

July 14, 1942.

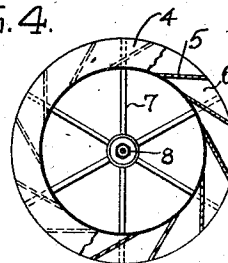
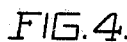
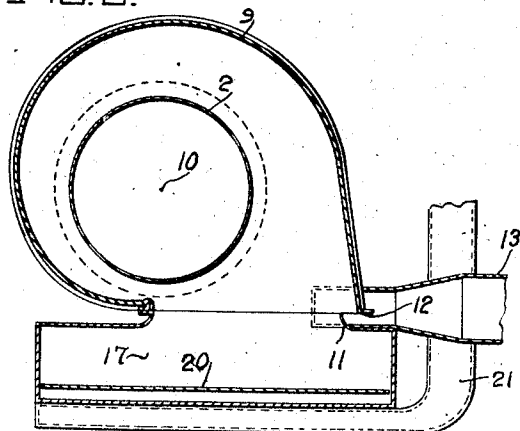
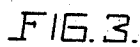
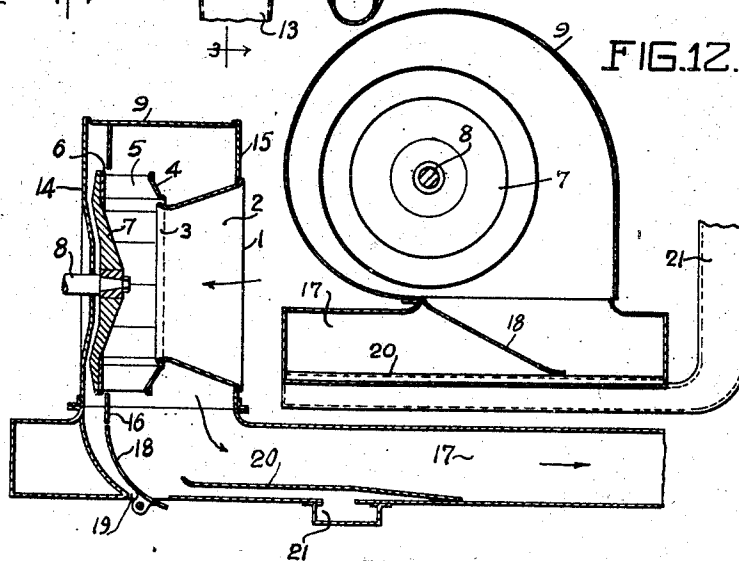
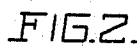
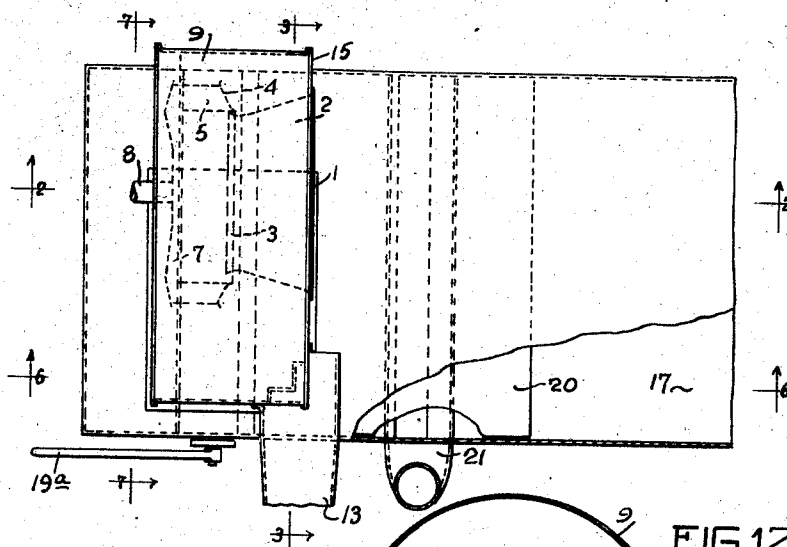
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2,289,474

APPARATUS FOR DUST COLLECTION

Filed May 18, 1937

4 Sheets-Sheet 1



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APPARATUS FOR DUST COLLECTION

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4 Sheets-Sheet 2

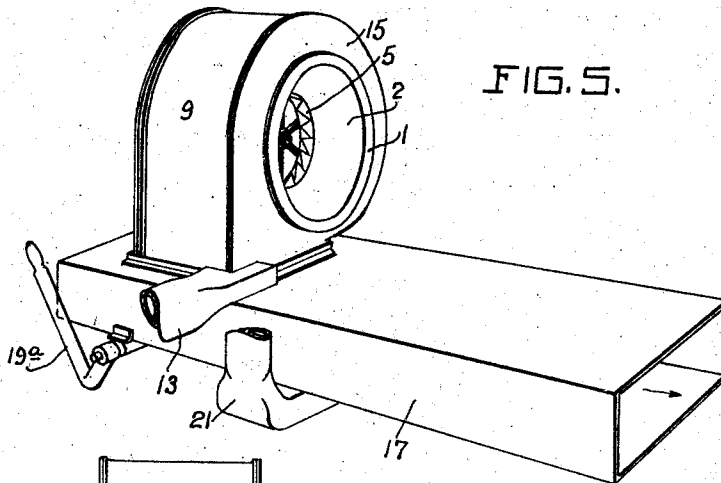


FIG. 5.

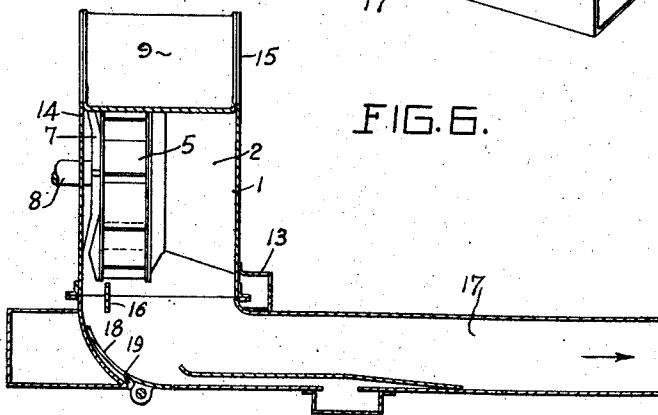


FIG. 6.

FIG. 7.

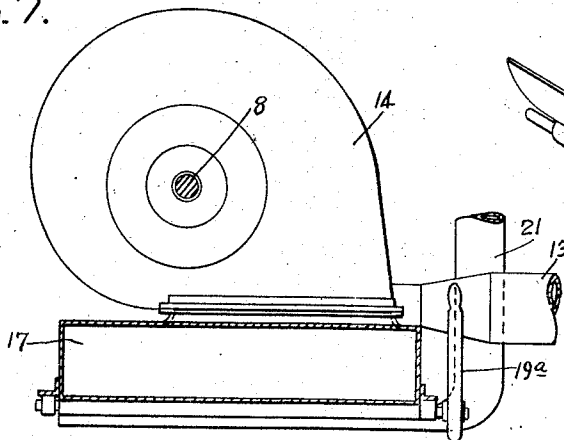
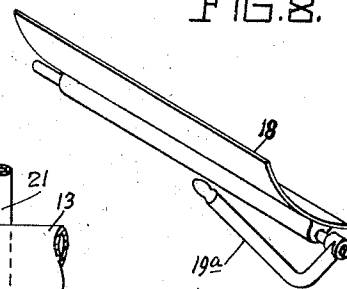


FIG. 8.



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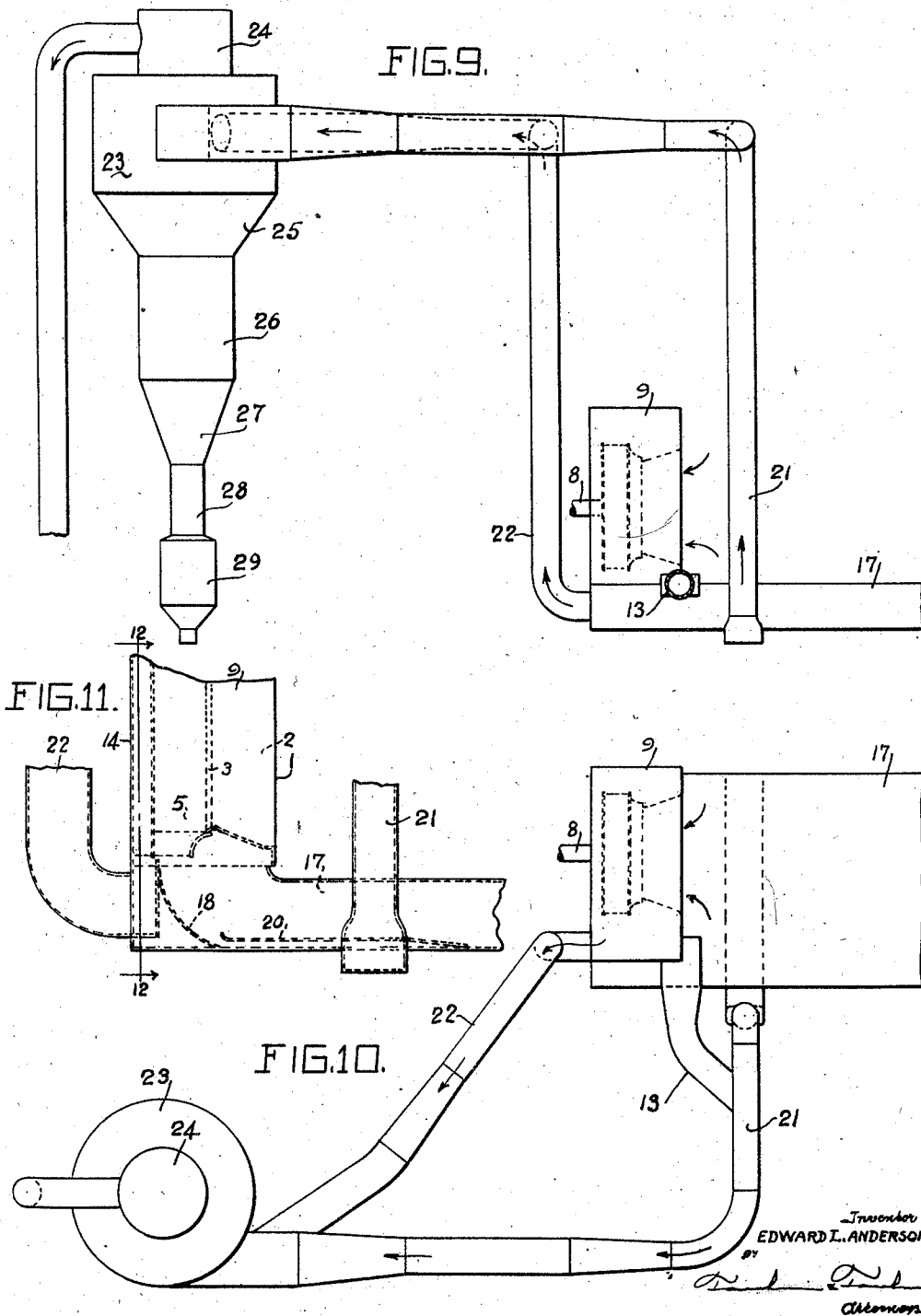
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FIG. 13.

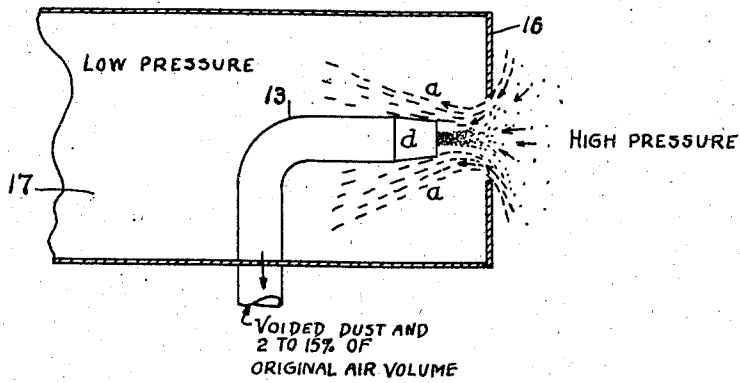
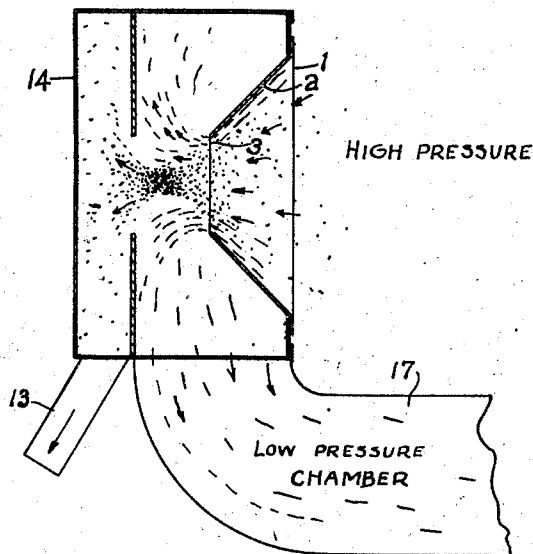


FIG. 14.



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UNITED STATES PATENT OFFICE

2,289,474

APPARATUS FOR DUST COLLECTION

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Application May 18, 1937, Serial No. 143,326

9 Claims. (Cl. 183-77)

My invention relates to an apparatus for handling air and collecting dust therefrom.

It is the object of my invention to provide a combined fan and dust collector in a single unitary mechanism so arranged that the movement of the air by the fan will result in moving the dust in the air out of the air longitudinally, so that it can be collected from the moving air while the dust free air is moved away from the fan simultaneously by the action of the fan.

It is my further object to provide a fan in a volute dust collecting casing, the axis of the fan being located on the axis of the volute.

It is my further object to provide in such combination a dust collecting lip for collecting the dust thrown out centrifugally by the action of the fan in moving the air so the two operations of dust collection and air movement are performed simultaneously by the single instrumentality of the fan and dust collecting casing, which also forms the fan casing.

It is my object to provide in this connection a secondary collector for removing from the dust whatever remaining entrained air that is left in the dust extracted from the air by the fan.

It is my further object to provide with the connection of the dust collector fan and dust casing the means for adjustably skimming the dust extracted from the air away from the air; and to provide an adjustable skimmer for this purpose.

It is the object of my invention to collect dust, cinders, snow and the like which enters the inlet of the fan under pressure. This body of dust, cinders and snow having greater weight than that of the air or gas converges to a focal point or line toward the center of the fan wheel and resists the effort made to turn it from a straight line movement with the air, which is turning at substantially right angles, into the fan blades.

It is my object to permit this concentrated stream of dust, cinders and snow to pass beyond the fan into a secondary collecting chamber at the back of the fan within the secondary scroll plate and then to allow the dust concentrated air therein to escape, separate from the air being delivered by the fan.

It is my object to permit heavier particles in an air stream to continue their normal direction of movement and to be conveyed away independently of the lighter air which is deflected laterally and delivered separately by a fan.

Referring to the drawings in detail:

Figure 1 is a top plan view of a volute fan casing and the outlet ducts for air and dust.

Figure 2 is a section of the line 2-2 of Figure 1

1 looking in the direction of the arrows. This is a longitudinal section.

Figure 3 is a transverse section of the lines 3-3 looking in the direction of the arrows.

Figure 4 is a detailed view, partially broken away, in elevation of the fan rotor.

Figure 5 is a perspective of the apparatus.

Figure 6 is a section of the line 6-6 of Figure 1 looking in the direction of the arrows.

Figure 7 is a section of the line 7-7 of Figure 1 looking in the direction of the arrows.

Figure 8 is a perspective of the dust collecting skimmer and damper.

Figure 9 is a side elevation of the dust collecting apparatus connected to a secondary collector.

Figure 10 is a top plan view of the same apparatus shown in Figure 9.

Figure 11 is a modified form of the preliminary dust collecting apparatus shown in section along the line 2-2 of Figure 1.

Figure 12 is a section on the line 12-12 of Figure 11.

Figure 13 is a diagrammatic view showing the principles of my invention to illustrate how the converging dust stream tends to continue in a straight line while the lighter air can be bent or diverted laterally of this straight line into areas of low pressure.

Figure 14 is another diagrammatic view illustrating the principles of my invention and applying them specifically diagrammatically to the particular mechanical forms in which my invention is embodied as set forth herein.

Referring to the drawings in detail, 1 designates the dust laden air opening. By air is meant any gas. This opening is connected with a conical Venturi shaped inlet passageway 2 arranged with its inner lip 3 in overlapping spaced parallel engagement with the end shroud 4 of the fan comprising the rotor blades 5 and the annular plate 6 carried upon the arms 7 of the spider which in turn is supported and driven by the shaft 8. As shown in Figures 2 and 4, these arms have a rectangular cross-section and considerable width or depth near the hub, tapering to less width near the plate 6. The air is then introduced with its burden of dust into the center of the fan and thrown out peripherally into the fan casing 9 which, in this case, is a volute casing so arranged that the axis 10 of the fan and of the inlet passageway through the inlet tube 2 is coincident with the axis of the description of the volute casing 9. The dust is thus thrown off centrifugally so that it collects on the side of the wall 9 of the casing and

is skimmed off by the skimmer 11 adjacent the lip 12, which is the end of the volute casing 9. This dust, with any entrained air, passes off through the pipe 13. Due to the fact that the incoming air, as it turns from a horizontal path to a radial path, does so in a general diagonal direction with respect to the entering axis so the major portion of the dust is thrown out against the back wall 14 of the volute casing. 15 is the front wall supporting the inlet passageway 2. The dust thus thrown off, due to the right angle turn of the air from its entering axis to the leading axis of the fan is collected within the space between the skimming plate 16 and the rear wall of the casing. The plate 16 is an annular flat ring arranged adjacent the left end periphery of the fan and in parallel spaced relationship with the wall 14. This body of dust is then permitted to descend by gravity and into the influence of the air making its exit through the air passageway 17. In doing so, it is engaged by an adjustable skimming plate 18 having a lip so that the dust is discharged through the opening 19 into a hopper or into a pipe leading into a secondary dust collector hereinafter described. If there is any further dust of lighter character which is not so collected, it passes, due to the right angle turn of the air from the fan casing 9, to the air passageway 17 beneath the skimmer 20 into outlet 21, where it may pass to the open air or to the secondary dust collector. It will be understood that the directing lip 11 may extend completely across the volute casing 9.

The plate 18 may be manually or automatically controlled. A handle 19a is shown for the manual control.

As will be seen in Figure 11, the pipe 22 is adapted to carry away the dust that is collected in which there is a certain amount of entrained air. The lighter dust will be skimmed off by the skimmer 20, which in turn is connected to the same secondary collector as the pipe 22. These pipes 21 and 22, and optionally pipe 13, are connected to the secondary collector 23, where the dust is thrown out centrifugally and whatever remaining air remains in the center of the collector and is extracted through the air exit line 24 at the top of the collector while the dust is moved progressively downwardly in a spiral of decreasing diameter through the successive stages of the dust collector designated by the conical wall 25, vertical wall 26, conical wall 27 and vertical wall 28 into the dust collecting hopper 29. The air outlet pipe 24 is connected (not shown in the drawings) to the air outlet passageway 17.

Operation

Assuming a volume of air having dust, cinders, or snow in it be induced to move from the high pressure to the low pressure side, the stream will be deflected as at AA (Fig. 13) in which the vena contracta's least radius of the stream lies on the low pressure side of the hole. On the induction or high pressure side, the air and dust are induced in multi-directional lines to the focal points formed by the edge of the orifice, as dust, etc., has anywhere from 30 to 80% greater weight than the air, it resists to a much greater extent the change in the direction of flow. It forms what might be termed a secondary vena contracta of a great deal smaller diameter than that of the air. My invention provides means to collect this central stream of

dust, and to remove a great percentage with comparatively little effort.

In the particular adaptation of my invention shown herein (diagrammatically illustrated in Fig. 14) the orifice 1 has become a cone 2, having an inner outlet opening 3, the vena contracta of both the air and dust is substantially the same nature, the dust being allowed to pass into the secondary chamber while the clean air is removed in the primary chamber. The fan wheel 5 is interposed between the inlet opening 3 and the secondary baffle 16. This brings about centrifugal action in both chambers on both sides of the baffle, although the separation of the dust primarily occurs not through centrifugal action but through the concentration of the dust, due to its difference in weight and tendency to form a vena contracta of lesser diameter than the air stream.

Referring to Figure 2, the dust or snow laden air entering the conical inlet 2 converges the dust or snow, which has greater weight than that of the air or gas, to a focal point toward the center of the wheel shaft 8. The dust or snow resists the effort to be made to turn from the opening 3 into the blades 5, which is substantially a right angle turn. It therefore follows in a concentrated stream at the central section of the inlet, the majority of it passing through the spider arms 7 into the secondary chamber to the left of the spider arms. It will be noted that the arms 7 have considerable width in the direction of the axis of the fan so that as they revolve a fanning action takes place, causing the dust or snow which passes through the arms or blades to be forced radially outward along the passageway between the rear surface of the fan and the back wall 14 of the casing. The dust or snow laden air in this passageway is allowed to escape through passage 19 either into the air or to a secondary collector which will take the concentrated dust out of the air. The arcuate plate 18 may be thrown backward clear of the scroll 16 in such a manner that providing there is no dust in the air, the fan may be used with the full blast section, the air which otherwise would be voided through passageway 19 now being projected down through the duct 17. Still other particles of dust strike the back plate 6. It is evident that the front side of the back plate is not directly in line with the rear side of the annular plate 16, leaving a small annular space therebetween. The dust particles which strike the back plate are caused to slide outwardly by centrifugal action and to be caught within the chamber between the annular plate 16 and the wall 14.

Some small residual dusts are carried through the blades 5 and for this purpose a skimmer 20 has been provided, as this dust is again thrown out centrifugally along the valve 18 this being a secondary method of collection of a majority of the dust which is not passed out in the back side scroll of the fan at point 6 and voided at 19. This skimmer may be connected to a secondary type of dust collector for recovery at 21 by a connection to any such secondary apparatus.

There is still a source of fine dust which will not be removed at either passage 19 or 21. This is dust carried in the scroll piece itself and if it is desired to remove this dust it is done by the skimmer lip shown best in Figure 3 at point 12. This may again be connected to a secondary collector, or reclamation, or otherwise, or any or all of the three points of collection may be

volded directly through the air. The most important object of this invention is to cover the condensation and focusing of the dust particles in the conical section. This may be either a conical or an orifice plate which operates very much in the same manner.

It will be understood that I desire to comprehend within my invention such modifications as may be clearly embraced within the claims and scope of my invention.

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

1. In combination, in a combined fan and dust collection apparatus, a fan casing of curvilinear configuration having an axial side opening for admitting dust-laden air and having a peripheral opening for expelling separated air and dust, a fan rotor mounted within said casing to receive the combined air and dust from the side openings, said rotor having an annular ring from which the rotor blades extend into a position adjacent said peripheral opening, said ring being carried by spaced ribs which radiate from the hub of the rotor, and a dust collecting passageway between the rotor and the side of the casing opposite from said side opening, the dust laden air entering said side opening being caused to make a sharp change in direction by the fan blades to separate the dust from the air, the separated dust proceeding in its original direction through the inter-rib spaces of the rotor into said passageway.

2. In combination, in a combined fan and dust collection apparatus, a fan casing having an axial side opening for admitting dust-laden air, said casing having a partition therein comprising a skimmer plate, a fan rotor with blades carried on a hub and mounted within said casing to receive air and dust internally through said fan casing opening, said rotor having an annular ring closely adjacent the internal periphery of said skimmer plate located adjacent the inner ends of the fan rotor blades, said ring being carried by spaced ribs which radiate from the hub of the rotor, and a passageway between the rear side of the rotor and the side of the casing opposite said side opening, said passageway being in alignment with the space between the skimmer plate and the side of the casing adjacent thereof, the dust laden air entering the side opening of the casing being caused to make a sharp change in direction by the fan blades to separate heavy dust from the air, the heavy dust proceeding in its original direction through the inter-rib spaces of the rotor into the space between the skimmer plate and the casing, the light dust carried by the body of the air through its change of direction being caused to impinge upon said ring by centrifugal action upon the dust particles and pass through said passageway.

3. A device of the class described comprising a housing of curvilinear configuration, an impeller rotatably mounted within said housing to receive dust-laden gas axially and discharge it more or less radially and a partition dividing the housing into a clean gas chamber and a dust-laden gas chamber, said partition being interposed between the housing and the periphery of the impeller, said impeller comprising a plurality of substantially radially extending vanes secured to an annular ring, said ring being mounted from the impeller shaft on spaced ribs, a passageway between the ring and the side of the housing opposite the side which receives the incoming

dust-laden gas, the dust-laden air axially entering the housing being caused to make a sharp change in direction by the impeller blades to separate the dust from the gas and cause the dust to proceed in its original axial direction through the inter-rib spaces of the impeller to enter the dust-laden gas chamber.

4. In combination, in a combined fan and dust collection apparatus, a circular fan casing having an axial side opening for admitting dust-laden air axially and having a peripheral opening for expelling separated air and dust tangentially, a fan rotor mounted within said casing to axially receive the combined air and dust from the side opening, said rotor having an annular ring from which the rotor blades extend in planes parallel to the rotor axis and substantially radially with respect to said axis to a position adjacent said peripheral opening, said ring being carried by spaced ribs which radiate from the hub of the rotor, and a dust collecting passageway between the rotor and the side of the casing opposite said side opening, the dust-laden air axially entering said side opening being caused to make a sharp change in direction by the fan blades to separate the dust from the air and cause the separated dust to proceed in its original axial direction through the inter-rib spaces of the rotor, said ribs providing a fan to cause the dust-laden air to leave the casing through said passageway.

5. A device of the class described comprising a housing of curvilinear configuration, an impeller rotatably mounted within said housing to receive dust-laden gas axially and discharge it more or less radially and a partition dividing the housing into a clean gas chamber and a dust-laden gas chamber, said partition being interposed between the housing and the periphery of the impeller, said impeller comprising a plurality of substantially radially extending vanes secured to an annular ring, said ring being mounted from the impeller shaft on spaced ribs, a passageway between the ring and the side of the housing opposite the side which receives the incoming dust-laden gas, the dust-laden air axially entering the housing being caused to make a sharp change in direction by the impeller blades to separate heavy dust from the gas and cause the separated dust to proceed in its original axial direction through the inter-rib spaces of the impeller and to enter the dust-laden gas chamber, said annular ring being positioned between said partition and the back wall of the dust-laden gas chamber leaving an annular space between the front side of the ring and said back wall so that the light dust which passes through the vanes of the impeller and strikes the front side of said ring is caused to slide over the side of the ring in an outward direction and to enter the dust-laden gas chamber.

6. In combination, in a combined fan and dust collecting apparatus, a fan casing, a fan rotor having open ends, said rotor being rotatably positioned within said casing and receiving air and dust axially and discharging the air more or less radially, means forming a dust collecting chamber adjacent the end of said rotor opposite the air entering end, an air inlet for said rotor, said air inlet converging toward the axis of the rotor to form a reduced diameter throat through which the air passes to said rotor, said rotor causing the dust-laden air entering the same to make a sharp change in flow direction to separate the dust from the air and to concentrate the dust

axially within said rotor, the separated dust proceeding through said rotor to said dust collecting chamber.

7. In combination, in a combined fan and dust collecting apparatus, a fan casing, a fan rotor having open ends, said rotor being rotatably positioned within said casing and receiving air and dust axially and discharging the air more or less radially, means forming a dust collecting chamber adjacent the end of said rotor opposite the air entering end, a cone shaped air inlet for said rotor tapered inwardly toward the axis of said rotor to form a converging throat through which the air passes to said rotor, said rotor causing the dust-laden air entering the same to increase in axial velocity by convergence of the air through said inlet and to make a sharp change in flow direction thereof to separate the dust from the air and to concentrate the dust axially within said rotor, the separated dust proceeding through said rotor to said dust collecting chamber.

8. In combination, in a combined fan and dust collecting apparatus, a fan casing, a fan rotor having open ends, said rotor being rotatably positioned within said casing and receiving air and dust axially and discharging the air more or less radially, means rotatably supporting said rotor within said casing including a plurality of ribs, means forming a dust collecting chamber adjacent the end of said rotor opposite the air entering end, said ribs being positioned substantially within said dust collecting chamber, an air inlet for said rotor, said air inlet converging toward the axis of the rotor to form a reduced diameter throat through which the air

passes to said rotor, said rotor causing the dust-laden air entering the same to make a sharp change in flow direction to separate the dust from the air and to concentrate the dust axially within said rotor, the separated dust proceeding through said rotor to said dust collecting chamber wherein said ribs provide the blades of a fan to aid in expelling the dust from said dust collecting chamber.

9. In combination, in a combined fan and dust collecting apparatus, a fan casing, a fan rotor having open ends, said rotor being rotatably positioned within said casing and receiving air and dust axially and discharging the air more or less radially, means rotatably supporting said rotor within said casing including a plurality of ribs, means forming a dust collecting chamber adjacent the end of said rotor opposite the air entering end, said ribs being positioned substantially within said dust collecting chamber, a cone shaped air inlet for said rotor tapered inwardly toward the axis of said rotor to form a converging throat through which the air passes to said rotor, said rotor causing the dust-laden air entering the same to increase in axial velocity by convergence of the air through said inlet and to make a sharp change in flow direction thereof to separate the dust from the air and to concentrate the dust axially within said rotor, the separated dust proceeding through said rotor to said dust collecting chamber wherein said ribs provide the blades of a fan to aid in expelling the dust from said dust collecting chamber.

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