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ELECTRICAL CONTACT ASSEMBLY

Filed Dec. 31, 1956

2 Sheets-Sheet 1

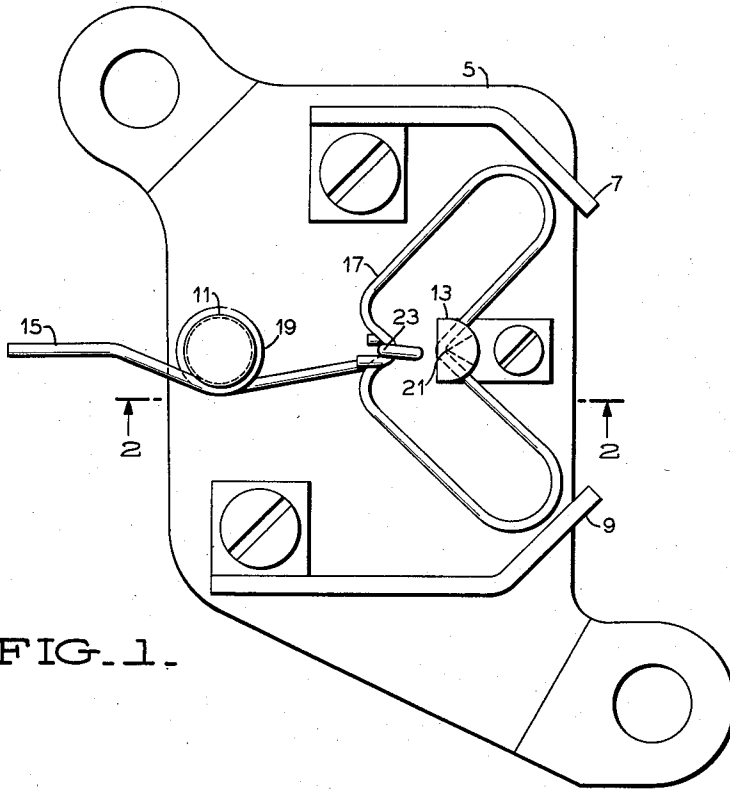


FIG. 1.

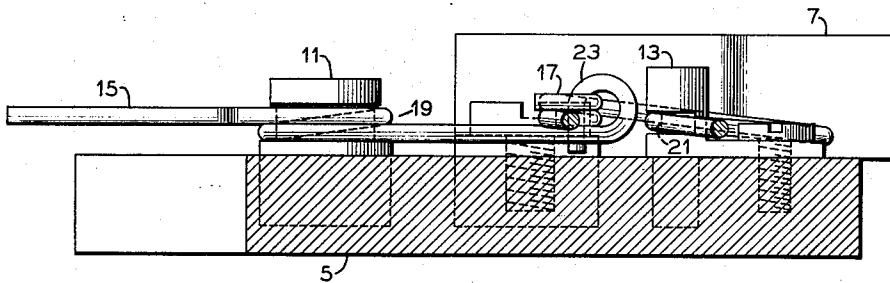


FIG. 2.

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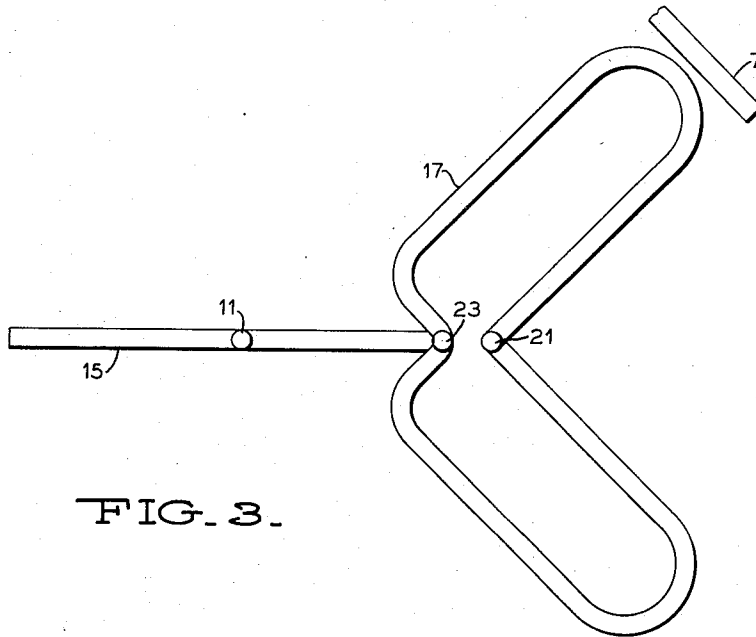


FIG. 3.

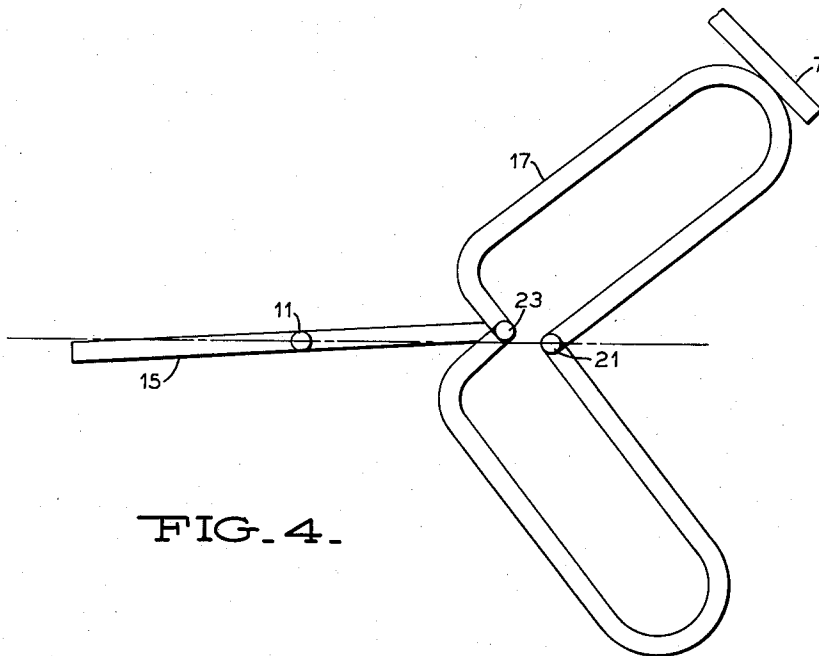


FIG. 4.

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3 Claims. (Cl. 200—67)

This invention relates to electrical contact assemblies, and particularly to a compact and economical electrical contact assembly providing both good wiping action of the contacts and a toggle or detenting action. More particularly the invention is directed to a contact assembly of the type described in which the movable parts are relatively light in weight so that the switch is capable of fast operation and presents a minimum mechanical load to the operating device.

In many applications of electrical contact assemblies or switches, a number of requirements must be met, such as small size, ease and economy of fabrication, a minimum of moving parts so that the inertia is low, good wiping action to provide low contact resistance, and toggling or detenting action to maintain the contacts in a selected position.

It is accordingly an object of this invention to provide an improved electrical contact assembly having a minimum number of lightweight and easily fabricated moving parts.

Another object of the invention is to provide an improved electrical contact assembly having only two movable elements arranged to provide, by their inherent resilience, suitable contact wiping action and toggling action.

A further object of the invention is to provide an improved electrical contact assembly particularly suited for high speed-low force operation, with toggle action and wiping action to insure the maintenance of a low contact resistance for the operated positions of the switch.

Briefly described, an electrical contact assembly constructed in accordance with the present invention comprises a movable contact element formed of a single length of resilient contact material shaped in the form of a V-shaped loop having oppositely disposed interior and exterior pivot points located on a line bisecting the apex angle, a knife-edged support for the movable contact loop, which engages the loop at its interior pivot point, an actuating member formed of a single length of resilient material, arranged to pivot on a suitable pivot piece, and having one end thereof operatively connected to the exterior pivot point of the movable contact loop. The other end engages with any suitable actuating means, such as manual, mechanical or electrical actuators. At least one stationary contact element is provided and arranged so that one of distal or outer ends of the movable contact loop engages the stationary contact element at one extremity of motion of the loop. Preferably two stationary contact elements are provided, giving the equivalent of a single-pole, double throw switch. Because of the resilience of the movable contact element, the engagement of the ends of the loop with their associated stationary contact elements are of a wiping nature, thus providing a low contact resistance.

The detenting or toggle action is provided by alignment of the knife-edge support for the movable contact element, the pivot point of the actuating member, and the end of the actuating member which engages the movable contact loop, so that only in the mid-position of the

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movable contact loop are these three pivots aligned in a straight line. Displacement of the actuating member to either side of its mid-position, which can be said to be an unstable equilibrium position, throws the mentioned points out of alignment, and the resilience of the movable contact loop then provides a force which operates the assembly to one or the other of its extreme positions, in which the movable contact element contacts one of the stationary contact elements, and thereafter maintains the movable contact in this position until a subsequent operation of the actuating member operates the movable contact member to its other stable position.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of examples, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a plan view of an electrical contact assembly constructed in accordance with a preferred embodiment of the invention.

Fig. 2 is a sectional view of the arrangement shown in Fig. 1, taken substantially along the line designated by the reference characters 2—2 in Fig. 1, and to a slightly larger scale, to more clearly illustrate the arrangement of the parts.

Figs. 3 and 4 are schematic diagrams of the arrangement shown in Fig. 1, illustrating the toggle action of the assembly.

Similar reference characters refer to similar parts in each of the several views.

Referring now to Fig. 1, there is shown one preferred embodiment of the invention, which can serve as a single pole, double-throw toggle switch. A base plate 5 of suitable insulating material such as Bakelite, Micarta, or the like, is employed in this example as a mounting means for the various parts. Molded into or otherwise affixed to the base plate 5 are first and second stationary contact elements 7 and 9, each of which is provided with a screw-type terminal for attaching wires thereto. A first pivot post 11 and a second pivot post 13 are also molded into or otherwise affixed to base plate 5. Post 13 is provided with an extension carrying a terminal screw as shown to permit circuit attachment. The movable parts, two in number, are the actuating member 15 and the movable contact member 17. Actuating member 15 is preferably formed from a single length of suitable material, such as music wire, bent into the configuration shown. The first pivot post 11 is provided with a slot or groove-cut therein, and the loop portion 19 of actuating member 15 is disposed therein, by deforming the member 15 sufficiently to slide the loop 19 over the post 11 to the point where it can snap into the groove. Alternatively, post 11 may have a shouldered or offset portion thereon to support loop portion 19, with suitable retaining means, such as a split washer, to retain the loop on the post.

The movable contact member 17 comprises a single length of resilient wire formed into a V-shaped configuration as shown in Fig. 1. Considering the junction of the two loop portions, for the purposes of this specification the junction of the loops at the second pivot post 13 is defined as the interior pivot point, and the junction of the free ends of the wire 17, which are engaged by the one end of actuator 15, is defined as the exterior pivot point and these points lie on a line bisecting the apex angle of the movable contact element. The interior and exterior pivot points are designated by the reference characters 21 and 23, respectively.

Interior pivot point 21 provides, in conjunction with a recessed knife edge in pivot post 13, a pivot for rotation of the movable contact element 17, in such manner that

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the outer side of the movable contact element 17 can engage the fixed contacts 7 or 9 with a wiping motion, according as the element 17 is rotated in a clockwise or counterclockwise direction respectively from its mid-position as shown.

Outer pivot point 23 is obtained by forming the ends of the wire 17 into small loops which engage a loop formed at the end of wire 15 in the manner shown. It is apparent therefore that rotation of wire 15, as by an external operating means, not shown, will cause rotation of the movable contact member, so that it engages one or the other of the fixed contact elements.

The movable spring member 17 is formed so that the loops are compressed when the switch is assembled, consequently, a spring force is present which has a lateral component directed perpendicularly one side or the other of the line passing through the center of posts 11 and 13, when the movable portions of the switch are not in their mid-position. This lateral spring force supplies the toggle action for the switch, and will be apparent from reference to Figs. 3 and 4, which illustrate, in schematic form, the relations of the moving parts when the switch is in its mid-position, and in one of its two operated positions.

In Fig. 3, the actuator 15 and the movable contact spring 17 are occupying their mid-positions, and it can be seen that the second pivot point 23 is aligned with the line passing through pivot post 11 and pivot point 21. The spring forces created by the arms of movable contact member 17 produce a resultant force which is directed to the left along this line and it will be apparent from the symmetry of the arrangement that no lateral forces will exist.

If the left-hand end of actuator 15 is moved down, as shown in Fig. 4, pivot point 23 is displaced upwardly by rotation of actuator 15 and movable contact member 17. Accordingly, the spring forces are now unbalanced, and an upwardly-directed lateral force will exist, rotating the movable spring member 17 in a clockwise direction until the upper loop engages stationary contact element 7. The unbalanced spring force thus provides the required toggle or detenting action.

Since the only moving parts employed in this switch are relatively small shapes formed from suitable wire stock, the inertia of the switch and the required operating energy will both be low, suiting it for applications where high speeds of operation and low available force are involved. The small number of parts and their simplicity lead to economical manufacture and assembly. Because of the detenting or toggle action, plus the wiping action of the contacts, reliable low resistance contacting is obtained.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. An electrical contact assembly comprising, in com-

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bination, a base plate of insulating material, a first and a second pivot post mounted on said base plate, an actuating member pivoted for rotation on said first pivot post, a movable contact member comprising a single length of resilient contact material formed into two loops extending oppositely from a first and a second pivot point formed by the junction of the loops, said movable contact member being arranged for rotation at said first pivot point about said second pivot post, and operatively connected to said actuating member at said second pivot point, and at least one stationary contact element adapted to be engaged by said movable contact member.

2. An electrical contact assembly comprising, in combination, a base plate of insulating material, a first and a second pivot post mounted on said base plate, an actuating member pivoted for rotation on said first pivot post, a movable contact member comprising a single length of resilient contact material formed into two loops disposed at an angle less than 180 degrees and having a first and a second pivot point located on opposite sides of the member and lying on a line bisecting the apex angle of the member, said movable contact member being pivoted at said first pivot point on said second pivot post, and operatively connected to said actuating member at said second pivot point, so that said movable contact member is in an unstable equilibrium condition when and only when said first and second pivot points are aligned with said first and second pivot posts, and at least one stationary contact member mounted on said base plate, and engaged by said movable contact member when the movable contact member is displaced from its unstable equilibrium condition.

3. An electrical contact assembly comprising, in combination, a base plate of insulating material, a first and a second pivot post mounted on said base plate, an actuating member formed from a single length of resilient material and pivoted on said first pivot post, said actuating member having one end adapted to be connected to an external operating means, a movable contact member formed from a single length of resilient contact material, operatively connected to the other end of said actuating member and pivoted for rotation about said second pivot post, said movable contact member having a V-shaped configuration of two oppositely extending loops joined at the apex of the V, and providing a first and a second pivot point at the apex, said first pivot point being located at the interior junction of the loops and said second pivot point being located at the exterior junction of the loops, said first pivot point engaging a knife edge on said second pivot post to form a fulcrum for rotation of the movable contact member, and said second pivot point providing the connection between said actuating member and said movable contact member, said movable contact member being pre-stressed so that an unbalanced rotational force is developed when said first and second pivot points are not aligned with said first and second pivot posts, and stationary contact elements mounted on said base and engageable by the loops of said movable contact member.

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