Dec. 18, 1945. G. M. WALTON 2,391,208

OIL SEPARATOR

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Fig.-1

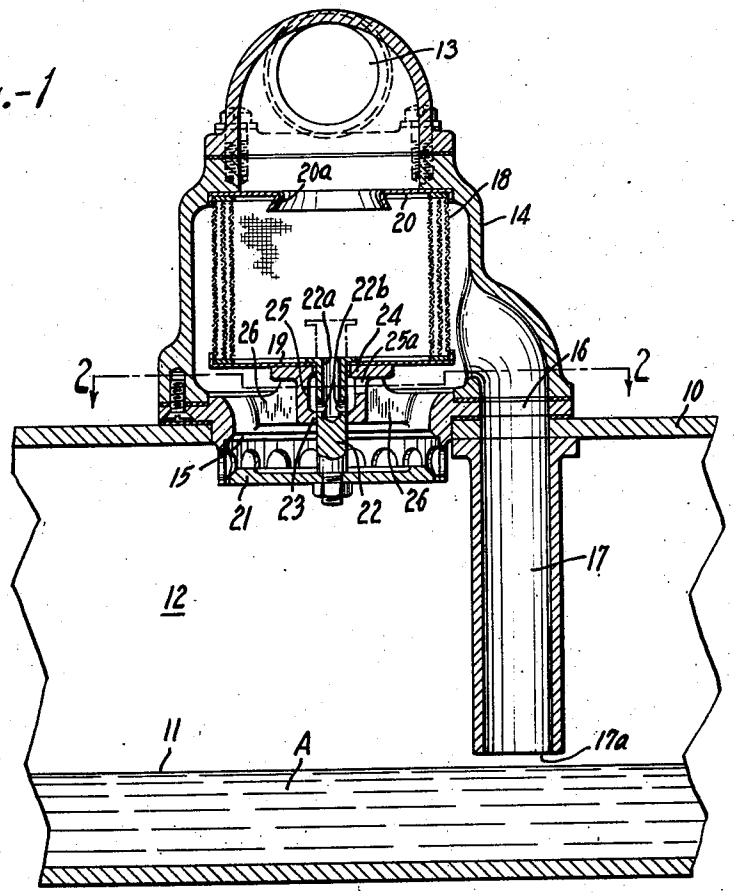
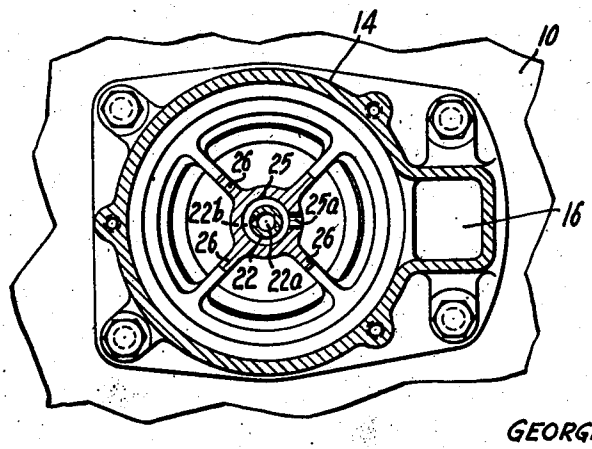


Fig.-2



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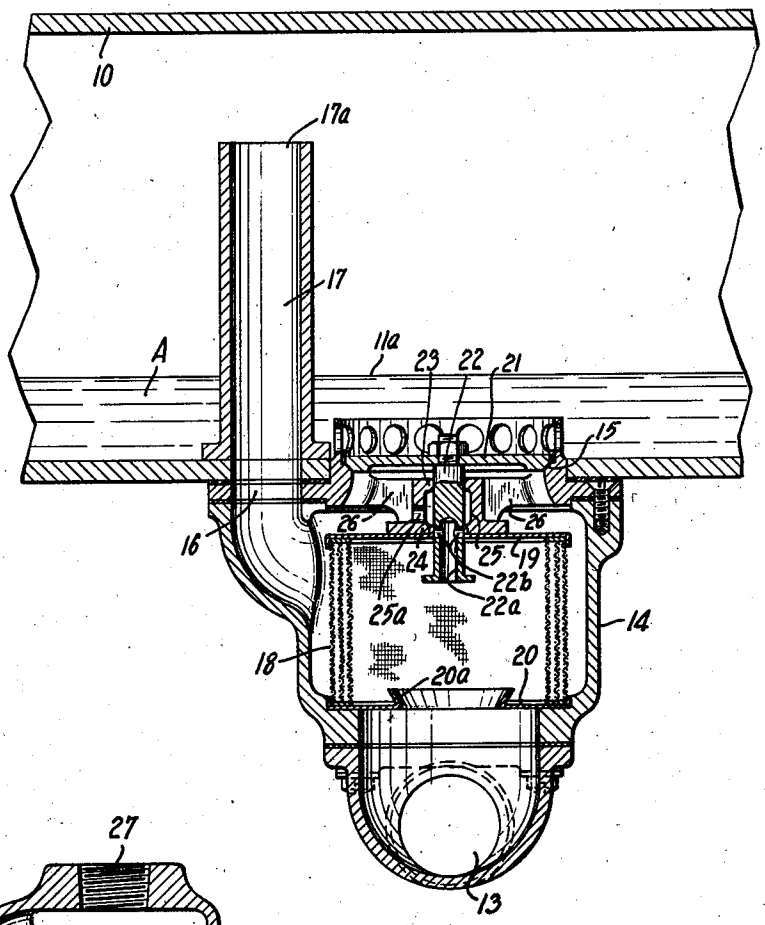
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Fig.-3



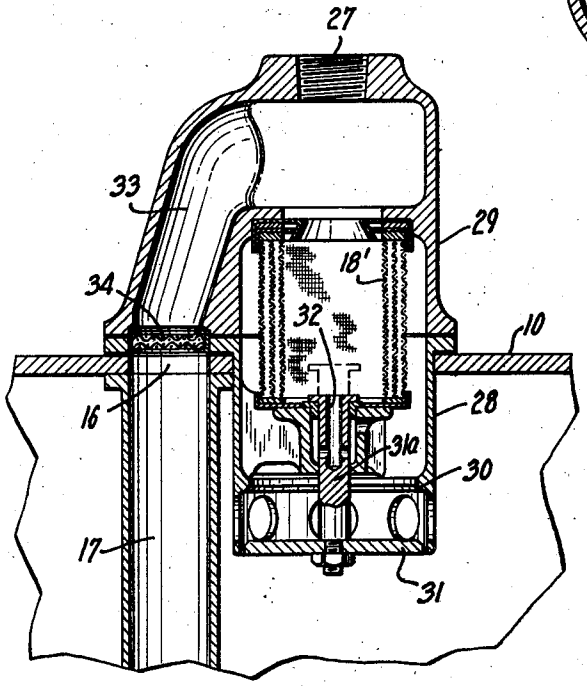


Fig.-4

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UNITED STATES PATENT OFFICE

2,391,208

OIL SEPARATOR

George M. Walton, Shaker Heights, Ohio, assignor to Air-Maze Corporation, Cleveland, Ohio, a corporation of Delaware

Application March 25, 1943, Serial No. 480,442

9 Claims. (Cl. 183—67)

This invention relates to improvements in oil separators for removing oil globules in vapor from crankcase fluids and the like.

One of the objects of the present invention is to separate oil entrained in fluid removed from a casing either in globule form or in a fine mist, coupled, if desired, with means for returning the recovered oil back to the casing whence it came. Among the objects of the present invention is that of carrying out this oil removing operation if the casing assumes various positions—for instance, if it is a casing connected with an airplane engine which at times may fly upside down.

Other objects and advantages of the present invention will be apparent from the accompanying drawings and specification and the essential features thereof will be set forth in the claims.

In the drawings, Fig. 1 is a sectional view through one form of my device shown in its normal position right side up; Fig. 2 is a sectional view of the same taken along the line 2—2 of Fig. 1; Fig. 3 is a view similar to Fig. 1 showing the action of the device in an upside down position; while Fig. 4 is a sectional view through a modified form of device shown in a position similar to that of Fig. 1.

It is often desirable in the case of airplanes to remove the vapors from the crankcase of the engine so that they do not escape to coat portions of the plane with oil to cause a fire hazard or so that they do not coat windshields or other windows to obstruct the view. In any case, a plane starts out with a limited supply of oil in the crankcase or other oil holding reservoir and a continuous loss of oil vapor from the casing of the engine might result in lowering the oil supply to the danger point. The present invention therefore is directed to the recovery of oil vapors from the casing of the engine and the return of those oils so that the above described purposes may be accomplished.

In the drawings 10 represents the casing of an engine or the like which in some cases may be the crankcase itself, or it may be an extension thereof in front of or in rear of the engine proper. In any case, 10 represents a reservoir partly filled with oil to the level 11, as indicated in Fig. 1, when the engine or other device is in its normal position. The chamber 12 above the oil level will normally contain some oil in globule or vapor form and in order to prevent its escape a slight vacuum is created in the casing 10 by means, not shown, connected to the outlet opening or pipe 13. This may be connected to the suction manifold of an internal combustion engine or to another pump if desired.

Suitably connected to the casing 10 is a housing 14 which has an opening 15 communicating with the upper portion of the casing 10 and an opening 16 which by means of the tube 17 extending inside the casing is provided with an outlet 17a considerably below the opening 15, as shown in Fig. 1, or considerably above the opening 15 in the upside down position of the parts shown in Fig. 3. Located within the housing 14 is an oil separating element 18. This element may be of any suitable type, one such being shown in my Patent No. 2,230,278, issued February 4, 1941. As shown in Figs. 1 and 3, the oil separator element comprises a cylindrical unit built up of several layers of screen having the finer screen radially outermost and the coarsest screen radially innermost. The bottom of the cylinder is substantially closed by means of the head 19 and the top of the cylinder is closed around the outer portion by a head 20 which is provided with the central opening 20a for exit of the fluid stream upwardly to the pipe 13. The arrangement of the housing and the head 19 and associated parts is such that all fluid leaving the casing 10 either by way of the outlet 15 or the outlet 17 is compelled to pass through the oil separator unit 18 on its way to the outlet 13. The action of the plurality of screens in the element 18 is such that the oil mist or small globules coalesce as they pass towards the radially innermost screen and then drain downwardly to pass along the head 19 toward the center where the collected oil escapes back to the casing 10. A novel arrangement is provided at this point for carrying out this purpose.

Associated with the opening 15 is a valve 21 for the purpose presently to be disclosed. Rigidly connected with this valve is a stem 22 extending upwardly through suitable bearings 23 and 24 of the housing 14. These bearings are part of a cup 25 which is centrally supported by radially extending ribs 26. The upper end of stem 22 is hollow, as indicated at 22a. At its lower end this hollow portion is provided with openings 22b through which oil may escape into the cup 25. In the upper portion of this cup is an outlet opening 25a which permits oil to return to the casing 10 through a U-seal of the manometer type, so that the collected oil from the upper surface of head 19 is returned to casing 10 while sealing the casing against the suction exerted at pipe 13. In other words, the hollow portion 22a of the stem provides the longer

leg of the manometer, and the cup 25 between the openings 22b and 25a provides the shorter leg of the manometer.

Obviously, if the oil level 11 is below the opening 17a, fluid will be sucked out of the casing 10 through the tube 17 and through opening 16, but this will also pass through the oil separator element 18 on its way toward the outlet 13.

As best seen in Fig. 3, the device provides against loss of oil from the casing 10 if the plane or other device is upside down, so that the oil A now lies in what was formerly the top of the casing 10. It will be noted that the valve 21 has now closed against the coacting seat formed in the opening 15 by the action of gravity. This effectually closes the opening 15 but leaves the opening 17a in the clear space above the oil level 11a so that the suction outlet 13 may still maintain a partial vacuum in the casing 10 to prevent the escape of oil vapors. These vapors now passing through the tube 17 and opening 16 must pass through the oil separating element 18 as before, collecting the oil globules and mist on the screens or other collecting means. The collected oil will drain down into the slight cup formed by the head 20 and the lip 20a. Ordinarily the plane is upside down for a relatively short period so that there is only a small amount of oil to be thus collected. When the plane rights itself, the parts return to the position of Fig. 1, the collected oil drops down to the head 19 and flows away through the opening 22a through the seal to the casing 10, as previously described.

In the modified form shown in Fig. 4, the casing 10 and tube 17 are arranged as before and suction is applied at the outlet opening 27. In this case the housings 28 and 29 combine to enclose the oil separator element 18' which is similar to the element 18 previously described. The normal outlet opening for fluid escaping from the casing 10 to the connection 27 is indicated at 30 and is closable by the valve 31 when the plane is in upside down position. It will be noted that the opening 30 is not at the very top of the casing 10, but is near enough the top to be above the normal level of oil in the casing 10. The valve stem 31a is provided with an oil seal indicated generally at 32 which functions in all respects like that already described in connection with Fig. 1. It normally returns the oil from the interior of the oil separating element 18' to the casing 10 without subjecting the casing to suction through the oil returning seal.

When the device of Fig. 4 is turned upside down, the valve 31 closes against the seat in opening 30, effectually preventing loss of oil or further fluid suction through opening 30 while the parts are in the upside down position. In this case the suction from the connection 27 is exerted through passageway 33 upon the tube 17 and draws fluid and oil vapors from the casing 10 through the opening 17a exactly as shown and described in Fig. 3. In this case the oil vapors are not collected on the element 18' but instead a small oil separator element 34 is inserted at the opening 16. This oil separating unit 34 may be of any suitable type. In fact, it may be constructed upon the same principle as referred to in my prior patent mentioned above, comprising a plurality of screens arranged in layers with the coarsest screen in the lowermost position and the finest screen in the uppermost position, as viewed in Fig. 4. Oil globules will then be coalesced and held by the screens of the element 34 while the plane is in the upside down position and in fact, a small amount of oil may collect along the walls of the passageway 33. Since the plane is upside down for a very short period, as soon as the plane returns to normal position and the parts return to the position shown in Fig. 4, the oil in the passageway 33 and on the screens 34 will flow down the tube 17 and return to the general body of oil A in the casing 10.

What I claim is:

1. In combination, casing means for containing liquid and having an outlet opening above the normal level of liquid therein, an outlet conduit by means of which a fluid flow outwardly from said casing means may be conducted, a liquid separating unit providing a maze of interstices between said opening and said conduit, housing means compelling all fluid passing from said opening to said conduit to pass through said unit, valve means adapted to close said opening, said valve means being closable in response to a predetermined change of position of said casing means, and an outlet passageway leading from said casing to said outlet conduit, said passageway terminating above the level of liquid in said casing means when the latter is in its predetermined changed position and said outlet passageway leading through said liquid separating unit.

2. In combination, casing means adapted to be partly filled with a liquid, two fluid outlet passageways communicating with said casing means, the first of said passageways communicating therewith near the top thereof and the second of said passageways communicating therewith nearer the bottom thereof than the first, outlet conduit means through which a fluid flow away from said casing means may be induced, means providing a maze of fine interstices for collecting entrained liquid from a fluid stream flowing in said first passageway, means operative when said casing means is in normal upright position for returning said liquid to said casing means while closing said casing means against gas flow through said liquid-returning means, and means in said second passageway for collecting entrained liquid while permitting gas flow when said casing means is upside down.

3. In combination, casing means adapted to be partly filled with a liquid, a fluid outlet passageway communicating with said casing means near the top thereof, a liquid separating unit in said passageway, housing means compelling fluid moving through said passageway to pass through said unit, valve means associated with said unit and housing and passageway for closing the latter when said casing means is upside down, sealing means for returning liquid from said unit to said casing means when the latter is right side up, said last named means comprising a manometer having a shorter leg in communication with said casing means and a longer leg in communication with said unit, and said valve having a hollow stem providing one of said legs.

4. In combination, casing means adapted to be partly filled with a liquid, two fluid outlet passageways communicating with said casing means, the first of said passageways communicating therewith near the top thereof and the second of said passageways communicating therewith nearer the bottom thereof than the first, outlet conduit means through which a fluid flow away from said casing means may be conducted, an entrained liquid separating means providing fine interstices between both of said passageways and said outlet conduit means, valve means for closing said first passageway when said casing means

is upside down, manometer means for returning liquid from said separating means to said casing means when the latter is right side up, said manometer means having a shorter leg communicating with said casing means and a longer leg communicating with said separating means, and said valve means having a hollow stem communicating with said unit and providing the longer leg of said manometer means.

5. In combination, casing means adapted to be partly filled with a liquid, two fluid outlet passageways communicating with said casing means, the first of said passageways communicating therewith near the top thereof and the second of said passageways communicating therewith nearer the bottom thereof than the first, outlet conduit means through which a fluid flow away from said casing means may be conducted in both of said passageways, a liquid separating unit in said first passageway, valve means adapted to close said first passageway when said casing means is upside down and adapted to open said first passageway when said casing means is right side up, and screen means in said second passageway adapted to retain liquid globules for at least a relatively short period.

6. In combination, casing means adapted to be partly filled with a liquid, two fluid outlet passageways communicating with said casing means, the first of said passageways communicating therewith near the top thereof and the second of said passageways communicating therewith nearer the bottom thereof than the first, outlet conduit means through which a fluid flow away from said casing means may be conducted in both of said passageways, a liquid separating unit positioned between both of said passageways and said outlet conduit means, sealing means between said casing means and said unit in said first passageway operative when said casing means is in normal upright position for returning liquid from said unit to said casing means by gravity flow while closing said casing means against suction through said sealing means, and a cup-like depression associated with said unit in upside down position thereof for retaining liquid collected by said separating unit from a fluid stream flowing through said second passageway.

7. In combination, casing means adapted to be partly filled with a liquid, a fluid outlet passageway communicating with said casing means near the top thereof, a liquid separating unit in said passageway, housing means compelling fluid moving through said passageway to pass through said unit, valve means associated with said unit and housing and passageway for closing the latter when said casing means is upside down, sealing means for returning liquid from said unit to said casing means when the latter is right side up, and said last named means comprising a manometer having a shorter leg in communication with said casing means and a longer leg in communication with said unit.

8. In combination, casing means adapted to contain a gaseous fluid and adapted to be partly filled with a liquid, a passageway communicating with said casing means near the top thereof, a liquid separating unit in said passageway comprising a hollow cylindrical foraminous element positioned with its axis normally substantially vertical, an outlet conduit for gaseous fluid above said element, said conduit communicating directly with the interior only of said cylindrical element, means closing the lower end of said hollow of said cylindrical element against gaseous fluid flow, whereby gases and liquids passing from said casing to said outlet conduit are compelled to pass radially inwardly through the cylindrical walls of said element and then out the top of said element generally axially thereof, a valve adapted to close the casing end of said passageway when said casing means is upside down, and a second passageway providing communication between said outlet conduit and a zone in said casing substantially below the top thereof independently of said valve.

9. The combination of claim 8 including a foraminous element in said second passageway for separating liquid from gaseous fluid.

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