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G. M. SPENCER

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AIR CLEANER

Original Filed Nov. 23, 1925

FIG. 1

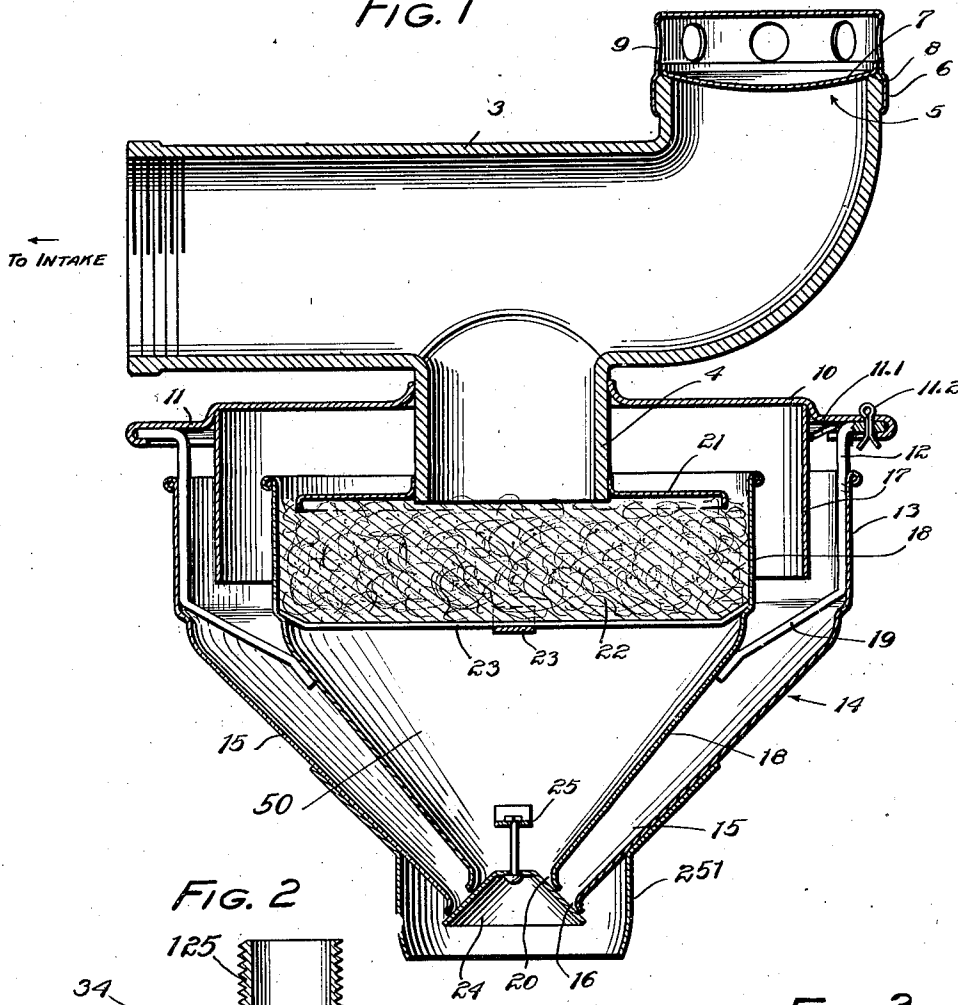


FIG. 2

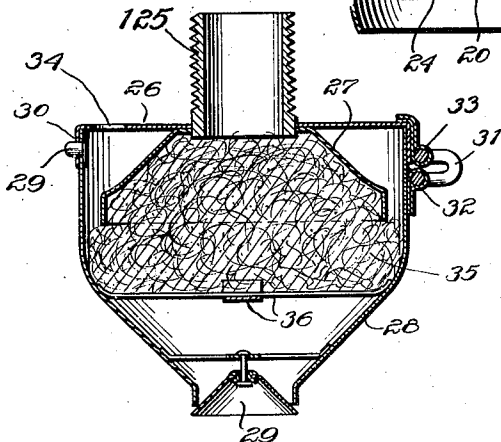
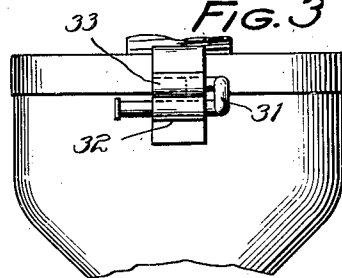


FIG. 3



Inventor
George M. Spencer
by Rummel & Rummel
Attys

UNITED STATES PATENT OFFICE

GEORGE M. SPENCER, OF CHICAGO, ILLINOIS

AIR CLEANER

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This invention relates to improvements in air filters or fluid cleaners and is especially adapted for use in connection with gas engines or compressors and the like where there is a pulsating suction.

The main objects of the invention are to provide an air cleaning device in which the foreign particles are effectively removed with little resistance to the air or fluid flow; to provide a filtering arrangement which arrests the particles in the air but does not retain them in the filtering mass, the particles being shaken down or falling through the mass into the collecting hopper; to provide a relief to prevent the soot of a backfire from getting into the filter material; and to provide a simple, substantial apparatus of low resistance which will require no attention and which may be readily assembled, installed or taken apart for cleaning and repairing.

Two specific embodiments of the invention are illustrated in the drawings, in which:—

Fig. 1 is a cross sectional view of an air cleaning device particularly designed for use on the air intake of an internal combustion engine.

Fig. 2 is a cross section of a somewhat simplified form designed for general application.

Fig. 3 is a side elevation of Fig. 2.

In general the present invention contemplates utilizing the inertia or momentum of heavier particles of dust for removing them from the path of the air flow, utilizing filtering means for intercepting the lighter particles of dust and utilizing the force of gravity and vibration of the apparatus and incidental to the movement of fluid through the filter mass for keeping the filter mass clear of accumulations of dust and for discharging the dust from the apparatus.

In the form shown in Fig. 1, the tubular member 3 is a part of or is attached to the suction end of the inlet manifold of the engine. This tube 3 has a short downwardly projecting tube 4 which is referred to herein as the outlet tube of the air cleaner; and has an upper opening 5 upon which is secured a cage or casing 6 for the relief valve 7. The valve 7 is a stamped disk which fits loosely

in the casing 6, and normally, or during the suction period, rests on a suitable shoulder 8 provided by the margin of the pressure relief opening 5, in a position below the perforations 9. In case of back pressure in the tube 3, the disk 7 is of course raised and relieves the pressure to the atmosphere through the ports 9.

The circular cover member 10 is brazed or welded on to the tube 4 and the outer marginal portion is formed over to furnish an annular groove 11, in which are seated the outturned ends of the straps 12 which are secured to the cylindrical portion 13 of the shell 14, thereby supporting the shell 14 in spaced relation with the cover 10. There are a sufficient number of these straps to rigidly support the shell. In small devices, three or four are sufficient. Openings 11.1 suitably spaced in the rim of the grooved margin of the cover 10 allow the outwardly bent end portions of the straps 12 to enter the groove. The cover 10 is then rotated slightly and the parts locked by a split cotter 11.2.

The shell 14 has an upper cylindrical portion 13 and the lower portion 15 is hopper-shaped and converges to a small opening 16. A baffle ring 17 is attached to the cover 10 and is in spaced relation to the shell 14 and to the upper portion of an inner shell 18 which is supported by extensions 19 of the straps 12. This inner shell 18 is also in the form of a hopper, concentric to the outer shell 14 and converges to a lower opening 20. To the lower end of the outlet 4 is secured the circular flange member 21 which is marginally spaced from the member 18. The filtering means 22, preferably a mass of loosely packed fibrous material such as curled horse hair, is supported against the end of the tube 4 and beneath the flange 21, by a grating shown as two intersecting flat strips 23, secured in the upper portion of the inner shell 18.

The filter mass 22, in the present embodiment is arranged to divide the housing or shell 18, to provide a storage compartment 50, and by the arrangement of the parts fluid passing between the inlet and outlet openings is directed into and through the filter mass

in a substantially horizontal direction so that solid particles intercepted by the filter mass may be removed from the path of the fluid and discharged from the filter mass into the storage compartment 50. The fibrous material when loosely packed and of sufficient size permits relatively free movement of fluid and provides a series of obstructions which repeatedly interrupt movement of dust particles and the like carried by the fluid thus slowing down the movement thereof with the fluid and giving gravitational action time to remove the particles from the path of the flowing fluid and to a quiescent and remote location such as the storage compartment 50.

The trap valve 24 is adapted to cooperate with both of the openings 20 and 16 and is loosely supported from the cross member 25 which is secured to the lower walls of the shell 18. A guard 251 is provided around the lower openings to shield the valve and hopper throats from injury.

In the form shown in Fig. 2, 125 is the outlet tube to which is secured a cover member 26 and an inverted cup or flange 27. The shell or main body 28 of the air cleaner is removably secured to the cover 26 by means of a stud 29 engaging in the opening 30 in the flange of the cover 26, and an oppositely located latch member 31 which connects a loop 32 on the shell 28 and a loop 33 secured to the cover 26 (see Fig. 3). The lower end of the shell 28 and the trap valve 29 are constructed in the same manner as the shell 14 and valve 24 of Fig. 1. The flange member 27 extends a short distance down into the shell 28 and is marginally spaced therefrom. Air enters a series of inlet ports 34 in the cover member 26, passes outwardly and through the reduced marginal passage into the filter mass 35 which is supported by the straps 36 which are secured across the shell 28.

The two devices shown are similar, except that the device shown in Fig. 1 includes the relief valve and means for extra baffling of the air before it passes into the filter mass.

In the operation of the device shown in Fig. 1, the air enters the annular space between the upper edge of the shell portion 13 and the cover 10. It is deflected downwardly by ring 17 and again drawn up around the lower edge of the baffle ring 17, where the air is expanded and slowed down because of the enlarged area of the passage between walls 17 and 18. It is next drawn downward with a high velocity in a thin stream through the narrow opening provided between the margin of the flange 21 and the inside of the shell 18 and is then directed into the loose fibrous filter mass 22, where it follows an upwardly curving path to the outlet 4.

In making the turn around the lower edges

of the baffle ring 17, the heavier particles, through inertia and their momentum, tend to continue in their direction and are thrown down into the hopper formed by the lower walls 15. The heavier particles may be thrown off by changes in direction, but the lighter particles cannot be eliminated in this manner. Therefore, it is intended that the lighter particles shall be removed by contact, when the air is flowing in a thin stream in a curved path and in intimate relation with the fibres of the filter mass 22. The dust particles striking the fibers of the filter mass are deflected out of the path of air flow or are delayed, so as to lose their momentum and fall out of the path of the air flow. The clean air is drawn up through the outlet tube 4 and into the intake manifold of the engine or whatever device is being served by the cleaner.

The particles which are caught in the filter mass 22, having been brought to rest, are no longer conveyed along by the air current, but fall into the bin formed by the lower end of the inner shell 18. The vibration of the device and filter mass, due to the vibration of the engine or compressor to which it is attached and to the pulsating air movement, shakes down the dust that is caught by the filter mass and prevents the latter from becoming clogged.

The valve 24 operates to automatically open and discharge any accumulations of dust from the hopper whenever there is no suction at the air outlet 4 and whenever there is such suction, the valve closes and prevents inflow of air at the throats of the hoppers.

The device shown in Fig. 2 operates in a similar but modified manner. Suction is applied to the tube 125 which draws the air downwardly through the inlet openings 34, pulls it through the narrow space between the margin of the flange 27 and the inside of the shell 28, and directs the air with a high velocity into the fiber mass 35. The air is pulled around the lower edge of flange 27, then up through the mass 35 and out through the tube 125. While the air is circulating through the filter mass 35, the particles of matter are removed by momentum and by contact with the filter mass, and by virtue of the vibration, the dust particles work down through the fibers and fall into the bottom of the shell 28, as described above.

Although but two specific embodiments of this invention have been herein shown and described, it will be understood that the fibrous filtering mass may be composed of any suitable substance such as horse hair, metallic filaments or fibers, which will be sufficiently dense to arrest movement of the dust particles but loose enough to permit them to fall therethrough under vibration. It will also be understood that numerous details of the construction shown may be altered or

omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

- 5 1. An air cleaner having a casing with a bottom opening, a cover removably secured over said casing, and having a suction outlet tube extending into the upper part of said casing, a laterally extending flange around
10 the lower end of said tube in marginally spaced relation to the casing, air inlet openings to the upper part of the casing, and a filtering mass supported beneath said flange and suction outlet, and a valve for said bot-
15 tom opening normally open, but adapted to be closed by suction at the outlet tube.
2. An air cleaner having a casing with a bottom opening, a cover removably secured over said casing in spaced relation, a baffle ex-
20 tending downwardly from the cover and in spaced relation within the upper walls of the casing, an inner casing in spaced relation within the baffle and having a bottom opening within said first named bottom opening,
25 an outlet tube extending through the cover and into the upper part of the inner casing and having a laterally extending flange marginally spaced from the inner casing walls, a loose fibrous mass supported beneath the
30 said flange, and a check valve cooperating with both of said bottom openings to discharge accumulations of dust automatically through pulsations in the air pressure in said casing.
- 35 3. An air cleaner comprising a cylindrical outer casing having a conical shaped bottom and inner casing conforming to and mounted within the outer casing to form a narrow air space, a cover removably secured to and in
40 spaced relation with the top edges of the casings, a circular flange attached to the cover to project into the space between the walls of the casing, a suction outlet pipe projecting through the center of the cover, a
45 loose fibrous filter mass held in the upper portion of the inner casing against the end of the pipe and a flange secured to the end of the pipe to cover the filter mass and restrict the air passage to a narrow annular space
50 around the edge.
4. An air cleaner comprising a casing, a fibrous filtering mass supported within the top portion of said casing and spaced from the bottom thereof, an outlet tube, means
55 connected to said tube for supporting said casing, and means within the top of said casing and in engagement with said filtering mass cooperating with said casing to define a narrow inlet adjacent the wall of said cas-
60 ing and directing the flow of air in a laterally and upwardly curving path through said filtering mass to said outlet.
5. An air cleaner comprising a casing, a fibrous filtering mass supported within the
65 top portion of said casing, an outlet tube

above said casing and adjacent the center thereof, means connecting said tube and said casing, and means above said filtering mass cooperating with the wall of said casing to de-
fine a narrow inlet passage, said inlet pas- 70 sage being proportioned to the filtering mass so as to effect expansion of air passing to said outlet tube.

6. An air cleaner comprising a casing open at the top, a cover for said casing, means for 75 securing said casing and cover in spaced relation, an outlet tube extending through said cover, a laterally extending flange on the lower end of said tube, a fibrous filtering mass, and means supporting said fibrous mass 80 within the upper portion of said casing and in contact with said flange, the periphery of said flange being spaced from the inner wall of said casing to provide a narrow inlet.

7. An air cleaner comprising a casing open 85 at the top, a cover removably secured to said casing and vertically spaced therefrom, a downwardly extending outlet tube having a laterally extending flange with its rim within the top of said casing and spaced from the 90 inner wall thereof, and a fibrous filtering mass supported within the top portion of said casing in engagement with said flange, whereby air entering the top of said casing is directed downwardly and then in an up- 95 wardly curving path through said filtering mass.

Signed at Chicago this 19th day of November, 1925.

GEORGE M. SPENCER. 100

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