March 6, 1945. W. R. APPELDOORN 2,370,629

DUST PRECIPITATOR

Filed June 2, 1943

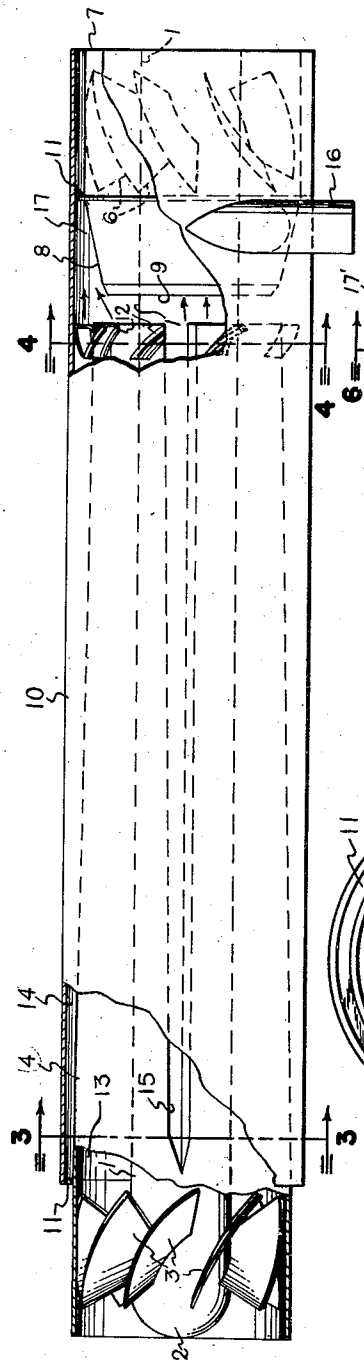


FIG. 1

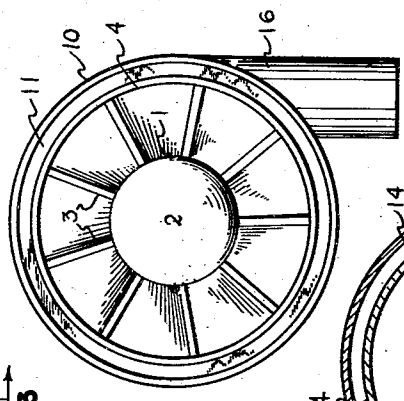


FIG. 2

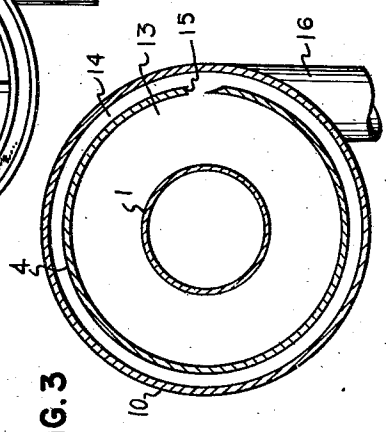


FIG. 3

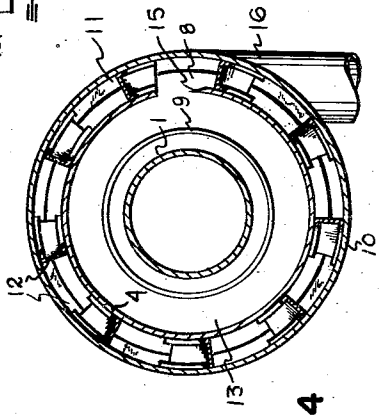


FIG. 4

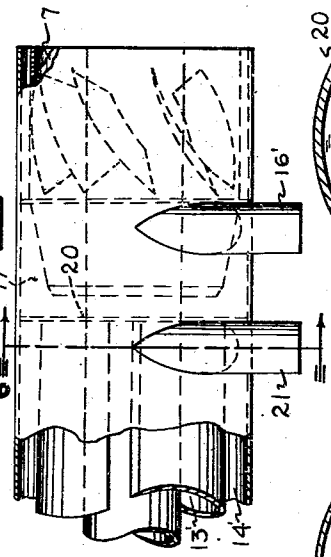


FIG. 5

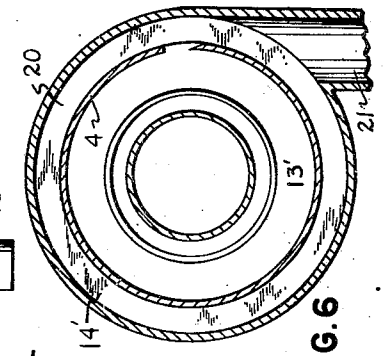


FIG. 6

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2,370,629

DUST PRECIPITATOR

William R. Appeldoorn, Detroit, Mich.

Application June 2, 1943, Serial No. 489,360

1 Claim. (Cl. 183—80)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention pertains to a novel dust precipitator adaptable for the general purpose of removing dust or other particles from a gas such as air. One of the specific applications of the device is its use as an air cleaner in connection with the interior of a combat tank. Another illustrative use is the cleaning of air for the carburetor of an internal combustion engine.

The apparatus is designed with a main flow chamber of gradually decreasing cross-sectional area, thereby accelerating the stream and decreasing the turbulence. This chamber has restricted communication through its outer wall with an outer or precipitating chamber. The stream is whirled in the inner chamber and as a result the heavier laden portion is discharged centrifugally into the outer chamber where the major precipitation occurs. This chamber is provided with a discharge duct at or near its rear end.

The cleaner portion continues through the inner chamber which is provided at its discharge end with an oppositely directed whirling device for imparting a linear direction to the stream. At the same time the rotational energy of the whirling stream is converted into pressure energy in a linear direction.

The invention is fully disclosed by the way of example in the following description and in the accompanying drawing in which:

Figure 1 is a side elevation of the device, partly in section;

Figure 2 is an end view;

Figures 3 and 4 are sections on the lines 3—3 and 4—4 respectively of Figure 1;

Figure 5 is a partial side elevation of a modification, and

Figure 6 is a section on the line 6—6 of Figure 5.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

The device may be regarded as built around a central core 1 which may be in the form of a tube closed at 2 at the intake end of the device. Around this end is fixed a set of spiral vanes 3 constituting a whirler. These vanes also serve to support one end of a tube 4 enclosing the vanes and core 1 in concentric relation with the latter. The tube 4, as shown in Figure 1, tapers slightly from the vanes to the other end, where it terminates considerably short of the core. The protruding end of the core carries another set of vanes 6 similar to vanes 3 but oppositely directed, for a purpose that will presently be described. The vanes 6 support an exhaust tube 7 which is coaxial with the tube 4 and tapers as at 8 towards the adjacent end of the tube 4. The smaller end 9 of the tapered portion 8 is smaller than the adjacent end of the tube 4 and is spaced longitudinally therefrom, as shown in Figure 1.

The tubes 4 and 7 are enclosed in an outer tube or shell 10 supported and spaced from the first named tube by suitable end closure rings 11 and spiral straps 12. The straps also support the smaller end of the tube 4.

As shown in the sectional views, the annular chamber 13 around the core 1 diminishes in cross-sectional area from the intake to the outlet because of the tapered character of the inner tube 4. Likewise, the annular chamber 14 between the tubes 4 and 10 increases in cross-sectional area from the intake end of the device to the outlet.

A slot 15 is cut through the wall of the tube 4 and increases in width roughly in proportion to the increasing area of the chamber 14, in order to supply the chamber at an increasing rate. Although, shown as occupying a longitudinal position, the slot may be formed spirally if desired. The dust outlet consists of a tangential tube 16 communicating with the annular space 17 around the discharge tube 7 at a point adjacent to the tapered portion 8 and in advance of the rear vanes 6.

In the operation of the device the air is forced between the vanes 3 into the annular space 13 and has imparted to it a whirling motion in passing between the vanes. The dust particles are thrown outwardly by centrifugal force and the air that becomes more concentrated with particles in this manner escapes through the slot 15. At the same time, the decreasing cross-sectional area of the chamber 13 accelerates the velocity of the current and thereby reduces the turbulence. The concentrated air passes from the space 14 to the space 17 around the tube 7, from which it is discharged through the duct 16.

The cleaner air continues along the chamber 13 and the major portion passes therefrom into the tube 7. A comparatively small portion, constituting the more concentrated fraction, readily escapes into the annular chamber 17 by rea-

son of the difference in radius between the end 9 of tube 7 and the rear or smaller end of tube 4 and the longitudinal spacing therebetween, as previously set forth. The latter fraction is obviously discharged through the outlet 16. The clean air is discharged between the vanes 6 which, being directed oppositely through the vanes 3, restore the whirling current to a straight path. At the same time, the rotational energy of the whirling current is regained as pressure energy in the discharged stream.

In the modification shown in Figures 5 and 6, the rear end of the channel 14' is closed by a ring 20, and another outlet duct 21 is placed tangentially in communication with the chamber 13' immediately in front of the ring 20. Thus, the entire contents of this chamber is discharged before entering the tube 7'. Otherwise, the operation is as previously described. Some of the air from chamber 13' passes to space 17' and any precipitant therefrom is discharged through the duct 16'. This device is used in special cases where it is desired to exhaust the more concentrated fraction, or the major portion of solids, before it may become diluted in the adjoining chamber 17'.

Although specific embodiments of the invention have been illustrated and described, it will be understood that various alterations in the details on construction may be made without departing from the scope of the invention as indicated by the appended claim.

What I claim is:

A dust precipitator comprising a core, a tube spaced around the same and tapering from one end to the other to form with such core a chamber of gradually decreasing cross-sectional area, a shell enclosing said tube and forming therewith a chamber, the larger end of said tube being the intake, a whirling device in said end, said tube having a slot extending substantially from end to end, and increasing in width from the inlet end of said tube, the second chamber gradually increasing in cross-sectional area.

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