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METHOD OF FILLING SUBMERSIBLE PUMP MOTOR CHAMBERS

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This invention relates to submersible pumps and more particularly to a method for testing and filling submersible pump motor chambers.

The need for a satisfactory submersible pump for applications requiring long and continued operation, such as in septic tanks, sumps and the like has increased markedly in recent years. Difficulty has been experienced in providing satisfactory pumps for these uses because constant surveillance, maintenance and upkeep are not possible or economically feasible under normal conditions of use in homes and small and isolated locations, because service by experienced personnel is not readily available, and, most importantly because a satisfactory pump of this type must have low initial operating and maintenance costs and a long life and must be simple and compact in structure. It is also important that pumps for use in septic tanks, sumps and the like be protected against water condensation within the motor chamber in order to prevent shorting the motor or internal electrical system.

I have determined that submersible pumps for septic tanks and the like having the aforesaid desired requirements and characteristics are best obtained by providing a submersible pump which, interalia, has a gas filled submersible motor chamber in order to reduce operating costs below those experienced where oil or other liquid is used to fill the motor chambers. In order to be suitable for filling submersible pump motor chambers the gas should combine the features of having a maximum possible heat conductivity, in order to conduct the heat generated by long and continuous motor operation to the exterior of the motor chamber and pump and a low cost, so as to keep the initial costs of the pump within a range which will be competitive for the average householder and the gas should be non-flammable and non-explosive, so as to be safe for use by the ultimate and unskilled consumer and user and should be readily available to the manufacturer. Further the gas used must be and must remain absolutely dry in order to prevent any condensation of moisture on the motor coils or electrical circuit and switches within the motor chamber and the motor chamber itself must be leakproof against both exfiltration and infiltration in order to ensure that the gas remains within the motor chamber and that the liquid surrounding the pump and within the septic tank pump in which the pump is disposed does not enter the motor chamber.

I have found that nitrogen is particularly advantageous for the purpose of filling submersible pump motor chambers for use for the purposes and under the conditions set forth above for the reason that nitrogen combines all of the aforesaid desired characteristics to a good degree. Nitrogen is a good heat conductor, low in cost, abundant and readily available, non-explosive and readily obtained without difficulty due to federal and other government regulations and extra dry in order to eliminate moisture within the motor chamber. In contrast, for example, hydrogen is explosive and helium is difficult to obtain due to federal restriction.

It is essential, however, as noted above that the motor chamber be and remain leakproof during the life of the pump and the general object of this invention is to provide an improved method for filling submersible pump motor chambers which is readily and economically used; which ensures that there are no leaks in the motor chamber; and which provides for the ultimate filling of the motor chamber with a gas having relatively high heat conductivity and/or other desired characteristics.

A further object of this invention is to provide a method for filling submersible pump or other motor chambers and the like which facilitates the determination of the presence of even very slight leaks and provides for the use of gases for filling the chamber which cannot be easily detected but which have the characteristics and advantages ultimately desired; which permits filling the pump to any desired internal pressure; and, which prevents and inhibits the introduction of air and/or moisture into the motor chamber either at the time of filling or subsequently during the use of the pump.

These and other advantages and objects of this invention will appear from the following description of a preferred embodiment thereof.

The method of this invention can be used to gas fill rather than oil fill, any hermetically sealed motor chamber including, for example, the motor chambers in submersible pumps having structure generally similar to that shown in U.S. Patent No. 2,743,673, issued September 19, 1955, and now assigned to applicant's assignee. An electric motor is, of course, disposed within the chamber and a rotatable shaft leads from the motor through a suitable running seal in the chamber wall to the impeller. Suitable connections are also provided through the chamber wall with a power source and, if desired, with other auxiliary apparatus and parts such as pressure sensitive controls, etc. The motor chamber is also preferably provided with a suitable filling hole and a threaded or other tight closure therefor. The method of the present invention is particularly useful for filling the motor chambers of submersible pumps, which are particularly adapted for use in septic tanks and the like, where the pumps cannot be observed readily and must operate for long and continuous periods of time (as much as 16 or more hours per day). In these uses, as pointed out above, it is essential that the initial operating and maintenance costs be low, that the motor chamber remain dry at all times and that sufficient cooling be provided to prevent the motor of the pump from burning out due to the high incidence of operation during use.

To this end it is important that there be no leaks to the motor chamber. Accordingly in its preferred form this invention comprises the steps of filling the motor chamber with a test gas, which does not have the characteristics desired of the operating gas with which the chamber is ultimately to be filled but which is easily detected; running the pump a predetermined period of time in order to lap in running seals adjacent the shaft; testing the pump by means adapted to detect the test gas with which the chamber has been filled to determine whether or not any of the test gas is leaking therefrom; evacuating the test gas and air from the chamber, and filling the motor chamber with the desired operating gas, which must be confined within a leakproof space but cannot be readily detected. Preferably the pump is filled with operating gas to a pressure such that the pressure within the pump exceeds the pressure expected to exist in the tank or sump and surrounding the pump during the use for which the pump is intended.

More particularly the method for filling submersible pump motor chambers embodying a preferred form of this invention comprises the steps of first filling the motor chamber of a submersible pump with dichlorodifluoromethane, Freon or Genetron 12, to a predetermined pressure, preferably of about 5 lbs. per sq. in. or higher; operating the entire pump unit under water for a predetermined period of time, preferably about one minute, in order to lap in the seal surfaces adjacent the motor-impeller shaft and inspecting the pump with a halogen leak

detector which is preferably capable of detecting leaks as small as one half ounce per year.

The leak detector used is preferably of a common type and includes a gun probe adapted to be disposed adjacent the pump to be tested; a platinum element which is electrically heated to about 800° C. and which is affected electrically by even a trace of halogens in a gas passed thereover and a suitable electronic circuit for amplifying the current produced by the presence of halogens in the gas and suitable dials, etc. for indicating the presence and/or percentage of halogen, and a blower for drawing air and gas into the gun, from adjacent the pump unit being tested and blowing the same over the platinum element for detection of any halogen gas which might have leaked from the motor chamber and would be in the sample drawn in by the blower from adjacent the pump. If no leaks are detected or after detected leaks have been eliminated the motor chamber is then evacuated by means of a vacuum pump to remove the dichlorodifluoromethane-air mixture and the chamber is then filled with extra dry nitrogen. The chamber is preferably filled with nitrogen to a pressure which, as noted above is preferably greater than the pressure that is expected to exist around the pump while the same is in use. When as is frequently the case, the pump is to be used at a submerged depth of about 4 ft., I prefer to fill the motor chamber with nitrogen to about 10 lbs. per sq. in., albeit the amount and pressure of nitrogen introduced into the chamber may be increased or decreased correspondingly when it is expected that the pump will be used at other depths. As suggested above, when the halogen leak detector detects a leak the pump is repaired, etc. and retested until the leak is eliminated, in order to ensure that the same is leakproof, before the nitrogen is introduced into the motor chamber.

Although the method of this invention has been described in conjunction with the use of dichlorodifluoromethane as the test gas and nitrogen as the operating gas it is within the scope of this invention to use other halogenated gases as the test gas and other gases having any desired properties and characteristics as the operating gas.

Changes and modifications to the preferred form of the invention herein particularly disclosed and described will occur to those skilled in the art who come to understand the principles and precepts thereof. Accordingly the scope of this patent should not be limited to the specific form of the invention herein specifically disclosed and described but by the advance by which the invention has promoted the art.

I claim:

1. The method of filling a submersible pump motor chamber having a motor and shaft with a running seal extending through the wall thereof comprising the steps of pressurizing an air filled submersible pump motor chamber with dichlorodifluoromethane, operating the motor and chamber under water for a predetermined period of time to lap in the seal, inspecting the pump chamber with a halogen type leak detector to detect any leaks in the motor chamber, evacuating the dichlorodifluoromethane and air from the motor chamber, and filling the motor chamber with extra dry nitrogen to a pressure at least equal to the pressure which will be imposed on the exterior of the pump and motor chamber during use.

2. The method of filling a motor chamber having a motor and a shaft with a running seal extending through the wall thereof comprising the steps of pressurizing an air filled motor chamber with dichlorodifluoromethane, operating the motor for a predetermined period of time to lap in the seal, inspecting the chamber with a halogen type leak detector to detect any leaks in the motor chamber, evacuating the dichlorodifluoromethane and air from the motor chamber, and filling the motor chamber with a predetermined quantity of nitrogen.

3. The method of filling a submersible pump motor chamber having a motor and a shaft with a running seal extending through the walls thereof comprising the steps of pressurizing an air filled submersible pump motor chamber with a halogenated gas, operating the motor for a predetermined period of time to lap in the seal, inspecting the motor chamber with a halogen type leak detector to detect any leaks in the motor chamber, evacuating the halogenated gas and air from the motor chamber, and filling the motor chamber with a predetermined quantity of nitrogen.

4. The method of testing and filling a leakproof chamber with a predetermined gas having required properties comprising the steps of pressurizing an air filled chamber with a readily detected gas, inspecting the chamber from without with a detector adapted to detect minute concentrations of said readily detected gas to determine the presence of leaks in said chamber, evacuating the said readily detected gas and air from the chamber, and filling the chamber with said predetermined gas.

5. The method of filling a submersible pump motor chamber having a motor and a shaft with a running seal extending through the walls thereof with a predetermined gas having required properties comprising the steps of pressurizing the motor chamber with a halogenated gas, operating the motor for a predetermined period of time to lap in the seal, inspecting the motor chamber with a halogen type leak detector to detect any leaks in the motor chamber, evacuating the motor chamber, and filling the motor chamber with said predetermined gas.

6. The method of filling a chamber with a predetermined gas having required properties comprising the steps of pressurizing the chamber with a halogenated gas, inspecting the chamber with a halogen type leak detector to detect any leaks in the chamber, evacuating the chamber, and filling the chamber with said predetermined gas.

7. The method of filling a submersible pump motor chamber having a motor and a shaft with a running seal extending through the walls thereof with a predetermined gas having required properties comprising the steps of pressurizing the motor chamber with a readily detected gas, operating the motor for a predetermined time to lap in the seal, inspecting the motor chamber from without with a detector adapted to detect minute concentrations of said readily detected gas to determine the presence of leaks in said motor chamber, evacuating the motor chamber, and filling the motor chamber with said predetermined gas.

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