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INCLOSED SUBMERSIBLE MACHINE

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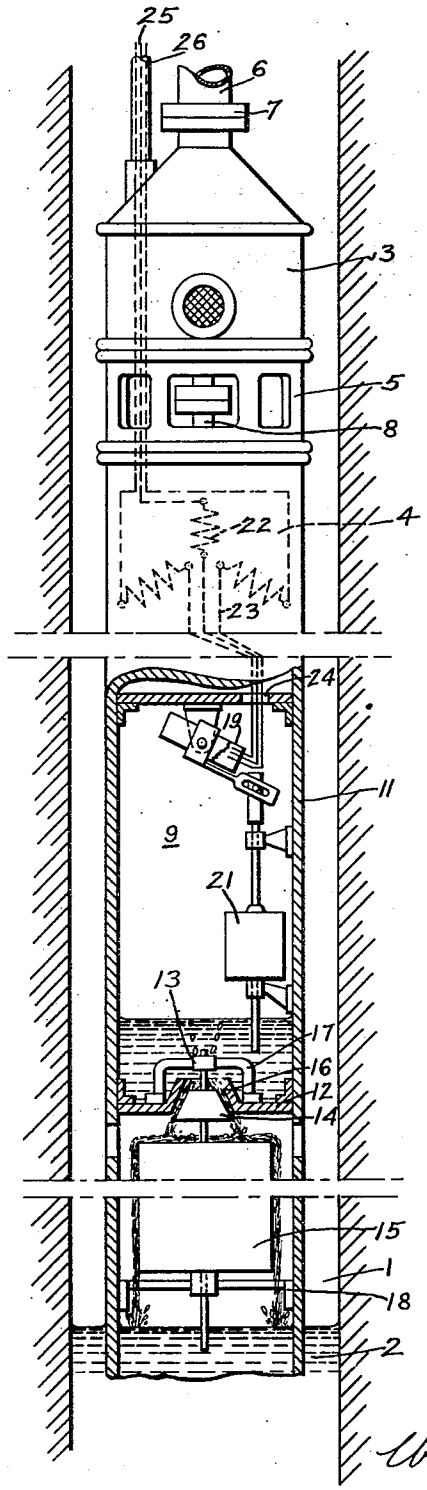

INVENTORS
Victor Gutmann and
Ludwig Steiner
BY
Wesley G. Carr
ATTORNEY

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VICTOR GUTMANN, OF NUREMBERG, AND LUDWIG STEINER, OF BERLIN, GERMANY, ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

INCLOSED SUBMERSIBLE MACHINE

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This invention relates generally to inclosed electrical machines for operation under water and more particularly to submersible electric motors.

In operating an electrical machine submerged in a liquid, such, for example, as a submersible pumping equipment for oil wells, special provision must be made to prevent the motor casing from filling with water or oil to such a degree as to result in injury to the motor windings.

Various means have been provided for removing leakage fluid from the motor casing, either continuously or intermittently, depending upon the particular structure utilized. In the first instance, the leakage fluid is collected in a reservoir located at the bottom of the motor casing from which it is discharged into the well by means of a high-pressure centrifugal pump actuated from the the motor shaft.

In removing the leakage fluid intermittently, a collecting reservoir is provided at the bottom of the motor casing and a suitable electric heater element is disposed therein to effect vaporization of the collected fluid. The supply of current for the electric heater element is controlled by a switch responsive to the fluid level in the reservoir. The heater element is energized and transforms the fluid into vapor which is discharged, under its own pressure, through a check valve, into the well.

The object of the present invention, generally stated, is to provide means for excluding leakage fluid from a submersible type electrical machine which shall be simple and economical to manufacture and operate.

A more specific object of the invention is to provide for collecting and discharging leakage fluid from the inclosing casing of a submersible-type electrical machine.

Another object of the invention is to provide for automatically interrupting the supply circuit of a submersible-type electrical machine to prevent the occurrence of a flash-over caused by excessive amounts of leakage fluid entering the machine casing.

A further object of the invention is to provide for indicating above ground when the inclosing casing of a submersible-type electrical machine becomes filled to a predetermined height with leakage liquid.

Other objects of the invention will become evident from the following description, taken in conjunction with the accompanying drawing in which the single figure is a view partly in section and partly in side elevation, of a submersible-type electrical pumping equipment showing details of construction.

Referring to the drawing, the numeral 1 designates a portion of a bore hole or well partly filled with a fluid 2.

In order to pump the fluid, an electrical pumping set comprising a centrifugal or screw pump 3 and a motor 4 for actuating the pump is provided. As shown, the pump 3 and motor 4 are joined together in a unitary structure by means of the skeleton casting 5. The set may be suspended in the bore hole 1 by the pump tubing 6 which is connected to the discharge port of the pump 3 by means of the coupling member 7.

Since it is practically impossible to construct a perfect fluid-tight packing for the motor drive shaft 8, a reservoir 9 is provided at the bottom of the motor casing in which all of the leakage fluid which enters the casing of the motor 4 may be collected.

In this embodiment of the invention, the reservoir 9 for collecting the leakage fluid is formed by extending the motor casing to provide a cylindrical member 11, as shown. The reservoir 9 is provided with a bottom 12 provided with an opening 13 through which leakage fluid may be discharged into the well or bore hole.

The discharge of the fluid through the opening 13 may be controlled by any suitable valve mechanism, and, in this particular embodiment of the invention, a fluid-actuated valve, comprising a movable valve member 14 and an actuating float 15 is provided.

As shown, the valve member 14 is disposed to be urged upwardly into engagement with the valve seat 16 when the float 15 is submerged in the fluid 2 and is actuated to its open or discharge position when the float 15 is raised above the fluid level. Guide members 17 and 18 are provided for maintaining

the valve mechanism in proper position to insure reliable operation.

In the preferred embodiment of the invention, the float 15 extends downwardly for a considerable distance below the bottom of the reservoir 9 in order that the discharge opening may be closed and sufficient pressure exerted upon the movable valve member 14 before the submersion of the motor.

It will be readily understood that, after the pumping set has been submerged and in operation for a considerable length of time, the natural leakage which occurs, gradually tends to fill the reservoir 9 and, if allowed to accumulate indefinitely, the fluid level will rise into the motor casing 4 and cause serious damage to the motor windings. Therefore, in order to indicate to the operator the quantity of leakage fluid which has collected in the reservoir 9, a suitable signalling or indicating system is provided.

In this particular embodiment of the invention, the signalling is accomplished by automatically stopping the motor 4 when the leakage fluid has risen to a predetermined height in the reservoir 9. As shown, a mercury switch 19 is mounted within the casing and disposed to be actuated by a float 2. The phase windings 22 of the motor 4 are connected to a star point in the mercury switch 19 through a plurality of leads 23 which extend from the phase windings 22 through a suitable opening 24 in the top of the reservoir 9, as shown. The mercury switch 19 is normally closed but may be actuated to the open position to interrupt the motor supply circuit when the fluid level in the reservoir 9 reaches a predetermined height. As shown, the motor-supply circuit comprises a plurality of conductors 25 which extend from a suitable source of power on the surface. The conductors 25 are run through a moisture-proof conduit 26 for protection against moisture and other harmful agents.

The interruption of the motor-supply circuit indicates to the operator that the reservoir has become filled with leakage fluid to a dangerous height which necessitates raising the motor out of the fluid 2 in order to cause operation of the valve member 14 to permit the leakage fluid to discharge from the reservoir 9.

It will be readily understood also that various current-responsive trip mechanisms may be utilized to open the supply switch of the motor at the top of the well thereby de-energizing the motor windings to prevent flashover in the event the leakage fluid comes into contact with motor windings. Furthermore, since the motor packing is more effective when the shaft is not turning, the automatic stopping of the motor will reduce the leakage of fluid into the motor casing until the pump can be raised and the collected fluid discharged, as described hereinbefore.

We would state, in conclusion, that, while the illustrated example constitutes a practical embodiment of our invention, we do not limit ourselves strictly to the exact details herein illustrated since modifications of the same may be made without departing from the spirit of the invention as defined in the appended claims.

We claim as our invention:

1. In a submersible electrical machine, in combination, a pump for pumping fluids, a motor for operating the pump, a casing for inclosing the motor, said casing being provided with a reservoir for collecting leakage fluid, means for discharging leakage fluid from the reservoir when the motor casing is raised out of the fluid, and means responsive to the level of the fluid in the reservoir for controlling the operation of the motor.

2. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir for collecting leakage fluid carried by the motor casing, means for discharging fluid from the reservoir when the motor casing is raised out of the fluid, and means provided within the reservoir for stopping the motor and thereby indicating when the motor casing should be raised to cause a discharge of the leakage fluid from the reservoir.

3. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir carried by the casing for collecting leakage fluid, a discharge opening in the reservoir, fluid-actuated means for closing the discharge opening when the motor casing is submersed, and fluid-actuated means within the casing for stopping the motor and thereby indicating when the motor casing should be raised to allow the discharge opening of the reservoir to open and discharge the leakage fluid from the reservoir.

4. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir carried by the casing for collecting leakage fluid, a float-actuated valve for controlling the discharge of leakage fluid from the reservoir, and means responsive to a predetermined quantity of leakage fluid in the reservoir for automatically stopping the motor.

5. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir carried by the casing for collecting leakage fluid, a float-actuated valve for discharging leakage fluid from the reservoir when raised out of the fluid, and means within the reservoir responsive to the height of the fluid level in the reservoir for automatically stopping the mo-

tor before the leakage fluid in the casing has reached the motor windings.

6. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir carried by the casing for collecting leakage fluid, and opening in the reservoir, a float-actuated device disposed to be controlled by the fluid outside the reservoir for automatically closing the discharge opening before the motor casing enters the fluid, and means responsive to the level of the fluid in the reservoir for stopping the motor and thereby indicating when the leakage fluid has collected in a predetermined quantity and for indicating when the leakage fluid has discharged from the reservoir after the opening of the discharge control device.

7. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir for collecting leakage fluid, an open sleeve portion at the bottom of said reservoir, a discharge port in the bottom of the reservoir communicating with the open sleeve portion, means disposed within the open sleeve portion for opening the discharge port when the casing is raised out of the fluid, and means responsive to fluid in the reservoir for stopping the motor and thereby indicating when the motor casing should be raised out of the fluid to permit the opening of the discharge port.

8. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir for collecting leakage fluid, and means for discharging fluid from the reservoir, said discharge means being disposed to automatically open and close when the motor casing is raised and submerged, respectively.

9. In a submersible electrical machine, in combination, a pump for raising fluids, a motor for operating the pump, a casing for inclosing the motor, a reservoir disposed beneath the motor for collecting leakage fluid, said reservoir having a discharge opening, and a float-actuated valve disposed to control the discharge opening, said float-actuated valve being disposed to close the discharge opening before the motor is submerged.

In testimony whereof, we have hereunto subscribed our names this 14th day of January, 1928.

VICTOR GUTMANN.
LUDWIG STEINER.