Feb. 19, 1952 G. F. McDOUGALL 2,586,243

AIR CLEANER

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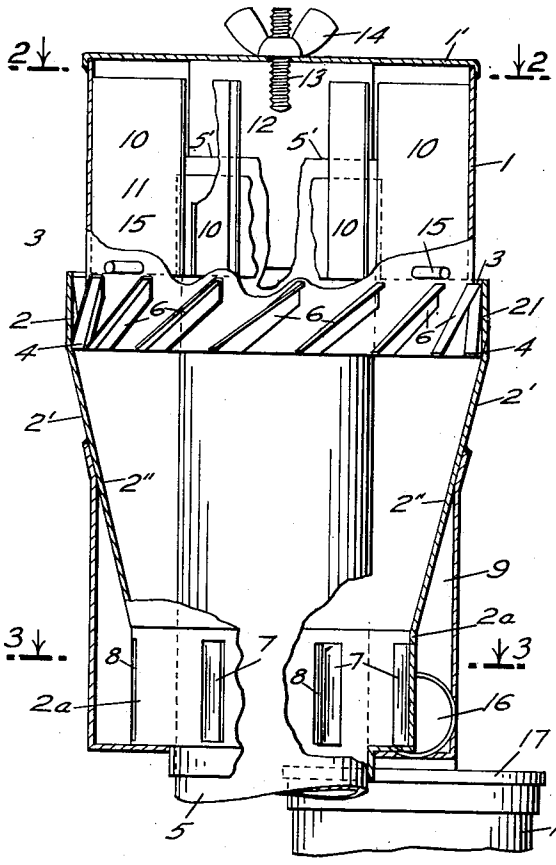


Fig. 1.

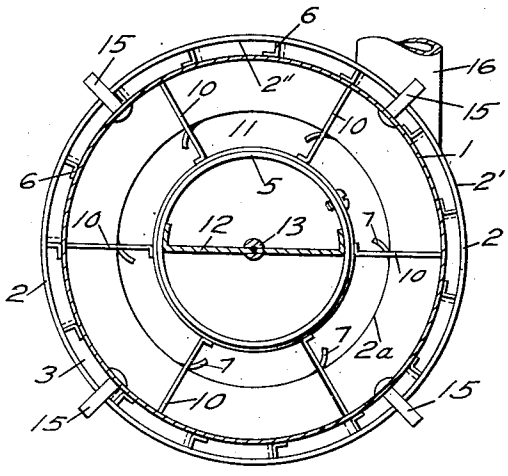


Fig. 2.

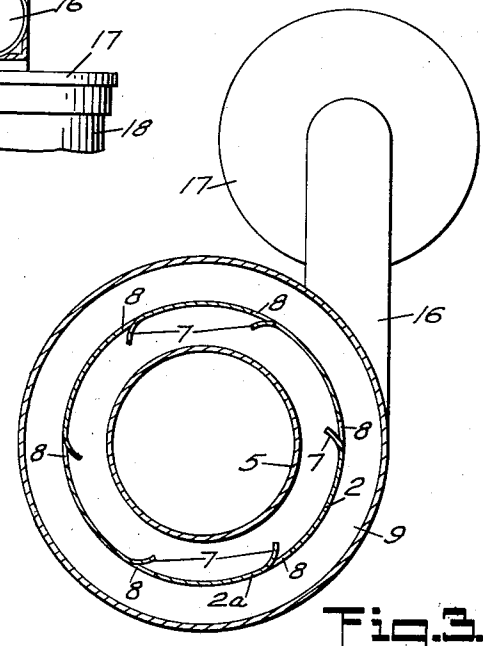


Fig. 3.

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AIR CLEANER

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7 Claims. (Cl. 183—80)

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This invention relates to dry air cleaners of the velocity type, where air for internal combustion engines is made to travel at relatively high velocity under influence of suction from the engine served, and where the mass or unit weight of the dust is made to store energy, to carry it away from the open end of the suction pipe that furnishes the energy, so that devices, of which many have been proposed, may entrap the dust; while the air, which for the purposes of such an instrument may be regarded as having zero mass, flows with more or less freedom towards and enters the suction of the engine supply pipe, at least partially cleaned for dust, especially the abrasive dust that is most dangerous.

By trial and experiment, it has been discovered that the advantages of the inertia forces resulting from my peculiar annular air inlet jet are enhanced materially by placing vanes or slanting louvres in the path of the entering air to give it a whirling motion, to make the lower bell so that it embodies an inverted frusto-conical chamber, the lower, smaller end of which is in sealed inner communication with a dust receiving receptacle. The combined result of the new annular air inlet jet, with the vanes for whirling the air, results in a decided improvement over the cleaner that embodies only the annular jet.

Improved results are the overall object of the invention, the scope of which is to be ascertained from the claims at the conclusion of this disclosure.

A drawing accompanies and forms a part of this invention, in which—

Fig. 1 is an elevation with parts cut away to show the interior construction;

Fig. 2 is a section taken on the plane 2—2, Fig. 1; and

Fig. 3 is a section taken on the plane 3—3 of Fig. 1.

Describing the drawings in greater detail, numeral 1 represents an upper bell member. The element 1 may be deep drawn of a single piece of metal or have an attached top as shown, but in any event it will have an air-tight outer wall. Numeral 2 represents a lower bell, the upper end of which is of larger diameter than the lower end of bell 1; the lower end of bell 1 being inserted into the upper end of bell 2 to define the outer and inner limits of the annular air inlet 3, hereinbefore referred to.

It will greatly contribute to the efficiency if the total area of the annulus at the point 4, that point which determines its inlet area, is nearly in proportion to the total cross-sectional area of

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the engine induction air tube 5, which areas will be closely similar, though a slight difference will result in a disproportionate effect on the efficiency of the instrument as a whole, with regard to choke effect on the engine. With respect to the air cleaner the air tube 5 is an eduction tube or pipe. The annulus as described may be properly called a velocity jet nozzle.

The outer surface 2′ and the inner surface 2″ of the lower bell 2, can be cylindrical as shown at 21, or it may have a uniform taper as an alternate, as the inlet area at 4 determines its air inlet capacity. If the taper is carried out to the upper terminal of the lower bell, the vanes 6, which impart a whirl to incoming air, will be better if made with a complementary taper.

The inner wall 2″ of the lower bell 2, constitutes an inverted frusto-conical whirl chamber and its decreasing diameter, often erroneously said to increase the speed of the incoming air, does increase the revolutions per unit of time and consequently the amount of centrifugal force developed. Such structures are well and widely known as "cyclones." The dirt carried inwardly through the inlet nozzle 3 to 4, moves rapidly to the lower portion of the lower bell 2 and into the cylindrical extension 2a thereof, where, still whirling, it encounters the lips 7 with accompanying slits 8 and passes into the dust catcher 9, an auxiliary chamber that surrounds the cylindrical extension 2a of the frusto-conical dirt separator, while the air less affected by the whirl and velocity passes upwards into the upper bell to enter the induction air tube 5.

To prevent whirl of the body of air passing to the tube 5, which is undesirable, a plurality of baffle plates 10, of which six are shown as a desirable number, are firmly attached to the collar 11 by their inside edges and are freely slidable into the upper bell to substantially the position shown in Fig. 1. To position the top of the upper bell 1, a plate 12 is made rigid with the upper inside of the tube 5, preferably by spot welding, and a threaded screw 13 is made rigid with the upper end of the plate 12. This forms a support for the upper closure disc 1′ of the upper bell 1 and a suitable nut 14 secures it against vibration loosening.

Projecting from the rim of the uper bell 1 is a plurality of pins 15, designed to rest on the upper rim of the lower bell, to fix the relative longitudinal measure of the annular inlet jet 3.

Tangentially disposed in respect to the dust catcher 9 is a tube 16, sealed in communication with the inside of the dust catcher 9, with its

outer end passing through the cover 17, to which will be sealed a dust receptacle, usually of glass, indicated at 18, a familiar standard auxiliary of every dry dust separating instrument.

The virtue and advance of this cleaner over others which have preceded it lies in the annular air inlet, positioned well below the open end of the tube 5 at 5' and directing the entering air with its dirt away from the tube, instead of other expedients that may be found. The frusto-conical chamber, vanes in different forms and the dust receptacle such as 18 in sealed communication with the small end of the frusto-conical chamber, considered as independent elements, are known in varying form in the art.

The novel feature of my new cleaner is therefore the structure substantially as shown in the drawings, an elongated body preferably vertically mounted though it will work in a less efficient manner when laid on its side; this elongated body has an annular air inlet in the median portion of the body, created by making the elongated body of half-length parts by assembling two parts in slightly telescoped relationship to form an air inlet all the way around the said median girth of the body by reason of the fact that the mouth of the upper bell is telescoped into the mouth of the lower bell, there being a calculated difference in size, to produce desirable entrance velocity. The velocity is produced by engine suction acting through the tube 5 and originates, insofar as the cleaner is concerned, in the extreme upper end of the elongated body. All the air that enters the body through the annular air inlet 3, with its burden of air-borne dust, is initially directed towards the bottom of the body, which contains the frusto-conical concentration surface 2'', from which extends the tangential tube 16 to the dust receptacle 18. The entrant air, having almost zero ability to acquire inertia velocity, must and does make a complete U turn in direction before it can enter the eduction pipe 5. Since it is highly desirable that the whirl remaining in the air, if any, be killed, I employ the vanes 10, which divides the inside of the upper bell into a plurality of vertical channels.

I claim:

1. A dry separation air cleaner comprising a two part elongated hollow vertical body, formed by partially telescoping two bell shaped members a small fraction of their lengths, the upper telescoped into the lower to form a velocity jet nozzle of annular form surrounding the median portion of said body, an air eduction pipe axially penetrating said body from end to end save for a short distance from the inside top of the upper bell, to which it is secured, said velocity jet nozzle formed with suitable area to impart entrance velocity to incoming air related to velocity of air in said eduction pipe, said air directed by said nozzle towards the inside lower end of said body opposite the point of air eduction, a dust concentrating cyclone incorporated with said lower bell, means for imparting whirl to air passing through said velocity jet nozzle, said jet nozzle positioned to deliver the whirling air to said cyclone.

2. The combination as claimed in claim 1 wherein the upper bell has its inside volume divided into vertical channels by baffles, the tops of said channels in free communication with said eduction pipe.

3. A dry air cleaner of the inertia type comprising an upper bell member of generally cylindrical form having an open mouth, a lower bell in reversed position having a larger mouth telescoped over the open end of said upper bell to leave an annular space between the ends of the bells, a centrally attached air eduction pipe within the body formed by joinder of said bells in partially telescoped relationship, said eduction pipe terminating in an open end spaced from the inside end of said upper bell and passing out of said body through the closed end of said lower bell, said annular space so related in total area to said air eduction pipe that it constitutes a velocity jet nozzle for air entering said body, a cyclone dust separator incorporated with said lower bell with its larger end positioned to receive incoming air through said velocity jet nozzle, air whirling means in said nozzle, a dust collector means in communication with the lower end of said cyclone and anti-whirl baffles inside of said upper bell below said open end of the eduction pipe.

4. A dry air cleaner of the inertia type comprising an elongated vertical body member formed from an upper bell-like member with a closed top and open bottom, telescoped for a small part of its axial length into a larger bell-like member, a dust concentrating cyclone incorporated with said larger bell-like member, a tangential dust tube in communication with said cyclone, said telescoped portion of said two body members being so proportioned that they form a velocity jet nozzle that directs entering dust towards said dust tube through said cyclone and an air eduction pipe having its intake end within the upper end of said upper bell member and so positioned that it forces incoming air to make a complete U turn after entering through said nozzle.

5. The combination as claimed in claim 4 and including baffles within said upper bell-like member that divide the space therein into a plurality of vertical airways, the upper ends of which are in free communication with said eduction pipe.

6. A dry separation air cleaner comprising a two part elongated vertical hollow body formed by telescoping open ends of two bell-shaped members a small fraction of their lengths, the upper telescoped into the lower, an air eduction pipe axially positioned within and secured to both of said bell-shaped members, an open end thereof near to the top of said upper bell member, the telescoped portions of said members so proportioned that the space between them constitutes a velocity jet nozzle properly proportioned with respect to said air eduction pipe, a dust separating cyclone incorporated with said lower bell-shaped member, said jet nozzle positioned to direct air through said cyclone and away from said open top of said induction pipe, air whirling vanes positioned within said velocity jet nozzle, a dust collecting receptacle in communication with the small end of said cyclone and anti-whirl means positioned within said upper bell-like member below the open end of said air eduction pipe.

7. A dry dust air cleaner of the cyclone separation type comprising upper and lower bell-like body parts axially telescoped for a short portion of their lengths to define an elongated body provided with an annular air inlet velocity jet nozzle in its median zone between said two bell-like body parts, air whirling vanes within said nozzle, said lower body part having a cyclone dust collector incorporated therewith, an axially positioned air eduction pipe that is entered through the lower end of said cyclone and terminated with an open

end near to the inside top of said upper bell-like body part, air whirling vanes positioned within said velocity jet nozzle to deliver incoming air to the larger end of said cyclones in a direction away from the said open end of said eduction pipe and anti-whirl baffle plates within said upper bell-like body part above the upper limits of the large end of said cyclone.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,430,066	Evans	Sept. 26, 1922
1,464,741	Bennett	Aug. 14, 1923
1,523,916	Tompkins	Jan. 20, 1925
1,534,831	Berg	Apr. 21, 1925
1,756,909	Cram	Apr. 29, 1930
1,820,530	Davies	Aug. 25, 1931
2,046,093	Schaaf et al.	June 30, 1936
2,106,589	Bigger et al.	Jan. 5, 1938
2,417,130	Russell	Mar. 11, 1947