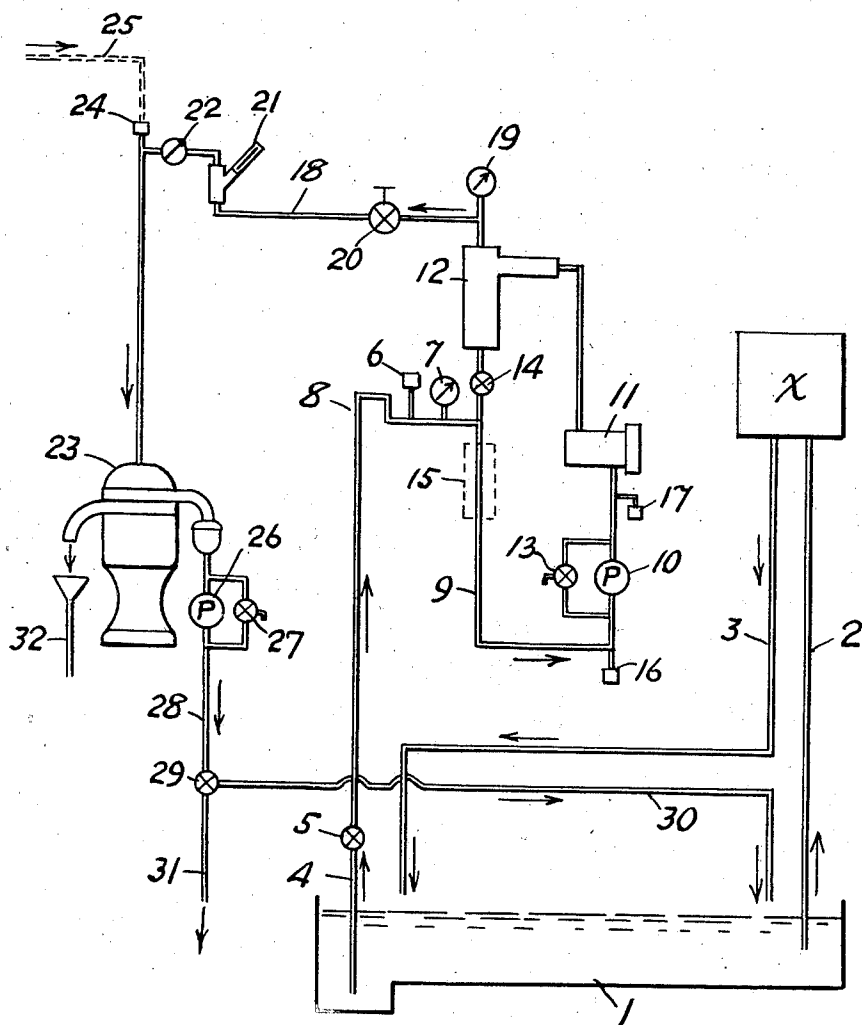


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METHOD FOR PURIFYING USED OILS

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METHOD FOR PURIFYING USED OILS

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Purification of different kinds of oils, particularly lubricating oils in systems providing continuous circulation of the oil, is a problem which is encountered in many machinery installations. In such plants it is customary to purify the oil of the impurities it has collected while circulating in the lubricating system. With small plants the whole quantity of circulating oil can be led through the purifying arrangement. This is generally impracticable with large plants. In such plants, in order that the purifying arrangement shall not be too cumbersome, means are provided to effect a so-called partial purification of the lubricating oil, the purifying system being arranged in parallel with the circulating lubricating system, whereby, by using a comparatively small purifying plant, the required degree of purity of the lubricating oil can be maintained.

It is desirable to keep the oil at a high temperature while it is being purified, thereby considerably facilitating the elimination of its impurities. However, certain difficulties are encountered when heating the oil; for example, its contained water and gases may be separated in the heating device as the oil passes slowly through it, or sludge from the oil may get burnt on to the interior of the heating device for the same reason.

Other difficulties, too, are encountered when thermostatically regulating the oil's heating device, due to the great difference in temperatures between oil entering and oil leaving the heating device.

By the present invention, having for its object a method of purifying oils containing sludge and/or water, and a practicable device to practice this method, an efficient purification of the oil, without the occurrence of the aforementioned drawbacks, is obtained by a construction and arrangement that may be described briefly as follows.

Between an oil tank and the purifier, the oil is passed through a circulating circuit equipped with a pump and a heating device. The circuit also contains an inlet for the oil coming from the oil tank and an outlet through which the heated oil, after all or part of the oil has circulated in the circuit for a suitable length of time, is led to the oil purifier. The circulation circuit should then also comprise a deaerator in which the oil returning to the pump is freed of the gases, especially the air, contained in it.

The annexed drawing is a diagrammatic view of a plant embodying my invention and by means

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of which my improved method may be practiced with maximum efficiency.

1 is a storage tank for oil, e. g., the oil tank of an engine plant, from which the oil is fed by a pipe 2 to the lubricating system x of the engine, from which, by a pipe 3, the used oil is returned from the lubricating system. Both pipes should preferably enter the tank, as shown, at as great a distance from one another as practicable. From tank 1 extends another outflow pipe 4, with a valve 5, a plug 6 and a vacuummeter 7, forming a so-called "threshold" 8. Oil is fed by pipe 4 to the oil purifying system arranged in parallel with the lubricating system. Pipe 4 communicates with the suction pipe 9 (the two pipes joining at a right angle) of a circulation circuit fitted with a pump 10, a heating device 11 and a deaerator 12.

The pump 10 is provided with an overflow valve 13, adjustable to any desired pressure and functioning here as a safety valve.

Pipe 9 is provided with a valve 14 and possibly, also, with a tank 15. At the lowest point of the circulation circuit there is a plug 16 for drawing off the oil, and immediately before the heater 11 there is a plug 17 for the same purpose.

From the deaerator 12 extends a pipe 18 fitted with a manometer 19, an adjustable valve 20 and a thermometer 21, and with, possibly, a non-return valve 22. The oil is fed through pipe 18 to a centrifugal separator 23 in which it is purified. In pipe 18 there is also a filling orifice closed by a plug 24, through which the water, required to form the liquid seal in the separator, is admitted. The water may be led into the separator directly through pipe 25. The admission of water may take place during the separation, if there is a non-return valve 22, without the risk of water getting into the circulation circuit. The oil purified in the separator is discharged through a pipe 28, fitted with a pump 26 including an overflow valve 27, and also with a three-way cock 29, through which the purified oil may be led back via pipe 30 to tank 1, or be drawn off through an outlet 31 for testing and measuring the throughflow. The heavier liquid separated in the separator is led away through the outlet 32. The heating device 11 should be preferably fitted with a manometer and safety valve.

The arrangement described has the following mode of operation: If there is no oil in the circulation circuit, plug 6 is screwed off and oil is then poured in up to the level determined by the threshold. The air present in the circulation circuit may then escape through pipe 18 if valve

20 is kept open. After the oil has been poured in and plug 6 screwed in, pump 10 is started. Pump 10 should be a gear pump like pump 26, driven at a constant speed from separator 23.

Oil is then transferred from the suction side to the pressure side of the pump, a certain vacuum being created on the suction side, the magnitude of which is determined partly by the resistance in the circulation circuit (chiefly in the valve 14), partly by the re-leakage in the pump itself caused by the pump not being tight, and partly by the flow resistance in pipe 4. The re-leakage will be smaller if the pump is kept moistened by oil, i. e., a higher vacuum can be maintained on the suction side of the pump when oil is being conveyed through it than when only air is passed through. In order that the air present on the suction side of the pump shall be expelled with certainty and oil be passed on to the circulation circuit from tank 1 by the sucking action of the pump, there should always be oil on the suction side of the pump. Instead of the oil being led away by the pump, fresh oil should be constantly flowing up to it, a prerequisite for this being that, when the oil is being poured in, a sufficient quantity is introduced, which in turn necessitates that the circulation circuit on the pump's suction side shall have the required volume. That part of the oil on the suction side of the pump which is transferred, when the pump is started, to the pressure side of the pump, must be sufficient to fill up the circulation circuit on the pressure side of the pump as far as the deaerator and to create also in the latter a liquid seal preventing the air entering the deaerator from passing back to the suction side of the pump through valve 14. Considering this, it may be necessary, in case the volume of the suction pipe is not sufficient, to insert in pipe 9 a tank 15, indicated in the figure by dotted lines.

By arranging the circulation circuit in the way described, the air in the feed pipe is eliminated relatively quickly from the circulation circuit via pipe 18 by pump 10 at the start, while oil from tank 1 is sucked into the circulation circuit through pipe 4.

It is obvious that the adjustment of valve 14 is of a certain importance, for if it is, for instance, kept quite closed, there will be no circulation in the circulation circuit. Then all the oil on the suction side of the pump in the circulation circuit may be transferred to its pressure side without there having been time meanwhile to remove the air present in pipe 4 and for oil from tank 1 to reach the pump. On the other hand, if valve 14 is kept somewhat open, a certain quantity of oil from the deaerator 12 is led back through the valve, whereby pump 10, if the aforementioned conditions regarding the volume of the suction pipe 9 are fulfilled, will be always kept moist and the propulsion of the air safeguarded.

By the aid of the vacuummeter one can regulate the adjustment of valve 14 during starting in such a way that the greatest possible vacuum is continuously maintained in the feed pipe 4, and the highest possible efficiency at the start of the circulation is obtained.

The threshold 8 serves mainly to prevent the oil returning from deaerator 12, during starting, from passing through feed pipe 4 to tank 1, instead of getting into suction pipe 9. For this purpose, other devices may of course be used;

for instance, a guide plate, ejector or the like arranged at the connecting point between feed pipe 4 and pipe 9.

When the circulation in the circulation circuit has got started, valves 14 and 20 are so regulated that separator 23 works at the desired throughput. However, the separator must have been first provided with the quantity of water necessary to form the liquid seal, the water being admitted through an opening that may be closed by plug 24.

The throughput can be determined by drawing off the oil from the separator through pipe 31. By simultaneously reading the manometer 19, the valve 14 may, at a certain adjustment of valve 20, be so calibrated that, subsequently, the desired throughput may be obtained by simply adjusting the valve 14, while reading the pressure on manometer 19. It is evidently also possible to graduate manometer 19 so that it gives a direct indication of the throughflow.

Despite the fact that only a small part of the oil quantity flowing through the heater 11 is normally led to the separator, a high speed of flow can be maintained in the heater, which causes a good heat transmission to be obtained, and, at the same time, prevents the separation of water and gases in the heating device and the burning onto it of sludge deposits.

With the circulation circuit arranged in the way described, there is the additional advantage that a very accurate regulation of the oil quantity fed to the separator may be effected in a simple way by the two valves 14 and 20 or, after adjustment of valve 20, even by valve 14 alone. The oil quantity fed to the separator will be, besides, more independent of the pressure variations in the deaerator caused, for instance, by changes of the liquid level in tank 1; this desirable condition being insured by the overpressure which may be kept in the circulation circuit by the throttling caused by valve 20.

Further advantages are attained at thermostatic regulation of the heating devices and are largely rendered possible by the described utilization of the circulation circuit. The thermostat, which, for obvious reasons, should be located at the outlet side of the heater, will thus be more rapidly affected, due to the high velocity of the oil at breaking interruption of the current, by oil heated in the heater to the limit temperature. On the other hand, the temperature variations caused by the inertia of the thermostat will be reduced, and the interval between engaging and disengaging the heater prolonged, due to the difference, reduced by the circulation, between the oil temperatures at the inlet side and outlet sides of the heater.

It is important that the two liquid currents in pipes 4 and 9 shall not disturb each other. This is avoided by joining pipe 4 with pipe 9 at a substantial angle, preferably a right angle. If pipes 4 and 9 were, for example, arranged in parallelism, the oil, flowing from the deaerator at a relatively high speed, might then flow on directly through pipe 4, through which the oil of the circulation circuit would be rapidly returned to tank 1. It is also important that the pump 10 be placed so that the maximum possible oil quantity let into suction pipe 9 can flow to the pump, so that it is really kept moistened with oil during the starting period.

Valve 5, located in pipe 4, is intended for use mainly when the purifying system is common to two or more plants.

If the system is quite open, i. e. without a non-return valve, and if the purifying plant is shut by stoppage of the pump 10, at least part of the oil in the circulation circuit will flow back to tank 1. If then valves 14 and 20 are open, the part of the circulation circuit lying above the junction of feed pipe 4 and pipe 9 will be completely emptied by back flow of the oil to tank 1. The quantity of oil remaining in the circulation circuit is then such as to render possible, at the start of the pump, the re-establishment of the circulation in the circulation circuit in the way described above, without the necessity of adding fresh oil through the opening closed by plug 6. It is evident that in this case the location of the heating device 11 at a lower level than the junction of pipes 4 and pipe 9, as shown on the drawing, is of importance, as when the pump is stopped, it will remain full of oil, whereby the volume of the suction pipe can be reduced correspondingly, if, when the oil is poured in, care be taken that the oil level is approximately as high on the pressure side as on the suction side in the circulation circuit, which, because the oil leakage in the pump should be as small as possible, can be brought about by keeping the pump running also during the oil filling. Should valve 14 be shut, for some reason, when pump 10 comes to a standstill, the entire circulation circuit, excepting the deaerator, may be emptied by the suction action of the oil column in inlet pipe 4. In order that, also in this case, the circulation will be re-established, when the pump is started, without the necessity of introducing fresh oil into the circulation circuit, it is necessary to retain in the deaerator sufficient oil both to fill up the part of the circulation circuit situated on the pressure side of the pump as far as the deaerator and also to form the liquid seal in the deaerator, preventing the air from passing from the deaerator to the suction side of the pump.

The herein described arrangement may be modified in various details without departing from the invention. For example, one or both of the valves 14 and 20 may be replaced by fixed throttling discs with their through-flow area fixed beforehand. Valve 14 may be a spring-loaded valve adjustable for a certain pressure. Valve 14 may be also arranged in such a way that it can never be quite closed. These modifications are

merely illustrative of permissive variations from the specific disclosure.

What I claim and desire to protect by Letters Patent is:

1. A method for the continuous purification of used oil, which comprises pumping oil through an endless circuit and heating the oil in a heating locus during its passage through the circuit, continuously flowing oil to be purified from a source of supply into said circuit at a rate less than the rate of flow through the heating locus, continuously releasing a part of the oil flowing through said circuit while reconveying through said circuit the part of the oil not so released, and purifying the released oil and returning it to the supply.

2. The method defined in claim 1 in which gas flowing with the heated oil is removed and released along with the part of the oil that is released from the circuit for purification.

3. The method defined in claim 1 in which only a minor portion of the quantity of oil heated per unit of time in the circuit is released for purification, thereby maintaining a high rate of flow through the heating locus and substantially preventing separation of water during heating and the burning of sludge deposits at said locus while at the same time insuring good heat transmission.

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