

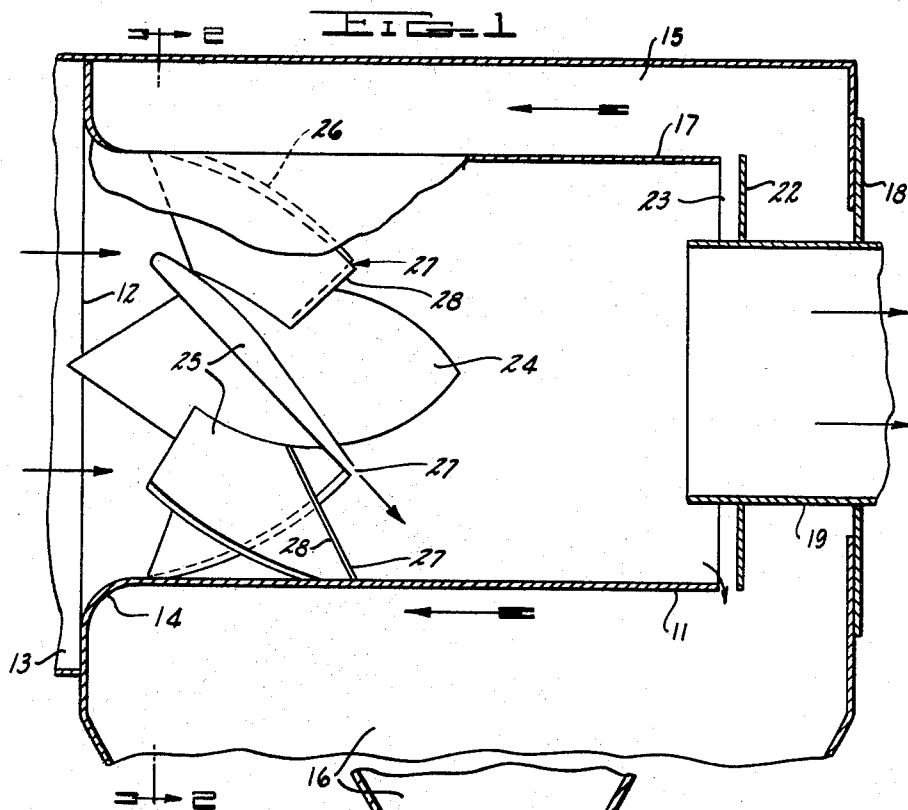
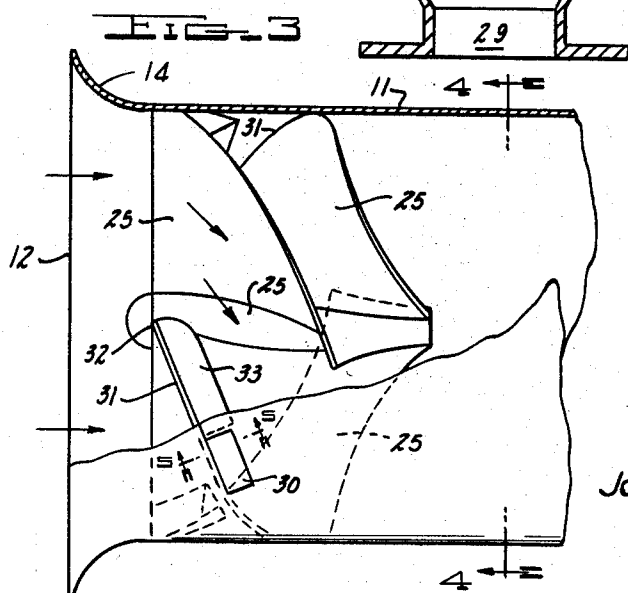
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J. C. JOHNSON
DUST COLLECTORS

2,847,087

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2 Sheets-Sheet 1



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FIG. 2

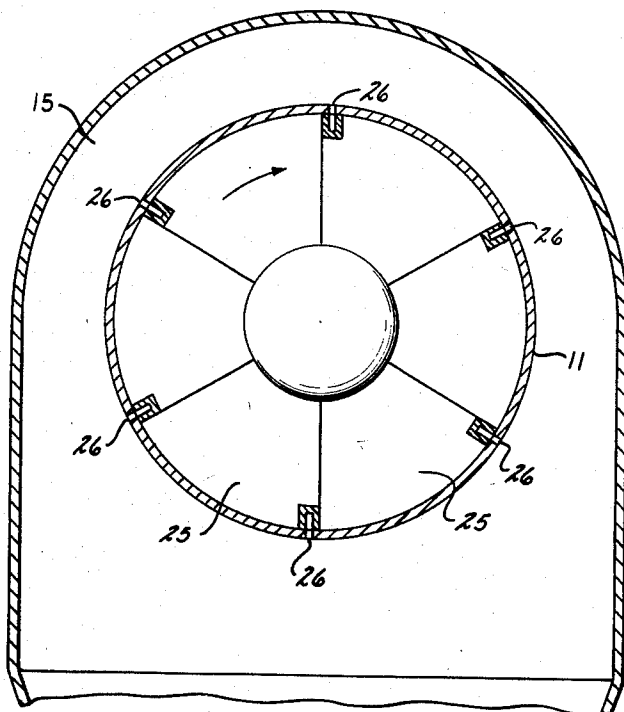


FIG. 4

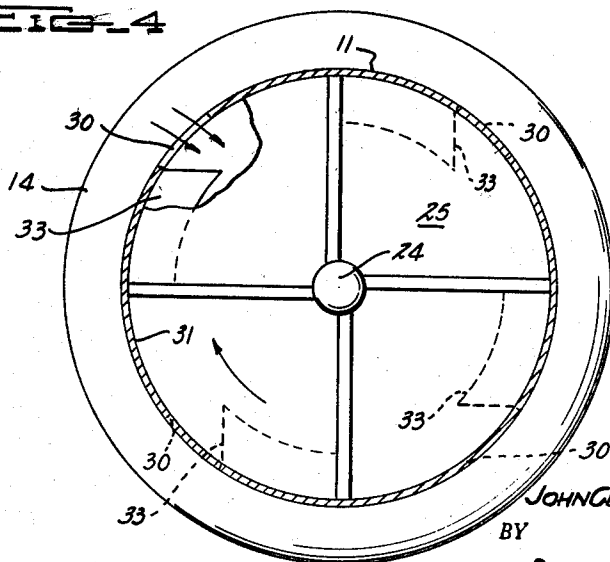
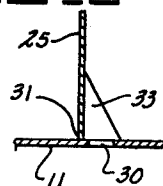


FIG. 5



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DUST COLLECTORS

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1 Claim. (Cl. 183—80)

This invention relates to dust separators and collectors, and particularly to dust separators and collectors of the kind comprising a tubular member in which there is disposed a series of vanes adapted to cause dust laden air or other gas, hereinafter referred to, for convenience, as air, which is admitted to and caused to flow through said tubular member, to acquire a vortical or swirling motion, and thereby cause dust carried by said air to be thrown centrifugally against the wall of the tubular member, and in which a circumferential opening is formed at the outlet end of said tubular member, through which opening the said dust may be caused to pass from said tubular member into an outer chamber which is connected to a hopper, the inlet end of an outlet pipe being also disposed at the outlet end of the tubular member to allow dust-free air to be withdrawn from the tubular member.

In some forms of dust separators and collectors of the kind referred to, the said circumferential opening is provided by disposing a plate adjacent to but spaced from the outlet end of the tubular member so as to form a circular passage through which the dust, separated from the air by centrifugal force due to the vortical motion of the dust-laden air through the tubular member, may pass into the outer chamber. The outlet pipe for dust-free air is disposed with its inlet end projecting into and substantially co-axial with the outlet end of the tubular member, the said plate being disposed around the said outlet pipe near to the inlet end of said pipe, and being carried by or carrying said end of the outlet pipe. The said outlet pipe is connected to a fan or other air exhausting device which creates the necessary flow of air through the tubular member and outlet pipe.

In dust separators and collectors of the kind described, the dust extracted from the tubular member through the said circumferential opening is accompanied by a small amount of air. This is desirable because although the larger grits contained in the dust may be projected or conducted for some distance without actually being "airborne," the finer grain dust requires that it be entrained with some air in order to separate it from the main stream of air.

The portion of air with the entrained dust which thus passes out of the tubular member into the outer chamber, through the circumferential opening, has to be treated further in order that the dust airborne thereby may be extracted therefrom before the said air is taken into the said air outlet pipe or other dust-free air conductor, pipe or device.

The object of the present invention is to provide improvements in dust separators and collectors of the kind described whereby the said air which passes from the said tubular member to the outer chamber is substantially freed of dust.

According to this invention, a dust separator and collector of the kind described is characterized in that means

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are provided for recirculating the air which passes out of the tubular member into the outer chamber.

The said means may comprise apertures in the wall of said tubular member and adjacent the outer edges of the vanes, which outer edges are contiguous with the wall of the tubular member, the said apertures being located rearwardly of the leading faces of the vanes, that is, those faces which are presented to the main stream of air flowing into the tubular member. The said means may comprise ducts in said vanes in the tubular member, the outer edges of said vanes being contiguous with the wall of the tubular member, said wall of the tubular member having orifices open to the outer chamber and connecting with the outer ends of said ducts in the vanes, the inner ends of said ducts being open to the interior of the tubular member. Preferably the said inner open ends of said ducts are directed towards the outlet end of the tubular member.

For convenience of description in this specification the air inlet end of the apparatus will be considered the front end, whilst the air outlet end will be considered the rear end.

Other objects of this invention will appear in the following description and appended claim, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Embodiments of the invention are illustrated in the accompanying drawings, wherein:

Fig. 1 is a sectional side elevation, substantially diagrammatic, of a dust separator and collector embodying one form of the invention, and

Fig. 2 is a transverse sectional elevation on line II—II of Fig. 1,

Fig. 3 is a sectional side elevation, substantially diagrammatic, of a tubular member of a dust separator embodying a modified form of the invention,

Fig. 4 is a transverse sectional elevation on line IV—IV of Fig. 3, and

Fig. 5 is a fragmentary sectional elevation taken on line V—V of Fig. 3.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

In the dust separator and collector illustrated in Figs. 1 and 2, a cylindrical tubular member 11 is provided having one end 12, the inlet end, open to a header or conduit 13 to which dust-laden air is fed. The said inlet end 12 of the tubular member 11 is flared at 14 to ensure a smooth flow of dust-laden air from the header or conduit 13 into the tubular member 11.

The tubular member 11 is disposed within an outer chamber 15 which communicates with a dust collecting hopper 16, the hopper being formed as a downward prolongation of the said outer chamber. The chamber 15 is substantially arcuate above and at the sides of the tubular member 11, the top and side portions of the wall of the said outer chamber being concentric with and spaced outwardly from the wall of the tubular member, the hopper 16 forming the bottom of the chamber. Alternatively, the outer chamber may be substantially rectangular in section, with the hopper at the bottom.

The outlet end 17 of the tubular member 11, which member in the form now being described is disposed with its axis horizontal, is spaced from the adjacent end wall 18 of the outer chamber 15, and a cylindrical

outlet pipe 19 is mounted in said end wall 18, the said outlet pipe being coaxial with the tubular member 11 and having its inlet end 20 projecting slightly into the outlet end 17 of the tubular member, the outlet pipe 19 being of smaller diameter than the tubular member 11 so that an annular passage 21 of short axial length is formed between the outlet end 17 of the tubular member 11 and the inlet end 20 of the outlet pipe 19.

The outlet pipe 19 is connected to a suitable air exhausting device, for example, a fan.

A plate 22 is mounted externally, in the form of a collar, on the outlet pipe 19, near to the inlet end 20 thereof and so as to be disposed close to but spaced outwardly from the outlet end 17 of the tubular member 11, the said plate 22 extending at least to the external diameter of the said outlet end of the tubular member. Thereby, a circumferential opening 23 is formed between said plate 22 and the said outlet end 17 of the tubular member 11.

A hub 24 is disposed within the tubular member 11 near to the inlet end 12 thereof. The hub 24 is circular at all transverse sections, and is disposed coaxial with the tubular member 11; it is of suitable aerodynamic shape to provide little obstruction to the flow of air through the tubular member. A series of vanes 25 are mounted radially on the hub 24, at equal circumferentially spaced intervals, the said vanes being so shaped that air entering the tubular member 11 at the inlet end 12 thereof and caused to flow towards the outlet end 17 will be given a vortical or whirling motion through the tubular member.

The vanes 25 extend radially to the wall of the tubular member 11. The vanes 25 are hollow, and the outer edges thereof register with slots 26 formed in the wall of the tubular member 11 so that the hollow interior of each vane 25 is in communication with the outer chamber 15 surrounding the tubular member 11. Each vane 25 is provided, near to the central hub 24, with an orifice 27 in its wall, communicating with the hollow interior of the vane, which orifice is directed towards the outlet end 17 of the tubular member 11; the said orifice 27 is elongated in the form shown, and extends along the whole of an edge 28 of a vane, which edge extends from the hub 24 to the wall of the tubular member 11; in some cases, however, the orifice may extend along part only of the vane edge 28, and the orifice may be round or of any other suitable shape.

In use, dust-laden air enters the inlet end 12 of the tubular member 11 from the dust-laden header or conduit 13, and is caused, by the exhausting device connected to the outlet pipe 19, to flow along the tubular member 11 towards the outlet end 17 thereof. By reason of the vanes 25, a vortical or whirling motion is given to the dust-laden air and thereby dust contained in the air is thrown centrifugally on to the wall of the tubular member 11. As dust and air reaches the outlet end 17 of the tubular member 11 the dust is separated from the main stream of air, the dust passing through the circumferential opening 23 between the plates 22, which forms a baffle, and the outlet end 17 of the tubular member 11, the main stream of air, which now is substantially or wholly free of dust, being drawn by the exhausting device into the outlet pipe 19 and conveyed thereby to atmosphere or elsewhere; in some cases, if necessary, the substantially dust-free air may be passed through a further dust separator for further dust extraction.

The dust which passes through the circumferential opening 23 has entrained with it a small quantity of air which assists in taking the finer grain dust through said opening. The greater proportion of the dust which passes through the opening 23 into the outer chamber 15 promptly falls into the collecting hopper 16, from which it is removed periodically or continuously through a bottom discharge door, throat or valve at 29.

The air which passes through the circumferential opening 23, from the tubular member 11 to the outer chamber 15, re-enters the tubular member 11 by way of the slots 26 in the wall thereof, the hollow vanes 25, and the outlet orifices 27 in the vanes, so that said air, together with any dust entrained therewith, re-enters the main stream of dust-laden air through the tubular member 11. The depression set up within the tubular member 11 by the exhausting device connected to the outlet pipe 19 will extend by way of the hollow vanes 25 to the outer chamber 15 and thereby cause said air and some entrained dust to re-enter the main stream of dust-laden air through the tubular member 11, the flow being assisted by the pressure differential existing within the apparatus.

Thereby said air is recirculated through the tubular member 11, and again, when combined in the stream of new dust-laden air, is acted upon centrifugally to separate dust therefrom. By such means, the air is efficiently freed of dust.

By reason of the aspirating effect of the main air flow on the outlet orifices 27 of the vanes 25, the pressure at said orifices will be less than at the circumferential opening 23 where the pressure is increased due to centrifugal force, and this pressure difference causes the recirculating flow.

The tubular member 11 may have an axial length of approximately one and one-half diameters.

It is obvious that the apparatus may be disposed with the axis of the tubular member 11 otherwise than horizontal, for example, vertical.

In Figs. 3 and 4, which, together with Fig. 5, illustrate a modified arrangement, the inlet header or conduit, outer chamber, outlet pipe, baffle plate and hopper, all of which are provided and are similar to those illustrated in Figs. 1 and 2, are not shown.

In said Figs. 3, 4 and 5, the vanes 25 are solid. Orifices 30 are provided in the wall of the tubular member 11, one orifice for each vane 25, and each said orifice is disposed immediately adjacent and rearwardly of the outer edge 31 of the vane, which outer edge is contiguous with the inner surface of the said wall of the tubular member, and the orifice is spaced from the leading or front edge 32 of the vane.

The space on the rear face of each vane 25, between the leading edge 32 thereof and the orifice 30, and in the angle formed at the outer edge 31 of the vane by said rear face and the wall of the tubular member 11, is occupied by a shield 33 which extends substantially in the form of a ramp from the leading edge 32 of the vane to the orifice 30. The rear end of the shield 33 terminates abruptly and inwardly of the orifice 30.

Dust, together with entrained air, which has passed through the circumferential opening 23 (Fig. 1) from the outer end of the tubular member, re-enters the tubular member 11 through the orifices 30. Main dust-laden air which enters the tubular member 11 at 12 is caused to whirl by the vanes 25, and some of said air passes over the shields 33 and across the orifices 30 at a considerable velocity, thereby creating an eddy or rarefied condition at said orifices which will operate, in conjunction with the main flow of air through the tubular member 11, to promote a strong recirculating flow of the dust and entrained air from the outer chamber, through the orifices 30 and into the tubular member 11 again.

Dust separating means as hereinbefore described may form one element of a dust separating and collecting apparatus, such apparatus comprising a plurality of such elements, and providing a single collecting hopper which is common to all outer chambers of the elements, a plurality of collecting hoppers each of which is common to a plurality of outer chambers, or a separate collecting hopper for each outer chamber. Furthermore, a single outer chamber may be common to a plurality of elements, each element comprising a tubular member, hub and

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vanes, outlet pipe and baffle plate. Furthermore, a single baffle plate may be common to a plurality of elements comprising a tubular member, hub and vanes, and outlet pipe, the outlet pipes of the several elements being mounted in the one baffle plate. The number of elements contained in the apparatus may be, and preferably is, in direct proportion to the maximum volume of air which is to be handled by the apparatus.

What I claim is:

A dust separator and collector comprising a tubular member through which dust-laden air can be passed, vanes mounted in the inlet end of said tubular member to impart vortical motion to such dust-laden air, a casing forming an outer chamber into which said tubular member extends, an outlet pipe of reduced diameter extending into the outlet end of said tubular member coaxially thereof and discharging externally of said casing so that dust in said air will be thrown centrifugally outwardly and will pass between the outer surface of said pipe and the inner surface of said tubular member into said outer chamber, said tubular member having orifices therein

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immediately adjacent the downstream faces of said vanes and rearwardly of the outer edges thereof for aspirating air from said outer chamber, and shields disposed between said orifices and the leading edges of the vanes in the angles formed by the downstream faces of the vanes and the wall of the tubular member, whereby air passing over said shields will create a rarified pressure condition over said orifices for aiding in carrying out the aspiration of air from said outer chamber.

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