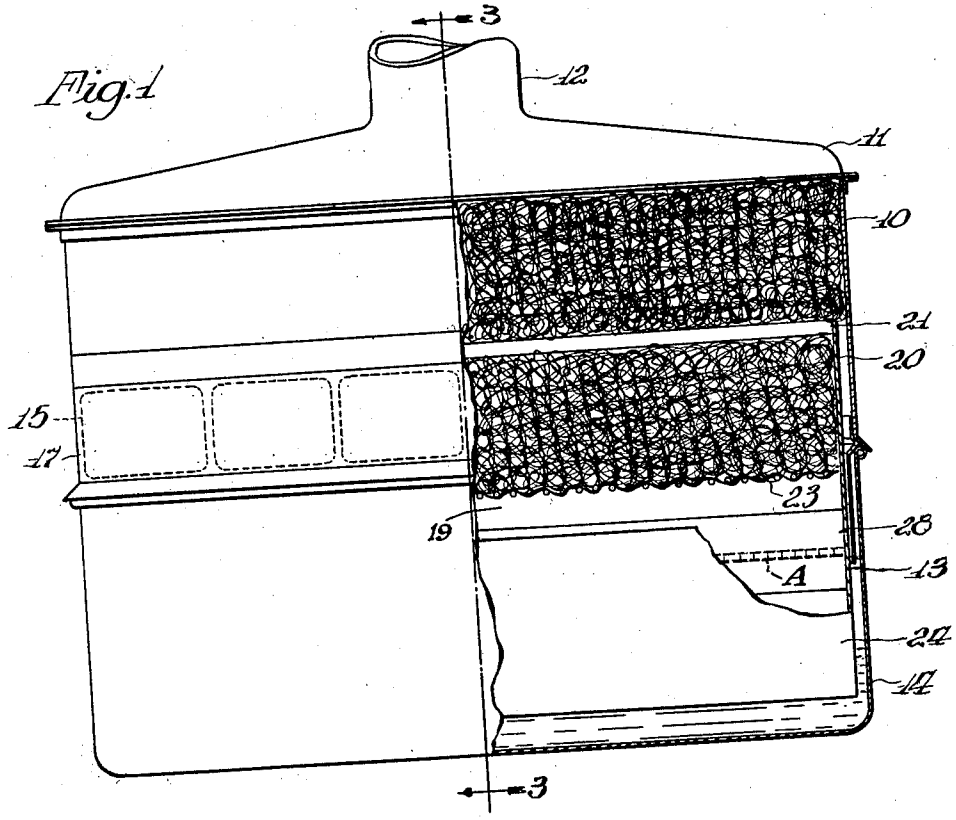
May 29, 1934. R. D. ACTON 1,960,260

AIR CLEANER

Filed Jan. 6, 1933 3 Sheets-Sheet 1

Fig. 1



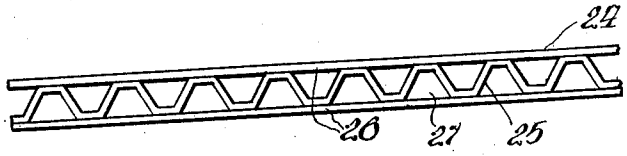


Fig. 2

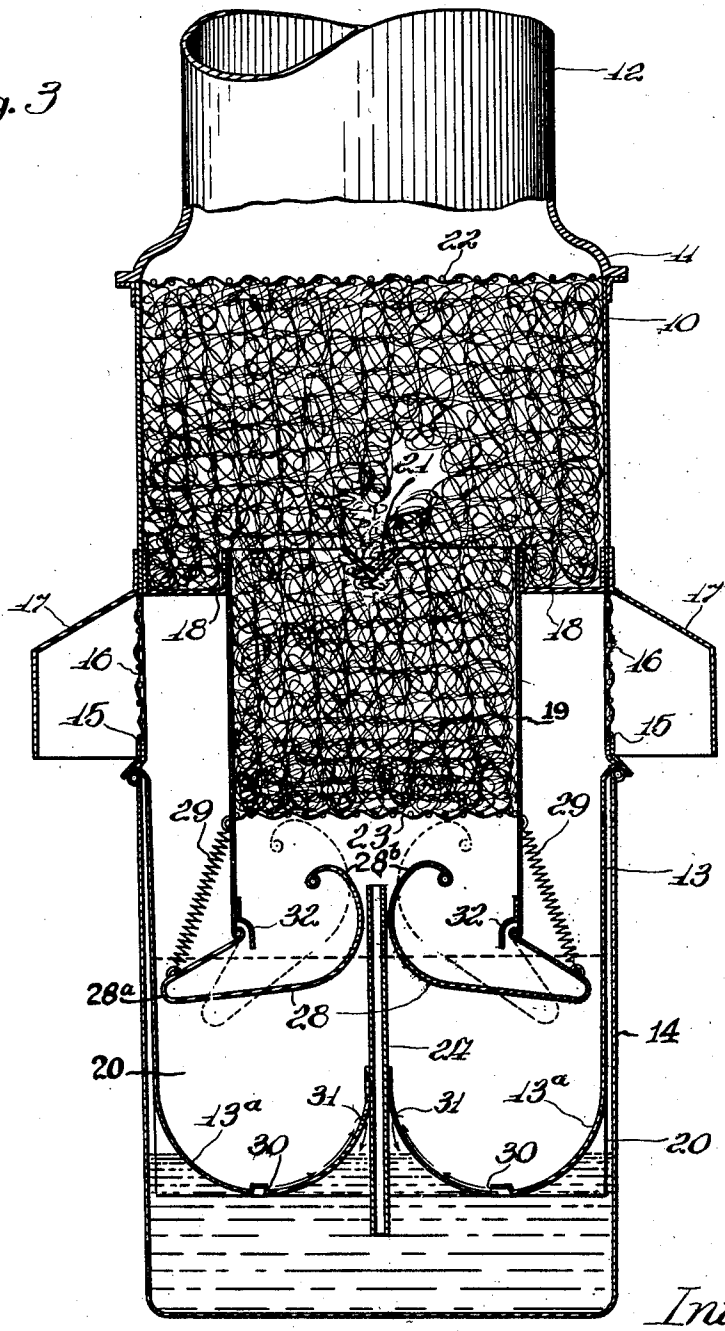
Inventor
Russel D. Acton
By H. P. Doselite
Atty.

May 29, 1934. R. D. ACTON 1,960,260

AIR CLEANER

Filed Jan. 6, 1933 3 Sheets-Sheet 2

Fig. 3



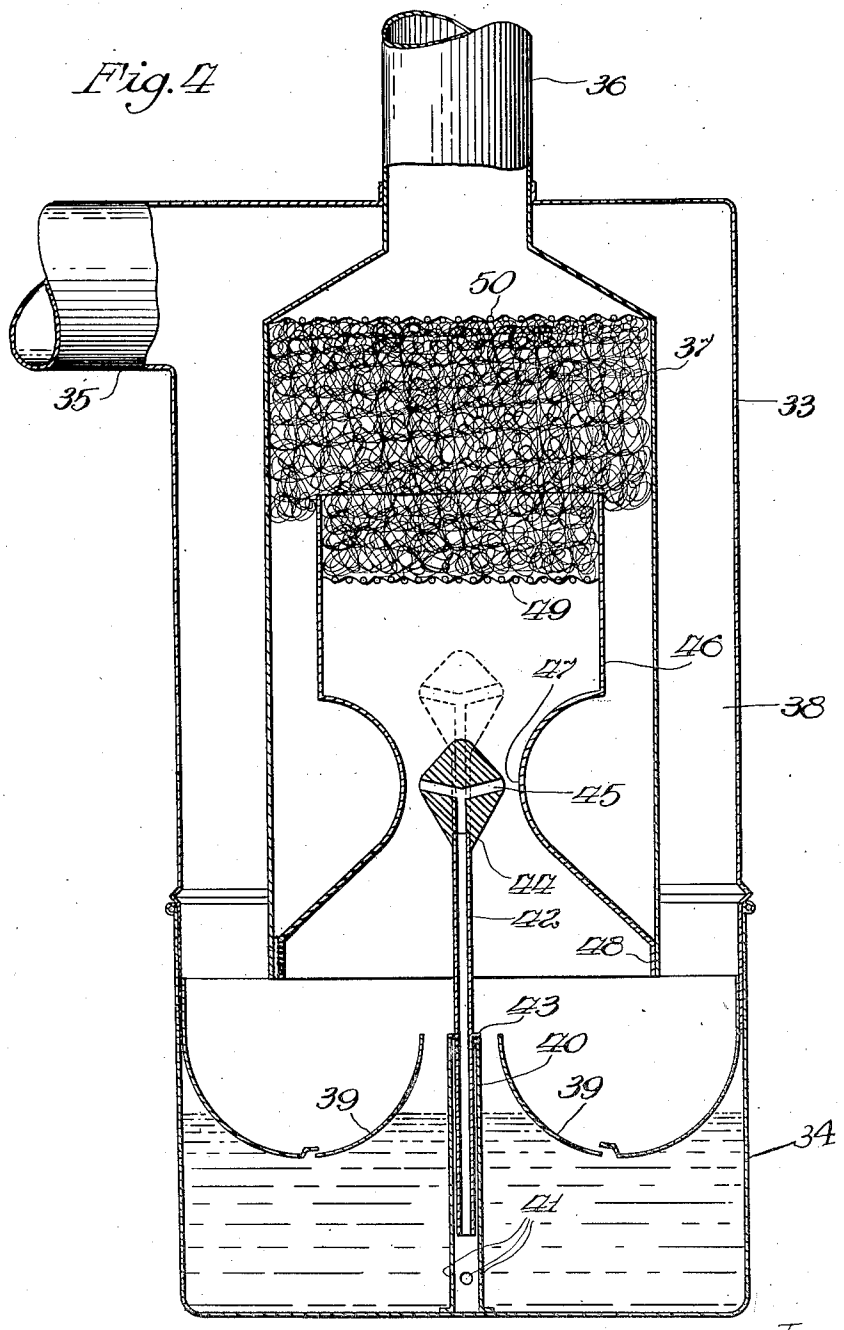
Inventor
Russel D. Acton
By W. P. Deslich
Atty.

May 29, 1934. R. D. ACTON 1,960,260

AIR CLEANER

Filed Jan. 6, 1933 3 Sheets-Sheet 3

Fig. 4



Inventor
Russel D. Acton
By W. P. Doolittle
Atty.

Patented May 29, 1934

1,960,260

UNITED STATES PATENT OFFICE

1,960,260

AIR CLEANER

Russel D. Acton, Chicago, Ill.

Application January 6, 1933, Serial No. 650,392

10 Claims. (Cl. 183—15)

This invention relates to an air cleaner, particularly adapted for internal combustion engines.

This application is filed as a substitute for application Serial No. 538,709, filed May 20, 1931, which has become abandoned.

The principal object of the invention is to provide an air cleaner or filter of the liquid type which is effective at all rates of air flow. Another principle object is to devise such a cleaner in which the resistance to air flow is substantially uniform for varying rates of air flow. Another object is to provide an air cleaner in which means, operated by the air flow, effectively lift liquid into the filtering material at practically all rates of air flow through the cleaner. Another object is to provide a compact two-stage cleaner in which the heavier particles of dirt are removed by inertia separation and in which the remaining dirt and particles are removed by filtration and a wetted contact material.

A more specific object is to provide means for directing air at all rates of air flow with a high velocity over the curved contact surface, provided with means for continually supplying liquid thereto and for removing liquid therefrom. Another specific object is to provide an air flow actuated means operable to increase the area for air flow upon an increase in the rate of air flow. Another specific object is to provide a venturi which is effective to lift liquid from a reservoir into the air stream. Another specific object is to provide a variable venturi which is effective to lift liquid over a wide range in the rate of air flow. Other objects, such as the provision of a compact and simplified structure, will be apparent from the following detailed description.

The objects of the invention are accomplished by a particular construction and arrangement of elements, such as shown in the drawings, in which:

Figure 1 is a side elevation of an air cleaner embodying the invention; part of said figure being broken away in section to show certain of the elements within the cleaner casing;

Figure 2 is an enlarged plan view of the liquid delivery element in the cleaner;

Figure 3 is a cross section taken on the line 3—3 of Figure 1; and

Figure 4 is a diagrammatic view showing a modification of the cleaner, which is circular in cross section.

In the drawings the details of construction have been omitted, except where necessary to show the elements and their cooperation. In most respects the drawings are essentially diagrammmatic, particularly Figure 4 showing a modification.

A casing 10, rectangular in cross section, is provided with an outlet header 11, which is secured thereto in an air-tight manner. The header 11 is provided with a circular air outlet pipe 12, which is in operation of the device, attached to suction producing means, such as to the intake of a carburetor. The casing 10 is provided with a downwardly extending portion 13, over which a reservoir 14 is removably fitted. The reservoir 14 has a beaded top edge which fits against an outwardly extending bead formed around the casing. Said reservoir may be held in position by any suitable means. Intermediate the top and bottom of the casing 10 and above the top of the reservoir 14 a series of openings 15 are formed along each of the longer sides of the casing. Said openings are covered with wire gauze 16 to prevent the entrance of large size particles of foreign material which may be carried in the air. Deflectors 17, secured to the casing extend outwardly therefrom and downwardly as far as the openings 15. Along the inside of the casing, approximately at the same vertical height as the upper edges of the opening 15, horizontal baffles 18 extend inwardly from the sides of the casing. Vertical walls 19, extending somewhat above the baffles 18, extend downwardly into the lower portion of the casing.

As shown in Figure 1, an end wall 20 extends across the casing and is secured to the side walls of the casing 10 at its upper portion. Said end wall is also secured to the horizontal walls 18 terminating therewith and to the vertical walls 19 extending to the top thereof. It is to be understood that one of the end walls 20 is positioned at each end of the casing. Said walls are spaced from the end walls of the casing to form liquid return passages, as will be hereinafter described. At their lower portions the walls 20 are secured to the downwardly extending side portions 13 of the casing as well as to the lower curved portion 13*a*. A longitudinally extending trough 21 is positioned centrally between the walls 19 and is secured to the end walls 20. A screen 22 extending across the top of the casing 10 and a screen 23 extending between the walls 19 adjacent the bottom thereof, form retaining means for holding filtering or contact material, such as steel wool, in the space defined by said screens and by the casing 10, the baffles 18 and the walls 19 and 20.

The side portions 13 of the casing are provided with extensions 13*a* which are curved inwardly and upwardly, as shown in Figure 3, and terminate adjacent a longitudinally extending member 24. A plan view of a portion of the member 24 is shown in Figure 2. Said member consists of a corrugated member 25, on each side of which a smooth plate 26 is attached.

This construction provides the member 24 with a plurality of non-communicating vertical passages 27. The member 24 may be held in position by supports attached to the curved parts of the casing portions 13, or by other means. The lower ends of the passages 27 communicate with liquid in the reservoir 14. The upper ends of said passages terminate a short distance below the screen 23.

The portions 13 of the casing 10 at the ends terminate as shown in Fig. 1, extending a sufficient distance into the reservoir to form a seal against the escape of liquid. This construction forms a setback in the ends of the side portions 13 as shown in Fig. 1, said portions extending only to the walls 20 below the ends of the end portions 13.

A pair of peculiarly shaped members 28 are hinged respectively to the walls 19 at opposite sides of the casing. Said members, in stationary position when air is not flowing through the casing, have portions 28*a* which extend downwardly from the walls 19 and outwardly to the lower portions 13 of the casing. Said members also have curved portions 28*b* which extend closely adjacent the centrally positioned member 24. Springs 29 are provided for normally urging the members into the position above described. Clearance is provided so that said members, during operation of the device, may assume the dotted position as shown in Figure 3.

The curved parts of the lower portions 13 of the casing are provided with liquid inlets 30 and are spaced over the central member 24 to provide liquid outlets 31. The inlets 30 and the outlets 31 may be spaced or may be substantially continuous. Baffles 32, attached to the inside of the walls 19 adjacent their lower ends, extend over the hinging position of the members 28 and downwardly therefrom.

In the operation of the particular embodiment of this invention, as above described, suction is provided to the outlet pipe 12. Air passes inwardly under the shields 17, through the screens 15, and downwardly between the walls 19 and the lower portions 13 of the casing. Pressure against the outwardly extending portion of the member 28 pivots said member about its hinging point with the result that a small space is formed between said member and the lower portions 13 of the casing. In this manner a thin flat stream of air is produced along the entire length of the casing. The same result is accomplished at both sides of the casing, although it is to be understood that a device very similar may be constructed, in which the air inlet is provided at one side of the casing only. Such a construction might be found preferable where the device is to be positioned closely adjacent an engine. The thin stream, as produced, is projected downwardly, the energy of said stream being largely directional with a comparatively high velocity. Said stream engages the surface of the liquid, which at the initiation of operation stands above the curved part of the casing portion 13. Due to the comparatively high velocity and the thinness of the air stream a very effective centrifugal cleaning action is brought about. The air then passes upwardly between the member 24 and the curved portions of the members 28 lying closely adjacent thereto. The curved portions of the members 28 are shaped to form a venturi with the result that suction is produced in the passages 27. Due to the smallness of the venturi at the initiation of operation, a sufficient depression will be produced at comparatively low rates of air flow to lift liquid through the passages 27. When the liquid is raised to the top of said passages, it falls over into the air stream and is projected into the lower portion of the contact material above the screen 23. As the suction increases on the air outlet piping 12, the members 28 swing about their hinges, thereby increasing the size of the passage adjacent the lower casing portion 13 and increasing the size of the venturi throwout formed adjacent the top of the member 24. As the air flow increases in this manner, the air sweeping across the top of the liquid in the curved parts 13*a*, carries the liquid across and over through openings 31. As a portion of the liquid is carried into the filter and as the air flow increases, all of the liquid may be swept out of the curved parts 13*a*. However, the openings 30 provide for the continuous admission of liquid to said curved parts. In other words, the air is being projected against a continually wetted surface, which carries off the heavier particles of foreign material projected thereagainst. Each time that the air flow stops or becomes very small, liquid again fills the curved parts 13*a*, thoroughly cleaning them of any dirt which may have accumulated.

It will be understood that the movement of the members 28 increase the cross sectional area of the passages provided for air flow, in such a manner that the resistance to air flow through that part of the device is not materially increased with increased rate of air flow. This is a particularly important feature of an air clearner to be used in conjunction with carburetors. It will also be clearly understood that the provision of the hinged members, as described, provides for effective centrifugal separation of dirt at low air flows and provides for the effective lifting of liquid into the air stream at comparatively low rates of air flow.

The liquid carried into the filter creates therein an increased resistance, due to bridging across the passages in the contact material, and is carried upwardly therethrough. At the top of the walls 19 and above the trough 21 the increased cross sectional area allows the oil to spread out. Said oil will collect on the baffles 18 and in the trough 21 and will run to the ends of the casing, where it will pass through the passages formed between the walls 20 and the ends of the casing, back into the reservoir.

The modification shown in Figure 4 does not embody the variable means for downwardly projecting an air stream. Said modification embodies in a circular device a means for forming a variable venturi for drawing liquid upwardly into filtering material. A casing 33 is provided with a reservoir 34 positioned at the bottom and fitted in overlapping relationship over the bottom of said casing so as to form an air seal therewith. An air inlet pipe 35 is connected adjacent the top of said casing. An air outlet pipe 36 is connected with the top of the casing centrally with respect thereto. Said outlet pipe is connected with a centrally disposed cylindrical member 37, which is spaced from the wall of the casing, forming thereby an annular air passageway 38. The member 37 terminates a substantial distance above the normal liquid level in the reservoir 34. A curved baffle 39 is positioned in the reservoir and extends from the wall thereof downwardly inwardly and then upwardly, where it terminates in spaced relation to a guide tube 40. The tube

40 is secured to the bottom of the reservoir 34 and is provided with a plurality of inlet openings 41 adjacent the bottom. A hollow tube or pipe 42 is slidably fitted in the guide tube 40. A flange 43 on said pipe seats on the top of the tube 40 thereby limiting the downward movement of said tube. A member 44 is mounted on the upper end of the pipe. Said member decreases in cross section upwardly and downwardly from the center section. A plurality of conduits 45 formed in the member 44, communicate with the pipe 42 and terminate at the surface of the member slightly above the center section. A member 46 having a cylindrical upper portion, is mounted within the member 37 with the cylindrical portion in spaced relation with respect to the member 37. Screens 49 and 50 confine a mass of crimped steel wire in the cylindrical chambers formed by the upper parts of the members 37 and 46. The lower portion of the member 46 is constricted to form a Venturi throat 47 in the center of which the member 44 is positioned. The lower end 48 of the member 46 is slightly spaced from the lower end of the member 37 to permit the escape of liquid therebetween.

The operation of the device shown in Fig. 4 is similar to the other form previously described. The venturi formed by the member 44 and the Venturi throat 47, draws liquid from the reservoir through the openings 41 in the tube 40, through the pipe 42 and the conduits 45 into the air stream which projects it into the filter. The liquid returns between the members 37 and 46, dripping out between the lower ends of said members, after which it is carried over the upper adjacent edges of the baffles 39 back into the reservoir. As the rate of air flow increases the member 44 is lifted, thereby preventing an undesirable increase in resistance to air flow. The Venturi throat and the member 44 are so shaped that in any relative positions sufficient suction is produced by air flow to draw a sufficient amount of liquid from the reservoir.

Although applicant has shown and described only certain preferred embodiments of his improved air cleaner, it is to be understood that he contemplates as his invention all modifications falling within the scope of the appended claims.

What is claimed is:

1. An air cleaner comprising a casing, a liquid reservoir at the bottom of said casing, filtering material positioned in the casing above the normal liquid level in the reservoir, an air outlet from the casing beyond the filtering material, an air inlet communicating with the casing between the filtering material and the liquid in the reservoir, means for providing a variable venturi between the liquid level in the reservoir and the filtering material, and means for supplying liquid from the reservoir to said venturi.

2. An air cleaner comprising a casing, filtering material positioned in said casing, an air inlet and air outlet to the casing, an automatically variable venturi positioned in the casing at the air inlet side of the filtering material whereby the cross sectional area of the air flow passageway is increased with an increase in the rate of air flow, and means to supply a nonvolatile cleaning liquid to an area of low pressure in the venturi.

3. An air cleaner comprising a casing, means for containing liquid at the bottom of said casing, means for providing a variable restriction for projecting a stream of air downwardly against the surface of the liquid, and means for lifting liquid from the containing means into the air stream subsequent to its projection against the liquid.

4. An air cleaner comprising a casing, means for containing liquid at the bottom of said casing, means for providing a variable restriction for projecting a stream of air downwardly against the surface of the liquid, and an automatically variable venturi effective to lift liquid into the air stream subsequent to its contact with the liquid in the reservoir.

5. A device as set forth in claim 4, in which the means forming the variable restriction and the means forming the variable venturi are interconnected for simultaneous operation.

6. An air cleaner comprising a casing, a liquid reservoir at the bottom of said casing, filtering material positioned in the casing above the normal liquid level in the reservoir, an air outlet from the casing beyond the filtering material, an air inlet communicating with the casing between the filtering material and the liquid in the reservoir, said inlet being annular in cross section, and an air passageway circular in cross section, formed within the inlet, said passageway being in the form of a venturi and being provided with a liquid supply means communicating with the liquid in the reservoir.

7. An air cleaner comprising a casing, filtering material positioned in the casing, liquid containing means below the filtering material, an air passageway leading to the filtering material, a portion of said passageway being shaped to form a venturi, a movable restricting member centrally located in the throat of said venturi, said member being formed with passageways communicating with the liquid containing means and being so mounted that increased air flow automatically lifts said member to provide a passage of increased cross section for air flow.

8. An air cleaner comprising a casing, a liquid reservoir in said casing, filtering material positioned in the casing, an air inlet and an air outlet for said casing, an automatically variable suction producing means positioned in the casing at the air inlet side of the filtering material, means for supplying a non-volatile cleaning liquid from the reservoir to the low pressure area in the suction producing means, and means for returning liquid from the filtering material to the reservoir out of the air flow path.

9. An air cleaner comprising a casing, a curved wall in said casing, means for delivering air in a flat stream to said curved wall, means for automatically varying the thickness of said stream depending upon the rate of air flow, and means to supply liquid for wetting said wall.

10. An air cleaner comprising a casing, a liquid reservoir at the bottom of the casing, a curved wall positioned in the casing with a portion of its curved surface below the normal liquid level in the reservoir, means for delivering air in a flat stream in contact with the upper surface of said curved wall, means for delivering liquid to said upper surface, and outlet means for the liquid from said wall independent of the air flow.

RUSSEL D. ACTON.