United States Patent

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[54] QUICK-ACTING ELECTRIC SWITCH

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[51] **Int. Cl.** **H01h 13/36**

[58] **Field of Search** .....200/67 R, 67 D

[56] **References Cited**

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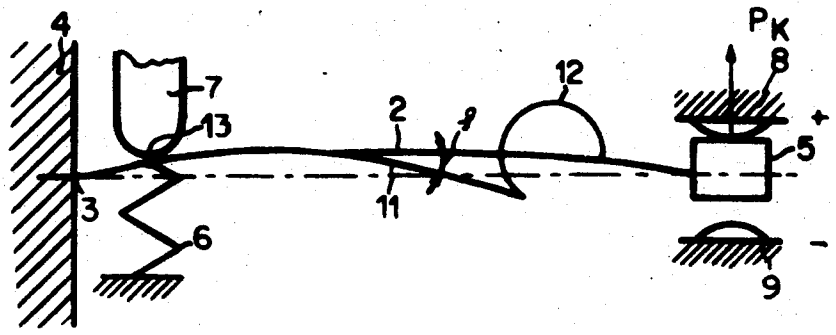
[57] **ABSTRACT**

A quick-acting electric switch with a rocker which is clamped to the switch case at one end and has a contact attached to the free end thereof, which free contact moves between two fixed contacts. The rocker arm is driven by means of a ram and a compression spring in a manner so that the rocker arm accelerates before contact is broken between the free and fixed contacts.

3 Claims, 5 Drawing Figures



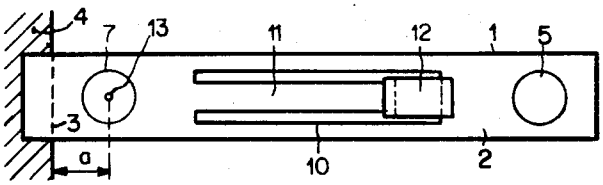


Fig.1

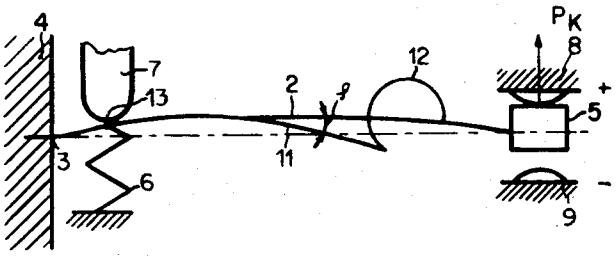


Fig.2

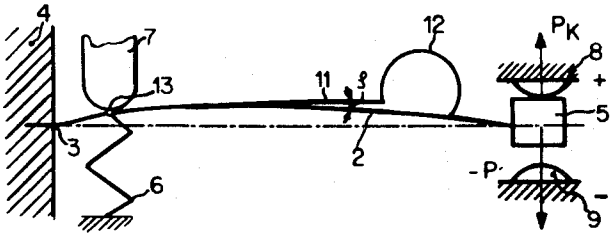


Fig.3

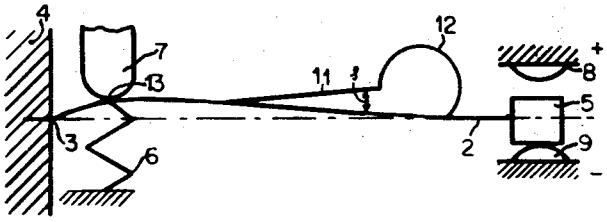


Fig. 4

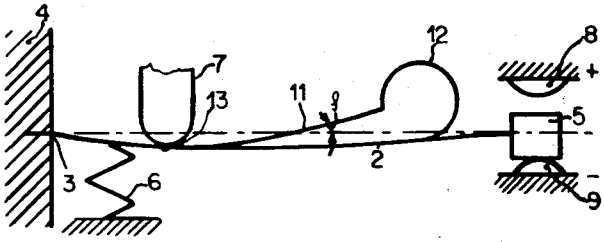


Fig.5

QUICK-ACTING ELECTRIC SWITCH

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

The invention relates to a quick-acting electric switch with a switching rocker which is clamped to the switch case at one end and has a transmission arm and a working spring connected thereto and driven by means of a ram and a compression spring.

In known switches of this type the rocker usually consists of an external frame carrying a switching contact in combination with an inner tongue which acts as the transmission arm and movable tipping element. A working spring provides the resilient connection between the transmission arm and the external frame. The drive for the rocker is then provided by a ram acting against a return spring. The disadvantage of conventional switches of this type results from the fact that contact pressure becomes zero when the switching point is reached, and remains near zero for a varying length of time depending on the velocity of the drive. A switch of this type is very prone to oscillation, so that interruptions of current occur before the tipping point is reached. This intermittent contact is particularly noticeable when there are low drive velocities and currents of less than one ampere. Even thin films of foreign matter on the contacts are sufficient to cause an interruption of current before the tipping point is reached when forces of less than 0.01 Newton (0.036 oz.) are used.

In order to get around these deficiencies it is known to cause tipping to take place before the contact force becomes zero, by giving the mechanism a preliminary acceleration. For this purpose sprung contacts or series-connected tipping systems have been used. Alternatively, the external frame of the rocker was biased towards the contact. However, this bias prevents a throw-over switch from being produced because of the lack of symmetry in the structure.

The present invention avoids the disadvantages of known switches of this type and provides a switch in which the force of the actuating ram is used to obtain a residual contact force at the tipping point by causing the driving force to act on the external frame of the rocker with a moment such that tipping takes place before the moment becomes zero.

According to the invention, the disadvantages of known switches are overcome in a quick-acting electric switch of the just described type wherein the point where the ram acts on the external frame is displaced from the point where the rocker is clamped into the switch case, so as to enable the force of the drive upon the transmission arm to be transmitted via the external frame to the contact. In this way the internal system, comprising the transmission arm and the working spring, is set in motion before the zero point of the contact force is reached.

This solution to the problems posed by the disadvantages of prior switches ensures that the movement of the system comprising the transmission arm and working spring is initiated and accelerated before the force at the contact reaches zero. The contact is not set in motion until the force of the spring exceeds that of the external frame. At this point the arm-spring system reaches a velocity and energy sufficient to ensure quick-acting switching. In this way the same results are obtained as would be obtained with switches which utilize preliminary acceleration caused by sprung contacts, but with the difference that no additional apparatus are required to achieve this effect.

BRIEF DESCRIPTION OF THE DRAWINGS

An illustrative embodiment of the invention is described in the following detailed specification which includes the drawings and wherein:

FIG. 1 is a plan view of the rocker of the switch;

FIG. 2 is a view in section of the rocker before the tipping point is reached;

FIG. 3 is a view in section of the rocker at the tipping point;

FIG. 4 is a view in section of the rocker after the tipping point has been reached; and

FIG. 5 is a view in section of the rocker in which the points acted on by the compression spring and ram are displaced relative to one another.

DETAILED DESCRIPTION

FIGS. 1 and 2 illustrate the basic elements of the quick-acting switch, including a switching rocker 1 formed by an external frame 2 with one end clamped to the switch case 4 at point 3 and the other end carrying a contact 5. A support is provided for a helical compression spring 6, as well as a guide (not shown) for a ram 7 and fastening means for two stationary contacts 8 and 9. The external frame 2 of the rocker 1 is provided with a U-shaped aperture 10, so that a transmission arm 11 is formed. The free end of the transmission arm is resiliently joined to the external frame 2 by a working spring 12. The distance between the point 13 acted on by the ram 7 and the clamping location 3 is defined as *a*.

The tipping process will now be described with reference to FIGS. 2, 3 and 4. Before the process begins there is a contact pressure Pk (FIG. 2) exerted upon contacts 5 and 8. Also, the external frame 2 of the rocker 1 is bent positively, i.e., upwardly, and the working spring 12 holds the transmission arm 11 at the negative side, i.e., at the lower side of frame 2. The angle ϕ formed between the external frame 2 and the transmission arm 11 is negative and the system is in balance. If the ram 7 is moved further in a vertical direction then the angle ϕ reaches zero and the transmission arm-working spring system 11 and 12 is set in motion with increasing acceleration. As soon as the angle ϕ has reached a position value large enough to make the force P resulting from ϕ and the force of the working spring equal to Pk (FIG. 3), the contact 5 starts moving in a negative direction, i.e., downwardly, and the zero value of the contact 5 is bypassed at high speed. When the tipping action has taken place the rocker 1 is in the position shown in FIG. 4. In this way the driving force of the ram 7 and compression spring 6 take effect in a residual contact force which acts up to the tipping point.

For the switch to operate satisfactorily it is preferable for the rocker 1 to have a symmetrical arrangement, i.e., that the contact 5 be located approximately midway between the two stationary contacts 8 and 9, when the ram 7 and compression spring 6 are effectively removed from the system.

Depending on the material selected and the geometrical design of the rocker 1, it is sometimes necessary to give the rocker 1 the necessary resilient properties by providing bracing means, although this destroys the symmetry of the switch. In order to compensate, the points acted on by the compression spring 6 and ram 7 are transposed in space relative to one another, as shown in FIG. 5.

We claim:

1. A quick-acting electric switch including:

a switching rocker formed by an external frame which is fixed at one end and which carries a contact at the free end thereof; a pair of fixed contacts disposed on either side of said rocker contact such that one of said fixed contacts is normally touching said rocker contact;

a transmission arm forming a part of said rocker and having one end fixed to said rocker;

a working spring resiliently connecting the free end of said transmission arm to the body of said rocker;

a ram acting on said external frame of said rocker at a distance *a* from said fixed end of said rocker and

a compression spring acting on said external frame at the opposite side from said ram,

this distance *a* being such that the force of the drive upon said transmission arm and through said external frame upon the contact of the rocker is transmitted in such a manner that the internal system comprising said transmission arm and said working spring are set in motion before the force between said rocker contact and said fixed contact is zero.

2. A quick-acting switch according to claim 1 wherein said rocker contact is located equidistant said fixed contacts in the absence of said ram and said compression spring.

3. A quick-acting switch according to claim 1 wherein the points at which said ram and said compression spring act upon said rocker are displaced from each other, the compression spring point lying between the ram point and the point where said external frame is attached.

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