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R. MARSHALL, JR

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AIR CLEANER

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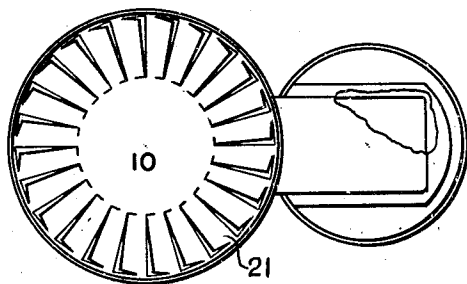


FIG. 1

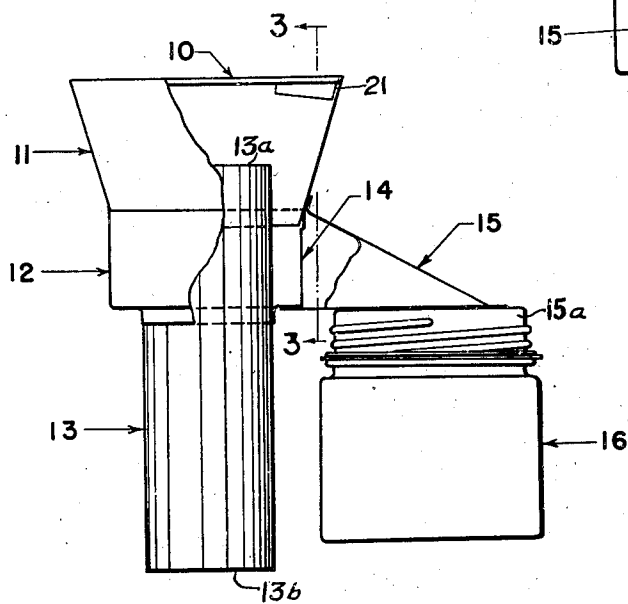


FIG. 2

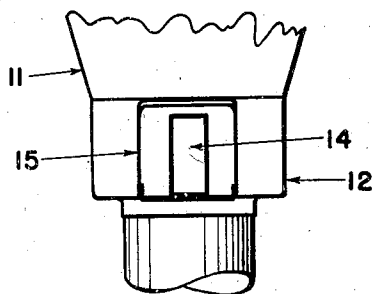


FIG. 3

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AIR CLEANER

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4 Claims. (Cl. 183—92)

My invention relates to improvements in dry centrifugal air cleaners for cleaning the air entering the cylinders of internal combustion engines, in combination with an improved structure for extracting entrained abrasive dust from the air, before it enters the engine or the carburetor as the case may be.

An object of the invention is to so protect the engine induction pipe that a minimum of abrasive dust will find opportunity to enter it, in any range of operation from lowest to highest speed.

Another object is to separate the dust segregated by influence of centrifugal force into a receptacle wherein it falls by gravity uninfluenced by the turbulence inseparable from centrifugal separation of dust from air.

Other objects that will be apparent from the following description of a preferred form of the invention will be obvious to those to whom this specification is addressed; and are particularly pointed out in the claims which follow the description.

It is not believed that the invention has any particular merit save in cases where air is induced into a separator, such as by suction influence of an internal combustion engine or a suction fan, and in the case of an engine it will operate far better on a multi-cylinder engine that induces practically a steady stream of incoming air for combustion use, as distinguished from a single cylinder engine, particularly of the "hit-and-miss" governed type where the induction is interrupted.

A drawing of the preferred form of the invention is hereinafter described in detail by way of disclosure but this description is not intended as a limitation, the scope of the invention being intended to be ascertained from claim language.

In the drawing:

Fig. 1 is a view of the inlet end of the cleaner, in this case the top;

Fig. 2 is a side elevation of the cleaner, with a part broken away to show internal construction of an essential part that will later be described in detail and its peculiar purpose explained; and

Fig. 3 is a section taken on line 3—3 of Fig. 2.

A generally frusto-conical body 11, is closed at its larger end by the head 10, save that an annular air intake portion is provided by the annular row of vanes 21. These vanes 21 will be of selected pitch to impart a whirling motion to air entering therethrough.

An induction pipe 13 is made rigid with the smaller end of the frusto-conical body 11, its axis being coincident with the axis of the body 11 and

having an open end 13a inside the frusto-conical body 11, spaced from the solid portion of the head 10 and so shielded thereby that entering air does not impinge directly against this open end 13a.

The smaller end of the frusto-conical body 11 is preferably made cylindrical as at 12, for a short distance, then the walls are brought in abruptly to contact relationship with the outside of the induction pipe 13, to which they are made fast by welding, brazing or other preferred method.

It will be understood that the word "frusto-conical" as applied to the element 11 refers to the inside surface and the outside surface is not intended to be defined.

The induction pipe 13 will have its outside end 13b in operative connection to a source of suction such as the intake of an internal combustion engine and it will be seen at once that when such source is operating, air will enter the annular air intake, between the vanes 21, which by reason of their shape will impart a whirling motion to the incoming air that is proportional to its velocity of entrance.

It will also be seen that any entrained abrasive dust in suspension in this air will be thrown to the outside of the whirling conical mass of entering air because the unit specific gravity of such material is much greater than air. This principle of separating air from entrained mineral dust has often been proposed and I make no claim to structures employing it, broadly. However, it will now be seen that the induction pipe is so disposed with respect to its entrance 13a that entering dust particles are prevented from entering it by virtue of the solid shield portion of the head 10, which I believe to be new and know to be very important.

As the whirling body of air continues to enter under influence of suction, the exceedingly thin wall of mineral dust that it contains continues to follow the inside surface of the body 11 under influence of maintained centrifugal force, finally reaching the cylindrical portion 12, of the body 11, with its tendency to fly still further practically undiminished; hence in whirling around the wall of this cylindrical portion 12, it encounters the opening 14, which it enters. The conduit 15 is made rigid with and in sealed relationship to the body portion 12 and terminates in an abrupt turn or elbow 15a, the conduit being hermetically sealed over the opening 14.

The elbow 15a is conveniently made with a screw threaded outlet suitable to engage the thread on the receptacle 16, which will usually

be a glass jar, well known as a standard article of commerce. The sealing rubber, well known as means for sealing these jars, will be employed because leakage of atmosphere into this part of the apparatus will completely defeat its operation.

The aero-dynamic principle of operation of this separator depends upon the fact that dust of abrasive character is always of mineral origin and heavier than air, though it may be in such small particles that it can be held in suspension in air for a considerable time. When such particles have centrifugal force applied to them by whirling a mass of air within which they are suspended, they tend to fly off at a tangent to the air body and if means are provided through which they can fly into a dead air space that is protected from turbulence reaching into it from the whirling air, they can and will settle into a pile.

I have discovered that means for inducing air by suction into a body, in the general form of a cone of whirling air, will rapidly place the heavy particles of abrasive dust at the perimeter of the cone, then the clean air can be drawn from the center of the base of the cone, which will be much cleaner than by any other structure with which I am familiar. But there is still another problem, that of taking care of the dust thrown outwardly, and depositing it within a turbulence free receptacle. This is almost completely solved by connecting a dust conduit in communication with the perimeter of the cone, near its small end, the axis of which is substantially normal to the axis of the cone. The length of the dust conduit is important and the longer it is the greater the effectiveness, up to say as much as four inches though I have not tested one longer, since ordinarily there will not be room under an engine hood to accommodate a dust conduit that long with a receptacle on the end of it. I have found that putting a turn at the end of the dust conduit is as effective as several inches of dust conduit, the purpose of both being, of course, to quiet any tendency to turbulence within the receptacle itself.

In Fig. 3, it is clearly shown that the end of the dust conduit 15, sealed over the opening 14, is considerably larger than the opening 14. Such construction is very important in killing turbulence, as ascertained by test.

I therefore conclude that the elbow is an effective substitute for a long conduit and that the complete sealing of the receptacle is necessary to its successful operation as described; that the lead-off dust conduit must be generally normal to the axis of the cone and that initial separation of entrained dust from the air is best performed by the structure which naturally and normally keeps the induced air in the shape of a hollow whirling cone, the induction pipe being inside the

cone and located as near its hollow base as possible, thus furthest from the dust.

It will be observed that this cleaner can be operated in a vertical or horizontal position by merely altering the manner of attaching container 16.

I claim:

1. In an air cleaner, a body member containing a generally frusto-conical chamber, a base member for said chamber with a solid center and an annular vaned inlet, an induction pipe axially positioned in said chamber in such manner that its inner end is shielded by the solid center of the base, and a dust tube normal to the smaller end of the chamber and in communication therewith, the said dust tube embodying a turn portion spaced from the chamber by the tube and a dust receptacle hermetically sealed to the outlet of the said turn portion.

2. In an air cleaner of the character described, a body member embodying a generally frusto-conical chamber, an induction tube extending axially into said chamber through the smaller end to a point near the larger end, a shield for the tube comprising a part closure for the large end of the chamber provided with an annular air inlet surrounding a solid center, vanes in said annular inlet and a dust tube positioned at the small end of the chamber with its axis normal to the axis of the chamber, said dust tube embodying a turn portion and a receptacle sealed to the outlet of the turn portion in such position that it is adapted to receive dust therefrom by gravity.

3. An air cleaner of the centrifugal separation type, comprising a frusto-conical chamber, a base member fitted to the larger end of said chamber, an annular system of vanes disposed around the perimeter of said base, a solid center in said base, an induction pipe extending into the chamber from the small end to a point short of the center of the base, a lateral dust outlet near the small end of the chamber, a dust conduit sealed over said outlet and a dust receptacle connected to said dust conduit.

4. A centrifugal air cleaner for an internal combustion engine, comprising a straight tubular member adapted for engagement with the engine induction air inlet, a frusto-conical housing surrounding said tube with its small end sealed to the tube intermediate the ends of said tube, a partial closure for the large end of the housing comprising a plate closure member with an annular air inlet and a solid disc-like center having a diameter not smaller than the open end of the tube and spaced therefrom, vanes in the annular air inlet and a laterally disposed dust collecting receptacle in communication with the housing below the open end of the tube and sealed thereto in airtight relationship.

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