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(54) **A fluid-tight electrical pressure switch for hydraulic or pneumatic circuits**

Dichter elektrischer Druckschalter für pneumatische oder hydraulische Kreisläufe

Interrupteur électrique étanche de pression pour des circuits pneumatiques ou hydrauliques

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(73) Proprietor: **BITRON S.p.A.**
I-10064 Pinerolo (Torino) (IT)

(72) Inventor: **Bianco, Giovanni, c/o Siceb S.p.A.**
I-17045 Legino (Savona) (IT)

(74) Representative: **Henke, Erwin et al**
Ing.Barzanò & Zanardo Milano S.p.A.
Via Borgonuovo, 10
I-20121 Milano (IT)

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Description

The present invention relates to electrical pressure switches or pressostats, generally used in hydraulic or pneumatic circuits in the suspension or braking systems of motor vehicles to indicate that a maximum pressure has been reached.

In particular, the invention relates to a fluid-tight electrical pressure switch of the type indicated in the pre-characterising portion of appended claim 1.

EP-A-403 254 discloses a pressure switch of the type defined above.

In some known electrical switches, when a predetermined pressure threshold value is reached, the movable contact is detached from the fixed contact, overcoming the opposing action of a compressing spring which opposes its displacement. Such a solution however renders uncertain the separation of the movable contact from the fixed contact which can occur at pressure levels which are close to but which may not be equal to the predetermined separation pressure, creating the risk of inaccurate indication by the signalling circuit associated with the switch.

One object of the present invention is to provide an electrical switch which is not subject to uncertainty during the opening and closing phases of the electric contacts and in which the fluid-tightness of the membrane which is directly exposed to the action of the pressure of the circuit is improved.

The present invention is characterised by the features set forth in the characterising portion of claim 1.

By reason of the above-defined characteristic features, the electrical switch which is the object of the present invention is not subject to uncertainty during the phases of closure and opening of the electric contacts, even in the presence of minor fluctuations of the pressure around the predetermined value at which the switch is to be tripped, guaranteeing a better pressure resistance due to a double system of locking of the elastic membrane, and characterised by an increased operative reliability and structural compactness.

Further characteristic features and advantages of the invention will become evident from the ensuing detailed description in which reference is made to the single drawing attached, and supplied purely by way of non-limitative example, which illustrates a longitudinal section through an electrical switch according to the present invention.

With reference to the drawing, reference numeral 1 generally denotes a fluid-tight electrical pressure switch for hydraulic or pneumatic circuits of the "normally closed" type. It comprises a body 2 of cylindrical shape, of which one end is narrowed to form a union 3 provided with an external screw thread 3a, for example, for connection to pipe work (not shown in the drawing) in which there is contained a pressurised fluid, and inside which there is provided a conduit 4.

The opposite end of the body 2 is open and has an

edge 5 which is bent over a folding process.

Corresponding to the open end there is a head 6 locked axially by the folded edge 5 and which carries two blades 7 for electrical connection are integrated into it for example by stamping, which blades are intended to be connected to an electric signalling or alarm circuit of conventional type, not shown in the drawing.

Inside the cavity in the body 2 and close to the conduit 4 there is an elastic membrane 8 of generally disc shape, the peripheral edge of which is indicated at 8a. Above the membrane 8 (with reference to the drawing) there is a cap-shaped elastic member 9 adapted to change with snap action from an extroverted configuration to a symmetrically opposed introverted configuration illustrated in its stable extroverted state. A cup-shaped element 10 is disposed adjacent the membrane 8 and is clamped to compress the peripheral edge 8a against the body 2. The element 10 has a screw-threaded portion 10a on its outer surface which engages a corresponding screw thread 2a provided on the inside of the body 2 and it is furthermore rigidly fixed to the body 2 by means of the folded end 5. On the bottom part of the base 10b of the element 10 is a seat 11 adapted to house the cap-shaped flexible member 9. The base 10b has passing through it an axial bore 12 which functions as a guide, through which slides a rod 13 which has a shoulder consisting of an annular projection 14 close to its middle portion.

Inside the cup-shaped element 10 is inserted a substantially cylindrical element 15 which carries a pair of fixed electric contacts 16 carried by respective support arms 16a respectively connected to the connecting blades 7.

The rod 13 carries in a slidable manner an annular member 17 of conductive material which is disposed coaxially above the projection 14 (with reference to the drawing) and constitutes a movable contact adapted to assume either a position in which it connects the two fixed contacts 16 or a position in which the fixed contacts 16 are spaced apart from each other and the switch is open. Between the cylindrical element 15 and the movable contact 17 is interposed a helical spring 18 which tends to bias the said movable contact 17 in the direction of the fixed contacts 16.

In operation, under normal pressure conditions, the switch is disposed in the configuration shown in the drawing. In such a configuration, the cap-shaped elastic member 9 is, as previously stated, in an extroverted condition of stable equilibrium and the fixed contacts 16 and the movable contact 17 are mutually engaged in such a way as to determine a connection between the electrical connection blades 7 and therefore closure of the electric circuit.

Upon an increase in the pressure in the conduit 4 in the union 3, the membrane 8 tends to deform in such a way as to exert a pressure on the elastic member 9 in the direction of the rod 13.

Thanks to the double locking system of the element

10, which comprises both its screwing onto the screw thread 2a on the body 2 and the subsequent folding over of the end edge 5 to prevent its becoming unscrewed accidentally, optimum sealing and pressure-tightness of the membrane 8 is guaranteed, this membrane being subject to the effective action of compression along all its peripheral edge 8a.

When the pressure in the conduit 4 reaches a predetermined threshold level p_1 , for example corresponding to a maximum pressure which the circuit will withstand, the deformation of the elastic membrane 8 overcomes the reaction of the elastic member 9 causing it to change over rapidly to an introverted configuration in which its concavity is opposite that shown in the drawing. In passing into this configuration, the elastic member 9 brings about axial displacement of the rod 13 which moves and in doing so entrains the movable contact 17 overcoming the action of the spring 18 and therefore producing a closure of the switch and intervention of the electric signalling associated with it.

The introverted configuration may be unstable or stable.

In the first case, whenever the pressure of the circuit falls below the threshold value p_1 , the elastic member 9 will immediately return to the extroverted configuration, closing the switch again.

In the second case, the fresh closure of the switch will be verified at a pressure value p_2 which is less than the value p_1 so that the circuit will remain open even in the presence of minor fluctuations in the value of the pressure around the value p_1 . The difference ($p_1 - p_2$) is a parameter which can be defined at the design stage with the geometrical characteristics of the cap-shaped elastic member 9 and the loading on the thrust spring 18.

For example, electric switches of the "normally open" type may be constructed in which the fixed contacts 16 are carried directly by the cylindrical element 15 and in which the switch closes when the predetermined pressure p_1 is attained.

Claims

1. A fluid-tight electrical pressure switch for hydraulic or pneumatic circuits, comprising a substantially cylindrical hollow body (2) which has at the one end a tubular union (3) for connection to the circuit and which carries on the other end electrical connection means (7) intended to be connected to an electrical signalling circuit, the said body (2) accommodating:

at least one fixed contact (16) connected to said electrical connection means (7),
a contact (17) adapted for movement between a first position of engagement with the said fixed contact (16) and a second position in which it is spaced apart from the said fixed contact (16),

thrust means (18) acting on the movable contact (17),

an elastic membrane (8) which sealingly separates the cavity of the said body (2) from the tubular union (3), for controlling the displacement of the movable contact (17) between the first and the second position as a result of a predetermined pressure level being attained in the said union (3),

a locking member (10) disposed inside the hollow body (2) to clamp the peripheral edge (8a) of the membrane (8) in relation to the union (3), and

a substantially cup-shaped elastic member (9) interposed between the movable contact (17) and the aforesaid membrane (8), disposed normally in an extroverted configuration and adapted to bring about displacement of the movable contact (17) by changing its shape with a snap action into an introverted configuration by the effect of a pressure threshold value being attained in the said union (3), characterised in that the locking member (10) has an external screw thread (10a) adapted to engage a corresponding screw thread (2a) provided on the inside of the cavity of said body (2), in order to fix it to the body (2), and it is furthermore axially locked relative to the body (2) by folding of an end edge (5) of the hollow body (2), the folded edge (5) allowing to further fixing the locking member (10) to the body (2) and to prevent it becoming unscrewed accidentally, and in that said thrust means (18) tend to maintain the movable contact (17) in the said first position, the elastic membrane (8) being adapted to control the displacement of the movable contact (17) from said first position to said second position, against the action of the said thrust means (18).

2. As switch according to Claim 1, characterised in that it comprises a pair of fixed contacts (16) engageable by the movable contact (17) carried by a rod (13) which has a shoulder (14) disposed axially inside the hollow body (2) and is slidable between a first back rest position and a second forward operative position as a result of displacement of the aforesaid cap-shaped elastic member (9) between the said extroverted configuration and the said introverted configuration respectively.
3. A switch according to Claim 1 or 2, characterised in that the aforesaid external electrical connection means (7) are carried by a closure member (6) which is locked in respect of the body (2) by the folding over of the aforesaid end edge (5).
4. A switch according to Claim 3, characterised in that

the aforesaid clamping member (10) is a cup-shaped element the base (10b) of which is traversed by an axial guide bore (12) for the said rod (13) and in that it has a seat (11) which faces the aforesaid membrane (8) and in which the said cap-shaped elastic member (9) is disposed.

Patentansprüche

1. Fluiddichter elektrischer Druckschalter für hydraulische oder pneumatische Kreisläufe, bestehend aus einem im wesentlichen zylindrischen Hohlkörper (2), der an einem Ende ein röhrenförmiges Anschlußstück (3) aufweist und am anderen Ende elektrische Kontaktelemente (7) trägt, die für eine Verbindung zu einem elektrischen Schwachstromkreis vorgesehen sind, wobei das Gehäuse (2) umfaßt:

- zumindest einen feststehenden Kontakt (16), der mit den elektrischen Kontaktelementen (7) verbunden ist,
- ein Kontaktelement (17), geeignet für eine Bewegung zwischen einer ersten Position mit Kontakt zum feststehenden Kontakt (16) und einer zweiten Position, in der es vom feststehenden Kontakt (16) abgehoben ist,
- eine Druckeinrichtung (18), die auf das bewegliche Kontaktelement (17) einwirkt,
- eine elastische Membran (8), die den Hohlraum des Gehäuses (2) dicht vom röhrenförmigen Anschlußstück (3) abtrennt, um die Verschiebung des beweglichen Kontaktelementes (17) zwischen einer ersten und zweiten Position als Ergebnis der Erreichung eines vorbestimmten Druckniveaus im Anschlußstück (3) zu steuern,
- eine Feststelleinrichtung (10), die innerhalb des Gehäuses (2) angebracht ist, um den äußeren Rand (8a) der Membran (8) gegen das Anschlußstück (3) zu verspannen und
- ein im wesentlichen tellerförmiges, elastisches Element (9), das sich zwischen dem beweglichen Kontaktelement (17) und der Membran (8) befindet, wobei es sich normalerweise in einer nach außen gewölbten Lage befindet und sich dazu eignet, als Effekt der Erreichung eines Druckschwellenwertes im Anschlußstück (3) durch ein Umschnappen seine Form in eine nach innen gewölbte Lage zu ändern und dabei eine Verschiebung des beweglichen Kontaktelementes (17) zu bewirken,

dadurch gekennzeichnet, daß die Feststelleinrichtung (10) an der Außenseite ein Schraubgewinde (10a) aufweist, das geeignet ist, in ein korrespondierendes Schraubgewinde (2a) an der Innenseite des Hohlraumes des Gehäuses (2) einzugeifen und

damit die Feststelleinrichtung (10) am Gehäuse (2) zu fixieren, welche zusätzlich relativ zum Gehäuse (2) durch die Umschlagung eines Steges (5) des Gehäuses (2) axial fixiert ist, wobei der umgeschlagene Steg (5) eine zusätzliche Fixierung der Feststelleinrichtung (10) am Gehäuse (2) erlaubt und eine zufällige Aufschraubung verhindert, und daß die Druckeinrichtung (18) versucht, das bewegliche Kontaktelement (17) in der zuvor genannten ersten Position zu halten, wobei die elastische Membran (8) dazu geeignet ist, die Verschiebung des beweglichen Kontaktelementes (17) von dieser ersten Position in die zuvor genannte zweite Position gegen die Wirkung der Druckeinrichtung (18) zu steuern.

2. Schalter nach Anspruch 1, dadurch gekennzeichnet, daß er ein Paar feststehender Kontakte (16) umfaßt, die von einem beweglichen Kontaktelement (17) geschaltet werden, wobei dieses von einer Stange (13) bewegt wird, die eine Schulter (14) aufweist, axial im Gehäuse (2) gelagert ist und zwischen einer ersten hinteren Raststellung und einer zweiten vorderen Betriebsstellung als Folge der Verschiebung des tellerförmigen elastischen Elementes (9) zwischen der nach außen gewölbten Lage und der nach innen gewölbten Lage verschiebbar ist.
3. Schalter nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die äußeren elektrischen Kontaktelemente (7) von einem Abschlußstück (6) getragen werden, das durch die Umschlagung des Steges (5) in bezug zum Gehäuse (2) fixiert ist.
4. Schalter nach Anspruch 3, dadurch gekennzeichnet, daß die Feststelleinrichtung (10) ein topfförmiges Element ist, dessen Boden (10b) durch eine axiale Führungsbohrung für die Stange (13) durchbrochen ist und daß sie einen Sitz (11) aufweist, der zur Membran (8) schaut und in dem das tellerförmige, elastische Element (9) gelagert ist.

Revendications

1. Interrupteur électrique étanche aux fluides de pression, pour circuits hydrauliques ou pneumatiques, comprenant un corps creux (2) sensiblement cylindrique ayant à sa première extrémité une jonction tubulaire (3), devant être connectée au circuit, et comportant, à son autre extrémité, des moyens de connexion électrique (7) destinés à être connectés à un circuit de signalisation électrique, ledit corps (2) logeant :

au moins un contact fixe (16) connecté auxdits moyens de connexion électrique (7),
un contact (17) adapté pour se déplacer entre

une première position de contact contre ledit contact fixe (16) et une deuxième position dans laquelle il est espacé dudit contact fixe (16), un moyen de poussée (18) agissant sur le contact déplaçable (17),

une membrane élastique (8) qui sépare de manière étanche la cavité dudit corps (2) de la jonction tubulaire (3), pour commander le déplacement du contact déplaçable (17) entre les première et deuxième positions, suite à l'obtention d'un niveau de pression prédéterminée dans ladite jonction (3),

un organe de verrouillage (10) disposé à l'intérieur du corps creux (2) pour serrer le bord périphérique (8a) de la membrane (8) par rapport à la jonction (3), et

un organe élastique (9) sensiblement en forme de coupelle, disposé entre le contact déplaçable (17) et ladite membrane (8), disposé normalement dans une configuration déployée et adapté pour donner lieu au déplacement du contact déplaçable (17) en changeant de forme à l'aide d'une action de détente, pour obtenir une configuration rétractée sous l'effet d'une valeur de seuil de pression atteinte dans ladite jonction (3),

caractérisé en ce que l'organe de verrouillage (10) présente un filetage (10a) adapté pour s'engager contre un taraudage (2a) correspondant prévu à l'intérieur de la cavité dudit corps (2), en vue de le fixer au corps (2), et est en outre verrouillé axialement par rapport au corps (2) par le pliage d'un bord d'extrémité (5) du corps creux (2), le bord plié (5) permettant en outre la fixation de l'organe de verrouillage (10) au corps (2) et l'empêchement d'un dévissage intempestif de ce dernier, et en ce que ledit moyen de poussée (18) tend à maintenir le contact déplaçable (17) dans ladite première position, la membrane élastique (8) étant adaptée pour commander le déplacement du contact déplaçable (17) de ladite première position à ladite deuxième position, à l'encontre de l'action exercée par ledit moyen de poussée (18).

2. Interrupteur selon la revendication 1, caractérisé en ce qu'il comprend un couple de contacts fixes (16) pouvant être placés en contact avec le contact déplaçable (17) supporté par une tige (13) ayant un épaulement (14) disposé axialement à l'intérieur du corps creux (2) et qui peut coulisser entre une première position, arrière et de repos, et une seconde position avant et de service, suite au déplacement dudit organe élastique (9) en forme de coupelle, entre ladite configuration déployée et ladite configuration rétractée respectivement.

3. Interrupteur selon la revendication 1 ou 2, caracté-

risé en ce que lesdits moyens de connexion électrique (7) extérieurs sont supportés par un organe de fermeture (6) qui est verrouillé par rapport au corps (2), par le rabattement dudit bord d'extrémité (5).

4. Interrupteur selon la revendication 3, caractérisé en ce que ledit organe de serrage (10) est un élément en forme de coupelle, dont la base (10b) est traversée par un alésage de guidage (12) axial pour ladite tige (13) et en ce qu'il présente un siège (11), qui est tourné vers ladite membrane (8) et dans lequel est disposé ledit organe élastique en forme de coupelle (9).

