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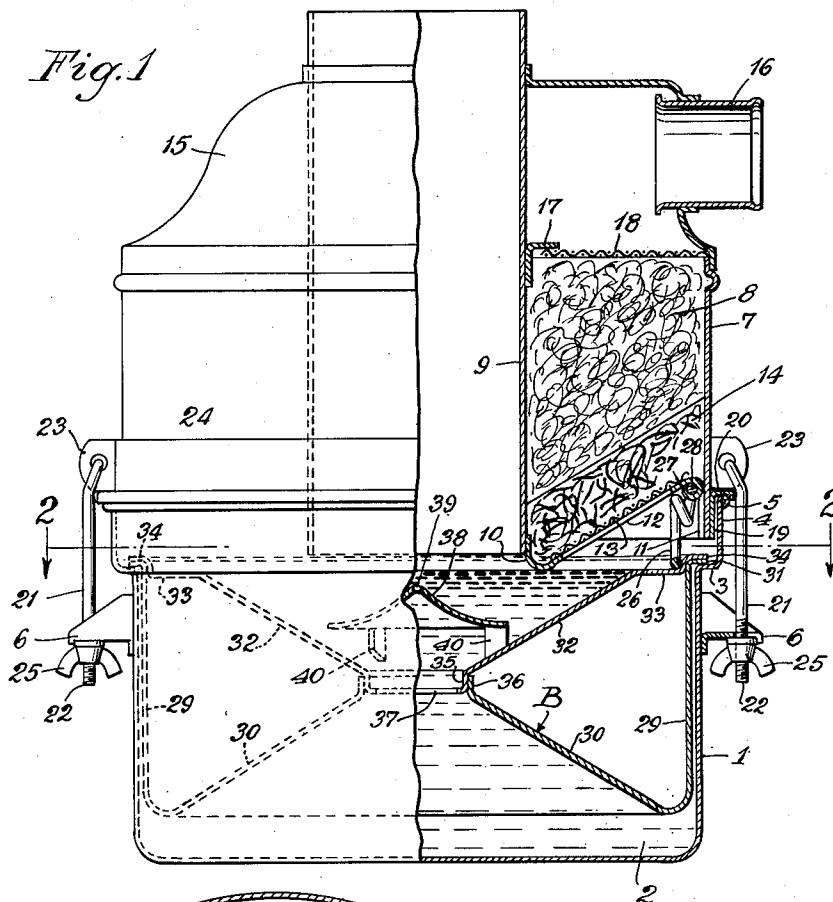
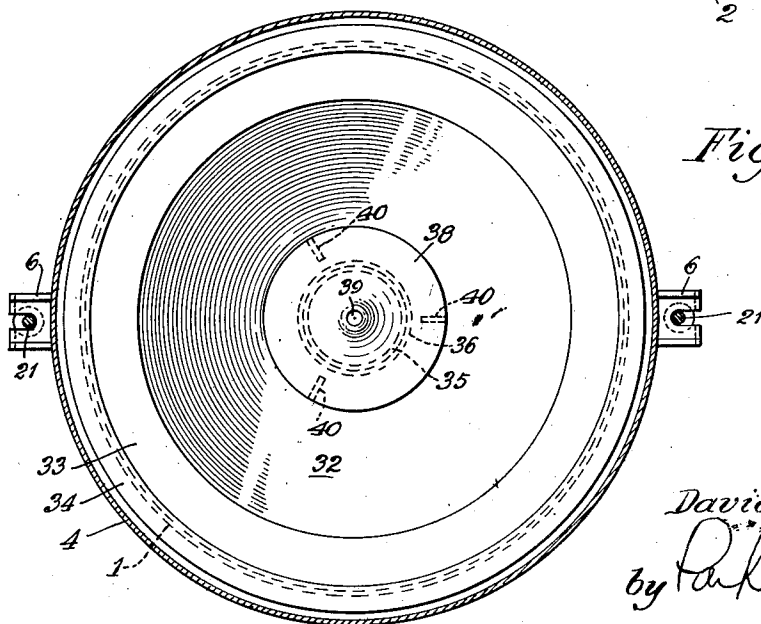
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DISPLACEMENT AIR CLEANER

Filed Oct. 11, 1954

2 Sheets-Sheet 1



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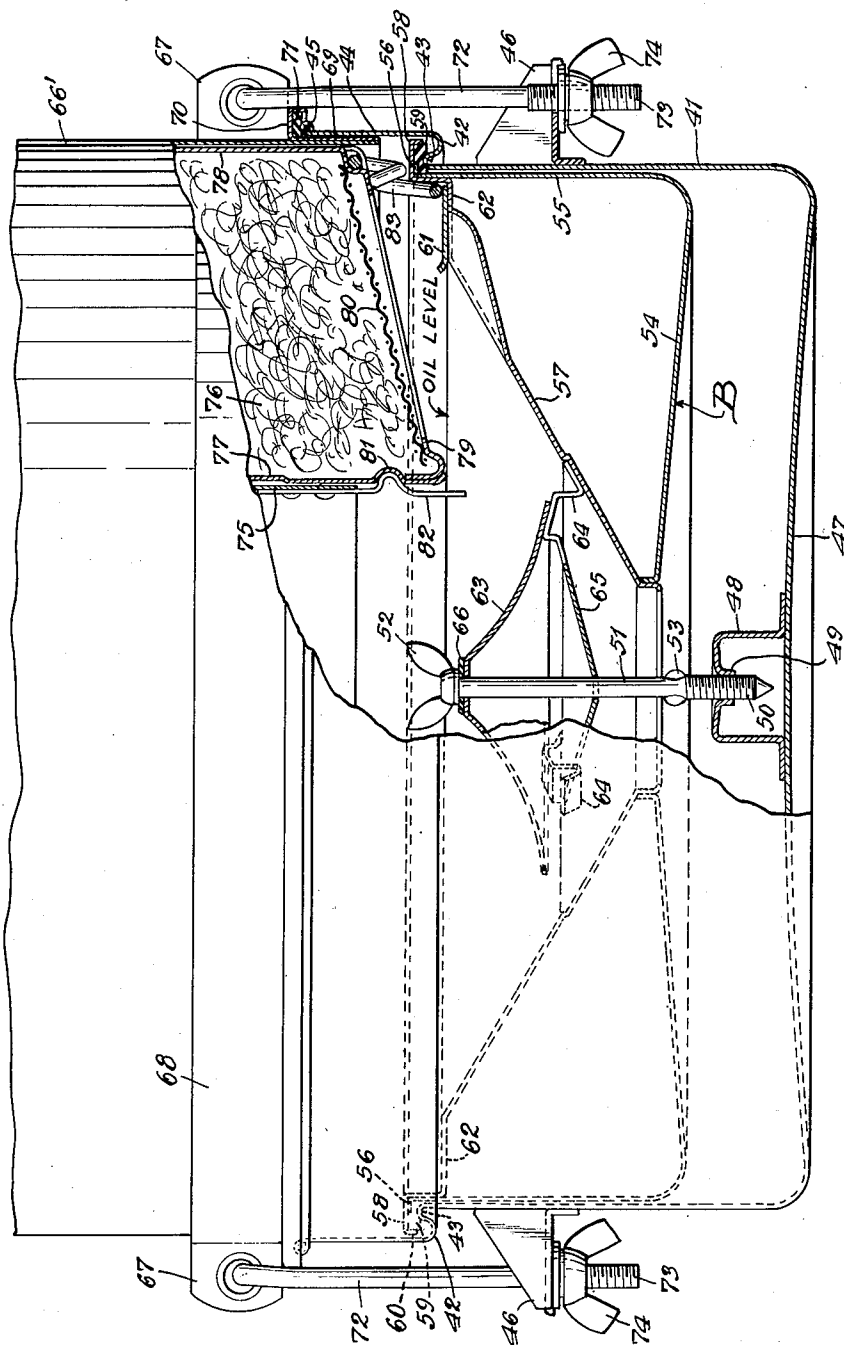
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2 Sheets-Sheet 2

Fig. 3



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DISPLACEMENT AIR CLEANER

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12 Claims. (Cl. 183—15)

This invention relates to an air cleaner and has for one object the provision of a cleaning device adapted to remove dust and other impurities from moving air as that air moves to a point of use. An object is an automotive air cleaner arranged for use with an internal combustion engine and adapted to remove dust and other impurities from the air as the air moves from the outside to the engine cylinder.

In the particular form here shown, the invention is embodied in an oil bath air cleaner in which, in addition to passage members suitable for conducting the air through the cleaner and to a point of discharge from the cleaner, there is an oil sump, a filter mass preferably above the sump and beyond the sump in the direction of air flow. Also in the path of the air through the cleaner, there is positioned a baffle. This baffle is normally positioned within the sump member and one of the objects of the invention is to obtain more precise control of the oil or other liquid within the sump or reservoir with respect to the amount of the oil or liquid which may be carried into the filter mass as the result of air flow through the cleaner during use.

Another object of the invention is a ready passage means whereby collected dust and other foreign matter moves or is moved readily from the filter mass to the lower position of the liquid sump or reservoir.

A still further object is to provide a baffle construction which is effective to control the displacement of liquid from the reservoir which might otherwise result when the cleaner is tipped or tilted in use, for example, as a result of tipping, bouncing or tilting of the vehicle upon which the cleaner is mounted.

Other objects will appear from time to time throughout the specifications and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a side elevation with parts in section illustrating one form of the device.

Figure 2 is a transverse section taken at line 2—2 of Figure 1.

Figure 3 is a fragmentary view generally similar to Figure 1, and showing a modified form of the device partially in section and partially in side elevation.

Like parts are designated by like characters throughout.

1 is a sump vessel or cup and it is arranged of suitable size and shape to contain an adequate quantity of liquid 2 as indicated in Figure 1. It is also preferably of such size and shape as to accommodate a baffle. In the particular form shown in Figures 1 and 2, the cup is shaped to provide a shoulder 3 above which it is enlarged as at 4. Its upper outer edge may be rounded as at 5. A pair of notched or slotted lugs 6 is positioned on the exterior of the member 1.

7 is a housing member arranged to contain a filter mass 8. A center tube 9 is positioned within the housing 7, and furnishes an inner housing section for positioning and maintaining the filter mass 8. A spider 10 is posi-

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tioned to engage and support the lower end of the center tube 9 and the spider also engages and is secured to the housing 7 by means of its external cylindrical position 11. The spider 10 is provided with spoke-like members 12, which support a screen or other air pervious member 13 beyond which the filter mass rests. The filter mass may, if desired, be uniform throughout, or it may be provided with a main upper section of a given material or given compactness, and it may be a lower section 14 of different material or different compactness. This particular invention is not limited to any type of filter mass or filter arrangement and the filter arrangement shown is merely typical of what may be used if desired.

A top or cover portion 15 closes the upper end of the housing 7 and engages the center tube 9. An outlet passage member 16 penetrates the housing 15 and furnishes an outlet passage for cleaned air emerging from the cleaner. If desired, an inwardly turned member 17 may be fixed to the center tube 9 above the filter mass and this member serves, among other purposes, that of pushing the screen 18 positioned generally on the top of the filter mass, and it may also serve the purpose of retaining particles of liquid which have moved to the top of the filter mass and which might tend to move from the filter mass through the outlet 16.

The housing member 7 is provided also with a ring 19 which carries a laterally directed flange 20. This flange, when the parts are assembled, rests upon the edge 5 of the sump member and limits the inward movement of the housing 7 and of the parts fixed in relation to it with respect to the sump cup 1.

One or more movably mounted fastening members 21 may be attached to the housing 7 in any desired manner. As shown in Figure 1, these members 21, which are threaded at their free ends as at 22, are hinged to eyes 23 which are joined to or form a part of, a band or collar 24 positioned about the housing 7 and above the flange 20. When the parts are assembled, the members 21 are positioned as shown in Figures 1 and 2 in the slots of the lugs 6, and thumb nuts 25 which are positioned on the threaded portions 22, are tightened to hold the parts in place.

Fastened to the under surface of the spider 10, and adjacent the housing 7, may be one or more springs 26. These springs are secured to the spider in any desired manner. As shown they are fastened by members 27 integral with the spider and partially severed from it to engage the parts 28 of the springs 26.

A hollow baffle is positioned within the sump member 1, and as shown it is a generally annular member provided with walls so shaped and secured together that the baffle, which is hollow, does not contain any liquid and possesses substantial displacement when liquid is present in the sump. The invention is not necessarily limited to any precise shape for the baffle and any baffle structure of suitable shape and of effective displacement will carry out the purposes of the invention. It is essential merely that the baffle be so shaped and constructed that it has within itself a substantial volume from which liquid is excluded at all times.

In the particular form shown in Figure 1, the baffle which is designated generally in both forms of the invention by the letter B, is formed of a plate or sheet having an outer cylindrical portion 29 and an inwardly and upwardly inclined portion 30. The member 29 terminates at its upper end in an outwardly directed flange 31. The baffle is completed by a plate 32 or sheet which is of generally conical shape and may have a flat portion 33 which terminates in an upwardly and outwardly directed part 34 overlying and fixed to the flange 31. At its inner end the sheet or plate member 32 has a relatively cylindrical portion 35, which fits closely within and is secured to a cylin-

drical portion 36 formed preferably as a part of the member 30. The portion 35 may or may not have an inwardly bent lip-like part 37.

The baffle is thus formed of the members 29, 30, and 32, which constitute an air-tight and liquid-tight chamber which acts as the baffle and also displaces a substantial volume of liquid when the sump contains the proper quantity of liquid for proper operating conditions.

The baffle may also have mounted upon it a generally conical or upwardly pointed member 38. This member may, if desired, have in its apex, a perforation 39. It is positioned above the surface of the member 32 and is secured to that member by feet portions 40. A clearance of substantial size is thus provided about the periphery of the member 38 and between it and the member 32.

When the baffle is in position in the sump member 1 the flange 31 and the flange 34 which is fixed to it rest upon the shoulder 3 of the sump cup. The spring or springs 26 bear upon the portion 33 and since this spring is under compression when the parts are drawn together as shown in Figure 1, the spring or springs hold the baffle firmly against the shoulder 3 and prevent rattling or displacement.

When the parts are separated for cleaning or repair, the thumb nuts 22 are loosened, the members 21 are moved out of engagement with the slotted members 6, and the upper assembly, including the housing section 7 and all the parts joined to it is removed from the lower assembly, which includes the sump cup and the baffle. When the two main assemblies are thus separated, the baffle may be lifted out of place and the sump may be cleaned, the oil changed, or any other necessary adjustments may be made. When the parts are thus separated, the filter mass may also be cleaned and any repairs or adjustments required are made.

In the modified form of Figure 3 the parts are generally the same in essence as those shown in the earlier figures. As in the case of those figures, there is a sump, a baffle within the sump, and an upper housing enclosing a filter mass.

The sump member or sump cup of Figure 3 comprises the member 41 which is a generally cylindrical outer wall member. It is downwardly and outwardly bent as at 42 to form an upwardly directed lip 43. A second short cylindrical portion 44 is integral with the remainder of the cup 41, and terminates at its upper edge in a bead 45. One or more slotted lugs 46 may be positioned on the exterior of the cup position 41. The cup is completed by the bottom member 47, integral with the side wall 41. The member 47 may be upwardly curved or "dished" as indicated. A stud guide 48 is secured to the inner face of the member 47 by welding or otherwise, and is provided with an interiorly threaded portion 49 which removably receives the threaded end 50 of the stud 51.

The stud carries at its upper end a thumb nut portion 52, by means of which it may be rotated. The stud is also provided with lateral enlargements 53 intermediate to its ends. The stud is fastened within the baffle structure in such manner as to prevent separation but to permit some relative movement of the parts. The baffle comprises a bottom plate 54, inclined somewhat inwardly and upwardly and having an integral portion 55 which is generally cylindrical and forms the outer wall of the baffle. The wall 55 terminates in a laterally directed flange 56. A second member 57 forms the upper surface of the baffle, and this member is shaped to overlie the flange 56 as at 58. The sealing or packing member 59 may be positioned beneath the flanges 56 and 58, and a downwardly directed peripheral flange 60 serves to hold the member 59 in place. When the parts are assembled, as shown in Figure 3, the sealing member 59 is positioned upon the lip 43. A ring-like extension 61 may be positioned upon the flattened portion 62 of the member 57.

A generally conical upwardly facing member 63 is fixed in relation to the baffle. It is secured to feet portions 64

which form a part of a generally conical downwardly directed member 65. The feet 64 are welded or otherwise secured to the member 63 and to the baffle member 57. The stud 51 passes freely through perforations in the members 63 and 65 and may be rotated with relation to these members to engage the stud guide 48 and to draw the parts into proper position to seal the baffle to the sump cup and to prevent looseness and rattling. A sealing member 66 is positioned beneath the head of the stud 51 and above the upper end of the member 63.

The upper assembly of the cleaner of Figure 3 is shown only sufficiently to make clear the fact that it is present and includes a housing, a filter mass, and means for attaching the assembly to the sump and baffle assembly. As shown, the upper assembly comprises a generally cylindrical housing 66' to which are positioned ears 67 attached to or forming a part of a band 68. Fixed to the member 66' is a handle member 69, terminating in an outwardly directed flange 70, beneath which is positioned a sealing band 71. When the parts are assembled, the member 71 is in sealing contact with the bead 45 on the upper edge of the sump cup.

Movably mounted in the eye members 67, is a pair of attached members 72. Each is threaded at its lower end as at 73. It carries a thumb nut 74.

The upper assembly includes also a central inlet tube 75. One or more filtered cartridges 76 is removably positioned within the annular space defined by the housing 66 and the center tube 75. As shown, this filter cartridge comprises an inner tubular member 77 and an outer cylindrical member 78 joined by a spider 79. The spider carries a screen member 80 upon which the filter mass rests. The tubular member 77 may be provided with a groove 81 to receive one or more spring fingers 82 positioned on the center tube 75. These spring fingers may be moved inwardly to the center of the tube 75 to free them from engagement with the groove 81. They are normally biased to spring into the groove when free to do so. They assist in holding the filter cartridge or cartridges in place. The spring 83 which is fixed to the lowermost filter cartridge, if more than one is present, bears upon the plate 61 or the flat portion 62 of the baffle and further assists in positioning the filter mass whether the latter includes one or more cartridges, and thus avoids looseness of the parts and prevents rattling.

When the cleaner is to be repaired or cleaned, the thumb nuts 74 are loosened, the members 72 are moved out of engagement with the lugs 46, and the two cleaner assemblies, the upper and the lower, may be separated. The baffle assembly may then be removed by rotating the stud 51 until it is disengaged from the member 48, and the baffle assembly may then be moved out of the cup 41 so that the parts may be cleaned and the oil changed or removed.

Also when the parts have been separated, the filter mass may be cleaned, and if the removable filter cartridges are included, they may be removed from the assembly by moving the spring finger 82 out of engagement with the groove 81. Thus the parts may be separated for cleaning and repair and they may be re-assembled thereafter. They are so shaped that they can be re-assembled only in correct position.

The use, operation and function of my invention are as follows:

Air cleaners of considerable diameter are required for large machines, and the area of the liquid pool in the reservoir becomes relatively large. Between the lower end of the air inlet and the air deflecting means in the sump, there must be sufficient space to permit the air stream to flow without crowding. The large area of the reservoir coupled with the large gap required between the deflector and the lower edge of the air inlet tube gives rise to a relatively large volume of liquid which must be displaced by the air moving through the cleaner. Actually, the amount of liquid displaced has been greater

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than necessary for adequate cleaning, and the excess liquid carried to the filter has adversely affected the capacity of the air cleaner assembly.

The displacement type of baffle shown in Figures 1 and 3 reduces the diameter of the liquid pool available to the moving air. The baffle reduces the quantity of liquid available to the air stream for transfer to the filter mass to as much as one-fourth of what would be transferred if no displacement of liquid within the reservoir was provided. As the air flows through the air cleaner, the liquid in the sump will be lowered from the level shown to a level somewhere in the region of the cylindrical portion 36 in Figure 1. Since the pool is confined between the walls of the conical upper surface of the displacement baffle, the volume will be considerably less than in the more conventional type of baffling arrangement where liquid also fills the volume below member 32.

Formation of the lower surface of the displacement baffle into a downwardly sloping conical body 30 provides an advantage in liquid control when the air cleaner is tipped at an angle, for example, when a tractor or other piece of equipment on which the air cleaner is mounted operates on a grade. In the conventional type of air cleaner under tipped conditions, the liquid surface stands at an angle to the axis of the air cleaner. The liquid level will be high on one side of the air cleaner and low on the other. In an air cleaner equipped with a displacement baffle, tipping of the air cleaner will produce less rise of liquid on the one side because lowering of the liquid on the opposite side uncovers a portion of the displacement baffle. Considering the tipping of a liquid vessel as transfer of liquid from one side of the sump to the other, the displacement baffle has effectively removed liquid from the one side, and there is no liquid on this one side within the displacement baffle which may be transferred to the other side. Thus, the rise of liquid at one side of the air cleaner under tipped conditions is materially reduced or entirely eliminated, because liquid is not available on the opposite side.

The purpose of providing the conical shape on the bottom of the displacement baffle is to prevent liquid from breaking away from the under side of the displacement baffle under tipped conditions. As soon as the liquid level in tipped condition breaks away from the displacement baffle, liquid formerly beneath the displacement baffle will be effectively displaced and will give rise to an increase in liquid level on the opposite side. The displacement baffle therefore increases the air flow capacity of the air cleaner when the vehicle is operating on a grade.

It should be obvious that a gasket such as at 59 in Figure 3 between the baffle and the shoulder can be used in the Figure 1 species. It should also be understood that the dimensioning of the parts such as the cup, the baffle, the housing, and the springs 26 and 83 is such that when the cup is fully seated on the housing by the attaching mechanism, a force fit is effected so that the baffle will be seated against the shoulder, regardless of whether the gasket is present or not.

While I have shown and described a preferred form and one modification of my invention, it should be understood that numerous modifications, changes, substitutions and alterations can be made without departing from the invention's underlying theme. I therefore

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wish that my invention be unrestricted except as by the appended claims herein.

I claim:

1. In a liquid bath air cleaner, a housing defining an air path with filtering means therein and having an air inlet and outlet, a liquid reservoir in communication with the air path, and a liquid tight hollow displacement baffle in the reservoir spaced from the bottom of the reservoir and defining upper and lower liquid chambers.

2. The structure of claim 1 in which the baffle converges inwardly to a center opening and is sealed to the sides of the reservoir so that liquid communication between the chambers is only possible through the center opening.

3. The structure of claim 2 in which the baffle is generally annular.

4. The structure of claim 2 characterized by and including a deflector positioned over but spaced from the center opening.

5. In a liquid bath air cleaner, a housing defining an air path with filtering means therein and having an air inlet and outlet, and a liquid reservoir in communication with the air path, the reservoir being composed of upper and lower chambers that converge to a center access between them, only the upper chamber being in direct communication with the air path.

6. The structure of claim 5 in which a displacement baffle with a center opening is positioned in the reservoir and defines the chambers.

7. The structure of claim 5 in which the housing is generally cylindrical.

8. In a liquid bath air cleaner, a generally cylindrical housing with an air path through it, an inlet and outlet in the housing, filter means in the air path, a reservoir cup removably attached to and closing the bottom of the housing, a shoulder formed around the cup, a liquid-tight hollow displacement baffle in the cup mounted on the shoulder, and means depending from the housing engaging the baffle, the fit between the parts being such that the baffle is forced firmly against the shoulder when the cup is fully seated on the housing.

9. The structure of claim 8 characterized by and including gasket means between the shoulder and baffle.

10. The structure of claim 8 in which both the upper and lower surfaces of the baffle converge inwardly toward each other to a center opening, the baffle being spaced from the bottom of the cup.

11. In a liquid bath air cleaner, a housing defining an air path having an inlet and outlet with a filtering medium between them in the air path, a liquid reservoir in the housing in communication with the air path, and a liquid-tight hollow displacement baffle in the reservoir dividing the reservoir into upper and lower liquid chambers communicating with each other by a passage, only the upper chamber being in direct communication with the air path.

12. The structure of claim 11 in which the passage establishing communication between the liquid chambers is disposed generally through the center of the displacement baffle.

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