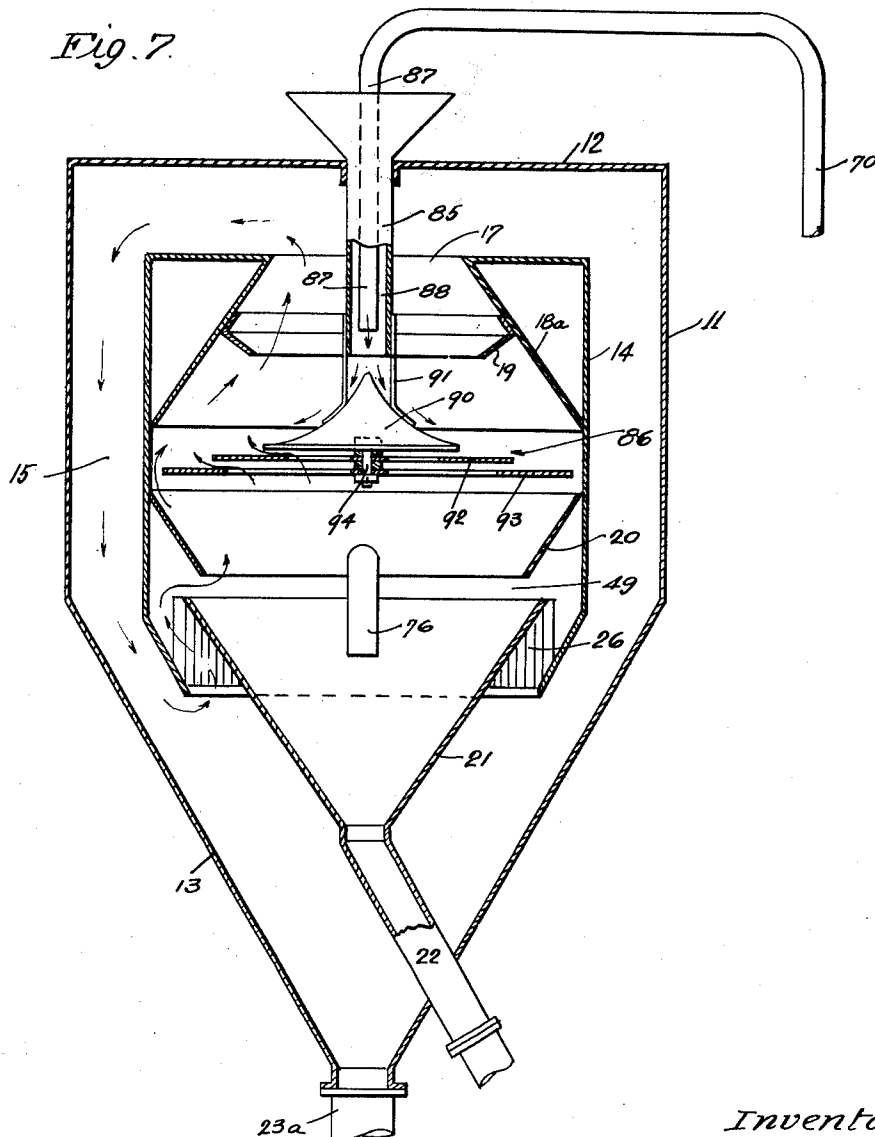
H. S. MONTGOMERY

1,962,455

AIR SEPARATOR

Filed Jan. 30, 1931

4 Sheets-Sheet 4



Inventor
Henry S. Montgomery.

James T. Muller

Attorney.

UNITED STATES PATENT OFFICE

1,962,455

AIR SEPARATOR

Henry S. Montgomery, Maywood, Calif.

Application January 30, 1931, Serial No. 512,351

17 Claims. (Cl. 209—139)

This invention has reference to air separators for classifying and separating pulverulent materials consisting of particles of different sizes or weights, into their finer and coarser, or heavier and lighter, constituents.

The invention may be more particularly characterized as having to do with types of separators in which the pulverulent materials are delivered onto a central area of a distributing floor and dispersed outward toward the edges thereof, while simultaneously being exposed to an upwardly flowing stream of air which acts to carry with it the finer particles, leaving the heavier particles to be separately removed. In the usual separators of this character, dispersion of the solid particles from the distributing floor structure is brought about by rotating the latter at a fairly high rate of speed so as to cause the particles being delivered to a central area of the floor, to be thrown outward by centrifugal force and beyond the periphery of the floor. A current of air is drawn upwardly around the floor assembly so as to pick up the fine particles and deposit them in a separate chamber, the heavier particles which the air stream is incapable of carrying with it, being permitted to fall into a second chamber or receiver. It may be further stated with reference to common separators of this type of which I am aware, that heretofore the distributing floor has consisted merely of a solid or imperforate disk, and that separation of the finer particles by the ascending air stream has taken place only in the space beyond the periphery of the floor, and into which space the particles are thrown by centrifugal force as described.

One of the primary objects of the invention is to provide an improved form of distributing floor construction whereby additional and more efficient separation of the coarse from the fine particles is brought about by causing additional and more thorough action to be had upon the dispersed particles by the ascending air stream. And it is a further object of the invention to provide, as an exclusive feature, or one in combination with a distributing floor structure having the characteristics mentioned, highly effective means for causing distribution of the fine particles on the floor assembly, by the use of air as the medium whereby the particles are agitated or dispersed.

In accordance with the invention, I provide, instead of the usual solid plate distributing floor, an apertured floor assembly which permits the particles being agitated or dispersed to become acted upon, not only at the point of their dis-

charge beyond the periphery of the floor, but also during their movement across the distributing floor. In accordance with the invention the rising air stream is caused to have additional separating action on the agitated particles over that had in the usual separator, due to the fact that in passing upwardly through apertures in the distributing floor, preliminary separation of the fine particles by the air stream occurs before the particles reach the periphery of the floor. The result of this action is to bring about, in addition to an effective preliminary separation while the particles yet remain above the floor, higher separating efficiency in the space beyond the periphery of the floor, due to the preliminary removal of a considerable portion of the fine particles that are readily carried away by the air streams passing up through the floor.

Preferably, agitation and dispersion of the comminuted particles on the distributing floor, is accomplished by a downwardly flowing stream or streams of air so directed that the heavier particles are thrown outwardly beyond the periphery of the floor, and the finer particles are left in a state of agitation toward the central area of the floor. And as will hereinafter appear, the invention contemplates the provision whereby the agitating air may be directed onto the distributing floor in a manner such that the particles are dispersed in a circular direction, and as a result are thrown outwardly by centrifugal force. It may be mentioned that while the primary purpose of the agitating air also has the effect of putting the particles into such a state of agitation and condition of distribution in the atmosphere above the distributing floor, as to greatly increase the effectiveness of the rising air stream in removing the fine particles. This is due to the fact that in such a condition of agitation and distribution, the particles become thoroughly exposed to the air stream passing upwardly through and around the distributing floor. The air being drawn up around the distributing floor is retained or recycled within the apparatus, the fine particles taken off in the air stream being removed therefrom, and as the separating medium. In accordance with the invention, similar provisions are made whereby the agitating air may be recycled for continuous use. Preferably this is accomplished by withdrawing the agitating air from the apparatus, and at a point at which the dust content of the air is lowest due to the dust having previously been allowed to settle out. The withdrawn air then preferably is passed through an arrester and then forced by means of a

suitable fan or blower, through the agitating air nozzles.

In addition to the features and objects outlined above, the invention contemplates the provision of numerous other improvements, all of which however will be best understood without further preliminary discussion, from the following detailed description. Reference is had throughout the description to the accompanying drawings in which:

Fig. 1 is a general view of the apparatus including a showing of the agitating air by-pass line and dust arrester;

Fig. 2 is an enlarged vertical sectional view of my preferred form of separator, and of the general type shown in Fig. 1;

Fig. 3 is a fragmentary enlarged sectional view of the upper end of the concentric rod assembly for supporting the distributing floor;

Fig. 4 is a section on line 4—4 of Fig. 2;

Fig. 5 is a section on line 5—5 of Fig. 2 showing the annular agitating air manifold and connections therewith;

Fig. 6 is a view similar to Fig. 2 showing a variational form of the invention; and

Fig. 7 illustrates still another variational form.

Referring first to Fig. 2, the separator, generally indicated at 10 in Fig. 1, comprises an outer shell 11 having a top closure 12, and a lower downwardly tapered or conically shaped wall 13. Within and annularly spaced at 15 from the outer shell 11, is an inner shell 14 having at its lower end a downwardly tapering annulus 16 extending substantially parallel with the bottom wall 13 of the outer shell. Shell 14 may be supported in any suitable manner as by means of brackets 25. At the upper end of shell 14 is an opening 17 through which the separating chamber 18 within the inner shell assembly, communicates with the annular passage 15 at the outside. The upper interior conical wall 18a of shell 14 carries on its inner surface an inwardly sloping annular flange 19, the purpose of which will hereinafter appear.

A downwardly tapering apron 20 is welded to the wall of shell 14 at a suitable distance below the bottom of the conical wall 18, and directly below the apron 20 is a hopper 21 supported on pipe 22 which, as shown in Fig. 1, discharges into the fine product bin 23. A second discharge pipe 23a serves to conduct the settlings from the bottom of the outer shell to a coarse product bin 24. The relative positions of the lower end of the inner shell apron 16 and hopper 21 preferably are such that the upper end of the latter is substantially in vertical alignment with the bottom edge of the skirt. An annular vertical and apertured baffle wall, generally indicated at 26, is provided between apron 16 and the inner hopper 21, and while baffle wall 26 may be of any suitable construction for accomplishing the purpose herein-after described, it preferably is of a louver type, consisting of a series of circularly spaced louvers 27 arranged at angles relative to the path of the air stream taken upwardly between hopper 21 and apron 16.

A vertical tubular feed shaft 28 is mounted in the upper interior of the separating chamber 18, and is shown to be carried on a support consisting of a spider having radial arms 29 and a central portion 30 through which the shaft extends, the spider conveniently being formed integral with the annular flange plate 19 hereinabove mentioned. An upper rotatable and smaller diameter feed shaft section 31 extends through

the cover plate 12 of the outer shell and projects down into the upper end of pipe 28. Upper feed shaft section 31 is journaled in a bearing 32 mounted on the cover plate 12, and also within an upper bearing 33 supported upon housing 34. Shaft 31 carries on its upper end a funnel-shaped feed hopper 35. Keyed to shaft 31 between the bearings 32 and 35 is a collar 36 having an upper bevel gear face 37 meshing with pinion 38 carried on a horizontal shaft 39, the latter being journaled in bearing 40 in the housing structure 34 and in a bearing 41 on support 42. Shaft 39 may be driven in any suitable manner, as by way of a belt passing over pulley wheel 43. A fan 45 is mounted on shaft 31 between cover plate 12 of the outer shell and the upper end of the inner shell structure 14, the fan comprising a hub 46 keyed to the feed shaft and a suitable number of blades 47.

It may be stated at this point that upon rotation of the shaft 31 and the fan 45, the latter causes a flow of air to be set up in the apparatus in the path indicated by the arrows. That is, the fan causes a current of air to be drawn upwardly through the separating chamber 18, and downwardly through the annular space 15 between the shells, the air stream then reversing its direction of flow upon being caused to flow upwardly between the louvers 27 of baffle wall 26 and then back into the separating chamber through the space 49 between the lower end of apron 20 and the upper end of hopper 21. The pulverulent material 50 fed into the hopper 35 passes downwardly through the upper rotating shaft 31 and the lower stationary shaft 28, and is delivered onto the distributing floor structure, generally indicated at 51, positioned a suitable distance below the lower end of shaft 28.

The distributing floor assembly may be characterized as providing a surface over which the pulverulent material discharged from shaft 28 is caused to be dispersed outwardly toward the wall of the separating chamber, the floor being provided with apertures which allow for the upward passage of air through the interior portions of the floor. It is to be understood that the invention broadly contemplates the provision of any suitable distributing floor construction having such characteristics, and that while I show herein certain typical forms, the invention is not to be regarded as limited by these particular showings.

The preferred form of distributing floor structure shown in Fig. 2 comprises a plurality of vertically spaced plates having their edges in stepped overlapping relation, there being provided annular air passing apertures between the plates. The floor comprises a lower annular plate 52, peripherally spaced at 53 from shell 14 or the upper end of skirt 20, plate 52 being supported on a rod 54 attached to a web 55, see Fig. 4, extending diametrically across the interior of the plate. A second annular plate 56 is supported a suitable distance above plate 52 so as to provide an annular air passing aperture 57, the exterior diameter of plate 56 being somewhat greater than the diameter of opening 52a of plate 52 so as to provide a suitable amount of horizontal overlap between the plates. Plate 56 is supported similarly to the lower plate, being carried on a pipe 58 extending around the inner rod 54, and joined to a web 59 extending across the center of plate 56, similar to the web 55 of plate 52. A solid circular plate 60 is supported above plate 56 and in spaced relation to provide an inner annular aperture 61, plate 60 being of greater diameter than the inner diameter

of plate 56 so as to overlap the latter a suitable distance. The upper plate 60 is carried on the lower end of a pipe 62 slipped over the inner pipe 58 supporting plate 56.

5 While I have shown the distributing plate assembly to comprise three vertically spaced plates in the relative proportions and positions described, it is to be understood that the invention contemplates the use of any suitable number of such plates and that the illustrated construction is typical only. And I may also mention at this point that while I characterize a structure at 51 as a distributing "floor", the implication is not to be derived by the use of the term "floor" that the distributing assembly need be horizontal or substantially so, although it is within the scope of the invention to provide, if desired, a substantially horizontal aperture or foraminous distributing floor. It will be seen that should the form of distributing floor shown in Fig. 2 be built up so as to comprise a considerable number of plates arranged in a manner similar to those illustrated, in effect a downwardly sloping distributing surface would be provided which would not necessarily constitute a substantially horizontal floor structure.

The plate supporting members 54, 58 and 60 extend centrally upward through the feed shafts 28 and 31 and are supported on a yoke 63 extending over and above the hopper 35 and supported on the housing 34. The outer plate supporting pipe 62 is supported by means of a nut 64 threaded on its upper end and bearing against a spacer 65 placed between the nut and yoke 63. Pipe 58 and the inner rod 54 are similarly supported by nuts 66 and 67 threaded on their upper ends and bearing on spacers 68 and 69 respectively. A particular advantage is gained through the described distributing floor plate supporting means in that the spacing between the plates, and also the vertical position of the entire plate assembly may be within the separating chamber, may be varied by simple adjustments of the supporting members. Thus in order to vary the spacing between plates 52 and 56, or between the latter and the upper plate 60, it is but necessary to insert spacers 68, or 69 of predetermined thickness in accordance with the plate spacing desired. In a similar manner the vertical position of the entire plate assembly may be adjusted simply by inserting spacers 65 of selected likeness. The capability for so adjusting the entire floor assembly is of particular advantage in view of the fact that the amount of clearance at 53 between the peripheries of the lower plate 52 and the inwardly projecting apron 20 may be adjusted to regulate the velocity of the air stream passing upwardly through the space.

The pulverulent material delivered onto the distributing floor is maintained in an agitated condition and is caused to be thrown toward the walls of the separating chamber in a circular direction, by means of air streams directed downwardly in paths such that the air tends to drive the particles in a circular direction on the floor and toward its outer edge. As shown in Figs. 1 and 5, the agitating air is delivered through pipe 70 to an annular manifold 71 mounted on the outside of shell 11, from which the air is discharged into the separating chamber 18 through a plurality of radially extending pipes 72 projecting inwardly through the walls of the inner and outer shells. Each of the pipes 72 carries a series of downwardly directed nozzles 73, the latter projecting downwardly and laterally relative to their respective pipes 72 in corresponding

directions as clearly indicated in Fig. 5. It will be seen that by virtue of this positioning of the nozzles, the agitating air streams are directed against the top surface of the distributing floor in such directions as to cause the particles to be carried around in a circular direction, and to become thrown outwardly, by virtue of the impact of the jetted air streams and by centrifugal action, toward the clearance space 53. On account of the agitating air being so directed as to cause the particles to be subjected to centrifugal action, a certain amount of classification is brought about by virtue of this feature alone, due to the fact that there is a tendency to throw the heavier and coarser particles to the outside, whereas the finer or lighter particles are less effected by the centrifugal action and tend to remain in a state of agitation toward the center of the floor. In case it is desired to vary the vertical angular position of the nozzles, such adjustment may be made by turning pipes 72 within their T-connections with the annular manifold 71.

While the pulverulent particles are being dispersed outwardly on the distributing floor under the influence of the agitating air as described, air is constantly being drawn up through the clearance spaces 61 and 57 between the annular plates, and through the peripheral clearance space 53. As previously explained, in the usual separator of this type, the agitated or dispersed particles are acted upon by the ascending air stream only at the clearance space beyond the periphery of the distributing floor. As will readily be seen, by the provision, in accordance with the present invention, of the air passing apertures 57 and 61 within the distributing floor area, the particles while being maintained in a state of agitation on the floor, are preliminarily acted upon, before they reach the outer edge, by the air streams taken upwardly through these apertures. Thus there is a tendency for the finer particles remaining in a state of agitation toward the inner area of the floor, or in other words the finer particles which are less effected by the centrifugal action of the air jets, to become picked up by the air streams passing through the floor apertures, resulting in an efficient preliminary separation before the particles become projected beyond the peripheral edge of the floor. Consequently, the particles which do reach the outer clearance space 53 and become subjected to separation by the air stream drawn upwardly therethrough, have become depleted of the finer or lighter particles to an extent such as to materially increase the efficiency of the separation at the outside of the floor.

The degree of separation accomplished by the air stream passing up through space 53 is of course determined by the velocity of the air stream at that point. This velocity may be regulated as desired, in accordance with the nature of the materials being separated and the degree of separation required, by adjusting the vertical position of the floor assembly so as to vary the area of the peripheral clearance 53, as previously explained.

The heavier or coarser particles which are not picked up by the air stream passing upwardly through space 53, drop down over skirt 20 and thence fall through the space 49 into hopper 21, from whence they are conducted through pipe 22 to the coarse product bin 23. The finer or lighter particles gathered by the air streams flowing through the floor apertures 57 and 61

and also space 53, are carried upwardly through opening 17 and thence into the annular space 15 in the direction of flow of the air stream as indicated by the arrows. In the event of any tendency for the coarser particles driven beyond the outside of the distributing floor to become picked up in the air stream rising through space 53, the annular flange 19 will serve effectively to remove such heavier particles from the air stream, due to the fact that upon striking the flange, such particles will be caused to drop back onto the distributing floor. Also by virtue of the retardation of the outer portion of the air stream upon striking flange 19, the heavier particles originally taken into the air stream by virtue of its high velocity, will drop out as a result of the substantial reduction in velocity of that portion of the air stream carrying the heavier particles.

Due to the reduction in velocity of the air stream in the annular space 15, a certain amount of the fine particles will drop out and settle in the bottom portion 13 of the outer shell. Further separation of the fine particles is brought about as a result of the air stream being required to entirely reverse its direction of flow in passing from the outside clearance space into the space between apron 16 and the hopper 21. Upon passage of the air through the last mentioned space, separation of the particles remaining suspended in the air is brought about as a result of the impingement of the air stream against the louvers 27 in baffle wall 26. The particles impinging against the baffles immediately drop into the lower portion of the shell, and these particles, together with the particles previously separated in space 15, or at the point of reversal in the flow of the air stream, are conducted through pipe 23a to the fine product bin 24.

Final separation of fine particles that may have become carried down in the coarse particles dropping from the lower edge of apron 20, is effected by the air stream flowing through space 49 and thence upwardly through the distributing floor. As will be noted, the air stream passing through space 49 flows transversely with relation to the stream of coarse particles dropping into the hopper, with the result that the air serves effectively to pick the lighter particles which it is undesirable to have present in the separated coarse aggregate.

Agitating air to be discharged into the separating chamber through nozzle 73, is taken from a suitable point near the upper end of hopper 21, at which point the air is in a comparatively quiescent state. The agitating air is withdrawn through a pipe 76 extending through the walls of shells 11, 14, and apron 20, into the upper end of the hopper. Pipe 76 is connected through the dust arrester 77 with the suction intake of a blower 78. Dust arrester 77 may be of any suitable type and is provided primarily for the purpose of extracting as completely as possible the fine dust particles that may be carried in the air stream being taken into the blower, to prevent abrasive wear on the latter. The air is then forced by the blower through line 70 into the annular manifold 71 and thence through pipes 72 and nozzles 73 in the manner previously described.

The variational form of the invention shown in Fig. 6 is generally similar to the previously described form, but differs primarily in the provision whereby the distributing floor assembly is mounted so as to be capable of rotation, for the purpose of causing the particles of the material

to be thrown outwardly by centrifugal action. In Fig. 6 a single rotatable feed shaft 78 is provided which is mounted and rotatably driven in a manner similar to the upper feed shaft section 31 in Fig. 2. The part in Fig. 6 corresponding to similar parts in Fig. 2 are given the same reference characters. The distributing floor 79 is carried on the lower end of shaft 78, and while the floor assembly may be mounted thereon in any suitable manner, I have shown the plates 52, 56 and 60 to be carried on a bolt 80 extending through the bottom end plate 81 of the shaft. The plates in this case are held apart by spacers 82. The pulverulent material fed to shaft 78 is discharged through opening 83 onto the surface of the distributing floor.

Upon rotation of the shaft and floor assembly, the particles fed onto the surface of plate 60 are thrown outwardly toward the edge of the floor by centrifugal force, and simultaneously the particles are subjected to agitation by the downwardly directed air jets discharged through nozzles 73a. While it will generally be preferred to incline the nozzles in the manner and arrangement shown in Fig. 2, in some instances the nozzles may be pointed straight down. Thus in Fig. 6, the nozzles 73a are shown to extend vertically from a pipe 72 and to discharge the air vertically and normal to the horizontal plane of the distributing floor. Under some circumstances it may be desirable to incline the nozzles in a reverse direction to the direction of rotation of the floor assembly, in which case the nozzles may be so adjusted by turning pipes 72 as hereinabove mentioned. The particles being centrifugalized are subjected to separation by the air streams being drawn upwardly through the spaces between the distributing floor plates, and through the exterior clearance space, in substantially the same manner as previously described with reference to Fig. 2.

In Fig. 7, I show another variational form of the invention in which the material being fed through the stationarily mounted shaft 85 is discharged onto the distributing floor 86 together with a downwardly directed stream of air. In this case the agitating air nozzles preferably are dispensed with, and the agitating air is discharged downwardly at the center of the floor together with the pulverulent material, preferably at a point near the lower end of the feed shaft. While any suitable feed shaft and air nozzle arrangement may be provided to so cause the material to be delivered onto the distributing floor under the influence of an air stream, I have shown, as typical, pipe 70 to extend at 87 downwardly within the feed shaft 85 to a point near the lower open end of the latter. The pulverulent material thus passes down through the annular space 88 and is projected under the influence of the air stream being discharged through the pipe 87, onto the distributing floor as indicated. It may be stated that the material in space 88 may be permitted to merely feed through the shaft in accordance with its rate of delivery to the hopper on its upper end, or the parts may be so proportioned that the air stream being discharged through pipe 87 will serve, by virtue of its velocity, to regulate the rate at which the pulverulent material is discharged onto the distributing floor.

In Fig. 7, the floor assembly comprises an upper deflecting member 90, generally conical in shape, but preferably having its sides curved in the manner indicated. The deflector 90 is suspended

from the lower end of the shaft 85 by means of straps 91, and the lower plates 92 and 93 are supported on the bottom of the deflector 90 by means of bolt 94. The air stream directed
 5 downwardly against the top of the deflector 90 causes the particles being fed through the shaft to be dispersed radially outward over the surface of the distributing floor structure, whereby the
 10 particles are subjected to such agitation and dispersion as to promote efficient classification by the air stream being drawn up through and around the floor. As in the previously described forms, the air discharged back into the separator through line 70 by blower 78, is withdrawn
 15 through pipe 76 at a suitable point near the upper end of the coarse product hopper.

I claim:

1. In a separator of the character described, walls forming a separating chamber, an apertured distributor floor structure in said chamber, means
 20 for delivering pulverized material onto said floor, means for agitating said material on the apertured floor by an air stream so directed as to cause the material to be carried outwardly by the
 25 air toward the edge of said floor, and means for passing air upwardly through the apertures thereof.

2. In a separator of the character described, walls forming a separating chamber, an apertured distributor floor structure in said chamber, means
 30 for delivering pulverized material onto said floor, means for directing a stream of air against the top surface of said floor, and means for passing air upwardly through the apertures thereof.

3. In a separator of the character described, walls forming a separating chamber, an apertured distributor floor structure in said chamber, means
 35 for delivering pulverized material onto said floor, means for directing an air stream at an angle with the vertical against the top surface of said floor, whereby the particles of said material are dispersed in a circular direction above the
 40 floor, and means for passing air upwardly through the apertures thereof.

4. In a separator of the character described, walls forming a separating chamber, a circular apertured distributor floor structure in said chamber, means
 45 for delivering pulverized material onto said floor, an air pipe extending radially above said floor, a plurality of nozzles on said pipe and adapted to direct air downwardly against the top
 50 surface of said floor, and means for passing air upwardly through the apertures thereof.

5. In a separator of the character described, walls forming a separating chamber, a circular apertured distributor floor structure in said chamber, means
 55 for delivering pulverized material onto said floor, a plurality of radially extending air pipes above said floor, a plurality of nozzles on said pipes, said nozzles being directed laterally
 60 downward from their respective pipes at an angle with the vertical, and means for passing air upwardly through the apertures thereof.

6. In a separator of the character described, walls forming a separating chamber, a distributor
 65 floor structure in said chamber and peripherally spaced from the wall thereof, means for delivering pulverized material onto a central area of said floor, a plurality of nozzles for directing streams
 70 of air against the top surface of said floor, means for producing relative rotation between said floor structure and the nozzles, and means for passing air upwardly through the space between said
 75 floor and the separating chamber wall.

7. In a separator of the character described,

walls forming a separating chamber, a distributor floor structure in said chamber and peripherally spaced from the wall thereof, an upwardly tapering conical wall extending above said floor and an annular, inwardly projecting baffle on said
 80 conical wall, means for delivering pulverized material onto a central area of said floor, means for agitating said material on said floor by an air stream so directed as to cause the material to be carried outwardly by the air toward the edge
 85 of the floor, and means for passing air upwardly through the space between said floor and the separating chamber wall.

8. In a separator of the character described, walls forming a separating chamber, an apertured distributor floor structure in said chamber and peripherally spaced from the wall thereof, means
 90 for delivering pulverized material onto said floor, means for directing a stream of air downwardly against the top surface of said floor structure, means for passing air upwardly through the floor apertures and through the peripheral clearance
 95 space between the floor and the wall of said shell, and means for adjusting said floor vertically to vary the peripheral clearance space between
 100 said floor and the shell.

9. In a separator of the character described, a shell having a downwardly tapering conical wall and enclosing a separating chamber, a distributor floor structure having peripheral clearance from
 105 said conical wall, said floor comprising a plurality of vertically spaced plates, means for delivering pulverized material onto said floor, means for passing air upwardly through the peripheral clearance space around said floor, and means for supporting
 110 said floor, said supporting means being adjustable to raise and lower all of said plates, and to vary the spacing therebetween.

10. In a separator of the character described, a distributing floor structure, means for delivering
 115 pulverulent material onto said floor, a nozzle for projecting a high velocity stream of air against said materials whereby they are caused to move along the floor in a predetermined path, means for passing a plurality of streams of air upwardly
 120 through said materials at predetermined intervals in their path of movement.

11. In a separator of the character described, walls forming a separating chamber, an apertured distributor floor structure in said chamber, said
 125 floor structure comprising a plurality of vertically spaced plates having edges in stepped overlapping relation, there being provided air passing spaces between said plates, means for moving all of said plates vertically and for adjusting the
 130 relative vertical positions thereof, means for delivering pulverized material onto the uppermost of said plates, and means for passing air upwardly through the apertures between the plates.

12. In a separator of the character described, walls forming a separating chamber, an apertured distributor floor structure in said chamber, means
 135 for delivering pulverized material onto said floor, a plurality of air nozzles for directing streams of air against the top surface of said floor, said floor structure comprising a plurality of vertically spaced concentrically arranged circular plates each of smaller area than the plate next below
 140 there being provided air passing apertures between said plates, means for producing relative rotation between said floor structure and the nozzles, and means for passing air upwardly through the apertures thereof.

13. In a separator of the character described, walls forming a separating chamber, an aper- 150

5 tured distributor floor structure in said chamber, means for delivering pulverized material onto said floor, said floor structure comprising a plurality of vertically spaced concentrically arranged circular plates each of smaller area than the plate next below, there being provided air passing apertures between said plates, a vertically extending feed shaft above said floor structure, pulverized material being delivered onto said floor by 10 way of said shaft, floor supporting means extending through said separating chamber walls, said floor supporting means including means for varying the relative vertical positions of said plates and for moving all the plates vertically, and 15 means for passing air upwardly through the floor apertures.

14. In a separator of the character described, walls forming a separating chamber, an apertured distributing floor structure in said chamber and spaced from the wall thereof, means 20 passing a stream of air upwardly through the space between said floor and the chamber wall, and through the floor apertures, means for delivering pulverized material onto said floor structure, means for directing a stream of agitating 25 air against the top surface of said floor, and means for withdrawing air from the separator to be supplied as agitating air to the last mentioned means.

30 15. In a separator of the character described,

walls forming a separating chamber, an apertured distributing floor structure in said chamber and spaced from the wall thereof, means passing a stream of air upwardly through the space between said floor and the chamber wall, and 80 through the floor apertures, means for delivering pulverized material onto said floor structure, means for directing a stream of agitating air against the top surface of said floor, and means for withdrawing air from the separator at a point 85 below said distributing floor to be supplied as agitating air to the last mentioned means.

16. In a separator of the character described, walls forming a separating chamber, a distributor floor structure in said chamber, means for dis- 90 charging pulverized material and a stream of air against the top surface of said floor, said means including an air nozzle, and means for adjusting said floor and air nozzle relatively vertically.

17. In a separator of the character described, 95 walls forming a separating chamber, an apertured distributor floor structure in said chamber, means for delivering pulverized material onto said floor, a nozzle for directing a stream of air against the top surface of said floor, means for adjusting said 100 floor and nozzle relatively vertically, and means for passing air upwardly through the floor apertures.

HENRY S. MONTGOMERY.

35

105

40

110

45

115

50

120

55

125

60

130

65

135

70

140

75

145

150