Sept. 11, 1923. 1,467,331

E. F. McDONALD ET AL.

LIQUID CIRCULATING PUMP

Filed Aug. 24, 1921

Fig. 1.

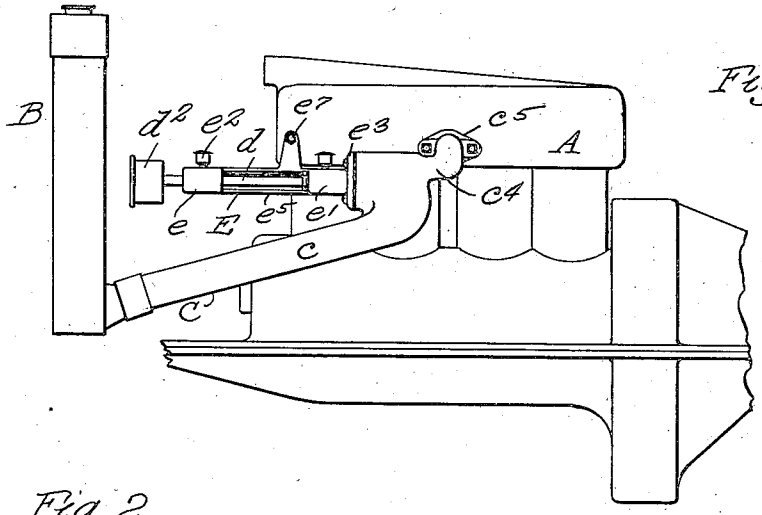


Fig. 2.

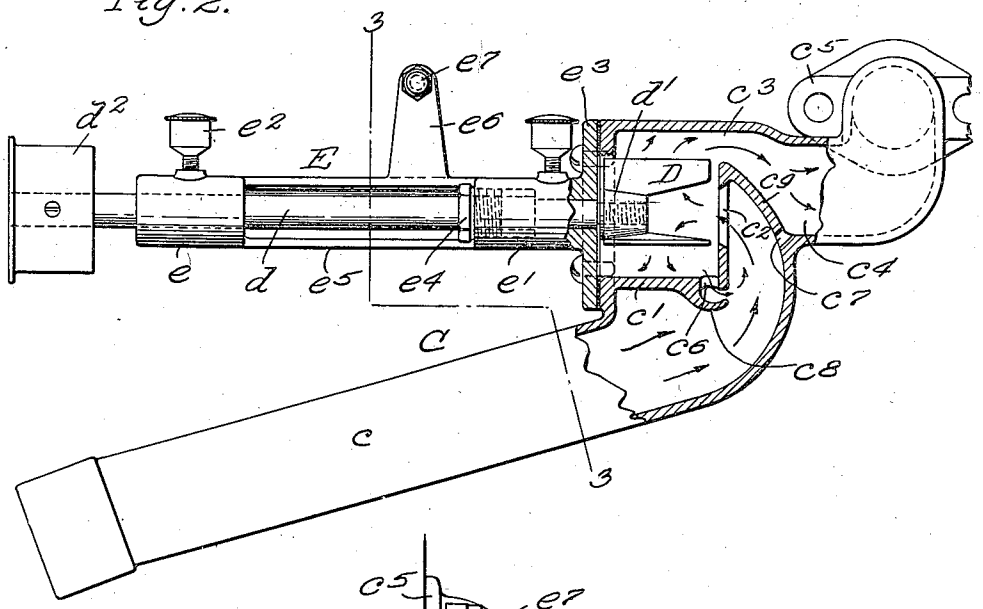
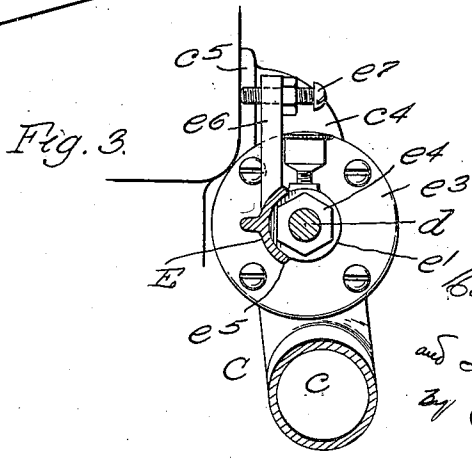


Fig. 3.



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UNITED STATES PATENT OFFICE.

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LIQUID-CIRCULATING PUMP.

Application filed August 24, 1921. Serial No. 494,924.

To all whom it may concern:

Be it known that we, EDWARD F. McDONALD, HOWARD KLEIN, and LUCIEN L. HAAS, citizens of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a certain new and useful Improvement in Liquid-Circulating Pumps, of which the following is a specification.

This invention relates to pumps of the kind commonly used for circulating a cooling liquid through the water jackets of an internal combustion engine.

The objects of the invention are to provide a pump of this kind of improved construction, which is reliable in operation and in which the difficulty of lubricating the bearings is successfully overcome; also to so mount the bearing bracket for the rotary shaft of the pump that the pressure exerted on this shaft will not tend to place strains on those parts of the pump which are likely to be damaged thereby; also to provide a pump of this kind in which the usual loss of power due to the water pressure through the drain hole in the pump casing is materially decreased; also to improve the construction of pumps of this kind in the other respects hereinafter specified.

In the accompanying drawings:

Fig. 1 is a side elevation of a pump embodying the invention, showing the same applied to an engine.

Fig. 2 is a side elevation thereof, partly in section, on an enlarged scale.

Fig. 3 is a transverse sectional elevation thereof on line 3—3, Fig. 2.

A represents an internal combustion engine of any suitable kind having jackets for the circulation of water or other suitable cooling medium, and B represents a radiator in which the temperature of the cooling medium is reduced. The engine and radiator may be of any suitable construction and constitute no part of this invention. The pump embodying this invention is intended to pump the cooling medium from the radiator to the engine jackets, although the pump may be used for other purposes, if desired.

The pump shown in the drawings comprises two main parts or units, namely, a flow passage member C which is preferably made of a single piece or casting, and an impeller supporting part which includes an impeller or rotor D, a shaft d therefor, and a bearing bracket E in which the shaft is rotatably mounted. The flow passage member C includes a tube c, which is suitably connected with the radiator B to receive the cooling medium therefrom and which terminates in a pump or impeller casing c' which is substantially cylindrical in form and which has a central inlet opening c^2 for the cooling medium and an outlet opening c^3 adjacent to the peripheral portion thereof. The cooling medium discharged from the pump casing through the outlet opening c^3, due to action of the impeller D, enters into a passage or tube c^4, from which it is discharged into the engine jackets. The tube c^4 is preferably provided with a flange c^5 which can be bolted or otherwise secured to the engine to form a water tight joint between the engine and the flow passage member C and to support this member in operative relation to the engine.

In order to make it possible to drain all of the cooling medium from the pump and engine, the pump casing c' and the discharge tube c^4 are preferably provided with drain holes c^6 and c^7 respectively which are arranged in the lowest parts of the casing and discharge tube so that the cooling medium may drain from these parts by gravity. In order to prevent these drain holes from interfering with the efficiency of the pump, the following construction is preferably employed: The outer wall of the impeller casing is provided with a deflecting lip or projection c^8 which extends below the drain hole c^6 and which is so formed as to direct the liquid discharged from the drain hole c^6, due to the centrifugal action of the impeller, in the direction of flow of the liquid passing to the pump, instead of against the direction of flow, as would be the case if the deflecting lip were omitted. In this manner, most of the energy of the water discharged through the drain hole c^6 is recovered. In the case of the drain hole c^7, loss of efficiency is avoided by the curvature of the wall or partition c^9 which divides the intake passage c from the discharge tube or passage c^4. By giving this partition the curvature shown, it not only guides the liquid into the intake or opening c^2 of the impeller casing, but also guides the liquid in the discharge passage c^4 in such a direction as to cause this liquid to

exert no pressure in the direction of the drain hole c^7, but rather to tend to form a suction in the immediate vicinity of this drain hole so that when the pump is in operation there is very little if any loss of efficiency due to the flow of liquid through the drain hole.

The impeller D may be of any suitable construction, that shown having three blades mounted on a hub d', which is suitably secured on one end of the shaft d, the opposite end of this shaft being provided with a pulley d^2 which is connected by a belt or other means to a rotary part of the motor (not shown). The shaft d is suitably journalled in the bearing bracket E, which for this purpose is provided with two bearings e e' projecting outwardly from the bracket E and spaced apart, preferably at the opposite ends of the bearing bracket E. The bearing e may be of any usual or suitable kind and is provided with a suitable lubricating device e^2. The bearing e' is provided at one end with a flange e^3 which is adapted to be bolted or otherwise secured to the impeller casing of the flow passage member C, and which forms one of the end walls of the casing. The flange e^3 forms the only connection between the two units or members of the pump and by disconnecting the flange from the flow passage member, the parts of the pump are rendered readily accessible. The part of the bearing opposite to the flange e^3 is provided with a packing member nut or bushing e^4 which forms a water and oil tight connection between the shaft and the bearing member. The arrangement of the bearings described is particularly desirable since the bearing e which operates under the greatest pressure, due to its proximity to the pulley d' is not subjected to the action of the cooling medium, as the bearing e' necessarily must be, and consequently good lubrication of the bearing e is assured. The two bearings are formed integral with and connected by a portion e^5 of the bearing bracket, this connecting member being so formed as to constitute substantially a continuation of the cylindrical portions of the bearings and is preferably of rounded or other cross section which resists the bending of the connecting member due to pressure on the pulley d^2.

The bearing bracket E is provided with the usual projection e^6, preferably formed integral with the connecting portion e^5 thereof, and provided with a set screw e^7 adapted to engage the engine frame or block for resisting the pressure exerted on the bearing bracket by the pull on the belt-engaging pulley d^2. By arranging the engine engaging projection on the bearing bracket E instead of on the flow passage member, the connection between the bearing bracket and the flow passage member is subjected to much less strain, so that the chance of leaks in this connection is greatly reduced. Also, by forming the two bearings on the bearing bracket, these bearings cannot get out of alinement, due to the forces acting on the pulley d' and on the projection e^6. The bearing projection e^6 and the set screw e^7 may be entirely omitted, if desired, since the flange e^3 affords sufficient support for the bearing bracket E without the use of a part on the bracket engaging the engine.

The pump described is very efficient in operation, due to the fact that losses in power due to the flow of liquid through the drain holes is greatly reduced owing to the construction of the flow passage member, and due to the fact that efficient lubrication of the impeller shaft bearings is insured and that the binding of the shaft in its bearings is prevented. The construction of the pump is such that the parts or units thereof can be readily taken apart to render the impeller and the impeller casing accessible, and the parts are so arranged that the strains on the connection between the two units is reduced to a minimum. The pump also has the advantage that the impeller and impeller casing offer very little resistance to the flow of liquid so that if the impeller is not rotated, the circulation of the cooling liquid will continue, due to the thermo-syphon action.

We claim as our invention:

1. In a pump for insertion in the fluid circulating cooling system of internal combustion engines, the combination of a flow passage member having an impeller casing provided with an open side and inlet and outlet passages, an impeller including an impeller support, an impeller shaft, bearings for said shaft which are spaced apart and separated from each other by an intervening space, said support including a rigid connecting member forming substantially a continuation of said bearings and formed integral therewith, said impeller support having a portion adapted to support said impeller in said impeller casing and to close the open side of said impeller casing, means for connecting a portion of said flow passage member adjacent its outlet passage to the engine, said rigid connecting member of the impeller support being spaced from contact with the outside of the engine.

2. In a pump for insertion in the fluid circulating cooling system of internal combustion engines, the combination of a flow passage member having an impeller casing provided with an open side and inlet and outlet passages, an impeller including an impeller support, an impeller shaft, bearings for said shaft which are spaced apart and separated from each other by an intervening space, said support including a rigid con-

necting member forming substantially a continuation of said bearings and formed integral therewith, said impeller support having a portion adapted to support said impeller in said impeller casing and to close the open side of said impeller casing, means for connecting a portion of said flow passage member adjacent its outlet passage to the engine, a wall separating said inlet passage and said impeller casing, and a wall separating said inlet passage and said outlet passage, each of said walls having drainage holes in the lower portions thereof.

3. In a pump for insertion in the fluid circulating cooling system of internal combustion engines, the combination of a flow passage member having an impeller casing, inlet and outlet passages communicating with said impeller casing, and a wall separating said inlet and outlet passages and extending above the lower portion of said outlet passage, said wall having a drain hole in the lower part thereof communicating with said inlet and outlet passages, whereby when the system is drained, the liquid may drain out of said outlet passage, said wall in proximity to said drain hole being formed to direct the flow of liquid to tend to draw liquid from said inlet passage through said hole to said outlet passage when the system is in operation.

4. In a pump, the combination of a flow passage member having an impeller casing having an axial inlet opening for the liquid, an impeller having a support including a shaft and bearings spaced apart and separated by an intervening space, a rigid member integral with portions of said bearings and connecting said spaced bearings whereby said bearings are mounted in permanent alinement, an inlet passage extending along said casing and leading to said inlet opening, a drain hole in the peripheral portion of said casing connecting said casing with said inlet passage, an integral projecting part on said casing extending into operative relation to said drain hole to deflect liquid discharged therefrom in the direction of the flow of liquid in said inlet passage.

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