

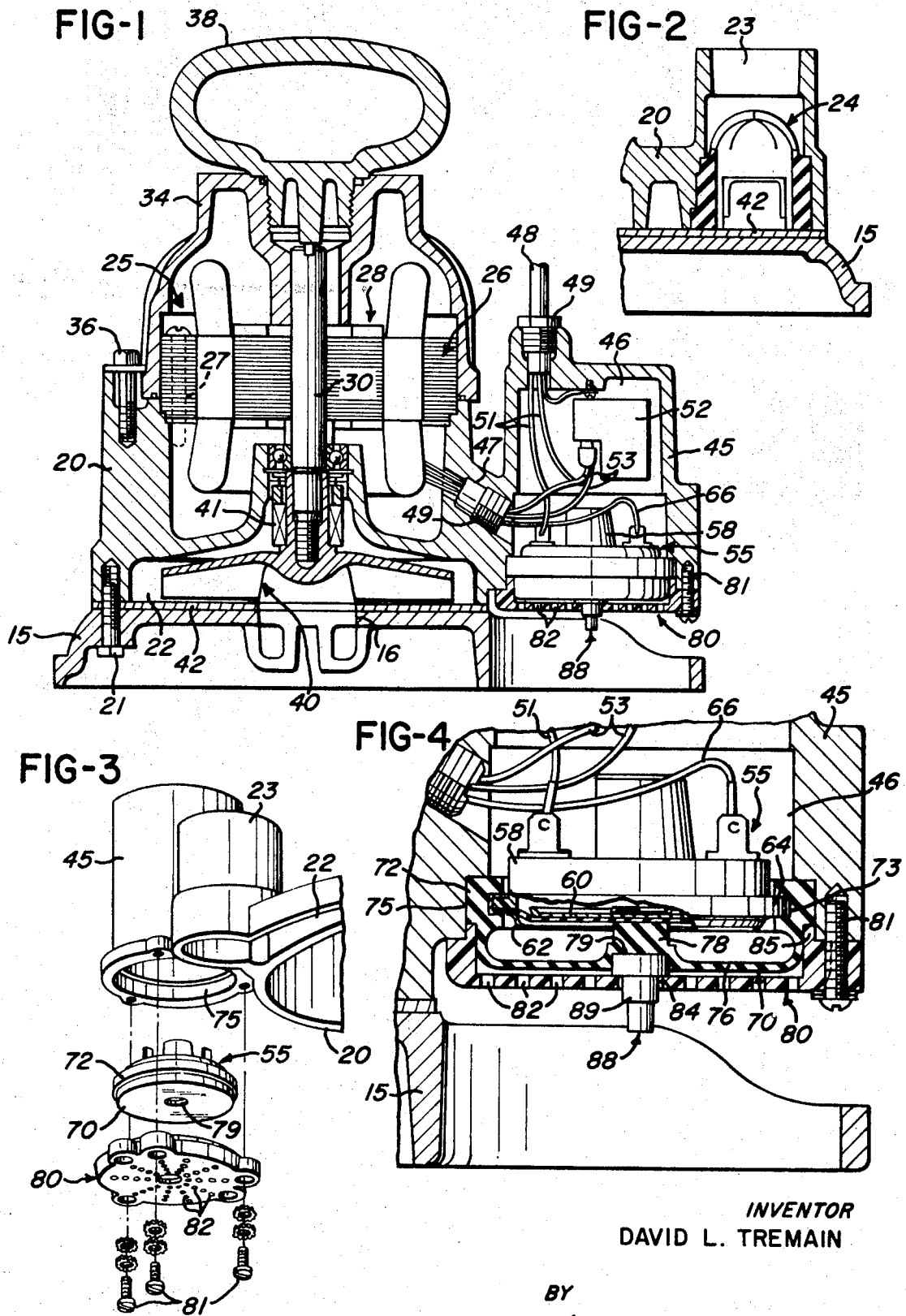
Jan. 19, 1971

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3,556,677

SUBMERSIBLE PUMP SWITCH ASSEMBLY

Filed Jan. 22, 1969



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3,556,677

SUBMERSIBLE PUMP SWITCH ASSEMBLY

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Filed Jan. 22, 1969, Ser. No. 792,966

Int. Cl. F04b 49/06; H01h 35/40; H04h 35/04

U.S. Cl. 417-44

5 Claims

ABSTRACT OF THE DISCLOSURE

A submersible pump incorporates a motor housing integrally connected to a switch housing which forms a chamber having a lower open end defined by a counterbore. A diaphragm switch is supported within the counterbore by a second resilient diaphragm having an annular portion which extends into the counterbore and around a peripheral flange of the switch to form a radially compressed fluid tight seal. The switch and second diaphragm are secured by a rigid perforated cover which protects the second diaphragm and is effective to urge the annular portion axially against the radial shoulder of the counterbore to form an axially compressed fluid tight seal.

BACKGROUND OF THE INVENTION

In a submersible pump or drainer such as disclosed in Pat. No. 3,216,361 which issued to the assignee of the present invention, usually a diaphragm switch is employed to control the operation of the pump motor in response to predetermined changes in the head of water above the pump. Commonly, the pressure switch comprises a phenolic cup-like housing or case which encloses and supports the switch contacts. A resilient diaphragm covers the open end of the case and is sealed to the case by an annular metal cover having a peripheral flange portion clamped to a periphery rib of the case. The switch is mounted within the open end of an inverted cup-shaped switch housing which is attached to the pump housing, and the switch is usually retained by an annular resilient seal which is pressed axially against the flange portion of the switch to avoid the seepage of water into the switch housing.

In recent years, it has been found desirable to employ a second resilient diaphragm positioned in spaced relation to the switch diaphragm so that if a fine pin hole should develop within the second exposed diaphragm by a sharp foreign object within the water being pumped, the switch contacts would still be protected by the switch diaphragm. The second diaphragm, however, has presented a problem in forming a dependable fluid tight and economical seal between the second diaphragm, the pressure switch and the switch housing.

SUMMARY OF THE INVENTION

The present invention is directed to an improved switch assembly for a submersible pump, including a diaphragm switch and a second diaphragm constructed and arranged to provide a highly effective and dependable fluid tight seal between the diaphragm switch and the switch housing. The switch assembly of the invention also provides an economical construction and significantly decreases the chance of a rupture by a sharp foreign object within the water being pumped.

In accordance with a preferred embodiment of the invention, the peripheral flange of a diaphragm pressure switch is received within an internal groove formed within an annular portion of a second resilient diaphragm. The annular portion of the second diaphragm is pressed into a counterbore within the switch housing and forms a radial-

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ly compressed fluid tight seal between the flange of the pressure switch and the switch housing. A rigid perforated plastic cover is secured to the switch housing for protecting the second diaphragm against foreign objects and includes a cylindrical portion which projects upwardly to engage and compress the annular portion of the second diaphragm upwardly or axially against the radial shoulder of the counterbore thereby forming combined radially compressed and axially compressed seal between the switch and the switch housing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical section of a submersible motor-pump unit incorporating a switch assembly constructed in accordance with the invention;

FIG. 2 is a fragmentary section through the discharge outlet of the pump shown in FIG. 1;

FIG. 3 is an exploded fragmentary perspective view of the switch assembly shown in FIG. 1; and

FIG. 4 is an enlarged fragmentary section of the switch assembly shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a submersible drainer or pump incorporates a base 15 having a circular inlet 16. A combined bearing bracket and pump housing 20 is secured to the base 15 by a series of screws 21 and has a volute-shaped pumping chamber 22 which connects to an outlet 23 (FIG. 2) through a resilient check valve 24 constructed and assembled in accordance with patent No. 3,174,434 which issued to the assignee of the present invention.

An electric motor 25 includes a stator 26 which is secured to the housing by a series of screws 27. The motor 25 includes a rotor 28 having a vertically extending shaft 30 with a lower end portion supported by an anti-friction bearing 31 retained within a hub portion of the housing 20. The upper end portion of the shaft 30 is journaled within a bearing bracket 34 secured to the housing 20 by a series of screws 36, and a handle 38 is threadably connected to the bracket 34. An open face centrifugal impeller 40 is mounted on the lower end of the shaft 30 adjacent a rotary seal 41 and is positioned in closely spaced relation to a wear plate 42 sandwiched between the housing 20 and the base 15.

Referring to FIGS. 1 and 4, an inverted cup-shaped switch housing 45 is formed as an integral part of the housing 20 and defines a chamber 46 which is connected to the motor chamber by a passage 47. A power supply cable 48 is connected and sealed to the switch housing 45 by a fitting 49 and has a plurality of lead wires 51 which extend into the chamber 46 of the switch housing 45. A motor start relay 52 is secured to the housing 45, and lead wires 53 connect the relay 52 to the windings of the stator 26 by way of another fitting 49 inserted within the passage 47.

In accordance with the invention, a pressure switch assembly forms a closure for the lower open end of the chamber 46 and includes a diaphragm pressure switch 55 incorporating a plastic housing or case 58 and a resilient flexible diaphragm 60 which is secured to the switch case 58 by an annular metal cover 62 having an outwardly projecting circumferential flange 64 clamped to a peripheral rib of the case 58. The pressure switch 55 includes normally open contacts (not shown) which are enclosed within the case 58 and are closed in response to a predetermined pressure exerted upwardly on the switch diaphragm 60. One terminal of the pressure switch 55 is connected to one of the lead wires 51 of the power supply cable 48, and the other terminal is connected by a lead wire 66 to the windings of the stator 26.

The switch assembly further includes a second resilient flexible diaphragm 70 which forms a boot for the diaphragm switch 55 and includes an annular portion 72 having an inner circumferential groove 73 which receives the outwardly projecting flange 64 of the diaphragm cover 62. The diaphragm portion 72 is received within the counterbore 75 formed within the lower end portion of the switch housing 45 and is radially compressed between the flange 64 of the diaphragm cover 62 and the cylindrical surface of the counterbore 75.

The annular portion 72 of the diaphragm 70 is connected by a thin flexible portion 76 to an upwardly projecting center portion 78 having a cylindrical cavity 79 in its lower surface and having an upper surface positioned adjacent the underneath surface of the switch diaphragm 60. A rigid plastic cover 80 is secured to the lower surface of the switch housing 45 by a plurality of screws 81 and is provided with multiple small perforations 82 surrounding a center opening 84. The cover 80 includes a cylindrical portion 85 which projects upwardly into the counterbore 75 and compresses the annular portion 72 of the diaphragm 70 against the radial shoulder of the counterbore 75.

A shouldered lock member 88 is supported by the cover 80 and projects downwardly through the opening 84. When the lock member 88 is pressed upwardly, it raises the center portion 78 of the diaphragm 70 to depress the switch diaphragm 60 and thereby closes the switch contacts to provide continuous operation of the motor 25. Tilting of the lock member 80 after it is pressed upwardly causes the lower shoulder 89 on the lock member to engage the upper surface of the cover 80 and thereby to hold the switch 55 in a closed condition.

From the drawing and the above description, it is apparent that a submersible pump incorporating a switch assembly in accordance with the invention provides desirable features and advantages. For example, with the annular portion 72 of the second diaphragm 70 radially compressed between the outwardly projecting flange 64 of the pressure switch 55 and the cylindrical surface of the counterbore 75, a dependable water tight seal is formed between the pressure switch 55 and the switch housing 45. Furthermore, an additional seal is produced by the upward pressure exerted on the annular diaphragm portion 72 of the diaphragm 70 by the cylindrical portion 85 of the rigid cover 80.

Another advantage is provided by the rigid perforated cover 80 which forms a protector for the second diaphragm 70 by substantially preventing a sharp or pointed object carried within the liquid being pumped from cutting or puncturing the thin flexible portion 76 of the diaphragm 70. Moreover, the annular portion 72 of the diaphragm 70 forms a cushion support for the switch 55 and, in addition, provides for a convenient and quick assembly of the switch into the switch housing 45.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope and spirit of the invention.

What is claimed is:

1. In a submersible pump unit including a pump housing defining a pumping chamber, means defining an inlet and an outlet for said chamber, a motor mounted on said housing and including a rotor shaft, an impeller connected to said shaft and disposed within said chamber, an improved switch assembly comprising a switch housing connected to said pump housing and defining a switch chamber having an open end, said switch housing including a generally cylindrical surface located adjacent said open end of said switch chamber, a pressure switch positioned within said switch chamber and including a case supporting a first resilient flexible diaphragm, means forming an outwardly projecting peripheral flange on said case, a second resilient flexible diaphragm positioned adjacent said first diaphragm and including an integral annular portion extending between said case and said generally cylindrical surface, said annular portion of said second diaphragm defining an inner circumferential groove receiving said flange and being in radially compressed condition to form an effective fluid tight radial seal between said case and said switch housing, and means secured to said switch housing for retaining said second diaphragm.

2. A submersible pump unit as defined in claim 1 wherein said switch housing includes a generally radial annular shoulder extending inwardly from said cylindrical surface, and said retaining means comprise a substantially rigid member including an annular portion extending generally adjacent said cylindrical surface and urging said annular portion of said second diaphragm against said shoulder to effect an axial fluid tight seal in addition to said radial seal.

3. A submersible pump unit as defined in claim 2 wherein said retaining member comprises a substantially rigid protective cover member disposed adjacent said second diaphragm and having a plurality of holes therethrough.

4. A submersible pump unit as defined in claim 3 including means defining an opening within the center portion of said protective cover member, and an actuating member mounted within said opening and projecting below said cover member to facilitate manual operation of said switch.

5. A submersible pump unit as defined in claim 1 wherein said pump housing is integrally connected to said switch housing.

References Cited

UNITED STATES PATENTS

1,906,446	5/1933	Clement	200—83
3,216,361	11/1965	Leff	103—87
3,307,000	2/1967	Ekey	103—25
3,280,751	10/1966	Ekey	103—25
3,234,881	2/1966	Ekey	103—25
3,466,978	9/1969	Carlstedt	200—83X

FOREIGN PATENTS

1,286,785	1/1962	France	200—83
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U.S. Cl. X.R.

417—424; 200—83