

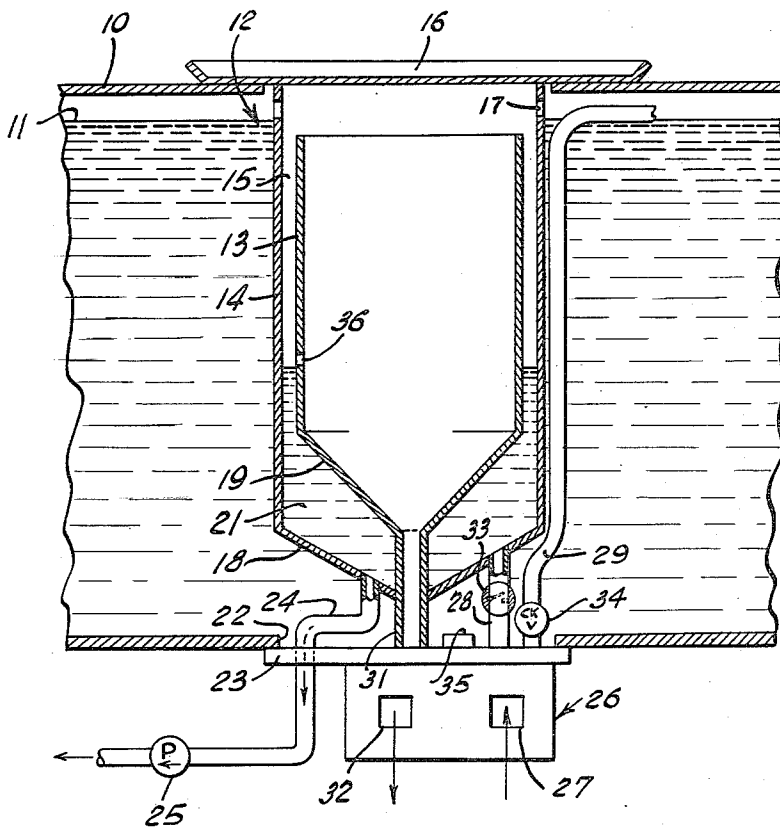
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STORAGE TANK FOR LIQUID CIRCULATING SYSTEM

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1

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STORAGE TANK FOR LIQUID CIRCULATING SYSTEM

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2 Claims. (Cl. 257-195)

This invention relates to systems circulating a congealable liquid, and particularly to a storage tank therein providing a reservoir whereby a portion of the circulating liquid is available for use as a hydraulic fluid.

An object of the invention is to adapt a known storage tank of the prior art, reference being had in particular to the storage tank disclosed in Patent No. 2,733,050 issued January 31, 1956, to Harry T. Booth, to incorporate therein a reservoir as described.

Another object of the invention is to provide a reservoir as described occupying a relatively small part of the storage tank but so situated in the tank as to insure an ample supply of hydraulic fluid both for repeated withdrawals, as for example in a repeated exercising of a propeller feathering mechanism, and for emergency use, it being contemplated that an adequate supply of liquid will remain in the reservoir for emergency use even though the total supply of liquid in the circulating system is seriously depleted.

Other objects and structural details of the invention will appear from the following description when read in connection with the accompanying drawing, which is a view, partly in diagram, of a storage tank in accordance with the illustrated embodiment of the invention.

Referring to the drawing, the storage tank thereof is one found in the engine lubricant circulating systems of aircraft and functions to hold a supply of replacement lubricant or oil while a portion of the lubricant continuously is circulated to and from the engine and through a hopper device installed within the tank.

As shown, a storage tank for lubricating oil is seen to comprise an outer shell 10 holding the main body 11 of stored lubricant. Received in the outer shell, in spaced relation to the walls thereof is a hopper assembly 12 comprising concentric, cylindrical inner and outer shells 13 and 14 spaced apart to define therebetween an annular space 15. The upper end or top of the outer shell 14 extends above the corresponding end of the inner shell 13 and may be closed by a cap 16, with restricted communication between the upper end of the outer shell 14 and the interior of the tank 10 proper being provided by small diameter openings 17 in the shell. The openings 17 provide for overflow from the hopper system into the tank and may serve also to obtain a pressurizing of the hopper system in a manner and for purposes which it is unnecessary here to consider.

The outer shell 14 has a conical bottom portion 18. The inner shell 13 has a similar bottom portion 19 which is, however, in non-parallel relation to the bottom 18 and in relatively widely spaced relation thereto in such manner as to define in the bottom of the outer shell 14 a relatively deep chamber 21 communicating at its upper periphery with the annular passage 15. In the bottom of the tank 10, beneath the hopper assembly 12, is an opening 22 closed by an adapter plate 23. An outlet conductor 24 communicates at its one end with the chamber 21 and extends at its other end to and through the plate 23. Extending beyond the plate 23 to a place

2

of utilization of a hydraulic fluid, as for example to a propeller feathering mechanism, the conductor 24 has a selectively operable pump 25 therein and it will be understood that upon operation of the pump 25 liquid is drawn from the chamber 21 and directed under pressure through the conductor 24 to a place of use.

The adapter plate 23 provides a mounting for a valve unit 26. The latter may be a valve as shown in F. E. Carroll, Jr., Patent No. 2,745,424, issued May 15, 1956, since it operates to the same end and purpose in controlling oil flow to and from the storage tank. Thus, oil returning from the engine enters the valve unit 26 by way of an inlet opening 27 and is directed alternatively to ducts 28 and 29 extending through the plate 23 into the interior of the storage tank. Duct 28 opens as shown through the conical bottom 18 of the outer shell 14 of the hopper assembly. Oil admitted to the hopper assembly through duct 28, therefore, enters the space 21 in the bottom of the outer shell 14 and rises through annular passage 15 to the top of the hopper assembly where it spills over into inner shell 13 and descends to the bottom thereof. At the bottom of the inner shell 13 is a duct 31 which extends downwardly through the space 21 and through the conical bottom 18 of the outer shell and through the adapter 23 to the valve unit 26 where it is discharged by way of an opening 32 for passage to the engine. The duct 29 rises as a stand pipe within the tank 10 outside the hopper assembly. It terminates at its upper end above the normal oil level and so provides for return flow into the tank proper outside the hopper assembly. The ducts 28 and 29 have respective check valves 33 and 34 therein preventing back-flow from the hopper and from the tank to the valve 26 by way of these ducts. A further duct 35 continuously communicates the lower part of the tank 10 with the valve unit 26 and outlet opening 32 therein.

In the operation of the system, oil returning from the system is placed under pressure by the engine scavenge pumps, and, subject to temperature control, is directed either through the duct 28 or through the duct 29 or through both thereof. The oil entering duct 28 is directed as described to the inner shell 13 of the hopper assembly, and, in flowing through the annular path 15, tends to raise the temperature of shell 14 with a consequent warming effect upon the oil in the tank 10 in contact with the exterior of the shell. Descending within the shell 13, the oil leaves the hopper assembly by way of conductor 31 and is returned to the engine by way of valve 26 and opening 32 therein. The oil directed through duct 29 is discharged into the upper part of the tank 10. When the principal flow is by way of duct 28 and the hopper system the duct 35 supplies make up oil from the tank to replace that lost in the circulating system. When the principal flow is by way of duct 29, duct 35 serves as the main return means to the valve 26 and the engine.

The construction and arrangement of parts accordingly is one which finds the space 21 normally filled with oil, and it will be understood that the size of the space 21 is determined to provide sufficient fluid for at least one emergency operation of the system to which outlet conductor 24 leads. In this regard, there is located in the inner shell 13, intermediate the ends thereof, an opening 36 communicating annular path 15 with the interior of inner shell 13. According to the concept of use and location of the opening 36 there is made available thereby the whole of the space above such opening and within the shell 13 as a source of oil to replenish the space 21 should the liquid be drawn out of this space by an actuation of the pump 25. Thus, a repeated exercising of the pump 25, as might be done in training or test work, will not exhaust the space 21, the liquid used being replaced by other liquid drawn from the inner shell 13

3

and flowing downward through the opening 36 into the space 21. Further in accordance with such location, however, the oil in the lower part of the inner shell 13, beneath the opening 36, cannot be drawn off by actuation of the pump 25 so that the hopper system cannot be evacuated by excessive use of the pump 25. Similarly a seriously depleted hopper system cannot drain the liquid from space 21 since the opening 36 lies above such space. An amount of liquid in the space 21 always will remain, therefore, sufficient for an operation of the hydraulic actuating system irrespective of the condition of the hopper system.

What is claimed is:

1. In a storage tank of an engine lubrication system, a hopper adapted to be vertically positioned in said tank to provide a flow path for heated oil in heat exchange relation with a main body of oil in said tank, said hopper including closely spaced concentric cylindrical inner and outer shells defining an annular path for flow of oil therebetween and being in interior communication with one another at their upper ends, each of said shells having a conical bottom and said conical bottoms of said inner and outer shells being spaced apart to define a relatively deep space at the bottom of the hopper communicating at its upper periphery with said annular path, the conical bottom of said inner shell being provided with a discharge connection communicating with the interior of said inner shell and extending through said deep space and the bottom of said outer shell to the exterior of said hopper, and the bottom of said outer shell being formed with separate inlet and outlet connections, the latter providing for selective use of said deep space as a reservoir of hydraulic fluid, said inner shell having an opening intermediate its top and bottom and above said deep space providing for limited flow to said space from the interior of said inner shell.

4

2. In a storage tank of an engine lubrication system, a hopper adapted to be vertically positioned in said tank to provide a flow path for heated oil in heat exchange relation with a main body of oil in said tank, said hopper comprising closely spaced nested inner and outer shells defining a narrow path for flow of oil therebetween, said outer shell being provided near its bottom with an inlet connection communicating with said narrow path and said inner shell being provided near its bottom with a discharge connection extending through said outer shell to the exterior of said hopper, the upper end of said outer shell terminating at a point above said inner shell, whereby oil flowing through said inlet connection and said narrow path can flow over the upper periphery of said inner shell into the interior of said inner shell, said outer shell being further provided with an outlet connection for selective use of the space between said shells as a reservoir of hydraulic fluid, and an opening in said inner shell intermediate its top and bottom whereby said reservoir may be supplied to a limited extent from the interior of said inner shell.

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