July 5, 1955 H. A. NICKELL ET AL 2,712,580

CONTACT MAKING AND BREAKING DEVICE

Filed April 26, 1952

Fig. 1.

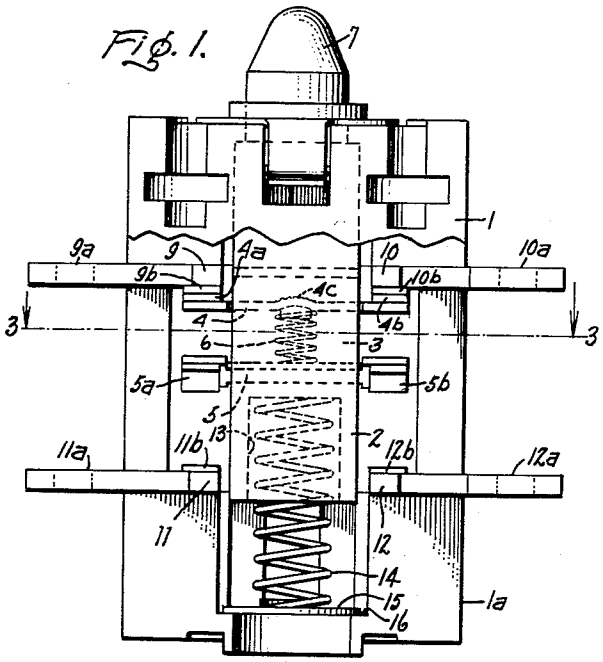


Fig. 2.

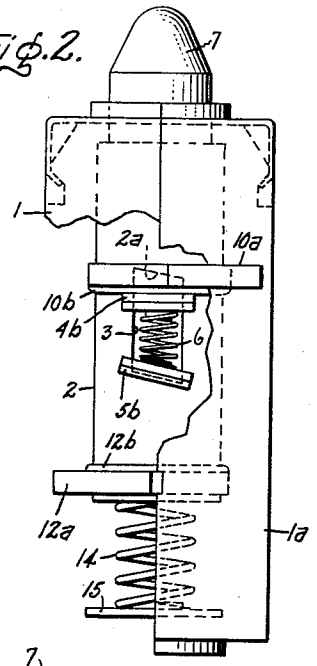


Fig. 3.

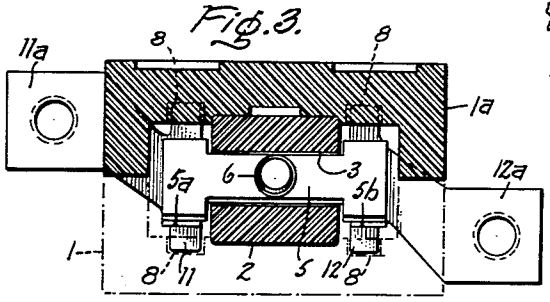


Fig. 4.

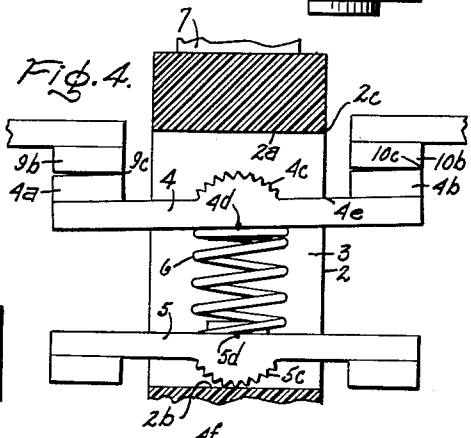
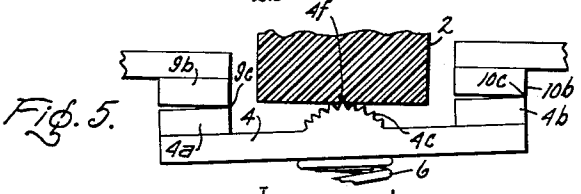


Fig. 5.



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CONTACT MAKING AND BREAKING DEVICE

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3 Claims. (Cl. 200—166)

This invention relates to improvements in contact making and breaking devices and more particularly to improvements in pushbutton switches.

A primary object of the invention is to effect simultaneous separation of both ends of a contact bridging member from its cooperating stationary contacts in response to contact opening movement of an actuating member in order to produce even distribution of arcing on all contacts and thereby lengthen their useful lives.

In carrying the invention into effect in one form thereof, a pair of stationary contacts are mounted in spaced apart relationship and with their contacting surfaces approximately in the same plane. They are bridged by a movable bar which, at its ends, is provided with contacts which mate with the stationary contacts. An actuating member is disposed between the stationary contacts for movement normal to the plane of their contacting surfaces.

Between its ends, the bridging member is provided with an arcuate curved portion having its center of curvature approximately equidistant from the ends of the bridging member to provide for simultaneous separation of both ends of the bridging member from the stationary contacts in response to contact opening movement of the actuating member.

For a better and more complete understanding of the invention, reference should now be had to the following specification and to the accompanying drawings, of which Fig. 1 is a view in front elevation of an embodiment of the invention in a pushbutton switch with a part of the contact block casing broken away, Fig. 2 is a side elevation with a portion of the contact block broken away, Fig. 3 is a plan view in section taken on the lines 3—3 of Fig. 1, and Figs. 4 and 5 are enlarged views of details.

Referring now to the drawing, the switch comprises a two-piece molded insulating block having identical halves 1 and 1*a*. Preferably, the block is made of a high arc resistant compound. The halves 1 and 1*a* are recessed to receive and to provide for sliding movement of a plunger or actuating member 2 which is molded of the same insulating compound.

An opening 3, a section of which has the shape of a non-rectangular parallelogram, extends through the plunger. A pair of contact bridging members 4 and 5 are mounted in the opening 3 and are biased apart by suitable means such as a spring 6.

One end of the plunger is provided with a projection 7 having a rounded end surface which is adapted to be engaged by an operating washer (not shown) of a pushbutton unit.

The inside opposing walls of the halves 1 and 1*a* of the contact block are provided with positioning indentations 8 which receive the ends of a pair of spaced apart, normally closed stationary contacts 9 and 10, and a pair of spaced apart, normally open stationary contacts 11 and 12. These contacts have terminals 9*a*, 10*a*, 11*a* and 12*a* which fit snugly into slots in the side walls of the block through which they project to the outside.

As shown, the stationary contacts are provided with contact tips 9*b*, 10*b*, 11*b* and 12*b*, which are made of a good electrical conducting and high oxidation resistant metal such as silver. Similarly, the ends of the movable bridging contact members 4 and 5 are provided with silver tips 4*a*, 4*b*, 5*a* and 5*b* which mate with stationary contact tips 9*b*, 10*b*, 11*b* and 12*b* respectively.

The lower end of the plunger 2 is provided with a cylindrical recess 13 which receives one end of a return spring 14. A spring retaining washer 15 rests against a circumferential shoulder 16 at the lower end of the recess in which the plunger slides.

Intermediate their ends, the movable bridging contact bars 4 and 5 are provided with arcuate curve-shaped portions 4*c* and 5*c* having centers of curvature 4*d* and 5*d* which are equidistant from the ends of the bars. Consequently, these centers of curvature lie in a central axial plane which is perpendicular to lines joining the stationary contacts 9*b* and 10*b* and stationary contacts 11*b* and 12*b*. These centers of curvature are lines which are parallel to each other and which are perpendicular to the plane which contains the centerlines of all of the contacts, which in the particular embodiment illustrated in the drawing is also the central dividing plane between the two halves 1 and 1*a* of the contact block.

The convex surfaces of the arcuate curve-shaped portions of the contact bridging bars are illustrated as being serrated. It is contemplated, however, that these surfaces may be made smooth.

When no force is exerted against the rounded end of the plunger, the return spring 14 biases the plunger to the position in which it is illustrated in Figs. 1, 2, 4 and 5 of the drawing, with the movable contact tips 4*a* and 4*b* engaging their mating stationary contact tips 9*b* and 10*b* and with movable contact tips 5*a* and 5*b* out of engagement with their respective mating stationary contact tips 11*b* and 12*b*. The force of the return spring 14 is greater than the force of the wipe spring 6. Consequently, after the moving contacts 4*a* and 4*b* have engaged their mating stationary contacts 9*b* and 10*b*, the wipe spring 6 is further compressed and the upper contact bar engaging surface 2*a* of the plunger is separated and moved upward from the arcuate portion 4*c* of contact bar 4 until the shoulder 2*b* of the plunger comes to rest against an internal shoulder of the contact block. This separation of the engaging surface from the contact bar provides lost motion which must be taken up when the plunger is depressed before engagement is effected between the engaging surface of the plunger and the contact bar.

Pushbutton switches are generally produced by mass production methods in order to realize the maximum possible economy in manufacture. As a result of such mass production methods, slight inaccuracies are found in the finished product which may lead to undesirable results. For example, in the manufacture of pushbutton switches, such as described in the foregoing, varying amounts of misalignment of the stationary contacts will usually be present. This is illustrated in Fig. 4 in which the contacting surfaces of stationary contacts 9*b* and 10*b* are not coplanar, i. e., do not occupy the same plane. The result is that when the movable contact tips engage their mating stationary contact tips, the contact bar is skewed or tilted so that its longitudinal axis is not parallel to the upper contact bar engaging surface 2*a* of the plunger.

Consequently, if the contact bar 4 were made in the conventional form, i. e., perfectly straight from end to end, first contact between the plunger and the contact bar in response to depression of the plunger would be

made at the meeting of the edge 2c of the contact engaging surface of the plunger with the upper surface of the contact bar. This meeting would take place along the line 4e which is observed in Fig. 4 as a point. Thus, the contact bar would become a lever having a fulcrum 9c on the meeting line of the stationary contact 9b and moving contact 4a. Further depression of the plunger would effect clockwise rotation of the contact bar 4 about fulcrum 9c and cause separation of contacts 4b and 10b prior to separation of contacts 4a and 9a. Consequently, the arcing at the contact tips would be uneven with by far the greater part of the arcing taking place at contact tips 4b and 10b, which separated prior to the separation of contacts tips 4a and 9b.

However, as a result of the presence of the arcuate curved portion 4c, the actuating surface 2a of the plunger engages the arcuate curved surface on the line 4f, which is observed in Fig. 5 as a dot. This meeting line lies in central plane which is defined by the centerlines of curvatures 4d and 5d and is parallel to these lines. Consequently, as the downward movement of the plunger is continued, there is no tendency for the contact bar to rotate about the meeting line 9c or the meeting line 10c as a fulcrum. The result is that both contact tips 4a and 4b separate from their mating contact tips 9b and 10b simultaneously, and the arcing is evenly distributed between both pairs of contact tips. This even distribution of the arcing between both pairs of mating contact tips reduces the duty on each pair and greatly lengthens their useful lives. Actual tests prove that the useful life of the contact tips is double that of contact tips in similar switches having conventional contact bars which are rectilinear from end to end.

The self-aligning operation with respect to arcuate portion 5c of contact bar 5 and contact bar engaging surface 2b is identical with that just described.

Although in accordance with the provisions of the patent statutes, this invention is described as embodied in concrete form and the principle thereof has been described, together with the best mode in which it is now contemplated applying that principle, it will be understood that alterations and modifications will readily suggest themselves to persons skilled in the art without departing from the true spirit of this invention or from the scope of the annexed claims.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a contact making and breaking device, a pair of stationary spaced apart contacts having their contacting surfaces approximately in the same plane, a movable actuating member disposed between said contacts for movement substantially normal to said plane, and having a planar surface, a bridging contact member providing intermediate its ends an arcuate portion with the extremities of its arc extending toward said ends and presenting its convex face toward said surface of said actuating member to provide for simultaneous separation of both said ends from said stationary contacts irrespective of misalignment of said stationary contacts in response to contact opening movement of said actuating member and engagement of said surfaces.

2. In a contact making and breaking device, a pair of stationary spaced apart contacts having their contacting surfaces approximately in the same plane, a movable actuating member disposed between said stationary contacts for movement substantially normal to said plane and having a planar movable contact actuating surface substantially parallel to said plane, a movable contact bridging member, and means for effecting simultaneous separation of the ends of said bridging member from said stationary contacts in response to contact opening movement of said actuating member comprising an intermediate arcuately curved portion of said bridging member presenting its convex surface toward said movable contact actuating surface and having its center of curvature approximately equidistant from said ends and the extremities of its arc extending toward said ends.

3. In a contact making and breaking device, a pair of stationary spaced apart contacts having their contacting surfaces approximately in the same plane, a movable actuating member disposed between said stationary contacts for movement substantially normal to said contact surface and having a planar movable contact actuating surface, a movable contact bridging member mounted on said actuating member, means for effecting simultaneous separation of the ends of said bridging member from said stationary contacts in response to contact opening movement of said actuating member comprising an intermediate arcuately curved portion of said bridging member presenting its convex surface toward said movable contact actuating surface and having its center of curvature approximately equidistant from said ends, and means providing lost motion between said actuating member and said bridging member comprising means for biasing said engaging surface out of engagement with said bridging member in the contact closing position of said bridging member.

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