

Oct. 22, 1940.

T. G. MYERS ET AL

2,218,937

SUBMERSIBLE STRUCTURE

Original Filed March 14, 1932

Fig. 1

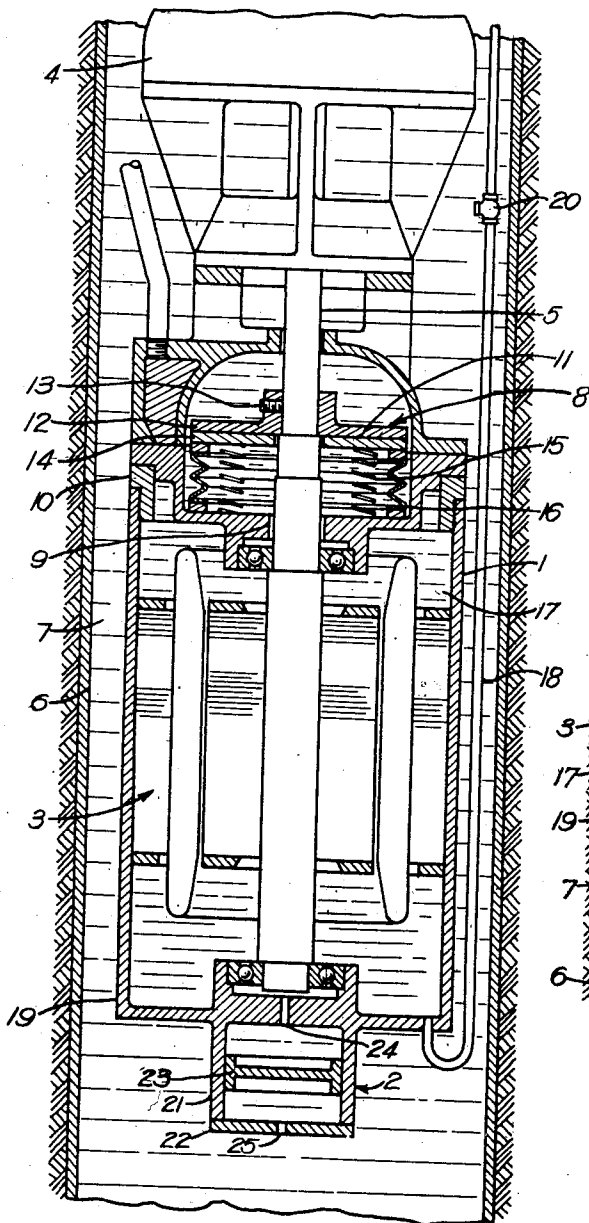
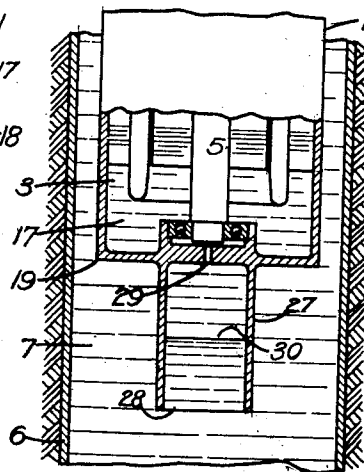


Fig. 2



INVENTORS

Thomas G. Myers
George T. Pflieger
Frank Mason

BY *John Flam*
ATTORNEY

UNITED STATES PATENT OFFICE

2,218,937

SUBMERSIBLE STRUCTURE

Thomas G. Myers and George T. Pfeiffer, Los Angeles, Calif., and Frank Mason, Chicago, Ill., assignors to U. S. Electrical Motors, Inc., a corporation of California

Original application March 14, 1932, Serial No. 598,763. Divided and this application August 23, 1937, Serial No. 160,485

1 Claim. (Cl. 172—36)

This invention relates to a submersible structure, such, for example, as a power unit for pumping liquids from a well. Such a unit comprises a pump and a source of power, which may be an electric motor, for driving the pump. In a device of this character, the motor must be so arranged that it is sealed against the entry of the well fluid.

This application is a division of an application filed in the names of Thomas G. Myers, George T. Pfeiffer and Frank Mason, for Submersible power unit, Serial No. 598,763, filed March 14, 1932.

It is one of the objects of this invention to provide an electric motor power unit that is effectively and inexpensively protected against entry of well fluid that may injure the motor, by maintaining a sealing material, such as oil, in the motor housing.

Experience has shown that upon continued operation of such a motor, the motor windings transfer so much heat to the oil filling that the oil expands in spite of the cooling effect due to the submerged condition of operation. Thus, if the casing is fluid tight, difficulty is bound to arise due to this expansion, such as the creation of an unsafe pressure in the casing. It is another object of the invention to obviate this difficulty by providing a casing having means to ensure substantial equality of pressure within and without the casing at all times.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of several embodiments of the invention. For this purpose there are shown a few forms in the drawing accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claim.

Referring to the drawing:

Figure 1 is a longitudinal sectional view of a submersible power unit, the motor of which embodies one form of the invention; and

Fig. 2 is a longitudinal sectional view, on a reduced scale, of the lower end of a similar motor, embodying a modified form of the invention.

In Fig. 1 of the drawing is illustrated a casing 1 having a pressure equalizing device 2 disposed at its lower end. Casing 1 serves to house an electric motor 3 adapted to drive a centrifugal pump 4 by means of a shaft 5, the whole forming a submersible pumping unit. This unit is in-

tended to be submerged in a well having a casing 6 filled with a liquid medium 7, the surface of which may be at a considerable distance above the unit, this distance sometimes being of the order of several hundred feet.

It is obviously essential to the successful and continued operation of the motor that the medium 7, which is usually water, or a mixture of water and other substances, should be entirely excluded from the casing 1. Thus, an effective seal 8 must be provided for the aperture 9 in the top closure 10 of the casing through which shaft 5 extends, and one capable of functioning effectively for long periods without adjustments or replacements, since it is not accessible except upon removal of the entire structure from the well.

As shown, this seal has an annular sealing surface 11 of large area formed between a rotating seal member 12 secured on shaft 5 by a set screw 13 and a non-rotating seal member 14 attached to cover 10. Springs 15 urge the non-rotating seal member into sealing engagement with the rotating seal member 12. Member 14 is secured to cover 10 by a metal bellows, or Sylphon 16, which in effect forms a flexible wall extension of casing 1 and permits the member to move axially into engagement with the cooperating member, at the same time maintaining it in fluid tight relation with the casing. It will be noted that the area of the sealing surface is large, thus ensuring long life of the parts; and that the quality of the seal will be improved by the relative wear of the members.

To further guard against entry of well fluid to the motor, and also as a means of equalizing the pressure within and without casing 1, the casing is filled with a lubricating and insulating liquid 17 such as oil. This may be supplied through a pipe 18, which leads from the top of the well and communicates with the interior of casing 1 through the bottom cover 19. A check valve 20 is provided in this pipe to prevent return flow of oil from the casing.

To prevent excess pressure within the casing due to expansion of the oil 17 from the heat developed incident to the operation of the motor, and also to prevent the pressure within the motor casing falling below that of the surrounding well fluid for any reason, pressure equalizing means 2 is provided. This comprises a downwardly extending cylindrical extension 21, provided with a cover 22 at its lower end. A slidable piston 23 is accommodated in cylinder 21, the upper side of the piston being subjected to the pressure of oil 17 within casing 1 by means of

port 24 which connects the interior of casing 6 and the cylinder. The lower side of piston 23 is subjected to the pressure of the well fluid 7, by means of port 25, passing through cover 2. Obviously, as the oil 17 expands, piston 23 will move downward against the pressure of the well fluid, thus increasing the effective volume of casing 1 and equalizing the pressure within and without the casing. Should oil 17 contract, piston 23 will move upward in response to the well fluid pressure, decreasing the effective volume and maintaining the pressures equal.

As the liquid 17 is generally lighter than the well fluid and not readily miscible therewith, it is possible to dispense with a division wall between the fluids, such as the piston 23. Such an arrangement is illustrated in Fig. 2, where corresponding parts bear the same numerals as in the first form.

In this modified form, a seal is provided at the upper end of the casing as before, and the lower head 26 of casing 1 is provided with a tubular extension 27, open to the well fluid at the bot-

tom as indicated by 28 and in communication with the interior of the casing by port 29. Here there is a contacting surface between the well fluid 7 and the body of oil in the casing 1. As the oil 17 is lighter than fluid 7, it is retained inside casing 1 and expands or contracts against the pressure of the well fluid as before, the surface of contact 30 rising and falling in the extension 27 in the same way as piston 23 moves in the first form.

What is claimed is:

In a submersible structure, a casing; a liquid filling the casing, a hollow extension extending outwardly from the casing and in communication therewith through a restricted port in the casing, said extension being open at the bottom, and a close fitting piston in said extension, subjected on one side to the pressure in the casing and on its other side to the pressure of the liquid in which the structure is submerged.

THOMAS G. MYERS.
GEORGE T. PFLEGER.
FRANK MASON.