

May 17, 1949.

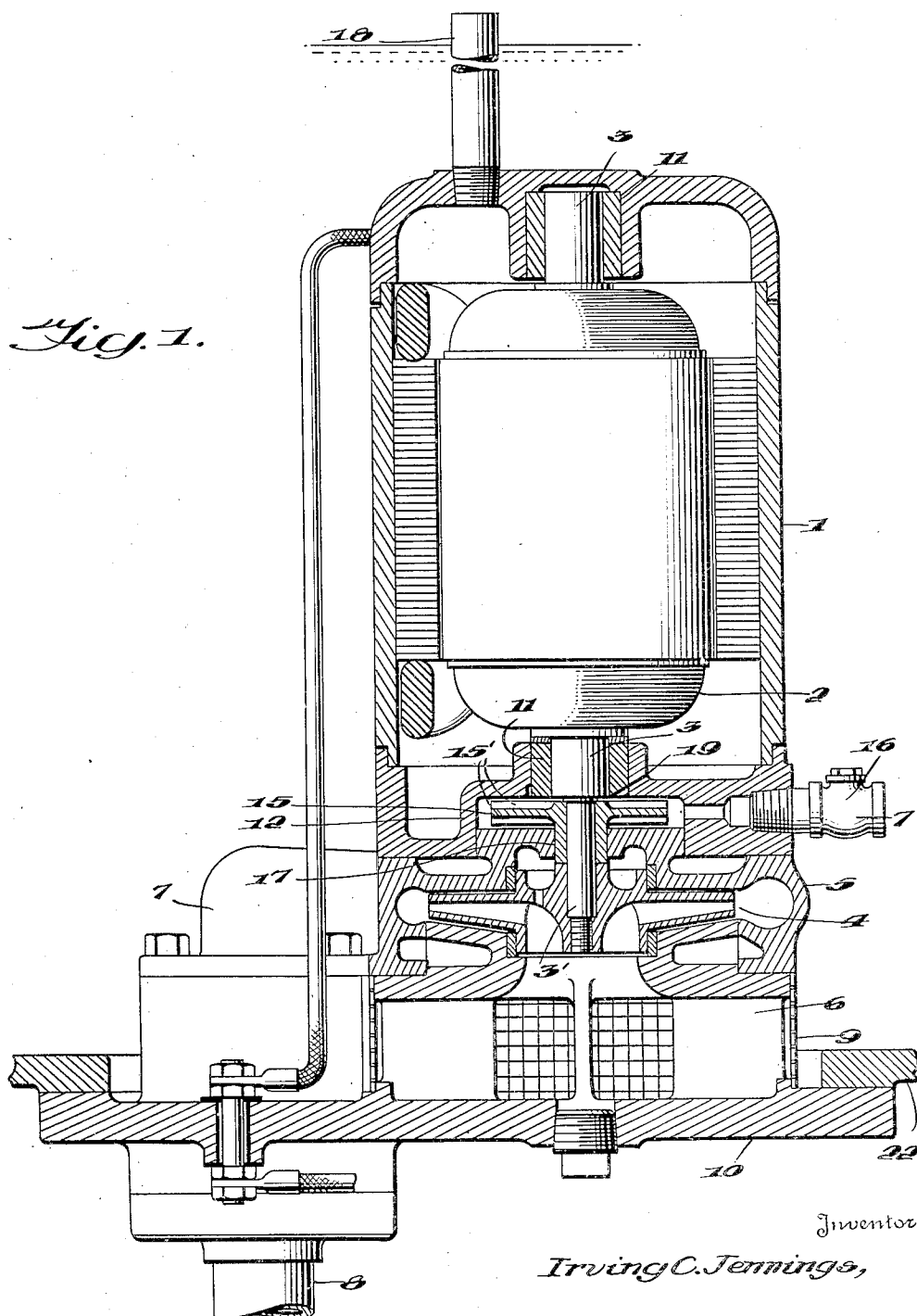
I. C. JENNINGS

2,470,563

PUMP

Filed Jan. 3, 1944

3 Sheets-Sheet 1



Inventor

Irving C. Jennings,

By Chas. E. Rindow Attorney

Attorney

May 17, 1949.

I. C. JENNINGS

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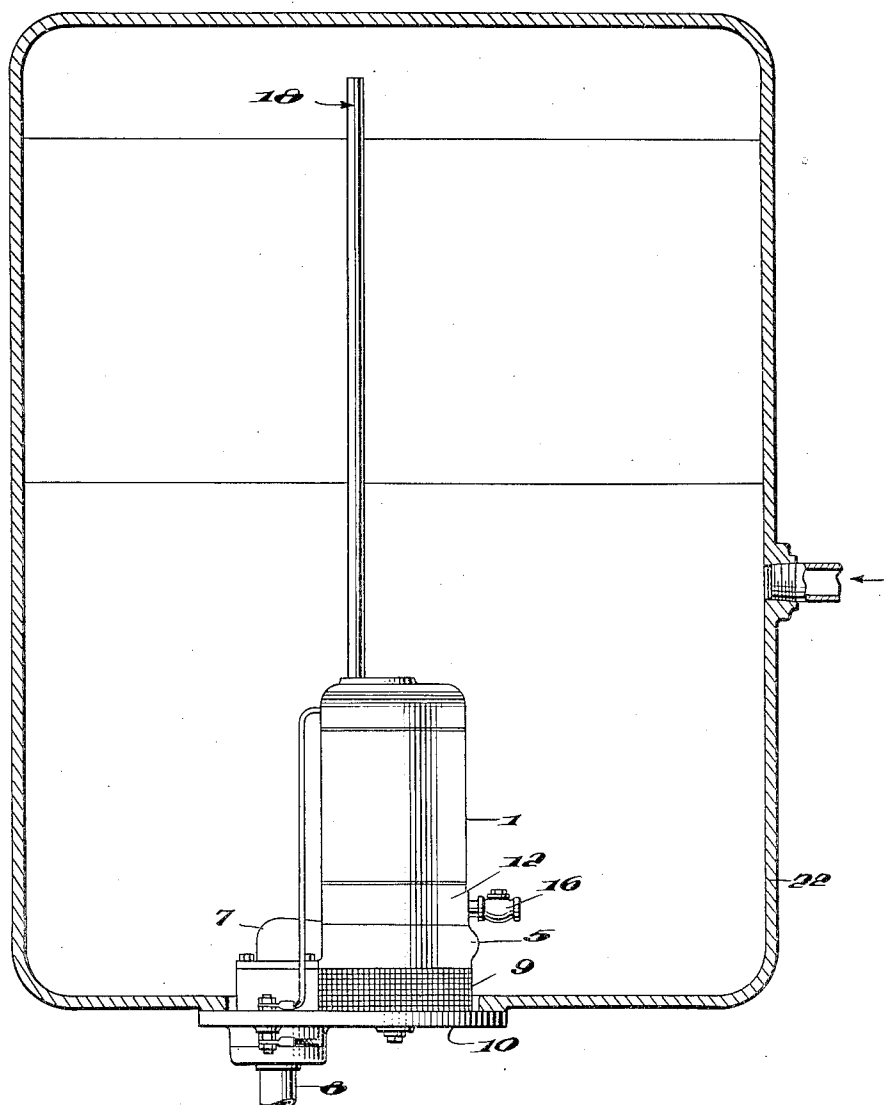


Fig. 2.

Inventor

Irving C. Jennings,

By Chas. E. Rader

Attorney

May 17, 1949.

I. C. JENNINGS

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PUMP

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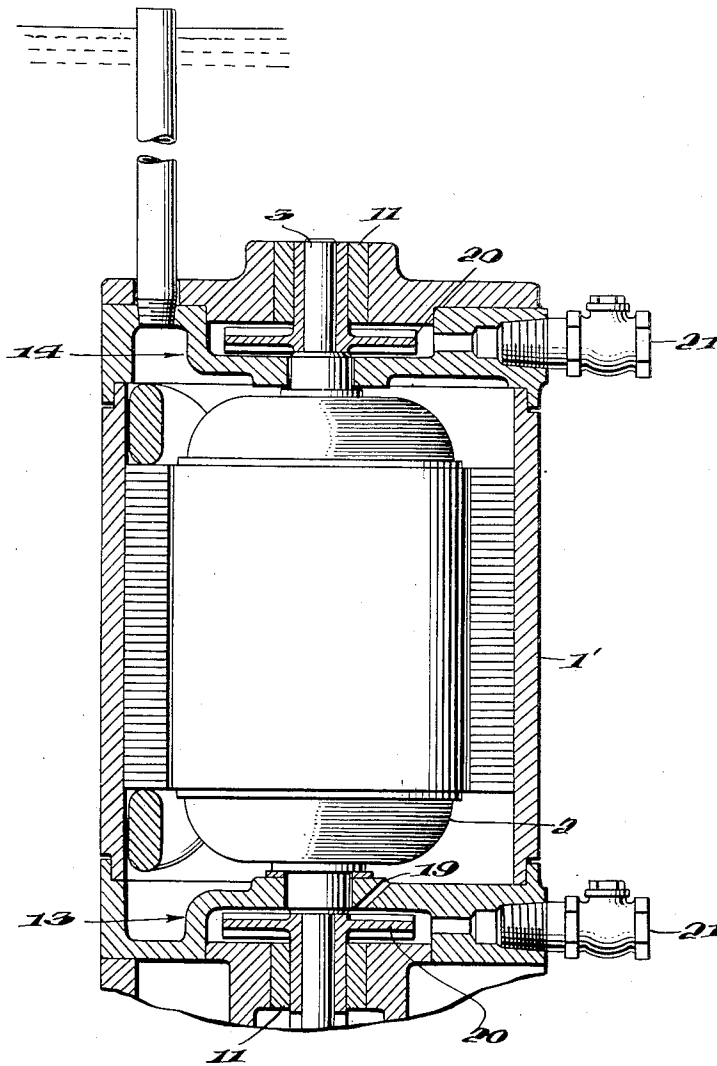


Fig. 3.

Inventor

Irving C. Jennings

By *Charles E. Rindus*

Attorney

UNITED STATES PATENT OFFICE

2,470,563

PUMP

Irving C. Jennings, South Norwalk, Conn.

Application January 3, 1944, Serial No. 516,787

6 Claims. (Cl. 103—87)

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This invention relates to improvements in electric pumps of the type adapted to be submerged in a liquid during operation thereof, for example, within the fuel tank of an airplane.

When it is desired to employ a booster pump in connection with a tank containing a solution, oftentimes volatile, and sometimes subject to pressure on the liquid, usually with low suction head, it is customary to mount a high speed, electrically operated centrifugal pump entirely within the tank in order to eliminate stuffing boxes with their attendant annoyances, such as leakage and development of friction, and to save space.

The primary object of the present invention is to provide a pump of the character aforesaid wherein drag is largely eliminated with consequent economy and increased efficiency in operation.

A further and more specific object of the invention is to accomplish the aforesaid result by preventing ingress of liquid to the motor during operation of the pump, and by automatically removing from the motor upon starting the same any liquid that seeps thereinto during periods of rest.

In the accompanying drawing:

Figure 1 is a vertical section through a pump in accordance with this invention in applied position.

Figure 2 is a reduced vertical section through a container showing a pump in accordance with this invention mounted therein.

Figure 3 is a fragmentary section similar to Figure 1 showing a slightly modified form of pump.

Referring to the drawing in detail, with particular reference to Figure 1, the numeral 1 indicates a motor housing which contains an armature 2 mounted on a shaft 3 supported in preferably self-lubricating bearings 11 adjacent the ends of the armature. As shown, the shaft 3 is provided with a reduced portion 3' upon which is mounted a centrifugal pump impeller 4 housed within a volute casing 5. The pump has an inlet 6, and discharges through an outlet passage 7 to a lead-off pipe 8, the latter being located outside the container or tank 22. Surrounding the inlet 6 is a strainer 9 having an open end abutting against a removable closure plate 10 for an opening in the container 22, the plate being detachably connected with the container in any suitable manner. The entire pump assembly is fixedly mounted on the plate 10 so that the same

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may be readily removed for inspection or repairs.

Disposed between the casings 1 and 5 is an auxiliary centrifugal pump 12 having an impeller 15 preferably in the form of a disc provided on its side faces with blades 15'. During rotation of the shaft, any liquid seeping past the impeller hub clearance indicated at 17 is picked up by the impeller 15 and discharged through a check valve 16 into the container 22.

During periods of rest, liquid will seep past the clearance into the casing 1 gradually filling the same, but upon starting the motor this liquid will be drawn through a passage 19 into the pump 12 and then discharged through the check valve 16.

The casing 1 is provided with a vent pipe 18 so that it is only necessary for the auxiliary pump 12 to overcome the static head of the liquid within the casing 1. Any superimposed pressure, which often is very high in enclosed tanks, is balanced.

The modification shown in Figure 3 is designed for use when it is desired to flow liquid through the armature shaft bearings 11 to cool or lubricate the same. In this modification, the upper end of the casing 1' is open, and the shaft 3 has mounted thereon an auxiliary pump adjacent each end of the casing. Such pumps are designated by the numerals 13 and 14, and each of which is disposed inwardly of the adjacent bearing 11. During rotation of the shaft 3, as well as during periods of rest, liquid may seep past the bearings to cool or lubricate the same, such seepage being picked up by the impellers 20 of the pumps 13 and 14 and discharged through check valves 21. Any liquid collecting within the casing during periods of rest is evacuated through the passage 19 by the auxiliary pump 13.

Since the auxiliary pump is relatively small, with only a small amount of liquid at low head being handled, the power required to drive the same is very small. Except immediately after starting the motor after a period of rest, the armature 2 turns freely in air or gas with only negligible friction whereby the efficiency of the entire unit is increased while the power required to operate the same is decreased.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a motor driven pump unit of the type adapted to be operated while submerged in a liquid, the combination comprising a casing pro-

vided with upper and lower end walls to define a motor chamber substantially sealed against the inflow of liquid, an electric motor in said chamber having a rotor and an upright shaft on which said rotor is mounted, bearings for said shaft, one of said bearings being mounted in said lower casing wall, a main rotary pump outside said motor chamber driven from said motor shaft, a rotary auxiliary pump outside said motor chamber and below said last-mentioned bearing, driven from said motor shaft, and having a rotor with its suction side in communication with the interior of said motor chamber through the relative slide faces of said last-mentioned bearing, whereby leakage liquid is drawn by said auxiliary pump from said motor chamber and along said bearing faces, and a gas vent pipe for said motor chamber adapted to extend above the surface of the pump submerging liquid to prevent pressure build-up in said chamber greater than that directly above the surface of the submerging liquid.

2. In a motor driven pump unit of the type adapted to be operated while submerged in a liquid, the combination comprising a casing provided with upper and lower end walls to define a motor chamber substantially sealed against the inflow of liquid, an electric motor in said chamber having a rotor and an upright shaft on which said rotor is mounted, bearings for said shaft, one of said bearings being mounted in said lower casing wall, a main rotary pump outside said motor chamber driven from said motor shaft, and a rotary auxiliary pump outside said motor chamber and below said last-mentioned bearing, driven from said motor shaft, and having a rotor with its suction side in communication with the interior of said motor chamber through the relative slide faces of said last-mentioned bearing, whereby leakage liquid is drawn by said auxiliary pump from said motor chamber and along said bearing faces, the stationary part of said lower casing wall having a passage between the motor chamber and the suction side of the rotor of said auxiliary pump separate from the leakage route defined by said bearing faces, said passage serving to evacuate the motor chamber through the action of said auxiliary pump.

3. In a motor driven pump unit of the type adapted to be operated while submerged in a liquid, the combination comprising a casing provided with upper and lower end walls to define a motor chamber substantially sealed against the inflow of liquid, an electric motor in said chamber having a rotor and an upright shaft on which said rotor is mounted, bearings for said shaft, one of said bearings being mounted in said lower casing wall, a main rotary pump outside said motor chamber driven from said motor shaft, and a rotary auxiliary pump outside said motor chamber and below said last-mentioned bearing, driven from said motor shaft, and having a rotor with its suction side in communication with the interior of said motor chamber through the relative slide faces of said last-mentioned bearing, whereby leakage liquid is drawn by said auxiliary pump from said motor chamber and along said bearing faces, said main pump being disposed below said auxiliary pump, and including a rotor, a shaft for said latter rotor coaxial with and driven from said motor shaft, and a bearing for said main pump shaft between the rotor of said auxiliary pump and the rotor of said main pump shaft, the rotor of said auxiliary pump having a suction side in communication with the slide faces of said

latter bearing, whereby leakage liquid is drawn by said auxiliary pump from the chamber of the main pump and along said latter bearing faces.

4. In a motor driven pump unit of the type adapted to be operated while submerged in a liquid, the combination comprising a casing provided with upper and lower end walls to define a motor chamber substantially sealed against the inflow of liquid, an electric motor in said chamber having a rotor and an upright shaft on which said rotor is mounted, bearings for said shaft, one of said bearings being mounted in said lower casing wall, a main rotary pump outside said motor chamber driven from said motor shaft, a rotary auxiliary pump outside said motor chamber and below said last-mentioned bearing, driven from said motor shaft, and having a rotor with its suction side in communication with the interior of said motor chamber through the relative slide faces of said last-mentioned bearing, whereby leakage liquid is drawn by said auxiliary pump from said motor chamber and along said bearing faces, the other bearing of said motor shaft being mounted in said upper casing wall and having the upper end of its relative slide faces exposed for direct communication with the submerging liquid, a second auxiliary pump at the upper end of the casing, having a rotor on said motor shaft between said upper bearing and the rotor of said motor, the rotor of said second auxiliary pump having its suction side in communication with the bearing slide faces of said upper bearing to draw liquid from the body of submerging liquid and along said last-mentioned slide faces.

5. In a motor driven pump unit of the type adapted to be operated while submerged in a liquid, the combination comprising a casing provided with upper and lower end walls to define a motor chamber substantially sealed against the inflow of liquid, an electric motor in said chamber having a rotor and an upright shaft on which said rotor is mounted, bearings for said shaft, one of said bearings being mounted in said lower casing wall, a main rotary pump outside said motor chamber driven from said motor shaft, a rotary auxiliary pump outside said motor chamber and below said last-mentioned bearing, driven from said motor shaft, and having a rotor with its suction side in communication with the interior of said motor chamber through the relative slide faces of said last-mentioned bearing, whereby leakage liquid is drawn by said auxiliary pump from said motor chamber and along said bearing faces, a gas vent pipe for said motor chamber adapted to extend above the surface of the submerging liquid to prevent pressure build-up in said chamber, said lower casing wall having a passage between the motor chamber and the suction side of the rotor of said auxiliary pump separate from the leakage route defined by said bearing faces, said passage serving to evacuate the motor chamber through the action of said auxiliary pump, and said main pump being disposed below said auxiliary pump and including a rotor, a shaft for said rotor coaxial with and driven from said motor shaft, and a bearing for said main pump shaft between the rotor of said auxiliary pump and the rotor of said main pump shaft, the rotor of said auxiliary pump having a suction side in communication with the slide faces of said latter bearing, whereby leakage liquid is drawn by said auxiliary pump from the chamber of the main pump and along said latter bearing faces.

6. In a motor driven pump unit of the type adapted to be operated while submerged in a liquid, the combination comprising a casing provided with upper and lower end walls to define a motor chamber substantially sealed against the inflow of liquid, an electric motor in said chamber having a rotor and an upright shaft on which said rotor is mounted, bearings for said shaft, one of said bearings being of the cylindrical sleeve type and being mounted on said lower casing wall, a main rotary pump outside said motor chamber driven from said motor shaft, and a rotary auxiliary pump outside said motor chamber and below said last-mentioned bearing, driven from said motor shaft, and having a rotor with its suction side in communication with the interior of said motor chamber through the relative cylindrical slide faces of said last-mentioned bearing, whereby leakage liquid is drawn by said auxiliary pump from said motor chamber and along said bearing faces.

IRVING C. JENNINGS.

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