

[54] **ARCUATE FORM ELECTRICAL SWITCHES HAVING AN AXIALLY DISPLACEABLE ACTUATOR**

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[56]

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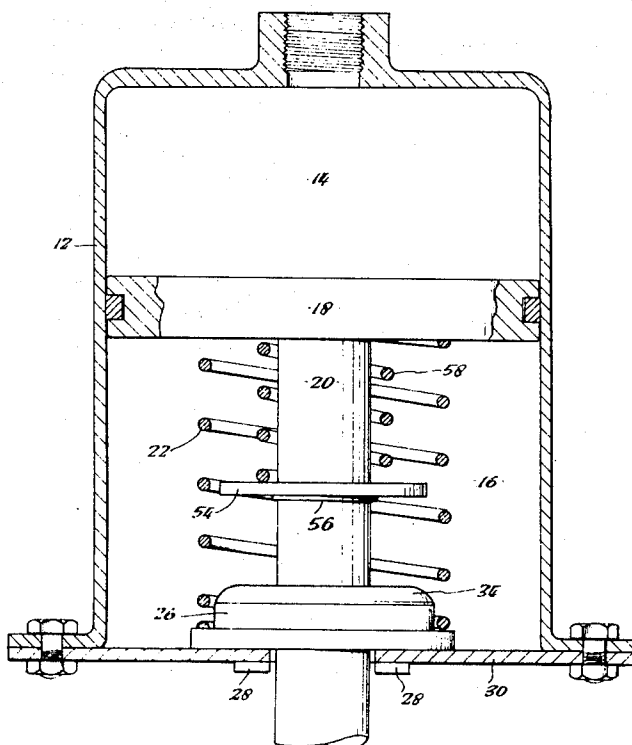
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ABSTRACT

An electrical switch device is adapted for use in conjunction with a fluid-operated cylinder and piston mechanism, for example to indicate overtravel of the mechanism. The device is in the form of a ring and surrounds the piston rod. It has a sealed housing for the contact elements of the switch, the top wall of the housing being resiliently deformable by a spring-mounted operated member carried by the piston rod to open the switch contacts.

13 Claims, 5 Drawing Figures



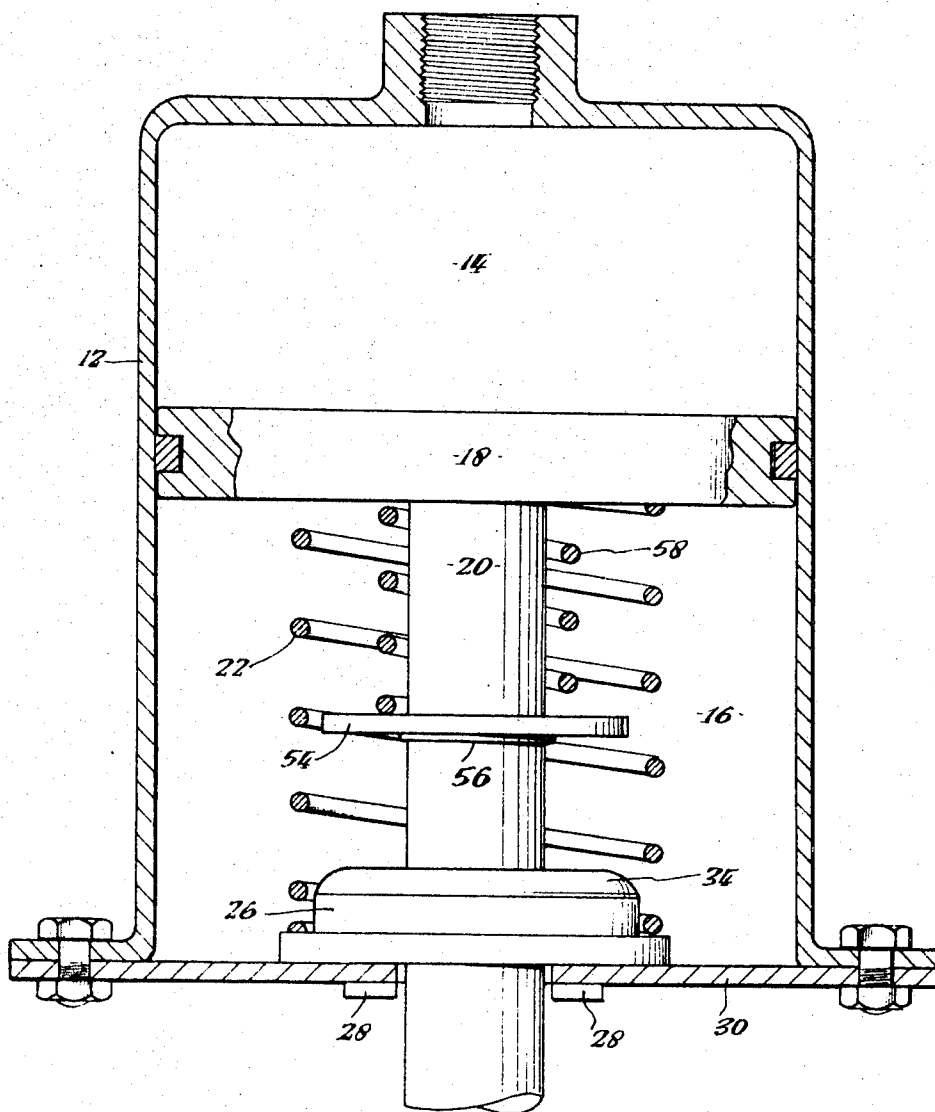
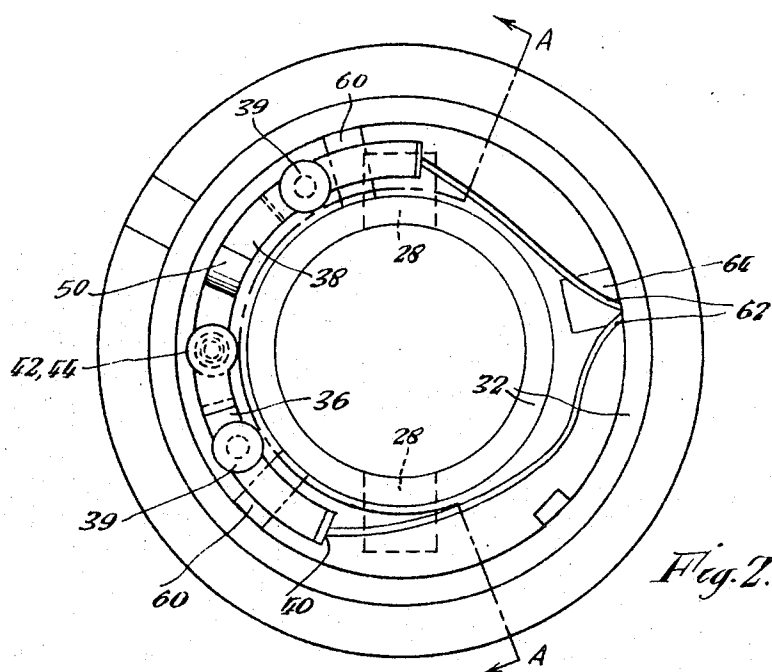
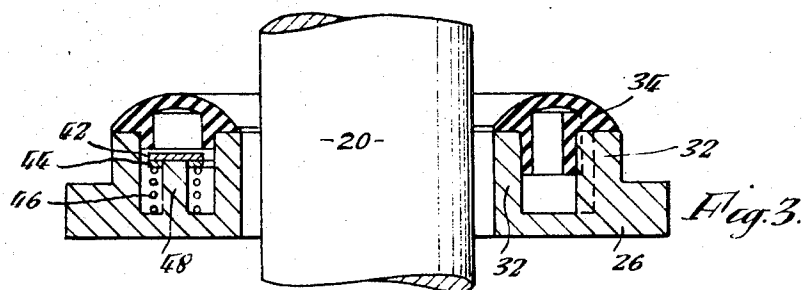
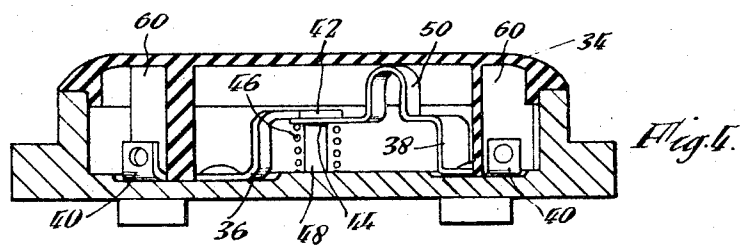
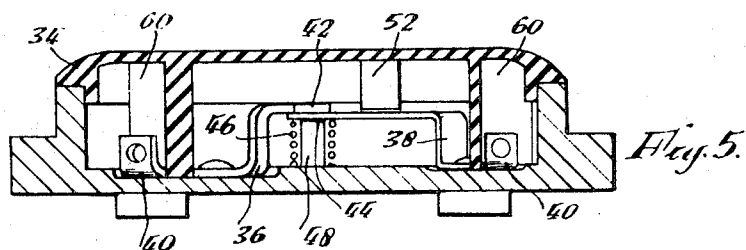


Fig. 1.



ARCuate FORM ELECTRICAL SWITCHES HAVING AN AXIALLY DISPLACEABLE ACTUATOR

This invention relates to electrical switches and is particularly, but not exclusively, concerned with switches that can be employed in conjunction with mechanisms, such as fluid-operated mechanisms to indicate movement of such mechanisms.

Fluid-operated mechanisms commonly comprise a cylinder and piston unit, a rod being secured to the center of the piston to project axially of the cylinder. For an electrical switch to be operated by the operation of the mechanism, the switch contacts can be carried by one of the members of the cylinder and piston unit and be engaged by an actuating element carried by the other member of that unit.

Problems can arise in devising a practical arrangement functioning in this manner. For example, it will generally be unsatisfactory to place the electrical switch in any sealed spaced provided for the operating fluid yet at the same time, to ensure trouble-free use it should be ensured that the switch is not likely to be rendered inoperative by the ingress of foreign matter or by moisture causing corrosion. Space limitations may also have to be taken into account, particularly if the switch is to be located close to the axis of the cylinder and piston assembly, which is desirable to minimize the effect of asymmetrical forces and displacements. Moreover it would generally be undesirable for the switch itself to form a mechanical stop limiting the displacement of the fluid-operated mechanism.

It is an object of the present invention to provide a switch device that can be protected from foreign matter and atmospheric corrosion, even when employed in a fluid-operated mechanism that is exposed to the elements.

It is a further object of invention to provide a switch device that can be placed close to the axis of a cylinder and piston assembly, or a like arrangement comprising a rod movable axially relative to a support member, the manner of operation being such that it does not impede said relative movement between the rod and the support member.

In accordance with the invention, an electrical switch device is provided for use with a mechanism comprising a rod movable axially relative to a support member and said device comprises a carrier in which a housing of arcuate or circular form is arranged to be disposed substantially concentrically to the rod, the carrier supporting electrical contacts of the switch device and means being provided to permit said contacts to open and close in response to relative movement between the rod and the support member.

It may be convenient to arrange the carrier to be mounted to the support member and to mount on the rod an operating member adapted to cause said opening and closing of the contacts with relative movement between the rod and the support member by displacing the contacts of the switch device as it approaches the support member.

Preferably, the arcuate or circular form of the housing comprises a channel defined by concentric flanges and said flanges are bridged by a displaceable sealing member that forms thereby an enclosure for the contacts. Closure elements may be associated with the

sealing member, preferably as integral parts of that member, at angularly spaced positions in the carrier channel to define the limits of an arcuate enclosure for the contacts.

At least one contact may be carried by a cantilever member engageable with the sealing member at a point between the region of support of the cantilever member and the contact. Said engagement may be made either by a protruding portion of the lever projecting towards the sealing member or by a portion of the sealing member projecting into the channel and bearing on the lever, the main part of the lever being spaced from the sealing member.

Conveniently, the operating member has resilient means urging it to a predetermined position on the rod such that said relative movement between the rod and the support member is not transmitted to the operating member after movement of the contacts to an end position by the operating member, but is taken up by deformation of the resilient means, so that the freedom for said relative movement is not impeded.

The invention will be more particularly described with reference to the drawings accompanying the provisional specification, wherein:

FIG. 1 is a sectional view of a fluid-operated actuator incorporating a switch device according to the invention, for example to operate an over-travel indicator means,

FIG. 2 is a plan view of the switch device in FIG. 1, with its sealing member omitted,

FIG. 3 is a view in diametrical section of the switch device in FIGS. 1 and 2, and

FIGS. 4 and 5 illustrate in sectional views on the line A — A in FIG. 2, two alternative forms of the switch device in FIGS. 1 to 3.

Referring more particularly to FIG. 1 of the drawings, there is shown there an actuator comprising a casing 12 the interior of which is divided into first and second chambers 14, 16 by a piston 18. The piston carries an operating rod 20 that projects from the casing and that is attached to a mechanism (not shown) to be operated by the admission of fluid to the first chamber so as to displace the piston 18 against the force of a return spring 22.

The mechanism operated by the actuator is not illustrated as it is not itself a part of the present invention and it may take a variety of forms. In accordance with the present invention, a switch is provided in the second chamber of the actuator to be responsive to the movement of the piston 18, e.g. for the purpose of indicating excessive travel of the mechanism associated with the piston. The switch comprises a ring-form or annular carrier 26 located in the actuator chamber by a pair of lugs 28, it being held against bottom plate 30 in which the lugs fit by the force of the spring 22, but if required means may be provided to secure the carrier positively to the plate 30.

The carrier 26 includes a pair of cylindrical flanges 32 providing an annular housing recess between them that is enclosed by a resilient sealing member 34 bonded to the flanges. The electrical conductors of the device are provided by metal strips 36, 38 each of an arcuate plan form conforming to the curvature of the annular recess of the carrier and these strips are secured to the carrier in a moulding operation in which

the carrier is formed, bosses 39 then anchoring the strips.

The strips have external terminal elements 40 at their mutually remote ends and overlapped contact elements 42, 44 at their mutually adjacent ends, a spring 46 urging these contact elements into abutment with each other. The contact element 44 is of ring form so that it can move along stem 48 projecting upwardly from the recess 4 as an integral part of the carrier 26 and providing a location for the spring 46. The electrical connection between the strips 36, 38 can thus be broken by depression of the contact element 44 against the force of the spring 46.

Such movement is arranged to be actuated by depression of the sealing member 34 with engagement of the strip 38, either by a raised portion 50 (FIG. 4) formed in the strip or by an internally projecting portion 52 (FIG. 5) of the sealing member. The sealing member is itself depressed by an actuating collar 54 of the switch device that is held against an abutment shoulder 56 (which may comprise a circlip) on the rod 10 by a spring 58. Thus, travel of the rod 20 beyond a certain extent will open the switch and, because of the resilient restraint of the spring 58, the collar 54 does not itself impede further travel of the rod after it has depressed the sealing member.

To protect the contact elements against dirt and moisture, they are contained in a region of the carrier recess bounded at regions intermediate the lengths of their strips 36, 38 by projecting portions 60 of the sealing member so that they are within a fully sealed arcuate housing space. Leads 62 from the terminal elements of the strips run out from the carrier through an aperture 64 in its base portion remote from the contact elements. Clearly, it would be possible to omit the portions 60 and form a completely circular enclosure by sealing instead at the aperture 64.

Since the arrangement is intended to indicate overtravel of the piston 18, in operation, the contact elements 42, 44 will remain in engagement with each other until the rod 20 is given more than a certain displacement and it is arranged that in normal operation this displacement position is not reached. However, as wear takes place in the mechanism connected to the rod, the displacement required of the rod to operate the mechanism will increase and after a given amount of wear the movement of the rod is sufficient to depress the sealing member and so separate the contact elements. This action is arranged to operate an indicating device (not shown) of a circuit in which the switch is connected by means which it is brought to the operator's attention that the mechanism must be serviced.

It will be noted that, since the indicating device is actuated by breaking the circuit normally completed by the contact elements 42, 44, the arrangement has a "fail-safe" characteristic in that if a fault occurs that opens the circuit it will be brought to the attention of the operator immediately.

Although the illustrated arrangement in which the carrier has a completely circular form has many practical advantages, it will be noted that the switching mechanism occupies only a part of its peripheral extent and it requires no further explanation to see how the switch device can be made with an arcuate form carrier. It will also be readily appreciated that multiple con-

tacts can be arranged within the housing space provided by the carrier, if required.

What we claim and desire to protect by Letters Patent is:

1. In a switch mechanism having a rod member movable axially relative to a support member, an electrical switch device comprising, in combination, a carrier having a recess formed therein occupying at least an arc of an annulus and electrical contacts supported on the carrier within said recess and extending over at least a portion of the annular extent of said recess, said carrier being disposed with the center of the arc of said recess substantially co-incident with the central longitudinal axis of the rod member, the carrier being fixed relative to one of said members of the mechanism, an actuator for the contacts being provided in fixed relation to the other of said members, whereby relative movement between said members effectuates an opening and closing of said contacts.

2. A switch mechanism according to claim 1 wherein the carrier is mounted on the support member and said actuator is in the form of an element carried by the rod member.

3. A switch mechanism according to claim 2, wherein resilient means act upon the actuator urging it to a predetermined position on the rod member such that said relative movement of the members, by deformation of the resilient means, can be continued with arrest of the actuator after movement of the contacts to an end position by the actuator.

4. A switch mechanism according to claim 1, wherein concentric flanges on the carrier define said recess, a displaceable sealing member bridging said flanges to form an enclosure for the contacts.

5. A switch mechanism according to claim 4, wherein closure elements are provided at spaced positions in said recess, an arcuate enclosure for the contacts having its angular limits defined thereby.

6. A switch mechanism according to claim 5 wherein the closure elements are integral with the sealing member.

7. A switch mechanism according to claim 5 wherein the sealing member continues over the full arcuate extent of the recess.

8. A switch mechanism according to claim 4 wherein the switch device comprises a cantilever member in said recess, one end of the member being secured to the carrier, a free end of the cantilever member carrying at least one of said contacts, a region of the cantilever member between said ends being capable of engagement with the sealing member for displacement of the cantilever member to open and close said contacts.

9. A switch mechanism according to claim 8 wherein a protruding portion of the cantilever member at said region projects towards the sealing member for said engagement.

10. A switch mechanism according to claim 8 wherein a portion of the sealing member projects into the recess to bear on the cantilever member at said region.

11. A switch mechanism according to claim 1 wherein the switch device comprises at least one elongate member carrying at least one of the contacts and said elongate member is of arcuate form and is mounted on the carrier to be concentric with the arcuate recess.

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12. A switch mechanism according to claim 1 wherein the switch device comprises at least one elongate member having one end secured to the carrier and having a region remote from said end carrying at least one of said contacts, a guide projecting from the carrier being engageable with the elongate to control the direction of displacement of said contact with said relative movement between the members.

13. An electrical switch device comprising, in combination, a carrier, an enclosed recess of annular form

on said carrier and the carrier extending at least partly around a space in the region of the central axis of said arcuate form, contact members within said recess projecting towards each other from angularly remote regions in said recess and being mutually engageable by displacement of at least one of the members substantially in the direction of said central axis, the top wall of said recess being deformable in said axial direction to cause said displacement.

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