April 23, 1968 S. O. LOMBARD 3,379,841

HYDRAULIC ACTUATED SWITCH CONSTRUCTION

Filed Oct. 22, 1965 2 Sheets-Sheet 1

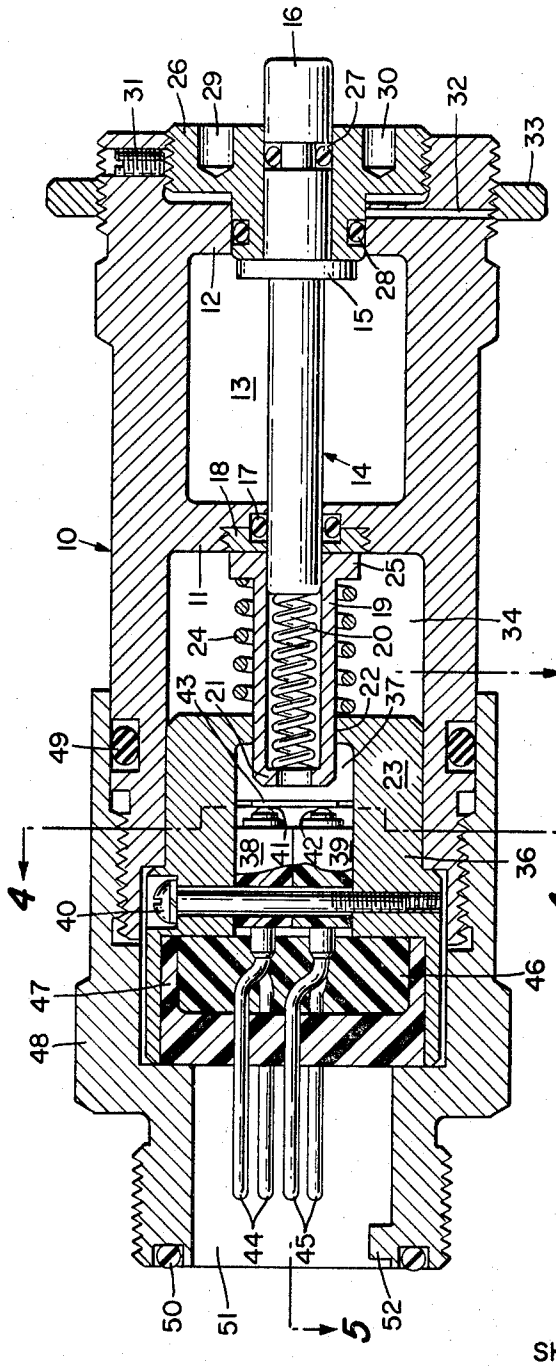


Fig. 1

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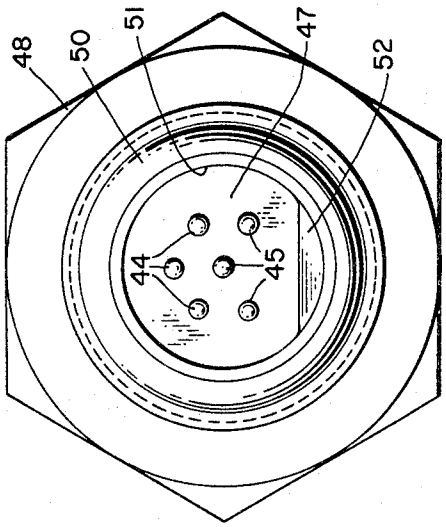


Fig. 2

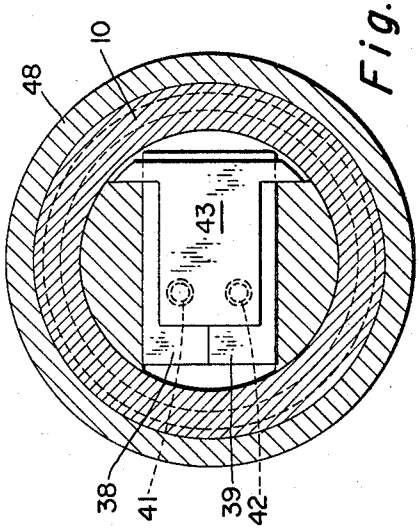


Fig. 4

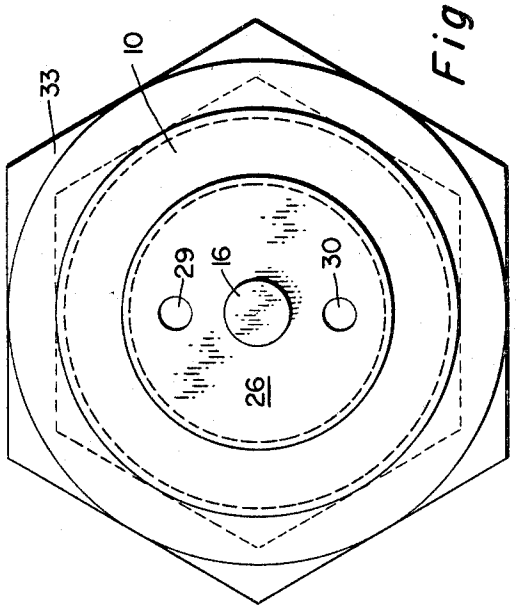


Fig. 3

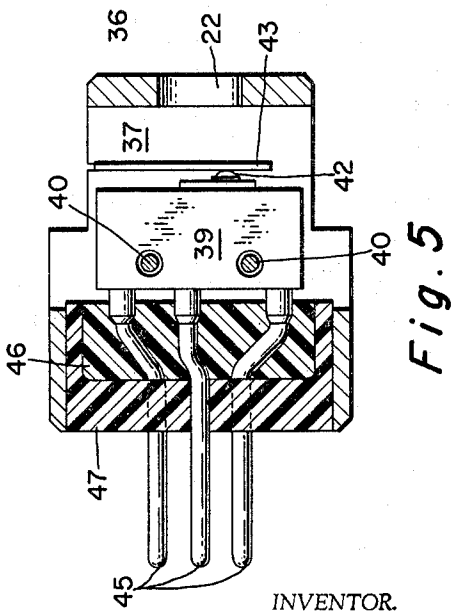


Fig. 5

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HYDRAULIC ACTUATED SWITCH CONSTRUCTION

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7 Claims. (Cl. 200—82)

ABSTRACT OF THE DISCLOSURE

An electric switch assembly comprising an electrical section and a hydraulic section wherein the electric elements are segregated from the hydraulic pressure.

This invention is directed to electric switches and more particularly to sealed switches for use in conjunction with pressurized hydraulic systems wherein the electric elements must be effectively segregated from the hydraulic pressure and such electric elements must be readily accessible for inspection and repair.

Heretofore switch constructions have been proposed which employ O rings or other sealing devices. However, it has been found that while effective for a short time such seals ultimately leak and thus permit shorting of the switch elements.

It is therefore an object of the present invention to provide a switch construction for use in association with hydraulic pressures ranging from zero p.s.i. to 2,000 p.s.i. or greater and wherein leakage of the hydraulic fluid is effectively prevented.

Another object is to provide a switch construction which is readily adapted to inspection or replacement of the switch elements without interference with the hydraulic circuitry with which the switch is associated.

Another object is to provide a switch activating construction for use in conjunction with hydraulic equipment wherein means are provided to prevent loss of effectiveness by hydraulic seals even when the switch is inactive for long periods of time.

Other objects, advantages, and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings wherein;

FIG. 1 is a vertical sectional view partially in elevation taken along the longitudinal axis of the devices;

FIG. 2 is a vertical elevational view of the electrical end of the device;

FIG. 3 is a vertical elevational view of the hydraulic end of the device;

FIG. 4 is a transverse vertical sectional view partially in elevation, taken along a line substantially corresponding to line 4—4 of FIG. 1;

FIG. 5 is a transverse horizontal sectional view, partially in elevation, taken along a line substantially corresponding to line 5—5 of FIG. 1.

Referring to the drawings in detail the device comprises a generally cylindrical housing 10 having inwardly directed walls 11 and 12 defining a hydraulic chamber 13 which is to be filled with hydraulic fluid.

An actuator shaft or rod 14 is supported within the cylinder for movement along the axis thereof. Rod 14 has a radial collar 15 on the opposite side of which the rod is slightly enlarged in diameter and terminates in an end portion 16 which extends outside of the housing when assembled. By the differential diameter arrangement just described pressure within chamber 13 normally urges the actuator rod to the right to the position shown in FIG. 1.

The smaller diameter portion of rod 14 extends through a central opening in wall 11 and is sealed for reciprocating movement therethrough by means of an O ring 17

maintained in place by a threaded packing nut 18. The rod is journaled for longitudinal movement in a tubular bushing 19 which has an internally mounted compression spring 20 disposed between the end of rod 14 and the inturned flange 21 at the end of bushing 19.

Bushing 19 is in turn received in an opening 22 in an electric switch enclosing block 23 separately shown in FIG. 5 and is retained firmly in place by the pressure of an externally mounted compression spring 24 which bears against the inner end of the switch assembly 23 and against ledge 25 on bushing 19.

The large end 16 of the actuator rod is journaled in a gland nut 26 and is sealed therein by an O ring 27 mounted as shown. The gland nut 26 is also sealed in place through O ring 28 which bears against the inner surface of the opening in wall 12. Openings 29 and 30 in the gland nut are adapted to receive the prongs of a conventional spanner wrench by which the nut may be tightened into place thereby compressing the oil in chamber 13 and maintaining a hydraulic pressure on the O rings 17, 27 and 28 to maintain them constantly in positive sealing engagement. A set screw 31 locks the gland nut in its adjusted position.

After the parts of the hydraulic end of the switch have been assembled and before the gland nut 26 is applied oil is poured into the chamber 13 through the open end. Thereafter when the actuator rod and gland nut 26 are threaded into place any excess oil is vented through a bleed passage 32 the outer end of which is clear when jam nut 33 is moved so as to expose that opening. In final assembly the nut 26 is tightened, compressing the oil in chamber 13. In the embodiment illustrated it has been found that one additional full turn compresses the hydraulic fluid to about 900 p.s.i. causing an immediate and effective seal by the O rings.

The left or electrical end of housing 10 defines a switch receiving chamber 34 which accommodates a removable plastic switch enclosing case 23 which is separately illustrated in FIG. 5. As there shown one half 36 is reduced in diameter and has a transverse slot 37 which receives two adjacent switches 38 and 39 which may be of the double pole double throw type and are secured in place by switch anchoring screws 40.

The usual actuating buttons 41, 42 protrude from each switch and are engaged by a deformable button engaging plate 43 secured at one end by silver solder or otherwise to the interior surface of the switch body member. This plate is located close to the flanged end 21 of bushing 19 and serves to evenly distribute the actuating pressure therefrom to the actuating buttons of each switch.

As illustrated the switch leads 44 and 45 extend rearwardly from the switch bodies 38 and 39 respectively and are pronglike in construction to provide contact points for engagement by a suitable electrical connector. These prongs may be imbedded in a potting compound 46 and are given further support by plastic insert 47 through which they extend.

The entire switch assembly can be tightly retained in chamber 34 by means of a threaded cap 48 which may be sealed by an O ring 49. Another O ring 50 at the far end provides sealing engagement with the connector assembly which fits into the open end portion 51. Improper insertion of the connector is prevented by an abutment 52.

It will be apparent that with this construction it is a relatively simple matter to service the switches by unplugging the connector, unscrewing cap 48, withdrawing the switch subassembly from the unit and replacing it with a substitute unit. This is done without any loss of hydraulic fluid or pressure and without interference with the operation or adjustment of the actuator rod. At the same time bushing 19 and springs 20 and 24 can be in-

spected or replaced and the end of rod 14 can also be examined.

Should further disassembly of the switch assembly be desired the anchoring screws 40 may be withdrawn, insert 47 slipped off and, depending upon the nature of the potting compound 46 employed, the switches 38 and 39 may be examined or replaced.

The above features are particularly important for equipment which must be inspected or repaired in the field since complicated disassembling tools are not required nor is advanced technical training necessary.

It will be noted that in the operation of the hydraulic portion of the switch the actuator rod 14 is constantly urged to the right through compression spring pressure which is supplemented by the differential pressures created through the use of different diameters 14–16 on the actuator rod. Diameter 16 being larger than diameter 14 there is at all times while hydraulic pressure exists within chamber 13 a differential tending to force the rod to the right. This keeps stop collar 15 of shaft snugly abutting the inside surface of the gland nut 26.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A hydroelectric switch assembly comprising a housing divided into an electrical section for receiving a switch to be actuated and a hydraulic section containing a hydraulic fluid and designed to receive a switch actuator;

an actuator in said hydraulic section having one portion exposed for application of an actuating pressure thereto and another portion positioned adjacent said electrical section;

sealing means permitting movement of the actuator through the hydraulic section of the housing without loss of hydraulic fluid; and

means connected to the hydraulic section for applying pressure to the hydraulic fluid contained therewithin to impart sealing pressure to said sealing means.

2. The device of claim 1 wherein the pressure applying means comprises a threaded gland nut through which a portion of the actuator extends.

3. The device of claim 1 wherein the electrical end of the actuator is received in an elongated bushing which is normally resiliently restrained against switch actuation.

4. The device of claim 1 wherein a vent passage is formed adjacent the hydraulic fluid pressure applying means and a pressure seal is movable over the vent passage opening and serving to prevent leakage of hydraulic fluid therethrough in its assembled condition.

5. The device of claim 1 further comprising two actuator supports each having a seal with said actuator to permit movement thereof without loss of hydraulic pressure, one of said supports being located between the hydraulic portion of the device and the electric switch receiving portion of the device whereby the electric switch unit may be bodily removed without loss of hydraulic fluid pressure.

6. The device of claim 1 wherein the actuator comprises a rod having portions of different diameters and the application of hydraulic fluid pressure thereupon results in a differential component of force urging the actuator rod away from the electric switch unit.

7. An electric switch assembly for actuation in response to high hydraulic pressures comprising:

an elongate tubular housing having an electric connector engaging portion and a hydraulic assembly engaging portion;

said hydraulic assembly engaging portion including an enclosed high pressure chamber and a sealed actuator rod extending through the chamber into the electric connection engaging portion;

pressure means for creating a high pressure within the hydraulic assembly engaging portion, and sealing means between the actuator rod and each point of passage through walls of the hydraulic portion whereby said high hydraulic pressure urges the seals into positive sealing engagement with said rod; and

a switch assembly in said electric connector engaging portion and removeable therefrom without affecting the hydraulic pressure retained by said seals.

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