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LIQUID BATH FILTER

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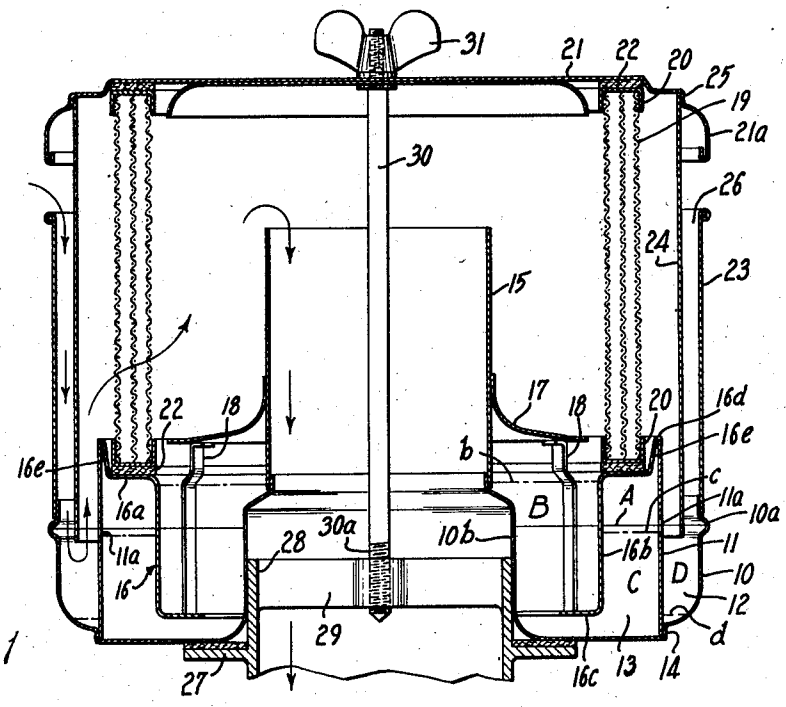


Fig.-1

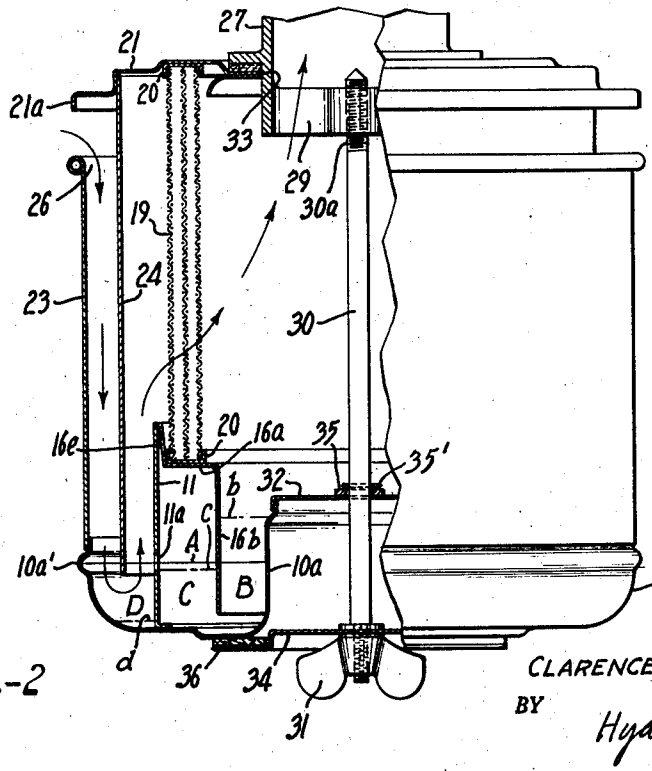


Fig.-2

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LIQUID BATH FILTER

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3 Claims. (Cl. 183—15)

This invention relates to improvements in liquid washed fluid filters and is particularly adapted for air filters of the oil bath type.

One of the objects of the present invention is to provide a filter for use under varying loads and where the supply of liquid for washing the filter is maintained in satisfactory amounts for all loads.

Another object of the present invention is to provide a filter adapted for use with internal combustion engines which provides efficient filtering at no load and at various engine loads up to the maximum.

Other objects and advantages of the invention will be apparent from the accompanying drawing and description and the essential features thereof will be summarized in the claims.

In the drawing Fig. 1 is a transverse sectional view taken centrally through a device of generally cylindrical type and having a bottom fluid outlet; Fig. 2 is a view taken partly in side elevation and partly in central transverse section of another embodiment having a top fluid outlet.

Prior filters of this type have been arranged for efficient action at some special point on the load curve, but these devices were relatively inefficient at other loads. The present device embodies a very novel manometer type means for feeding the filter washing liquid according to variations of the fluid load passing through the filter so that efficient washing of the filter occurs at all loads but carry-over of the washing liquid is avoided.

In the form of my device shown in Fig. 1, a closed bottom annular cup 10 has an upstanding ring 11 spaced radially inwardly from the outer walls of the cup 10 and dividing the cup into an outer reservoir 12 and an inner reservoir 13. These reservoirs are filled to the level of the full line A under normal conditions and this line A represents the no-load level of the liquid in the reservoirs. This point is marked on the casing by means of the annular projection 10*a* formed in the material of the cup. The ring 11 is suitably secured in position in the cup 10, in the present instance by welding to the cup at the point 14. Spaced perforations 11*a* are provided in the ring 11, in the present instance about eight of these, equally spaced about the circumference and one-quarter inch in diameter. The center line of these holes is on the line A. The inner wall of the cup 10 is provided with an upwardly extending tubular extension 15 which provides the fluid outlet for the device. A sheet member 16 provides an annular shelf 16*a* upon which the filter means rests and a manometer partition wall 16*b* located parallel to and radially inwardly from the ring 11. This wall may have an inwardly turned horizontal flange 16*c* at the bottom as shown in Fig. 1, although this is not a necessary construction, as will be apparent from Fig. 2. A flange 16*d* around the periphery of the member 16 rests upon the ring 11 to aid in the support and arrangement of the parts. Preferably (but not necessary in all cases) a number of holes 16*e* are provided through this flange for a purpose to be later described. It will be noted that the partition wall 16*b*, together with the inner cup wall 10, define an annular chamber B. Above this chamber is an annular baffle ring 17 which is held in position spaced above the chamber B by a plurality of legs 18 welded to the baffle ring and welded in turn to the wall 16*b*.

Suitable filter means 19 is provided so positioned with respect to the casing and the parts thereof that all of the fluid passing from the inlet to the outlet of the device must pass through the filter means. This filter means may be of any suitable character but preferably, as here disclosed, comprises a cylindrical ring of screen material built according to the teachings of Patent No. 1,566,088, granted December 15, 1925 to Oscar V. Greene. This cylinder of filter material is mounted bottom and top in the annular channels 20. A top cover member 21 covers the entire top of the device and the filter means is preferably sealed top and bottom by the annular gaskets 22 of felt or other suitable sealing material.

The air inlet for the device is here provided by extending upwardly a ring 23 in alinement with the outer wall of the cup 10 and this ring is welded to the cup. Spaced radially inwardly from the member 23 is a cylindrical wall 24 which is either integral with or rigidly secured to the top cover as by welding at the point 25. This cylindrical wall extends parallel to the walls 23 and 11 and radially between them. The lower edge of this wall 24 is below the normal liquid level A and also slightly below the bottom of the holes 11*a*.

If necessary or desirable, a protecting hood 21*a* may be provided in connection with the cover overhanging the wall 23 so as to prevent the entrance of material from above into the fluid inlet passageway 26.

The device above described is mounted in any suitable manner. In the present instance a bracket 27 has a tubular portion 28 which engages within the walls 10*b* of the cup 10 and the bottom of the cup rests upon the bracket as

shown in Fig. 1. The parts are held together by a spider 29 integral with the bracket 27 and receiving the threaded end 30a of a bolt 30 which extends through the top cover and parts and there held in place by a wing nut 31. This arrangement permits the ready disassembling of the parts for cleaning or inspection.

The operation of the device above described will be explained in connection with the filtering of air for an internal combustion engine and where oil is utilized as the filter washing method. It will be understood, however, that other applications of the structure will operate in similar fashion. With the device in position on the bracket 27 and the oil reservoirs filled to the line A, the suction of the internal combustion engine will be applied at the outlet pipe 15 so that air enters the inlet 26 and flows in the direction of the arrows shown in Fig. 1. If air is drawn along this path in even the slightest degree, as for instance at no-load of the engine, this air is forced to pass through the oil in the chamber D by the fact that the wall 24 extends below the normal level of the oil in this chamber. Thus the air at no-load is compelled to pass through the oil and some of this oil will be entrained with the air and carried to the filter means 19, thus keeping the filter means coated with a material which increases the dust arresting capacity of the filter means, and any excess of this oil will drain by gravity down the filter means, returning either directly to the chamber B or through the holes 16e to the chamber C. In any case, this oil will then flow out the holes 11a to replenish the supply in the chamber D.

As the load increases on the engines the amount of air, and therefore its velocity through the inlet passageway and chamber D, will increase, and I utilize this increase in velocity to automatically control the further feed of oil to the incoming stream of air. As the velocity increases the oil is practically all removed by the air stream from the chamber D, the condition of this chamber being then practically empty, as indicated by the dot-dash line d. This oil from chamber D is carried to the screen 19, charging it with a dust-retaining coating. Any excess drains back into the chamber B, raising the level toward that indicated by the dot-dash line b. At the same time the differential in the pressures exerted in the chambers B and C causes a change in the relative levels, as I will now explain. It will be understood by those skilled in this art that there is a greater suction on the downstream side of the filter means 19 than on the upstream side thereof, the difference being equal to the resistance of the passage of the stream through the filter means. This is due to the fact that chamber C is subject to the pressure at the upstream face of the filter, and chamber B is subject to the pressure at the downstream face of the filter. If, for instance, the suction on the downstream side of the filter means is equivalent to, say, a negative 3 inches of water and on the upstream side of the filter is equivalent to approximately negative 2 inches of water, then there is a 1 inch differential across the filter means. Thus the chambers B and C constitute two legs of a manometer means, the legs being separated by the partition wall 16b. Thus, as the level rises in the leg B to the level b, the level in the chamber c is depressed to the level indicated by the dot-dash line c. The difference between the levels b and c will vary with the engine load. At any load oil will trickle back through holes 11a to the incoming air stream. At the lighter loads the level c will be a little higher and the flow through holes 11a will be a little greater. At the heavier loads, more oil will be stored in chamber B and less will flow out of holes 11a. At heavy loads this prevents carry-over of oil to the outlet 15 by the air travelling at high velocity. The incoming stream of air is compelled to sweep past the holes 11a by means of the skirt ring 24, thus inducing the air to pick up oil at this point which is entrained and carried to the filter means. Continuous washing of the screen is thus insured and the feeding of the oil is in proportion to the load on the engine because the greater the load the greater the differential between the levels b and c.

The purpose of the holes 16e is to transmit to the oil in chamber C the pressure immediately at the upstream face of the filter 19. This, together with the fact the chamber B is subject to the pressure close to the downstream face of the filter, gives the least effective pressure differential across the manometer and holds the sealed depth of partition 16b to a minimum.

The modification of Fig. 2 is similar to Fig. 1, but in this case the outlet is at the top instead of at the bottom. Parts having a similar function to those already described will be given similar reference characters without further description.

It will be noted that the bottom of the casing is here closed by means of the plate 32 extending between the walls 10a. There is an opening 33 through the top cover plate and the bracket 27 extends through this opening. The parts are held together by the bolt 30 which is threaded into the spider 29 of the supporting bracket and which is clamped against the bottom of the casing by means of the clamping plate 34 and the wing nut 31. Oil leakage at the bottom is prevented by means of the gasket 36. The normal oil level A is indicated as before by the projecting annular rib 10a'.

The operation of the modification of Fig. 2 is similar to that already described in connection with Fig. 1. The air enters at the inlet 26 and travels as indicated by the arrows between the plates 23 and 24 downwardly to a point where the plate or ring 24 compels the air to pass beneath the oil or other fluid in the reservoir in the chamber D. The air then travels upwardly past the holes 11a, then through the filter means 19, and upwardly through the outlet. The differential which causes the flow of fluid through the filter means is transmitted to legs B and C of the manometer means as before, causing the level in the leg B to rise to the dot-dash line b and depressing the level in the leg C to the dot-dash line c. Whenever the engine is working at any appreciable load the chamber D is practically emptied as indicated by the dot-dash line d. The oil from this chamber is carried up into the filter means 19, charging the fitler means for more efficiently arresting dust and the excess draining down to the inner manometer leg B. The hydraulic head represented by the differences in height between the levels b and c causes oil to continuously pass out of the openings 11a into the incoming fluid stream so that there is a continuous replenishment of the oil in the filter means 19, keeping the filter means charged with liquid and washing the collected dirt down into the bottom of the casing means 10.

In the modification of Fig. 2, as in Fig. 1, the air must pass through the oil in the reservoir D

at no-load or very light engine loads, and at other engine loads up to the maximum oil is continuously entrained in the incoming air stream as it passes the openings 11*a* and the flow of oil through these openings is controlled by the manometer means B—C which stores more oil in chamber B as the load on the engine increases.

In all of this description nothing has been said about the cross sectional shape of my device, but the embodiments here shown are intended to show walls generally circular or cylindrical and the sectional views shown are intended to be taken diametrically across the circular sections.

While the flow of the air or other filtered fluid has here been shown as beginning at the radially outermost point of the device and travelling radially inwardly, those familiar with this art will understand that this is for convenience and is not essential for the carrying out of the principles here disclosed.

It will be noted that the ring 11 completely separates chambers C and D because of the tight joint at 14. Thus the only oil reservoir that can be blown empty by the incoming air stream is the chamber D. This is a definite amount so chosen as to properly charge the filter and store a little in chamber B. The level in chamber C can never fall below holes 11*a* and the depth from here to the bottom of partition 16*b* is greater than the differential across the filter at heavy engine loads so that the manometer can never be by-passed under wall 16*b* even by sudden surges in suction at the outlet 15 such as occur often in internal combustion engines.

What I claim is:

1. In a liquid bath filter, cup-shape casing means open at the top and having a generally cylindrical side wall and closed at the bottom to provide a well, a generally cylindrical partition wall extending upwardly from the bottom of said casing means and spaced radially inwardly from the cylindrical wall of said casing means and dividing said well into two reservoirs, one smaller radially outside said partition wall and one larger radially inside said partition wall, a top cover above and spaced from said casing means providing an air inlet above the cylindrical wall thereof, an imperforate generally cylindrical skirt extending downwardly from said cover and concentric with and positioned radially between said casing means cylindrical wall and said partition wall and providing a downwardly extending passageway outside said skirt and providing an upwardly extending passageway inside said skirt, a generally cylindrical filter element radially inwardly from said skirt and extending upwardly from a point above said larger reservoir substantially to said cover and there sealed against by-passing of air around said element, an imperforate division wall extending from the bottom of said filter element downwardly to a joint adjacent the bottom of said well and dividing said larger reservoir into a differential pressure manometer means, there being openings of limited size through said partition wall spaced above the bottom of said casing means, and there being an air outlet leading from said casing means radially inside said filter element.

2. In a liquid bath filter, cup-shape casing means open at the top and closed at the bottom to provide a well, a top cover for said casing means, there being an air inlet opening in said casing means near the top, means providing an air-directing passageway extending downwardly from said inlet to a point near said bottom and then inwardly and upwardly therefrom, partition wall means extending upwardly from said bottom dividing said well into a larger reservoir radially inwardly from said passageway and a smaller reservoir radially outside said partition wall in said passageway, a generally cylindrical filter element having its outer face radially inwardly from said passageway and extending from a point above said partition wall to said cover and sealed thereagainst, said air-directing passageway and said partition wall and said element being substantially concentric, an imperforate division wall extending downwardly from the bottom of said element to a point adjacent the bottom of said larger reservoir, there being openings of limited size through said partition wall spaced above the bottom of said casing means, and there being an air outlet leading from said casing means radially inside said filter element.

3. In a filter of the liquid-washed type, a filter element in the form of a generally cylindrical wall having a length at least several times the wall thickness and positioned with the cylindrical axis vertical, casing means including an inlet and an outlet for directing gaseous flow through said element generally radially of said cylindrical wall, said cylindrical wall being open and free for gaseous flow therethrough along its entire length, means coacting with said casing means to provide a liquid reservoir of limited capacity on the inlet side of said element and in the path of an incoming gaseous stream prior to said stream reaching said element, said means also providing a liquid well beneath said element, there being liquid in said well and said reservoir for filter operation, an imperforate division wall dividing said well into two legs communicating beneath said wall, the upper portion of said legs being in pressure communication one leg with the upstream side only and the other leg with the downstream side only of said element, and means for limited liquid flow from said well to said reservoir positioned in that leg communicating with the upstream side of said element and substantially at the level where liquid in said two legs is at a common level when no gaseous stream is flowing.

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