Dec. 3, 1940. J. D. MORGAN ET AL 2,223,791

SOLVENT CLEANSING

Filed Oct. 9, 1939

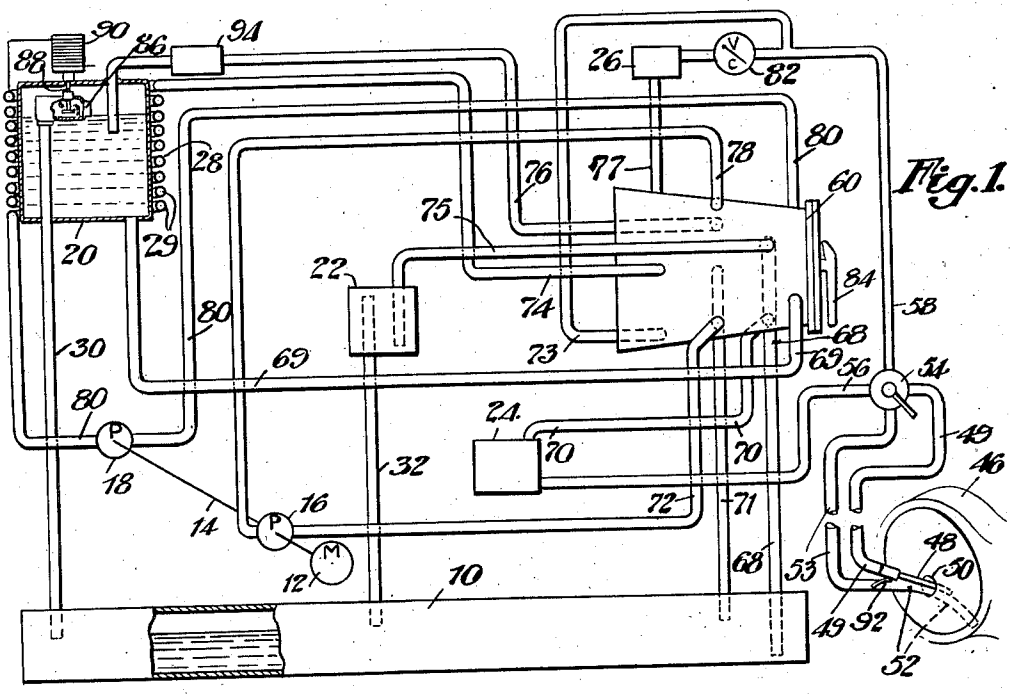


Fig. 1.

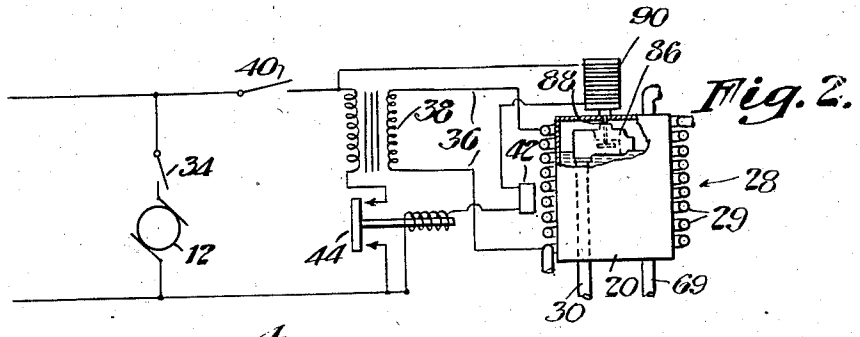


Fig. 2.

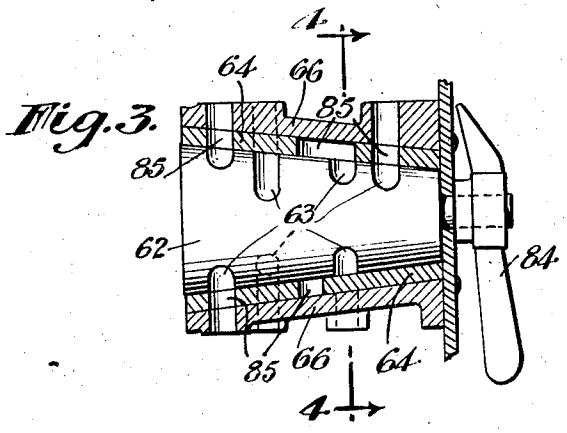


Fig. 3.

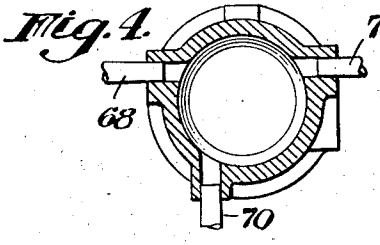


Fig. 4.

INVENTORS
JOHN D. MORGAN
PERCY B. LEVITT
BY
Edmund J. Borden
ATTORNEY

Patented Dec. 3, 1940

2,223,791

UNITED STATES PATENT OFFICE

2,223,791

SOLVENT CLEANSING

John D. Morgan, South Orange, and Percy B. Levitt, Millburn, N. J., assignors to Power Patents Company, Hillside, N. J., a corporation of Maine

Application October 9, 1939, Serial No. 298,676

5 Claims. (Cl. 184—1.5)

The present invention relates to the cleansing of differential gear housings and other inaccessible lubricant compartments of automobiles and the like, and is more particularly directed to an improved apparatus which is adapted for the flush cleansing of oil and grease residues and solid deposits from the inaccessible lubricant compartments of automobile engines and transmission members.

The primary object of the present invention is to provide improvements in method and apparatus which are adapted to effect such cleansing in a rapid, efficient and relatively inexpensive manner.

The present invention features an improved design of solvent flushing apparatus by means of which even an unskilled operator can rapidly and efficiently cleanse inaccessible transmission parts, crank cases, or other parts of automobiles with the use of a relatively small volume of solvent. In accordance with the present invention, the cleansing operation is designed to utilize the ordinary filling and drainage ports in the gear house or other parts to be cleansed as the means of access for the cleansing operation, whereby such cleansing can be effected without the necessity of any preliminary dismantling or partial dismantling operation.

With the above and other objects and features in view, the invention consists of the improved method and means for solvent flushing of lubricant compartments which is hereinafter described and more particularly defined in the accompanying claims.

In the following description of the invention reference will be had to the attached sheet of drawings, in which:

Fig. 1 portrays diagrammatically a preferred arrangement of solvent flushing apparatus in accordance with the present invention;

Fig. 2 is a wiring diagram of the electric circuits for controlling the apparatus of Fig. 1;

Fig. 3 is a longitudinal sectional view of the multiple ported and apertured circulation control valve of the apparatus of Fig. 1; and

Fig. 4 is a cross section of the control valve casing, taken on the plane 4—4 of Fig. 3.

The apparatus as portrayed particularly in Fig. 1, includes a tank or reservoir 10 within which can be stored a charge of grease solvent oil such as kerosene. 12 designates an electric motor having a drive shaft 14 on which is mounted the rotary impeller elements of a pair of rotary pumps 16 and 18. Pump 16 will be hereinafter referred to as a low pressure suction pump, while 18 designates a high pressure force pump. 20 designates a warming tank and 22 an auxiliary storage tank; solvent being charged and stored in both of these tanks at certain periods in the preferred operating cycle of the apparatus. 24 and 26 designate filters which are adapted for separating solid particles from entrainment in the liquid solvent passed therethrough. A tubular solvent heater 28 is shown as having a plurality of helical turns 29 arranged in close heat transferring relation to the walls of warming tank 20. An over-flow pipe 30 leads off from a point near the top of tank 20 into reservoir 10, and tank 22 is also provided with an overflow pipe 32 leading to reservoir 10.

In Fig. 2 the circuit supplying electric current for the operation of motor 12 is shown as including a motor control switch 34. An electric heating circuit 36 is provided for supplying heating current for the tubular heater 28. In the preferred apparatus, heater 28 is constructed of some suitable metal such as a nickel-chromium alloy steel which in itself forms the resistive heating element portion of circuit 36. The source of heating current includes a transformer 38 having its primary winding in a circuit under the control of a switch 40. In order to limit the maximum temperature to which the tubular heater is heated by the electric current in circuit 36, a thermostat 42 is provided which is operable to open a thermostatically controlled switch 44 in the primary circuit of transformer 38 whenever the temperature of the heater exceeds a predetermined safe maximum.

In Fig. 1 the apparatus has been illustrated as operatively set up for flushing out the differential housing 46 of an automobile. One of the principal elements of the flushing apparatus includes a small flushing nozzle 48 through which a jet of hot solvent liquid can be projected at high velocity into housing 46 through a port 50 in the housing which is the regular grease charging port therefor. Removal of the solvent carrying dissolved grease and entrained solid sediment from the housing 46 is effected through a suction nozzle 52 which is sufficiently small so that it can also be inserted into the housing through port 50. A flexible hose connection 49 leads off from the rearward end of nozzle 48 to one of four ports in a nozzle control valve 54. Another port of valve 54 is connected to suction nozzle 52 by a flexible hose 53. The other two ports of valve 54 are connected by conduits 56 and 58 respectively with the intake of filter 24 and with the discharge port of filter 26.

The multiple ported and apertured switching valve 60 (Figs. 1 and 3) is arranged to control the circulation of solvent between the storage reservoir and tanks, the pumps, the heating tube, the filters and the pressure and suction nozzles shown as located in the compartment to be flushed (in this case the housing 46). As shown in Fig. 3, valve 60 includes a rotatable frusto-conical core member 62 having a plurality of spaced grooves 63 in its peripheral face. Core 62 is rotatably journaled within a multi-apertured sleeve 64, and sleeve 64 is in turn closely surrounded by a multiported housing 66. A plurality of port openings in housing 66 are respectively tapped to threadably engage the ends of a plurality of pipes 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78 and 80, leading, respectively: to a point near the bottom of reservoir 10; to the discharge port of tank 20; to the discharge port of filter 24; to the upper part of reservoir 10; to the discharge port of pump 16; to conduit 58 bypassing filter 26 and a check valve 82 at the outlet side of the filter; to the discharge end of heater 28; to a point near the bottom of tank 22; to the top of tank 20; to the intake of filter 26; to the intake of pump 16; and to the intake of heating coil 28 through pump 18.

By means of a handle 84 attached to the stem of the valve core 62, the valve may be rotated to different positions in which certain of its ports are communicably connected through the apertures 85 in sleeve 64 and through the peripheral grooves 63 on the surface of core 62. For example, in one position of the valve, solvent may be drawn from reservoir 10 through pipe 68, valve 60 and pipe 78 into pump 16 and forced thence through pipe 72, valve 60 and pipes 75 and 76 into tanks 22 and 20, to charge these tanks to the level of the overflow pipes 32 and 30. During this operation, switch 34 would be closed and switch 40 preferably open.

After the tanks 20 and 22 have been filled and after nozzles 48 and 52 have been placed in position for flushing the differential 46 or other part to be cleansed, switch 40 is closed and valve 60 is turned to a position in which solvent is withdrawn from tank 20 through pipe 69, valve 60 and pipe 80, and forced by pump 18 through the coils of heater 28. In flowing through heater 28 the solvent is heated by electric resistance to a predetermined temperature under the control of resistance circuit 36 and thermostat 42. From heater 28 the hot solvent is forced under high pressure through pipe 74 and valve 60, and thence through pipes 73 and 58, valve 54 and tubing 49 to the nozzle 48, from which it is directed in a high velocity jet into the differential housing 46. Under the direction of the operator in manipulating nozzle 48, residual oil, grease and solid deposits can be thoroughly and rapidly removed from the gears and walls within housing 46, and the mixture of solvent and residue can be carried away under the suction of pump 16 through nozzle 52, tube 53, valve 54, and pipe 56, into filter 24. In passing through filter 24, any solids of substantial size are trapped and separated from the solvent stream. From filter 24 the solvent-oil-grease mixture is conducted through pipe 70, valve 60 and pipe 78 to pump 16, and is thence forced through pipe 72, valve 60, and pipe 76, back into tank 20.

In order to limit the size of the apparatus within a range which is easily portable by hand, and in order to provide for economical and efficient use of the liquid solvent, arrangement has been made to recirculate the solvent through tank 20, heater 28, the compartment to be flushed (for example housing 46), and filter 24. To permit of recirculation of solvent carrying grease or oil admixed therewith through tank 20 without contaminating any clean solvent which may be in the reservoir 10, a valve 86 is mounted in overflow pipe 30, and stem 88 of this valve forms the movable core of a solenoid 90 which is connected to be energized by the current flowing in the electric heating circuit 36 for heater 28. Thus so long as electric heating current is supplied to heater 28, valve 86 remains closed to prevent the flow of solvent through over-flow pipe 30; while the valve opens to permit over-flow of solvent from tank 20 during periods when heater 28 is not operating.

In order to drain solvent from housing 46 after the grease and solvent residue have been flushed out, a clamp valve 92 is provided to cut off flow of solvent to nozzle 48 during the period when pump 16 sucks out residual solvent from housing 46 through nozzle 52. After the above operation, nozzles 48 and 52 may be removed from the housing 46, and pump 18 may then be operated to draw contaminated solvent from tank 20 and to discharge it through nozzle 48 either to waste or to a solvent purifying unit. The degree of contamination of the solvent can be observed through a sight box 94 in pipe 76. During the period when contaminated solvent is being discharged from the apparatus, valve 60 may be turned to a third position at which, with switch 40 preferably open, clean solvent is drawn from tank 22 through pipe 75, valve 60, and pipe 78, into pump 16, and thence delivered to tank 20 from which it is circulated through the remaining parts of the system and finally discharged through nozzle 48. In this manner all of the units of the apparatus and the connecting pipes can be flushed out with clean solvent.

For flushing crank cases or other relatively large lubricant compartments, valve 60 may be turned to a fourth position by which storage reservoir 10 is brought directly into the circulating system. When using this circuit, solvent is withdrawn from tank 10 by the operation of pump 18 and is forced through heater 28 and thence into the crank case or other compartment to be flushed. The contaminated solvent is withdrawn from the crank case by suction of pump 16 and is returned to the reservoir 10 through valve 60 and pipe 71. The partially contaminated solvent may be recirculated until the crank case has been thoroughly cleaned. Filter 26 is provided as an auxiliary filter through which partially contaminated solvent may be circulated for removal of solid impurities therefrom.

The invention having been thus described, what is claimed as new is:

1. In apparatus for removing oil and grease from the lubricating compartments of automobiles and the like, the combination of a warming tank for lubricant solvents, a tubular heater disposed in heat transferring relation to the walls of said tank, means including a high pressure pump and connections for withdrawing solvent from said tank and forcing it through said heater, means including a nozzle and connections for directing hot solvent under the pressure developed by said high pressure pump at high velocity and in a controlled direction into the compartment to be cleansed, means including a suction nozzle and a low pressure suction pump and con-

nections for removing the solvent and dissolved lubricant from the compartment and recharging the tank therewith for recirculation, and a rotary valve having multiple ports and apertures arranged to control flow of solvent through all of said connections.

2. Apparatus as defined in claim 1 including a storage reservoir for solvent, suction connections between said storage reesrvoir and each of the pumps under the control of said rotary valve, and a filter in the suction connection between the compartment and the low pressure pump.

3. In apparatus for removing oil and grease from the lubricating compartments of automobiles and the like, the combination of a storage reservoir for lubricant solvents, a warming tank, a tubular heater disposed in heat transferring relation to the walls of said tank, an overflow pipe leading off from near the top of the warming tank into the storage reservoir, a valve for controlling said overflow, an electric heating circuit including said tubular heater as the heating element, means operatively associated with said electric heating circuit for actuating said valve, and pumps having flow connections with the reservoir, tank and heater.

4. Apparatus as defined in claim 1, together with a filter in the connection between the discharge end of the heating coil and the compartment to be flushed, and a by-pass for said filter under the control of the rotary valve.

5. In apparatus for removing oil and grease from the lubricating compartments of automobiles and the like, the combination of a storage reservoir for lubricant solvents, a small flushing tank having an overflow connection leading to the storage reservoir, a warming tank, a tubular heater, means including a high pressure pump and connections for withdrawing solvent from said warming tank and forcing it through said heater, means including a nozzle and connections for directing hot solvent under the pressure developed by said high pressure pump into the compartment to be cleansed, means including a suction nozzle and a low pressure suction pump and connections for removing solvent and dissolved lubricant from the compartment and recharging the warming tank therewith for recirculation, charging connections between the flushing tank and the warming tank and the discharge port of the low pressure pump, and discharge connections between the flushing tank and the storage reservoir and the suction port of the low pressure pump.

JOHN D. MORGAN.
PERCY B. LEVITT.