Dec. 4, 1962 D. J. McNEW ET AL 3,066,664

ENGINE PRE-OILING APPARATUS

Filed May 25, 1960

3 Sheets-Sheet 1

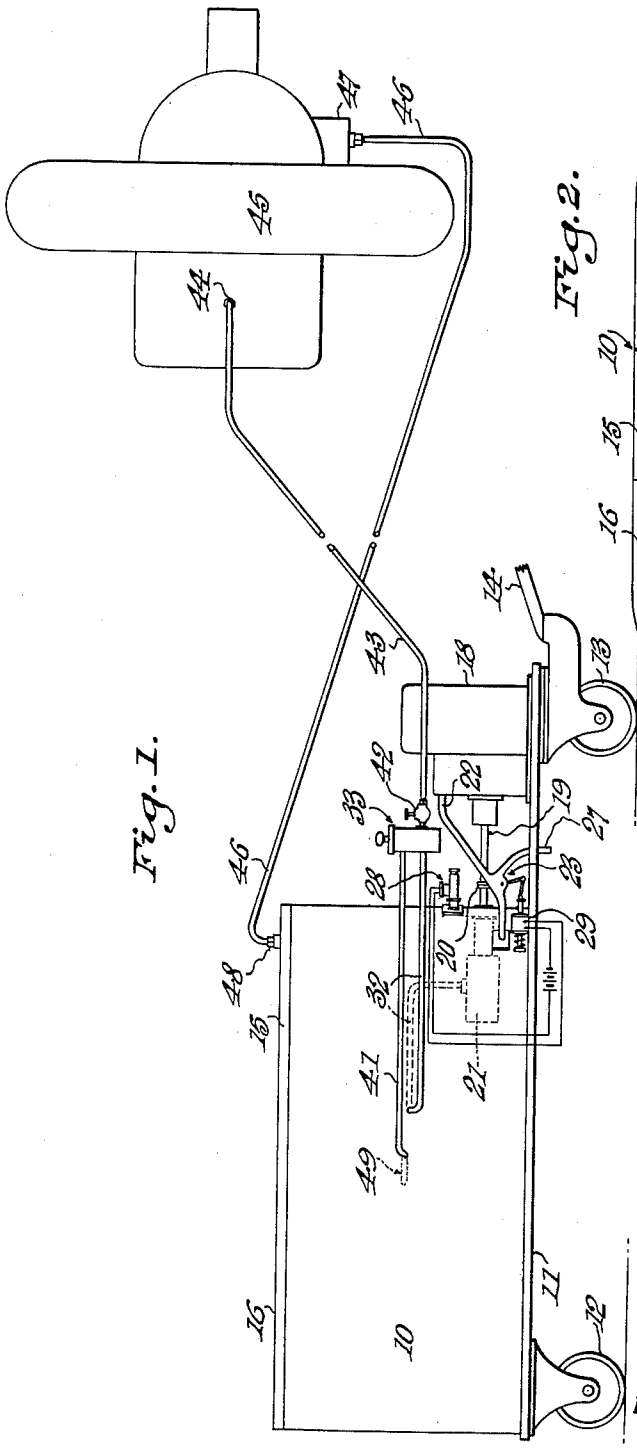


Fig. 1.

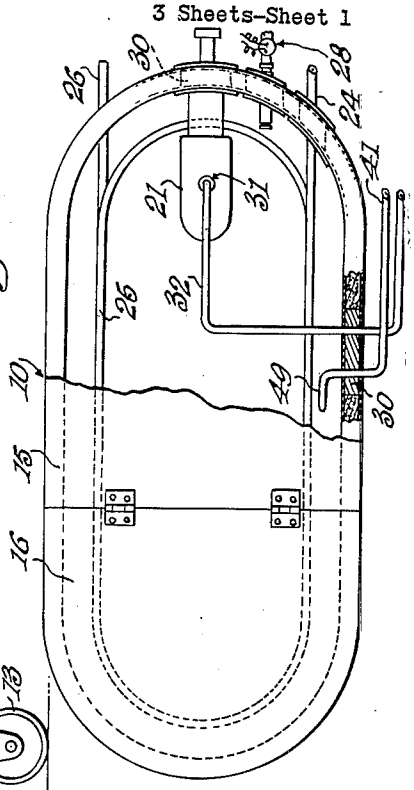


Fig. 2.

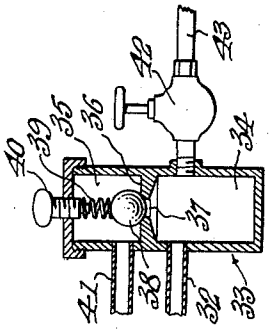


Fig. 3.

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Fig. 4.

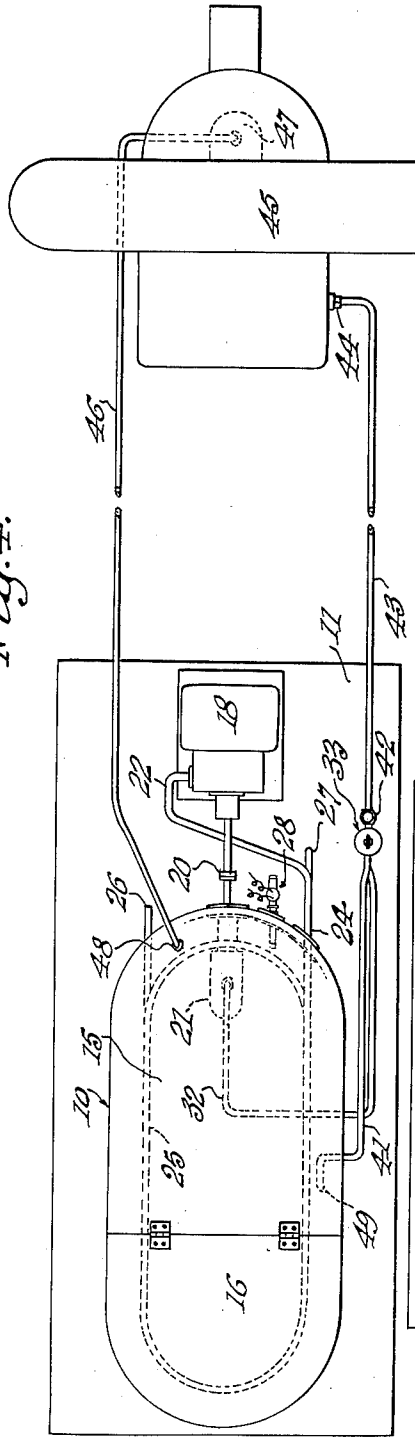
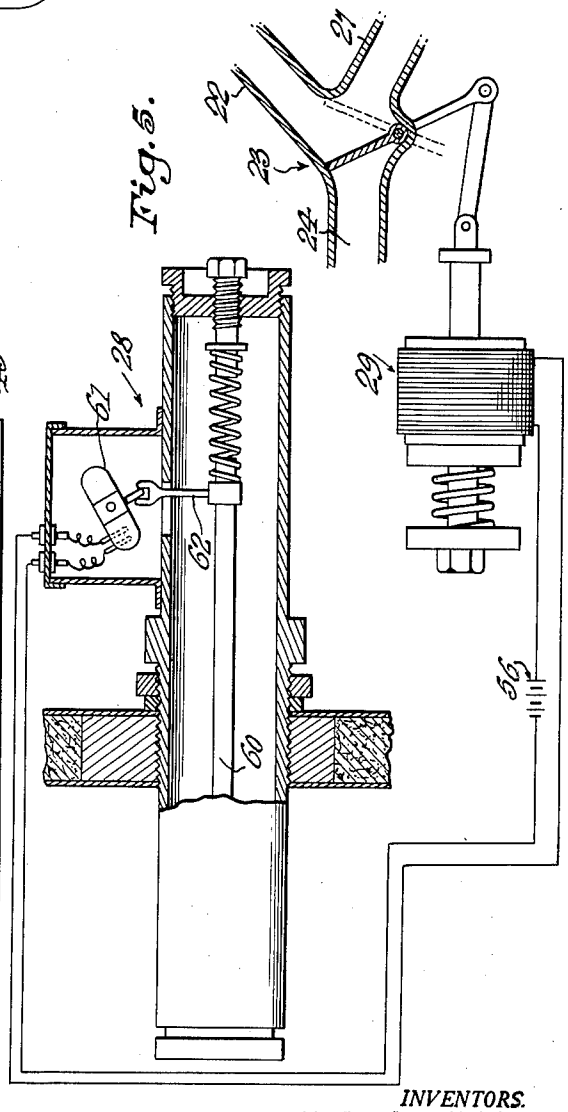


Fig. 5.



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ENGINE PRE-OILING APPARATUS

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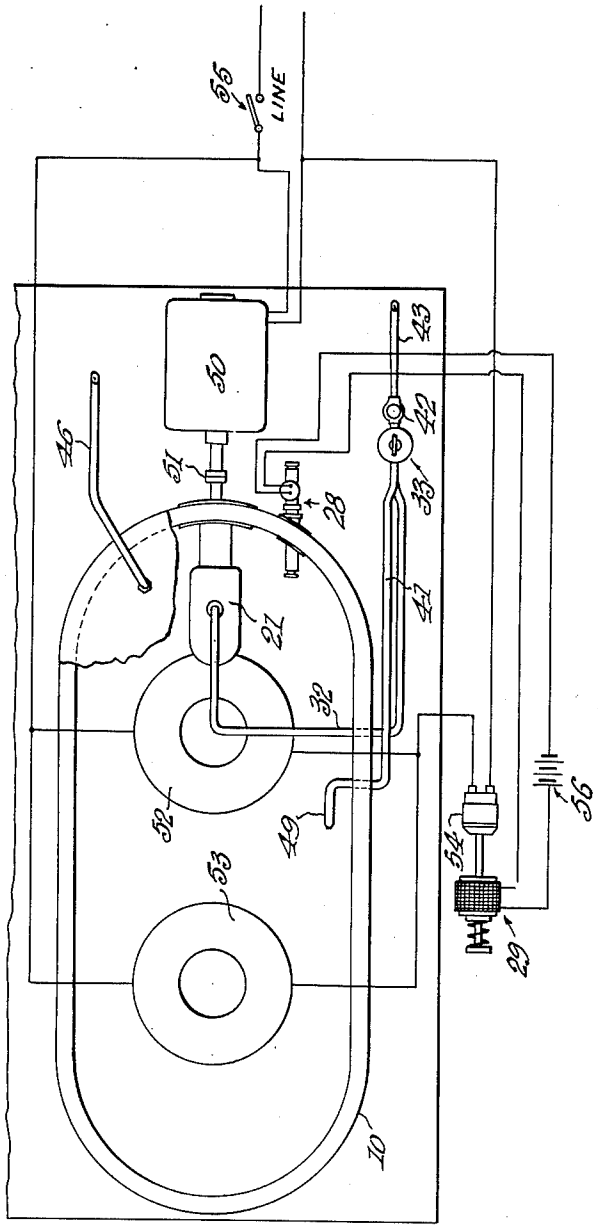
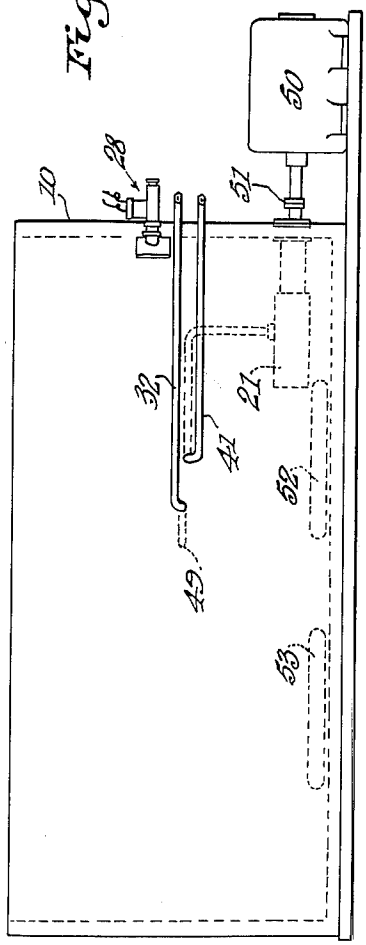


Fig. 6.

Fig. 7.



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ENGINE PRE-OILING APPARATUS

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7 Claims. (Cl. 123—196)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the government for governmental purposes without the payment of any royalty thereon.

This invention relates to apparatus for supplying heated lubricating oil under pressure to an engine before the engine is started and for circulating the heated oil through the engine bearings to free the bearings for easy starting of the engine. Although this invention may be used with a variety of internal combustion engines, it is particularly valuable for use with an aircraft engine of the dry sump type. Further description and illustration of the invention will be with reference to this type engine.

In cold weather operation, an aircraft engine that has been allowed to stand until its temperature has substantially equalized with the atmospheric temperature develops such extreme resistance to operative movement of its parts that it frequently cannot be started until it has been supplied internally with heated lubricating oil to free its bearings and free the pistons in the corresponding cylinders. In view of this condition, such aircraft engines are provided with a pre-oiling plug or tap through which a supply of heated oil under pressure can be delivered to the interior of the engine to flow through the working parts of the engine to the engine oil sump. The present invention deals with improved apparatus for heating lubricating oil and circulating such heated oil under pressure through an internal combustion engine to condition the engine for starting in cold weather operation.

A more complete understanding of the invention may be obtained by referring to the following description and claims taken in conjunction wtih the accompanying drawings which show an illustrative embodiment of the construction forming the basis of the invention and in which:

FIG. 1 is a side elevation view of the apparatus;

FIG. 2 is a partial, cut-away, top view of the tank portion of the apparatus;

FIG. 3 is a side elevation view in detail of the oil pressure control valve of the apparatus;

FIG. 4 is a top view of the apparatus;

FIG. 5 is a partial, cut-away, side elevation view in detail of the thermostatic control device;

FIG. 6 is a cut-away, partial, top view of an alternate form of the apparatus; and

FIG. 7 is a partial, side elevation view of an alternate form of the apparatus.

The apparatus, as shown in the accompanying drawings, comprises an oil tank or reservoir 10 mounted on a wheel carried platform 11. The platform may conveniently be supported on a pair of spaced apart wheels 12 at the rear end of the device and on a single, swivelly mounted wheel 13 at the front end. A tongue 14 may be connected to the pivotal support of wheel 13 for towing the pre-oiler device to and from appropriate locations for operation.

Tank 10 is of elongated shape with flat sides and semi-cylindrical ends and is provided with a cover including a fixed cover portion 15 and a hinged, movable cover portion 16 through which the oil in the tank can be replenished.

A small, preferably one cylinder, internal combustion engine 18 is mounted on the supporting platform 11 (FIGS. 1 and 4) at a location spaced forwardly from the front end of tank 10, and this engine has its drive

shaft 19 connected through flexible coupling means 20 with an oil pump 21 disposed within tank 10 and located near the bottom of the tank. The engine has an exhaust conduit 22 which leads to a two-way valve 23 disposed outside of the tank and adjacent the front end thereof. A conduit 24 leads from valve 23 to an oil heating coil 25 which extends around the interior of tank 10 and is disposed on or adjacent to the bottom of the tank. This coil may have one or more passes around the interior of the tank in order to provide ample heat conducting surface area, and is vented at its end opposite that connected to the conduit 24 by a conduit 26 which extends from the end of the coil through the front wall of the tank. A vent conduit 27 extends from valve 23 downwardly through platform 11, and valve 23 is effective to pass the engine exhaust gas either through conduit 24 to heating coil 25 or through vent conduit 27 to the atmosphere.

Valve 23 is controlled automatically. In FIG. 1, control 28 and solenoid 29 are mounted on the front end wall of the tank, and the thermostatic element of the controls is responsive to the temperature of the body of oil contained within tank 10. Details of the controls are shown in FIG. 5. Control element 28 is mounted so as to be partially inserted into tank 10. The portion of element 28 which projects into the tank contains a thermostatic element connected to rod 60, the thermostatic element being responsive to the temperature of the oil in the tank and of a construction well known in the art. When the oil in tank 10 is being heated, mercury switch 61 is in the "off" position, and valve 23 closes vent 27. When the oil in the tank is heated to a predetermined temperature, the thermostat causes arm 62 to turn mercury switch 61 to the "on" position completing the circuit through battery 56 energizing solenoid 29 which in turn causes valve 23 to open vent 27 to the atmosphere and close conduit 24 to the heating coil.

The wall of the tank 10 is preferably constituted by spaced apart inner and outer metallic walls with the space between the inner and outer walls filled with a suitable heat insulative material. At the locations where the drive coupling 20 and the various conduits extend through the wall, the space between the inner and outer metallic walls is preferably filled by a block of solid material, as indicated at 30 in FIG. 2, and suitable packing material (not shown) is provided to prevent the escape of oil from the interior of the tank around the drive coupling element and the conduits.

The oil pump 21 has an outlet port 31 and a conduit 32 extends from this port to the housing of an oil pressure control valve 33, particularly illustrated in FIG. 3. The housing of valve 33 provides interiorly thereof two chambers 34 and 35 separated by a transverse partition 36 having therein a pressure relief port 37. A valve ball 38 is disposed within chamber 35 in closing relationship to port 37 and is resiliently seated in the port by compression spring 39 compressed between ball 38 and the adjacent end of adjusting screw 40 threaded through the corresponding wall of the valve housing. Pressure conduit 32 leads into chamber 34 and return conduit 41 leads from chamber 35 back into tank 10 so that any oil forced by excessive pump pressure through the pressure regulating valve will flow back into the tank. The tank connected end of line 41 is preferably provided with a nozzle 49 so directed as to agitate or move the oil in the tank to maintain uniform heating of the oil. The pressure delivered by pump 21 can be regulated by turning adjustment screw 40 to increase or decrease the loading of spring 39.

A manually operated cut-off valve 42 is connected at one side to chamber 34 of pressure regulating valve 33 and a pressure oil supply line 43 is connected at one end

to the other side of valve 42. At its other end, supply line 43 is provided with a fitting which engages with the pre-oiling plug or fitting 44 on aircraft engine 45. An oil return line 46 is detachably connected at one end to a plug or fitting in the bottom of engine oil sump 47 and is connected at its opposite end to fitting 48 which leads through the fixed top portion 15 of the oil tank to the interior of the tank so that the oil forced through the engine and flowing into the engine oil sump will be returned to tank 10 for reheating and resupply to the engine. Since the pre-oiling apparatus will normally be disposed below the engine, the return flow of oil may be accomplished at least partly by gravity.

In the use of the pre-oiling apparatus, starting from a cold condition valve 42 will be closed and preferably adjusting screw 40 will be moved to substantially relieve the pressure provided by pressure regulating valve 33. Engine 18 is then started, and, since the oil in tank 10 is cold, control 28 will operate valve 23 to connect engine exhaust conduit 22 with heating coil 25 in oil storage tank 10. As soon as the oil in the tank has been heated to a sufficient temperature, control 28 will operate valve 23 to connect engine exhaust 22 to vent conduit 27 which will notify the operator that the temperature of the oil is sufficient. Adjusting screw 40 will then be turned until the proper oil pressure is obtained, as indicated on a suitable pressure gauge, not illustrated. The conduits 43 and 46 are then connected to the engine pre-oiling fitting 44 and engine oil sump 47, respectively, and valve 42 is opened. The heated oil will now be forced through engine 45 and returned to oil storage tank 10. If the temperature of the oil now falls below the temperature for which control 28 is set, this control will operate valve 23 to again connect the engine exhaust conduit to oil heating coils 25 to supply additional heat to the oil. Operation of the pre-oiler is continued until the associated aircraft engine becomes sufficiently free for easy starting, at which time valve 42 is closed and conduits 43 and 46 disconnected from the engine.

In the modified arrangement shown in FIGS. 6 and 7, the construction is substantially identical with that shown in FIGS. 1 to 5 inclusive and described above except that, in the modified arrangement, an electric motor 50 is used to drive the oil pump 21 and electric heating elements 52 are provided in the bottom of the tank 10 in lieu of the heating coil 25.

The electric motor 50 is positioned adjacent the front end of tank 10 and firmly mounted on platform 11, and this motor has its drive shaft connected through a suitable drive coupling 51 with oil pump 21. A suitable manually operated switch 55 is provided for controlling the energization of the motor and the supply of heating current to heating elements 52 and 53 mounted in the bottom portion of tank 10. Control 28, instead of controlling valve 23, controls a switch 54 which regulates the supply of heating current to heating elements 52 and 53 so that heating current will be supplied when the device is in operation and the temperature of the oil in storage tank 10 is below the temperature for which control 28 is set. The modified form of the device is used in the same manner as the first described form, the main difference being that the modified form can be used only in locations where suitable electric power is available while the engine driven form can be used in substantially any location.

We claim:

1. An engine pre-oiling apparatus comprising, in combination, a reservoir for containing lubricating oil, an internal combustion engine having an exhaust conduit having a vent, a coil within said reservoir connected to said exhaust conduit for receiving hot exhaust gases from said internal combustion engine for heating the oil, a valve selectively directing exhaust gas from said engine to said coil or said vent, and means responsive to the temperature of oil in said reservoir controlling said valve to regulate the supply of exhaust gas to said coil, and means driven by said engine supplying and circulating the oil between said reservoir and an engine being pre-oiled.

2. A pre-oiling apparatus for a dry sump engine comprising a mobile support, a heat insulated tank mounted on said support and constituting an oil reservoir, a pump having an inlet within said reservoir and an outlet outside of said reservoir, a power plant carried by said support and drivingly connected to said pump, flexible conduit means extending from the outlet of said pump for connecting the pump outlet to the oil inlet port of an engine, flexible conduit means extending from said tank for connecting the interior of said tank to an engine oil sump, oil heating means disposed within said tank, and control means responsive to the temperature of the oil within said tank to discontinue operation of said oil heating means whenever the oil in said tank is heated to a predetermined temperature, said control means comprising an electromagnetic device effective to interrupt the flow of heating medium to said tank, and a switch responsive to the temperature of the oil in said tank and connected to said electromagnetic device for energizing and de-energizing said device.

3. A pre-oiling apparatus for a dry sump engine independent of the normally provided engine lubricating oil comprising a mobile support, a heat insulated tank mounted on said support and constituting an oil reservoir, a pump having an inlet within said tank and an outlet outside of said tank, an adjustable pressure regulating valve connected to the pump outlet and having a pressure outlet and a pressure relief outlet, conduit means connecting the pressure relief outlet to the interior of said tank and including a nozzle disposed within said tank for directing pressure relief oil flowing therethrough in a direction to cause circulation of the oil in said tank; a manually operated cut-off valve connected to said pressure regulating valve and effective when closed to return all of the oil delivered by said pump through said pressure relief valve and back to said tank for circulating the oil in the tank while such oil is being heated, a flexible oil pressure conduit extending from said cut-off valve for connection to an engine oil inlet port, a flexible oil return conduit extending from said tank for connecting an engine sump to said tank, oil heating means in said tank, and means responsive to the temperature of the oil in said tank controlling said oil heating means to maintain the temperature of oil in said tank at a preselected value.

4. A unitary, self-supported pre-oiling apparatus for treating different dry sump aircraft engines with preheated lubricating oil or engine pickling fluid comprising a mobile support, a tank mounted on said support constituting a reservoir for lubricating oil or pickling fluid, heating means in said tank, means responsive to the temperature of the contents of said tank controlling said heating means to maintain the temperature of said contents at a preselected value, a pump carried by said support and having an inlet connected to the interior of said tank and an outlet outside of said tank, an adjustable pressure regulating valve connected to the outlet of said pump, a pump driving power plant carried by said support, an adjustable cut-off valve connected to the outlet of said pressure regulating valve, a flexible pressure conduit connected at one end to the outlet of said cut-off valve and adapted to be connected at its other end to the pre-oiling inlet port of an engine to be treated, and a return conduit connected at one end to the interior of said tank and adapted to be connected at its other end to the oil sump of an engine to be treated.

5. A unitary self-supported apparatus for pre-oiling aircraft engines prior to starting such engines in cold weather comprising a mobile support, a tank carried by said support constituting a lubricating oil reservoir, a pressure pump having an inlet connected with the interior of said tank and an outlet, a pressure relief valve connected to the outlet of said pump and having a pressure outlet and a vent outlet connected to the interior of said tank in a

manner to create circulation of the oil in said tank, conduit means connected to the pressure outlet of said relief valve and adapted to be connected to the oil inlet ports of engines to be pre-oiled, conduit means connected to the interior of said tank for returning oil from engines being pre-oiled to said tank, a pump driving power plant carried by said support, and thermostatically controlled oil heating means in said tank.

6. A unitary self-supported pre-oiling apparatus for treating dry sump aircraft engines with preheated lubricating oil prior to starting the engines comprising a mobile support, a tank carried by said support constituting a lubricating oil reservoir, oil heating means in said tank comprising a tubular coil, a pump having an inlet connected to the interior of said tank and an outlet adapted to be connected to the pre-oiling inlet ports of engines to be treated, a pump driving internal combustion engine carried by said support, means including a valve effective to connect the exhaust of said pump driving engine to said tubular coil or to vent the engine exhaust to atmosphere, means responsive to the temperature of the contents of said tank controlling said valve to maintain the contents of said tank at a preselected temperature while said pump driving engine is in operation, and conduit means connected to the interior of said tank and adapted to be connected to the oil sumps of engines to be treated for returning oil to said tank.

7. An engine pre-oiling apparatus comprising, in combination, a reservoir for containing lubricating oil, an internal combustion engine having an exhaust conduit, a heating coil within said reservoir connected to said exhaust conduit for receiving hot exhaust gases from said internal combustion engine for heating the oil in said reservoir, an actuator responsive to the temperature of the oil in said reservoir, a source of electrical energy, a solenoid connected to said source of electrical energy and energized by said actuator, a valve interposed between said exhaust conduit and said heating coil and having a plurality of passages, and means connecting said solenoid to said valve to selectively connect said passages for directing exhaust gas through said heating coil or for discharging exhaust gas to the atmosphere before entering said coil to thereby control the heating of the oil in said reservoir by hot exhaust gases passing through said heating oil.

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CERTIFICATE OF CORRECTION

Patent No. 3,066,664 December 4, 1962

Daniel Joseph McNew et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, lines 3 to 5, for "Daniel Joseph McNew, Rte. 1, Box 414C, Enterprise, Ala., and Emory Fred Sheffield, 140 Hermitage Road, Newport News, Va." read -- Daniel Joseph McNew, Rte. 2, Enterprise, Ala., and Emory Fred Sheffield, 146 Hermitage Road, Newport News, Va. --.

Signed and sealed this 2nd day of April 1963.

(SEAL)

Attest:

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Attesting Officer

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