Jan. 16, 1962 R. C. SCHWEITZER ET AL 3,016,977

OIL TANK ASSEMBLY

Filed Jan. 26, 1959 2 Sheets-Sheet 1

Fig. 1

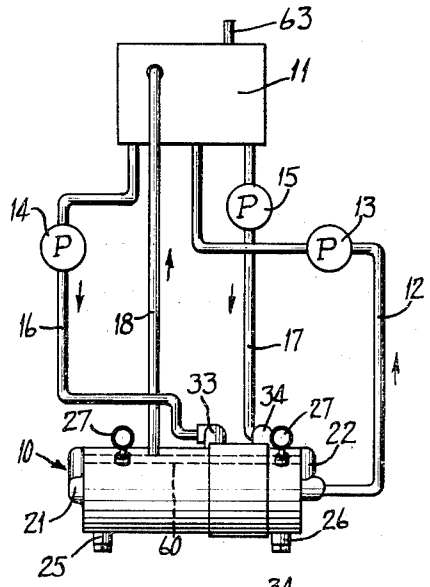
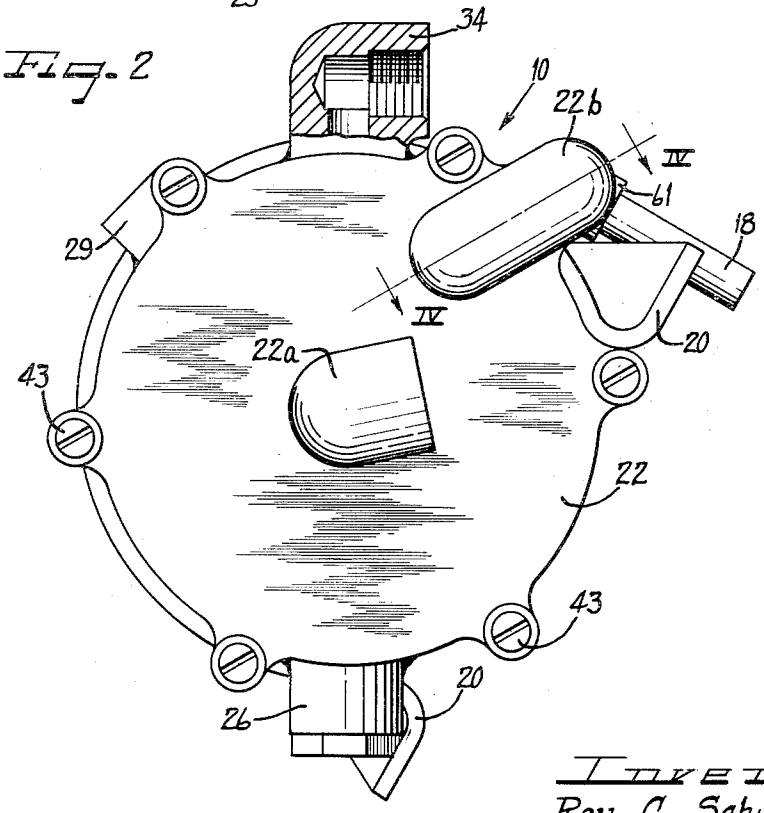


Fig. 2



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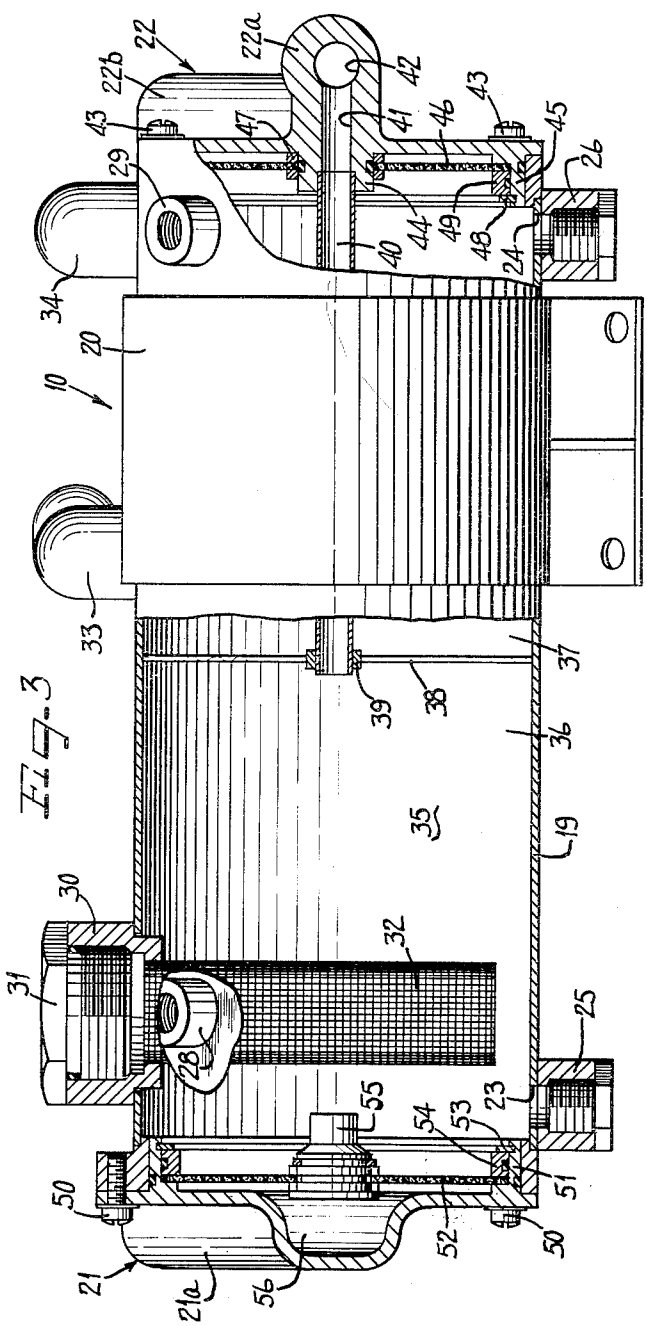


Fig. 3

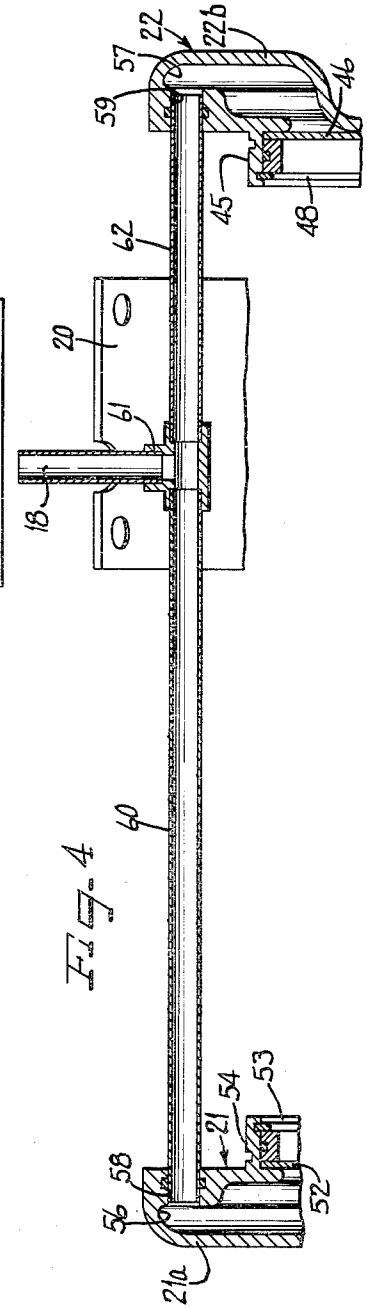


Fig. 4

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United States Patent Office 3,016,977 Patented Jan. 16, 1962

3,016,977

OIL TANK ASSEMBLY

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Filed Jan. 26, 1959, Ser. No. 789,140
4 Claims. (Cl. 183—2.5)

The present invention relates broadly to lubricant supply systems for aircraft and the like, and is more particularly concerned with a new and improved oil tank assembly wherein there is effected a pressure standardization to prevent oil foaming at altitude and an air-oil separation varying attitudes.

It is an important aim of the present invention to provide an oil tank assembly having novel means in association therewith to standardize oil tank pressure to a predetermined pressure greater than ambient pressure to essentially entirely eliminate the prior art problem of oil foaming at altitude.

Another object of this invention lies in the provision of an oil tank assembly constructed to effect an air-oil separation from either or both ends thereof under varying attitudes.

A further object of the present invention is to provide an oil tank assembly, which comprises a receptacle having a first connection direction essentially air-free oil away from said receptacle, a second connection supplying a mixture of oil and air to the receptacle, and a third connection directing substantially oil-free air from the receptacle, and filter means in said receptacle permeable to air and essentially impervious to oil located upstream of said third connection.

Other objects and advantages of the present invention will become more apparent during the course of the following description, particularly when taken in connection with the accompanying drawings.

In the drawings, wherein like numerals are employed to designate like parts throughout the same:

FIGURE 1 is a schematic view illustrating one application of the present invention, and showing an oil tank assembly constructed in accordance with the principles of this invention in association with pump and gear box structure;

FIGURE 2 is an end elevational view of an oil tank assembly embodying the novel concepts herein disclosed;

FIGURE 3 is a side elevational view, with parts in section showing the interior structure of the oil tank receptacle; and

FIGURE 4 is a sectional view taken substantially along the line IV—IV of FIGURE 2.

Briefly stated, an oil tank assembly as constructed in accordance with the present teachings comprises an oil tank or receptacle for utilization in a system having a mechanism requiring a constant supply of oil thereto, and typified by a gear box. The receptacle is provided with connections receiving an air-oil mixture by means of scavenge pumps from the gear box, and a connection supplying essentially air-free oil through a pressure pump to the mechanism. The receptacle is provided with cap means at opposite ends, and preferably supported by each of the cap means is a sintered metal disc which functions as a filter to pass air and block oil. The back or downstream side of each disc communicates with connections to the gear box, whereby the excess pressure of the oil tank is vented to said box and by said box to ambient. Extending along essentially the central axis of the receptacle interiorly thereof is an oil supply conduit communicating with the supply connection and assuring a flow of air-free oil to the gear box under various attitudes. It is thus to be seen that oil foaming at altitude is prevented by a constant flow of the air-oil mixture to the tank by the scavenge pumps, the air within said tank being compressed and vented through the sintered disc to maintain a particular pressure greater than ambient. And by the arrangement of the oil supply conduit, a supply of air-free oil to the gear box is assured regardless of the attitude of the vehicle. Other structural features of the present invention will become apparent as the description now proceeds.

Referring now to the drawings, and first to FIGURE 1 thereof, an oil tank assembly generally designated by the numeral **10** is shown in an illustrative application as a part of a continuous oil supply system. A mechanism requiring an essentially constant supply of oil or other lubricant is indicated at **11**, and said mechanism may comprise a gear box which receives essentially air-free oil from the assembly **10** through conduit means **12** under action of a pressure pump **13**. A mixture of air and oil is continuously removed from the gear box **11** by action of scavenge pumps **14** and **15** located in conduit means **16** and **17** communicating with the interior of the oil tank assembly **10**. The mixture of air and oil scavenged by the pumps **14** and **15** compresses the air within the oil tank assembly **10**, and by provision within the oil tank assembly of structural means essentially impervious to oil and permeable to air, excess pressure within the assembly **10** is vented by conduit means **18** to preferably the upper portion of the mechanism **11**, effecting a standardization of oil tank pressure within the assembly **10**. The gear box **11** is preferably vented to ambient, and by removal of excess oil tank pressure said pressure is standardized to a predetermined pressure somewhat in excess of ambient pressure to reduce the possibility under particular altitude conditions of oil foaming.

The structural details of the oil tank assembly **10** are shown in FIGURES 2, 3 and 4, and it may be noted that there is provided a generally cylindrical housing or receptacle **19** carrying thereabout support bracket means **20** and mounting at opposite ends cap members **21** and **22**. The receptacle is preferably apertured at axially spaced locations to provide drain openings **23** and **24** and welded or otherwise secured at these locations are drain plug means **25** and **26**. To provide pressure information, gauges **27** (FIGURE 1) may be mounted in gauge receiving means **28** and **29** supported along the receptacle circumference, and said circumference may further be apertured to mount by welding or other techniques filler means **30** provided with a closure cap **31** and having in association therewith a filter **32** which may be of the cylindrical screen type. Scavenge pump inlets **33** and **34** are additionally provided at axially spaced locations along the receptacle circumference, and these inlets communicate with the interior of the receptacle and with the conduit means **16** and **17** terminating in the mechanism **11**.

The receptacle or housing **19** provides interiorly thereof an oil supply chamber **35** and said chamber is divided into a pair of communicating compartments **36** and **37** by a filter member **38** which may be a foraminous disc. The filter member **38** may be attached in any suitable manner to the inner diameter of the receptacle **19** and generally centrally thereof receives a sleeve **39** supporting one end of an oil supply tube or conduit **40** terminating at its opposite end in the cap member **22**. As will be later described, the illustrated location of the oil supply conduit **40** assures a constant flow of essentially air-free oil or other lubricant through the conduit means **12** to the gear box **11** under any attitude. The cap member **22** is provided with an axial bore **41** communicating with supply tube **40** and with a radial bore **42** in said cap

member 22, the latter bore receiving the conduit 12 to the mechanism 11. The cap member 22 is attached to the receptacle 19 by screw means or the like 43 and abuts thereagainst in fluid tight relation as shown.

The oil supply tube 40 is received in an apertured embossment 44 extending axially inwardly into the supply compartment 37, and radially outwardly of the embossment there is provided an annular rim flange 45 receiving filter means 46, which in accordance with the novel concepts of this invention is preferably a stainless steel sintered disc having the characteristic of being permeable to air and essentially impervious to oil. The disc 46 is preferably received along its inner diameter in a sleeve 47 surrounding the embossment 44, and the disc at its outer diameter is maintained in position by a snap ring or the like 48 bearing against a spacer ring 49.

The cap member 21 at the opposite end of the receptacle or housing 19 is secured thereto in fluid tight relation in a generally similar manner, and screw means or the like 50 may be employed for this purpose. The cap member 21 is formed along its inner surface with an annular rim portion 51 received in the receptacle, and said rim portion receives filter means 52 of the same character earlier identified by the numeral 46. The filter disc 52 is held in position by a snap ring or equivalent means 53 bearing against a spacer ring 54, and the inner diameter of the disc 52 may be received in a mounting insert 55, or other means effective for this purpose. A sintered disc 52 without a central aperture therein may of course be employed in substitution for the construction shown.

Referring now particularly to FIGURE 4, the cap or cover member 21 is formed downstream of the disc 52 with a semi-annular cavity or air flow passage 56, while the cap member 22 at the opposite end of the receptacle 19 is shaped outwardly or downstream of the disc 46 to provide a semi-annular cavity or air flow passage 57. Communicating with the passage 56 is a relatively short length axial bore 58 in the cap member 21, while a similar bore 59 is provided in the cap member 22. Received in the bore 58 is a tubular member or air discharge conduit 60 spaced radially of the outer diameter of the receptacle 19, the opposite end of the conduit 60 being received in a passage junction member 61 mounted by either the housing walls or the support bracket thereon. The junction member 61 further receives a tubular member or air discharge conduit 62 terminating at its opposite end in the passage or bore 59 in the cap member 22. The junction member 61 provides a three branch connection, and extending in generally right angular relation to the conduit 60 and 62 is the main air discharge conduit 18 (FIGURE 1) which ports the excess pressure from the oil tank 19 to the upper region of the gear box 11.

To operate the oil tank assembly in an application of the character illustrated in FIGURE 1, a quantity of oil or other lubricant is inserted through the filler means 30 to a depth sufficient to maintain an oil level above the oil supply conduit 40. With the assembly connected in the manner of FIGURE 1, the scavenge pumps 14 and 15 continuously withdraw from the gear box or other mechanism 11 an air-oil mixture and direct the same through the conduit means 16 and 17 through the inlets 33 and 34 to the oil chamber 35 provided by the receptacle 19. The air-oil mixture upon entering the chamber 35 compresses the air therein and the excess pressure is vented through the oil impervious discs 46 and 52 at opposite ends of the chamber 35, and into the semi-annular chambers 56 and 57 formed by cap member portions 21*a* and 22*b* through the air discharge conduits 60 and 62 and thereafter through the main air discharge conduit 18 to the upper region of the gear box or other mechanism 11. The mechanism 11 is vented to ambient, as indicated by the numeral 63, and by venting the excess oil pressure through the air permeable-oil impervious discs 46 and 52 the pressure within the receptacle 19 is standardized to a particular value slightly greater than ambient pressure to thereby reduce or essentially eliminate the possibility of oil foaming, as occurs with conventional structures operating at various altitudes. The excess pressure being vented in this manner, the oil supply conduit receives essentially air-free oil and discharges the same through the axial bore 41 and radial bore 42 formed by the cap member portion 22*a* and from said cap or cover member the air-free oil is directed under action of the pressure pump 13 through the main supply conduit 12 and into the lower region of the gear box 11. The oil level is continuously maintained at least above the entrance end of the axially extending conduit 40 within the receptacle 19, so that regardless of the particular attitude of the receptacle 19 during flight conditions the conduit 40 continuously withdraws oil or other lubricant from either of the compartments 36 or 37 to supply the requirements of the gear box or other mechanism 11.

The general construction and composition of the sintered steel discs 46 and 52 are known to the art, and it is of course appreciated that the structure of these discs may be varied to effect a particular pressure standardization within the receptacle 19. The discs 46 and 52 function in the manner of filter means, being permeable to air and essentially impervious to oil, and as provided in the present structure in association with other elements of the oil tank assembly, the filter means 46 and 52 effect a more efficient operation of the scavenge pumps by functioning to vent the air in the oil tank and reduce the back pressure therein.

Various modifications may of course be effected in the structure herein disclosed without departing from the novel concepts of the present invention.

We claim as our invention:

1. An oil tank assembly, which comprises a housing providing an oil supply chamber therein, cap means secured to opposite ends of the housing and having air flow passages formed therein, one of said cap means being passaged to provide an oil supply path therethrough, an oil supply conduit within said chamber connecting with the supply passage in said one of the cap means and located to receive oil when the housing is at various attitudes, first conduit means received by the housing and communicating with the chamber to direct an oil-air mixture thereto at generally ambient pressure to compress any air in said chamber, second conduit means receiving essentially air-free oil from the supply passage in said one of the cap means, third conduit means receiving substantially oil-free air from the flow passages in each of the cap means, and filter members associated with each of the cap means and extending diametrally thereacross for venting air from the chamber to the air flow passages while blocking the movement of oil thereinto to standardize the pressure in said chamber at a pressure greater than ambient to prevent oil foaming at altitude.

2. An oil tank assembly, which comprises a housing providing an oil supply chamber therein, cap means secured to opposite ends of the housing and having air flow passages formed therein, one of said cap means being passaged to provide an oil supply path therethrough, an axially extending oil supply conduit terminating at one end in generally the center of the chamber and at its opposite end in the supply passage in said one of the cap means, first conduit means received by the housing and communicating with the chamber to direct an oil-air mixture thereto at generally ambient pressure to compress any air in said chamber, second conduit means receiving essentially air-free oil from the supply passage in said one of the cap means, and third conduit means receiving substantially oil-free air from the flow passages in each of the cap means, and a sintered metal disc supported by each of the cap means and extending diametrally thereacross axially inwardly of the air flow passage therein and venting excess pressure from the chamber through

said passages while blocking oil flow thereto to standardize the pressure in said chamber at a pressure greater than ambient to prevent oil foaming at altitude.

3. An oil tank assembly, which comprises a housing providing an oil supply chamber therein, cap means secured to opposite ends of the housing and having semi-annular air flow passages formed therein, one of said cap means being axially and radially passaged to provide an oil supply path therethrough, an axially extending oil supply conduit terminating at one end in generally the center of the chamber and at its opposite end in the supply passage in said one of the cap means, first conduit means received by the housing and communicating with the chamber to direct an oil-air mixture thereto at generally ambient pressure to compress any air in said chamber, second conduit means receiving essentially air-free oil from the supply passage in said one of the cap means, and third conduit means receiving susbtantially oil-free air from the flow passages in each of the cap means, and a sintered metal disc supported by each of the cap means and extending diametrally thereacross axially inwardly of the air flow passage therein and venting excess pressure from the chamber through said passages while blocking oil flow thereto to standardize the pressure in said chamber at a pressure greater than ambient to prevent oil foaming at altitude.

4. An oil tank assembly, which comprises a housing providing an oil supply chamber therein, cap means secured to opposite ends of the housing and having air flow passages formed therein, one of said cap means being passaged to provide an oil supply path therethrough, an oil supply conduit within said chamber connecting with

the supply passage in said one of the cap means and located to receive oil when the housing is at various attitudes, first conduit means received by the housing and communicating with the chamber to direct an oil-air mixture thereto at generally ambient pressure to compress any air in said chamber, second conduit means receiving essentially air-free oil from the supply passage in said one of the cap means, and third conduit means receiving substantially oil-free air from the flow passages in each of the cap means, filter members associated with each of the cap means and extending diametrally thereacross for venting air from the chamber to the air flow passages while blocking the movement of oil thereinto, a mechanism requiring an essentially continuous supply of oil connecting with each of the conduit means, and pump means in the first conduit means directing an oil-air mixture to the chamber and also in the second conduit means receiving essentially air-free oil from the chamber to effect a constant flow of said oil to the mechanism and a continuous scavenge of the mixture therein to compress the air in the oil supply chamber to standardize the pressure in said chamber at a pressure greater than ambient to prevent oil foaming at altiude.

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