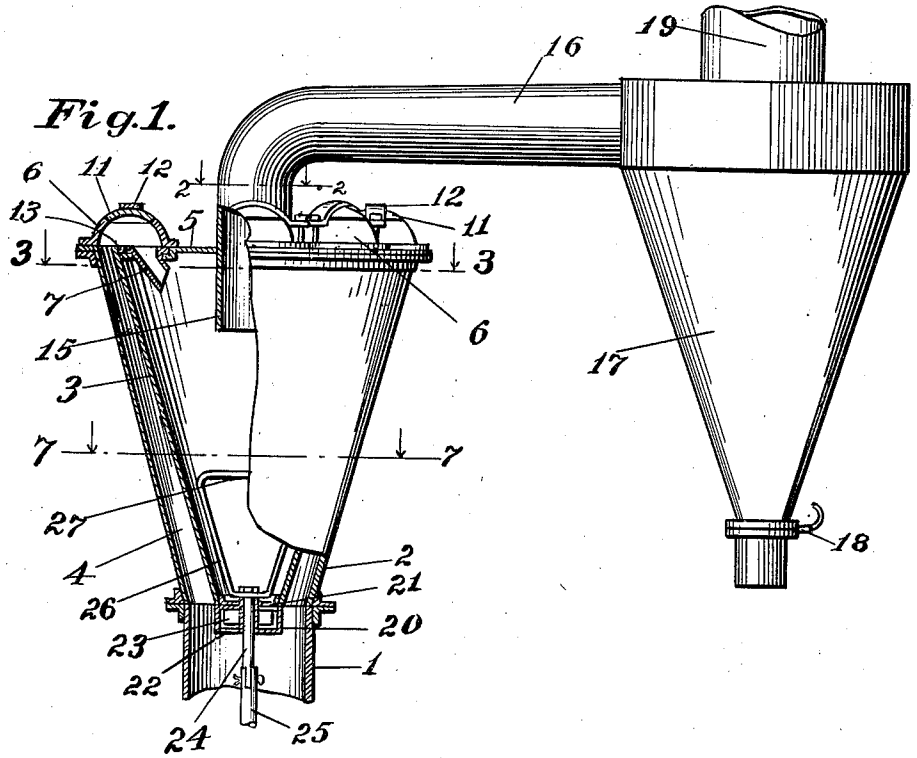
March 22, 1938. J. PETERSEN 2,111,725

SEPARATOR

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Fig. 1.



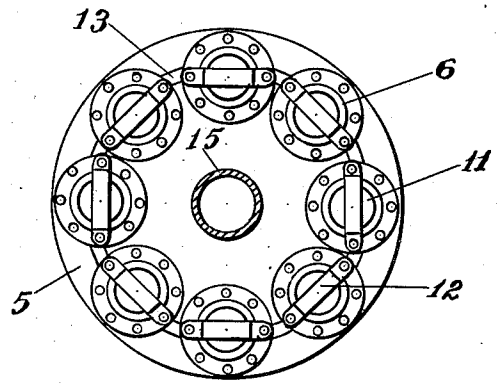


Fig. 2.

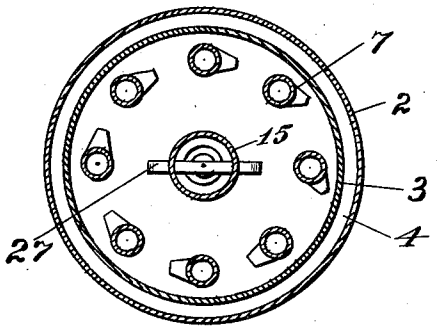


Fig. 3.

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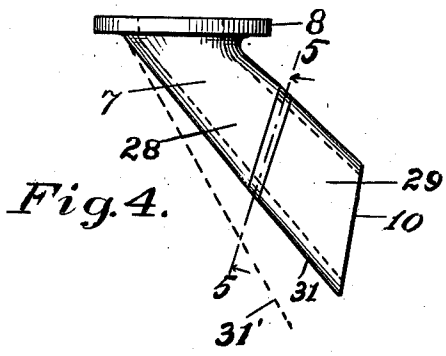


Fig. 4.

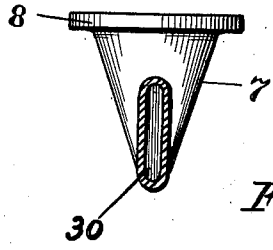


Fig. 5.

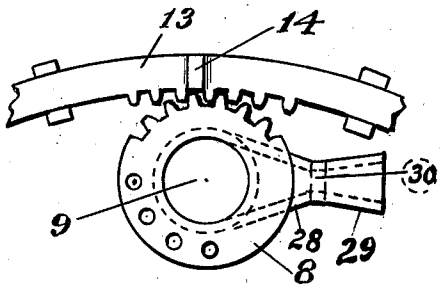


Fig. 6.

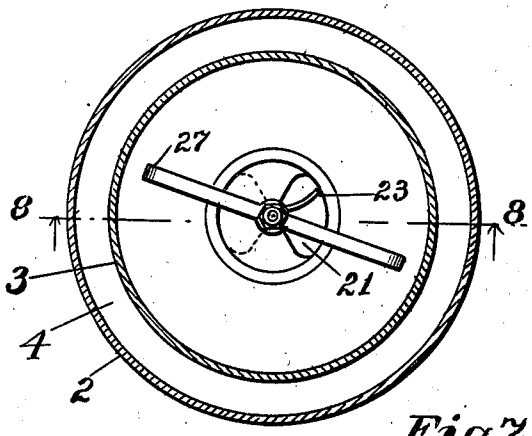


Fig. 7.

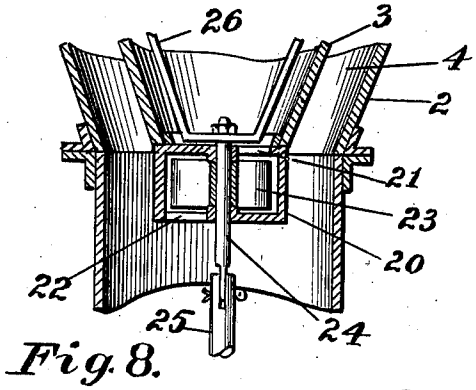


Fig. 8.

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2,111,725

SEPARATOR

James Petersen, St. Louis, Mo.

Application February 25, 1937, Serial No. 127,671

10 Claims. (Cl. 209—144)

This invention relates to certain new and useful improvements in separators, the peculiarities of which will be hereinafter fully described and claimed.

More specifically, this invention relates to multiple inlet separators and can be used with practically any make of pulverizer and air system operating to reduce and separate the finer particles in grinding coal, lime-stone, sawdust, fibre, chemicals, ore, etc.

The main objects of my invention are to provide means to produce uniform multiple jets of material laden air currents and direct said jets in various adjusted directions more or less tangential to a concentric conical plane through said jets or parallel circumferentially to respectively adjacent portions of the inner face of a separator without changing the size of its jets nor diminishing their velocity. I thus avoid changing the size of the jets as is usually done by bringing closer together pivoted vanes defining inlet spaces, and provide instead a uniform discharge into the separator, a uniform velocity in any adjusted direction, an increased capacity, and also prevent or remove any lodgment of the material on said inner face tending to obstruct the desired separation. In other words, I change the direction of the jets entering the separator without varying the size of the jets themselves, and have full control over the adjustment of multiple rotary spouts adjustably mounted so as to turn the depending discharge ends of said spouts in the desired directions.

Another object is to provide such a discharge opening for my multiple spouts delivering said jets so as to facilitate primary separation of the coarsest tails particles of such material from the medium and finer particles.

Another object is to avoid clogging the outlet for said tails and facilitate their discharge from the separator.

Another object is to provide such construction that any one of my multiple spouts can be removed, replaced, or independently adjusted.

Another object is to provide for adjusting said spouts simultaneously.

Another object is to simplify construction and operation, avoid expensive and unreliable mechanical movements, provide complete control of air currents, and reduce air drag.

In the accompanying drawings in which like reference numerals indicate corresponding parts,

Fig. 1 represents a cyclone collector connected to my separator, the latter shown partly in section;

Fig. 2, a plan view of my separator and section on the line 2—2 Fig. 1 of the outlet pipe for fines;

Fig. 3, a sectional plan view on the line 3—3 of Fig. 1 just below the top wall, showing the multiple spouts arranged more or less parallel to respectively adjacent portions of a separating cone;

Fig. 4, an enlarged detail side view of one of my multiple spouts;

Fig. 5, a front view of the same showing the vertically disposed discharge opening with constricted portion in section on 5—5 of Fig. 4;

Fig. 6, a plan view of the same showing pin holes in the flange and a portion of a master ring geared thereto for simultaneous adjustment of the spouts;

Fig. 7, a sectional plan view on the line 7—7 of Fig. 1, showing an agitator at the coarse tails outlet; and

Fig. 8, an enlarged partial sectional elevation of the lower end of Fig. 1, showing a discharge valve for the tails outlet.

Referring to the drawings, the numeral 1 designates the upper end of an upward discharge pipe of a pulverizer, such as a roller mill. On this discharge end is mounted an upwardly flaring conical casing 2 provided with inner cone 3 forming with said casing, an upwardly flaring annular space 4 for guiding the material-laden air from the pulverizer to definite points above a top wall 5 for the cone and its casing, where the upward currents meet curved deflectors 6 located above openings in said top wall, wherein are mounted multiple adjustable spouts 7. These spouts extend below said top wall 5 near the inner face of the cone in a downwardly slanting direction about 45 degrees, and consist of a top flange portion 8 supporting its respective spout in its recessed opening in said top wall. The inlet 9 of said spout is circular and the side walls of the depending portion 7 are brought toward each other to form a discharge opening 10, Fig. 5, which is narrow horizontally as compared with its height vertically. A slit discharge opening is thus formed adapted to direct a relatively thin jet of material-laden air spirally within said inner cone, and more or less parallel to respectively adjacent portions of said cone according to the rotated adjustment of the said spouts.

The spout portions are thus mounted inside of and spaced away from the inner face of the separating cone.

Said curved deflectors 6 are mounted above said upper wall 5 over respective spouts, and are

provided with a cap 11 secured by a clamp 12 or otherwise so as to form a continuous deflecting surface to guide the material-laden air currents from the upper end of the annular space 4 into the respective spouts.

The cap 11 is available for a hand hole through which the adjacent spout may be turned by hand, and may be removed or replaced when desired. The said deflectors are shown as hemispherically curved, but may be otherwise formed to guide the said currents to the inlet of said spouts.

Each of these spouts is loosely fitted in the recess for the flange in the top wall and a series of holes are provided in said flange for reception of a pin passing into a matching hole in the top wall, by which the spout is prevented from turning out of its adjusted position while operating.

The said flange 8 is provided with a series of teeth on a quadrant of its periphery as shown in Fig. 6. These teeth mesh with rack teeth on a master ring 13 similarly engaged with all the spouts so that said spouts can be turned simultaneously by means of upward projections 14 from said ring, operated by hand or otherwise.

As illustrated in Figure 3 it is evident that the spout portions when directed more or less parallel to the adjacent portions of the cone, will send their respective streams outward and downward without interference from each other or with the spout respectively in front. Thus the streams of material-laden air are not crossing each other in normal direction, but will make a sliding contact with the inner face of the cone without diminishing velocity and said streams will merge into a downward spirally moving stream of particles in which the heaviest particles by the centrifugal force are caused to hug the inner face of the cone while the lighter particles are caught in the vortex and drawn upward through tubular.

When said spouts are disposed more or less parallel to the inner cone as shown in Fig. 3, the thin vertical jets discharged therefrom have a downward spiral motion of such velocity that the centrifugal force causes the particles to hug the inner face of said cone as they spiral downward. The heaviest and coarsest particles discharged from the said opening 10 tend to leave said vertical opening by the lower portion of the discharge end and gravitate spirally downward towards the bottom end of said cone, while the finer particles tend to spiral around near the central vortex produced by said currents till they emerge through the tubular 15 depending from the center of said top wall 5 and below the discharge ends of said spouts. This tubular is connected by a pipe 16 to a cyclone collector 17, or other suitable collector for the finer particles passing upward through the tubular under the impulse of an exhaust fan (not shown) connected to the outlet of the cyclone 19. The bottom of said cyclone has a cut off slide 18.

Such connection to an exhaust fan is usual when a roller mill is used to pulverize material.

When the discharge pipe 1 is that of a hammer mill for instance which produces a blast of air currents carrying the material upward into the separator above described, the outlet 19 of said cyclone, only serves for the discharge of purified air currents.

The lower end of the inner cone is provided with a valvular outlet consisting of a cylindrical box 20 having an inlet opening 21 at the top, and an outlet opening 22 at the bottom which does not match with the inlet opening. Within said box is mounted a wheel having radially curved blades 23 snugly fitting said box and rotated by a vertical shaft 24, pivoted at its lower end or otherwise flexibly connected to the upper end of the roller shaft 25. Other means for rotating the wheel and agitator may be employed. Said coarse particles collecting in the bottom of the inner cone, are prevented from clogging or lodging by an agitator consisting of upwardly flaring arms 26 adjacent to the inner face of the cone and preferably connected by a cross band 27. Any lodgement of material in the bottom of said cone, is thus scraped off by said arms and caused to enter the opening 21 of the box and be discharged through the opening 22 by said wheel blades. The spaces between said blades being filled with the material form a constant choke and valvular outlet for returning the course particles to the mill, without causing interference with the partial vacuum of said inner cone.

In separating certain gummy or adhesive pulverized material such as titanium pigment it has a tendency to lodge upon the inner face of said cone. To overcome such lodgment, or to remove it when formed, the multiple spouts are rotated so as to discharge their contents forcibly against the inner face of the cone and thus tend to scour said face and prevent forming or remove any portions of material lodged thereon. The velocity of discharge from said openings 10 of the multiple spouts is maintained substantially uniform in any disposed position of said spouts as above described. The discharge openings 10, vertically disposed, tend to preserve a free discharge of the material-laden air currents in thin jets moving spirally downward when more or less parallel to the inner cone. If desired they may be turned so as to discharge more nearly radial towards the central vortex, in the separation of certain pulverized material; or as above stated, they may be turned more or less oblique to cause the jets to impinge more directly upon the inner face of said cone,—and all of such adjustments can be made without varying the size of the discharge openings or velocity of said jets.

Referring again to Figs. 4, 5, and 6, the sides of the spout 7 are inclined toward each other from the circular inlet 9 as indicated at 28 and then they flare outward at a lesser inclination to each other and a greater length at 29 than at 28. Where these two converging and diverging portions of the spout nearly meet each other there is a straight laterally constricted portion 30, having parallel side walls forming a vertically elongated throat passage.

The top and bottom walls diverge from each other from the inlet to the outlet as shown. This form of spout is on the principle of a Venturi meter by which the constricted area of the throat 30 is considerably compensated for by my preferred lateral constriction (instead of the usual conical cylindrical form) and the discharge increased over the amount discharged through a uniformly converging spout portion. I do not confine myself to the particular form of spout portion 7 herein shown but show this as one form by which my multiple rotary spouts can be used with a separator cone, as I wish to lay broad claim thereon.

Wherever a flow of material-laden air passes from a constricted passage, more or less of an eddy is usually formed at the discharge end of said passage. In previous constrictions by which inclined vanes define such a passage, considerable deposit of material is made adjacent to said discharge opening and interferes with the

proper action of the separator until such deposit is removed. This interference and lessening of efficiency is commonly known as "air drag". In previous constructions using vanes, whether fixed or adjustable, for passages directing such material, the air drag is greater than with my construction herein exemplified. The function of rotating the spouts to scour from the adjacent surface of the cone in deposits that may be made, especially when sticky material is being separated, largely eliminates the difficulty heretofore experienced as above mentioned. Also the Venturi form of spout portion gives increased discharge from the spouts over the quantity that would otherwise be discharged from a constricted opening; such Venturi form is therefore my preferred form of spout portion in my rotatable flanged spouts for separators.

While 45 degrees for the inclination of the bottom 31 of said spout portion is the preferred construction as stated above, I may increase this inclination to about 60 degrees to the horizontal and practically parallel to the adjacent cone when the spout is so adjusted. Such parallel inclination downward to a greater degree than that of 45, as indicated by dotted line 31' in the drawings, will allow of a longer vertical dimension for the discharge opening, and correspondingly increase the area of outlet.

In separating porcelain frit, a vitreous abrasive substance, there is danger of its being contaminated by minute particles of iron scraped from the iron surfaces exposed to impact of the frit. It is known that a very small portion gaining admission to the finished product,—even as little as 27/100 of 1%,—will discolor the porcelain glaze made from such frit. In order to minimize this danger of contamination when operating on frit or the like, my rotatable inlet spouts and the deflectors may be made of glass, or other non-contaminating material such as ceramic products containing no iron.

As shown in Fig. 1, the inner portion of the flange 8 is slightly overlapped by the adjacent portion of the deflector 6. The outer portion of the flange however is easily lifted and the slant of the spout portion allows the withdrawal of the spout as above described.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A separator comprising an inverted cone for separation of material-laden air having a top wall provided with multiple openings near the inner face of said cone, multiple spouts rotatably mounted in said openings and inclined downward approximately 45 degrees and each having a supporting flange with a circular inlet and a depending spout portion with side walls brought toward each other forming a vertically elongated outlet, means to direct the material-laden air to the spout inlets, and means to remove separated coarse and finer particles from said cone, substantially as described.

2. A separator comprising an inverted cone for separation of material-laden air having a top wall provided with multiple openings near the inner face of said cone, multiple spouts each having a supporting flange and downwardly inclined spout portion rotatably and removably mounted in its respective opening, curved deflectors detachably mounted above said spout inlets providing access to said spouts, means to deliver material-laden air to said deflectors, and means to remove separated coarse and finer particles from said cone, substantially as described.

3. A separator comprising an inverted cone for separation of material-laden air currents and having outlets respectively for coarse and finer particles and having a top wall with multiple openings, spouts having each a supporting flange with toothed segment and a depending spout portion rotatably adjustable in its respective opening, a master ring having teeth meshing with respective segments, means to rotate said ring to adjust said spouts simultaneously, an outer casing spaced from said cone forming an upwardly flaring annular space subject to upward passage of material-laden air currents, and curved deflectors above said passage and spouts to guide said currents to said spouts, substantially as described.

4. A separator for pulverized material-laden air currents having, in combination an inverted separating cone fed by multiple spouts mounted inside of and spaced away from the adjacent inner face of said cone near its top and each characterized by a circular inlet end having a horizontal flange and a downwardly inclined straight bottom in its spout portion the side walls of which are inclined toward each other forming a vertically elongated passage substantially as described.

5. A separator having, in combination an inverted cone having respective outlets for coarse tails and finer particles and having a top wall with multiple openings, multiple spouts rotatably mounted in said openings and characterized by supporting flanges at their upper inlet ends having toothed segments and having inclined spout portions extending below said wall, a master ring having teeth meshing with respective segments for simultaneous rotated adjustment of said spout portions relative to the inner face of said cone, and means to deliver material-laden air currents to the inlet ends of said spouts, substantially as described.

6. A separator comprising an inverted cone having a top wall provided with multiple openings near the inner face of said cone, and multiple depending spouts mounted in said openings and extending down below said top wall, to direct the material-laden air passing therethrough in streams substantially parallel circumferentially to the adjacent wall of said cone and each spout disposed outward and downward to direct its stream independently of and without interference with the other streams from said spouts, substantially as described.

7. A separator comprising an inverted cone for separation of material-laden air having a top wall provided with multiple openings near the inner face of said cone, multiple depending spouts mounted in said openings and each having a bottom inclined straight from inlet to outlet below said wall and spaced away from the inner face of said cone, means to direct the material-laden air to the spout inlets, and means to remove separated coarse and finer particles from said cone, substantially as described.

8. A separator having, in combination a separating cone having a top wall, and multiple depending spouts characterized by their upper inlet ends being rotatably mounted in the upper face of said wall adjacent the top of said cone and their depending spout portions inclined downward and spaced away from the inner face of said cone, and means to rotatably adjust said spouts, substantially as described.

9. A separator having, in combination a sep-

arating cone having a top wall, and multiple depending spouts characterized by their upper inlet ends being mounted in the openings of said wall and their depending spout portions inclined downward below said wall and spaced away from the inner face of said cone, and having their side walls inclined toward each other and then flaring outward forming a laterally constricted portion of the passage intermediate of the inlet and outlet ends and the top and bottom walls diverging from each other from the inlet to the outlet, substantially as shown and described.

10. A separator having, in combination an inverted cone forming a separating chamber having a top wall provided with a series of openings near said cone each having a recess in the upper face of the wall, rotatable spouts each having a flange adjustably mounted in said recess and having depending inclined spout portions extending below said wall and spaced away from the inner face of said cone, means to prevent said spouts turning out from adjusted position while operating, and means to supply material-laden air to said spouts, substantially as described.

JAMES PETERSEN.