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APPARATUS FOR TESTING OIL IN LUBRICATING SYSTEMS

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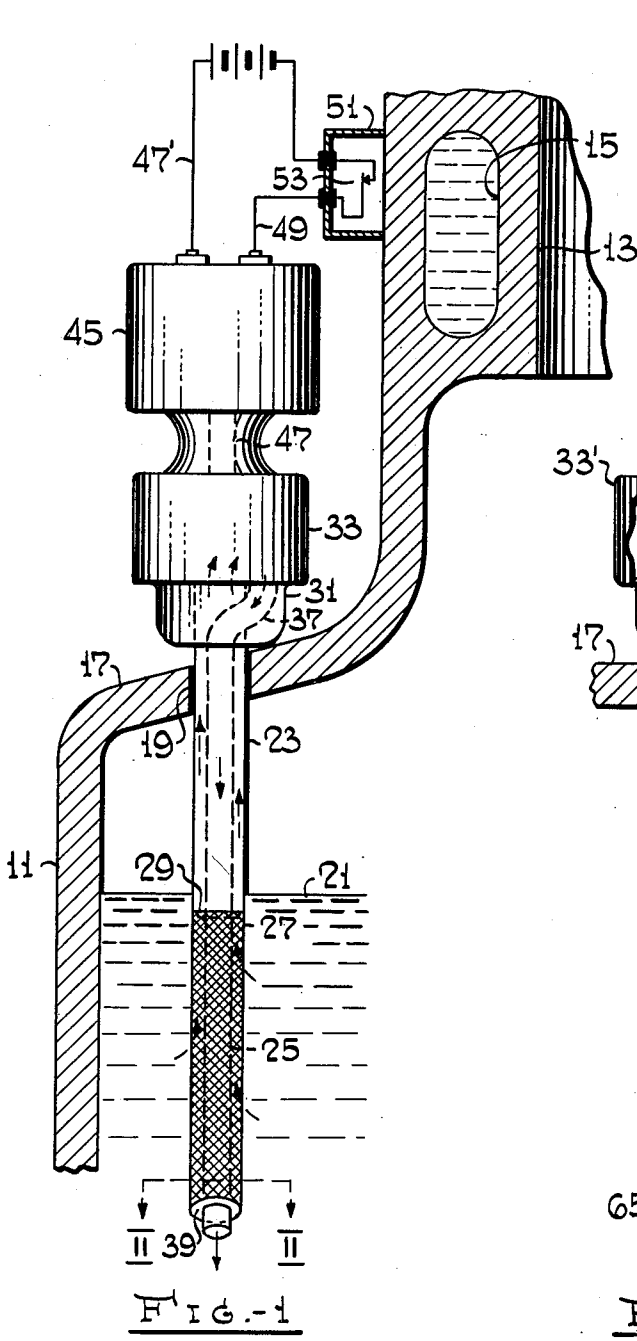


FIG.-1

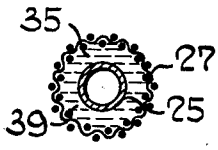


FIG.-2

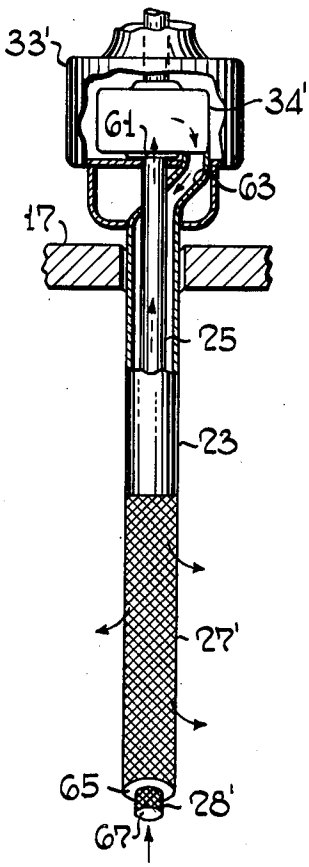


FIG.-3

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APPARATUS FOR TESTING OIL IN LUBRICATING SYSTEMS

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8 Claims. (Cl. 73—61)

The present invention relates to apparatus for testing oil in lubricating systems, and particularly in systems from which a relatively small stream of oil may be continuously diverted or withdrawn over an extended period of time. The invention is especially applicable for testing the quality, degree of contamination, or extent of deterioration, etc., of crank case lubricating oil in internal combustion engines. Such systems require periodic checking and are almost universally used in automotive vehicles. Hence they constitute a most important class of oil or lubricating systems but it will be understood that the present invention is applicable also to other systems and in fact to almost any system where oil in a closed zone is used over an extended period so that it is desirable to check its quality at frequent intervals.

In the oil industry, continuous efforts are made by various manufacturers and refiners of lubricating oils to learn more about the type, rate, and extent of deterioration of lubricating oil products. Since crank case lubricants form a most important class of lubricants because of their extensive use, much of the time and expense involved in studying lubricant problems is concerned with these. Other types of lubricants are important, also, such as those used in enclosed gear lubricant systems, lubricants for steam turbines, and oils for hydraulic oil systems, automotive transmission systems, transformer and other electrical insulation oil systems, etc. An object of the present invention is to make available an improved and simplified sampling system for the periodic or continuous evaluation of oils and related products of any of the types mentioned above.

A further object of the present invention is to make it possible to take over an extended period of time a continuous sample of an oil from a lubricating system such as an internal combustion engine crankcase to determine the sludge-forming tendencies and other elements of deterioration within such oil while the oil is still in service.

A further and specific object is to provide an apparatus which can be inserted into the crankcase lubricating system of a conventional automotive vehicle through the measuring stick opening which is commonly provided in such systems.

Other and further objects will appear more fully as this description proceeds. Reference will, therefore, be made next to the attached drawings forming a part of this specification wherein specific physical embodiments of the invention are illustrated in detail. Referring to the drawings,

Figure 1 is an elevational view with parts shown in section of an apparatus embodying the invention;

Figure 2 is an enlarged cross-sectional detail of the apparatus of Figure 1 taken substantially along the line 2—2 of Figure 1 and looking in the direction of the arrows;

Figure 3 is a fragmentary view with parts broken away of an apparatus corresponding to that of Figure 1, but differing in certain details.

Referring first to Figure 1 the apparatus of the invention is shown as comprising a unit for withdrawing oil from and recirculating it to the crankcase of an internal combustion engine of a standard automotive type. In this figure the crankcase wall **11** is shown fragmentarily, terminating in its upper portion in a cylinder wall **13**, said cylinder wall being jacketed as at **15** to provide suitable cooling as is conventional in internal combustion engines, particularly automotive engines.

At an upper portion indicated at **17** the crankcase wall is provided with an opening **19** and a conventional measuring stick or "dip stick" which is used by service station personnel and others to ascertain the oil level within the crank case. The oil level is indicated by line **21** and obviously it may vary from time to time as the oil supply is increased or diminished.

The apparatus representing the improvement of the present invention comprises a slender tube assembly composed of an outer tubular member **23** of such diameter that it can be readily inserted in the measuring stick opening **19**. Arranged more or less concentrically within the outer tubular member **23** is a smaller tube **25**. These tubes **23** and **25** are of such relative sizes that the slender inner tube **25** is spaced from the inner wall of the outer tube **23** to leave an annular passage through which oil may flow.

The lower portion of the outer tube **23** is provided with a foraminated or perforated portion to make a fine screen which will remove solid particles and other foreign matter from the lubricating oil which flows through the screen openings. This screen element **27** may be an integral part of the tube **23** or it may be detachable therefrom by flanged or threaded connections indicated generally at **29**.

At its upper end the tube assembly has a flange member **31** suitably secured to the upper end of the outer tube **23** and a circulating pump **33** is attached to the enlarged flange element **31**. The pump may be of any suitable construction; for example it may be of either centrifugal or gear type. It is so arranged and connected to the tube assembly that oil is withdrawn from the crankcase through one of the tubes and returned through the other to provide circulation which will cause the oil to be screened through the element **27**. The amount and rate of the deposits upon the screen **27**, and the type of such deposits will indicate the type and character of the deterioration taking place in the oil in the crankcase.

Although the arrangement may be revised if desired, as shown in Figure 1 oil is drawn into the test apparatus through the annular space **35** which separates the inner tube from the outer tube; see also Figure 2. This oil passes into the central part of the pump **33** and is returned through a peripherally located outlet port into the extended end **37** of the inner tube **25**. Since the lower end of the annular passage is closed as indicated at **39**, Figure 1, see also Figure 2, the oil must be drawn into the outer tube through the openings in the screen element **27**. The mass and character of the solid materials which collect on the screen may be evaluated by weighing and by other obvious methods.

The circulating pump, which is not shown in detail in Figure 1 but is indicated within the housing **33**, is driven by any suitable prime mover, preferably by a six volt motor **45** which may be directly connected to the pump through a drive shaft **47**. This motor is driven electrically by the battery of the automotive vehicle to which it is connected through leads **47'** and **49**. One of these leads, shown at **49**, is preferably connected in series with an automatic control device such as the temperature responsive switch **51** mounted in an appropriate manner on the jacketed cylinder wall. The arrangement is such that the contacts **53** of a switch are open normally. When the engine reaches operating temperature, for example 140 to 200° F. or so, the contacts close to energize the motor **45**. The motor drives the circulating pump and circulates a continuous stream of oil, withdrawing it from the crankcase and pumping it back into the crankcase, this oil being screened and foreign matter contained therein being collected on the outer surface of the screen **27**. A manual switch (not shown) may be provided for turning the motor **45** on or off without regard to the thermostat control. The latter may of course be omitted if desired.

It will be understood of course that the system might be operated in reverse, oil being drawn in through the inner tube and forced out through the foraminated screen member **27**. In the latter case the impurities, solids, etc., would collect inside the screen member **27**. In such a case it would be particularly desirable to have the screen

member readily detachable from the outer tube element 23 as indicated at 29, previously mentioned.

Another modification is shown in Figure 3 wherein both the inner and outer tube members 25 and 23 respectively are provided with screen elements 27′ and 28′. In this case, as illustrated, a centrifugal type pump is mounted on top of the tube assembly as indicated at 33′, the impeller 34′ being shown fragmentarily. In this arrangement also the inner tube 25 is connected to the central or inlet opening of the pump as indicated at 61, the outer tube 23 being connected to the peripheral port as shown at 63. In the arrangement shown the oil is drawn into the test apparatus through the perforated screen element 28 attached to the inner tube 25 and is forced out through the screen 27′. The mesh or fineness of the respective screens may be chosen so as to collect the larger solid particles on screen 28′ and the finer particles of foreign matter inside the screen 27′. In this case it is desirable to make both screen elements detachable from their respective tubes although this is not altogether necessary.

It will be understood that the operation of the apparatus of Figure 3, as in the case of the apparatus previously described, may be reversed so that oil is drawn into the test apparatus through screen 27′ and returned through the inner tube with its screen element 28′. Both tubes, of course, are closed at their lower ends as indicated at 65 and 67 respectively.

It will be understood also that a similar apparatus may be used in other oil systems as in transmission and differential units of automotive vehicles, electrical transformers, oil systems and steam turbines, and other analogous installations. The convenience of being able to insert the apparatus through an existing opening which is standard in automotive equipment plus the facility of driving the test unit from standard battery circuits of automotive vehicles makes the unit particularly adaptable for testing crankcase oils and the like in automotive vehicles. A similar procedure may be adopted for testing the quality of oils in automatic transmissions, gear cases, differential housings and the like.

It will be understood that various modifications and variations may be made within the spirit of the present invention and within the scope of the appended claims. The invention embodies apparatus for testing oils, the operation of which involves continuously withdrawing a stream of oil from an operating lubricating system without interrupting the ordinary operations and without necessitating taking down of equipment or removal of mechanical parts.

What is claimed is:

1. In apparatus of the character described for testing crankcase lubricating oil in service in a closed oil crankcase having a narrow measuring stick opening, a removable depending slender tubular assembly including an outer tube adapted to be inserted into said opening and containing a smaller concentrically mounted tube spaced from the inner walls thereof to provide an annular passage, a circulating pump attached to the upper end of said assembly and arranged to draw a sample stream of oil upwardly through one of said tubes and return it downwardly through the other, means for operating said pump, and a screen formed at the end of one of said tubes and being of sufficient fineness to retain thereon relatively solid particles from the stream whereby the relative particle content of said oil may be measured.

2. Combination according to claim 1 wherein the screen forms a portion of one of the tubes.

3. In apparatus for continuously withdrawing over an extended period a sample stream of oil from a closed oil crankcase having a narrow measuring stick opening, a slender tube assembly comprising an outer tube adapted to be inserted into said opening and a concentric inner tube of smaller diameter annularly spaced from the inner wall thereof, a circulating pump connected between said tubes to draw oil from said crankcase through one tube and return it through the other, means for operating said pump, and screen means provided in at least one of said tubes for removing foreign matter from said oil.

4. Apparatus according to claim 3 wherein said screen means is provided in the outer tube.

5. Apparatus according to claim 3 wherein said screen means is provided in the inner tube.

6. In apparatus for testing crankcase oil in an internal combustion engine having a measuring stick opening, the combination of a slender tube assembly comprising a slender outer tube adapted to be inserted in said measuring stick opening and having a foraminated screen structure in its lower portion and an inner tube annularly spaced from the inner wall of said first mentioned tube, a pump for drawing oil from said crankcase through one of said tubes and through said screen structure and returning it through the other tube, means for operating said pump, and temperature responsive means for controlling said operating means to pump oil only when said engine is at operating temperature.

7. Apparatus according to claim 6 wherein a foraminated screen element is provided in both tubes.

8. Apparatus according to claim 6 wherein the foraminated screen portion is detachable for cleaning.

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