Aug. 5, 1941. T. W. HALLERBERG 2,251,789

AIR CLEANER

Filed April 1, 1939

Fig. 2.

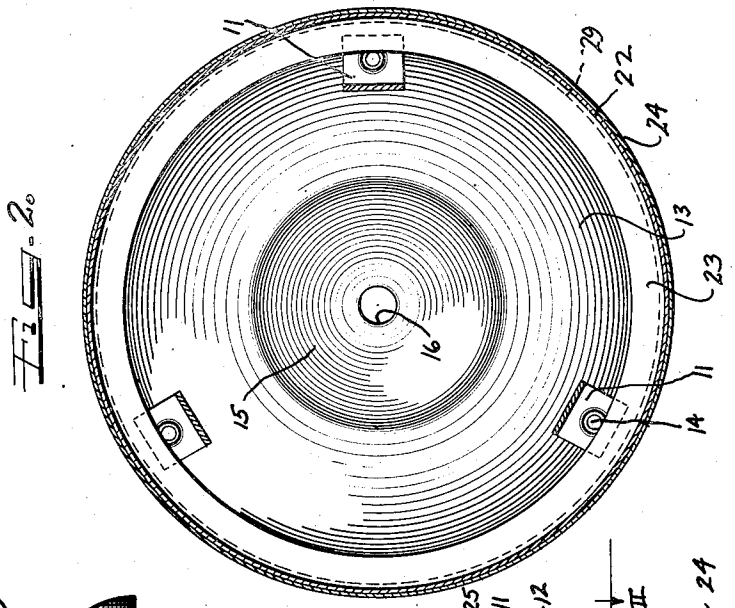
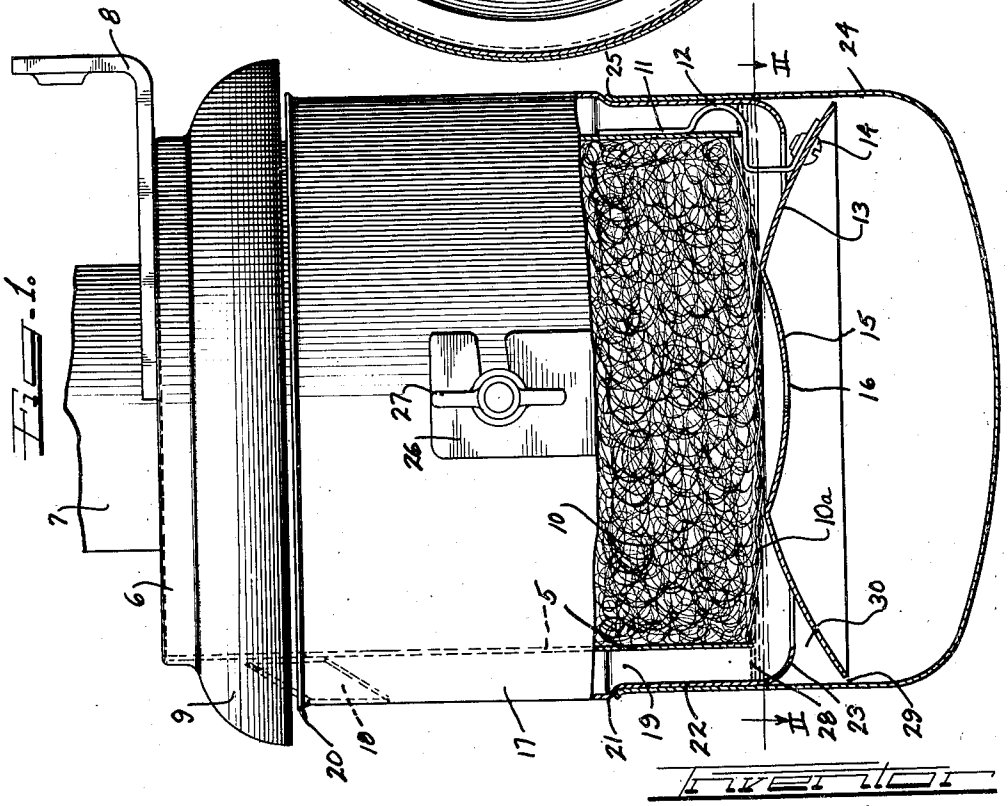


Fig. 1.



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AIR CLEANER

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5 Claims. (Cl. 183—15)

This invention relates to improvements in an air cleaner, and more particularly to an air cleaner of the type used in connection with internal combustion engines, air compressors, and other apparatus needing a fairly constant supply of clean air, and especially to a cleaner of the liquid bath type, wherein incoming air is washed by a cleansing liquid which is in turn removed from the air before it leaves the cleaner, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

I am aware that in the past many and various types of liquid bath air cleaners for automotive engines and other uses have been developed, and many of these formerly known types have included both a liquid sump and a baffle disposed in or closely adjacent the sump to effect some desired action of either the cleansing liquid or the air. In many cases, such cleaners of necessity had to be made with a relatively large diameter in order to render the cleaner of the desired capacity, maintain requisite efficiency and prevent pull-over of the cleansing liquid through the outlet of the cleaner. In other instances, difficulty was experienced in that the air would manage to pass to the wrong side of the baffle and agitate the dirt already accumulated in the liquid sump, so that there was in effect a partial redistribution of this removed dirt back through the cleaner.

Before these formerly known cleaners could be reduced in diameter, which is desirable both from a standpoint of fitting the cleaner into a limited space and from the standpoint of economy in manufacture, without the sacrifice of capacity and efficiency and without resultant pull-over, a different construction and arrangement must be provided to insure a positive and accurate circulation of the cleansing liquid, with the air moving only in the intended direction and not seeking any wayward path within the cleaner.

That, of course, is one of the primary objects of the present invention.

Another object of the invention is the provision of an air cleaner embodying a novel construction insuring adequate circulation of cleansing liquid through the provision of a low-pressure region inside the cleaner, which region of low pressure results from the action of the air traveling through the cleaner.

Another object of the invention is the provision of a liquid bath air cleaner which will have the same or greater capacity and efficiency without pull-over of corresponding air cleaners heretofore known made for operation in the same locale, but which may be made of a definitely smaller size than the corresponding formerly known cleaners.

A further object of this invention is the provision of an air cleaner embodying a special construction with increased capacity of the cleaner beyond that of corresponding cleaners heretofore known.

Another feature of the invention is the provision of a liquid bath air cleaner embodying a baffle disposed in or adjacent the liquid in the sump of the cleaner, with the parts of the cleaner so arranged that incoming air must pass over only one side of the baffle and cannot, under regular operation, find its way to the wrong side of the baffle.

It is also a feature of this invention to provide a liquid bath air cleaner having a liquid sump in which dirt removed from the air may collect, with the construction so arranged as to define a zone of quietude within the sump and effectively prevent any agitation of accumulated dirt sufficiently to cause a partial recirculation or redistribution of this dirt through the cleaner after it once arrives in the sump.

A further object of the invention resides in the provision of an air cleaner of the liquid bath type having a liquid sump disposed in the bottom of the cleaner with a substantially horizontally disposed baffle overlying a portion of the sump, the baffle being so arranged as to provide an opening through which sump liquid may be aspirated by traveling air, and guiding means associated with the baffle so that traveling air can only pass over the upper surface of the baffle, and this traveling air is prevented from seeking a position beneath the baffle.

While some of the more salient features, characteristics and advantages of the present invention have been above pointed out, others will become apparent from the following disclosures taken in conjunction with the accompanying drawing, in which:

Figure 1 is a fragmentary part-elevational, part-vertical sectional view, illustrating an air cleaner embodying principles of the present invention; and

Figure 2 is a plan sectional view taken substantially as indicated by the line II—II of Figure 1, looking in the direction indicated by the arrows.

As shown on the drawing:

In the illustrated embodiment of this invention, there is shown a liquid bath air cleaner comprising an upper casing section 5 having a closed top 6, through which an outlet conduit 7 for cleaned air extends, the conduit 7 preferably leading from a central position. Also attached to the top 6 is a suitable form of bracket 8 for mounting the entire cleaner in proper position. Also associated with the top 6 is an outwardly and downwardly extending hood 9.

This top section of the casing carries a filter mass 10 therein, which may be curled cattle-tail

hair, wavy or crimped wire, or some equivalent filtering substance of substantially uniform density throughout. This filter mass may be held in position by a strip of relatively heavy screen or hardware cloth 10a at the bottom of the casing section, and some equivalent structure may be employed at the top end if deemed desirable.

A series of baffle supporting clamps 11 are spot welded or otherwise secured to the lower part of the upper casing section 5. In this instance, three are illustrated spaced equidistantly around the casing section. Each of these clamps is outwardly bent or bowed, as indicated at 12, for a purpose that will later appear. Beneath the bow 12, each clamp turns inwardly and downwardly in position for engagement with a baffle 13, to which attachment is made by way of bolts 14 or equivalent means. The baffle 13 is of greater diameter than the casing section 5, and the outer portion of the baffle is in general of dome shape, with the convex side uppermost. The central portion of the baffle, however, is shaped similarly but to a lesser extent in the opposite direction, as indicated at 15, to provide a recess, with the concave side of this portion 15 uppermost. Preferably in the central part of the recess portion 15, an aperture 16 is provided which serves as a means for dirt removed from air during the operation of the cleaner finding its way to the liquid sump.

Disposed around the upper casing section 5 is an annular shell 17 held in position by a plurality of Z-brackets 18 or the equivalent. This shell is spaced equidistant therearound in concentric relationship with the casing section 5, so as to provide a downwardly extending annular air inlet passage 19. The upper end of the shell 17 is outwardly belled somewhat, as indicated at 20, to lessen restriction to incoming air. It will be seen that the aforesaid hood 9 extends outwardly over the inlet passage to prevent debris or the like from falling into the passage.

The lower portion of the shell 17 is stepped inwardly, as indicated at 21, to provide a shoulder, and the portion 22 below the shoulder 21 is of somewhat less diameter than the portion thereabove. The lower end thereof is definitely curved inwardly, as indicated at 23, to guide incoming air over the upper surface of the baffle and upwardly through the filter mass 10 towards the outlet conduit 7. While the Z-brackets 18 effectively support the shell in position, the bowed portions 12 of the baffle holders 11 abut the inner face of the shell 17 in a manner to rigidify the construction.

The lower casing section 24 which is in the shape of a cup to define a sump for cleansing liquid therein is telescopically associated with the part 22 of the shell 17. The upper edge of the cup 24 is outwardly turned, as indicated at 25, to abut the underside of the aforesaid shoulder 21 when the cup is in proper position on the cleaner. This cup is held removably in place upon the shell 17 by means of one or more brackets 26 affixed to the cup, each of which is engaged over the shank of bolt carried by the shell 17 and held in position by a suitable thumb nut 27, as more fully set forth in Milton W. Zander Patent No. 2,004,150, entitled "Air cleaner," issued June 11, 1935.

Where in the claims the expressions "substantially inside of the edge of the baffle" and "substantially above said baffle" are used, they mean that the edge of the member 23, which is referred to, is not merely slightly inside of the outer edge of the baffle 13 but that it is well inside and overhangs it definitely. Similarly, the expression means also that the edge 23 is not merely slightly out of contact with the adjacent upper surface of the member 13 but that it is well and fully out of contact.

Prior to attaching the cup to the shell 17 for operation of the cleaner, the cup is filled with sufficient cleansing liquid to establish a static level substantially as indicated at 28. This static level is preferably sufficiently high to initially seal off the annular air inlet passage 19. Any suitable form of cleansing liquid may be used, oil of the nature of crankcase oil being highly desirable.

In the illustrated instance, the baffle 13 is initially submerged by the sump liquid, and it will be noted that the baffle extends outwardly beneath the annular inlet, terminating short of the wall of the cup 24 so as to leave an annular passage 29 through which sump liquid may be aspirated during the operation of the cleaner, and dirt-laden cleansing liquid may return to the sump when operation is stopped.

It will be especially noted that the curved portion 23 at the lower end of the shell 17 extends inwardly above the outer margin of the baffle to an extent sufficient to prevent entering air from finding a way through the annular opening 29 into the liquid sump beneath the baffle. It should also be carefully noted that a reasonably wide space, as indicated at 30, is left between the edge of the curved portion 23 and the upper surface of the baffle. This space is sufficiently wide so that when operation is stopped, sump liquid draining from the filter mass 10 will effectively wash the upper surface of the baffle, and there is no place on the baffle where dirt may accumulate and thus build up a wall lessening the capacity and adding to the restriction of the cleaner.

In operation, the outlet conduit 17 is connected by any suitable means to a source of suction, such as the air intake port of a carbureter connected to an internal combustion engine. Upon starting the engine, due to the suction established therein, air will be drawn downwardly through the inlet passage 19, and in the first instant after starting substantially all of the sump liquid disposed on the outer upwardly convex portion of the baffle will be carried immediately up into the filter mass 10. The air merely follows a course downwardly through the inlet 19, over the curved portion 23 of the shell, upwardly through the filter mass 10 and out of the outlet 7. During the course of travel of the air, after the removal of the sump liquid on top of the upwardly convex part of the baffle, more sump liquid will be aspirated through the opening 29, over the upper surface of the baffle. Some of this aspirated liquid will become heavy with dirt and cling to the baffle, being urged into the concavity 15 by the traveling air, where it will descend through the aperture 16 into the sump, carrying the dirt removed from the air with it. The rest of the aspirated liquid will be commingled in the air stream and carried into the filter mass 10.

While the inwardly turned part 23 of the shell 17 is quite effective in preventing entering air from passing beneath the baffle, this will not prevent aspiration of sump liquid through the opening 29 by the rapidly traveling air. Due to the aspiration or eduction of sump liquid through the opening 29, and the traveling air following a defined path, a zone of low pressure is established both above and below the concave portion 15 of

the baffle. The low pressure region above the baffle will be of a substantially conical shape with the concave part 15 as the base of the cone, and the low pressure area beneath the concave part 15 will not be of as great a size as the region thereabove. The sump liquid above the baffle will naturally tend to move towards this region of low pressure, and consequently there will be a definite circulation of sump liquid established through the filter mass 10. Sump liquid will be carried up into the filter mass adjacent the outer portion thereof, and after entering the mass will tend to move towards the region of low pressure, where the liquid may descend through the hole 16, reach the sump, and again be aspirated through the opening 29.

There will also be a circulation of sump liquid through the opening 29, immediately over the outer dome portion of the baffle, into the concavity 15, through the opening 16, and back through the opening 29. This latter circulation is due to the fact that this will be the most heavily dirt-laden part of the liquid and will therefore tend to stay close to the upper surface of the baffle. It will also be noted that the sump liquid in the central bottom portion of the cup 24 will be disturbed very little by the traveling air or by the aspiration of the other sump liquid, so that there will be a region of quietude in the bottom of the sump, and any disturbance that may occur in this region will not be sufficient to recirculate accumulated dirt.

When operation stops, all of the sump liquid in the filter mass 10 will drain downwardly over the baffle. Because of the relatively wide space between the curved part 23 of the shell 17 and the adjacent upper surface of the baffle, any dirt remaining on the baffle will be washed into the sump by this drain flow of liquid from the filter mass. It will be seen, therefore, that there cannot be an accumulation of dirt remaining upon the baffle.

All of the above described features concerning the path of the air, the low pressure regions, definite circulation of the sump liquid, and the washing of the baffle by draining liquid tend to increase the capacity of the cleaner without sacrifice of efficiency and without danger of pull-over into the carbureter. Thus, the cleaner may be made of the same size as cleaners heretofore used for the same purpose and give greater air capacity, or may be built of reduced size and give the same capacity.

From the foregoing, it is apparent that I have provided a novel air cleaner construction which is considerably space-saving by virtue of its greater capacity in comparison with its size, which is highly efficient in operation, establishing a definite path for the air and a definite circulation for the sump liquid, and it will be appreciated that the device may be economically manufactured.

It will, of course, be understood that numerous details of construction may be varied through a wide range without departing from the principles of this invention, and it is therefore not the purpose to limit the patent granted hereon otherwise than is necessitated by the scope of the appended claims.

I claim as my invention:

1. In an air cleaner, a casing structure arranged to define a downwardly leading annular inlet, said casing having a liquid sump beneath said inlet, a baffle disposed generally transversely of said sump and extending beneath said inlet, said baffle being arranged to provide an opening adjacent its edge through which sump liquid may be educed by traveling air, said baffle also having a central depression with an opening therein leading back to the sump, a filter mass above said baffle, and an inwardly curved guiding member across said inlet passage above said baffle to guide air over the surface of said baffle and to prevent air reaching the opposite side of the baffle through the eduction opening.

2. In an air cleaner, a casing having an inlet and an outlet with a liquid sump in the lower part adjacent the path of air traveling from the inlet to the outlet, a filter in the upper part of the casing, and a baffle below the filter and extending substantially across the sump, the casing structure being arranged so the inlet leads downwardly towards the sump and the air is forced to turn upwardly over the upper face of the baffle to reach the outlet, said baffle being shaped to present an upwardly bulged part over which the air must pass to reach said filter, and said baffle having a central depression confronting the filter with an aperture therein through which liquid may return from the filter to the sump.

3. In an air cleaner, a casing structure having a liquid sump in the lower part thereof, means defining an air path through the casing substantially towards and then away from said sump, a filter in the upper part of the casing, a baffle disposed substantially transversely of the filter and sump and arranged to provide an opening adjacent a part of the air path through which sump liquid may be educed by traveling air, said baffle having a bulged formation towards the filter with a central apertured depression fronting the filter, and a guide element extending into the incoming air path over said eduction opening in a manner to prevent incoming air reaching the eduction opening and to guide air over the bulged part of the baffle.

4. In an air cleaner, a casing section having an outlet leading therefrom, a filter mass in said section, a shell around said section and spaced therefrom to define an air inlet passage, a cup-like casing section engaged with the lower part of said shell and defining a liquid sump below said filter mass, a baffle extending across said casing, terminating in close proximity to the wall thereof and disposed transversely of said sump below said filter mass and below and extending across said inlet passage, and the lower part of said shell being inwardly bent and terminating at a point substantially inside of the edge of said baffle and being positioned substantially above said baffle to turn the current of incoming air away from the edge of said baffle.

5. In an air cleaner, a casing having a liquid sump therein, an inner section spaced from the outer wall to provide an annular inlet passage therearound, a filter mass in said inner section above the sump, a baffle extending across said casing and arranged transversely of said sump and terminating short of the outer casing wall leaving an opening below said inlet passage through which sump liquid may be educed by traveling air, and an air guiding member curving inwardly above said baffle and away from the edge of said baffle and having its inner edge positioned substantially within the outer edge of said baffle and substantially above said baffle to guide the current of incoming air away from the edge of said baffle and to prevent incoming air from passing under said baffle.

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