METHOD AND APPARATUS FOR
CHANGING LUBE OIL


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Field of Search ............... 184/1.5; 137/234.6, 205

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An adapter, hose and self-sealing coupling half are connected to the oil pan drain hole of a vehicle, the coupling half being bracket-mounted adjacent the dipstick. Pumping means are provided for evacuating old oil and dispensing new oil through the hose. This means may combine evacuation and dispensing functions in a single unit, or separate units may be provided for each function.
METHOD AND APPARATUS FOR CHANGING LUBE OIL

BACKGROUND OF THE INVENTION

1. Field of the Invention
The invention relates to vehicular internal combustion engines and more particularly to the periodic changing of lube oil in such engines. The invention has particular application to vehicle fleets, in-plant vehicles, construction equipment and other vehicles where both speed of oil changing and dirt-free oil are important to reduce engine maintenance costs.

2. Description of the Prior Art
The conventional gravity drain method of lube oil changing, in which the oil is drained by removing a plug in the crankcase pan and replaced by pouring new oil from a can into an open filler tube, has many disadvantages for industrial vehicles. The process is slow and cumbersome, requiring that the vehicle be maneuvered over hoists or pits to reach the drain plug. As a result, oil changing schedules are often extended to coincide with other maintenance operations, thus contributing to decreased engine life. The gravity drain method results in the lowest oil flow rate toward the end of the drainage step, when the most sludge and dirt is being removed, and the result is that much sludge remains in the crankcase pan. The method of catching the old oil in a funnel often results in oil spills, and lost, damaged or cross-threaded pan plugs are a common problem. The plugs must be reinserted tightly to assure that vibration will not loosen them. During the filling operation, there is a constant introduction of contaminants into the new oil and crankcase since the filler tube and the new oil are exposed to moisture and dust in the ambient air. Moreover, oil levels could be improperly checked unless time is taken to allow the new oil to drain down into the pan. All of these factors are especially critical when fleets of vehicles, in-plant vehicles and construction equipment are involved, since the engine life and down-time control of such vehicles are important to profitable operation.

BRIEF SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method and apparatus which will eliminate the above-mentioned drawbacks of gravity drain methods of oil changing, and provide a fast, simple servicing system which can be carried out on level ground without hoists or pits.

It is another object to provide an oil change system of this type which can be adapted to existing vehicles by the use of a simple vehicle conversion kit.

It is another object to provide such a system which eliminates the possibility of oil spills and loss or damage to pan plugs and includes means for the storage and handling of the old oil.

It is a further object to provide an improved system of this character in which the oil drain plug is replaced by equipment which need not be manipulated during the oil changing procedure and is permanently affixed to the vehicle in a manner preventing loosening by vibrations.

It is also an object to provide a system with these characteristics, in which no contaminants can enter the crankcase or the new oil, the system being closed at all times and the new oil and crankcase being contained and unexposed to ambient air.

It is another object to provide an improved oil changing system which drains the oil at a rapid and constant rate, thereby removing much more of the dirt and sludge in the bottom of the crankcase pan than the ordinary gravity method.

It is also an object to provide an oil changing system of this nature in which the oil is metered to insure proper filling, and in which the oil level can be checked immediately after filling.

It is a further object to provide an oil changing system of this character which is adaptable to suit different types and capacities of maintenance operations.

Briefly, the invention comprises a lube oil changing method which includes the steps of replacing the crankcase pan drain plug with a connector leading to an upwardly extending hose having a self-sealing coupling half, evacuating the old oil by connecting the coupling half to a vacuum pump which delivers the oil to a container, and dispensing new oil to the crankcase from a closed container through the coupling half and hose.

The apparatus of the invention briefly comprises the aforementioned connector, hose and self-sealing coupling half, a mounting bracket securing the coupling half preferably adjacent the oil dipstick, and pumping means connectable to the coupling half for removing old oil and dispensing new oil. The pumping means may comprise a single unit having both evacuation and dispensing capabilities or separate evacuating and dispensing units.

BRIEF DESCRIPTION OF THE DRAWINGS
FIG. 1 is a front view of a vehicle engine showing the connector, hose and coupling half of this invention connected thereto;
FIG. 2 is a perspective view of the assembly comprising the oil pan connector, hose, mounting bracket, self-sealing coupling half and dust cap, which together may comprise a vehicle conversion kit for utilizing the system of this invention;
FIG. 3 is a perspective view of a combined gas-powered evacuation and dispensing unit for use in the back of a truck or for stationary operations;
FIG. 4 is a schematic electrical circuit diagram of the unit shown in FIG. 3;
FIG. 5 is a perspective view of a unit similar to that of FIG. 3 but which is driven by electric motors;
FIG. 6 is an electrical circuit diagram of the unit shown in FIG. 5;
FIG. 7 is a fragmentary perspective view of the connections of the new and old oil drums to the unit of FIG. 3;
FIG. 8 is a perspective view showing the manner in which the evacuation and dispensing unit of FIGS. 3 or 5 is connected to the hose coupling half in the vehicle;
FIG. 9 is a perspective view showing the meter for the oil being dispensed through the coupling;
FIG. 10 is a perspective view of portable pumping units used for evacuation and dispensing;
FIG. 11 is a fragmentary perspective view of a venturi evacuation system adaptable to existing construction equipment lubrication vehicles which carry out the lube changing function in the field;
FIG. 12 is a cross-sectional view of an unloader valve to be used in conjunction with the unit of FIG. 3;
FIG. 13 is a schematic fluid flow diagram showing the unloader valve in closed position;
Fig. 14 is a similar view showing the unloader valve in its open position; and
FIG. 15 is a cross-sectional view of a preferred flow indicator for use with the units shown in FIGS. 10 and 11.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention is intended for use with a vehicle engine such as that indicated generally at 11 in FIG. 1. This engine may drive a truck or other fleet vehicle, an in-plant vehicle such as a pallet handler, or a piece of construction equipment or a bulldozer or other construction equipment. Engine 11 is provided with a conventional crankcase oil pan 12 having a drain hole 13 in its bottom, this hole normally being fitted with a removable drain plug (not shown).

According to the invention, a vehicle conversion kit generally indicated at 14 is provided. This kit is shown in detail in FIG. 2 and comprises an L-shaped oil pan adapter 15 having a union connection to a fitting 16 at one end of a length of hose 17. The other end of this hose carries a conventional self-sealing coupling half 18. A suitable coupling is the 5600 series snap action self-sealing coupling manufactured by Aeroquip Corporation, Jackson, Michigan. A dust cap 19 is provided for this coupling half; the dust cap being connected by a ring 21 and chain 22 to the coupling half.

A mounting bracket is provided to secure coupling half 18 to a portion 23 of the vehicle such as a bulkhead adjacent dipstick 24. This bracket may take any of various forms depending upon requirements. One such bracket is indicated at 25 in FIG. 1 and another type is shown at 25a in FIG. 2. Oil pan connector 15 may also have various forms depending on the thread size of the pan plug. The above-mentioned union connection permits separating the line for gravity oil drain when evacuation equipment is not available. The length of hose 17 will, of course, accommodate the distance between drain opening 13 and the desired mounting location of coupling half 18. The latter will face upwardly so as to be accessible to an operator reaching into the engine compartment, but in any case will be substantially above the normal level of oil in the crankcase.

According to the invention, oil will be changed by connecting a hose with a mating coupling half to half 18, this hose leading to a vacuum pump connected to a storage tank for the old oil. The operator will remove dust cap 19, connect the coupling halves, and start the pump. This will rapidly suck out all the old oil from pan 12. The flow will be at a substantially constant rate so that sludge and dirt deposited in the bottom of the pan will have a greater tendency to be evacuated from the crankcase than with the gravity drain method in which the flow rate decreases toward the end of the draining operation. Coupling half 18 will then be connected to a second pump drawing new oil from a closed container. This oil will flow into crankcase 12 without being exposed to the ambient atmosphere, the interior of the crankcase also being unexposed during the entire evacuation and refilling cycle. Since the oil will flow into the crankcase from the bottom, it will be possible at all times to obtain a reading of the oil level from the adjacent dipstick.

The means for evacuating the old oil and dispensing the new may take any of various forms. A combined evacuation and dispensing unit is shown in FIG. 3. This unit is generally indicated at 26. For purposes of mounting the unit in the back of a truck, or for stationary mounting, it is provided with a cabinet 27 having a first upper compartment 28 which stores a line dispensing 29 and an evacuation line 31, and a second upper compartment 32 for battery 33, a control panel being 34 located between these compartments. A first lower compartment 34 contains two gear pumps 35, a second lower compartment containing an air-cooled gasoline engine 37. An old oil drum 38 and the new oil drum 39 (FIG. 7) are mounted in the back of the cabinet, being secured by means of straps 41.

In carrying out the method of this invention using pumping unit 26, the oil drum connections will first be made up as shown in FIG. 7. A suction-vent probe 42 will be inserted in the top of new oil drum 39 and the supply line 29 for dispensing pump 36, together with a return line 43, connected thereto by quick acting couplings 44 and 45 respectively. Old oil drum 38 should be empty, and a safety float assembly 46 may be inserted therein and connected to evacuation line 31. This assembly will indicate when drum 38 is full and will stop the evacuation cycle automatically so as to prevent the used oil drum from running over.

Engine 37 may then be started by a starting switch 47, thereby driving dispensing pump 36 through a centrifugal clutch. A throttle 48 and choke 49 are provided for controlling the engine. The output from evacuation pump 35 through an electromagnetic clutch 50 (FIG. 4). Dispensing pump 36 has either a pressure relief valve or a dump valve which permits the oil to return to new oil drum 39 through line 43 when it is not being dispensed. FIGS. 12 through 14, described below, show a suitable unloader valve for this purpose. During this time there is pressure in dispensing line 29 up to a dispensing meter nozzle, also described below.

The first step in changing the oil in a vehicle is to evacuate the old oil from the vehicle crankcase. Evacuation hose 31 may be removed from compartment 28 and connected to the free end of coupling half 18 on a vehicle by a mating coupling half 51 carried by the line. Dust cap 19 will, of course, be removed for this purpose. The throttle 48 may then be opened and a cycle start button 52 on the control panel pushed down. This will illuminate a cycle run light 53 and energize clutch 500 to initiate automatic evacuation of the oil in crankcase 12 through assembly 14 and hose 31 to old oil drum 38. The energization of clutch 50 will be by means of a timing relay TR (FIG. 4) which is adjustable for a predetermined time delay, usually about 15 to 20 seconds. This will provide enough time for the oil to reach evacuation pump 35 and be discharged through a flow switch FS shown in FIG. 4, such as Model No. FS4-3T manufactured by McDonnell & Miller, Inc., Chicago, Illinois. When oil begins flowing through flow switch FS, the latter will take over control of electromagnetic clutch 50 to keep it engaged for the rest of the evacuation cycle. When all of the oil has been evacuated from the vehicle, air will begin flowing up evacuation hose 31. As soon as air flows through flow switch FS, the switch will return to the off position, breaking the electrical circuit to electromagnetic clutch 50, thus stopping pump 35 and extinguishing...
panel light 53. Evacuation line 31 may then be disconnected from hose 17 (FIG. 8).

Dispensing line 29 will next be removed from compartment 28. This line has a meter nozzle 54 attached thereto, a suitable unit being Model 635564 distributed by The Arc Corporation, Cryon, Ohio. This nozzle (FIG. 9) has a quick disconnect coupling half 55 which mates with coupling half 18. After connecting the meter nozzle to assembly 14, the meter of meter nozzle 54 will be set to the proper amount of oil needed for the engine. Actuation of the nozzle trigger will initiate automatic dispensing of the new oil from drum 39 through line 29 which is already pressurized, meter nozzle 54 and assembly 14 to the crankcase. When the amount selected has been dispensed, the nozzle will shut off automatically, causing the oil to again recirculate through line 43. The oil level should then be checked with dipstick 24, the meter nozzle disconnected and the dust cap replaced on coupling half 18.

The time required for evacuation and dispensing will vary with the amount and temperature of the oil. In a typical installation, evacuation may be completed in about 30 seconds for 6 quarts of oil at room temperature, and dispensing in about 45 seconds for the same amount and temperature of oil.

FIGS. 5 and 6 illustrate a pumping unit generally indicated at 201 which is similar in its basic arrangement to pumping unit 26 but in which the oil pumps are driven by two electric motors instead of a gas engine. Unit 201 has a cabinet 202 with a first upper compartment 203 which stores a dispensing line 204 and an evacuation line 205. The cabinet contains an evacuation pump 296 driven by an electric motor 207 and a dispensing pump 208 driven by an electric motor 209. The control panel of cabinet 202 is provided with a power-on signal light 211, an ignition key 212, a cycle-run signal light 213, and a cycle start button 214.

In operation, unit 201 will function in the same manner as unit 26, except for the fact that the unloader valve mentioned previously with respect to unit 26 is replaced by a pressure switch 295 (FIG. 6). This switch will be responsive to a buildup of pressure in dispensing line 204 to shut off motor 209. However, when the meter nozzle of line 204 is opened and oil is dispensed, the pressure drops which will start the motor. Return line 43 is not present in this embodiment.

FIG. 10 illustrates a second form of pumping means comprising two pumping units generally indicated at 56 and 57. These units are portable and are used for evacuation and dispensing of oil respectively in a shop, yard, or on a dock where electrical power is available. In shops equipped with an overhead oil dispensing reel, only the evacuation unit 56 will be required whereas locations requiring both dispensing and evacuation will use both units.

Each unit comprises a tank 58 mounted on a pair of wheels 59 and having tank drain plugs 61 and oil level indicators 62 showing when the tank is full. Each unit is provided with an electric motor 63 mounted on its respective tank driving a pump 64, the inlet and outlet of which have self-sealing couplings 65. An electric cord 66 is provided for each motor. Unit 56 has an evacuation hose 67 with a self-sealing coupling half 68 at the outer end connectable to a coupling 18 and hose 67 which will indicate when the evacuation cycle is complete without interrupting the flow. A suitable construction for such an indicator is described below with respect to FIG. 15. A removable suction screen 71 is located at the pump end of the evacuation hose to keep foreign material out of the gear pump and provide a fast visual check for metal particles in the vehicle engine oil. The outlet port of the evacuation pump leads through a hose 72 to its tank 58.

Unit 57 is provided with a dispensing hose 73 equipped with a meter nozzle 74 that may be set to dispense the required amount of oil, the outer end of this nozzle having a self-sealing coupling half 75 connectable to coupling half 18. When the selected amount of oil has been dispensed, the nozzle will automatically shut off. New oil will flow from tank 58 of the unit 57 through a hose 76, pump 64, hose 73 and meter nozzle 74 to hose 17. Pump 64 has a built-in relief valve so that oil will recirculate through the pump when the nozzle is closed.

In operation, the electric cord 66 of the evacuation unit 56 will be plugged into an outlet and evacuation line 67 connected to hose 17. The motor will be turned on and the oil evacuated until indicator 69 shows that the evacuation cycle is complete. The electric motor will be turned off and the evacuation line disconnected. A check with the vehicle dipstick 24 will confirm evacuation.

To dispense the new oil, electric cord 66 of unit 57 will be connected to an outlet and its electric motor 63 turned on. Meter nozzle 74 will be set for the amount of oil to be dispensed and self-sealing coupling half 75 will be connected to coupling half 18 on the vehicle. Pulling the trigger on the meter nozzle will initiate dispensing of the oil which will be shut off automatically when the proper amount has been dispensed.

To remove old oil from tank 58 of evacuation unit 56 when its indicator 62 shows an almost full condition, drain plug 64 may be used. Alternatively, the line connections to the inlet and outlet of pump 64 may be reversed using the self-sealing couplings on the pump. The coupling half 68 on the dispensing line may then be opened by plugging in a mating coupling half, and the electric motor turned on to empty tank 58.

FIG. 11 illustrates an evacuation system especially adapted for lube vans of the type used by many construction equipment fleets to carry out lube schedules. These vans carry tanks such as that indicated partially at 77 for collecting old oil. The system shown in FIG. 11 is capable of being built into such existing lube vehicles. The system comprises a venturi or ejector valve 78 having a vacuum port 79 connected to the top of tank 77 through a conduit 81, a shutoff valve 82, and check valve 83. Ejector 78 has an inlet port 84 connected to a source of compressed air (not shown) by a hose 85 and a control valve 86. The upper portion of tank 77 is connected to a compound pressure and vacuum gauge 87 and a hose 88 leading to a coupling half 89 capable of mating with coupling half 18 of assembly 14. A flow indicator 91 is disposed between coupling half 89 and hose 88.

In operation, valves 82 and 86 will be opened so that the compressed air passing through ejector valve 78 to its exhaust port 92 will create a partial vacuum in the upper portion of tank 77. The degree of this vacuum as indicated by gauge 87 may be controlled by varying the position of valve 83. The coupling half 89 may then be connected to coupling half 18 to evacuate the lube oil from the vehicle. After each vehicle evacuation, valve
86 may be closed to conserve air pressure, check valve 83 holding the vacuum in the tank. To push the old oil out of tank 77 when it is nearly full, a bypass line 93 is provided between line 85 and valve 86 leading through a valve 94 to the top of tank 77. To remove old oil valves 82 and 86 will be closed and valve 94 opened to pressurize the tank. A drain valve 95 in the bottom of tank 77 may then be opened to let the old oil flow out, after which the valve will be closed.

FIGS. 12, 13 and 14 illustrate the structure and function of an unloader valve such as described with respect to dispensing line 29 of unit 26. The valve is indicated generally at 101 and comprises a cross-shaped body 102 having intersecting bores 103 and 104. Bore 103 has a first threaded port 105 for connection to the discharge of dispensing pump 36 by a conduit 106 (FIGS. 13 and 14) and a port 107 connected to new oil drum 39 by return line 43. Bore 104 has a spool valve member 108 and a piston 109 in tandem. A cap 111 with a vent 112 at one end of bore 104 supports a spring 113 which urges members 108 and 109 to the right, piston 109 engaging a cap 114 which has a port 115 connected to a pilot line 116. The other end of this pilot line is connected to line 29, a check valve 117 being interposed between the T connection 118 for pilot line 116 and the T connection 119 for line 106. Valve 117 will permit flow only toward T 118. Spool 108 has an extension 121 limiting its movement toward cap 111, and piston 109 has an extension 122 maintaining it in spaced relation with the spool valve.

In operation, with meter nozzle 54 open as seen in FIG. 13, there will be relatively low pressure in pilot line 116. Therefore, the parts will be as shown in FIG. 12 with the unloader valve closed and no bypass fluid flowing. When meter nozzle 54 closes, the buildup of pressure in pilot line 116 will cause piston 019 to shift spool valve 108 to the left, thereby opening bore 103, and the old oil will recirculate as shown in FIG. 14.

FIG. 15 illustrates a suitable flow indicator such as that designated 69 in FIG. 10 and 91 in FIG. 11, to furnish a visual indication of the completion of old oil evacuation. The unit is generally indicated at 123 and comprises a body 124 having a bore generally indicated at 125. This bore has a wider portion 126 and a narrower portion 127, these portions being connected by a frustoconical or tapered portion 128. Bore portion 126 is internally threaded and bore portion 127 externally threaded so that unit 123 may be connected in the evacuation line.

A recessed portion 129 is provided on the outer surface of body 124 radially outwardly from bore portion 128. An indicator housing 131 of tubular shape is mounted in this recess and extends radially outwardly therefrom, having an inwardly extending shoulder 132 at its outer end. An indicator button 133 is provided, this button having a piston portion 134 with an annular seal 135 slidably mounted in housing 131. A spring 136 urges button 133 outwardly through the opening 137 inside shoulder 132. A radial passage 138 connects the frustoconical bore portion 128 with the chamber 139 within member 131.

In operation, indicator button 133 will retract inward against the urging of spring 136 while oil is flowing in either direction in bore 125. (Normal flow will be in the direction of arrow 141.) This will be because of the partial vacuum effect created in the bore by the pumping operation. When all the old oil has been removed from the crankcase, air will be sucked into bore 125 and the relatively high vacuum will be lost. Spring 136 will thus return indicator 133 to its outwardly projecting position, indicating that all the oil has been removed.

I claim:

1. In an apparatus for changing the lube oil of an engine having a dipstick and a crankcase oil pan with a bottom drain hole, an assembly comprising an oil change hose having a connector at one end mounted in said drain hole and a self-sealing coupling half at the other end, means securing said other end adjacent said engine, a container for old oil, evacuation hose and pump means comprising an evacuation pump and an evacuation hose, the hose having a self-sealing coupling half connectable to said assembly for drawing off the old oil from said pan to said container, a closed new oil container, dispensing hose and pump means comprising a dispensing pump and a dispensing hose separate from said evacuation hose and pump means, connections between said evacuation and dispensing pumps and said old and new oil containers respectively, said dispensing hose having a self-sealing coupling half connectable to said assembly for delivering new oil from said closed container to said pan, an oil metering device connected to said self-sealing coupling half of the dispensing hose and adapted to shut off oil flow from said dispensing hose when the proper amount of oil has been dispensed, cabinet means adjacent said oil container, prime mover means mounted in said cabinet means and driving said evacuation and dispensing pumps, a starting switch for causing said prime mover means to drive said evacuation pump, a timing switch responsive to activation of said starting switch for maintaining said driving condition between the prime mover means and the evacuation pump for a predetermined time, and a flow switch connected to said evacuation hose and responsive to flow of oil therein to maintain said driving condition after said timing switch has timed out, said flow switch being responsive to lack of old oil in said evacuation hose to terminate said driving condition.

2. The combination according to claim 1, said prime mover means comprising an internal combustion engine mounted in said cabinet means, a centrifugal clutch connection between said engine and said dispensing pump, an electromagnetic clutch between said prime mover and said evacuation pump controlled by said starting switch, and recirculating means connected to said dispensing line responsive to closure of the exit end of said line to recirculate oil while said dispensing pump continues to run.

3. The combination according to claim 1, said prime mover means comprising two electric motors for said evacuation and dispensing pumps respectively, said starting switch controlling said motor for the evacuation pump, and a pressure switch connected to said dispensing hose and responsive to buildup of pressure therein when the exit end of said hose is closed to disconnect the electric motor for the dispensing pump, said switch being responsive to a lessening of pressure when said exit end is opened to re-start said motor.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.: 3,867,999
DATED: February 25, 1975
INVENTOR(S): Robert G. Cox

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 43, "removed" should be --removed--; line 50, "500" should be --50--. Column 5, line 6, "Cryan" should be --Bryan--; line 33, "296" should be --206--. Column 6, line 30, "selfsealing" should be --self-sealing--; Column 7, line 37, "019" should be --109--. In the Claims -- Claim 1, column 8, line 32, "moved" should be --mover--.

Signed and sealed this 24th day of June 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks