

[54] **PRESSURE ACTUATED ELECTRICAL SWITCH WITH CENTRALLY INSULATED CONTACT PORTION**

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[58] Field of Search 200/83 R, 83 C, 83 J, 83 N, 200/83 S, 83 V, 81 R, 159 B, 275, 243, 246, 245, 278, 279, 290, DIG. 58

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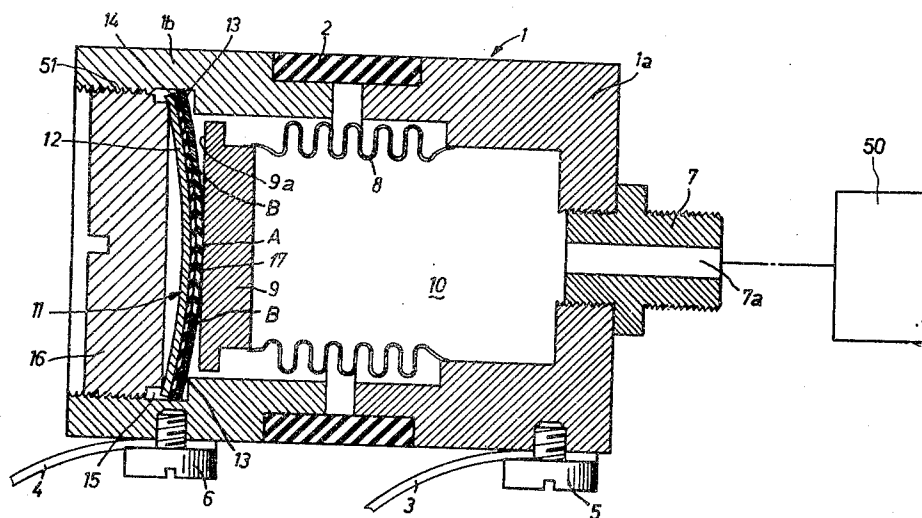
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[57]

ABSTRACT

An electrical switching device which can be actuated in response to a pressure comprising a domed or arched substantially plate-shaped elastic spring or resilient element supported at its edge, wherein the convex surface thereof possesses electrically conductive material at least at a region thereof which extends along its edge. There is further provided a pressure-actuated member which exerts a pressure force upon the spring element at the convex side or face of such spring element. The pressure-actuated member has a surface confronting the spring element and such confronting surface is provided with electrically conductive material at least at that location where it comes into contact with the conductive material of the convex surface of the spring element upon actuating the switching device.

12 Claims, 2 Drawing Figures



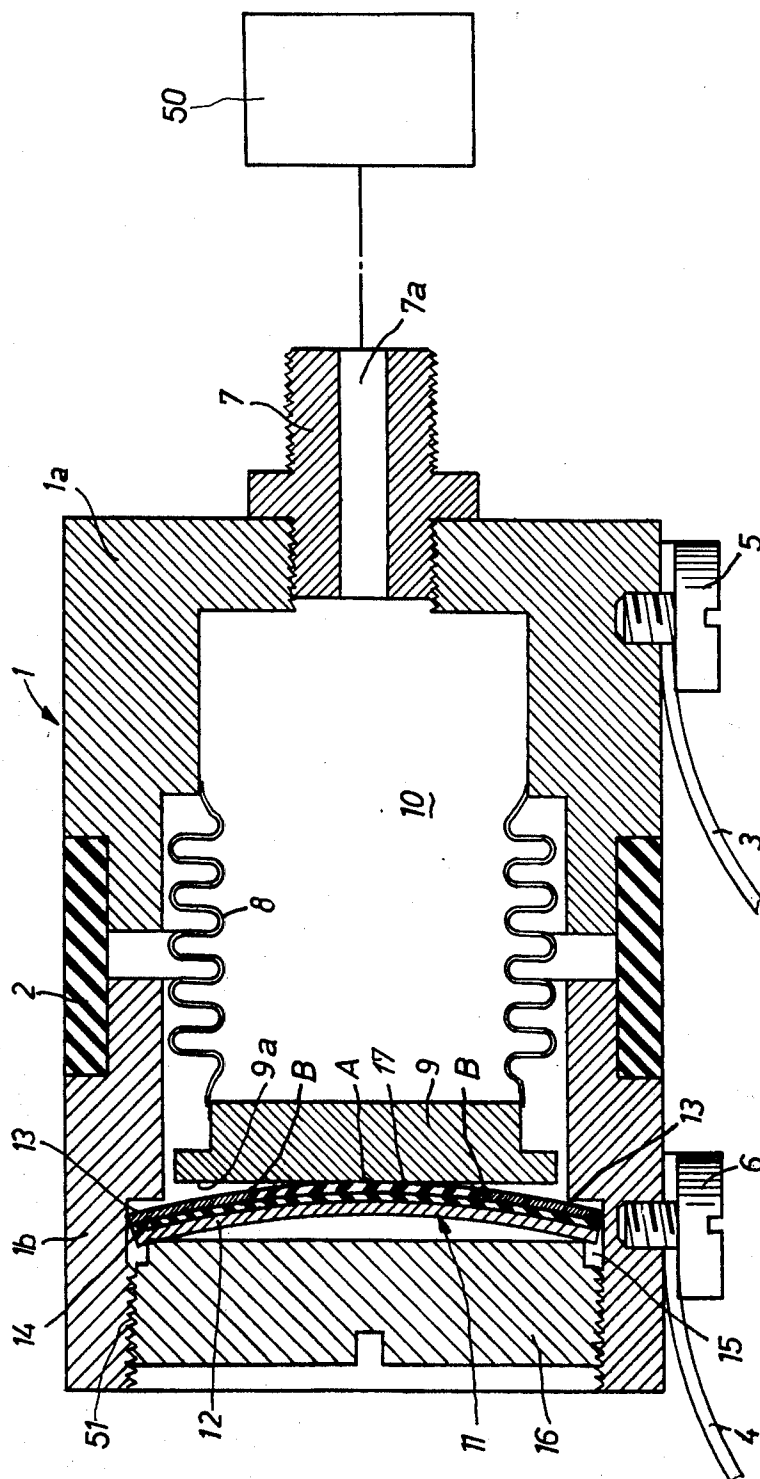


Fig 1

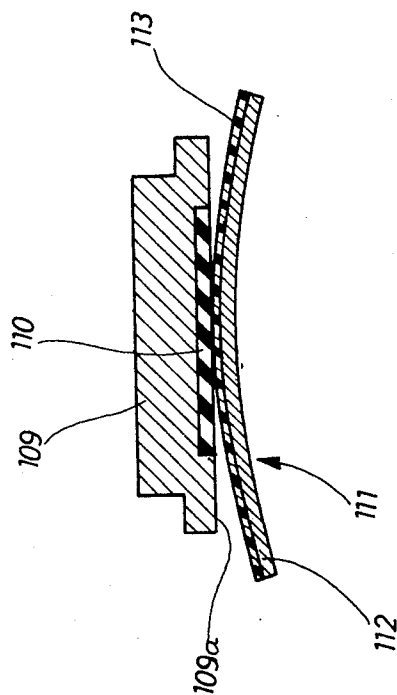


Fig. 2

PRESSURE ACTUATED ELECTRICAL SWITCH WITH CENTRALLY INSULATED CONTACT PORTION

BACKGROUND OF THE INVENTION

The present invention broadly relates to the electrical switching art and, more specifically, concerns a new and improved construction of an electrical switching device which can be actuated as a function of a pressure.

The state-of-the-art switching devices of this type only function reliably within a limited temperature range. For instance, the tripping or switching mechanism of microswitches is markedly dependent upon temperature. Additionally, such tripping mechanism is sensitive to jarring and for certain fields of application possesses an undesired large switching hysteresis.

SUMMARY OF THE INVENTION

Hence, it should be apparent that there is still a real need in this particular art for an electrical switching device which is not associated with the aforementioned drawbacks and limitations of the prior art constructions. Therefore, it is a primary object of the present invention to provide an improved construction of electrical switching device of the previously mentioned type which effectively and reliably fulfills the need existing in this art.

Another object of the present invention aims at the provision of a new and improved construction of switching device of the previously mentioned type which does not possess the aforementioned drawbacks and which always functions faultlessly and reliably.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the electrical switching device of this development is manifested by the features that it encompasses a domed or arched plate-shaped elastic spring element which is supported at its edge, the convex surface of which is provided with electrically conductive material at least at a region extending along its edge. There is further provided a pressure-actuated member which exerts a pressure force upon the convex face or side of the spring element. The pressure-actuated member has a surface which confronts the spring element and which is provided with electrically conductive material at that location wherein it comes into contact with the conductive material of the convex surface of the spring element upon actuation of the electrical switching device.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a cross-sectional view through a switching device which can be actuated by the pressure of a pressurized medium, for instance air; and

FIG. 2 is a schematic sectional view of a detail of a variant construction of a component of the switching device depicted in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, the exemplary embodiment of electrical switching device depicted in FIG. 1 will be understood to encompass a substantially cylindrical housing 1 which is constituted by two hollow cylindrical housing portions or housing halves 1a and 1b. These housing halves 1a and 1b are formed of a suitable electrically conductive material and by means of a ring member or ring 2 formed of insulating material are insulated from one another and at the same time connected with one another. At each respective housing half 1a and 1b there is secured a conductor wire 3 and 4 respectively, for instance by means of screws 5 and 6 respectively.

The device can be operatively connected via these conductor wires 3 and 4 with any suitable and therefore not particularly illustrated electrical switching circuit.

At the end face of the housing portion 1a there is threaded a coupling element 7 which is connected in conventional manner to a schematically illustrated container or vessel 50 which contains a pressurized fluid medium, such as compressed air or a hydraulic medium, by way of example.

A movable bellows or diaphragm 8 which can be displaced in its lengthwise direction is arranged internally of the housing 1, this bellows 8 being secured at its one end at its peripheral region at the inner wall of the housing portion 1a in any suitable fashion. The opposite end of the bellows 8 is connected with a pressure plate 9 constituting a pressure-actuated member. Both the pressure plate or pressure plate member 9 as well as also the bellows 8 are fabricated from electrically conductive material.

The connection between the bellows 8 and the inner wall of the housing portion 1a as well as the pressure plate member 9 must be gas tight, so that the internal space or compartment 10 formed by the housing portion 1a, the bellows 8 and the pressure plate 9 is sealed in a gas tight manner. This internal space or compartment 10 is connected via the throughpassage 7a at the coupling element 7 with the internal space of the compartment or vessel 50 which contains the pressurized fluid medium.

Continuing, it is to be understood that in the housing portion 1b there is arranged a substantially disk-shaped, domed or arched spring elastic element 11. In the embodiment under consideration this element 11 may be formed of a domed or arched carrier plate 12 fabricated of spring elastic material, for instance spring steel. An insulating layer 14 is applied to the carrier or support plate 12 at the side confronting the pressure plate member 9.

At the marginal region of the element 11 the insulating layer 14 is covered with a layer 13 formed of electrically conductive material. This layer 13 surrounds a layer 17 formed of insulating material and which is arranged at the central portion of the element 11. This layer 17 can be applied to the insulating layer 14 or can be formed by a portion thereof.

The layers 13 and 17 abut one another at the location designated by reference character B. The insulating layer 14 can also be omitted and the layers 13 and 17 can be arranged directly at the carrier plate 12.

The spring-elastic element 11 is accommodated in such a manner in a recess 15 at the housing portion 1b

that the layer 13 always is in contact with the wall of the recess 15.

The carrier plate 12 is supported at its edge upon an adjustment or setting screw member 16 or equivalent structure which is threaded into the recess 15, as generally indicated by the threading 51. It is possible to adjust the dependency of the deformation of the carrier plate 12, in other words the element 11, from the pressure forces exerted upon the element 11, by adjusting the position of the adjustment screw or nut member 16.

In FIG. 1 the pressure plate member 9 has been illustrated in bearing contact essentially only with the topmost location or apex A of the convex surface of the layer 17 formed of insulating material. The current circuit formed by the conductor wire 3, the housing portion 1a, the bellows 8, the pressure plate 9, the layer 13, the housing portion 1b and the conductor wire 4, is thus interrupted owing to the layer 17 of insulating material which is arranged in such current circuit.

Now if the pressure of the pressurized medium located in the internal compartment 10 and which acts upon the pressure plate member 9 increases, then, the pressure plate member 9 is pressed against the element 11, and which under the influence of such force is elastically deformed and pressed flat. With a certain pressure the contact surface 9a of the pressure plate member 9, owing to the flat configuration of the element 11 which is now attained, comes into contact with the layer 13 formed of electrically conductive material, with a result that the above-mentioned current circuit is now closed since the layer 17 formed of insulating material has been bridged.

On the other hand, if the pressure acting upon the pressure plate member 9 again decreases, then the carrier or support plate 12, owing to its spring-elastic properties, again bends back into its domed or arched terminal position as depicted in FIG. 1 in which the aforementioned current circuit is again interrupted.

Now in FIG. 2 there has been illustrated a further possible construction of the spring-elastic element and the pressure plate member portrayed in FIG. 1. FIG. 2 illustrates only the pressure plate member 109 and the spring-elastic element 111 which cooperates therewith, whereas the remaining components of the device which have been shown in FIG. 1 have been here omitted for purposes of simplifying the illustration of the drawing, but can be considered to be the same as those shown in FIG. 1.

The pressure plate member or pressure plate 109, which corresponds to the pressure plate member 9 of FIG. 1, consists of electrically conductive material, however is provided at its contact surface 109a with a central portion 110 formed of insulating material.

The spring-elastic element 111, which corresponds to the element 11 of FIG. 1, likewise possesses a domed or arched carrier plate 112 formed of spring-elastic material, for instance spring steel. This carrier plate 112 is covered at the side confronting the pressure plate 109 with a layer 113 formed of electrically conductive material.

Now if the pressure plate 109 and the element 111 of FIG. 2 are mounted in the switching device depicted in FIG. 1 in place of the pressure plate member 9 and the element 11 respectively, then basically nothing changes as concerns the mode of operation described in conjunction with the embodiment of FIG. 1.

The described device which can be switched-on and switched-off as a function of a pressure, can be electrically connected by means of the conductor wires or lines 3 and 4 with an electrical circuit of suitable design, which for instance can serve to carry out an indicating or control function as a function of pressure.

Since the respective pressure plate members 9 and 109 always bear under pressure against the layers 13 and 17 and 113 respectively, with constant pressure there does not occur any undesired change in the condition of the switching device even upon the occurrence of vibrations and centrifugal forces. It is for these reasons that this device can also be mounted for instance at rotating components and is suitable for monitoring the pressure of vehicle tires or for indicating centrifugal forces.

The movement of the pressure plate members 9 and 109 can occur both pneumatically, hydraulically as well as mechanically. In the last-mentioned situation the component 50 of FIG. 1 can be conceptually considered to constitute a mechanical actuation means.

The shape of the carrier plates 12 and 112 can be randomly chosen. It is conceivable to design such carrier plates to possess, for instance, a disk-, strip- or star-shaped configuration.

It would be also possible to fabricate the spring-elastic carrier plate 12 of insulating material and to omit the insulating layer 14. It would also be possible to construct the layer 113 (FIG. 2) such that it possesses the desired spring-elastic properties. In such case it would be possible to omit the carrier plate 112.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

Accordingly, what is claimed is:

1. A pressure-actuated electrical switching device comprising a domed, substantially plate-shaped elastically flexible spring element supported at its edge, said spring element having a convex surface, a pressure-actuated member removably contacting said elastic spring element for exerting a pressure force against the convex surface of said spring element, said pressure-actuated member having a surface arranged opposite to the convex surface of said spring element, said convex surface of said spring element being provided at its central region with electrically insulating material, said central region being surrounded by electrically conductive material arranged along the marginal region of said convex surface, said surface of the pressure-actuated member being completely formed of electrically conductive material, said conductive material of said pressure actuated member and said conductive material of said spring element movably contacting each other in accordance with movement of said pressure actuated member.

2. The switching device as defined in claim 1, wherein the spring element possesses a domed, elastically flexible carrier member, which at its convex side is covered at its central region with a layer of electrically insulating material and which is covered at its marginal region with a layer of electrically conductive material, said layer provided at said marginal region surrounding said layer provided at said central region.

3. The switching device as defined in claim 1, further including a support body, the spring element being sup-

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ported at its edge by said support body at its side situated opposite the pressure-actuated member, said support body being displaceable in a direction towards the pressure-actuated member for adjusting the resilient properties of the spring element.

4. The switching device as defined in claim 1, wherein the pressure-actuated member comprises a body of electrically conductive material, said body defining a substantially planar contact surface facing the convex surface of said spring element, said body being movable in a direction which is essentially perpendicular to the spring element.

5. The switching device as defined in claim 1, further including means for moving the pressure-actuated member.

6. The switching device as defined in claim 5, wherein such moving means comprises pneumatic means.

7. The switching device as defined in claim 5, wherein said moving means comprises hydraulic means.

8. The switching device as defined in claim 5, wherein said moving means comprises mechanical means.

9. A pressure-actuated electrical switching device comprising a domed, substantially plate-shaped elastically flexible spring element supported at its edge, said spring element having a convex surface, a pressure-actuated member removably contacting said elastic spring element for exerting a pressure force against the convex surface of said spring element, said pressure-actuated member having a surface arranged opposite to

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the convex surface of said spring element, said convex surface of said spring element being completely formed of electrically conductive material, said surface of said pressure-actuated member possessing a central region formed of electrically insulating material, said central region being surrounded by electrically conductive material, said conductive material of said pressure actuated member and said conductive material of said spring element movably contacting each other in accordance with movement of said pressure actuated member.

10. The switching device as defined in claim 9, wherein the spring element possesses a domed elastically flexible carrier which is covered at its convex side with a layer formed of electrically conductive material.

11. The switching device as defined in claim 9, further including a support body, the spring element being supported at its edge by said support body at its side situated opposite the pressure-actuated member, said support body being displaceable in a direction towards the pressure-actuated member for adjusting the resilient properties of the spring element.

12. The switching device as defined in claim 9, wherein the pressure-actuated member comprises a body of electrically conductive material, said body defining a substantially planar surface facing the convex surface of said spring element, a central portion of said planar surface of said body being formed of electrically insulating material, said body being movable in a direction which is essentially perpendicular to the spring element.

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