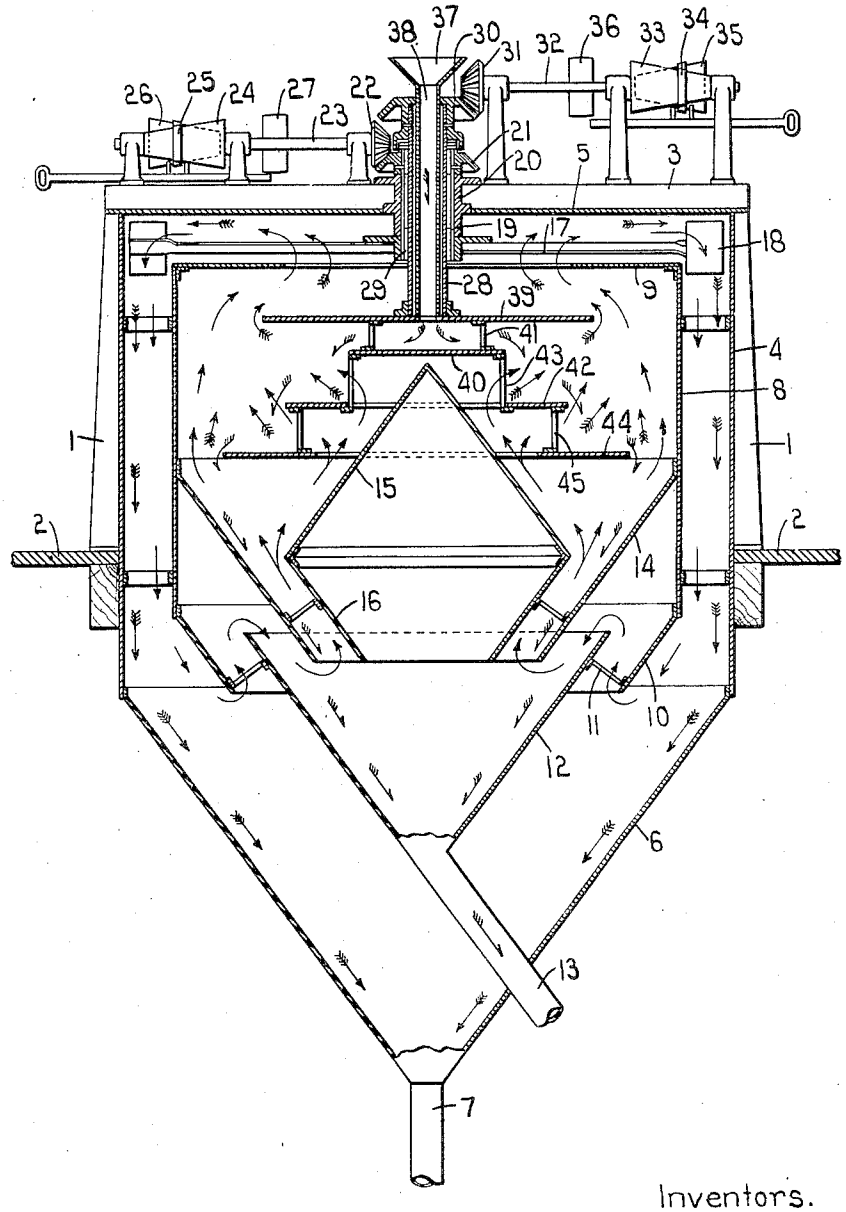
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AIR SEPARATOR.

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AIR-SEPARATOR.

1,346,015. Specification of Letters Patent. Patented July 6, 1920.

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To all whom it may concern:

Be it known that we, WILLIAM A. GIBSON, a citizen of the United States, and resident of Allentown, county of Lehigh, State of Pennsylvania, and CHARLES E. NEEDHAM, a citizen of the United States, and resident of Allentown, county of Lehigh, State of Pennsylvania, have invented an Improvement in Air-Separators, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to improvements in air separators in which a mass of finely ground pulverized or comminuted material is projected, preferably by centrifugal force, across the path of ascending air currents which winnow out the finer particles and deliver the same to a suitable receiving means while the heavier and coarser material is delivered to a separate receptacle.

The object of the invention broadly stated is to produce an apparatus of greater efficiency and capable of better control and more accurate regulation than has heretofore been accomplished.

More specifically the invention comprises certain improvements in air separating mechanism of the type illustrated in the following patents; Emerick No. 826,772, granted July 24, 1906; Emerick No. 877,557, granted January 28, 1908; and Emerick No. 928,953 granted July 27, 1909.

In the prior art as exemplified by these patents the force of the air currents have been regulated by controlling the speed of the fan which creates the air circulation within the device and also by various types of internal valves which may be adjusted to vary the course of the air currents. The proper adjustment of these valves is difficult under service conditions and the valves often are caused to stick by the accumulation of material upon them, furthermore the structures in which such valves are used are lacking in the rigidity desirable in apparatus of this character.

One of the principal objects of the present invention is to produce a structure in which all valves are eliminated and to provide means for properly correlating the force of the air current to the amount and character of the material being treated. This is accomplished in the preferred embodiment of the invention disclosed herein by providing means for rotating the distributing means independent of the means which produce the circulation of air within the device.

Another object of the invention is to provide a rotary distributing means by which the material being treated will be caused to cascade in a plurality of series of showers across the paths of ascending air currents whereby a more effective separation of the fines from the tailings will be produced.

Another object of the invention is to provide means for so directing the paths of the air currents as to increase the efficiency of their action upon the material.

Another object of the invention is to eliminate the dead air space in the central portion of the structure which in the present machines permits the fine dust to settle into the tailings hopper.

Another object of the invention is to provide a substantial and rigid structure having no relatively adjustable parts.

Another object of the invention is to provide concentric means for rotating the fan shaft which produces the air circulation and the distributing mechanism which will be economical in construction and effective in operation.

Other objects of the invention will more fully appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

The drawings illustrate a vertical central sectional view of a preferred form of apparatus embodying our invention, the driving gear mechanism being shown in elevation.

The apparatus illustrated in the accompanying drawings includes the usual frame consisting of posts 1 resting upon the floor 2 and supporting at their upper ends girders 3 which carry the superstructure including the driving mechanism. The air separator comprises the usual outer and inner casings spaced apart with means for causing the air to circulate upwardly through the inner casing and downwardly through the space between the inner and outer casing, the mechanism illustrated herein comprising a fan carried by a hollow vertical

shaft located in bearings centrally of the casing. The material is distributed by a rotating member or disk carried by a hollow shaft which is rotated independently of the fan. The material is delivered to the distributing member or disk by a hopper having a feed pipe leading centrally through the hollow shaft which actuates the distributing member. The novel mechanism for directing the air currents contained within the inner casing will be more fully described hereinafter.

The outer casing comprises a preferably vertical cylindrical portion 4 having a closed top 5 preferably secured to the girders 3 and a downwardly extending conical portion 6 forming a hopper for the fines which leads to a discharge pipe 7. The inner casing comprises a preferably cylindrical portion 8 concentric with the wall 4 of the outer casing having a top or cover 9 which partially closes the upper end of the inner chamber and is located at a sufficient distance below the top 5 of the outer casing to give the proper air space and to permit the rotation of the arms of the fan therein.

The inner casing is provided at its lower end with a downwardly converging member 10 which supports, by means of a series of brackets 11, the downwardly extending conical discharge hopper 12 for the tailings, the lower end of said hopper leading to a tailing spout 13.

A downwardly converging deflector 14 is secured to the cylindrical wall 8 of the inner casing at a distance above the lower end of the same and extends into the mouth of the hopper 12, the wall of the deflector preferably being parallel to the lower conical member 10 of the inner casing.

The deflector 14 supports a central filler which preferably is of double conical structure, the upper portion 15 of which extends into the distributing mechanism while the lower portion 16 desirably is truncated preferably terminating in substantially the same plane as the lower end of the deflector 14. This central filler serves the double function of eliminating the central dead air space and of guiding the paths of air currents through the material as will more fully appear hereinafter.

The wall of the lower conical portion 16 preferably is parallel to the wall of the deflector 14 and is spaced therefrom a suitable distance preferably equal to the width of the space between the walls 12, 14 and 10, 12. By reason of this construction, the ascending air current follows the sinuous path indicated by the arrows and crosses the path of the descending material thus adding to the effectiveness of the separation as will more fully appear hereinafter.

In the usual construction illustrated in the patents above mentioned the circulation of the air within the casing is produced by a fan which is located between the upper portions of the inner and outer casings and the material is distributed by the centrifugal action of a disk carried by the fan shaft. Various means, such as retarding rings or screens, have been used to control the path of the material which is projected from the rotating distributer but in all cases as far as we are aware a single distributing means has been provided which permits the material to fall in a circular shower.

In the present invention we have provided means for causing the material to cascade in a series of circular showers of progressively increasing diameter and have provided means by which currents of air are caused to pass through each of these showers so that all of the finer material will be caught by the various currents and carried off and the tailings will thereby be rendered free of fines.

In the preferred embodiment of the invention illustrated herein the air current is produced by a fan 17 having its vanes 18 located within the space between the inner and outer casings and deflected so as to produce a strong downward flow through the space between said casings. The fan is supported upon a hollow shaft 19 which is journaled in bearings 20 carried by the superstructure, said shaft having at its upper end a beveled gear 21 which meshes with a beveled gear 22 upon a countershaft 23. The countershaft 23 may be driven in any suitable manner but in order to provide for varying the speed of rotation of the fan preferably is provided with a conical pulley 24 which is connected by a suitable belt 25 to a reversely disposed conical pulley 26 located upon a suitable driving shaft which is actuated by a pulley 27 in any suitable manner.

The distributing mechanism illustrated herein is carried upon a hollow shaft 28 which is mounted within a suitable bushing 29 within the hollow fan shaft, the shaft 28 for the distributing member having at its upper end a beveled gear 30 which meshes with a gear 31 upon a countershaft 32 having a conical pulley 33 adapted to be actuated by a belt 34 on a reversely disposed pulley 35 located upon a suitable driving shaft actuated through a pulley 36. It will be obvious that by reason of this construction either the speed of rotation of the fan shaft or the speed of rotation of the distributing member may be varied so that the force of the current may be regulated according to the character and amount of the material to be separated or the distribution of the material may be varied as may be necessary for the strength of current produced by the fan. By providing this two-fold means of regulation proper correlation may be obtained between the amount and character of the ma-

terial being operated upon and the force of the air current which produces a maximum efficiency of separation.

The material may be fed to the distributing means in any suitable manner but preferably is delivered to the same through a hopper 37 having a feed pipe 38 leading through the hollow shaft 28 of the distributing member and discharging upon said distributing member. The lower end of the shaft 28 preferably supports a plate 39 which is of sufficient diameter to direct the ascending air currents outwardly toward the wall of the inner chamber. The distributing means comprises a central disk and a series of annular plates of progressively greater diameter supported at distances from the disk and from each other. As shown herein the material is deliverd from the hopper and feed pipe 38 to the disk 40 which is supported by brackets 41 from the plate 39. An annular plate 42 is supported by brackets 43 from the disk 41 and a third annular plate 44 of greater diameter than the annular plate 42 is supported from the latter by brackets 45.

The internal diameter of the plates 42 and 43 are such as to leave air spaces of substantially the same width between the wall of the upper cone 15 and said plates, thus providing a path for air currents which ascending upwardly will be deflected laterally through the showers of material as it cascades from the disk 40 to the annular plate 42 and from the annular plate 42 to the annular plate 44.

The direction of the air currents is illustrated by unfeathered arrows; the direction of the finished material by fully feathered arrows and the direction of the feeding of the material and of the tailings by half feathered arrows so that the graphic illustration of the course of the material and of the separation in the acompanying drawing is obvious. The current produced by the fan descends between the outer and inner casing, thence ascends through the space between the conical bottom of the inner casing and the outer wall of the tailings hopper, thence descends between the wall of the tailings hopper and the outer wall of the deflector, thence ascends between the upper wall of the deflector and the wall of the lower cone 16 of the filler, at this point meeting and traversing the tailings which have been subjected to the air currents in the upper portion of the inner casing. The ascending current then divides into two courses, the outer flowing near the wall of the inner casing while the inner current which is deflected from it by the annular plate 44 flows along the wall of the upper conical portion 15 of the filler and again is divided by meeting with the annular plate 42 so that a portion is forced through the material which cascades from the plate 42 to the plate 44 while the remaining portion of the current ascends still farther and passes through the material cascading from the disk 40 to the annular plate 42. The inner branch of the air current thereupon joins the outer branch of the air current, and ascending outwardly around the periphery of the deflector 39 enters the space between the inner and outer casings where it is again forced downward into the lower portion of the chamber formed by the outer casing. Inasmuch as the lower portion of this outer casing of the hopper 6 comprises a dead air space the fines which are carried with the circulating currents are precipitated and may be drawn off through the discharge pipe 7.

By thus causing the material to cascade from a central distributing disk 40 in showers of increasing diameter and traversing each shower by a current of air in the manner aforesaid a most effective separation is obtained and the tailings which are delivered to the tailings hopper 12 after having been finally acted upon by the strong current which ascends between the deflector 14 and the conical portion 16 of the filler will be substantially free of fine material.

It is to be understood that the particular embodiment of the invention disclosed herein is merely illustrative and that various changes in form, construction and arrangement may be made within the spirit and scope of the following claims.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is;

1. An air separator comprising a closed outer casing having a delivery hopper for the finished material, an inner casing spaced apart from said outer casing and having a delivery hopper for tailings, adjustable means for creating a continuous circulation of air upwardly through said inner casing and downwardly through the space between said inner and outer casings, a feed pipe for the material extending into said inner casing, rotary distributing means located beneath said feed pipe and adjustable means operated independently of the air circulating means for rotating said distributing means.

2. In an air separator comprising an outer casing, an inner casing having a top provided with a central opening spaced apart from said outer casing, a fan located in the space between the tops of the inner and outer casings mounted upon a depending hollow shaft, adjustable means for rotating said shaft, a feed pipe extending through said hollow fan shaft into the inner casing, a distributing member located below the end of said feed pipe, means for

rotating said distributing member independently of the rotation of said fan, and means for varying the speed of rotation of said distributing member independently of the speed of rotation of said fan.

3. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing, a fan located in the space between the tops of the inner and outer casings mounted upon a depending hollow shaft, means for rotating said shaft, a feed pipe extending through said hollow fan shaft into the inner casing, a rotatable distributing member located below the end of said feed pipe, and adjustable means including independently driven pairs of reversely arranged conical pulleys for driving respectively the fan and the distributing member.

4. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing and means for causing a circulation of air continuously upwardly through said inner casing and downwardly through the space between said inner and outer casings, means for delivering material to be separated into said inner casing and a plurality of rotating distributing means within said inner casing adapted to cause the material to cascade in a plurality of showers across the path of the ascending air currents and means for independently regulating the air circulating means and the speed of rotation of the distributing means.

5. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing and means for causing a circulation of air continuously upwardly through said inner casing and downwardly through the space between said inner and outer casings, means for delivering the material centrally into said inner casing and distributing means comprising a rotary central disk and a plurality of annular distributing members of progressively greater diameter than said central disk suspended therefrom and spaced apart from one another, whereby the material will be caused to cascade in a plurality of showers across the paths of ascending air currents produced by said fan and a conical filler extending upwardly within said annular distributing members.

6. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing and means for causing a circulation of air continuously upwardly through said inner casing and downwardly through the space between said inner and outer casings, means for delivering the material centrally into said inner casing and distributing means comprising a rotary central disk and a plurality of annular distributing members of progressively greater diameter than said central disk suspended therefrom and spaced apart from one another, and a central filler located within said annular distributing members operating to restrict the central area of the inner chamber and thereby to increase the force of air currents through the showers of material cascading from one distributing member to the other.

7. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing and means for causing a circulation of air continuously upwardly through said inner casing and downwardly through the space between said inner and outer casings, a tailings hopper carried by said inner casing, a downwardly converging deflector carried by said inner casing and extending into said hopper and spaced apart therefrom, a filler having reversely disposed inclined walls carried by said deflector and spaced apart therefrom, means for introducing material centrally into said inner casing, rotary distributing means operating to cause said material to cascade across the paths of air currents in said inner chamber whereby the cascading material will be traversed by a plurality of air currents and finally by a strong current ascending through the space between said hopper and said filler.

8. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing and means for causing a circulation of air continuously upwardly through said inner casing and downwardly through the space between said inner and outer casings, a tailings hopper carried by said inner casing, a downwardly converging deflector carried by said inner casing and extending into said hopper but spaced apart therefrom, a filler having reversely disposed inclined walls carried by said deflector and spaced apart therefrom, means for introducing material centrally into said inner casing, rotary distributing means comprising a central disk and a series of annular distributing members of progressively greater diameter carried by said disk operating to cause the material to cascade across the paths of air currents in said inner chamber, the inner walls of said annular disk being spaced at substantially equal distances from the upper wall of said filler.

9. In an air separator comprising an outer casing, an inner casing spaced apart from said outer casing and means for causing a circulation of air continuously upwardly through said inner casing and downwardly through the space between said inner and outer casings, a tailings hopper carried by said inner casing, a truncated conical deflector secured to said inner casing and extending inwardly into said hopper but spaced apart therefrom, a filler carried by but spaced apart from said deflector having

a conical upper portion and a truncated reversely disposed conical lower portion extending into said tailings hopper, adapted to decrease the dead air space, means for introducing material centrally into said inner casing and rotary distributing means for causing said material to cascade in a series of showers across the paths of the air currents of said inner casing.

In testimony whereof we have signed our names to this specification.

WILLIAM A. GIBSON.
CHARLES E. NEEDHAM.