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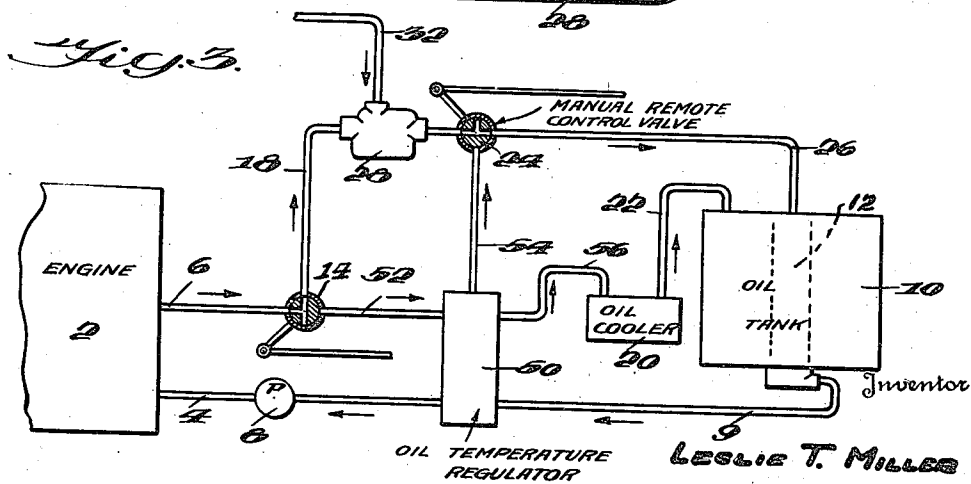
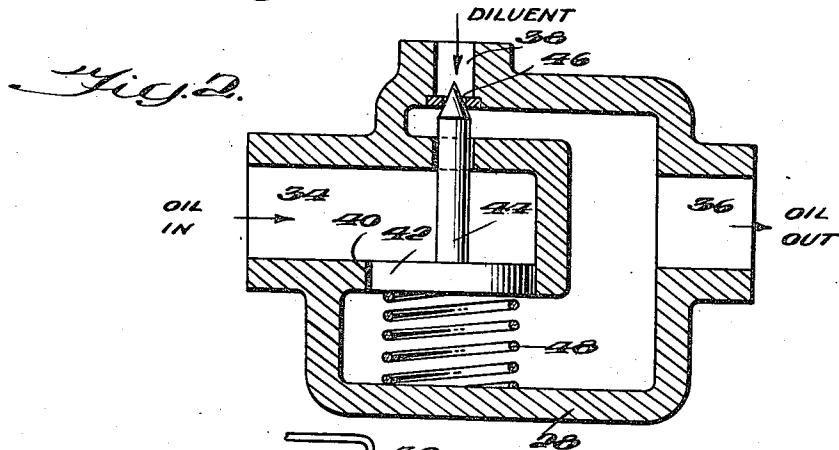
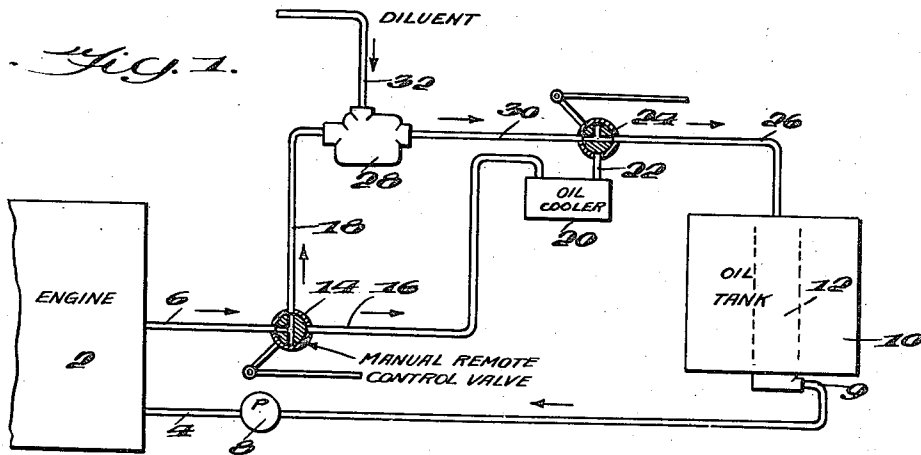
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2,311,069

LUBRICATING SYSTEM

Filed July 16, 1941

5 Sheets-Sheet 1



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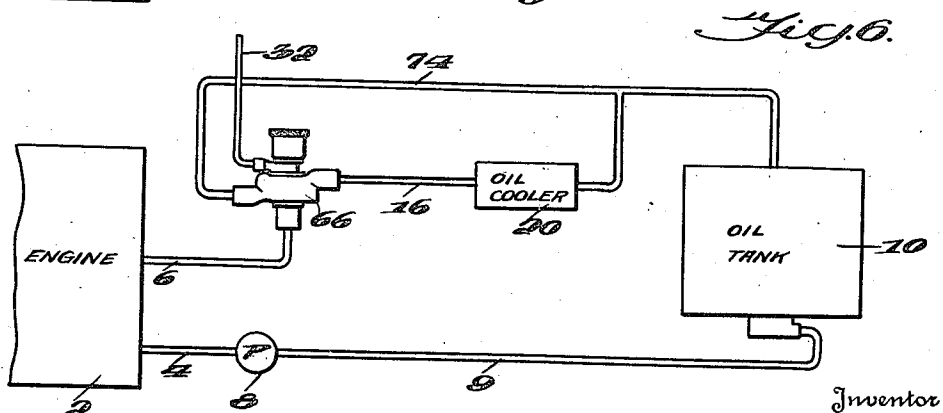
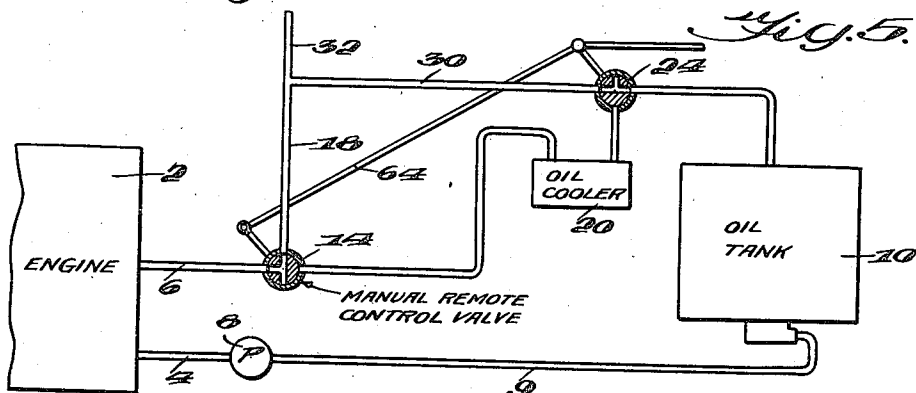
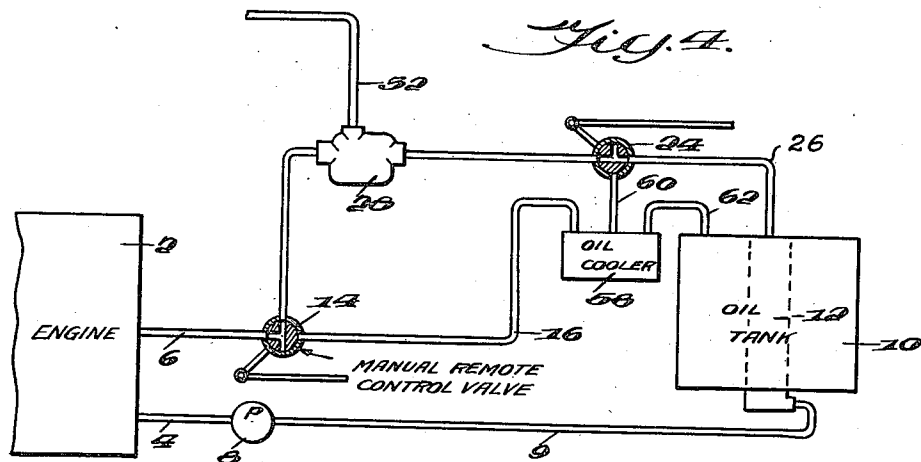
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LUBRICATING SYSTEM

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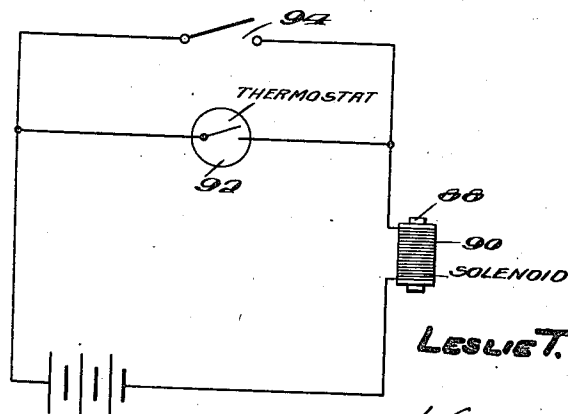
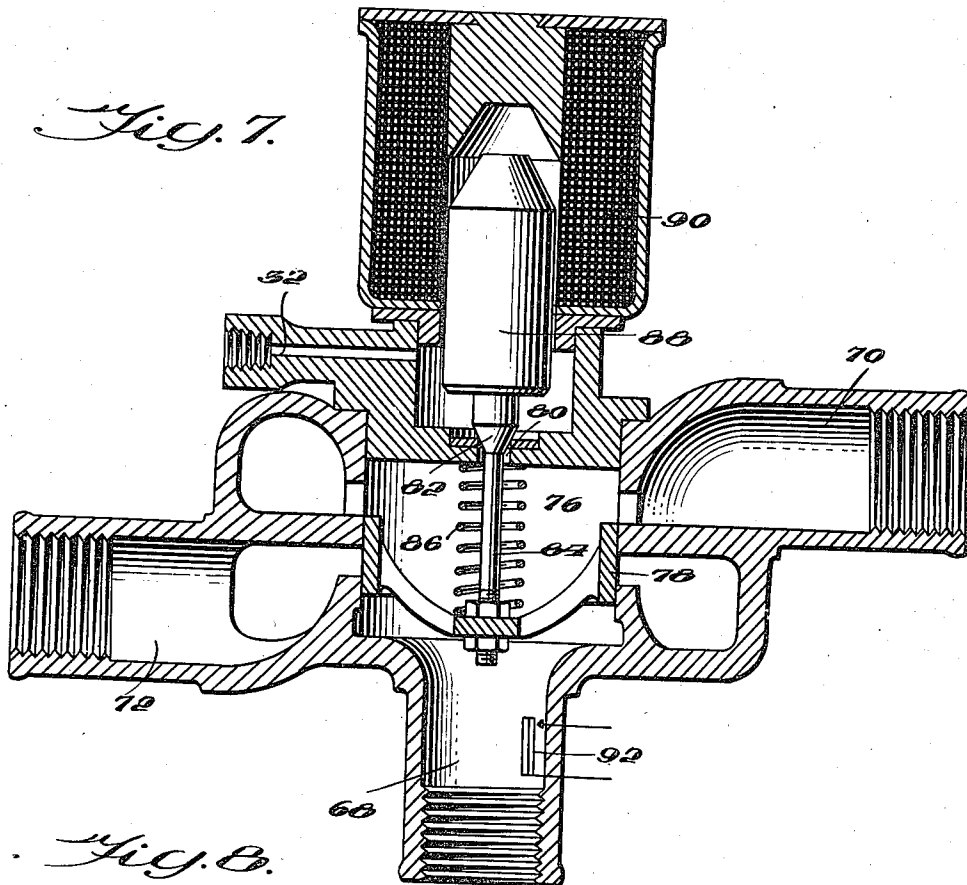
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LUBRICATING SYSTEM
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5 Sheets-Sheet 3



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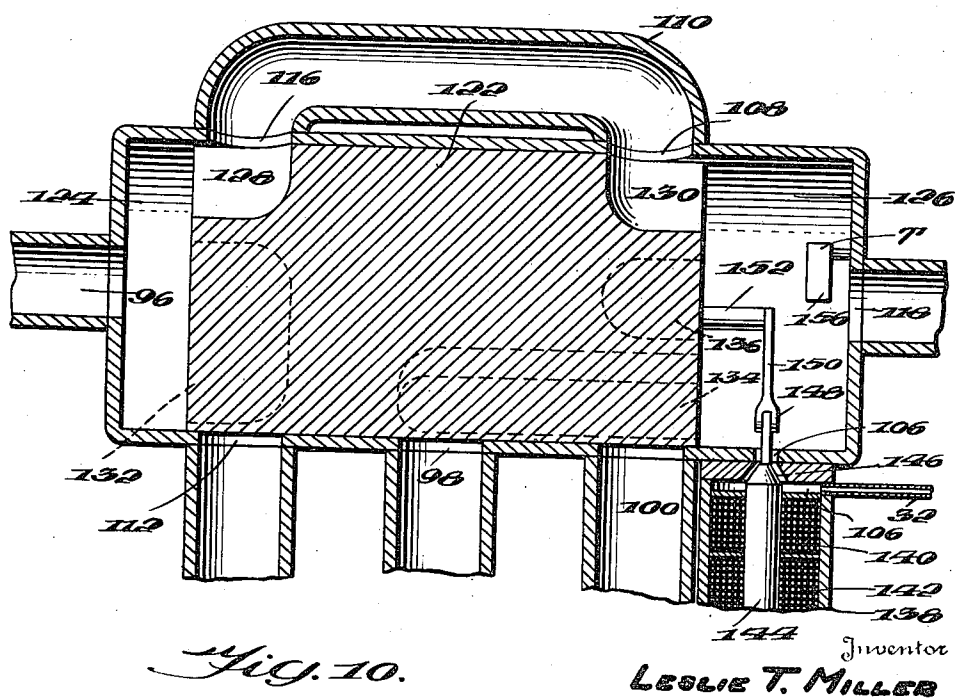
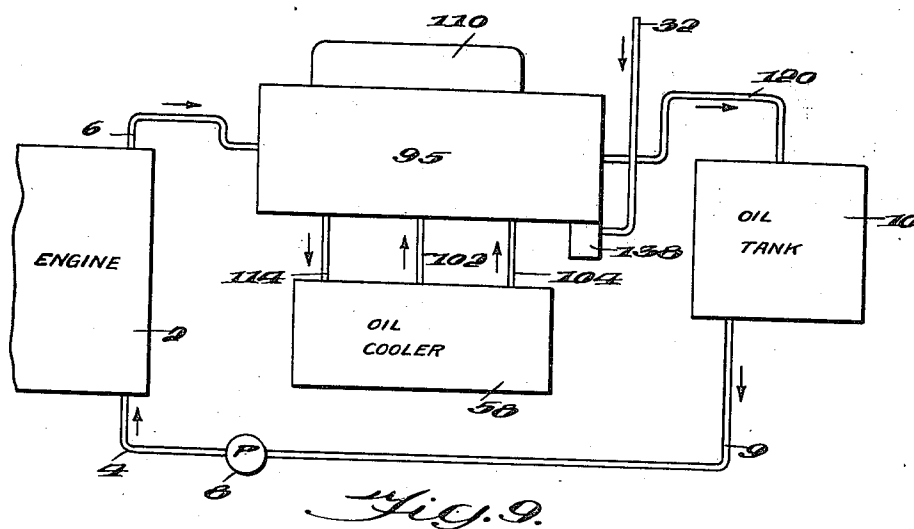
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2,311,069

LUBRICATING SYSTEM

Filed July 16, 1941

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LUBRICATING SYSTEM

2,311,069

Filed July 16, 1941

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Fig. 11.

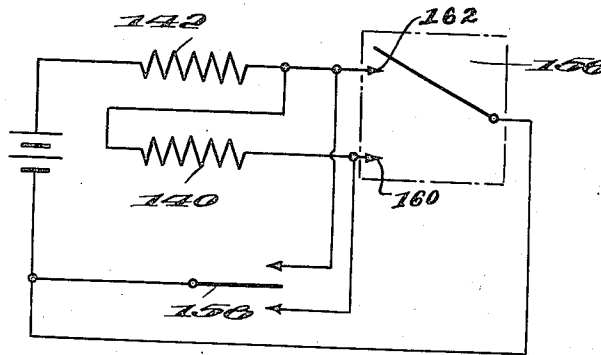


Fig. 12.

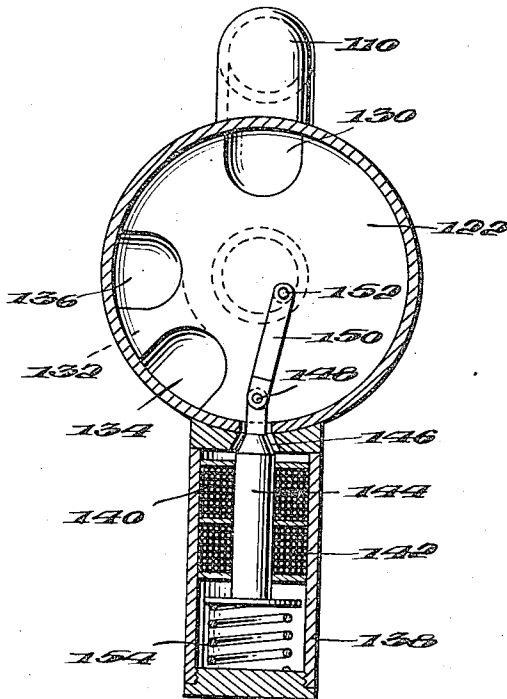
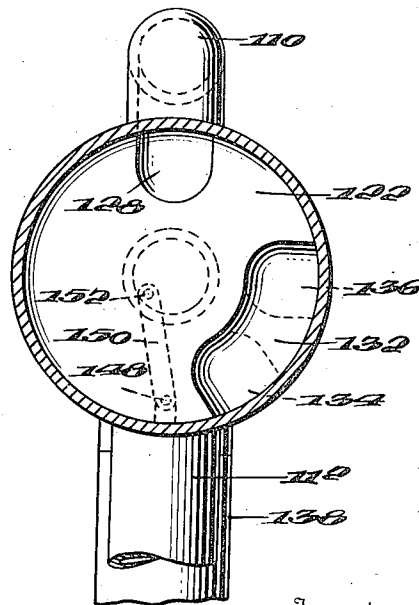


Fig. 13.



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UNITED STATES PATENT OFFICE

2,311,069

LUBRICATING SYSTEM

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Application July 16, 1941, Serial No. 402,569

16 Claims. (Cl. 184—6)

This invention relates to lubrication systems, and particularly to such systems intended for use with engines which are subjected to wide variations of heat and cold.

It is well known that the usual lubricating oils thicken when cooled, and therefore do not provide proper lubrication. The introduction of a lighter, less viscous lubricant during periods of starting, when the engine is cold, has been suggested. However, no satisfactory arrangement for introducing the diluting lubricant into the system has been provided.

The present invention is particularly applicable to a system which includes an oil cooler and an oil tank having a warm-up compartment. It has been found that in the usual system the forcing of cold oil through the oil cooler reduces the efficiency of the pump and is likely to damage the oil cooler.

The primary object of the present invention is to provide a simple yet effective construction for ensuring proper lubrication of the engine at all temperatures, while reducing the pressures required and avoiding damage to the system.

Another object of the invention is to provide a simple means for introducing a diluent into the oil in a lubricating system in such a manner as to ensure its proper distribution through, and thorough admixture with, at least that portion of the oil which will be used for lubrication, upon the next cold starting of the engine.

Another object of the invention is to provide a means to cause the oil to flow directly to the warm-up compartment, regardless of the temperature of the lubricant and at the same time add a diluent so that a quantity of low viscosity lubricant may be provided for the next cold starting of the engine.

A further object of the invention is to produce an arrangement of this type which avoids the flow of cold oil through the oil cooler so as to prevent damage thereto. More particularly, means are furnished for by-passing the oil cooler when so desired.

Still another object of the invention is to provide a valve arrangement for automatically permitting the flow of diluent when oil is being by-passed around the oil cooler, this valve closing off the diluent when the normal flow through the oil cooler is reestablished.

An additional object of the invention is to arrange an electrical control for simultaneously by-passing the oil cooler and admitting a diluent to the system.

Still a further object of the invention is to provide both a manual means, operable at will, and an automatic means, responsive to the temperature of the oil, for regulating the by-passing and the diluent introduction.

Further objects and advantages will be seen

from the following description when taken in conjunction with the accompanying drawings, which form a part thereof.

In the drawings:

5 Figs. 1, 3, 4, 5, 6, and 9 show diagrammatically lubricating systems embodying my invention;

Figs. 2, 7 and 10 are cross sections through valves for use in the systems shown in Figs. 1, 3 and 4, Fig. 6 and Fig. 9 respectively;

10 Figs. 8 and 11 are diagrams of the electrical circuits for the valves of Fig. 7 and Fig. 10 respectively; and

Figs. 12 and 13 are views of the right and left ends respectively of the valve of Fig. 10.

15 As shown, the invention is applied to a system for lubricating an engine 2 having an oil inlet 4 and an oil outlet 6. A pump 8 forces oil under pressure into inlet 4.

In the form shown in Fig. 1, pump 8 draws oil 20 from the outlet 9 of an oil tank 10 having a central warm-up compartment 12. The oil outlet 6 from the engine leads to a valve 14 to which are connected pipes 16 and 18. Pipe 16 leads to an oil cooler 20, the outlet of this being connected by pipe 22 to a second valve 24, to which connects pipe 26 leading to the oil tank 10. Pipe 18 leads to a valve device 28, shown in detail in Fig. 2, from which a pipe 30 leads to valve 24. Finally, a pipe 32 connects valve 28 to a suitable source of a diluent such as gasoline or the like. Valves 14 and 24 are both provided with suitable connections for manual remote control of this positions.

35 As shown in Fig. 2, valve 28 has an inlet 34 connected to pipe 18, an outlet 36 connected to pipe 30, and a diluent inlet 38 connected to pipe 32. Between inlet 34 and outlet 36 is a port 40 which is normally almost entirely filled by a piston 42, the stem 44 of which has a pointed end 46 forming a needle valve adapted to close inlet 38. A coil spring 48 normally holds this valve in closed position.

This mechanism operates as follows: In normal operations, valves 14 and 24 are set to direct the 45 oil from engine outlet 6 through oil cooler 20 to oil tank 10. However, when starting the motor if it is cold, and just before stopping, it is often desirable to introduce into the lubricant a certain amount of a diluent, so that the lubricant is less viscous. Upon starting the motor, it is 50 both unnecessary and undesirable to circulate a cold lubricant through the oil cooler, as the pressure required might burst the cooler. To accomplish these two purposes, the operator turns valves 14 and 24 to the position shown in Fig. 1, so that the oil cooler is by-passed.

As long as only slight pressures are present in valve 28, caused by leakage or in any other manner, these can equalize each other by leakage through the small space around piston 42.

When, however, the full flow of oil is directed through the valve, piston 42 is pushed downward by the pressure and opens port 40. At the same time, needle valve 46 opens inlet 38, and diluent flows into the valve body where it will mix with the lubricant in its passage therethrough. Thus the diluent is added whenever a substantial flow through the by-pass is established, but its supply is immediately cut off by the action of spring 48 when such flow ceases.

The circuit shown in Fig. 3 is generally similar to that of Fig. 1. However, there is included in the outlet line 9 of the oil tank an oil temperature regulator 50, for example of the Pratt and Whitney type. Valve 14 is connected by pipe 54 to valve 24 and by pipe 56 to oil cooler 20. Pipe 26 from valve 24 and outlet 22 from oil cooler 20 both lead to oil tank 10, the former to warm-up compartment 12.

In this construction, as in Fig. 1, the valves 14 and 24 may be set to produce normal flow, or, in the position shown, to by-pass the temperature regulator and oil cooler. In the latter case, valve device 28 produces the addition of a diluent into the by-passed oil.

In the form shown in Fig. 4, the oil cooler 58 is of the known type having a core section and a jacket section, in the latter of which comparatively little cooling takes place. The oil may pass through the jacket section only, in which case it is only slightly cooled, or through both the jacket and core, in which it is highly cooled. Outlet 60 for the jacket leads to valve 24, while pipe 26 leads to warm-up compartment 12 of tank 10. Core outlet 62 leads to the main portion of tank 10.

This device operates in the same general fashion. When the engine is cold, the operator may adjust valves 14 and 24 to by-pass the oil cooler entirely, and at the same time to produce dilution of the lubricant by valve 28. This diluted oil flows through the warm-up compartment, so that the whole body of oil in tank 10 is not diluted, but only the small circulating portion thereof. Even after the valves are restored to their normal positions, pipe 60 conducts the oil from the jacket of the oil cooler to the compartment 12. It is only when the oil has become warm and passes through the core and core outlet 62 that it mixes with the body of oil in the tank.

The form shown in Fig. 5 is similar in general to that shown in Fig. 1. However, instead of the valve device 28, pipe 32 is connected directly to line 18, 30, and the diluent is added by a suitable pressure in its line. Valves 14 and 24 are connected by a link 64 so as to be operated jointly.

Fig. 6 shows a circuit generally similar to that of Fig. 1, but utilizing a single device 66 which has the functions of both of valves 14 and 28. The valve itself is shown in Fig. 7. It has an oil inlet 68 for connection to engine oil outlet 6; a normal oil outlet 70 connected by line 16 to oil cooler 20; and a second oil outlet 72 connected by line 74 to tank 10. Inlet 68 leads into a cylindrical chamber 76 which has two rings of ports connected to outlets 70 and 72 respectively. A sleeve 78 slidable in the cylinder can cover one or the other of these sets of ports.

In the top of the chamber 76 is a diluent inlet 80 connected to pipe 32. This is controlled by a conical valve section 82 on a rod 84 which is connected to sleeve 78. A coil spring 86 normally holds sleeve 78 in its lower position, so as to close outlet 72. Rod 84 is connected to the core 88

of a solenoid 90, so as to raise the rod when the solenoid is energized.

Arranged in the oil inlet 68 is a thermostat 92 which is connected to solenoid 90 by the circuit shown in Fig. 8. A manual switch 94 is also provided in this circuit.

The operation is as follows: Normally, oil flows from the engine to inlet 68 and through outlet 70 to the oil cooler. If the oil is too cold, however, thermostat 92 is closed and energizes solenoid 90. This raises rod 84 and moves sleeve 78 up to close the ports to normal outlet 70 and open them to by-pass outlet 72. At the same time, valve 82 is raised and permits the diluent to enter through inlet 80. Thus the oil is simultaneously diluted and passed around the oil cooler. Before stopping the engine, the introduction of diluent may be obtained by closing manual switch 94.

Fig. 9 shows a circuit using an oil cooler of the type described in connection with Fig. 4. This modification utilizes the valve 95 shown in Figs. 10, 12 and 13. This valve has inlets 96 for connection to the engine oil outlet 6; 98, 100 for connection to the jacket and core respectively of oil cooler 58 by pipes 102, 104 respectively; 106, for connection to diluent supply pipe 32; and 108 for a by-pass 110; as well as outlets 112 leading by pipe 114 to oil cooler 58; 116 leading to by-pass 118; and 118 leading to oil tank 10 by pipe 120.

Within the valve is a body 122 mounted to turn. This is shorter than the casing so as to provide chambers 124, 126 at the ends. Passages 128, 130 are provided in opposite ends to provide connections to outlet 116 and inlet 108 respectively. Passage 132 connects with outlet 112, while passages 134, 136 can connect with inlets 98, 100 respectively.

A depending chamber 138 near outlet 118 contains two solenoid coils 140, 142 each adapted to operate on a core 144. This core has a conical valve portion 146 adapted to close inlet 106. Pivoted to the core at 148 is a link 150 which is also pivotally connected to a pin 152 extending from an eccentric point in the end face of valve body 122. A coil spring 154 normally urges core 144 upward.

In chamber 126 is arranged a two-contact thermostat 156, the contacts of which are connected, by the circuit shown in Fig. 11, to one and both, respectively, of the coils 140 and 142. A manual switch 158 for selectively energizing coils 140, 142 may also be provided.

This device operates in the following manner: Normally, oil from the engine will flow from the engine to chamber 124, passage 132, pipe 114, jacket and core of oil cooler 58, pipe 104, passage 136, chamber 126 and outlet 118 to tank 10. If, however, the engine is cold, thermostat 156 will close the lower contact 160 and will energize both coils 140, 142. This will pull core 144 fully down and through link 150 will turn valve body 122 to the position shown in the drawings. Oil will then flow through chamber 124, passage 128, by-pass 110, passage 130 and chamber 126 to outlet 118. At the same time, valve surface 146 will be moved down to open the diluent inlet 106, so as to permit the diluent to enter and mix with the lubricant.

As the oil warms up, thermostat 156 moves to the upper contact 162 and energizes only coil 142. This permits partial upward movement of core 144, which turns valve 122 to an intermediate position in which passage 134 communicates with

inlet 98. Oil then flows through the jacket only of the oil cooler.

While I have described herein some embodiments of my invention I wish it to be understood that I do not intend to limit myself thereby except within the scope of the appended claims.

I claim:

1. In a system including an engine, a reservoir for lubricant, a circuit for conducting lubricant from the reservoir to the engine and back to the reservoir, an oil cooler in said circuit, means to by-pass oil around said oil cooler, and means in said by-pass to introduce a diluent.

2. In a system including an engine, a reservoir for lubricant, a circuit for conducting lubricant from the reservoir to the engine and back to the reservoir, an oil cooler in said circuit, selectively operable means to by-pass oil around said oil cooler, and means controlled by the flow of lubricant through said by-pass means to introduce a diluent into said by-pass means.

3. In a system including an engine, a reservoir for lubricant, a circuit for conducting lubricant from the reservoir to the engine and back to the reservoir, an oil cooler in said circuit, selectively operable means to by-pass oil around said oil cooler, and means controlled by the flow of lubricant through said by-pass means to introduce a diluent into said by-pass means, said last means closing off the flow of diluent when no lubricant is flowing in the by-pass means.

4. In a lubricating system, means for introducing a diluent into the system, and means controlled by the flow of lubricant in a portion of the system to operate said first means, said first means closing off the flow of diluent when no lubricant is flowing in such portion of the system.

5. In a lubricating system, means for introducing a diluent into the system, and means controlled by the temperature of a lubricant in a portion of the system to operate said first means, said first means closing off the flow of diluent when no lubricant is flowing in such portion of the system.

6. In a system including an engine, a reservoir for lubricant, a circuit for conducting lubricant from the reservoir to the engine and back to the reservoir, an oil cooler in said circuit, means to by-pass oil around said oil cooler and means operated upon operation of said by-pass means to introduce a diluent into said by-pass means.

7. In a system including an engine, a reservoir for lubricant including a warm-up compartment, and a circuit for conducting lubricant from the reservoir to the engine and back to the reservoir, an oil cooler in said circuit, selectively operable means to by-pass oil around said oil cooler and return said lubricant to said warm-up compartment, and means to introduce a diluent into said circuit when the oil is flowing to the warm-up compartment and to stop the introduction of said diluent upon the stoppage of flow of lubricant to the warm-up compartment.

8. In a device as claimed in claim 4, said first means comprising a diluent supply means having a valve therein, and a piston connected to said valve and arranged in said portion of the system to be actuated by the flow of lubricant therethrough.

9. In a device as claimed in claim 4, said first means comprising a diluent supply means hav-

ing a valve therein, spring means normally holding said valve closed, and a piston connected to said valve and arranged in said portion of the system to be actuated by the flow of lubricant therethrough.

10. In a device as claimed in claim 6, said last means including a diluent supply means having a valve therein, means to direct lubricant to said by-pass means, and means connecting said valve to said last means to be operated thereby.

11. In a device as claimed in claim 6, said last means including a diluent supply means having a valve therein, means responsive to the temperature of oil in said system to direct lubricant to said by-pass means, and means connecting said valve to said last means to be operated simultaneously therewith.

12. In a lubricating system for an engine, a reservoir for lubricant having a main section and a warm-up compartment, a supply conduit for conducting lubricant from the reservoir to the engine, a normal return conduit from the engine to the main section of the reservoir, and a secondary return conduit from the engine to the warm-up compartment, means to change the flow from one return conduit to the other return conduit and means to add a diluent to the circulating lubricant, after the flow has changed from the normal to the secondary conduit.

13. In a system including an engine, a reservoir for lubricant, and a circuit for conducting lubricant from the reservoir to the engine and back to the reservoir, an oil cooler in the return portion of said circuit, selectively operable means to by-pass oil around said oil cooler, and return said oil to said reservoir, and means to introduce a diluent into said circuit when the oil is flowing through the by-pass and to stop the introduction of said diluent upon the stoppage of flow of lubricant through said by-pass.

14. In a lubricating system for an engine, a reservoir having a main section and a warm-up compartment, a supply line from the reservoir to the engine, and a normal return line from the engine whereby lubricant is conducted to the main section of the reservoir, a secondary line whereby lubricant is conducted to the warm-up compartment, selectively operable means to direct oil flow in the secondary line, and means to add a diluent to the circulating lubricant after it has been directed to flow in the secondary line.

15. In combination in a lubrication system for an engine, a reservoir for lubricant, a supply line to conduct lubricant from the reservoir to the engine, a return line to conduct lubricant from the engine to the reservoir, and a valve in the return line to introduce a diluent into said return line.

16. In a lubricating system for an engine, a reservoir for lubricant having a main section and a warm-up compartment, a supply conduit for conducting lubricant from the reservoir to the engine, a return conduit for connecting the engine and the reservoir and including a primary portion communicating with the main compartment of the reservoir and a secondary portion communicating with the warm-up compartment of the reservoir, means to direct returning lubricant through either the primary or secondary portions of the return conduit and means to add a diluent to the lubricant circulating in said system.

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