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ELECTRICAL CONTACT FOR SWITCHING DEVICES

Original Filed June 29, 1945

FIG. 3

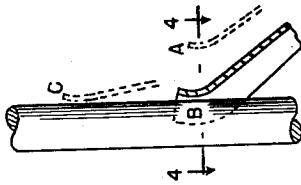


FIG. 4



FIG. 2

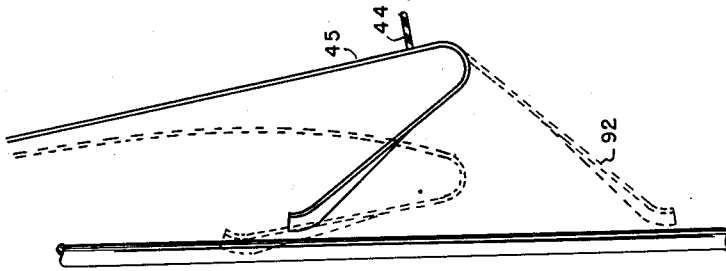
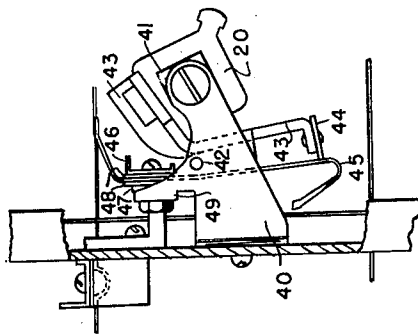


FIG. 1



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ELECTRICAL CONTACT FOR SWITCHING DEVICES

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Original application June 29, 1945, Serial No. 602,232. Divided and this application March 10, 1948, Serial No. 13,964

2 Claims. (Cl. 200—166)

1

The present invention relates in general to switching apparatus of a kind suitable for use in establishing connections in a telephone system, and more particularly to electrical contacts for switching devices.

This application is a division of the application Serial No. 602,232, filed June 29, 1945.

An object of the invention is to provide an improved form of electrical contact spring for switching devices which operates in a new and novel manner to produce very effective and low resistance contacts.

A feature of the invention relates to the new and novel configuration of the contact spring whereby, when operating pressure is exerted at an intermediate point of the spring, the contact making end of the spring first makes contact with a corresponding bare (uninsulated) conductor and then slides along the bare conductor for a certain distance, thereby to produce a wiping action which tends to remove from the bare conductor any film which may be present thereon in the path of such movement.

Another feature of the invention resides in the novel arrangement wherein the contact making end of the spring engages the corresponding bare conductor at two spaced apart points thereby to greatly increase the electrical reliability of the contact.

A further feature of the invention concerns the novel manner in which the contact making end of a contact spring misaligned with a corresponding bare conductor cooperates with the bare conductor to bring the contact spring into complete electrical contact with the bare conductor.

There are other objects and features of the invention having to do for the most part with the details in carrying out the foregoing. The various objects and features of the invention will be understood best upon a perusal of the following description of the accompanying drawing which shows a preferred embodiment of the invention.

Referring now to the drawing:

Fig. 1 is an end view of a relay to which the electrical contact spring of the present invention has been applied. A detail description of the relay shown in Fig. 1 is given in the co-pending divisional application Serial No. 13,963, filed March 10, 1948.

Fig. 2 is an enlarged view of a contact spring and an associated bare wire conductor.

Fig. 3 is a still more enlarged view of the connecting portion of the contact spring.

Fig. 4 is a cross-sectional view of the connecting portion of the contact spring and the bare wire conductor, taken along the line 4—4 of Fig. 3.

Referring particularly to Fig. 1, an end view

2

is shown therein of the relay described in the co-pending divisional application Serial No. 13,963, filed March 10, 1948. In this end view, the relay is shown fitted with a contact spring of the present invention, the contact spring being identified by the reference character 45. Only a sufficient explanation of the relay will be included in this specification to properly describe the action of contact spring 45, as reference may be had to the mentioned co-pending divisional application for a complete description of the relay.

Parallel to core 41 of electromagnet 20 of the relay is a shaft 42, its ends supported by the end plates 40. This shaft carries a pivotal armature 43 and riveted to the lower edge of armature 43 is a strip 44 of stiff insulating material which engages the hook-shaped (or V-shaped) contact spring 45. The contact spring 45 is clamped between a channel member 46 and a bar 47 but is insulated therefrom by intervening strips of insulating material 48. The assembly thus formed is bolted to lugs 49 on the end plates 40, whereby the lower end of contact spring 45 is positioned opposite a vertical bare wire conductor. The upper end of contact spring 45 is brought into engagement with a related horizontal bare wire conductor, permitting the two conveniently to be soldered together.

Considering now contact spring 45, it has two sections of unequal length. The longer section is supported at one end in the manner just described, and the shorter end is "doubled back" from the free end of the longer section in such a way as to give the spring a modified V-shape. Terminating the shorter section is a trough-like or grooved portion which is adapted to engage the associated bare wire conductor at two points, as indicated in Fig. 4. Dirt or other foreign matter occasionally may insulate the wire from the spring at one of these points, but it is highly improbable that such ever will occur at both points at the same time, and accordingly the dual contact surfaces greatly increase the electrical reliability of the contact. It will be appreciated that the bare wire and both sections of the associated contact spring are intended to lie in a common plane, but due to manufacturing tolerances it sometimes may happen that the free end of the shorter spring section is displaced slightly to one side of this plane. In such a case, when the spring is flexed by the associated relay, one sloping surface of the grooved end of the spring will engage the wire first and will cooperate with the wire to draw the shorter spring section into alignment with the wire. Small variations in the position of the free end of the spring thus are corrected or adjusted automatically.

In order to deflect contact spring 45 from its

normal position, a force is applied to the longer section thereof near its free end. The initial movement of operating member 44 (Figs. 1 and 2) produces a corresponding movement of the contact making end of the spring to the left, thus to bring the spring into engagement with the vertical bare wire conductor; and, then, during the further movement of operating member 44 to the left, the contact making end of the spring slides upwardly along the wire, so that when member 44 reaches its maximum displacement the spring 45 is flexed in the manner shown by the dotted lines in Fig. 2. The spring's normal position A, the point at which it first engages the wire B, and its final position C are shown in an enlarged scale in Fig. 3. When the associated relay armature 43 restores to normal, spring 45 first moves from C to B and then moves from B to A.

As the spring slides along the wire between points B and C it produces a wiping action which tends to remove from the wire any film which may be present thereon in the path of such movement. It will also be noted that as the spring moves from B to C its slope with respect to the wire changes progressively; this produces a rocking movement of the spring about its curved tip, which not only improves the spring's tendency to wipe the wire clean but also causes the changing contact area of the spring itself to be cleaned in similar fashion.

Still another advantage is derived from this form of relative movement between the spring and the wire. If they are used to make or break live electrical circuits, any corrosive action due to arcing or the like will take place, if at all, either as the spring first engages the wire or as it leaves the wire, i. e., at point B. The surface areas damaged by such action consequently are not the ones ultimately used to carry current (i. e., those shown in engagement at C), and this manifestly improves the electrical reliability of the contact.

It will be seen that a somewhat similar wiping action would be obtained if the shorter section of the contact spring made an obtuse angle with the longer section, as indicated by dot and dash lines at 92 in Fig. 2. Bending the spring back upon itself at an acute angle, however, permits a plurality of relays fitted with contact springs of this type to be mounted one above another in more closely spaced relationship than otherwise would be possible, with a consequent saving of space and corresponding gain in the overall compactness.

Furthermore, tests disclose that certain operating characteristics of reversed bend type of spring are considerably more favorable than those of its somewhat straighter counterpart. To cause the reversed bend spring to exert a certain force on the vertical wire (thus to insure good electrical contact therewith) it is necessary for the contact operating member 44 to apply an approximately equal force to the spring; to cause the equivalent straighter spring 92 to exert the same force on the wire, however, it would be necessary for member 44 to apply approximately three times as great a force to the spring. In other words, for a given force applied to the spring by member 44, the reversed bend spring exerts approximately three times as great a force upon the wire as would be exerted by the straighter spring. This greater contact pressure makes the electrical reliability of the

reversed bend spring considerably greater than that of a straighter spring.

Having fully described the invention, what we believe to be new and desire to protect by Letters Patent is set forth in the appended claims. We claim:

1. In an electrical contact, a stationary support, a spring comprising a first portion, a second portion extending from said first portion at an angle thereto, and an arcuate tip portion extending from said second portion, the free end of said first portion mounted on said support, a straight stiff bare wire supported adjacent said tip portion of said spring, said wire and said portions of said spring all lying in a common plane, means for applying a force to said first portion of said spring in a direction towards said wire, said application of said force causing said arcuate tip portion of said spring to contact the surface of said wire at two spaced apart points simultaneously, said two spaced apart points lying in a plane perpendicular to the longitudinal axis of said wire.

2. In an electrical contact, a support, a contact spring mounted on said support, said spring comprising a first portion extending in a straight line from said support and terminating in a free end at an angle to said straight line, a second portion extending from said angled end of said first portion, and an arcuate tip portion extending from said second portion, a stiff bare conductor supported adjacent said tip portion of said spring, the longitudinal axis of said conductor and the longitudinal axes of said portions of said spring all lying in one plane, means for applying a force to said first portion of said spring in a direction towards said conductor, said force through the media of said angled end of said first portion of said spring and said second portion of said spring causing said tip portion of said spring to contact the surface of said conductor at two spaced apart points lying in a plane substantially at a right angle to the longitudinal axis of said conductor, said force thereafter flexing said second portion of said spring through the media of said angled end of said first portion of said spring and said contacting of said tip portion of said spring to cause said tip portion of said spring to rock along the surface of said conductor, said rocking of said tip portion of said spring causing different pairs of spaced apart points on the surface of said tip portion of said spring to successively contact different pairs of said spaced apart points on the surface of said conductor, each said pair of spaced apart points lying in a plane substantially at a right angle to the longitudinal axis of said conductor.

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