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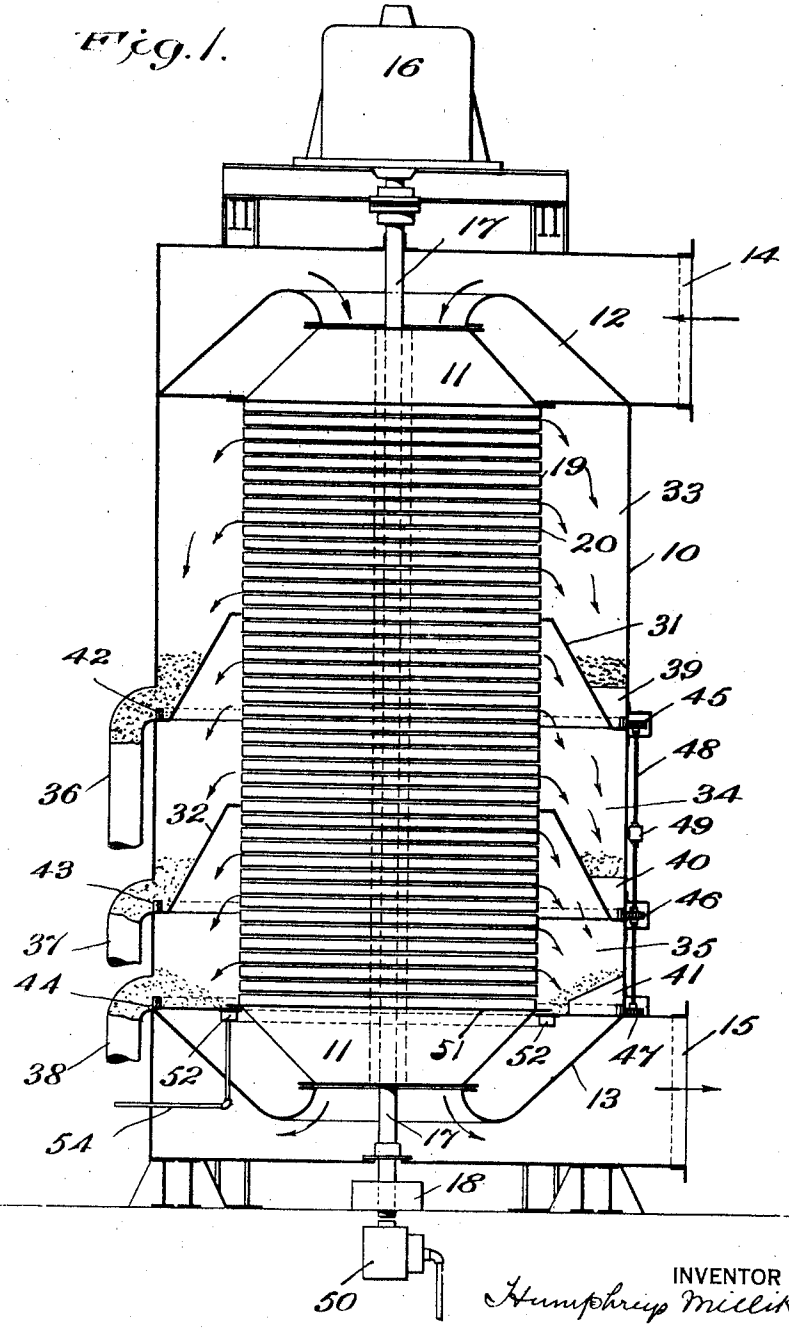
APPLICATION FILED MAR. 1, 1919.

1,344,055.

Patented June 22, 1920.

3 SHEETS—SHEET 1.

Fig. 1.



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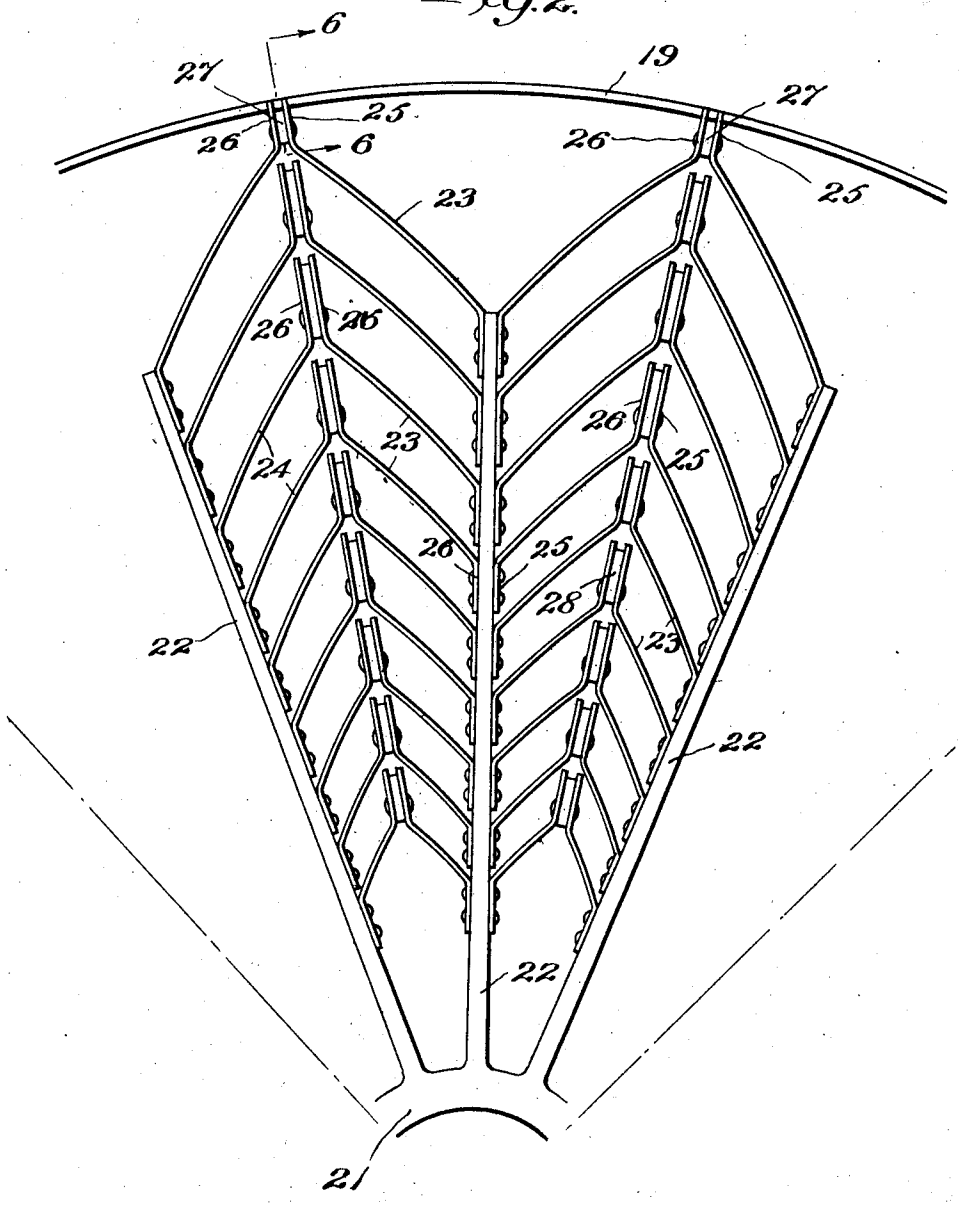
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

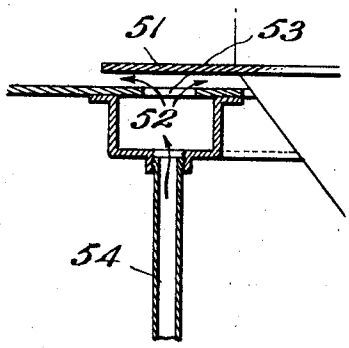


Fig. 4.

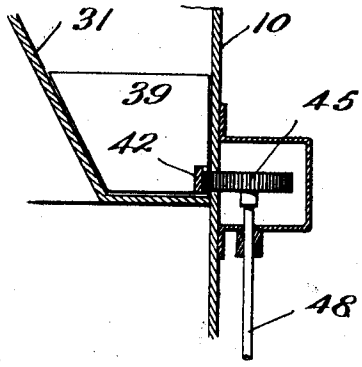


Fig. 5.

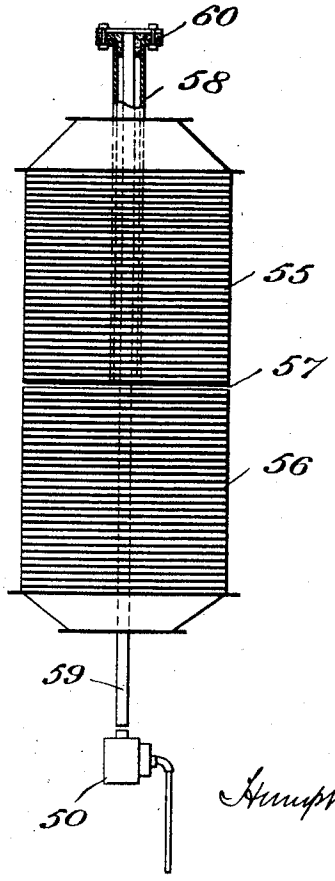
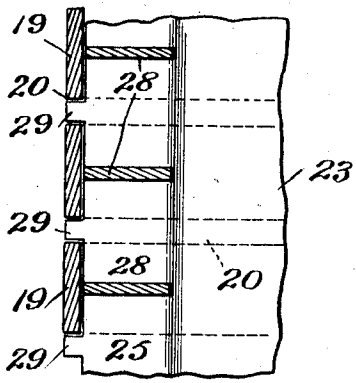


Fig. 6.



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1,344,055. Specification of Letters Patent. Patented June 22, 1920.

Application filed March 1, 1919. Serial No. 279,930.

To all whom it may concern:

Be it known that I, HUMPHREYS MILLIKEN, a citizen of the United States, residing at Tenafly, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Dust-Separators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to an improved form of high speed centrifugal dust separator, especially adapted to extracting or separating extremely fine dust or fumes from air or gases in which the same is suspended.

In centrifugal separators of this character it is advantageous so to treat the dust-laden gases that the dust may have to travel a minimum radial distance in reaching the surface upon which it is collected, and may be thereafter conducted outward to the area of delivery with as little resistance as possible to its progress. It is one of the principal objects of the present invention to provide apparatus whereby these ends may be carried out, either in a vertical or horizontal type of machine.

Among other objects of the present invention are the following—To provide means for accelerating and rendering more certain the effective travel of dust along the primary collecting surfaces; to provide means for preventing escape and loss of dust from the clearance space between the rotating and the stationary portions of the machine; to provide means for the separate collection and delivery of bodies of dust of different grades or degrees of fineness and to facilitate final delivery of the masses so collected; to provide a form of mounting for vertical machines in particular, whereby a limited degree of freedom is given to the rotating portions of the machine, permitting the same to accommodate themselves to their natural axes of revolution, thereby avoiding strains upon the bearing. While the means whereby these different objects are attained are all capable of conjoint use upon one and the same machine, this is not essential in all cases, and these various means have therefore been claimed herein separately.

The invention is illustrated in a preferred form in the accompanying drawings, wherein Figure 1 is a diagrammatic representation of the entire device, the rotating member being shown in elevation and the outer stationary casing in section, Fig. 2 is a plan view of a segment of the rotating member on an enlarged scale, Fig. 3 is a vertical sectional view of the means for preventing loss of dust at the joint, Fig. 4 is a similar view of the driving means for the dust gathering or sweeping device, Fig. 5 is a view partly in elevation and partly in section showing the sectional mounting employed to permit a gyroscopic movement, and Fig. 6 is a fragmentary sectional view taken on the line 6—6 in Fig. 2.

At 10 is shown the exterior stationary casing, within which is revolubly mounted the hollow rotating member within which the centrifugal separation takes place. This member has conical ends 11 narrowing toward their inlet and outlet openings respectively, and the stationary casing is provided with conical extremities 12 and 13 turning inward at the apexes of the cones to form inlet and outlet openings respectively, close to the inlet and outlet openings of the rotary member, but not touching the same. An inlet pipe 14 is adapted to convey the dust-laden gases to the separator, while a pipe 15 at the opposite end receives the gases after separation.

The rotating, or active separating, member is driven by any suitable means, and preferably by the electric motor 16, which drives the central shaft 17, and may be located at either end of the machine. The free extremity of this shaft is preferably received in a heavy bearing block 18 which is not secured to its support. This construction permits a certain amount of gyroscopic movement in the shaft, which is, at the same time damped and limited by the mass of the bearing, and its frictional action upon its support.

The main body of the rotating member comprises a succession of parallel circular

rings 19, of uniform diameter, separated by annular delivery openings 20, from which the separated dust is ejected by centrifugal force, as indicated by the arrows in Fig. 1. These rings 19 are supported by and rotate with the central shaft, preferably in the following manner.

Upon the shaft 17 is fixed a hub 21, from which radiate the impelling arms or plates 22. These are seen in edge view in Fig. 2, and extend from one end to the other of the main rotating body, forming wedge shaped chambers or spaces which receive the dust-laden gases from the pipe 14. These plates 22 impel the gases forward and impart to them the rotary motion which creates the centrifugal force serving to separate the dust which they carry.

Upon opposite faces of each impelling plate there are carried outwardly inclined collecting plates 23, 24, also extending from end to end of the main rotating member, and arranged in pairs, as shown in Fig. 2. These plates are preferably slightly bowed outward to lend elasticity and to accommodate them to the centrifugal stresses.

The collecting plates 23 on each impelling plate are preferably mutually parallel, and the same is true of the plates 24. The outer edges of the collecting plates are bent, as, at 25 and 26, so as to unite to form the opposite sides of a radial discharge passage 27 extending through and out of each wedge shaped space between the impelling plates. It will be seen that, by this arrangement, the greater part of the interior of the rotating member is subdivided into secondary chambers limited by outwardly sloping collecting plates placed a short distance apart. It follows that the dust carried by the longitudinal air stream in these secondary chambers is obliged to travel only a relatively short distance radially before it is received by the collecting plate on the outer side of such chamber. Here it gathers and forms agglomerations whose increased mass favors an increased centrifugal effect, and this force causes it to slide outward until it reaches a discharge passage 27, where it is free to join the general stream which is finally discharged through the annular openings 20.

In order to prevent interference of this travel through the radial discharge passages 27, it is preferred to provide means to exclude the longitudinal stream of gases from these passages. For this purpose impedance plates 28 are fastened at intervals (preferably by welding) across the spaces between plates 25, 26. These impedance plates, lying in transverse radial planes, afford a succession of nearly continuous partitions across the discharge passages, and thereby exclude the longitudinal air stream which would otherwise interfere with prompt travel of the dust along these passages. The plates 28 also serve to fasten together the opposed plates 25 and 26.

I prefer to support the exterior rings 19 upon the outer ends of the passages 27 in the manner shown in Figs. 2 and 6. For this purpose the outermost plates 25 and 26 all around the rotating member are extended to form tongues 29, which extend into the spaces 20, and the rings 19 are held free in the spaces between these tongues. The elasticity of the bowed plates 23 and 24 will facilitate insertion of the rings 19. This construction has the advantage of allowing the various parts a certain degree of relative movement in response to the stresses incident to operation.

It is clear that the coarser particles of dust will be more promptly expelled by centrifugal force than the finer ones, and I take advantage of this to so arrange my apparatus that dust of various degrees of fineness may be separately collected. For this purpose the outer casing is divided by transverse partitions 31 and 32 preferably having conical walls as shown in Fig. 1, thus forming a succession of collecting compartments 33, 34 and 35. In the outer portion of each compartment I prefer to locate a movable sweeper, which moves slowly around the same and sweeps the dust out through the respective discharge tubes 36, 37 and 38.

These sweepers may take various forms, but I prefer to use upright sweeping plates or scrapers 39, 40 and 41 attached to toothed rings 42, 43 and 44, in the respective compartments. These rings are driven slowly by the pinions 45, 46 and 47 on the shaft 48, driven by any convenient means, as by a belt (not shown) on the pulley 49. Each pinion is preferably protected by a housing, as shown.

In order to promote the rapid and certain travel of the dust along the collecting surfaces, and prevent sticking, so far as possible, I prefer to provide means for imparting vibration to the rotary member, and in the modification shown this takes the form of a pneumatic hammer 50 or equivalent means for delivering rapid blows upon the end of the shaft 17.

In apparatus of this kind there will exist a material tendency for the dust collected near the lower end to escape around the space necessarily existing between the lower edge of the rotary member and the stationary part of the machine. In Figs. 1 and 3 is illustrated the means which I have devised for preventing this escape of dust.

The lower end of the rotary member carries a circular horizontal flange 51, which overlaps the floor of the lowermost compartment 35, and immediately beneath this flange I place an annular air chamber 52

communicating continuously or at close intervals with the space under the flange by an opening or openings 53. Compressed air is supplied to the chamber 52 by the pipe 54 and this air, escaping by the openings 53, flows partly toward the main opening of the machine to join the clean discharge gases, and partly toward the chamber 35, creating a pressure which opposes the tendency of the dust to escape through the joint.

For obtaining the best results, particularly in the separation of very fine dust, it is desirable to make the rotating member very long in proportion to its diameter. On the other hand, it is found that, where freedom of accommodation to gyroscopic motion is given to a rapidly rotating body, certain unavoidable elements of strain are less seriously evident in proportion as the length of rotating body is less, the diameter remaining the same.

In certain cases, therefore, it will be found desirable to divide the rotating member of my machine into two or more independent sections, and to give to each the necessary freedom of motion for accommodation to unbalanced forces. In Fig. 5 is illustrated a preferred mode of construction for this purpose.

As there shown, the rotating member is divided into two parts 55 and 56, which are separated along the plane 57 a sufficient distance to permit of the small independent motion desirable. The section 55 is carried upon a hollow shaft 58, and the section 56 is carried upon an inner shaft 59, passing axially through the shaft 58. The two shafts are bolted together at one end, as shown, and between them is placed a packing 60 of rubber or other suitable resilient material, which will permit the necessary small angular displacement between the two shafts. Means for flexibly supporting and driving rotating devices so that they may accommodate themselves to unbalanced forces are well known in the art, and any of these may be applied to the combined shafts to drive the machine. For greater clearness these have been omitted, as they do not form a part of my present invention.

The driving end of this modification, as well as that first described, may be placed either at the bottom or the top of the machine, as desired. Other changes may be made by those skilled in the art without departing from my invention, and I do not limit myself to the details herein shown and described.

What I claim is—

1. In a centrifugal dust separator, a rotating member having substantially radial discharge passages and a plurality of separating chambers opening into each passage.

2. The structure set forth generally in claim 1 hereof, wherein the separating chambers are formed by outwardly inclined plates each leading to a separate opening in the side of the discharge passage.

3. The structure set forth generally in claim 1 hereof, wherein the discharge passages are furnished with means for preventing longitudinal flow of gases through the same.

4. In a centrifugal dust separator, impelling plates, a discharge passage located between them, and separating plates carried in pairs on said impelling plates and forming chambers opening at intervals into the opposite sides of said discharge passage.

5. The structure set forth generally in claim 4 hereof, wherein the discharge passage is formed by the outwardly bent edges of the separating plates.

6. The structure set forth generally in claim 5 hereof wherein the outwardly bent edges of the separating plates are united by means of impedance plates.

7. The structure set forth generally in claim 4 hereof, wherein the separating plates are bowed and are inclined outwardly from their bases of attachment.

8. In the rotating member of a centrifugal dust separator, exterior parallel rings with spaces between them, in combination with interior supporting members having tongues projecting into said spaces; said rings lying free between said tongues.

9. The structure set forth generally in claim 8 hereof wherein the supporting members comprise resilient plates adapted to permit sufficient displacement to facilitate mounting the exterior rings between the tongues on said plates.

10. In a centrifugal dust separator, an internal rotating body, an external casing surrounding the same and divided into compartments at different distances from the inlet end of the machine, and an emptying passage for each compartment, in combination with mechanism adapted to sweep the dust in each compartment toward its emptying passage, the sweeping mechanism comprising a scraper in each compartment, a toothed ring attached thereto, pinions for driving said rings and means for driving said pinions.

11. In a centrifugal dust separator, a rotating member, a stationary casing for the same and means for delivering a current of air under pressure around the edge of the rotating member near its discharge end.

12. The structure set forth generally in claim 11 hereof wherein the discharge end of the rotating member has an annular flange and wherein a stationary annular wind chamber is placed parallel to said flange and is provided with an opening for discharging air under said flange.

13. In a centrifugal dust separator, a rotating member made in two sections placed

end to end, and mounting means for said sections adapted to permit their separate accommodation to independent axes of revolution.

14. In a centrifugal dust separator, a rotating member made in two sections placed end to end, an innner shaft to which one member is fixed, a hollow shaft surrounding said inner shaft, to which the second member is fixed, and connecting means for said shafts at one end thereof comprising a resilient packing adapted to permit a small relative angular movement of said shafts.

In testimony whereof, I affix my signature.

HUMPHREYS MILLIKEN.