May 9, 1939. S. L. WALDEN 2,157,513

LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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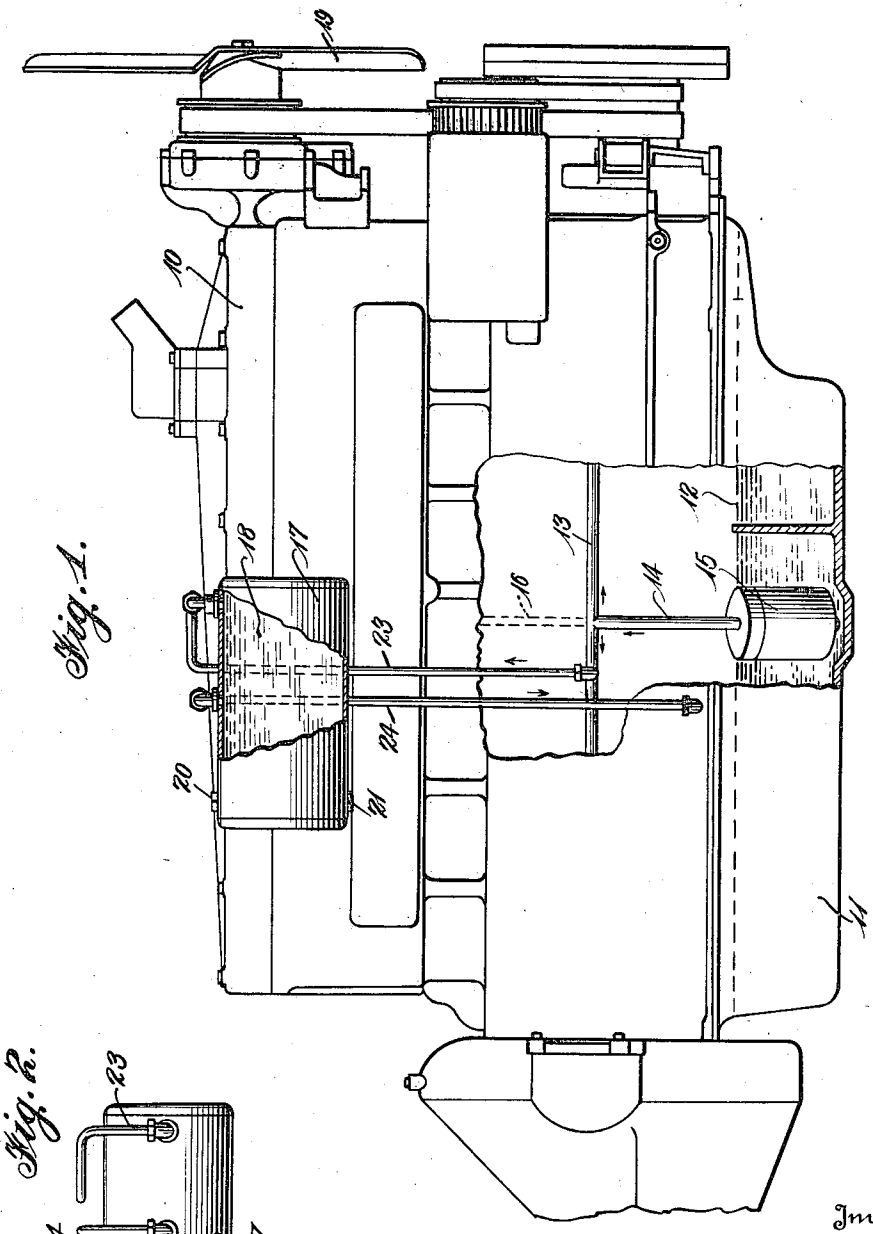


Fig. 1.

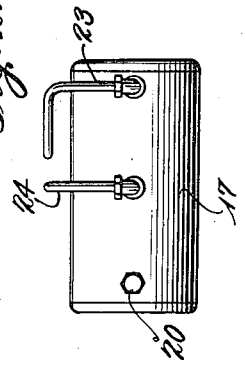


Fig. 2.

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Fig. 4.

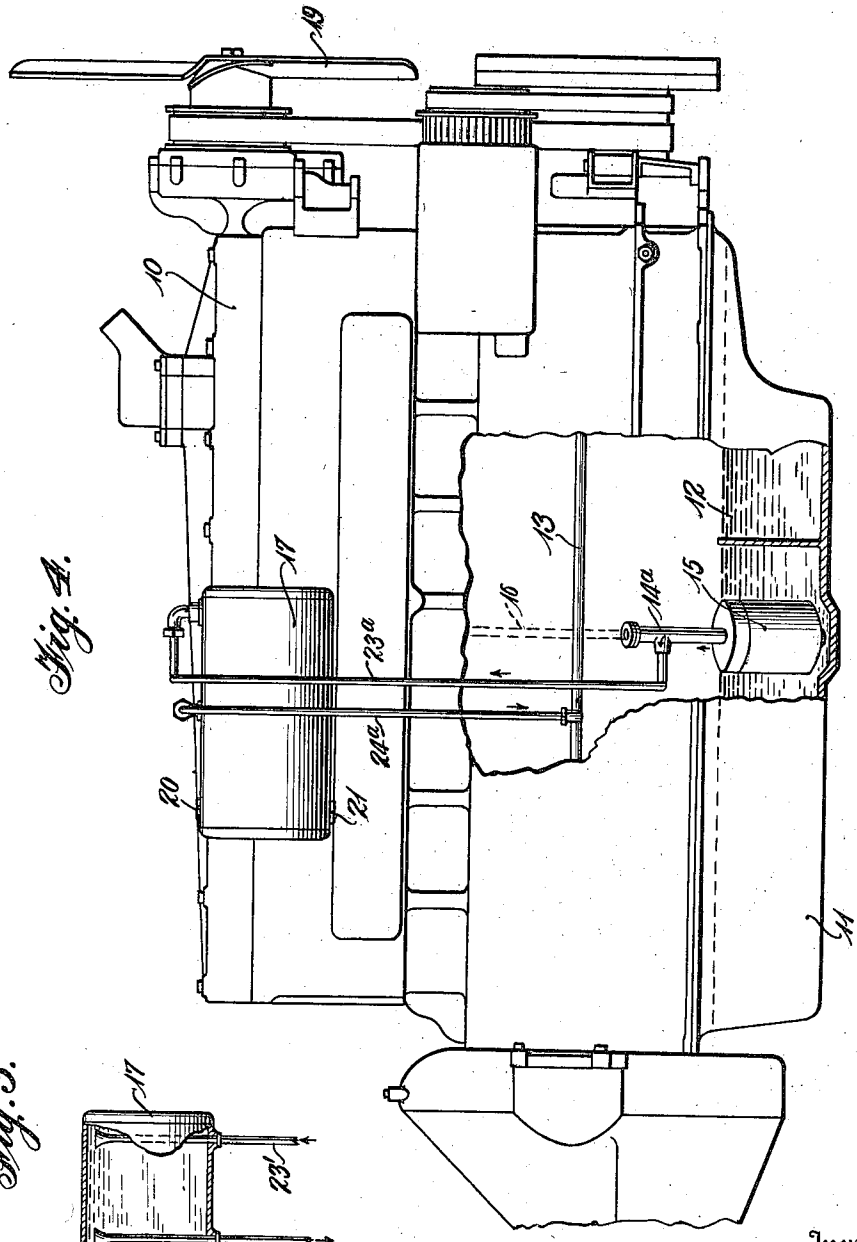


Fig. 3.

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LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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Application February 7, 1936, Serial No. 62,837

6 Claims. (Cl. 184—6)

My invention relates to internal combustion engines and more particularly has refreence to improvements in lubricating systems therefor of the force-feed type.

While the invention is generally applicable to internal combustion engines having a force-feed oiling system and crank case, it is of special utility in connection with automobile engines wherein there are certain restrictions or limitations upon the crank case capacity due to the necessity for preserving a given road clearance, a low center of gravity, a standard tread, etc.

A primary object of the invention is to increase, materially above the normal crank case capacity of an engine, the quantity of oil constantly circulating in a pressure lubricating system without enlarging the crank case or otherwise appreciably altering the design and construction of present internal combustion engines.

The advantage of thus increasing the volume of oil in the lubricating system resides principally in the fact that the larger quantity of oil, unlike the relatively small amount now employed in internal combustion engines, does not become abnormally heated during operation of the engine and is hence less susceptible to the deteriorating influences of the heat generated by the engine. Due to the large volume of oil constantly circulating in the system and the increased capacity for heat absorption thus obtained, the lubricant is at no time heated to the disintegrating point, thus materially prolonging the useful life of the oil, as well as that of the working parts of the engine, and in general effecting better and more efficient lubrication and engine operation.

A further object of the invention resides in the provision of an arrangement whereby the surplus oil in excess of the normal crank case capacity is constantly cooled, specifically by the air current from the fan of the motor, in order further to insure against undue heating of any part of the total oil circulating in the system.

Additional objects of the invention are to provide a construction for constantly circulating and cooling a substantial excess of oil and which is readily applicable to standard internal combustion engines without alteration thereof; to provide an arrangement for the purposes mentioned wherein there is no danger of the large volume of surplus oil flooding the crank case and wherein normal circulation of oil from the surplus supply back to the crank case is accomplished without the intervention of check valves or like devices that might become clogged or deranged; to provide a system of the character mentioned which dispenses with the need for oil filters inasmuch as there is no breaking down of the oil to carbon; and to provide a generally improved pressure lubricating system wherein the improved operation is attained by the incorporation into the engine of a minimum of additional parts.

For a more detailed understanding of the invention, reference will be had to the accompanying drawings wherein:

Figure 1 is a side elevational view with parts broken away, of a conventional automobile engine having the present improvements applied thereto;

Figure 2 is a plan view of the auxiliary oil tank;

Figure 3 is a side elevation of the auxiliary tank, with parts broken away to show a modified form of inlet and outlet to the tank;

Figure 4 is a view similar to that of Figure 1, but showing a modified form of connection of the auxiliary tank into the lubricating system whereby the total oil from the circulating pump is supplied to the auxiliary tank prior to its distribution to the engine parts to be lubricated.

Referring more particularly to Figs. 1 and 2 of the drawings, the numeral 10 indicates generally an internal combustion engine having the customary crank case or oil sump 11 containing a body of oil 12. The pipe 13 represents the main oil distributing passage connected, through line 14, to the customary gear type oil pump 15 driven from shaft 16 and immersed in the body of oil in the crank case, the distributing header 13 discharging, through suitable tubes, to the parts of the engine to be lubricated. These elements, as well as others shown on the drawings, are of conventional and well-known design and arrangement and more detailed description thereof is therefore unnecessary.

As a feature of the present invention, an auxiliary tank 17 of substantial capacity is mounted in any suitable manner above crank case 11 and oil distributing tube 13. This tank is completely filled with surplus oil 18, that is, a substantial quantity over and above that of the normal crank case capacity represented at 12. The tank is disposed in the path of the air stream from the fan 19 of the engine and is equipped with a filler plug 20 and a drain plug 21. The excess oil in tank 17 is thus constantly cooled during the operation of the engine. A feed pipe 23 leads from the pressure distributing line 13 and discharges into the top of tank 17 as illustrated. A drain

pipe 24 discharges into the crank case or oil sump from the top of reservoir 17 at a point remote from the inlet of pipe 23.

During operation of the engine, there is a continuous removal of a part of the oil from the lubricating system through pipe 23, this oil being tapped from distributing line 13 and introduced to tank or reservoir 17 where it diffuses through the large volume of surplus oil and displaces an equal volume of relatively cool oil through drain pipe 24 into the crank case. The total oil in the system, including the auxiliary supply as well as the crank case oil, is thus kept in constant circulation and the entire crank case load is therefore being constantly changed while the motor is in operation.

An important feature of the invention is the maintenance of a large and substantial auxiliary supply in excess of the normal crank case capacity and that the volume of the air cooled tank 17 is such that the tank is completely filled with this auxiliary oil supply.

In most instances the auxiliary oil supply exceeds the quantity of oil normally added to the crank case and I have found that for best results the ratio of the quantity of auxiliary oil in tank 17 to the normal crank case capacity should be about one and a half to one. For example, with a crank case capacity of eight quarts, the auxiliary tank should contain twelve quarts, making a total of twenty quarts of lubricant in constant circulation and use in the oiling system of the engine. This substantial increase in the quantity of oil in circulation not only prevents overheating but also maintains the oil in relatively cool condition because of the higher heat adsorbing power of the greater volume of circulating oil. With the exception that the crank case oil will get hotter in extremely warm weather than in cold weather, the amount of heat received by the crank case oil is ordinarily constant once the motor is in operation. This constantly generated heat is ordinarily sufficient to tend to disintegrate the normal quantity of oil contained in the crank case whereas it is entirely insufficient to heat to the breaking down point the substantially greater volume of oil employed according to the present invention. Therefore, at no time does the oil become abnormally heated and its life is greatly prolonged since there is no tendency toward decomposition under excessive heat. The oil eventually loses its initial lubricating qualities but this impairment is not the result of overheating and consequent burning of the oil. The elimination of this tendency toward overheating, according to the present invention, prolongs the serviceability of the oil to at least four times its normal life. Thus, in the case illustrated, with a normal crank case capacity of eight quarts of oil good for 1000 miles, the increased capacity to twenty quarts enables the oil to remain in satisfactory service for 10,000 miles.

While best results are obtained with the ratio of auxiliary supply to crank case capacity of one and one half to one, the invention is not limited to this preferred ratio as satisfactory results may be obtained by deviating therefrom within certain limits. By decreasing the quantity of oil in the auxiliary supply, the operation becomes progressively less efficient and I have found that no appreciable advantages are obtained when the ratio of auxiliary supply to crank case capacity is less than approximately 0.75 to 1. This is due to the fact that with this low ratio there is an insufficient quantity of oil in the system to absorb the heat without deterioration setting in.

Upon increasing the volume of oil in the auxiliary supply, there is an increase in efficiency until the ratio of auxiliary oil to crank case capacity reaches two to one. Above this point, the advantages obtained are not commensurate with other factors involved such as the necessity for an unduly large auxiliary tank, its interference with accessibility and the crowding of conditions under the hood of the vehicle. Such large volumes of oil are unnecessary to prevent excessive heating and are in fact undesirable because of the increased weight and other factors already mentioned. Therefore, for practical purposes, the ratio of auxiliary oil to the normal crank case oil should lie between 0.75 to 1 and 2 to 1.

The tank 17 being maintained completely filled with oil and the pipes 23 and 24 being connected thereto at the top, there is constant circulation under the pump pressure from the distributing line 13, through the tank and back to the crank case. By this arrangement, the oil in tank 17 cannot drain back into and overflow the crank case notwithstanding the fact that no check valves or like devices are employed in the connecting lines. Not only are check valves or the like unnecessary to retain the auxiliary oil in tank 17, but a special oil pump is also unnecessary as the conventional pumps used on practically all present internal combustion engines are ample for use in the present system. If the inlet tube were connected to the tank elsewhere than at the top, oil could drain back through the pump gears and if the outlet were not at the top, there would be drainage to the level of the outlet, thus overloading the crank case. While these objections could be overcome by means of check valves, the latter are likely to become clogged and render the system inoperative. According to the present invention, such objectionable devices are dispensed with by the simple expedient of providing both the inlet and outlet at the top of the auxiliary oil reservoir.

The pipes 23 and 24 are, of course, so constructed as to offer sufficient resistance to oil flow as to maintain an adequate pressure in the lubricating system. For example, the pipes 23 and 24, as illustrated, may be of smaller cross-sectional area than the distributing pipe 13. The tank 17, being positioned in the air current from fan 19, functions not only as a reservoir for the auxiliary oil but also as a cooler therefor. The oil lost through use in the engine is supplemented in the usual way, that is, by checking the oil gauge or stick and adding fresh oil to the crank case through the filler tube.

While the main consideration in preventing deterioration of the oil is that the substantially increased volume thereof does not become unduly hot or burned, this result is augmented by the continuous cooling of the oil which is constantly being by-passed through the auxiliary tank. While air cooling of the auxiliary tank is most convenient for automobile engines, the tank could obviously be cooled by other means such as by water jacketing. The auxiliary tank may also be provided with fins or veins on the exterior thereof to assist the cooling and the efficiency of the air cooling may be obviously increased by streamlining the tank so that the air current will hug the entire exterior surface of the tank.

In Figure 3 I have illustrated an alternate form of feed and discharge arrangement at the top of

the auxiliary tank. In this arrangement the open ended inlet and outlet pipes 23' and 24' respectively, are projected through the bottom of the tank 17 to a point near the top, as illustrated. While this arrangement is effective for the desired purposes, the construction of Figures 1 and 2 is preferred inasmuch as it is less expensive and less susceptible to mechanical difficulties.

According to the modification of Figure 1, a portion of the oil circulating in distributing line 13 to the points of lubrication is by-passed to the auxiliary tank. In Figure 4, I have illustrated a modified form of the invention according to which the total oil from the circulating pump is passed through the auxiliary tank and thence to the distributing header and engine parts to be lubricated.

Referring now to Figure 4, wherein like numerals indicate the same elements as in Figure 1, the inlet pipe 23a of the auxiliary tank is here directly connected to line 14a leading from circulating pump 15 while the outlet pipe 24a discharges from the top of tank 17 into the distributing line 13. By this arrangement it will be seen that, instead of a portion of the oil being by-passed through the auxiliary tank, the total oil from the pump is introduced to the tank 17 which in turn feeds the distributing pipe and engine parts to be lubricated. The construction and operation are otherwise the same as described in connection with the modification of Figure 1. The invention thus provides both a by-pass method and a full flow method to the auxiliary supply tank.

It will thus be seen that I have made provision for substantially increasing the quantity of oil circulating in an internal combustion engine lubricating system in an exceedingly simple manner and through the use of a minimum of additional structure which is readily applicable to present engine design and construction without alteration of the engine.

Having thus described my invention, I claim:

1. In an internal combustion engine having a crank case and a pressure oil distributing passage, the combination of an oil-filled tank, and means for continuously introducing oil from said passage into the tank and for discharging an approximately equal volume of oil from the tank into the crank case, said means comprising a connecting pipe between said distributing passage and the top of said tank and an independent connection between the top of said tank and the crank case.

2. In an internal combustion engine having a pressure lubricating system including a crank case, the combination of an oil-filled tank, and a pair of conduits establishing communication between the top of the tank and spaced points of said system, said conduits being the only means of communication between the tank and the lubricating system.

3. In an internal combustion engine having a crank case and means for circulating the crank case oil under pressure to the engine parts to be lubricated and back to the crank case, the combination of a closed oil-filled tank and of a volume at least 0.75 times the normal oil capacity of the crank case, and means for continuously introducing circulating crank case oil to said tank and for discharging an approximately equal volume of oil from the tank into the crank case, said last-named means comprising a connecting pipe between the first-named means and the top of the tank, and a second connecting pipe between the top of the tank and the crank case.

4. In an internal combustion engine lubricating system having an oil circulating pump and an oil distributing passage, the combination of an oil-filled tank, a connection between the top of the tank and the pump, and a second connection between the top of the tank and said passage, said connections being the only means of communication between the tank and the lubricating system.

5. In an internal combustion engine having a crank case and means for circulating the crank case oil under pressure to the engine parts to be lubricated and back to the crank case, the combination of a closed oil-filled tank, a connecting conduit between said means and the top of the tank, and a second connecting conduit between the top of the tank and the crank case, said conduits being the only means of communication between the tank and the lubricating system.

6. In an internal combustion engine having a crank case and means for circulating the crank case oil under pressure to the engine parts to be lubricated and back to the crank case, the combination of a closed oil-filled tank, and means for continuously introducing circulating crank case oil to said tank and for discharging an approximately equal volume of oil from the tank into the crank case, said last-named means comprising a connecting pipe between the first-named means and the top of the tank, and a second connecting pipe between the top of the tank and the crank case.

SAMUEL L. WALDEN.