

[54] CLEANER

[72] Inventor: **Ross K. Petersen**, 3116 Girard Avenue
South, Minneapolis, Minn. 55408

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417/355

[51] **Int. Cl.**.....**B01d 45/12**

[58] **Field of Search**.....55/404, 405, 406, 407, 399,
55/394, 449, 456, 457, 430, 431, 432; 417/355

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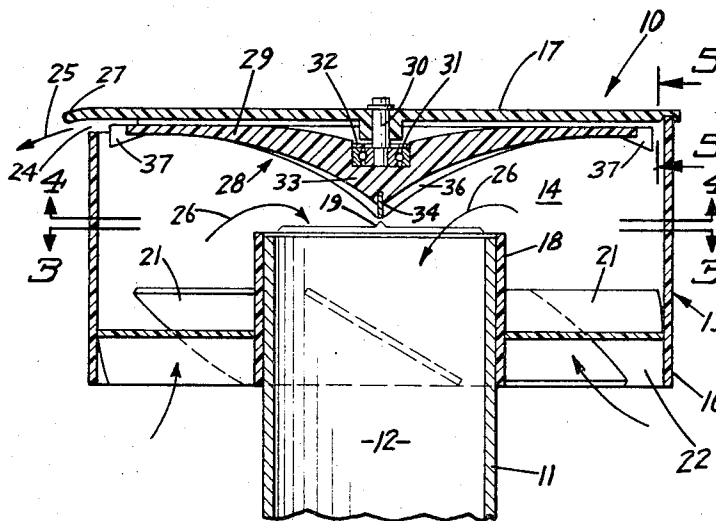
Primary Examiner—Bernard Nozick

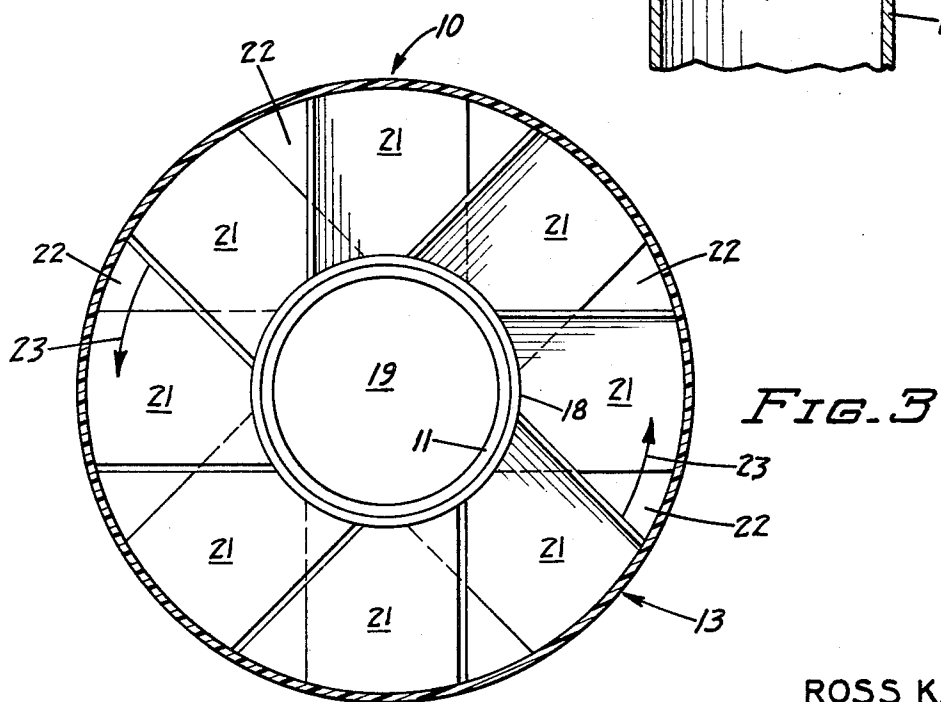
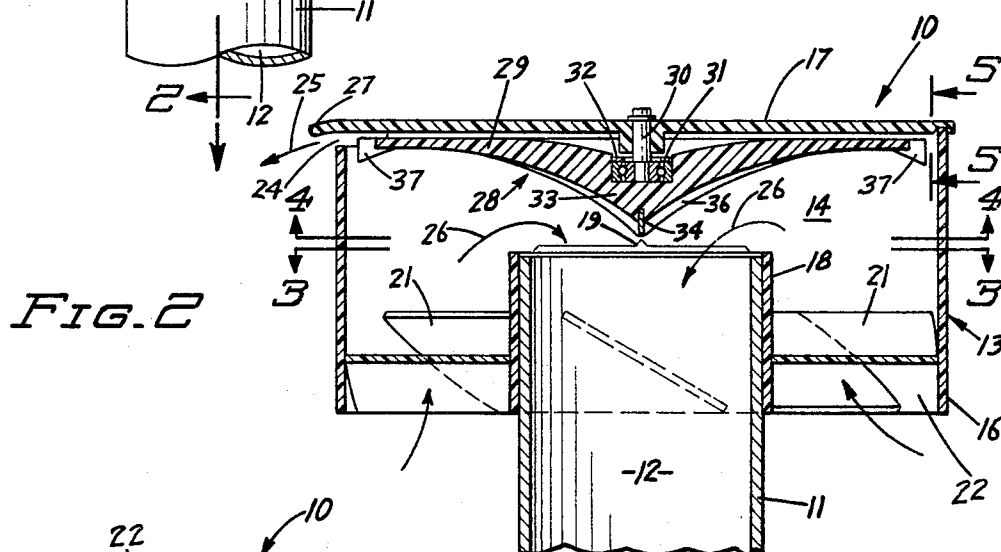
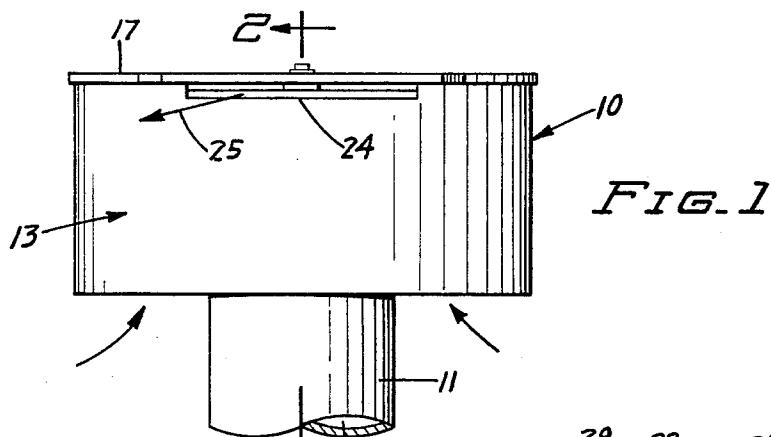
Attorney—Burd, Braddock & Bartz

[57] **ABSTRACT**

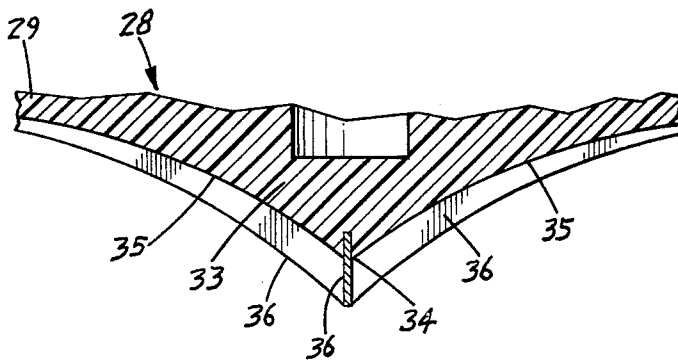
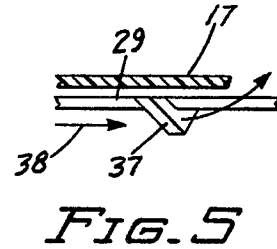
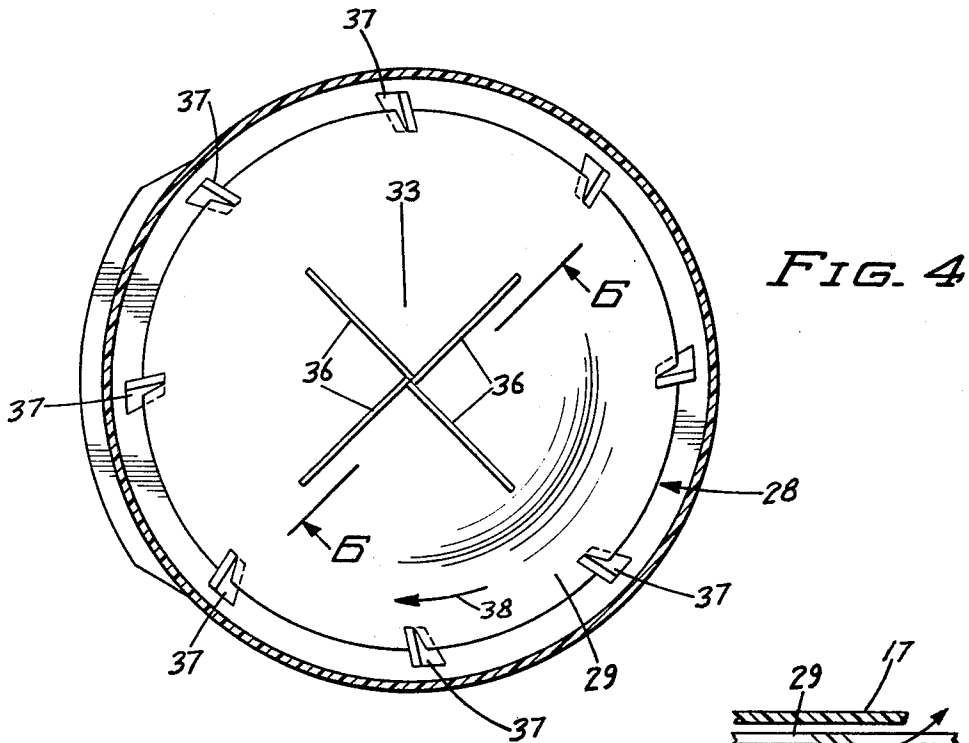
An apparatus for separating particulates, as dust, dirt, sand, snow and the like, from air being directed to an air cleaner of an internal combustion engine. The apparatus has a cylindrical housing surrounding a separation chamber. Located within the housing is a sleeve having a central outlet passage for carrying cleaned air from the chamber. A plurality of circumferentially spaced vanes attach the sleeve to the housing and provide an inlet passage open to the chamber for directing the air and particulates into the chamber. An impeller rotatably mounted on the top wall of the chamber has a plurality of circumferentially spaced blades. The blades are located in a contiguous relationship with respect to a second opening in the housing. Movement of air through the chamber causes the disc to rotate, whereby the blades pump air and particulates out of the second opening. The rotating impeller produces a positive pressure at the point of discharge of the second opening to insure a flow of air carrying the particulates through the discharge opening.

14 Claims, 6 Drawing Figures





INVENTOR.
 ROSS K. PETERSEN
 BY
Burd, Braddock & Bart
 ATTORNEYS



INVENTOR.
 ROSS K. PETERSEN
 BY
Burd, Braddock & Barty
 ATTORNEYS

CLEANER

BACKGROUND OF THE INVENTION

Air cleaners and pre-cleaners are in general use for removing dust, dirt and other particles from the air prior to the flow of air to the carburetor of an internal combustion engine. Numerous devices have been developed which utilize a centrifugal force to separate the particles from the air so that relatively clean air will flow to the carburetor. These devices have housings defining a separation chamber having an opening to the inlet of the carburetor and a discharge opening for the particles and air. Stationary deflection blades and vanes are used with the housing to provide circular motion of the air flowing through the housing. Examples of these types of air cleaners are shown in U.S. Pat. Nos. 1,734,030 and 1,934,311. The efficiency of the separation of particles from the air of these cleaners is diminished by the lack of positive pressures and forces to remove the particles from the separation chamber. The flowing air through the housing creates a reduced pressure in the separation chamber which impairs the separating efficiency of the cleaner.

SUMMARY OF THE INVENTION

The invention is broadly related to an apparatus for separating particulate material, as dust, dirt, sand, ice, snow and other solid and liquid particles, air-borne particles and aerosols from carrier gas, as air. The apparatus has a housing having a separation chamber with a first outlet open to the chamber for carrying the gas, separated from a substantial part of the particles, out of the chamber and a second outlet spaced from the first outlet providing a passageway for gas and particles from the chamber. The gas and particles flow through an inlet passage open to the chamber which directs the particles into the chamber. Movably mounted within the chamber is a rotatable member or impeller operable to produce a positive pressure to pump the particles and gas through the second outlet passage and in this manner continuously purge the chamber of separated particles.

In the drawings

FIG. 1 is a side elevational view of the cleaner of the invention mounted on an intake pipe;

FIG. 2 is an enlarged cross sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is an enlarged sectional view taken along the line 5—5 of FIG. 2; and

FIG. 6 is an enlarged sectional view taken along the line 6—6 of FIG. 4.

Referring to the drawings, there is shown in FIG. 1 the cleaner of the invention, indicated generally at 10, mounted on an intake pipe 11. The pipe 11 has a passage 12 for directing air, gas or fluids to a selected location. The cleaner 10 is particularly suitable for use in connection with an air cleaner of an internal combustion engine. Cleaner 10 serves as a pre-cleaner for separating the air-borne particles, as dust, aerosols, fibers, dirt and the like from the air prior to the passage of the air to the air cleaner. A pre-cleaner operates to remove a substantial portion of the air-borne particles from the air and thereby serves to prevent the air cleaner from plugging up. Cleaner 10 is adaptable for use in other environments where it is desirable to remove particles from a gas, as air, carrying the particles.

Cleaner 10 has a tubular or cylindrical housing, indicated generally at 13, having a separation chamber 14. The housing 13 has an upright cylindrical side wall 16 attached to a flat top wall 17. Both the side wall 16 and the top wall 17 can be made of plastic or metal. Located concentrically within the chamber 14 is a sleeve 18 having a central outlet opening 19 forming the mouth of passage 12. The sleeve 18 has an internal diameter designed to have a tight fit over the pipe 11 to mount the

housing 13 on the pipe 11. The top of the sleeve 18 is in general transverse alignment with the center of midportion of the separation chamber 14. The lower portion of the sleeve 18 lies in the same general transverse plane as the lower edge of the side wall 16 so that the sleeve is located within the chamber 14. The sleeve 18 is secured to the side wall 16 with a plurality of radially outwardly directed vanes or fins 21. The adjacent vanes 21 are spaced from each other to provide inlet openings 22 around the sleeve 18 open to the outer area of the separation chamber 14. The vanes 21 are inclined upwardly in a circumferential direction to direct the inlet air, indicated by arrows 23 in FIG. 3, in an upward and circumferential or spiral direction into the cylindrical separation chamber 14. The circular movement of the air establishes centrifugal forces on the air and particles carrying the particles outwardly against the side wall 16.

As shown in FIGS. 1 and 2, the housing has a top discharge opening 24 in the shape of a circumferential slit located adjacent the top 17 providing an exit passage for the air and particles, indicated by arrows 25. The air in the center portion of the separation chamber, indicated by arrows 26, flows down into the clean air outlet passage 12 to the air cleaner. The top 17 has a short outwardly directed circumferential lip 27 which projects over the discharge opening 24 to prevent foreign material and water from entering the separation chamber 14.

Located within the separation chamber 14, adjacent the inside face of the top wall 17, is a rotatable impeller or spinner, indicated generally at 28. Spinner 28 can be a one-piece plastic or metal member. The spinner 28 is operative to produce a positive pressure at the point of discharge or immediately adjacent the discharge opening 24 to insure the positive flow of air and entrained particles through the discharge opening 24. The spinner 28 overcomes the negative pressure of the air as it flows through the separation chamber 14. Spinner 28 comprises a relatively flat circular disc 29 located in a parallel relationship with the flat inside face of the top wall 17. A short downwardly directed stub shaft 30 secured to the top wall 17 extends into a bearing 31 to rotatably mount the spinner 28 on the top wall 17. Bearing 31 is located in a recess in the center of the disc 29. A fastener 32, as a split ring, holds the bearing 31 in assembled relation with the disc 29. The bottom center portion of the disc 29 has a downwardly directed cone-shaped portion 33 which terminates in a lower point 34 positioned along the central longitudinal axis of the outlet passage 12. As shown in FIG. 6, the cone-shaped center portion 33 has a generally circular concave face 35 and downwardly projected radial drag ridges or ribs 36.

As shown in FIG. 4, the ribs 36 extend in radial outward directions and are spaced approximately 90° from each other. These ribs 36 serve as paddles which interfere with the flow of air through the separation chamber 14 and thus aid in rotating the spinner 28. A plurality of outwardly directed short fan blades 37 are secured to the outer periphery of the disc 29. Eight blades 37 are shown on the disc 29 in FIG. 4. The outer portions of the blades 37 are located in close circumferential and horizontal alignment with the discharge opening 24 whereby the blades 37 function as impellers to pump the air and particles from the outer portions of the separation chamber 14 through the circumferential discharge opening 24.

The blades 37, shown in FIGS. 2 and 5, are short triangular members which are angularly related with respect to the plane of the disc 29 so as to pick up the particles and air from the outer circumferential portion of the separation chamber 14 and move the air and particles through the discharge opening 24. The blades project in a circumferential forward and downward direction to pick up air and particles and move the air outwardly toward the discharge opening 24. The angular inclination of the blades 37 causes a flow of air upwardly along the inside of the side wall 16 and thereby keeps the air moving to prevent settling and separation of the particles from the air. The number and size of the blades can vary according to the

size of the cleaner and the speed of rotation of the disc. Preferably, the total number and pumping surface of the blades 37 is proportioned to move sufficient air out of the separation chamber 14 to eliminate the particles small enough to prevent excessive drag on the spinner 28.

In use, the flow of air through the separation chamber 14 initially causes the air to move in a circumferential or spiral pattern. This establishes centrifugal forces on the particles causing the particles to move outwardly into the outer peripheral portions of the separation chamber 14. The circumferentially spaced inclined vanes 21 cause the air to move circumferentially in the separation chamber 14. This circular movement of the air also causes the spinner 28 to rotate about the central axis of the chamber. The moving air acting on the cone-shaped center 33 and ribs 36 continuously rotate the spinner in the direction of arrow 38, shown in FIGS. 4 and 5, as long as the air is moving through the separation chamber 14. The blades 37, mounted on the outer peripheral portions of the spinner 28, function as small impellers or pumps which force air to flow upwardly along the insides of the wall 16 and out through the discharge opening 24. The moving blades 37 continuously unload the chamber 14 so that the cleaner can be termed a self-unloading device which does not need any external source of power.

While there has been shown and described a preferred embodiment of the invention, it is understood that various changes in size and material and parts can be made by those skilled in the art without departing from the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An apparatus for separating particulates from a gas carrying particulates comprising: a generally tubular housing having a side wall surrounding a chamber, wall means attached to said side wall closing one end of said chamber, an inlet passage open to the other end of said chamber adjacent the side wall, means within the inlet passage for directing the gas and particulates into the chamber in a circular direction whereby the particulates move outwardly by centrifugal force, a first outlet passage substantially coaxially extending into and open to the chamber for carrying gas separated from a substantial part of the particulates out of the chamber, said first outlet passage having an inlet opening located in the central portion of said chamber, a second outlet passage spaced from the first outlet passage in said side wall providing a passageway for gas and particulates from the chamber, rotatable impeller means located in the chamber operable to move gas and particulates out of the chamber through the second outlet passage, said rotatable impeller means having first means directed toward the first outlet passage responsive to gas flow to rotate the impeller means, and second means on the outer peripheral portions thereof to move gas and particulates out of the chamber through said second outlet passage, and means mounting the rotatable impeller means on the wall means.

2. The apparatus of claim 1 wherein: the means mounting the rotatable impeller means on the housing includes a bearing assembly for rotatably connecting the impeller means to the wall means for rotation about an axis generally aligned with the longitudinal axis of the first outlet passage.

3. The apparatus of claim 1 wherein: the wall means is a generally flat top wall, said rotatable impeller means comprising an impeller located in the upper portion of the chamber adjacent the top wall of the housing.

4. The apparatus of claim 1 wherein: said first means on the rotatable impeller means are paddle means extended toward the first outlet passage.

5. The apparatus of claim 1 wherein: the second means on said impeller means has downwardly projected portions.

6. The apparatus of claim 1 wherein: the housing has an upright sleeve having the first outlet passage open to the center portion of the chamber, and means attaching the sleeve to the side wall.

7. The apparatus of claim 6 wherein: the means attaching the sleeve to the side wall comprise inclined spaced vanes to direct the gas and particulates moving into the chamber in a circular direction.

8. The apparatus of claim 1 wherein: the rotatable impeller means has a cone-shaped center portion directed toward the first outlet passage and the second means comprise blade members on the outer peripheral portions of the impeller means, said blade members having portions aligned with the second outlet passage whereby on rotation of the impeller means the blade members pump gas and particulates out of the chamber through the second outlet passage.

9. The apparatus of claim 8 wherein: the second outlet passage is an elongated circumferential slot in the side wall.

10. The apparatus of claim 1 wherein: said second means comprise blade members attached to the impeller means aligned with the second outlet passage whereby on rotation of the impeller means the blade members pump gas and particulates out of the chamber through the second outlet passage.

11. The apparatus of claim 10 wherein: the second outlet passage is an elongated slot in the housing.

12. The apparatus of claim 10 wherein: the impeller means has a downwardly directed center portion directed toward the first outlet passage.

13. The apparatus of claim 1 wherein: the second outlet passage in the side wall is located adjacent the outer portions of the impeller means and said impeller means includes blade members attached to the outer peripheral portions thereof in general alignment with the second outlet passage, whereby upon rotation of the impeller means, the blade members pump gas and particulates out of the chamber through the second outlet passage.

14. The apparatus of claim 13 wherein: the second outlet passage is an elongated slot.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,670,480 Dated June 20, 1972

Inventor(s) Ross K. Petersen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the references cited, "3,566,585" should be --3,585,586--

Signed and sealed this 26th day of September 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents