Sept. 6, 1932. G. H. FRASER 1,876,516

AIR SEPARATOR

Original Filed Sept. 12, 1924 3 Sheets-Sheet 1

Fig. 1.

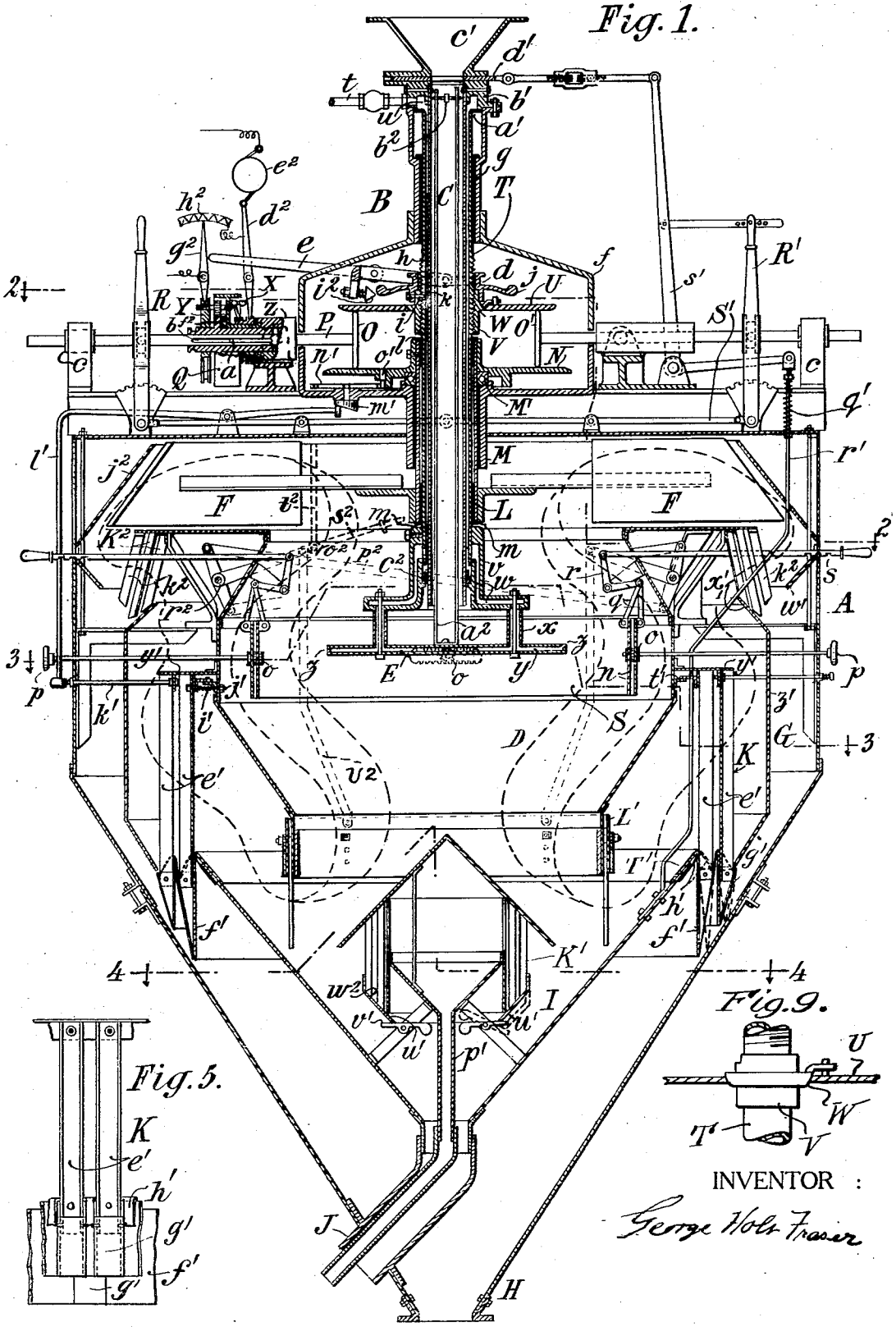


Fig. 5.

Fig. 9.

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AIR SEPARATOR

Original Filed Sept. 12, 1924 3 Sheets-Sheet 2

Fig. 2.

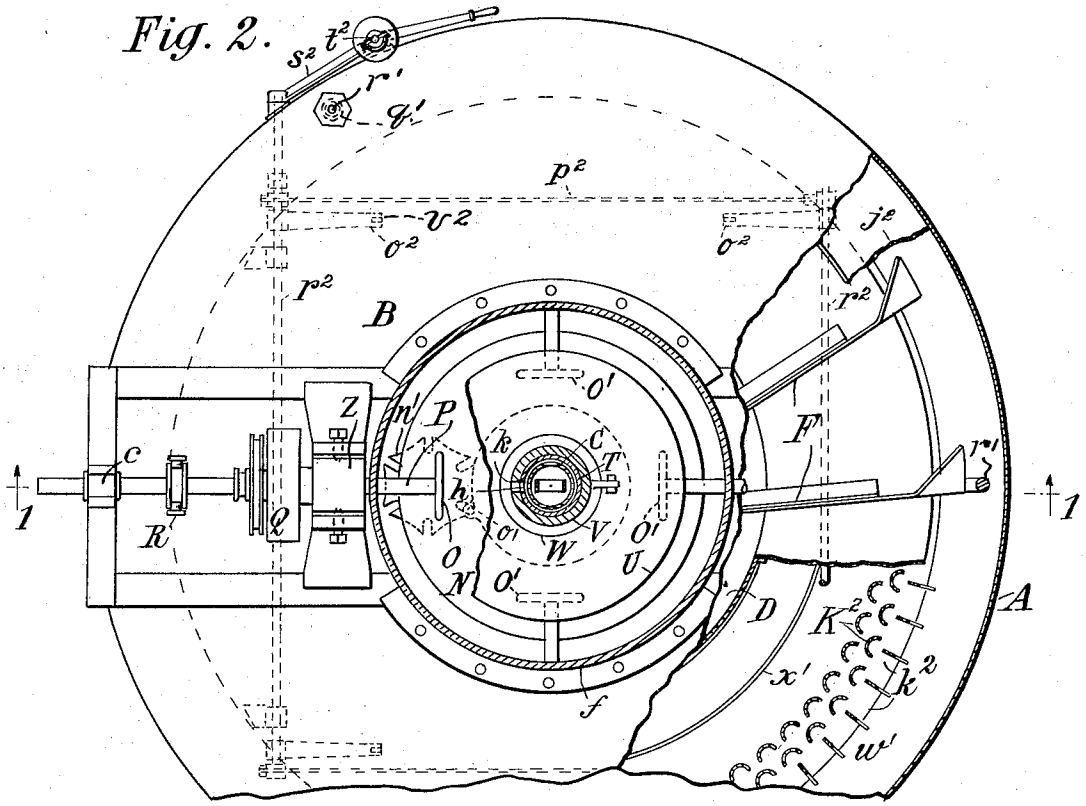
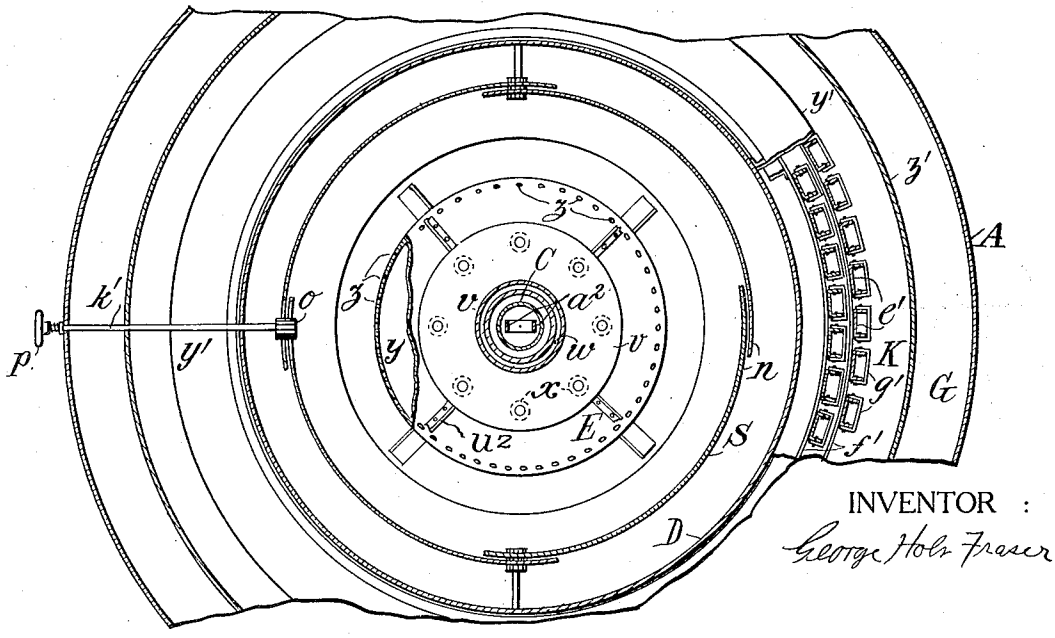


Fig. 3.



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AIR SEPARATOR

Original Filed Sept. 12, 1924 3 Sheets-Sheet 3

Fig. 4.

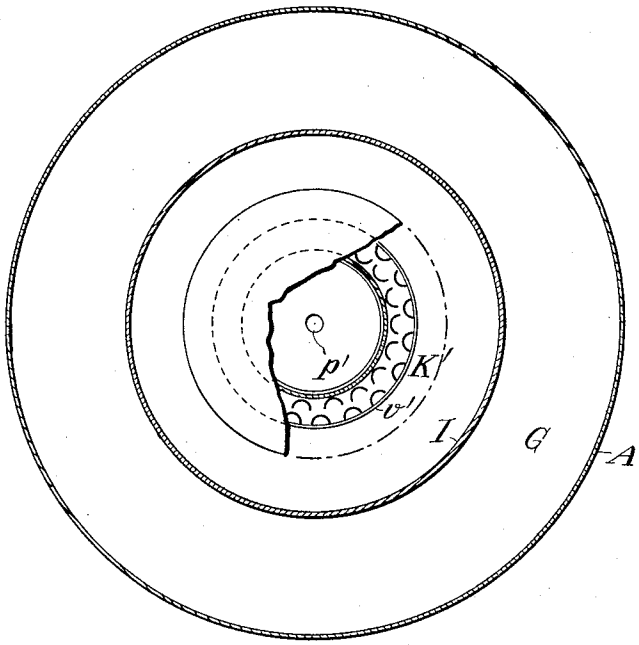


Fig. 6.

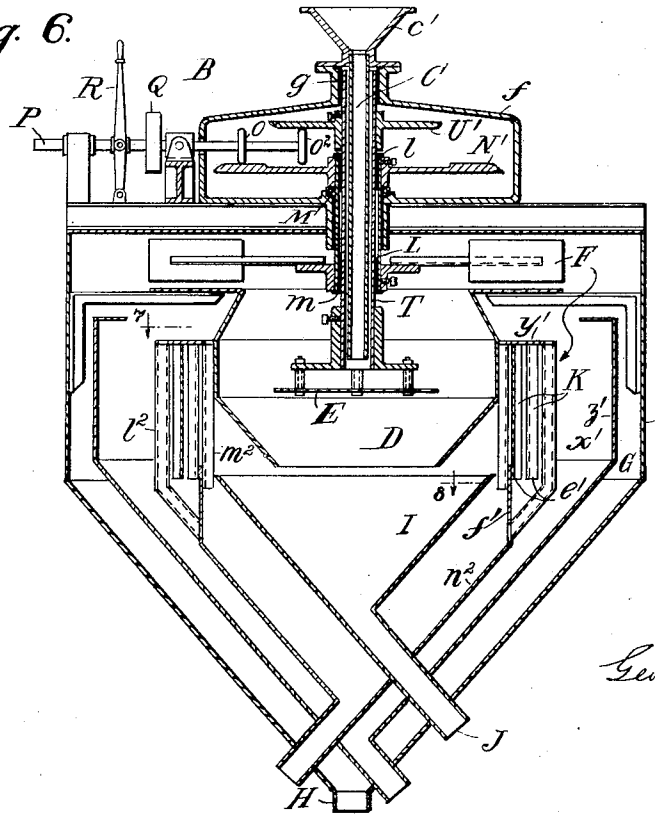


Fig. 7.

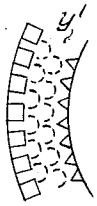
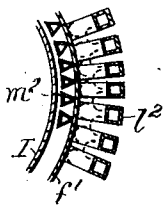


Fig. 8.



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Patented Sept. 6, 1932 1,876,516

UNITED STATES PATENT OFFICE

GEORGE HOLT FRASER, OF BROOKLYN, NEW YORK

AIR SEPARATOR

Application filed September 12, 1924, Serial No. 737,411. Renewed May 5, 1930.

This invention relates to air or other fluid current separators and to driving mechanism therefor and for other driven devices, and aims to provide certain improvements therein.

It relates especially to air separators of the type in which a separating current is circulated in an endless path in the form of a vortex ring up through and down around a separating chamber to float out fine material and drop coarser material as tailings into a tailings receiver for conveying them from an outer casing enclosing an outer chamber, in spaced relation within which the separating chamber, the revolving fan blades for circulating the current, and the revolving means for distributing material to be separated, are concentrically disposed.

In my companion application Serial No. 687,359, filed Jan. 19, 1924, I disclose improvements in such a separator comprising, in addition to other features of my improvements, therein set forth, revolving the fan and distributor in the same direction, but at different and independently variable speeds; introducing hot air from without concentrically into the vortex ring of separating fluid above the distributing and separation zones; exhausting vapor from within the separating chamber within and concentrically of the vortex ring and below such zones; varying the distribution and current spaces by radially expanding the distributor; vertically power jarring the separating chamber itself, and a vertically spring sustained filter thereon, and the tailings receiver, intermittently and at reduced speed from the distributor driving mechanism, and automatically increasing the speed of distributor revolution and diminishing the supply of material with increase in the weight of the stream of tailings flowing on to the tailings receiver by providing a weight operated vertically movable counter-balanced receiver and means responsive to increase in the weight of such stream flowing on to such receiver for increasing the speed of operation of the distributor and fan and for diminishing the supply of material to be separated.

The said features set forth in my said application Serial No. 687,359 are claimed in said application, and are distinguished from the improvements set forth and claimed in this application in that the present invention aims to automatically discontinue drive of the separator, instead of accelerating such drive, with increase in the weight of the stream of material flowing through the separator; and to automatically diminish, instead of accelerating, speed of revolution of the distributor or blower with increase in the weight of such stream; and to introduce below the distributor, instead of above it, additional external fluid or compressed air into the circulating separating fluid; and to exhaust vapor or pressure from without the separating chamber itself, instead of from within it, and externally of and preferably below and concentrically of the path of circulation of the separating fluid, instead of within the upflowing leg of such fluid; and to radially vary the distribution and current space around the distributor by radially adjusting adjustable segments around the distributor, instead of radially adjusting it; and to radially, instead of vertically, power jar or vibrate the separating chamber itself, and a radially movable filter thereon, by a speed reducer driven by the blower drive wheel, instead of by the distributor drive wheel.

The invention aims to increase efficiency and availability of such separators and mechanism, and to improve their construction and operation.

To this end in carrying out the preferred adaptation of my present improvements I provide preferably, automatically operated drive discontinuance means, responsive to variations in the weight of the stream of material flowing through the separator, for automatically discontinuing drive of the separator with increase in the weight of such stream; and automatically operated distributor drive speed reducer means, responsive to variations in such weight, for automatically reducing speed of revolution of the distributor with increase in such weight; and automatically operated blower drive speed reducer means, responsive to variations in

such weight, for automatically reducing speed of revolution of the blower with increase in such weight; and a spring sustained vertically movable tailings conveyor receiver, responsive to variations in the weight of the stream of tailings flowing on to it through the dropping opening of the separating chamber, and operatively connected to said discontinuance, or to said speed reducer, means, for automatically operating said discontinuance or speed reducer means, to reduce speed of revolution of said distributor, for diminishing distribution with increase in such weight, or to discontinue revolution of the distributor, to arrest distribution, should an excessive weight of tailings accumulate in such receiver, or to reduce speed of revolution of said blower, to diminish speed of flow of the separating current, simultaneously with diminution of such distribution; and, below the distributor, and within the separator casing, I preferably provide a rotary, fluid-jetter, fluid introduction inlet for compressed air, or other external fluid additional to the circulating separating fluid, communicating from externally of the separator casing to within it below the distributor, for introducing below the distributor, and preferably jetting concentrically of the circulating separating fluid, additional fluid from externally of the separator casing into it concentrically of the path of circulation of the separating fluid, to dry, treat, impell, or agitate, the material in the separator; and, externally of the separating chamber, and within the separator casing, I preferably provide a fluid exhaust outlet below and concentrically of the path of circulation of the separating fluid, and without and below the separating chamber, and communicating from within to externally of the casing of the separator, for exhausting vapor or pressure from the separator casing exteriorly of the separating chamber itself, and preferably below and from concentrically of and without the path of the circulating separating fluid, and for discharging such vapor or pressure externally of the separator casing, for relieving the separator or the material being separated from vapor or pressure during separation, or to dry or treat the material being separated or the separating fluid; and I preferably provide a ring of radially adjustable segments around the distributor, for varying the space through which material may be distributed or the space through which the separating current may flow; and I preferably provide radial springs for radially positioning the filter on the separating chamber, and radially impactive, blower drive wheel power operated, jarrers, without and around and extended above and below the blower, for radially power vibrating such filter and the separating chamber from the blower drive wheel; and I preferably provide various features of improvement in the construction, arrangement and use of such separators and devices, which will hereinafter be more fully set forth.

My present improvements are applicable to a wide range of mechanical and other devices, and can be applied to many transmission uses, but for purpose of illustration I will describe them in their preferred form as applied to the preferred form of my improved air separator, with reference to the accompanying drawings in which

Fig. 1 is a vertical axial section of an air separator embodying the preferred form of my improvements cut approximately on the plane of the line 1—1 in Fig. 2;

Fig. 2 is a plan view thereof partly in horizontal section on the planes of the line 2—2 in Fig. 1;

Fig. 3 is a fragmentary horizontal section thereof cut approximately on the planes of the lines 3—3 in Fig. 1;

Fig. 4 is a horizontal section thereof cut approximately on the planes of the line 4—4 of Fig. 1,

Fig. 5 is a fragmentary side elevation of the filter troughs looking toward their outer faces, and

Fig. 6 is a fragmentary axial section showing a modification in which two rollers are in fixed relation on the axially adjustable shaft to reversely drive the feed disc and fan at predetermined differences in relative speed.

Fig. 7 is a fragmentary horizontal section thereof cut on the plane of the line 7 in Fig. 6, and,

Fig. 8 is a fragmentary horizontal section thereof cut on the plane of the line 8 in Fig. 6.

Fig. 9 is a fragmentary side elevation of the hub V showing its convex portion seated rockingly in the concave of the center of the wheel U which is shown in section.

Referring especially to Figs. 1, 2 and 3 I will now describe the preferred form of my invention as applied to an air separator:

Referring to the drawings, let A represent the main frame or outer casing of an air separator, B the driving mechanism thereof, C the feed inlet pipe therefor, D the inner casing or upper receptacle or separating chamber thereof, E the feeder or distributor therein, F the fan or blower therefor, G the dust or settling chamber, H the dust or fine outlet, I the lower casing or receptacle or tailings receiver thereof, and J the coarse or tailings outlet.

These parts may be of any usual or suitable construction for utilizing a fluid current to separate a fine or light from a coarse or heavy material the fan causing a current to rise through the material as it is distributed in the feed chamber so as to float the lighter particles into the fine chamber and permit the

heavier particles to fall and escape through the coarse outlet.

The casing A usually has a flat top, cylindrical sides, and a conical bottom, separably and movably connected and enclosing the chamber G.

The receptacle D encloses the separating chamber and is usually an inner circular casing or annular wall having a cylindrical center and reversely tapering or contracted upper and lower portions affording upper and lower openings communicating with the chamber G within which it is mounted in spaced relation to the outer walls of the casing A. It has a flat annular top wall or shelf above which the blades of the fan F revolve to cause a current to rise through the separating chamber, circulate down through the dust chamber, and return through the lower opening, and again rise through the separating chamber, in an endless circuit in the form of a vortex ring as indicated by the endless dotted line in Fig. 1.

Filtering means K are usually disposed in the path of this current to intercept and conduct below and out of its zone particles floating in it, and usually surround said lower opening to prevent return of fine particles thereto.

The distributor E usually revolves opposite the lower end of the stationary feed pipe C, to spread pulverulent material descending through this pipe and to distribute it centrifugally in the receptacle D so that it will be thrown or projected outwardly from its circular edge across the rising current to enable the latter to extract fine particles.

The driving mechanism revolves the distributor and fan to continuously distribute the material to be separated and to cause a current to rise through it and flow through and around the receptacle in an endless path so that the fines may be separated and withdrawn through the fine outlet and the coarse may descend and be withdrawn through the tailings outlet.

According to one feature of my present invention I preferably provide such a separator with my improved driving mechanism automatically responsive to variations in the weight of the stream of material flowing through the separator, and adapt this to operate the driven parts frictionally or by traction, to discontinue their drive or reduce their speed, or to disconnect either or both, with increase in such weight, and to drive each in reverse direction to the other, so that distribution and current can be automatically varied to suit conditions or desired results, and adjustment and control will be facilitated and I provide various other features of improvement, all of which will be more fully hereinafter set forth.

Preferably the fan F is mounted on a tubular shaft L, revolving in a bearing M, and has fixed on its upper part a friction wheel N, which has an anti-friction or ball bearing M', and has a speed reducer side traction face engaged by the edge traction face of a roller O which frictionally drives it and is axially adjustable to vary the speed of the fan, and out of engagement with the wheel N to disconnect the fan drive.

The roller O is preferably carried by a sliding shaft P driven by a pulley Q and operated by a shifter R to vary its position and adjust it in to increase fan speed or out to diminish such speed or out of engagement with the wheel N to stop the fan drive. The shifter R is preferably responsive to variations in the weight of the stream of material flowing through the separator, and is preferably operated with increase in such weight to adjust the roller O outwardly to diminish such speed with moderate increase in such weight, and to adjust such roller out of engagement with the wheel N to discontinue drive with excessive increase in such weight.

Preferably the distributor E is mounted on a tubular shaft T, within and concentric of the fan shaft L and surrounding and spaced from the feed pipe C, which shaft T is carried by or sustained and driven by a friction wheel U, having a speed reducer side friction face opposed to and spaced from that of the wheel N and tractionally driven and supported by the friction roller O. The wheel U rides on the top edge of the roller O and is driven by it in reverse direction to the wheel N, so that the distributor revolves in one direction and the blower in the other and both revolve at the same speed which is varied as the roller is adjusted in or out.

The wheel U is preferably smaller than the wheel N so that distributor drive may be disconnected by moving the roller O beyond the periphery of the wheel U to stop revolution of the distributor while slowly revolving the blower, and then movement of the roller to beyond the periphery of the wheel N will stop revolution of the latter.

The shaft P is preferably mounted on an inner rocking bearing Z and an outer vertically sliding bearing *c* see Figs. 1 and 2 so that it can adjust itself vertically and passively between the wheels N and U. The shaft P slides axially in these bearings and through the hub of the pulley Q with which it is connected to rotate by a pin *a* traversing a slot *b* in the shaft, which slot is long enough to permit its desired axial movement.

The weight of the distributor is preferably utilized to afford traction for driving purposes, and is sustained by the wheel U which is sustained by the roller O, which is sustained by the wheel N, which is sustained in fixed position by the rigid ball bearing M', so that the weight of one of the driven parts is utilized for the traction driving of both of them, which will ordinarily be sufficient in a ma-

chine of this type, but may be supplemented by, in a machine of this type, applying pressure through additional traction rolls and wheels and anti-friction bearings at either side of these primary wheels opposite the rollers intermediate of them.

The variable speed and speed reducing wheels N and U and the roller O will be proportioned to suit individual requirements and to reduce the high speed of the driving means 2 to give the desired mean speed when the roller is in its mid-position.

My invention preferably provides for balancing the load utilized by traction to avoid other stress, and obtains this by providing one or more similar rollers O′ co-acting with the friction wheels at points diametrically opposite to or equidistant from the driving roll O, which are preferably yieldingly mounted in bearings similar to the bearings Z and *c* and are preferably independently rotative and axially movable to move in and out as the roll O does, so as to connect or disconnect drive to the distributor while the fan may still be revolved. One diametrically opposite roll O′ is shown shifted by a shifter R′ which is operated by a lever S′ operated by the shifter R so that the rolls can be shifted from either side by using either shifter.

As the roll O′ is tractionally driven by the wheel N from which it sustains the wheel U it tractionally drives the wheel U, thus multiplying the tractional contact and action, and balancing this at each side of the shaft, as well as sustaining the load at each side thereof or at equidistant points around the axis of the tubular shafts.

The wheel U may be directly connected to its shaft T, but I prefer to movably or adjustably connect it so that it can move to adapt itself to any slight difference in diameter between the two traction rollers or to compensate for any foreign matter which may enter between the traction faces. This is preferably accomplished by providing a hub V on the shaft T, which is sustained on the wheel U by a compensating joint W so that the wheel can rock relatively to the hub but is drivingly connected to it to rotate it as the wheel rotates, as shown in Figs. 1 and 2 and in Fig. 9. This enables the wheel to adapt itself to the rollers and relieve the shaft T of any stress which might be occasioned by inequality in these. This compensation is provided for as shown in Figs. 1, 2 and 9 by making the wheel U with a concave socket in the shape of a segment of a sphere and the hub with a convex part sustained in this socket which concave and convex parts constitute the universal compensating joint W shown in Figs. 1 and 2.

The edges of the wheels N and U and of the roller O are preferably chamfered to facilitate entering the rollers between the wheels, and the hub of the roller N is close to the bottom of the hub V, which settles on to it and is sustained by it when the rollers are removed from the wheel U, which is then held just high enough to permit the easy re-entry of these rollers under its chamfered edge, which will again lift the wheel U until its hub is above the hub of the wheel N.

It is desirable to vertically adjust the distributor to suit the material being treated or to vary the fineness of product, and my invention preferably according to one feature provides for doing this easily, and preferably during operation and from without the machine, and I preferably accomplish this by providing a male screw thread on the pipe T and a female screw thread on its driving wheel or hub V, so that the pipe can be vertically adjusted in the driving member to raise or lower the position of the distributor E.

Preferably the pipe T is provided with a groove or slot *h* engaged by a pin *i* on a lock *j*, which is shown as a collar vertically movable on the hub V of the wheel U, which hub has a notch *k* in which the pin *i* drops when the lock is down, so that the hub, wheel, and the pipe T, must then revolve together. When the lock is lifted the pin leaves this notch, and if its revolution is resisted, it holds the pipe T against revolution while the hub V revolves, so that the pipe is screwed up in the hub until the lock is released and falls until its pin *i* again engages the notch *k* and locks the hub V and pipe T to rotate together. To screw the pipe down the wheel U may be stopped and the lock lifted and turned by hand to rotate the pipe T until it has descended to the desired point.

I prefer to form the lock with a groove *d* and provide a forked lever *e* for operating it from without the machine, so that starting with the distributor in the lowest position it may be screwed up little by little from without and during operation until the highest position is reached.

A shell or drive casing *f* preferably encloses the friction wheels, rollers and lock, and carries the bearings M and M′ for the blower and an upper bearing *g* for the pipe T which can move vertically therein.

Preferably the bearing *l* is provided within the pipe L for the central part of the pipe T and a bearing *m* within the lower end of the pipe L for the lower part of the pipe T.

The distributor E preferably centrifugally discharges the material falling on it from the feed pipe C, and projects this material across the rising air current and against intercepting means S arranged around the distributor and spaced inwardly of the inner wall of the feed chamber, which means arrests the material and diverts or distributes it downwardly so it falls through the rising current and on to the tapering lower wall of the feed cham-

ber. Part of the current preferably rises between the distributing discs and this interceptor and part of it between the interceptor and the wall of the feed chamber, and preferably extracts the fine dust from the material projected from the disc to the interceptor and from that falling from the interceptor toward the lower outlet, and raises all this dust to the upper opening.

The interceptor is preferably annular, and non-rotary, and according to one feature of my invention it is adjustable to radially vary the space between it and the disc or between it and the wall, and preferably it is adjustable vertically relatively to the feed chamber and relatively to the feed disc, to vary its position to suit that of the disc, or to vary the point of interception to suit the material being separated, and preferably also circumferentially to increase or diminish its diameter to radially vary the distribution and current spaces around the disc, or vary the annular passages between it and the disc or between it and the wall of the chamber. Preferably I make it of overlapping segments *n* of arc shaped spring steel which are assembled in the form of a circle but can be moved upon each other from without the casing to expand or contract the circle in any manner as by the rack and pinion *o* and hand wheel *p* shown as an example, and preferably I also vertically adjust the ring S by swinging links *q* from a lever *r* which can be tilted and operated from without by a handle *s*.

My invention provides, according to another feature of improvement, for blowing outwardly material within one of the casings, and preferably for aerating and impelling the pulverulent material below the zone of and during its distribution, to facilitate separation of the fine dust or to dry or treat the material, and this is preferably accomplished by providing a valved compressed air inlet *t* communicating with the air chamber *u* communicating with the space between the feed pipe C and distributor pipe T, which space affords an annular conduit to the feed hub *v* and communicates with air ducts *w* which are in this, which communicate through the spacer pipe *x* from this hub to the air chamber *y* preferably circular and revoluble with and formed in the hollow distributor disc E, which is preferably provided with diagonally inclined outblowing and radial jet openings *z* around its edge through which air may blow outwardly to displace material within the casings, or into and under the material being thrown off the disc to agitate it and release the fine dust so that this may be readily floated by the rising current within the chamber.

To protect the upper bearing *g* a gravity packing ring *a'* resting on the top of the shaft T rises and falls with the shaft to close access of dust above this upper bearing *g*. The air inlet *u* is preferably formed in an annular casting *b'* mounted on the shell *f* and sustaining the feed pipe C, and above it the feed hopper *c'*. An adjustable feed gate *d'* is provided preferably between the hopper and feed pipe.

My invention provides improved means for sealing the filter K on the principle shown in my Patent No. 1,542,050, dated June 16, 1925, which consists of two rows of trough shaped baffles *e'* preferably of rectangular cross section and arranged in staggered relation with their hollow faces opposed to the approaching current so that current voids may form in these faces in which fine material may be intercepted and descend across and below the zone of the current.

I preferably seal the lower ends of these troughs against upflow of current by providing at the inner side of or on each trough, or of each row of troughs, a valve closing or seating face, preferably as an annular wall or inner ring *f'* and by closing the hollow side of or enclosing the lower end of each trough with a gravity flapper valve *g'* which is preferably pivoted to the square lower end of the trough so that it will normally swing slightly open from the ring *f'* to permit descent of dust, but will flap against this ring and inwardly seat against or co-act with its valve seating face to close the lower end of the trough against ingress and upflow of air current from beneath. This valve will fluctuate with variations in current and with variations in any weight of dust descending into it and automatically vibrate accordingly to clear itself of dust and prevent upward counter currents.

I preferably provide an automatic gravity adapter T' for closing the space between the top of the tailings cone I and the inside of the filter K, which is preferably a loose conical ring sliding vertically in the filter and resting on the top edge of the cone which sustains it at whatever height the cone rises to. It follows the vertical movements of the tailings cone, and preferably has a reversely inclined outer edge which is preferably notched to slide between the inner filter troughs and seal the space between these.

The free rings *f'* extend upwardly and preferably carry a cloth or other damper *h'*, and the inner edge of this inner damper flaps against the tailings cone I to prevent escape of air inwardly of the filter, and the outer edge of which is stretched around the filter troughs and fastened near their inner edges to seal the space between them, and the inner edge of the outer damper *h'* flaps against the lower front of the inner troughs to prevent air from rising between them and its outer edge which is stretched and fastened between the outer row of troughs, and affords with the inner damper *h'*, the cone I, and the wall *z'*, a current confining wall past the troughs to pre-

vent air from rising between them from below.

The filter according to another feature of my invention, is preferably mounted movably on the separating chamber so it can be slid slightly radially, and is held yieldingly in radial position by springs i', which compress when it is forced in and react when it is released, so that it is arrested with a jar by the bolts j' on which these springs are mounted, and it and the separating chamber are thus radially outwardly jarred or vibrated.

It may be jarred by hammering on rods k' extending from it to without the casing, but according to one feature of my invention I prefer to automatically intermittently and at low frequency, power jar it radially from above and without the fan and by the variable reduced speed of the fan drive wheel N by a horizontally fulcrumed swinging impactive striker or hammer lever l' acting on these rods k' and lifted by a cam m' carried by a toothed or other intermittently acting frequency reducing means, as a star wheel n' operated by a pin o' on the under side of the wheel N.

My invention, according to another feature of improvement, preferably provides for relieving or exhausting from below or without the separating chamber, and concentric of and below the path through which the separating current circulates in the form of a vortex ring, the excess air introduced to agitate the feed, and preferably for filtering below and without such path this air to clean dust from it or to prevent escape of dust with it.

Preferably I provide a relief pipe p' extending through the tailings outlet and rising in the tailings cone where it preferably has an enlarged head surrounded by a filter K' similar to the filter K and through which excess air may escape while dust will be intercepted and dropped into the tailings cone.

Overfeeding or interrupted discharge may clog the separator by filling up the tailings cone which is spaced below the dropping opening of the separating chamber, and my invention preferably provides for automatically reducing feed and speed to vary these to suit the ability of the tailings cone to discharge its load, and to arrest operation of the distributor and ingress of feed in case of dangerous accumulation in the tailings cone. Preferably according to this feature of my invention I make the tailings receiver automatically weight operated and vertically movable with variations in the weight of the stream of tailings flowing on to it, and provide means responsive to variations in such weight for reducing or arresting supply of material to be separated, and reducing or stopping operation of the distributor, with increase in such weight, and preferably this is accomplished by movably yieldingly, elastically, resiliently, suspending or sustaining the tailings cone movably relatively to the separating chamber by springs q' through rods r' one of which is attached to a lever s', which springs are adjusted to hold the cone in its normal position, but yield and permit its descent when it is overloaded, so that the lever s' will be swung and vary the feed gate d' to regulate the feed, and also operate a shifter R' to move the rollers outwardly to reduce speed, or entirely out of engagement with the distributor driving wheel U to stop revolution of the latter in case of too great an overload, thus automatically varying and regulating operation to suit conditions in the tailings outlet, while permitting the fan to slowly revolve to filter out any floating dust remaining in the air within the separator.

My current space varying damper L' is positively uniformly adjusted preferably by connected levers o^2, reversely moved by crossed connecting links p^2 and the shafts r^2 operated from without by handle s^2 and screw-wheel t^2 having a flat adjustment indicating and locking face for pin or padlock engagement.

Vertical movement of the tailings cone preferably is permitted by the telescopic joint between its lower end and its outlet J, and by the rods r' which suspend it and guide it by slidingly passing through the brackets t' on which the filter K is slidingly mounted.

The relief pipe p' preferably is mounted on the cone I and moves with it, and telescopically engages its outlet pipe to permit this. Its filter K' preferably is dust sealed at the bottom of its troughs to prevent air rising between these, preferably by a counterbalanced or gravity valve u' which encloses and co-operates with the valve seating faces on the inclined ends or valve seats w^2 of the troughs and fills with dust descending from them until this overbalances its weighted lever v', which then lets it descend and release the accumulated dust, whereupon it is restored by this lever and by the air pressure beneath it.

My invention preferably provides a preliminary inclined filter K^2 immediately under the fan, through which the air is first directed by an annular inward deflector w', which directs the air inwardly through this filter into an annular chamber x' through which it descends around the top sealing ring y' of the filters K to reach and pass through these. A partition or intermediate casing z' encloses the filter K and the intermediate chamber x' and isolates these from the outer dust chamber, and keeps the dust extracted by the filter K^2 from reaching the filter K, so that the air is successively subjected to filtration before returning to the feed chamber.

Movable supply stirring means, preferably as a revolving U-shaped spring scraper a^2

preferably is fastened on the distributor disc E and its legs rise through the feed pipe C and their free ends are adjustably connected together by a screw b^2 so that they can be collapsed more or less to agitate the material descending in the feed pipe or to prevent clogging of this, and below the hopper c' to prevent clogging there.

Preferably as shown in Fig. 3 a number of material checking ledges u^2 are provided around the upper face of the distributor E, against which material may dam, to prevent wear by slippage of the material being revolved by the distributor or to facilitate the centrifugal out-throwing of the material being distributed. Any desired shape, number or arrangement of such ledges may be employed, but preferably as shown they consist of radiating lengths of angle iron fastened on the top of the distributor.

A closure against escape of air between the feed pipe C and the drive pipe T is preferably provided preferably in the form of a ring of packing c^2 screwed on the end of the pipe T and engaging the inner face of the hub v to permit its revolution and vertical adjustment while preventing undue escape of compressed air around the pipe. My invention preferably provides for maintaining uniform speed of the drive pulley Q, as by a centrifugal governor X thereon for regulating the speed of the driving element, in any suitable manner.

As shown the governor X, through a lever d^2 shifts the commutator brushes to vary the speed of the motor e^2 shown as the primary drive for the pulley Q.

My invention preferably provides for varying supply of power to suit work, preferably by a load governor Y on the pulley Q, which consists of a disc revolving with it and transmitting its revolution to the shaft P, but movable axially of and around the axis of the pulley Q and yieldingly connected to it as by a spiral spring f^2 normally holding the parts in juxtaposition, but permitting one to move around the other as load increases. Such movement is utilized to axially displace the governor, and such axial displacement is utilized to vary the supply of power to suit the load, as shown by the lever g^2 varying the resistance h^2 in the line feeding the motor. For gas or steam engines these governors would respectively vary the spark and gas supply, or the cut-off and throttle valves to vary speed and power to suit variations in work.

My invention preferably provides for power operating the vertical adjustment of the feed pipe T in either direction, which is preferably done by providing a yielding traction roller i^2 on the operating lever e so proportioned and mounted that when this lever is operated to disengage the lock j, the roller i^2 will engage the rim of this lock and resist its rotation to cause the pipe T to screw down as the wheel U continues to rotate, but will yield if the lever is further depressed so that the tapering inner end of the wheel will pass under the lock and frictionally engage it and the edge traction face on the outer part of the roller i^2 will tractionally engage the top surface of the wheel U and be revolved thereby and frictionally revolve the lock j to cause it to revolve the pipe T in reverse direction to the revolution of the wheel U so the pipe will be screwed down in the wheel U until the lever e is again raised. Thus upward adjustment of the feed disc can be effected by partially depressing the lever e and downward adjustment can be effected by further depressing it.

To increase and facilitate downward current flow, according to another feature, my invention preferably provides an annular inclined wear preventing, current intercepting, lining or deflecting wall j^2 around the blower F and extends the blades to adjacent this inclined, angular wall at their outer edges, which edges I preferably incline relatively to their axis of rotation, as by diagonally bending their upper corners transversely, to cooperate with and to correspond to this wall, so that outflowing air will be deflected downwardly by the wall and forced downwardly by the transversely bent ends of the blades shown in Fig. 2.

The wall j^2 is spaced opposite and around and encircles the outward current passage through the blower F, and is above and around the downward current passage communicating with the settling chamber G, and co-operates with the blower to accelerate circulation of the outflowing dust laden current downwardly toward the settling chamber G and in through the cleaning means K and up above the exhausting means p' and through the lower inlet to return up through the separating chamber, and facilitates the circulation of the separating current in the form of a vortex ring through this endless path. The wall j^2 preferably is a wear preventing and a dust laden current intercepting lining wall within and adjacent the outer wall of the casing A and extending across and also below the outward current passages, to prevent abrasive material from wearing the outer wall opposite and below this passage, and to intercept outflowing dust laden current inwardly of and adjacent the outer wall opposite and below the outward passage, as well as to downwardly deflect and accelerate downward flow of the outflowing separating current. The wall j^2 may be provided in any suitable or desired manner, but preferably as shown it is loosely and removably mounted on the succeeding lower deflecting lining wall w', which is successive and complementary to it and receives impingement of current and material deflected downwardly by it and fur-

ther protects the outer wall from such impingement. Preferably the wall j^2 is a separate downwardly and outwardly extending flaring or conical, loose, movable, removable wall across the corner formed by the top and side walls of the outer casing, and is sufficiently close to the similarly shaped outer edges of the fan blades to co-operate with these and accelerate downward flow of the circulating separating fluid, and such flow is further accelerated by the downwardly and outwardly inclined transversely bent corners of the fan blades, the inner downwardly and outwardly inclined faces of which in themselves also afford cross blade revolving downward current deflecting faces which also accelerate the downward circulation of the separating current.

To interrupt the whirling air and direct it towards the troughs of the initial filter K^2 I prefer to provide radial vanes k^2 on the under side of the fan shelf in front of the filter troughs to slice off the whirling air and direct it toward the hollow centers of the troughs.

In operation, the blower will be started by moving the roller O into engagement with the wheel N to cause current to flow outwardly and impinge against the lining j^2, which will deflect it and particles floating in it downwardly toward the dust chamber G and accelerate circulation of current through and around the receptacle D. The feed disc will be caused to revolve in reverse direction by further moving the roller O into engagement with the wheel U, and then this roller will be moved to the mid-position for normal speed, and feed of material will be introduced through pipe C in the desired quantity by adjusting the feed gate d' to the position desired. The current will separate the dust and the filters will extract it. Observation of the dust to determine its fineness, and of the tailings to determine their cleanness will indicate any adjustment desirable and the speed will be varied accordingly by moving the friction rollers in or out. The distributor will be adjusted vertically to vary the fineness of the dust, and the distributing ring S will be adjusted vertically to follow the adjustment of the distributor and adjusted radially or axially to vary the current passages around it, to vary the fineness of separation, and to vary the distributing space between it and the disc to vary the percentage of fines escaping with the tailings.

Compressed air will be introduced through the external air supply pipe t and jets diagonally upwardly through the material leaving the edge of the disc to agitate it and generate a dust cloud in the path of the ascending current, and the material will be impelled upwardly and outwardly by the air jets until it impinges on the ring S which will arrest and precipitate it downwardly. The rising air preferably travels between the disc E and the ring S and also between the ring S and the outer wall of the dust chamber, so that it will have two opportunities to extract the fine dust before the material finally reaches the wall of the feed chamber from which it will fall to the tailings cone I.

Dust extracted by the filter K^2 will descend around the partition z' into the dust chamber. Dust extracted by the filter K will descend through its valved outlets into the dust chamber, from which return of air will be prevented except through these filters. Excess air will be withdrawn through the relief pipe p' and escape of dust prevented by its filter K'.

The current will be varied from without the casing by vertically adjusting the current space varying annular valve L' concentric of the current passage, by positively and uniformly down pushing the valve by the valve vertically positioning means concentric of and above the valve, as the compression means v^2 spaced equi-distantly around it and the vertically swinging spaced valve down pushing levers o^2 carrying and for down moving said means v^2, and the lever connecting means p^2 for synchronously and simultaneously similarly vertically swinging said levers, and the valve down pushing operating means without the casing A and operatively connected to for operating the down pushing means, as the screw t^2 moving the handle s^2 on one of the shafts r^2.

When speed, feed and these adjustments produce satisfactory results under normal operation use of the apparatus may continue without varying adjustment until conditions require change, but stoppage of tailings outflow may occur, and this will cause the cone I to descend and operate the feed gate d' to reduce feed during accumulation of excess material in the tailings cone or arrest feed in case such accumulation is excessive. This is done through its lever s', which preferably simultaneously will vary the speed by operating the roller shifters to diminish the speed of the distributor and fan as the feed is diminished, and to stop the distributor and slowly operate the fan or to stop the latter before accumulation in the cone I becomes dangerous.

In the construction shown the driving roller O is balanced between the wheels N and U as to all stresses by a balanced opposite roll O', and these are mutually adjusted toward and from each other to vary speed and they mutually transmit traction drive from one to the other wheel.

It will be understood that my improvements can be variously or advantageously availed of in whole or in part as the judgment of those skilled in the art may dictate, without departing from the spirit of my invention, which is not limited to the particular

details set forth as constituting its preferred form nor to the particular applications hereinbefore set forth.

In the simpler form shown in Fig. 6 the rollers O and O2 are fixed on the axially adjustable shaft P, and the roller O drives the fan wheel N′ at slow speed and the roller O2 drives the distributor wheel U′ reversely at faster speed. Pipes l^2 m^2 conduct fines from above y' past filter to fine cone n^2. Grits centrifugally go to G, and medium filtrates to x'.

What I claim is:

1. In combination, a casing enclosing a chamber, a receptacle therein having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, blower means for causing a fluid current to flow up through and around said receptacle, vertically adjustable revolving distributor means in said receptacle for distributing in such upward current material to be separated, a vertically adjustable suspended pipe above and suspending and vertically adjustable with said distributing means and having an open upper end above said receptacle and an open lower end in said receptacle and affording a passage through which such material may descend into said receptacle and to said distributing means, drive means around and for revolving said pipe, and vertically adjustable pipe transverse sustainer means for sustaining and vertically adjusting said distributing means and said pipe, and outer air inlet conduit means around said pipe for inletting outer air around said distributor.

2. In combination, a casing enclosing a chamber, a receptacle therein having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, blower means for causing a fluid current to flow up through and around said receptacle, vertically adjustable revolving distributor means in said receptacle for distributing in such upward current material to be separated, a vertically adjustable suspender pipe above and suspending and vertically adjustable with said distributing means and having an open end above said chamber and affording a downward passage through which such material may descend to said distributing means, drive means around and for revolving said pipe, support means around and for vertically supporting said pipe and as to which said pipe is vertically adjustable, adjustable pipe traversed sustainer means for sustaining said pipe vertically from and adjusting it vertically relatively to said supporting means, and outer air inlet means around said pipe and below said distributor and communicating from without to within said casing for inletting outer air around said pipe.

3. In combination, a casing enclosing a chamber, a receptacle therein having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, blower means for causing a fluid current to flow up through and around said receptacle, vertically adjustable revolving distributor means in said receptacle for distributing in such upward current material to be separated, a vertically adjustable suspender pipe above and suspending and vertically adjustable with said distributing means and having an open upper end above said chamber and affording a passage through which such material may descend to said distributing means, drive means around and axially adjustable as to and drivingly connected to said pipe for revolving said pipe and through which said pipe is vertically adjustable, adjuster means for adjusting said pipe vertically through said driving means, and vertically adjustable outer air inlet means below and vertically adjustable with said distributor and communicating from without to within said casing for inletting outer air below said distributor.

4. In combination, a casing enclosing a chamber, a receptacle therein having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, distributor means for distributing pulverulent material in said receptacle, blower means within said casing for causing a fluid current to flow up through such material to float fine dust through said upper opening into said chamber and return through said lower opening, and fluid inlet means below said distributing means and above said lower opening, and out of the zone of such passage, for introducing additional fluid from without into said casing to treat such material.

5. In combination, a casing enclosing a chamber, a receptable in said chamber having upper and lower openings communicating with said chamber, material supply means for supplying material to be separated in said receptacle, blower means for causing a fluid in said chamber to circulate up through said receptacle and upper opening into said chamber and return through said lower opening to float fine material into said chamber, fluid inlet means within and for introducing additional fluid into said chamber for subjecting such material to the action of such additional fluid, coarse material outlet means for withdrawing coarse material from said receptacle, fine material outlet means for withdrawing fine material from said chamber, and fluid withdrawal means within said casing and out of and below the path of circulation of such

floating fluid for withdrawing such additional fluid from said chamber.

6. In combination, a casing enclosing a chamber, a receptacle in said chamber having upper and lower openings communicating with said chamber, material supply means for supplying material to be separated within said receptacle, blower means for causing a fluid within said chamber to circulate up through said receptacle and upper opening into said chamber and around said receptacle and return through said lower opening to float fine material from said receptacle into said chamber, fluid inlet means within and for introducing additional fluid into said chamber for subjecting such material to the action of such additional fluid, coarse material outlet means for withdrawing coarse material from said receptacle, fine material outlet means for withdrawing fine material from said chamber, fluid withdrawal means within and for withdrawing fluid from said chamber, and filter means within said casing and around said fluid withdrawal means and out of the path of circulation of such floating fluid for separating fine material from such withdrawn fluid.

7. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and expansible material distributor means within and spaced from the wall of said chamber and concentric of said supplying means for distributing such material in the path of such current and expansible to vary radially of such chamber such distribution to vary the fineness of such separation.

8. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and radially adjustable material distributor means within and spaced from the wall of said chamber and concentric of said supplying means for distributing such material in the path of such current and adjustable to vary radially of such chamber such distribution to vary the fineness of such separation.

9. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, circular material supply means within and concentric of said chamber for outwardly projecting material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and annular adjustable material distributor means within and spaced from the wall of said chamber and concentric of and around and spaced from said circular supplying means and affording between said adjustable means and said supplying means an annular space variable radially of said supplying means for distributing such material in the path of such current and adjustable to radially vary such space to vary the fineness of such separation.

10. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and expansible current passage wall means within and spaced from the wall of said chamber adjacent and additional to and around and concentric of said supplying means and expansible to vary the space around said supplying means through which such current may pass to vary the fineness of such separation.

11. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and adjustable current passage wall means within said chamber and affording a current passage between said adjustable means and the wall of said chamber and concentric of and adjacent and additional to and around said supplying means and adjustable to vary such passage through which such current may flow around said adjustable means to vary the fineness of such separation.

12. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be

separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and radially adjustable current passage wall means within said chamber and concentric of and adjacent and additional to said supplying means for varying the space through which such current is permitted to pass for varying the fineness of such separation.

13. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and segmental current space wall means within said casing and concentric of and around said supplying means and affording past said segmental means an upward passage for such current, the segments of said segmental means being adjustable on each other to vary the space through which such current may flow to vary the fineness of such separation.

14. In combination, in a separator, a casing enclosing a circular separating chamber having a lower current inlet and an upward current passage and an upper current outlet, material supply means within and concentric of said chamber for supplying material to be separated in said passage, blower means for causing a fluid current to enter said chamber through said inlet and flow up through said passage and through said outlet to separate and float fine material from said chamber, and segmental material distributor means within and spaced from the wall of said chamber and around and concentric of said supplying means for receiving such material from said supplying means and distributing it in such current, the segments of said segmental means overlapping and being adjustable to vary the distribution of such material in said passage to vary the fineness of such separation.

15. In combination, in a separator, a casing enclosing a chamber, a receptacle within and in spaced relation to said casing and having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, material supply means for supplying pulverulent material to be separated in said receptacle, blower means for causing a fluid current to flow up through said receptacle and upper opening into said chamber and return through said lower opening to separate and float pulverulent material from said receptacle into said chamber, and compressed air jetting means within said casing for directing compressed air from without said casing toward such material for outblowing any such material.

16. In combination, in a separator, a casing enclosing a chamber, a receptacle within and in spaced relation to said casing and having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, material supply means for supplying pulverulent material to be separated in said receptacle, blower means for causing a fluid current to flow up through said receptacle and upper opening into said chamber and return through said lower opening to separate and float pulverulent material from said receptacle into said chamber, and circular compressed air jetting means within said casing for directing compressed air from without said casing toward such material for outblowing any such material.

17. In combination, in a separator, a casing enclosing a chamber, a receptacle within and in spaced relation to said casing and having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, material supply means for supplying pulverulent material to be separated to said receptacle, blower means for causing a fluid current to flow up through said receptacle and upper opening into said casing and return through said lower opening for separating and floating pulverulent material from said receptacle into said chamber, and revoluble compressed air jetting means within said casing for directing compressed air from without said casing into said chamber for outblowing any such material within said casing.

18. In combination, in a separator, a casing enclosing a chamber, a receptacle within and in spaced relation to said casing and having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, material supply means for supplying pulverulent material to be separated in said receptacle, blower means for causing a fluid current to flow up through said receptacle and upper opening into said chamber and return through said lower opening for separating and floating pulverulent material from said receptacle into said chamber, and compressed air directing jet means below said supplying means for directing air under pressure from without said casing toward such material for displacing such material.

19. In combination, in a separator, a casing enclosing a chamber, a receptacle within and in spaced relation to said casing and having upper and lower openings commu-

nicating with said chamber and affording an endless current passage up through and down around said receptacle, material supply means for supplying pulverulent material to be separated in said receptacle, blower means for causing a fluid current to flow up through said receptacle and upper opening into said chamber and return through said lower opening to separate and float pulverulent material from said receptacle into said chamber, and upwardly compressed fluid directing upward jet means in said casing and below said supplying means for directing fluid under pressure from without said casing upwardly toward any such material within said casing to displace such material.

20. In combination, in a separator, a casing enclosing a chamber, a receptacle within said casing and having upper and lower openings communicating with said chamber and affording an endless current passage up through and down around said receptacle, material supply means for supplying material to be separated in said receptacle, blower means for causing a fluid current to flow up through said receptacle and upper opening into said chamber and return through said lower opening to separate and float fine material from said receptacle into said chamber, and inlet compressed fluid introducing means in said casing and below said supplying means and above said lower opening for introducing additional fluid under pressure from without said casing into the path of said first current intermediate said supply means and said lower opening for acting on any such material.

21. In combination, in a separator, a casing enclosing a chamber, a receptacle within and in spaced relation to said casing and having a lower current inlet and an upward current passage and an upper current outlet communicating with said chamber, material supply means for supplying material to be separated in said receptacle, blower means for causing a fluid current to enter said receptacle through said inlet and flow up through said passage and through said outlet to float fine material from said receptacle into said chamber, fluid withdrawal outlet passage means affording a fluid withdrawal passage communicating from said chamber to without said casing for withdrawing fluid from said chamber, and material intercepting filter means within said casing and without the path of flow of such floating fluid and across said withdrawal passage for intercepting and cleaning from such current fine material floating in such current flowing through said withdrawal passage.

22. In combination, an outer casing enclosing an outer chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet and an upward current passage and an upper current outlet communicating with said outer chamber and affording an endless current path up through and down around said inner casing, material supply means for supplying material to be separated in said upward passage, blower means for causing a separating fluid current to circulate up through and down around said inner casing and through said endless path in the form of a vortex ring, to float fine material from said separating chamber to said outer chamber, and drier means within said inner casing and below said supplying means, and concentrically of said upward passage, comprising an external fluid conductor conduit inwardly of and concentric of said endless path, and extended from exteriorly of said outer casing into said inner casing and below said supplying means, and in communication from without said outer casing to within said inner casing, for conducting external fluid from without said outer casing into said inner casing below said supplying means to inwardly of and concentrically of said endless path, for drying such floating material.

23. In combination, an outer casing enclosing an outer chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet and an upward current passage and an upper current outlet communicating with such outer chamber and affording an endless current path up through and down around said inner casing, material supply means for supplying material to be separated to said upward passage, blower means for causing a separating fluid current to circulate up through and down around said inner casing in the form of a vortex ring to float fine material from said inner casing to said outer casing, and fluid external discharge exhaust outlet means intermediate said casings, and concentric of and below and without said inner casing, and extended from intermediate said inner and outer casings to without and having a discharge end without said outer casing, for exhausting fluid from intermediate said inner and outer casings, and for discharging such exhausted fluid without said outer casing, to relieve such circulating fluid from pressure during such circulation.

24. In combination, an outer casing enclosing an outer chamber affording a downward current passage, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet and an upper current outlet communicating with said outer chamber and affording an endless current passage up through, out over, and down around, said inner casing, material supply means for sup-

plying material to be separated to said separating chamber, blower means comprising revolving fan blades between said casing for causing a fluid current to flow up through said separating chamber and out into and down through said outer chamber and return in under said inner casing for separating and floating fine material from said separating chamber out into said outer chamber, and a separable downwardly and outwardly extended liner wall within and adjacent the outer wall of said outer casing and above said downward passage, and opposite and encircling the outer ends of said fan blades, for receiving impingement of and downwardly deflecting such outflowing dust laden current and precipitating particles floating therein toward said downward passage.

25. In combination, an outer casing having an outer wall enclosing a settling chamber and affording a downward current passage above and discharging into said settling chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet communicating with said settling chamber, and having an upper current outlet, and affording an outward current passage communicating from said outlet outwardly with said downward current passage, material supply means for supplying material to be separated to said separating chamber, blower means comprising fan blades having downwardly and outwardly extended outer ends revolving in said outward passage for causing a separating fluid current to circulate up through said separating chamber and upper outlet, and outwardly into said outward passage, and downwardly into said settling chamber, and inwardly to said lower inlet, to separate and float fine material from said separating chamber into said settling chamber, and current downward deflector means affording a downwardly and outwardly extended current downward deflector wall adjacent said outer wall and around said downward passage, and around and encircling the downwardly and outwardly extending outer ends of said blades, for deflecting such outwardly flowing separating current downwardly toward said settling chamber, and for co-operating with said blades for accelerating such circulation of such separating fluid.

26. In combination, an outer casing enclosing a settling chamber and affording a downward current passage above and discharging into said settling chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet communicating with said settling chamber, and having an upper current outlet, and affording between said casings an outward current passage communicating with said downward passage, material supply means for supplying material to be separated to said separating chamber, and blower means for causing a separating fluid current to circulate up through said separating chamber and upper outlet, and out into said downward passage, and through said settling chamber, and through said lower inlet, to separate and float fine material from said separating chamber into said settling chamber, comprising revoluble fan blades revolving above said separating chamber, and revoluble downwardly and outwardly extended current downward deflector means revolving above and disposed around said downward passage, and opposite and disposed around said outward passage, and adjacent and across the outer ends of said blades, for receiving impingement of such current outflowing between said blades and deflecting such outflowing current downwardly toward said settling chamber, to facilitate such circulation of such separating current.

27. In combination, an outer casing enclosing a settling chamber and affording a downward current passage above and discharging into said settling chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet communicating with said settling chamber, and having an upper current outlet, and affording between said casings an outward current passage communicating with said downward passage material supply means for supplying material to be separated to said separating chamber, and blower means for causing a separating fluid current to circulate up through said separating chamber and upper outlet, and out into said downward passage, and through said settling chamber, and through said lower inlet, to separate and float fine material from said separating chamber into said settling chamber, comprising revoluble fan blades revolving above said separating chamber, and revoluble downwardly and outwardly extended current downward deflector means opposite and above said downward passage, and opposite and around said outward passage, and carried by and revolving with said current means, and affording a downwardly and outwardly extending current deflecting surface adjacent and across the outer ends of said blades, for receiving impingement of such outflowing separating current and deflecting such current downwardly toward said settling chamber, to promote such circulation of such separating current.

28. In combination, a separator for separating fine material and dropping coarser material as tailings, variable speed driven material supply means for supplying material to be separated to said separator, and tailings weight operated speed reducer drive means for reducing the speed of operation of

said supplying means for varying such supply of such material comprising a weight operated vertically movable tailings receiver for receiving and conveying such tailings from said separator, and tailings weight operated speed reducer operator means responsive to variations in the weight of the stream of such tailings flowing on to said receiver for reducing the speed of operation of said supplying means with increase in the weight of such stream of tailings flowing on to said receiver.

29. In combination, in a separator for separating fine material and dropping coarser material as tailings, driven material supply means for supplying material to be separated to said separator, discontinuable drive means in operative relation to and for driving said supplying means, and tailings weight operated drive control means for controlling operation of said separator comprising a weight operated vertically movable tailings receiver for receiving and conveying such tailings from said separator, and tailings weight operated drive discontinuance means responsive to variations in the weight of the stream of such tailings flowing on to said receiver for discontinuing driving relation between said driving means and said supplying means to discontinue said supply of such material with increase in such weight of such tailings flowing on to said receiver.

30. In combination, in a separator for separating fine material and dropping coarser material as tailings, variable speed revoluble material supply means for supplying material to be separated to said separator, variable speed revoluble blower means for causing a separating fluid current to flow in said separator for floating fine material therefrom, and tailings weight operated operation control speed reducer means for reducing speed of revolution of said supply means and of said blower means for reducing such supply and for reducing the speed of flow of such separating current comprising a weight operated vertically movable tailings receiver for receiving and conveying such tailings from said separator, and tailings weight operated speed reducer operator means responsive to variations in the weight of the stream of such tailings flowing on to said receiver for reducing such supply and such speed of flow of such separating current with increase in the weight of such tailings flowing on to said receiver.

31. In combination, in a separator for separating fine material and dropping coarser material as tailings, means affording a separating chamber, revoluble material distributor means for supplying material to be separated in said chamber, discontinuable drive means for revolving said distributing means, and tailings weight operated operation control means for discontinuing revolution of said supplying means comprising a weight operated vertically movable tailings receiver for receiving such tailings from said separator, and tailings weight operated drive discontinuance means responsive to variations in the weight of the stream of such tailings flowing on to said receiver for discontinuing revolution of said supplying means with increase in the weight of the stream of such tailings flowing on to said receiver.

32. In combination, in a separator for separating fine material and dropping coarser material as tailings, means affording a separating chamber, variable material supply means for supplying material to be separated in said chamber, variable speed revoluble blower means for causing a fluid current to flow in said separator for floating fine material therefrom, and tailings weight operated control means for controlling operation of said supplying means and of said current means comprising a weight operated vertically movable tailings receiver for receiving such tailings from said separator, and tailings weight operated supply and speed reducer means responsive to variation in the weight of the stream of such tailings flowing on to said receiver for reducing such supply and for reducing the speed of revolution of said current means with increase in the weight of such stream of tailings flowing on to said receiver.

33. In combination, in a separator for separating fine material and dropping coarser material as tailings, means affording a separating chamber having a lower current inlet and an upper current outlet, material supply means for supplying material to be separated in said chamber comprising a material downward inlet conduit above and depending through said outlet, revoluble distributor means in said chamber and spaced below said conduit for receiving and distributing such material, and revoluble radially adjustable material stirrer means carried by and revolving with said distributing means and extending upwardly therefrom into said conduit for stirring such material in said conduit to facilitate flow of such material to said distributing means, and stirrer adjustment means for adjusting said stirrer means radially relatively to said conduit, to facilitate such stirring.

34. In combination, in a fluid current separator, a casing enclosing a seperating chamber and having a current inlet and an upper current outlet and a lower discharge for unseparated material, material supply means for supplying material to be separated in said chamber, revolving blower means above said outlet for causing a fluid current to enter said chamber through said inlet and flow up through said outlet for separating and floating fine material from said chamber, and blower means power operated

separating chamber jarrer means above said inlet and normally in operative relation to and power operated by said blower means for jarring said separating chamber to facilitate discharge of unseparated material therefrom.

35. In combination, in a fluid current separator, a casing enclosing a separating chamber and having a current inlet and an upper current outlet and a lower discharge for unseparated material, material supply means for supplying material to be separated in said chamber, relatively high speed revolving blower means for causing a fluid current to flow up through said chamber and upper outlet to separate and float fine material from said chamber, speed reducer jarrer operator means in operative relation to and power operated by said blower means, and relatively slow speed blower means power operated separator chamber jarrer means above said current inlet and in operative relation to and operated by said speed reducing means for jarring said separating chamber to facilitate discharge of unseparated material therefrom.

36. In combination, in a fluid current separator, a casing enclosing a separating chamber and having a current inlet and an upper current outlet and a discharge for unseparated material, material supply means for supplying material to be separated in said chamber, relatively high speed revolving blower means above said outlet for causing a fluid current to flow up through said chamber and through said outlet to separate and float fine material from said chamber, relatively low speed intermittent jarrer operator means in operative relation to and slowly operated by said blower means, and intermittent blower means power operated separating chamber jarrer means above said current inlet and in operative relation to and slowly intermittently power operated by said slow speed intermittently acting jarrer operating means for jarring said chamber to facilitate flow of unseparated material therefrom.

37. In combination, in a fluid current separator, a casing enclosing a separating chamber and having a current inlet and an upper current outlet and a lower discharge for unseparated material, material supply means for supplying material to be separated in said chamber, variable speed revolving blower means for causing a fluid current to flow up through said chamber and upper outlet to separate and float fine material therefrom, variable speed revolving jarrer operator means, variable speed drive means for driving said revolving means at variable speed, and variable speed power operated separating chamber jarrer means above said current inlet and in operative relation to and operated at variable speed by said variable speed jarrer operating means for jarring said separating chamber at variable speed for facilitating discharge of unseparated material therefrom.

38. In combination, in a fluid current separator, a casing enclosing a separating chamber and having a current inlet and an upper current outlet and a lower discharge for unseparated material, material supply means for supplying material to be separated in said chamber, revolving blower means above said chamber for causing a fluid current to enter said chamber through said inlet and flow up through said outlet for separating and floating fine material from said chamber, drive means for revolving said blower means, and radially actuated power operated separating chamber jarrer means above said current inlet and in operative relation to and operated by said driving means and acting radially of said chamber for jarring the latter to facilitate discharge of unseparated material therefrom.

39. In combination, in a fluid current separator, an outer casing enclosing an outer chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber and having a lower current inlet and an upper current outlet communicating with said outer chamber, material supply means for supplying material to be separated within said separating chamber, revolving blower means above said outlet and between said casings for causing a fluid current to flow up through said separating chamber and upper outlet into said outer chamber and return through said lower inlet to separate and float fine material from said separating chamber into said outer chamber, filter means encircling said lower inlet for cleaning from such returning current fine material floating in such current flowing toward said inlet, drive means above and for operating said blower means, power operated jarrer operator means above said separating chamber and operated by said driving means, and radially actuated power operated cleaning means jarrer means, disposed above said current inlet and acting radially of said cleaning means, and below and in operative relation to and operated by said jarrer operating means, for radially power jarring said cleaning means to facilitate flow of fine material therefrom.

40. In combination, in a fluid current separator, a casing enclosing a separating chamber and having a current inlet and an upper current outlet and a lower discharge for unseparated material, material supply means for supplying material to be separated in said chamber, revolving blower means above said upper outlet for causing a fluid current to enter said chamber through said inlet and flow up through said outlet to separate and float fine material from said chamber,

drive means for revolving said blower means, and power operated separating chamber jarrer means above said current inlet and comprising a hammer moving radially of and impactively acting radially toward and relatively to said separating chamber, and hammer power operator means above said chamber and in operative relation to said driving means for operating said hammer to jar said separating chamber radially to facilitate flow of unseparated material therefrom.

41. In combination, a fluid current separator, a casing enclosing a separating chamber and having a current inlet and an upper current outlet and a lower discharge opening for unseparated material, material supply means for supplying material to be separated in said chamber, revolving blower means above said outlet for causing a fluid current to enter said chamber through said inlet and flow up through said outlet for separating and floating fine material from said chamber, drive means above and for revolving said blower means, separating chamber jarrer means above said current inlet and below said blower means, and power operated jarrer means operator means without and above and extended below and past said blower means and in operative relation to and power operated by said blower driving means above said blower means, and in operative relation to and power operating said jarring means below said blower means, for power jarring said separating chamber to facilitate discharge of unseparated material therefrom.

42. In combination, in a fluid current separator, an outer casing enclosing an outer chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet and an upper current outlet communicating with said outer chamber and affording an endless current path up through and down around said separating chamber, material supply means for supplying material to be separated within said separating chamber, blower means for causing a fluid current to circulate up through and down around said separating chamber to separate and float fine material into said outer chamber, radially actuated power operated jarrer means above said lower inlet and around said separating chamber, and radially movable filter means across and encircling such path and movable radially of such separating chamber, for cleaning from such current fine material floating in such current, and in operative relation to and radially jarred by said jarring means, to facilitate flow of fine material from said radially movable cleaning means.

43. In combination, a casing enclosing a dust chamber and affording a current passage above said dust chamber, blower means for causing a dust laden fluid current to flow through said passage to float dust into said dust chamber, and dust filter means for intercepting fine material floating in such current comprising hollow outer sided spaced vertically extended baffle members disposed across said passage with their outer hollow faces opposed to the direct path of such current and opening into and communicating with said dust chamber for discharging such intercepted material into said dust chamber, valve means without and in-seated toward said hollow outer faces for closing the lower ends of said baffles, and valve outward faced seat means at the outer side of said hollow faces co-operating with said valve means for closing communication between said hollow faces and said dust chamber.

44. In combination, a casing enclosing a dust chamber and affording a current passage above and communicating with said dust chamber, blower means for causing a dust laden fluid current to flow through said passage to float dust into said dust chamber, and dust filter means for intercepting fine material floating in such current comprising hollow outer faced vertically extended valve seated spaced baffle members across said passage with their hollow outer faces communicating with said dust chamber, and inwardly seated valve means outwardly of and seated inwardly against and closing toward said hollow outer faces for closing communication between said faces and said dust chamber, said baffles and valve means the one without and embracing the other.

45. In combination, a casing enclosing a dust chamber and affording a current passage communicating with said chamber, blower means for causing a dust laden fluid current to flow through said passage to float dust into said dust chamber, and dust filter means for intercepting fine material floating in such current comprising spaced vertically extending hollow outer faced baffle members disposed across said passage with their hollow outer faces opposed to the direct path of such current and communicating with and for discharging such intercepted material into said dust chamber, valve means movable toward the hollow lower ends of said baffles for controlling such communication, and valve seat outward faces on said baffles and opposite and co-operating with said valve means for closing such communication.

46. In combination, a casing enclosing a dust chamber and affording a current passage communicating with said chamber, blower means for causing a dust laden fluid current to flow through said passage to float dust into said dust chamber, and dust filter means for intercepting and discharging into said dust chamber fine material floating in such current comprising vertically extended valve seated spaced inclined end hollow outer faced

baffle members disposed across said passage with their hollow outer faces opposed to the direct path of such current and communicating with and for discharging such separated material into said dust chamber, said baffles having lower ends inclined relatively to their vertical extension and affording inclined valve seat faces, and valve means opposite and movable toward and co-operating with said inclined ends for closing communication between said hollow faces and said dust chamber.

47. In combination, a casing enclosing a dust chamber and affording a current passage communicating with said chamber, blower means for causing a dust laden fluid current to flow through said passage to float dust into said dust chamber, and dust filter means for intercepting and discharging into said dust chamber fine material floating in such current comprising spaced vertically extended hollow faced baffle members disposed across said passage with their hollow faces opposed to the direct path of approach of such current and in communication with said dust chamber, said baffles having valve seat faces at their lower ends, and counter-balanced valve means opposite and co-operating with said seating faces for closing such communication through said hollow faces.

48. In combination, a conical casing enclosing a conical chamber and affording an inner annular current passage communicating with said conical chamber, blower means for causing a dust laden fluid current to flow through said passage, and dust filter means for intercepting and discharging into said chamber fine material floating in such current comprising spaced vertically extending inclined end hollow outer faced baffle members disposed across said passage with their outer hollow faces opposed to the direct path of such current, said baffle members at their lower ends in communication with and for discharging such intercepted material into said conical chamber, said baffle members having downwardly and inwardly beveled outer lower edges inclined relatively to the vertical axis of said conical casing and similarly to the inclination of the latter, to afford clearance for such discharge between the lower ends of such baffles and said conical casing, and valve means without and opposite and for closing said beveled ends.

49. In combination, a circular casing enclosing a dust chamber and affording an annular endless current passage within and concentric of and communicating with said dust chamber, blower means for causing a dust laden fluid current to circulate through said passage in the form of a vortex ring for floating dust into said dust chamber, and annular fluid exhaust means below and concentric of such passage affording an annular current withdrawal outlet communicating from within to without said casing for withdrawing fluid from within to without such casing below the path of circulation of such current.

50. In combination, a circular casing enclosing a dust chamber and affording an annular current path communicating with said chamber, blower means for causing a dust laden fluid current to flow through said path for floating dust into said dust chamber, fluid withdrawal outlet means below said path communicating from within to without said casing for withdrawing such current from within to without said casing, and annular valved withdrawn current dust filter means around and encircling said withdrawal outlet for intercepting fine material floating in such current flowing toward said outlet comprising spaced vertically extending hollow faced baffle members disposed across said withdrawal passage with their hollow faces opposed to the direct path of such current and having valve controlled lower ends below and around said outlet for discharging within said casing and without and below said outlet such intercepted material flowing toward said outlet, and valve means below said outlet and around and for controlling current passage through said filter means.

51. In combination, an outer casing enclosing a settling chamber, an inner casing within and in spaced relation to said outer casing and enclosing a separating chamber having a lower current inlet and an upper current outlet communicating with said outer chamber and affording an endless annular current path up through and down around said inner casing, material supply means for supplying material to be separated to said separating chamber, blower means for causing a fluid current to circulate up through and down around said separating chamber in the form of a vortex ring to separate and float fine material into said settling chamber, vertically movable annular valve means concentric of such path for varying the space through which such current is permitted to flow to vary the fineness of such separation, vertically movable valve down pusher compression means above and spaced equi-distantly around and for vertically varying said valve means, vertically movable spaced valve down pusher levers carrying and for down moving said pushing means, lever link means connecting and for synchronously and simultaneously similarly vertically swinging said levers, and lever operator means without said casing and connected to for simultaneously similarly vertically moving said levers.

52. In combination, a circular casing enclosing a settling chamber, an inner casing within and in spaced relation to said casing and enclosing a separating chamber having a lower current inlet and an upper current outlet communicating with said settling

chamber and affording an annular endless current passage up through and down around said inner casing, material supply means for supplying material to be separated in said separating chamber, revoluble fan blades between said casings for causing a separating fluid current to circulate in the form of a vortex ring up through and around said separating chamber to separate and float fine material into said settling chamber, vertically movable annular valve means concentric of said passage for varying the space through which such current is permitted to flow to vary the fineness of such separation, and valve operator means comprising vertically movable valve down pusher means concentric of and above and for vertically down pushing said valve means, and valve down pusher operator operating means without said circular casing and above and operatively connected to and for operating said down pushing means to uniformly vertically down push said valve means.

53. An air separator comprising, in combination, a casing having a separating chamber and a settling chamber, a fan above the separating chamber for causing air to circulate through said chambers, said fan having blades with outer edges oblique to the axis of rotation of the fan, and a frusto-conical lining plate in the casing adjacent to the oblique edges of the blades and cooperating therewith to promote the velocity of the air passing through the settling chamber.

54. An air separator comprising, in combination, an outer casing having a cylindrical portion and a head at the upper end of the cylindrical portion, an inner casing containing a separating chamber and spaced from the outer casing to provide a settling chamber, a fan above the separating chamber beneath said head, and a removable frusto-conical lining plate encircling the fan and located adjacent the juncture of the head with the cylindrical portion of the outer casing, said frusto-conical plate and fan cooperating to promote velocity of the air passing down through the settling chamber.

In witness whereof, I have hereunto signed my name.

GEORGE HOLT FRASER.