

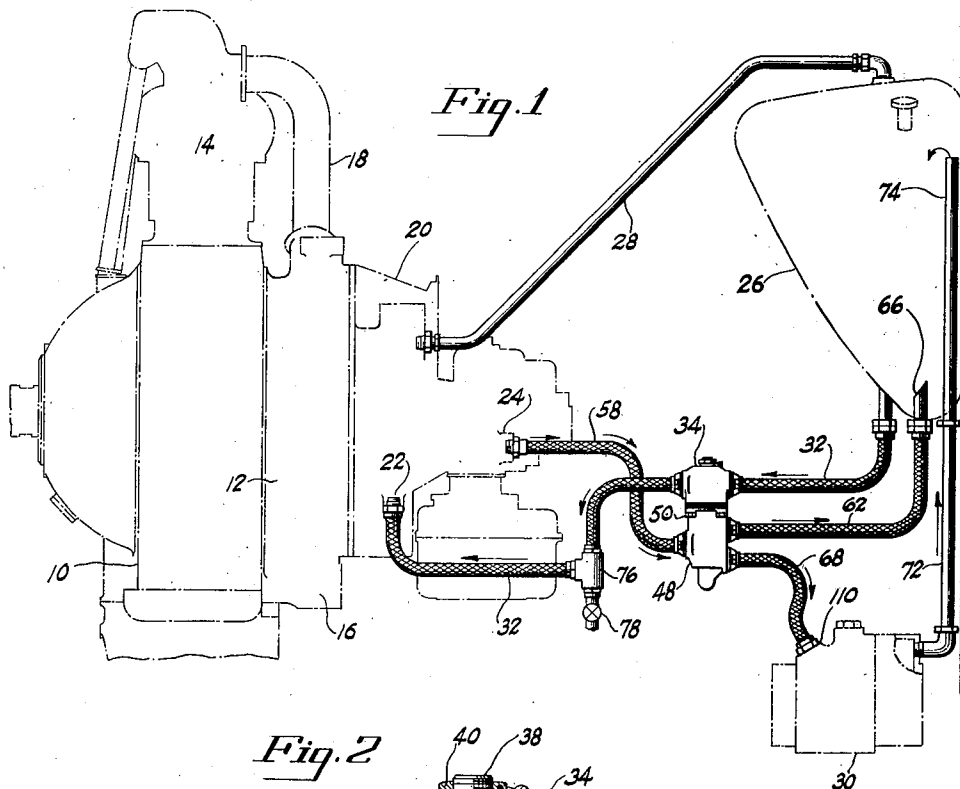
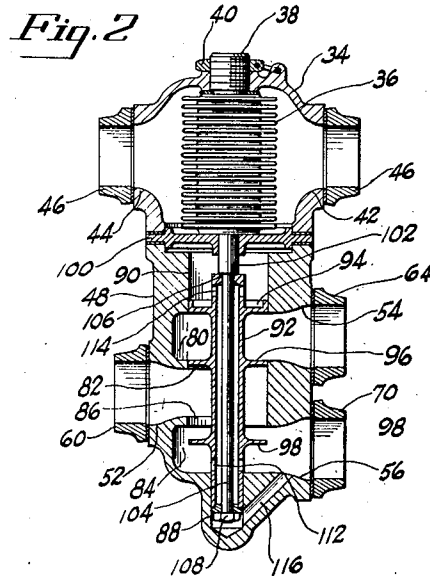
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TEMPERATURE CONTROL MEANS FOR MACHINE LUBRICATING SYSTEMS

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TEMPERATURE CONTROL MEANS FOR MACHINE LUBRICATING SYSTEMS

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This invention relates to improvements in temperature control means for machine lubricating systems and has particular reference to an oil temperature control device for the lubricating oil of an engine such as an internal combustion engine used for the propulsion of vehicles and has for an object the provision in the engine lubricating system of temperature responsive means for controlling the flow of lubricating oil through a cooling device.

A further object resides in the provision of means for providing the engine with a supply of lubricating oil having a temperature sufficiently high to permit full power operation of the engine a short time after the engine has been started by providing for a substantially direct recirculation of lubricating oil through the engine lubricating system during the warming up process.

Other objects and advantages will appear as the description proceeds.

In the accompanying drawing in which like reference numerals are used to designate similar parts throughout, we have illustrated a suitable mechanical embodiment of what is now considered to be the preferred form of the idea of the invention. The drawing, however, is to be taken for the purpose of illustration only and not as limiting the invention, the scope of which is to be measured entirely by the scope of the appended claims.

In the drawing, Fig. 1 is a partly schematic elevational view of an engine having a lubricating circuit composed in part of the internal lubricating system of the engine and in part of circuit completing means exterior of the engine showing the exterior portion of the lubricating circuit constructed and arranged according to the idea of this invention. Fig. 2 is a vertical sectional view of a thermostatic valve forming a portion of the exterior portion of the engine lubricating circuit illustrated in Fig. 1.

Referring to the drawing in detail, the numeral 10 generally indicates a machine such as an internal combustion engine for a vehicle. The engine illustrated is of the radial air-cooled type commonly employed for the propulsion of airplanes and is provided with a crankcase 12 of generally circular outline around the circumference of which are arranged a plurality of radially extending cylinders 14. A fuel manifold 16 is attached to the rear end of the crankcase 12 and is provided with headers 18 connecting the manifold with the intake ports of the engine in the conventional manner. A gear case 20 is secured to the rear side of the manifold 16 and contains an oil pressure pump having an inlet indicated at 22 and a scavenging pump having an outlet indicated at 24. An oil reservoir in the form of a separate tank 26 is mounted on the vehicle exterior of the engine and the inlet 22

and outlet 24 are connected with the tank 26 through suitable conduits so that the pressure pump may draw lubricant, such as crankcase oil, from the tank and force it under pressure through the internal lubricating system of the engine and the scavenging pump may draw oil from the engine oil sump and return it through the outlet 24 to the tank. The top of the tank may be connected with the engine crankcase by suitable vent tubes as indicated at 28.

It is a well-known fact that during the operation of an internal combustion engine, especially where the engine is developing power near its rated maximum, the crankcase oil is seriously heated and, upon continued high power operation, if no means are provided to reduce the temperature of the oil, it may become sufficiently heated so that it will no longer maintain a proper lubricating film on the engine parts and thus result in serious injury to the engine. In order to overcome this difficulty, it has been common practice to employ in combination with the engine 10, and reservoir 26, an oil cooling radiator as indicated at 30 for reducing the temperature of the oil flowing from the engine lubricating system back to the tank. If the oil cooling radiator is used without any means of controlling the flow of oil therethrough certain serious troubles result from such use, the chief of which being that during cold weather operation at relatively low engine power, the oil becomes chilled and viscous to such an extent that it can not be readily handled by the engine pumps. This difficulty has been previously alleviated to some extent by employing a manually controlled device for regulating the flow of oil through the oil cooling radiator. While this arrangement has rendered it possible to use an oil cooling radiator during cold weather operation, it is far from satisfactory in that it places an additional burden upon the operator of the vehicle to observe the temperature of the lubricating oil and attempt to regulate the flow of oil through the radiator to maintain the optimum oil temperature during the operation of the engine.

A further disadvantage that is inherent in the oil cooling systems heretofore employed is that the entire quantity of lubricating oil contained in the engine lubricating system and in the oil reservoir tank must be warmed up to a safe operating temperature before the engine can be operated at full power. This condition obviously requires an extended warming up period for the engine, especially if the lubricating oil has been severely chilled.

In order to overcome the above-mentioned difficulties, we have provided in the engine lubricating circuit, an automatic temperature responsive device for controlling the flow of oil through the oil cooling radiator to automatically main-

tain the temperature of the oil at the most desirable temperature for efficient engine operation, and have also provided means for supplying the engine with warm oil from almost the beginning of the warming up period by arranging the automatic temperature responsive device in such a manner that when the oil is cold a small quantity thereof will be recirculated through the engine and additional cold oil will be added to the recirculated quantity only as the temperature of increasing quantities of oil reaches a safe operating temperature.

Our invention comprises in general an improved thermostatically operated valve for controlling the flow of oil in the lubricating circuit, and an improved arrangement of conduits between the engine, the valve, the oil cooling radiator, and the oil reservoir.

In the form of the invention illustrated, we have provided a conduit 32 leading from the bottom of the tank 26 to the pressure pump inlet 22 and in this conduit we have interposed a hollow casing 34 containing a thermostatic element 36 of the bellows type, operated in response to temperature changes by the evaporation of a volatile fluid contained therein in the well-known manner. In the arrangement of the parts as illustrated, the bellows 36 is anchored to the top of the casing 34 by means of a screw threaded stud 38 and a lock nut 40, and the casing is provided at each side thereof with an oil passage as indicated at 42 and 44, the ends of the conduit 32 being connected to these passages by suitable means such as the flanged couplings 46.

From the above description it will be observed that lubricating oil flowing from the tank 26 to the inlet 22 of the engine pressure pump will flow past the thermostatic element 36 and cause the thermostatic element to expand or contract in response to the temperature of the oil flowing through the casing 34.

At the bottom of the casing 34 is secured a valve casing 48 by suitable means such as the bolts 50 extending through the flange provided on the casing 34. The casing 48 is provided with a single inlet passage 52 and with two outlet passages 54 and 56. The inlet passage 52 is connected to the outlet 24 of the scavenging pump by means of a suitable conduit 58 and a flange coupling 60. The valve outlet 54 is connected directly to the interior of the tank 26 by means of a suitable conduit 62 and a flange coupling 64, the conduit 62 opening into the tank adjacent to the opening of the conduit 32. If desired, a short extension 66 may be applied to the conduit 62 within the tank to bring the two conduit openings substantially opposite each other. The valve outlet passage 56 is connected by means of a suitable conduit 68 and flange coupling 70 to one side of the oil cooling radiator 30, the opposite side of which is connected to the interior of the tank by means of a conduit 72 having a portion 74 within the tank extending upwardly to a position adjacent to the top of the tank.

The conduits 32, 58, 62, and 68 are preferably of a flexible nature and may be constructed of a suitable woven or braided material in a manner well-known to the art. If desired, the conduit 32 may have connected to some low point thereof, a drain opening 76 controlled by a drain valve 78.

From the above description it will be observed that when the engine is operating, lubricating oil will flow from the bottom of the tank 26 through the conduit 32 and the casing 34, past

the thermostat 36 to the inlet 22 of the engine pressure pump, through the internal pressure lubricating system of the engine and out through the outlet 24 of the scavenging pump, thence through the conduit 58 to the valve 48 and from the valve 48 either through the conduit 62 directly back to the tank 26, or through the conduit 68 to the oil cooling radiator 30 and thence through the conduit 72 back to the interior of the tank 26, depending upon the position of the mechanism of the valve 48 as controlled by the temperature responsive thermostat 36.

Within the valve casing 48 the inlet passage 52 is separated from the outlet passage 54 by a partition 80 provided with a valve port 82 and from the outlet passage 56 by a partition 84 provided with a valve port 86. Upon the side of the outlet port 56 remote from the partition 84, the valve casing 48 is provided with a concentric cylindrical well 88 and upon the side of the outlet port 54 remote from the partition 80 the casing is provided with a concentric bore 90 having a diameter greater than the diameter of the well 88. A tubular valve stem 92 has its lower end reciprocally mounted in the well 88 and at its upper end is provided with an integral piston 94 reciprocally mounted in the bore 90. Intermediate its length, the tubular valve stem 92 is provided with valve gates in the form of integral radial extensions 96 and 98, so spaced that upon reciprocation of the valve stem, the valve gates will close one of the ports 82 or 86 and open the other. An apertured diaphragm 100 is located between the valve casing 48 and the thermostat casing 34 and a rod 102 extends from the bottom of the thermostat through the aperture in the diaphragm 100 to a connection with the tubular valve stem 92 provided by forming the rod 102 with a reduced portion 104 of a length slightly greater than the length of the valve stem 92 and extending such reduced portion through the tubular valve stem so that the upper end of the valve stem abuts against a shoulder 106 at the beginning of the reduced portion 104 of the rod 102 and the lower end of the valve stem abuts against a nut 108 screw threaded upon the lower end of the reduced portion of the rod 102.

From the above description it will be observed that as the thermostat 36 contracts and expands in response to changes in the temperature of the lubricating oil flowing past it through the casing 34, the contraction and expansion of the thermostat will be transmitted to the valve stem 92 through the connection afforded by the rod 102 to cause the valve stem 92 to reciprocate in the valve casing 48 and thereby to cause the valve gates 96 and 98 to alternately open and close the valve ports 82 and 86.

In the form of the device as illustrated, when the temperature of the oil is below the predetermined critical temperature for which the device is set, the thermostatic element 36 will be contracted and the valve stem 92 will consequently be in its uppermost position in which position the valve port 82 is open and the valve port 86 is closed by the valve gate 98. In this position of the valve, the oil will flow from the scavenging pump outlet 24 through the valve inlet 52, through the valve port 82 and through the valve outlet 54 and conduit 62 directly to the interior of the tank 26. The outlet end of the extension 66 is positioned in the bottom of the tank 26 adjacent to the inlet end of the conduit 32 so that a relatively short distance separates the adjacent ends of the conduits 32 and 62 within the tank. As the oil

flows from the valve 48 through the conduit 62 into the tank, the greater portion of the warm oil will flow across the short distance separating the outlet of the conduit 62 from the inlet of the conduit 32, and into the conduit 32 and back to the engine, thus recirculating the oil that has been warmed by passing through the internal lubricating system of the engine. As the warm oil emerges from the conduit 62 into the tank 26, it will, of course, come in contact with the cold oil in the tank and some of its heat will be transferred to this cold oil, thus gradually spreading the heat supplied by the engine through the entire mass of oil in the tank 26. It has been found, however, that before all of the oil in the tank 26 has been sufficiently warmed to circulate through the engine, the oil in the bottom has reached a temperature sufficiently high to affect the thermostat 36 and cause the thermostat to adjust the valve 48 so that a portion of the oil returned from the engine begins to flow through the oil cooler 30. The oil cooler, however, does not reduce the temperature of the oil flowing there-through to the temperature of the cold oil in the tank 26 so that oil emerging from the outlet end of the extension 74 contains an appreciable amount of heat which it can give up to the oil in the tank. As the conduit 74 gradually fills the top of the tank with relatively warm oil, the body of cold oil is reduced and is interposed between two bodies of warm oil, one at the top and one at the bottom so that the heat content of the oil returned from the engine is rapidly dispersed through the mass of oil in the tank 26 to raise the temperature of all of the lubricating oil to a degree sufficient for safe circulation of the oil to the engine during power operation thereof. While this warming up process of the entire body of oil is taking place, however, the engine is constantly supplied with a quantity of oil having a temperature sufficiently high for safe operation by reason of the recirculation of the oil from the conduit 62 to the conduit 32 so that the engine may be operated under power conditions a relatively short time after it has been started and long before the entire mass of lubricating oil has reached a safe operating temperature. As the temperature of the entire mass of oil gradually increases, the adjustment of the valve 48 by the thermostat 36 progresses to divert more and more of the oil through the oil cooler 30 and reduce the quantity flowing through the conduit 62.

When the temperature of the lubricating oil is above the critical temperature for which the device is set, the thermostat 36 will be completely expanded, thus forcing the valve stem 92 downwardly to the position illustrated in Fig. 2. In this position of the valve, the oil will flow from the scavenging pump outlet 24 through the conduit 58, valve inlet 52, and valve port 86, to the valve outlet 56 and thence through the conduit 68 to the inlet 110 of the oil cooling radiator 30 and from the oil cooling radiator 30 through the outlet conduit 72 to the interior of the tank 26, the temperature of the oil being reduced during its passage through the oil cooling radiator.

If the valve were left in its unbalanced condition as so far described, the pressure of the oil in the intake passage 52 would act against whichever one of the valve gates 96 or 98 happen to be in closing relation with its respective valve port 82 or 86 and tend to open such closed valve port against the action of the thermostat until the pressure upon the two valve gates was sub-

stantially equalized by a flow of oil through the two valve ports to equalize the pressure in the two outlet passages 54 and 56.

In order to overcome this difficulty and render the valve easily controlled by the thermostat and the thermostat extremely sensitive to changes in the temperature of the oil flowing past it, I have provided means for balancing the valve against the pressure of the oil flowing there-through. The primary element of this valve balancing mechanism is the piston 94 reciprocally mounted in the cylinder 90. One side of this piston is exposed to the oil outlet passage 54 so that when the valve port 82 is open the oil in said passage exerts a force against the piston in opposition to the force exerted by the pressure of the oil in the inlet passage 52 upon the valve gate 98 when this valve gate is in closing relation with the valve port 86. Thus, when the valve stem 92 is in its uppermost position to permit the oil to flow from the inlet passage 52 through the valve port 82 and out through the outlet passage 54 the oil pressure in the inlet passage 52 will exert a downward force on the valve gate 98 tending to open the valve port 86. This force is counteracted by the force exerted by the pressure of the oil in the outlet passage 54 against the exposed side of the piston 94 so that the valve stem may be moved to and retained in its uppermost position by the thermostat without resistance from the oil pressure in the valve.

When the valve stem is in its lowermost position as illustrated in Fig. 2 so that the oil will flow from the inlet passage 52 through the valve port 86 and out through the outlet passage 56, the pressure of the oil in the inlet passage 52 will act against the valve gate 96 and tend to open the port 82 and partly close the port 86. The effect of this force is overcome by providing in the tubular valve stem 92, ports 112 opening into the outlet passage 56 and with ports 114 opening into the interior of the cylinder 90 on the side of the piston 94 opposite the side exposed to the outlet passage 54. These ports provide for the flow of oil under pressure through the ports 112, the tubular valve stem 92, and ports 114 to the interior of the cylinder 90 to provide above the piston 94 a downward force which counteracts the upward force exerted by the pressure of the oil in the inlet passage 52 upon the underside of the valve gate 96. Thus it will be seen that my improved oil control valve is balanced in both directions of operation so that a slight force exerted by the thermostat 36 will be sufficient to move the valve stem 92 from one to the other of its two operative positions. The lower end of the well 88 is connected to the interior of the outlet passage 56 by means of a channel 116 to relieve the effect of any pressure or vacuum which might accumulate in the well beneath the lower end of the valve stem.

While we have illustrated and described a particular mechanical embodiment by means of which the idea of our invention may be practiced, it is to be understood that the invention is not limited to the specific mechanical embodiments so illustrated and described, but that such changes in the size, shape, and arrangement of parts may be resorted to as come within the scope of the appended claims.

Having now described our invention so that others skilled in the art may clearly understand the same, what we desire to secure by Letters Patent is as follows:

What we claim is:

1. In combination with an engine having a lubricating system, a reservoir for lubricant, a lubricant cooling device connected with said engine and said reservoir, and a bypass around
5 said cooling device connecting said engine directly with said reservoir, valve means responsive to the temperature of lubricant in said reservoir disposed between said engine and said cooling means to direct said lubricant through
10 said cooling means or through said bypass.

2. In combination with an engine having a lubricating system and an inlet and an outlet for lubricant connected with said system, a reservoir for lubricant and a lubricant cooling means,
15 means connecting said inlet with said reservoir, a thermostat in said connecting means, means connecting said outlet with said reservoir, a lubricant cooling device in said connecting means between said outlet and said reservoir, a bypass
20 around said lubricant cooling device, and a valve in said connection between said outlet and said lubricant cooling device actuated by said thermostat for directing lubricant through said cooling device or through said bypass.

3. In an oil circuit for an engine, an internal pressure lubricating system having an inlet and an outlet, means between said inlet and outlet completing said circuit said means including a tank, a conduit connecting said tank with said
30 inlet, a second conduit connecting said tank with said outlet, an oil cooler interposed in said second conduit, a thermostat in said first mentioned conduit, and a valve in said second conduit between said outlet and said oil cooler actuated
35 by said thermostat to control the flow of oil through said cooler in response to the temperature of the oil flowing past said thermostat.

4. In an oil circuit for an engine, an internal pressure lubricating system having an inlet and an outlet, means between said inlet and said outlet completing said circuit said means including a tank, a conduit connecting said tank with said
40 inlet, a second conduit connecting said tank with said outlet, an oil cooler interposed in said second conduit, a thermostat in the first mentioned conduit, a valve in said second conduit between said outlet and said cooler, a third conduit between said valve and said tank said valve being actuated
45 by said thermostat to cause said oil to flow through said oil cooler or through said third conduit in response to the temperature of the oil flowing past said thermostat.

5. In combination with an engine provided with a lubricating system having an inlet and an outlet, an oil storage tank, a conduit connecting
55 said tank with said inlet, a thermostat in said conduit, a valve connected with said thermostat and having one inlet and two outlets, a second conduit connecting said engine outlet with said valve inlet, an oil cooling device, a third conduit
60 connecting one of said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank, and a fifth conduit connecting the other of said valve outlets to said tank, said valve being operative to divert
65 oil flowing therethrough from one to the other of said valve outlets in response to the temperature of oil flowing through said first conduit past said thermostat.

6. In combination with an engine provided with a lubricating system having an inlet and an outlet, an oil storage tank, a conduit connecting
70 said tank with said engine inlet, a thermostat in said conduit, a valve having one inlet and two outlets connected with said thermostat, a port

between said valve inlet and each valve outlet, a gate associated with each port, a single reciprocal stem carrying both gates in permanently spaced relation to close one of said ports and open the other upon reciprocation of said stem,
5 a second conduit connecting said engine outlet with said valve inlet, an oil cooling device, a third conduit connecting one of said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank, and
10 a fifth conduit connecting the other of said valve outlets to said tank, said valve being operative upon reciprocation of said stem to divert oil flowing therethrough from one to the other of said valve outlets in response to the temperature of
15 oil flowing through the first mentioned conduit past said thermostat.

7. In combination with an engine having a lubricating system, a reservoir for lubricant, and a lubricant cooling device, valve means responsive
20 to the temperature of said lubricant disposed between said engine and said cooling means to direct said lubricant through said cooling means or directly to said reservoir and means for balancing said valve against the flow of lubricant there-
25 through.

8. In combination with an engine provided with a lubricating system having an inlet and an outlet, an oil storage tank, a conduit connecting
30 said tank with said inlet, a thermostat in said conduit, a valve having one inlet and two outlets connected with said thermostat, a port between said inlet and each outlet, a gate associated with each port, a single reciprocal stem carrying both
35 gates in permanently spaced relation to close one of said ports and open the other upon reciprocation of said stem, a second conduit connecting said engine outlet with said valve inlet, an oil cooling device, a third conduit connecting one of
40 said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank, and a fifth conduit connecting the other of said valve outlets to said tank, said valve being operative upon reciprocation of said
45 stem to divert oil flowing therethrough from one to the other of said valve outlets in response to the temperature of oil flowing through the first mentioned conduit past said thermostat, and means for balancing said valve against the pressure of the oil flowing therethrough.

9. In combination with an engine provided with a lubricating system having an inlet and an outlet, an oil storage tank, a conduit connecting
55 said tank with said inlet, a thermostat in said conduit, a valve having one inlet and two outlets connected with said thermostat, a second conduit connecting said engine outlet with said valve inlet, an oil cooling device, a third conduit
60 connecting one of said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank and a fifth conduit connecting the other of said valve outlets to said tank said valve being operative to divert oil flowing therethrough from one to the other of said valve outlets in response to the
65 temperature of oil flowing through said first conduit past said thermostat, and means for balancing said valve comprising, an expandable chamber in said valve, means for varying the pressure in said chamber, and means connected with said valve stem and subject to said pressure urging said stem against the pressure of the oil flowing through said valve.

10. In combination with an engine provided with a lubricating system having an inlet and an
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outlet, an oil storage tank, a conduit connecting said tank with said inlet, a thermostat in said conduit, a valve having one inlet and two outlets connected with said thermostat, a port between said inlet and each outlet, a gate associated with each port, a single reciprocal tubular stem carrying both gates in permanently spaced relation to close one of said ports and open the other upon reciprocation of said stem, a second conduit connecting said engine outlet with said valve inlet, an oil cooling device, a third conduit connecting one of said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank, and a fifth conduit connecting the other of said valve outlets to said tank, said valve being operative upon reciprocation of said stem by said thermostat to divert oil flowing therethrough from one to the other of said valve outlets in response to the temperature of oil flowing through the first mentioned conduit past said thermostat, and means for balancing said valve, comprising, a cylinder in said valve surrounding said valve stem adjacent to one end thereof said cylinder opening into one of said valve outlet passages, a piston fixed to said valve stem and reciprocable in said cylinder having one side thereof exposed to the pressure of the oil in said one outlet passage, said tubular valve stem having ports therein for exposing the opposite side of said piston to the pressure of the oil in the other of said outlet passages.

11. In combination with an engine provided with a lubricating system having an inlet and an outlet, an oil storage tank, a conduit connecting said tank with said inlet, a thermostat in said conduit, a valve having one inlet and two outlets connected with said thermostat, a port between said inlet and each outlet, a gate associated with each port, a single reciprocal tubular stem carrying both gates in permanently spaced relation to close one of said ports and open the other upon reciprocation of said stem, a second conduit connecting said engine outlet with said valve inlet, an oil cooling device, a third conduit connecting one of said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank, and a fifth conduit connecting the other of said valve outlets to said tank, said valve being operative upon reciprocation of said stem to divert oil flowing therethrough from one to the other of said valve outlets in response to the temperature of oil flowing through the first mentioned conduit past said thermostat, and means connecting said thermostat with said valve comprising, a rod secured to said thermostat and having a shoulder abutting one end of said hollow valve stem, a reduced portion extending through said hollow valve stem, and a screw threaded nut abutting the opposite end of said hollow valve stem.

12. A balanced valve comprising, a casing, having one inlet passage, two outlet passages and a bore in one end thereof opening into one of said outlet passages, respective partitions each having a valve port therein between each outlet passage and said inlet passage, a tubular valve stem extending through said ports reciprocally mounted in said casing, a pair of spaced apart valve gates on said stem cooperating with said valve ports, a piston on said valve stem recip-

rocal in said bore and having one side exposed to the outlet passage into which said bore opens, and means including said tubular valve stem for connecting the space at the opposite side of said piston with the outlet passage remote from the end of said casing containing said bore.

13. A balanced valve comprising, a casing having a centrally located inlet passage, an outlet passage on each of two opposite sides of said inlet passage, and a bore at one end thereof opening into one of said outlet passages, respective partitions each having a valve port therein disposed between each of said outlet passages and said inlet passage, a tubular valve stem reciprocally mounted in said casing extending through said valve ports and into said bore, a pair of spaced apart valve gates on said stem cooperating with said valve ports to close one and open the other upon reciprocation of said stem, a piston on said stem reciprocable in said bore and having one side exposed to the outlet passage into which said bore opens, said tubular valve stem having ports therein for hydraulically connecting the space at the opposite side of said piston with the interior of the outlet passage remote from the end of said casing containing said bore.

14. In combination with an engine provided with a lubricating system having an inlet and an outlet, an oil storage tank, a conduit connecting said tank with said inlet, a thermostat in said conduit, a valve connected with said thermostat and having one inlet and two outlets, a second conduit connecting said engine outlets with said valve inlet, an oil cooling device, a third conduit connecting one of said valve outlets with said oil cooling device, a fourth conduit connecting said oil cooling device with said tank, and a fifth conduit connecting the other of said valve outlets to said tank adjacent to the connection of the first mentioned conduit with said tank whereby oil may flow from said fifth conduit to said first conduit across a relatively short intervening space in said tank, said valve being operative to divert oil flowing therethrough from one to the other of said valve outlets in response to the temperature of oil flowing through said first mentioned conduit past said thermostat.

15. In combination with an engine having an internal lubricating system, a tank providing a reservoir for engine lubricant, and a cooler for said lubricant, a conduit leading from the bottom of said tank to said engine, a thermostat in said conduit responsive to the temperature of lubricant flowing therethrough, a valve operatively associated with said thermostat, a second conduit leading from said engine to said valve, an oil cooler, a third conduit connecting said valve with said oil cooler, a fourth conduit connecting said oil cooler with the top of said tank, and a fifth conduit leading from said valve to the bottom of said tank adjacent to the opening of the first mentioned conduit whereby, when said valve is in one operative position lubricant will flow from said tank to said engine, from said engine directly back to said tank and across the bottom of said tank and back to said engine to maintain a supply of warm oil to said engine.

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