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HYDRAULIC SWITCH

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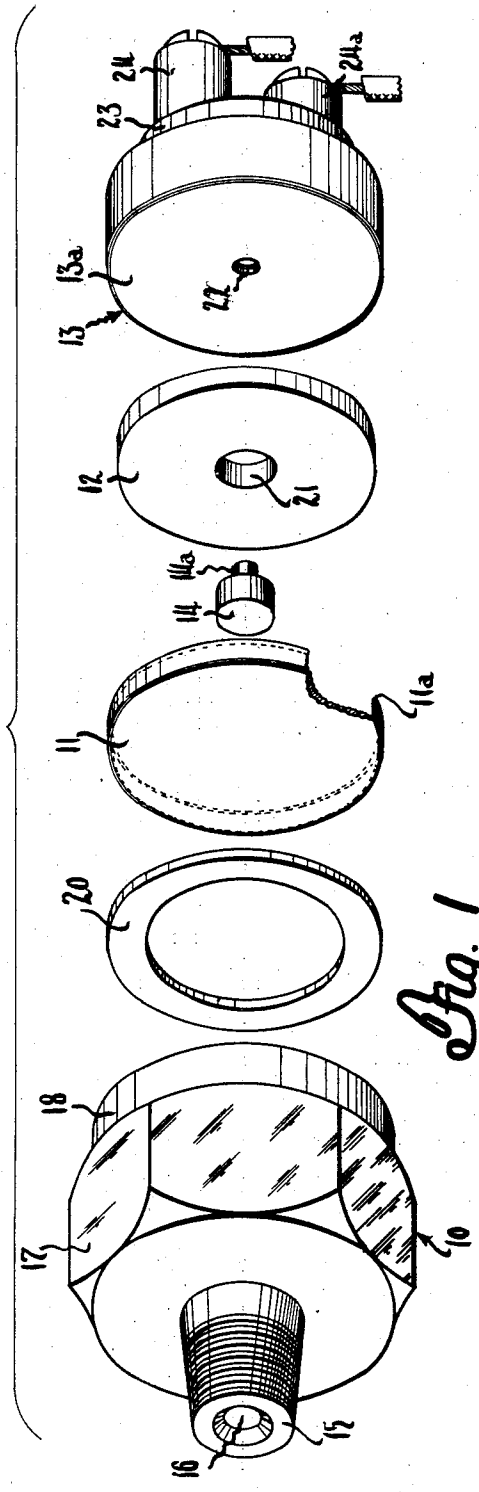


Fig. 1

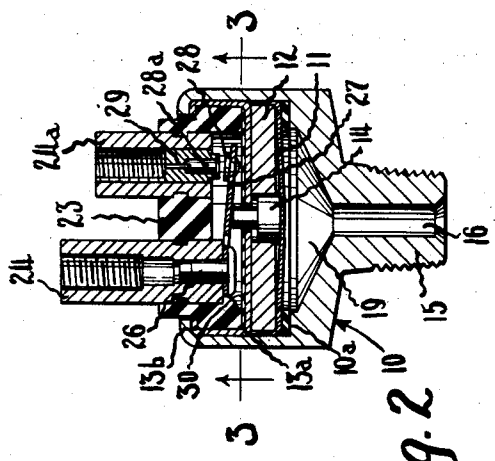


Fig. 2

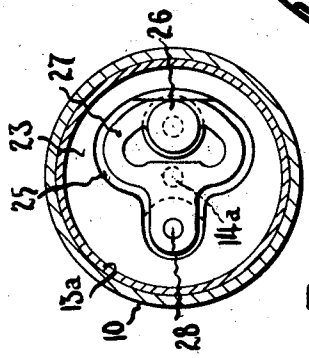


Fig. 3

INVENTOR
Frohman Kupferschmid
BY
D. Henry Stoltenberg
ATTORNEY

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HYDRAULIC SWITCH

Frohman Kupferschmid, Toledo, Ohio, assignor to The Electric Auto-Lite Company, Toledo, Ohio, a corporation of Ohio

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4 Claims. (Cl. 200—83)

This invention relates to hydraulic switches, more particularly to stop-light switches actuated by hydraulic pressure from a hydraulic braking system of an automobile.

In the past, switches of the old type have been subject to failure due to breakage of the frangible material such as Bakelite or the like, used in the stress members of the switch body. This allowed the hydraulic fluid to escape from the braking system of the automobile and destroyed the efficiency of the brakes. Another disadvantage of the old switch was the utilization of the diaphragm as the bridging member for the electrical contacts. The diaphragm was weakened by the additional burdens and failed frequently by being punctured or the like or changed its operation characteristic markedly as to be useless. Furthermore, manufacturing tolerances between the insulation block and the metallic envelope resulted in breakage of the insulation block arising from excessive pressure during the swaging process or in leaky points from insufficient pressure.

In the novel switch construction disclosed, these faults have been corrected. The diaphragm is segregated from the switch members and no longer carries an electric current. Furthermore, in the swaging processes during assembly, only metallic portions of the structure are conformed by pressure, thereby keeping the insulation material free from excessive pressures. This insures a higher percentage of perfect units assembled in the manufacturing process.

It is, therefore, a principal object of this invention to provide a switch actuated by hydraulic pressure, in which the stress-carrying members are formed of non-frangible material, so that a higher percentage of perfect units may be formed during the usual manufacturing steps using normal manufacturing tolerances.

It is a further object of this invention to provide a switch actuated by hydraulic pressure in which the actuating diaphragm does not carry an electric current, and in which a retaining wall of rigid material is provided to support the diaphragm when it is under the influence of high pressure.

It is a further object of this invention to provide a switch actuated by hydraulic pressure in which the fluid pressure chamber is made uniformly leak-proof with normal manufacturing tolerances by employing non-frangible material such as metal to place gasket members under stress.

Other objects and advantages of this invention relating to the arrangement, operation and function of the related elements of the structure, to various details of construction, to combinations of parts and to economies of manufacture, will be apparent to those skilled in the art upon consideration of the following description and appended claims, reference being had to the accompanying drawing forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Figure 1 is an exploded view of the parts of the switch as assembled in the envelope.

Figure 2 is a sectional elevation of an assembled switch unit.

Figure 3 is a view taken along the line 3—3 of Figure 2.

Referring to Figure 1 of the drawing, the component parts of the hydraulic switch are shown in an exploded view. The principal parts of the switch are a cup-shaped casing or envelope 10, a flexible diaphragm 11, a supporting plate 12, a unitary switch assembly 13, and an actuating plug 14 cooperating between the diaphragm 11 and the unitary switch assembly 13 to close the switch for completing an extraneous electrical circuit.

The cup-shaped casing or envelope 11 is provided with a threaded nipple 15 which may be fitted in operable relation with any hydraulic pressure system, the changes in pressure in the system being communicated to the interior of the envelope 10 through the medium of the inlet port 16 of the nipple. For convenience in attaching the complete assembly, a hexagonal section 17 is provided in any convenient position. An annular flange 18 is provided on the end of the envelope remote from the nipple 15 to provide material which may be turned inwardly by swaging to form a holding flange to be described hereinafter.

Referring to Figure 2 of the drawing, the inlet port 16 is in communication with a pressure chamber 19 formed at the bottom of the envelope, the chamber being defined by the envelope 10 and the diaphragm 11. The diaphragm 11 is also in the nature of a cup, the bottom having the convex contour and the sides thereof being formed by an upstanding flange 11*a*. The diameter of the diaphragm is such that it fits snugly within the cup-shaped envelope 10 with which it cooperates by being positioned on a shoulder 10*a*, a gasket 20 is provided therebetween to make a leaf-proof joint when the assembly is compressed by a swaging process to be described in further detail hereinafter.

Inasmuch as the diaphragm 11 is exceedingly flexible and, therefore, easily deformed by pressure, it has been found desirable to provide a supporting plate 12 therefor. The supporting plate 12 is comparatively thick and rigid to provide adequate strength to withstand the pressure acting within the pressure chamber 19. The pressure flexes the diaphragm 11 flat against the adjacent surface of the supporting plate 12 so that the principal stress arising under these circumstances is borne by the rigid supporting plate 12 rather than by the flexible diaphragm 11. At a central point in the supporting plate 12, an aperture 21 is provided in which is positioned a plug 14, fitting loosely therein for movement longitudinally. The plug 14 is provided with a pintle 14a which extends loosely into an aperture 22 forming the base of the unitary switch assembly to contact the switch member thereof. The plug 14 is of the same thickness as the supporting plate 12 so that when the diaphragm is flexed under pressure in the pressure chamber, the plug 14 and the supporting plate 12 will form a uniform supporting surface for the diaphragm, thereby preventing any portion of the diaphragm from being stressed beyond the yield point to give the same a new contour.

The unitary switch assembly 13 is provided with a cup-shaped metallic envelope 13a having an aperture 22 in the base thereof through which the pintle 14a of the plug 14 protrudes to cooperate with the switch member. Positioned within the cup-shaped envelope, there is a plug of insulating material 23 in which are positioned two contact studs 24 and 24a, both being bored and threaded to form binding posts for electrical connections. The lower side of the plug of insulating material 23 is provided with a recess 25 into which the contact studs 24 and 24a extend. The contact stud 24 is counter-bored at its lower end and has fitted therein a rivet 26 to hold a spring contact leaf 27 in operable position, the leaf being flexed to maintain contact points 28 and 28a separated. The contact point 28 is positioned on the end of the contact leaf 27 and the contact point 28a is positioned in a threaded plug 29, fitted into the threaded bore of the contact stud 24a. In order that the relation between the contact points 28 and 28a may be adjustable, the plug 29 is provided with a deep kerf on its upper end and the adjacent parts being slightly sprung so as to form a frictional threaded relation with the bore of the contact stud 24. The position of the plug 29 may be advanced or retarded by placing a screw driver in the kerf and turning the same to change the threaded relation so that any desirable position of the contact 28a may be attained. The pintle 14a of plug 14, extending through the aperture 22, cooperates with the contact leaf 27 so that as the diaphragm 11 is flexed under the action of pressure, the contact points 28 and 28a will be closed to complete an extraneous electrical circuit.

The unitary switch assembly is formed by a separate manufacturing operation wherein the parts on the insulation plug 23 are first mounted in position and then fitted within the cup-shaped member 13a, a further insulation being provided by means of a sheet 30 giving thereby complete insulation for the live parts of the electrical contacts. The cup-shaped envelope 13a is then provided at its upper end with an inwardly turned flange 13b to cooperate with a shoulder on the plug 23 of insulating material. Inasmuch as there is no fluid pressure developed on the interior of this assembly, no gasket fittings are required. Normal manufacturing tolerances are, therefore, allowable without destroying the efficiency of the unitary switch assembly.

In the final manufacturing steps, the parts of the complete hydraulic switch assembly are placed within the envelope 18 in order as shown in Figure 1, that is, first the gasket member 20, then the diaphragm 11, then the supporting plate 12 with its cooperating plug 14 and finally the unitary switch assembly 13. The flange 18 is then swaged inwardly to engage the inwardly turned flange 13b on the unitary assembly so that the metallic side of the unitary switch assembly, as supplied by the metallic envelope 13a, will transmit the compression formed during the assembly operation to the plate 12, thence to the diaphragm 11, where it acts to compress the gasket 20 to form a leak-proof joint. In this manner the insulating plug 23 is at no time placed under such compressive stress as to cause cracking or splitting. This freedom from undue stresses allows a very high percentage of perfect units to be manufactured with a minimum of rejects due to breakage of the insulating material.

In the normal use of the hydraulic switch disclosed, the variations of pressure are transmitted to the pressure chamber 19 through the port 16 where they influence the diaphragm to close the switch by displacing the plug 14. The flexibility of the diaphragm 11 varies with the thickness thereof so that by selecting a diaphragm of desirable thickness and by adjusting the contact bearing plug 29, the contact points may be adjusted to close within definite limits of pressure. After the desired adjustment has been made, the compartment in which the contact points are positioned is preferably sealed in any convenient manner to prevent infiltration of moisture and the like.

It is to be understood that the above detailed description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawing, since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the invention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

I claim:

1. In a device of the class described, a cup-shaped container, a diaphragm in the container, a pressure chamber formed between the container and the diaphragm having an inlet for communication with a source of pressure, a supporting plate adjacent the diaphragm to bear the stresses during periods of high pressure resulting in maximum flexure of the diaphragm, a unitary switch assembly positioned in the container, including a non-frangible supporting means, an inturned flange on the cup-shaped container cooperating with the supporting means, whereby non-frangible substances transmit stresses to the container, and an actuating means cooperating with the diaphragm to actuate the switch to control an electric circuit.

2. The device defined in claim 1, the unitary

switch assembly being further characterized by having an insulation block supporting contact elements and a cup-shaped metallic casing enclosing the contact make-and-break parts, the metallic casing forming the stress bearing member between the supporting plate and the container by cooperating with the inturned flange on the container.

3. In a device of the class described, an envelope, a diaphragm in the envelope, gasket means cooperating between the diaphragm and the envelope to form a pressure chamber, a unitary switch assembly adjacent the diaphragm having a metallic stress-bearing member, and means to actuate the switch by flexure of the diaphragm, the envelope being conformed to cooperate with the stress-bearing member of the unitary switch assembly, the diaphragm and the gasket means, to place a compression on the gasket means by stress transmitted by the stress-bearing member to form a leak-proof joint for the pressure chamber.

4. In a device of the class described, an envelope, a diaphragm adapted to cooperate with the envelope to form a pressure chamber, gasket means between the diaphragm and the envelope, a non-frangible stress-bearing member adjacent the diaphragm to support the diaphragm when subjected to pressure greater than that necessary for maximum deflection, a moulded switch assembly positioned adjacent the stress-bearing member, means cooperating with the diaphragm to actuate the switch, a non-frangible embracing portion cooperating with the unitary switch assembly, and a turned-in portion on the envelope to hold the parts in operable position and to make the pressure chamber leaf-proof, the holding force from the turned-in portion being transmitted by non-frangible elements.

FROHMAN KUPFERSCHMID.