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Andresen

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[54] SNAP-ACTION ELECTRIC SWITCH

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[51] **Int. Cl.**..**H01h 13/36**
[58] **Field of Search**............................200/67 D, 83 P

[56] **References Cited**

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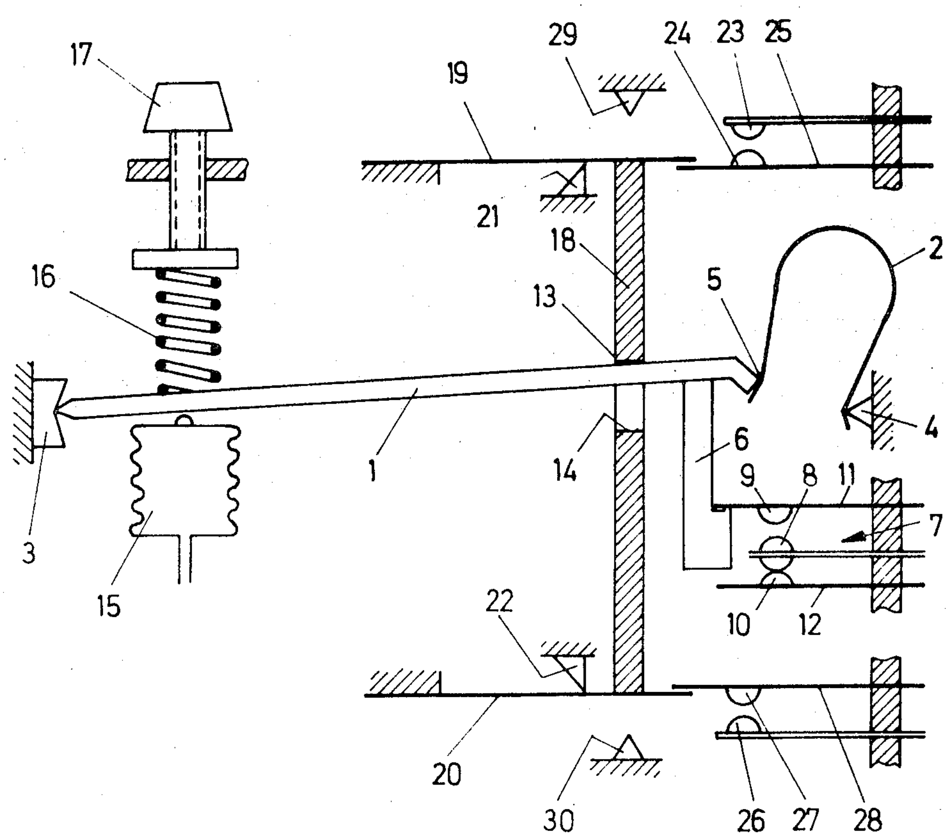
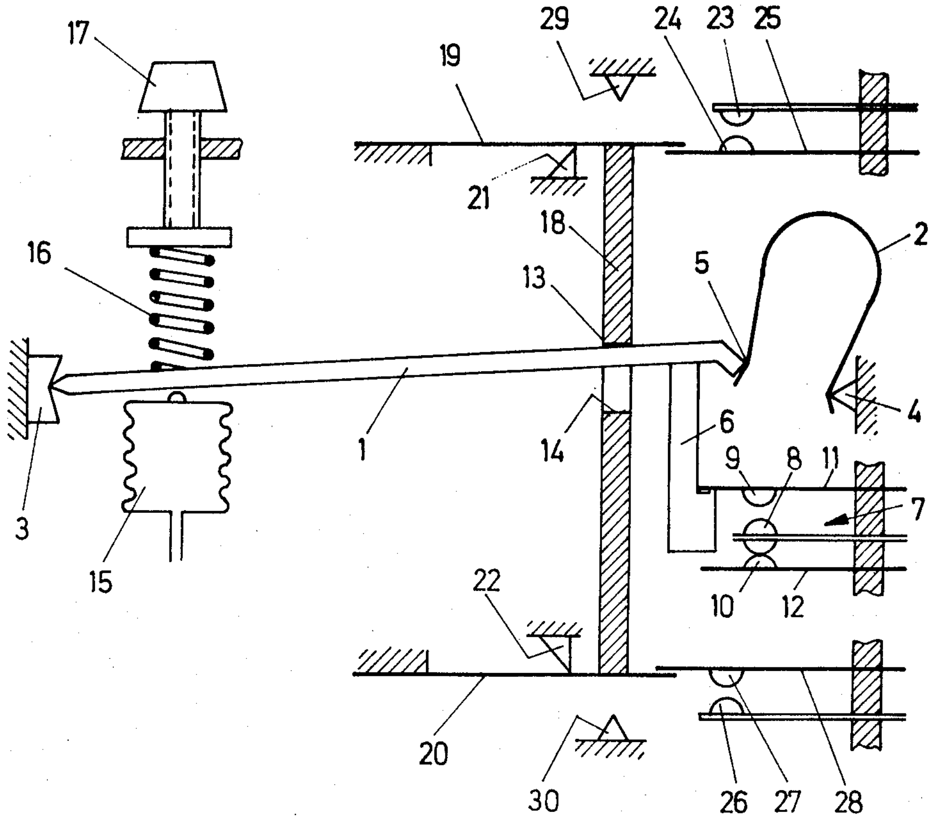
[57] **ABSTRACT**

The invention relates to a snap action switch assembly which in addition to the usual contact switch means has a middle or normal range bound by movable stops which movement is proportional to or determined by the amount of force applied thereto through an actuating lever. The actuating lever is not only acted upon by moderate forces in the usual way to provide the usual control but, in addition, is also acted upon by larger forces in response to extreme conditions in a system. These larger forces move the displaceable stops and one or more auxiliary switch means are provided which are actuated under these circumstances to provide control under the extreme conditions referred to.

2 Claims, 1 Drawing Figure

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SNAP-ACTION ELECTRIC SWITCH

The invention relates to a snap-action electric switch having a force-proportional snap-action system which comprises an actuating lever, movable between two stops, and a snap-action spring, the actuating lever being operated by a displacement force.

The use of force-proportional control is in contrast with distance-proportional control that is almost always used. The former method of control is based upon the fact that the snap-action spring produces a force component in the direction of the displacement force, and has a negative spring characteristic. Normally the actuating lever is urged against the stop by the sum of the displacement force and the force component of the snap-action spring. The system remains in this position until the displacement force falls below the force component of the snap-action spring. Snap-over into the other end position determined by the second stop then takes place. Generally only two parts, i.e. the actuating lever and the snap-action spring, are required for a force-proportional snap-action system. This results in a very simple construction and in ease of assembly. Also, the masses that have to be moved are relatively small. Furthermore, if the set of contacts to be actuated are separated from the actuating lever, extremely short periods of bounce results.

In many cases it is required to indicate a fault in the control system of an installation. A typical example is constituted by condenser thermostats in cold-boxes or refrigerating cabinets, in which an operating element, dependent upon the condenser temperature, acts on a snap-action electric switch, thereby overcoming the force of a rated-value spring. If the temperature inside the cold-box or refrigerating cabinet exceeds an upper limiting value, then this is a fault which should be indicated. If the operating element is not properly sealed, then the cold-box or refrigerating cabinet will operate continuously. This is also a fault which should be indicated. Considerable difficulties have hitherto been encountered in providing additional indications of this kind.

The object of the invention is to provide an electric snap-action system whereby not only is the normal control carried out in a simple manner, but it is also possible to indicate in a simple way when a limiting value has been exceeded.

Based upon the initially described snap-action switch having a force-proportional snap-action system, and in accordance with the invention, this object is achieved by at least one of the stops being adapted to be movable from its at-rest position by the actuating lever against the force of an additional spring when the displacement force exceeds or falls below a predetermined limiting value, and by a signal being released by the movement of the stop.

The basis for this arrangement is that a large portion of the faults that occur are manifested by an abnormal increase and/or decrease in the displacement force. This fact is utilized to displace at least one of the stops, which may be regarded as stationary during normal operations, against the force of the additional spring, and thus to release a signal.

The stop may be linked for example to a contact for starting off a signal. The signal is then passed on by electrical means. When this happens however, normal

operation of the snap-action switch is not interfered with.

In a preferred form of construction, an element carrying the stop is pressed in its at-rest position against a backing element by the additional spring. The position of the stop is thus precisely defined. It will pass beyond this position only if the force of the additional spring is exceeded by the forces occurring in the snap-action system.

Furthermore, one element may carry both stops and may be held between two additional springs acting in opposite directions, a fixed limit being associated with at least one of the additional springs. If the two additional springs are of different strength, the limit should be associated with the stronger of the springs.

A particularly simple space-saving construction results if the additional spring takes the form of a leaf spring and extends substantially parallel with the actuating lever.

Furthermore, the contact for starting off the signal may be actuable by the free end of the leaf spring.

The invention will now be described in greater detail by reference to an embodiment illustrated diagramatically in the drawing, this embodiment being constituted by the snap-action electric switch of a condenser thermostat for a refrigerating cabinet.

The snap-action switch has a snap-action system which consists of an actuating lever **1** and a snap-action spring **2** which is bent to the shape of the Greek letter omega. These parts are mounted in two fixed bearings **3** and **4** and are linked with each other by way of a movable bearing **5**. Fitted to the actuating lever **1** is a dog **6** which actuates a reversing switch **7**. The reversing switch consists of a fixed double contact **8** and two movable contacts **9** and **10** which are mounted on contact springs **11** and **12**. The dog **6** engages the free ends of the contact springs **11** and **12**.

The actuating lever **1** is able to move between two stops **13** and **14**. It is loaded on the one hand by an operating element **15**, which is connected through a capillary tube to a sensor which measures the condenser temperature, and on the other by a rated-value spring **16** which can be adjusted with the aid of a rotatable know **17**. In the position illustrated, the force of the rated-value spring **16** is fixed. Also, the snap-action spring **2** has a certain upwardly directed force component. Only the force applied by the operating element **15** is variable. It is not sufficient, for the purpose of displacing the actuating element **1**, for the force applied by the working element **15** to be below that of the rated-value spring **16**. Rather, it is necessary to reach a downwardly directed force differential which exceeds the upwardly directed force component of the snap-action spring **2** (calculated on the link **5**). Then however, the system suddenly snaps over into the lower end position as a result of the negative characteristic curve of the snap-action spring **2**. The pair of contacts **8** and **9** close, and the pair of contacts **8** and **10** open.

The two stops **13** and **14** are provided on a displaceable element **18** which is loaded at the top by a leaf spring **19** and at the bottom by another leaf spring **20**. The at-rest position of the element **18** is determined by two limiting means **21** and **22** for the leaf springs **19** and **20**. Associated with the leaf spring **19** is a fixed contact **23** and a movable contact **24** which is mounted on a contact spring **25**. Associated with the leaf spring **20** is a fixed contact **26** and a movable contact **27** which is mounted on a contact spring **28.** The free ends of the contact springs **25** and **28** are engaged by the leaf springs **19** and **20,** so that the pairs of contacts **23** and **24,** and **26** and **27** are open in the illustrated at-rest position. Also provided are fixed limits **29** and **30** which prevent excessive displacement of the element **28.**

If the compressor temperature and therefore the pressure in the operating element **15** rises above a predetermined limiting value, the actuating lever **1** displaces the stop **13** and thus the element **18** in the upward direction, thereby overcoming the force of the spring **19,** and closes the pair of contacts **23** and **24** so as to send an appropriate signal. If the operating element **15** is not properly sealed so that the rated-value spring **16** alone is effective, the actuating lever **1** not only moves into the position set by the stop **14,** but also moves the element **18** to overcome the force of the spring **20,** so that the pair of contacts **26** and **27** close and an appropriate signal is sent. In both cases the contact springs **11** and **12** are able to yield, so that the additional function is not adversely affected.

If the snap-action spring **2** is still operating in the negative portion of its characteristic curve defined by the limits means **29** and **30,** the actuating lever **1** cannot continuously return to the at-rest position it previously occupied when the displacement force returns to the normal range. Rather, the displacement force must fall below or exceed a force resulting from the corresponding force component of the snap-action spring **2.** Then the stop element **18** springs back into the normal position and the lever **1** bears against the opposite stop.

This snap-action switch may of course be used for other purposes, e.g. for a room thermostat in which the actuating lever **1** is constituted by a bimetal strip, in a pressostat or in any other control equipment in which the actuating lever **1** is acted upon by a displacement force.

I claim:

1. A snap action electric switch assembly comprising a pair of fixed supports with an actuating lever and a snap action spring disposed therebetween, an operating element biasing said lever in one direction and spring means biasing said lever in the opposite direction, a linearly displaceable control member movable in a transverse direction relative to the biasing direction of said operating element, said control member having an opening defined by wall means, said lever extending through said opening, said opening wall means forming stop means which define the limits of a first range of movement of said lever when said control member is in a neutral position, first switch means actuated by said lever within said first range limits defined by said stop means, spring means opposing movement of said control member in at least one direction, said stop means presenting a predetermined resistance force to movement in at least one direction and being movable in said one direction when a force exceeding said predetermined resistance force is exceeded in the engagement of said lever with said stop means, and second switch means actuated when said stop means is moved a predetermined distance.

2. A snap action electric switch assembly according to claim 1 wherein there are a pair of said stop means on said displaceable member and there are a pair of said spring means respectively opposing movement of said displaceable member in each direction.

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