July 24, 1934. H. B. MASSEY 1,967,623

ELECTRIC SWITCH

Filed Aug. 27, 1930 2 Sheets-Sheet 1

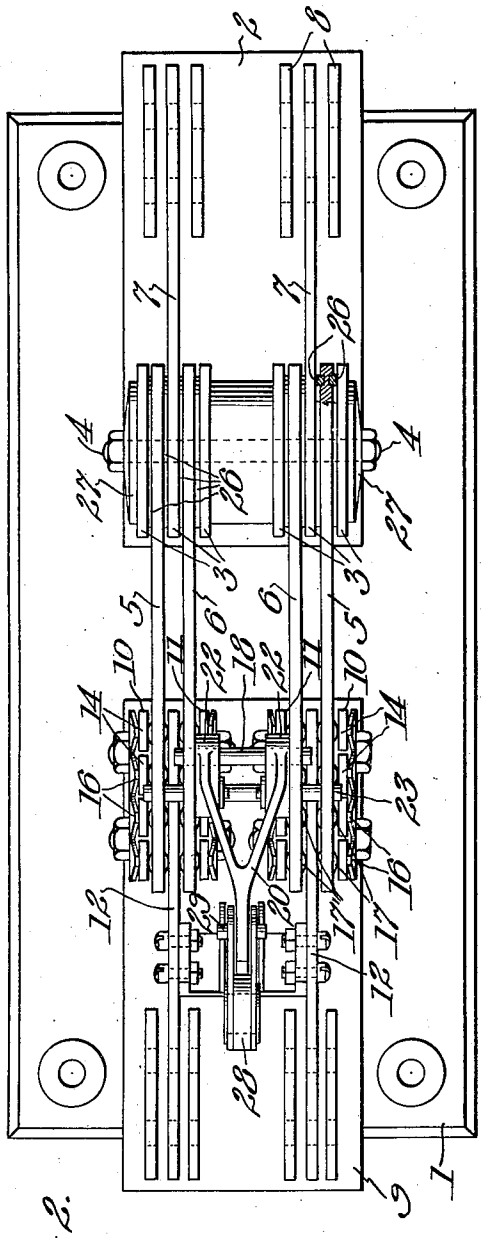


Fig. 2.

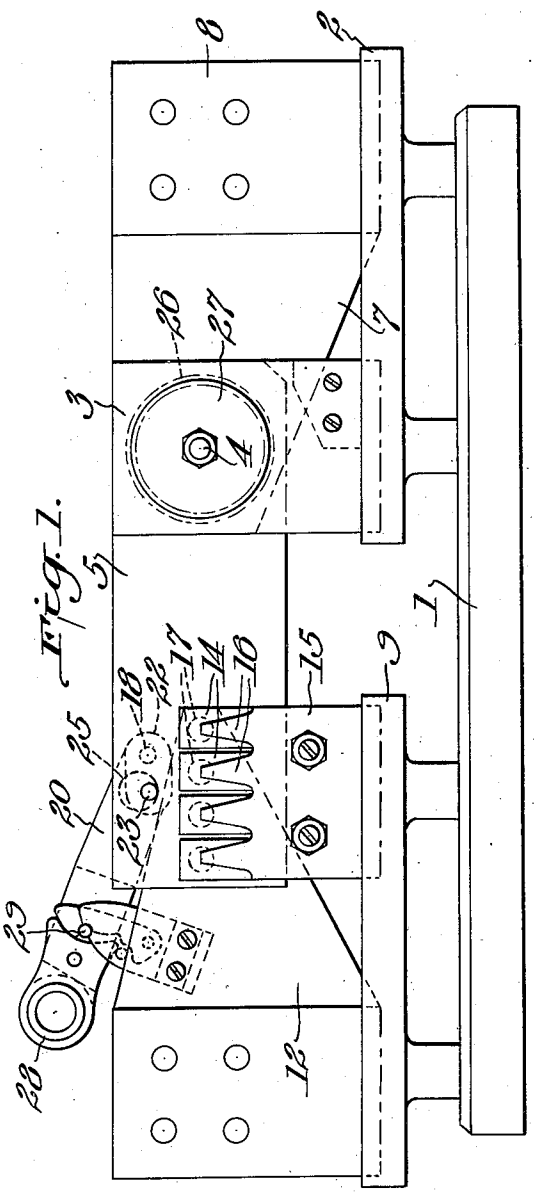


Fig. 1.

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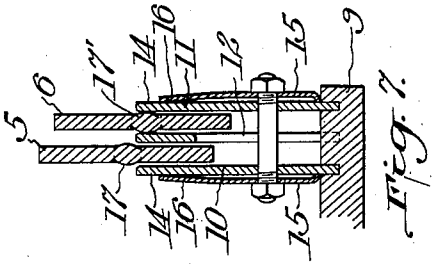


Fig. 7.

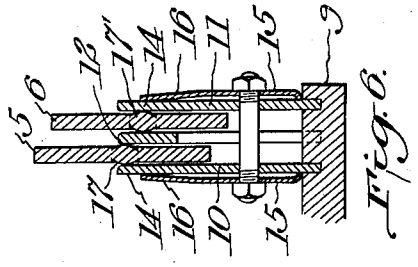


Fig. 6.

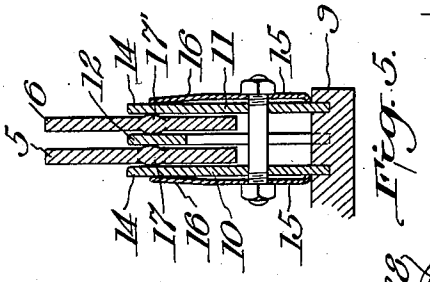


Fig. 5.

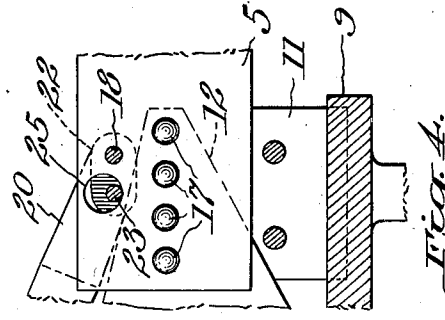


Fig. 4.

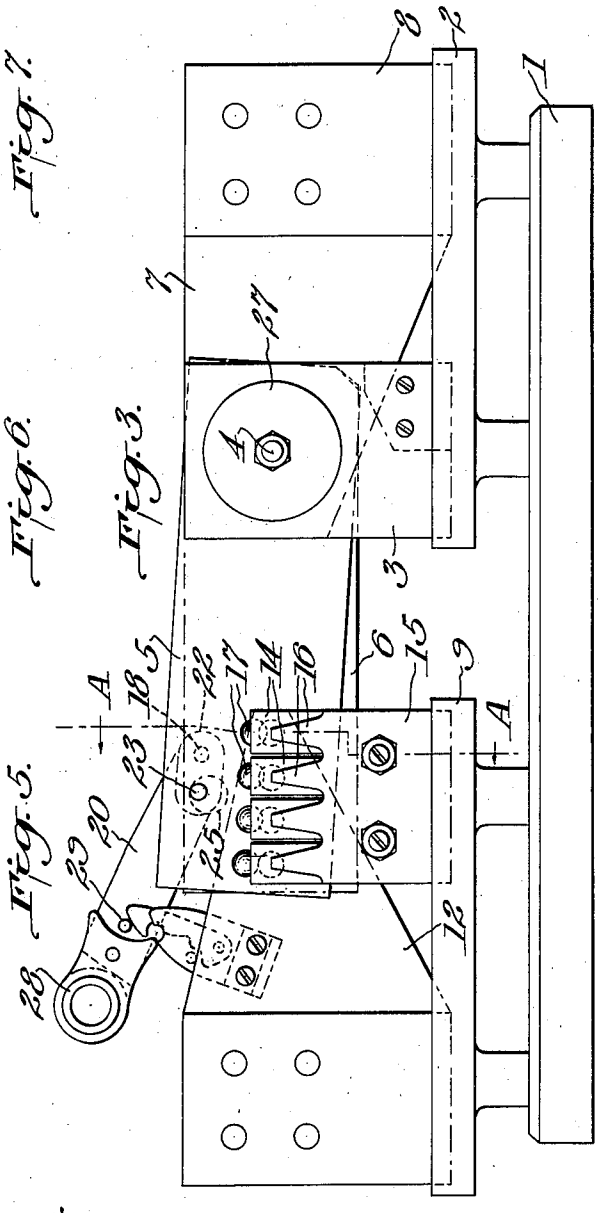


Fig. 3.

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UNITED STATES PATENT OFFICE

1,967,623

ELECTRIC SWITCH

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Application August 27, 1930, Serial No. 478,181

15 Claims. (Cl. 200—170)

This invention relates to a high contact pressure switch and more particularly to knife switches of the type including a plurality of knife blades having projecting bosses for limiting the contact area.

In large size high contact pressure switches of the type wherein a plurality of spaced knife-blade contact members are arranged for movement into spaced jaws, it has been found difficult to manually open such switches due to the high frictional effects which result from the firmness with which the blades are held by the jaws. It is, of course, impossible to design a switch having a materially lower pressure normally exerted upon the blades without sacrificing the benefits of a high contact pressure type of switch.

The present invention has for one of its objects the construction of a switch of the type mentioned wherein an operating mechanism is provided for opening the switch upon the application of a relatively small manual force.

Another object of the invention is to provide, in a multiple blade knife switch having a high unit pressure between limited areas of the contact members, an operating mechanism which functions upon an opening movement of the switch to move some of the blades out of firm engagement with the jaws prior to the movement of the remaining blades.

A further specific object of the invention is to provide a knife blade switch of the high contact pressure type in which the usual flexible jumpers for carrying current to the blade are eliminated.

These and other objects of the invention will be apparent from the following specification, when taken with the accompanying drawings, in which,

Fig. 1 is a side elevational view, partly in cross-section showing the switch in closed position.

Fig. 2 is a top plan view of the switch shown in Fig. 1,

Fig. 3 is a view corresponding to Fig. 1 showing the switch in partly opened position,

Fig. 4 is a fragmentary detail view, in side elevation, of the connection between the operating mechanism and the switch blades.

Figs. 5, 6 and 7 are fragmentary sectional views, on line A—A of Fig. 3, illustrating successive stages in the opening operation of the switch.

A base 1 of molded insulating material, such as phenolic condensate supports a base-plate 2 that carries two sets of spaced plates 3 forming a pivot support in which is mounted a pivot bolt 4. The pivot bolt passes through the ends of two pairs of outer blade members 5 and inner blades 6, and also passes through two connectors 7, which extend to a pair of terminal members 8, mounted on the base-plate 2.

A second base-plate 9, which is also mounted on the insulating base 1, carries two sets of jaw members. Each set of jaw members comprises two spaced parallel clip members 10, 11 and an interposed tongue member 12, so arranged that the blade members 5 can be rotated into the spaces between the jaw members to be engaged thereby. Each clip member is provided with slots which divide it into a plurality of fingers 14. A leaf spring 15 having four similarly arranged fingers 16 is disposed adjacent the outer side of the clip members with each finger 16 bearing against the corresponding finger 14 of the clip whereby separation of the clip members is resiliently opposed by the springs.

A plurality of limited contact areas or bosses 17 are disposed on both sides of each blade member at its free end. The buttons 17 are arranged in a row so as to be engaged by the fingers 14 of the clip members when the blade members are in fully closed position. Preferably, the bosses are formed integral with the blade by spinning or stamping, as described in the copending application of Arthur Musgrave, Serial No. 444,579, filed April 15, 1930, but they may be formed as projections on the blade when the latter is originally constructed. The bosses are of spherical form and extend beyond the plane of the surface of the blade proper so that the overall thickness of the blade is maximum at this point. It is preferable to aline each boss transversely with the corresponding button on the opposite side of the blade member, whereby all of the bosses may be in transverse alinement with the ends of the spring fingers 16 when the switch 12 is closed.

Mounted in the inner blade member 6 is a pivot pin on which is pivoted a handle or pry-out lever. The lower end of the handle is bifurcated to provide the longer lever arms 20 of a pair of cranks whose shorter arms 22 are perforated to receive a connecting pin 23 which passes through all of the blade members. The connecting pin 23 fits tightly in holes in each of the outer blade members 5 and passes through large openings 25 in each of the inner blade members 6 which openings cooperate with the connecting pin 23 to provide a lost-motion connection between the shorter crank arms 22, and the inner blade members 6.

Carried in each face of the pivoted end of each

blade member is a bearing ring 26 which bears upon the adjoining jaw member. These bearing rings restrict the contact between the blade and its supporting members to a small area, and the resilient washers 27 on bolt 4 establish a high unit pressure over these limited contact areas.

The switch preferably includes an appropriate form of latch for preventing inadvertent opening of the switch. As shown in the drawings, the latch may include a ring member 28 pivoted upon the outer end of the handle and a pin 29, also carried by the handle. The tongues 12 of the switch jaw carry the cooperating elements of the latch which is of the type described in the patent to Hartel No. 1,503,321. It will be understood that the particular construction of the automatic latch, if one be used, forms no part of the present invention.

The operation of the device is as follows:

A hook stick (not shown) is inserted in the pull ring 28 and the latter is moved in a direction away from the base 1. The pull ring member 28 rotates about its pivot pin to release the latch pin 27, thus permitting the bifurcated handle or pry-out levers 20 to turn on their mutual pivot 18, whereby the shorter arms 22 are also caused to rotate to carry with them the outer blade members 5 to which they are secured by means of the connecting pin 23. Because of the lost-motion connection between the connecting pin 23 and the inner blade members 6 the latter remain stationary during the first part of the opening movement. The connecting pin 23 moves freely in the holes in the inner blade members 6 until it engages the top edges of the holes, whereupon the inner blade members 6 are also rotated, and upon continued rotation of the blades 5, 6 the contact is broken.

The operation of the switch may be more clearly understood if reference is made to Figs. 4 to 7. In Fig. 5, the switch is shown in its fully closed position. In this position all of the contact bosses 17 are arranged on a line passing through the centers of pressure of the spring fingers 16. The maximum thickness of the stack formed by the blade members 5, 6 and the jaw members 10, 11, 12 is along this line of pressure whereby the outer clip members 10, 11 are separated the maximum distance, consequently the springs 15 establish the maximum compressive stress between the contact members.

When the outer blade member 5 is moved slightly, the contact bosses 17 carried thereon are moved out of alinement with the bosses on the inner blade as shown in Fig. 6. Due to the resiliency of the members forming the stack, the thickness of the stack is decreased at the center of pressure and consequently the pressure exerted on the stack by the springs is correspondingly decreased.

When the outer blade member has been moved to the position shown in Fig. 7, the contact bosses 17 are above the tops of the jaw members which then contact with the sides of the blade proper. The thickness of the stack is hence considerably decreased, the spring pressure is likewise decreased proportionally. When the contact bosses 17 have moved out of engagement with the clip fingers 14, the connecting pin 23 engages the upper walls of the apertures 25 to initiate the angular movement of the inner blades 6 to move the same out of engagement with the jaws 11, 12.

It will be seen that the maximum pressure exerted on the clip fingers to force them against the blade members is only applied when the switch is in its fully closed position. As soon as the opening movement is begun, the pressure is slightly relieved and before the movement of both the outer and inner blades is begun, the pressure very much relieved. Thus, a smaller force is necessary to open the switch than would be required if both the sets of blades were moved simultaneously throughout the entire opening operation.

The length of the lever arm constituted by the handle or the longer arms 20 of the crank is substantially greater than the length of the lever arm formed by the shorter arms 22 of the crank. This ensures a mechanical advantage which facilitates the opening of the switch.

In the closing operation, the blade members all are moved simultaneously, but inasmuch as the mass comprising the blades and handle attains a considerable energy of momentum before the blades are engaged by the jaws, it is not necessary to provide any successive movement of the blade member as in the case of the opening operation.

By restricting the contact are to a plurality of bosses, the angular movement corresponding to the actual establishment of the high contact pressure is materially less than that required when the blades contact with the jaws over their entire width. It will be noted that the top edges of the fingers are rounded in order to prevent stubbing of the buttons when the switch is closed and unnecessary wearing and sparking during the opening movement.

It will be apparent that the invention is applicable to knife switches having two or more blades and that, if desired, the ring member 28 may be replaced by an appropriate insulated handle which may be grasped by the operator. While particularly adapted for manually operated switches, the invention is obviously useful with power operated switches as it affords a convenient means for reducing the size and power of the operating mechanism.

I claim:

1. In a high contact pressure knife switch, the combination with a line terminal having a plurality of jaw members, of a plurality of blade members, a second line terminal having means mounting said blade members for angular movement into said jaw members, means resiliently tending to force said jaw members together to firmly engage said blade members when said switch is closed, and operating means for said switch, active upon an opening movement to move one of said blade members to reduce the contact pressure on another blade member prior to the initial angular movement of said other blade members.

2. The invention as set forth in claim 1, wherein said blade members are provided with thickened contact portions of limited area engageable by said jaw members, said thickened contact portions being in transverse alinement when the switch is fully closed, and said operating means is effective to move said contact areas on one of said blade members out of alinement with the contact areas of another blade member prior to the movement of said other blade members.

3. The invention as set forth in claim 1 wherein, said jaw members comprise resilient fingers, said blade members are provided with projecting contact bosses engageable by said fingers and said operating means is effective to reduce the contact pressure between said fingers and the bosses on one of said blade members prior to the movement of another of said blade members.

4. The invention as set forth in claim 1 wherein said jaw members comprise a plurality of contact fingers and said resilient means comprise a plurality of spring fingers cooperating with said contact fingers.

5. In a multiple blade, single pole switch, a line terminal having a plurality of parallel jaw members, a plurality of parallel blade members having thickened contact portions that are transversely alined when the switch is fully closed, means supporting said blade members for movement into engagement with said jaw members, and operating means active upon an opening movement to move only some of said blade members toward open position and active upon a continuation of said opening movement to move all of said blade members simultaneously.

6. The invention as set forth in claim 5, in combination with means for resiliently applying a force to said jaw members to oppose separation thereof, said force being applied along the line of contact portions when said blade members are in closed position.

7. The invention as set forth in claim 5, in combination with means for applying a force on said jaw members along a line passing through the thickest portion of said contact areas, and wherein said operating means is active upon an opening movement to move the contact areas of some of said blade members out of engagement with said jaw members prior to the movement of the contact areas of other of said blade members away from the said line of applied force.

8. In a knife switch, the combination with a pair of current carrying members, and means supporting said members for relative angular movement about a transverse axis through said members, of means comprising an annular ring concentric with said axis for restricting the contact area of said members.

9. The invention as set forth in claim 8, wherein said ring is seated in an annular recess in one of said members and projects beyond the face thereof.

10. In a knife switch, a stationary jaw, a knife blade, stationary plates carrying a pivot pin upon which said blade is mounted, and annular contact surfaces projecting beyond the body of said blade to restrict the contact area between said blade and plates.

11. In a high contact pressure switch, the combination of a hinge member, a blade member pivoted thereto, a contact member, and raised contact surfaces on one of said members restricting the contact between said blade member and each of said other members to an order substantially less than that of the transversely alined portions of said members.

12. The invention as set forth in claim 11, wherein the said raised contact surfaces restricting the contact area between said blade member and said hinge member comprises an annular ring carried by the blade member, the axis of the ring coinciding with the pivotal axis of said blade member.

13. In a switch of the knife type, a blade member, a hinge member on which said blade member is supported for pivotal movement, one of said members being bifurcated to provide portions at opposite sides of the other member, and annular contact restricting means carried by and projecting beyond one of said members to restrict the engagement thereof with the other member to an order substantially less than that of the transversely alined surfaces of said members.

14. In a high contact pressure switch of the tongue or clip type, the combination with a line terminal element, a blade element pivotally supported on said line terminal, a second terminal providing a contact for engagement with said blade element, and a raised contact rib of annular form on one of said elements for restricting the contact between said elements to the order of line contact.

15. In a disconnecting switch and operating mechanism therefor, the combination of a plurality of blades mounted for oscillation and operating means connected to each blade, the distance between the center of oscillation and the connecting point being different for each blade.

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