May 28, 1940. I. R. LATTA 2,202,698

ELECTRIC SWITCH

Filed Oct. 21, 1938 2 Sheets-Sheet 1

Fig. 1.

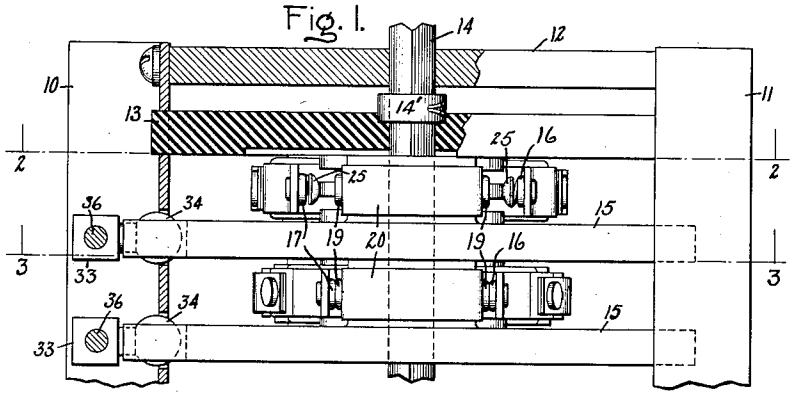


Fig. 2.

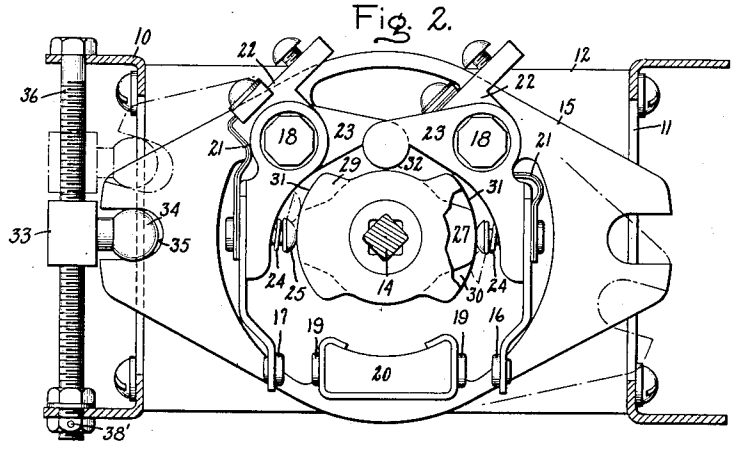
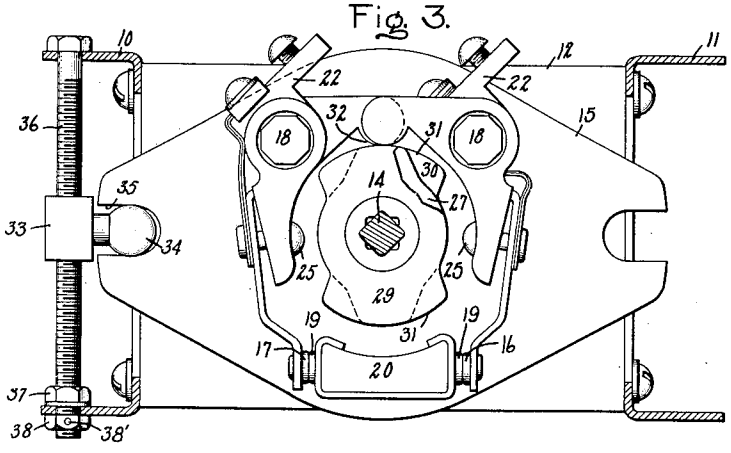


Fig. 3.



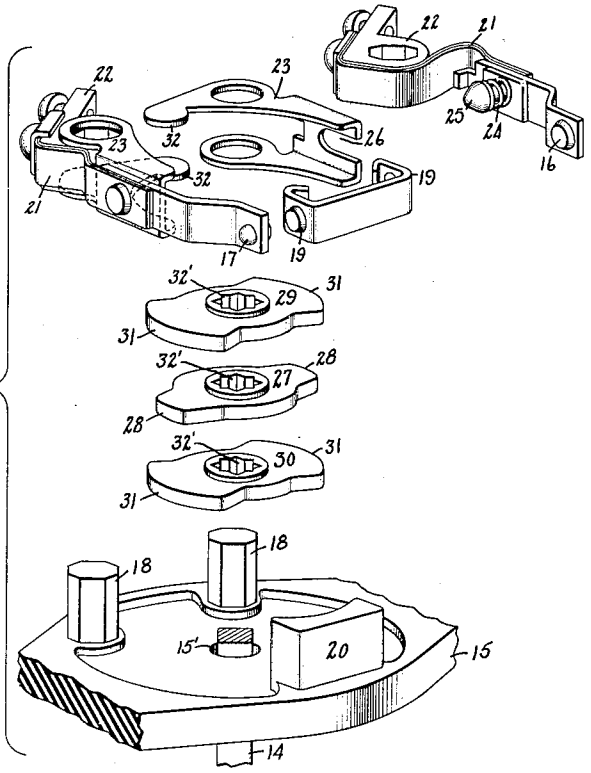
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Fig. 4.



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UNITED STATES PATENT OFFICE

2,202,698

ELECTRIC SWITCH

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Application October 21, 1938, Serial No. 236,269

4 Claims. (Cl. 200—6)

My invention relates to improvements in electric switches and more particularly to auxiliary switches whose circuit opening or closing movements or both have to be coordinated with another mechanism, for example a circuit breaker, so as to establish closely defined operating sequences. An object of my invention is to provide an improved electric switch whose circuit controlling movements can be closely adjusted for coordination with other mechanisms without disturbing the mounting or assembly of the switch. Another object of my invention is to provide an improved multistage electric switch in which the circuit controlling movements of the different stages can be independently and closely adjusted for definite sequences of operation with respect to each other and another mechanism. These and other objects of my invention will hereinafter appear in more detail.

In connection with the control of various devices, such as circuit breakers for example, it is often necessary to use auxiliary switches having one or more stages of contacts whose opening and closing movements have to be definitely and closely coordinated with the various phases of operation of the circuit breaker. Because of the indeterminate amount of lost motion necessarily involved in most circuit breaker and switch operating mechanisms, it is difficult, except by an expensive process of cut and try involving disassembling, fitting and reassembling of the various parts, to obtain the desired nicety of sequence of circuit controlling operations. In accordance with my invention, I eliminate these cut and try processes of disassembly, adjustment and reassembly and the cost associated therewith by a switch arrangement such that the desired nicety of adjustment or sequence of operation can readily be secured without disturbing the mounting or assembly of the switch. Moreover, further in accordance with my invention, in case of a multistage auxiliary switch, this nicety of adjustment can be secured in each stage independently of the others and also without disturbing the mounting or assembly of the switch.

My invention will be better understood from the following description when considered in connection with the accompanying two sheets of drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings Fig. 1 is a fragmentary plan view partly in section of a multistage switch embodying my invention; Fig. 2 is an elevation on the line 2—2 of Fig. 1 showing one stage in the open circuit position; Fig. 3 is an elevation on the line 3—3 of Fig. 1 showing another stage in the closed circuit position; and Fig. 4 is a disassembled perspective illustrating different parts of one stage of the switch shown in Fig. 1.

The multistage switch shown in the accompanying drawings for the purpose of illustrating a practical embodiment of my invention comprises a switch framework for supporting the different contact stages. As shown, this framework includes two side members 10 and 11, which may take the form of channels, and suitable end-connecting members, such as plates 12. In general these parts may be of metal, and in this case one end-insulating barrier 13 may be provided. A similar barrier at the other end will not be required as will hereinafter appear.

For operating the switch, I provide suitable operating means, shown as a shaft 14, which is journaled in the end plates 12 and which may be square in cross section for purposes hereinafter to appear. Longitudinal movement of the shaft 14 may be prevented in any suitable manner, as for example by collars 14' suitably secured to the ends of the shaft and bearing against the end plate 13 or its equivalent. It will be understood by those skilled in the art that this shaft may be connected to any mechanism, such as a circuit breaker operating mechanism, so as to be actuated in response to the movements thereof or the shaft may be manually operated by means of a handle secured thereto but not shown in the drawings.

In order to have each contact stage unitary, I provide a support 15 which extends transversely of the side members 11 through slots in the webs thereof. Each support is provided with a centrally disposed opening 15' through which the shaft 14 extends to provide a pivotal mounting for the support 15. Obviously any suitable number of these stages may be assembled by providing side frames 10, 11 and a shaft 14 of the necessary length. By making the support 15 of suitable insulating material, it is possible to insulate the contact parts of each stage and the support also acts as an insulating barrier between stages. Likewise, as will appear from Fig. 1, the last stage support constitutes the necessary insulating barrier at one end thus eliminating the necessity for an insulating barrier 13 at each end.

As shown, the contact mechanism comprises relatively movable cooperating contacts, such as one or more contacts 16, 17, which are movably positioned on projecting portions 18 of the sup-

port 15 and one or more inter-connected cooperating stationary contacts 19 fixedly mounted on a projecting portion 20 of the support 15. This construction provides the advantage of two breaks in series, but one movable and one stationary contact may be employed so far as my invention is concerned. In the arrangement shown, a flexible lead 21 secures the movable contacts to a terminal member 22 which embraces the projection 18 on the support 15 and is stationary relatively to this support. In order to provide a forced movement of the movable contact both to and from the circuit closing position, it is resiliently supported in a cradle 23, which may be of channel form as shown, so that the terminal 22 and the lead 21 can be inserted between its sides. The resilient support of the movable contact may be provided by a spring 24 which is carried on a projection of the movable contact provided with a combination bearing and spring restraining head 25. When the contact is assembled, this projection fits into a slot 26 in the cradle 23 with the cradle next to the contact and the spring biasing the cradle and contact arm together.

For forcibly moving the contacts to and from the closed circuit position, there are provided suitable cam means mounted on the shaft 14. The contact opening cam means may comprise a single cam 27 having one or more cam faces 28 which engage the projecting heads 25 associated with the movable contacts 16 and 17 so as to separate these contacts, as will appear more clearly from Figs. 2 and 4. The cam 27 thus constitutes a contact opening cam which forcibly moves each of the contacts 16 from the closed circuit position to the open circuit position when the cam is in a predetermined position which in the stage shown in Fig. 2 happens to be with the long dimension of the cam horizontal. For forcibly closing the contacts, there may be provided two cams 29 and 30 having cam faces 31. These cams are mounted on the shaft 14 one on each side of the cam 27. In the arrangement shown, one of these cams 29 engages a cam follower projection 32 on the cradle associated with the movable contacts 16 and the other cam 30 engages a cam follower 32 on the cradle 23 associated with the movable cam 17 so as forcibly to move these cradles in opposite directions about their pivotal mountings on the support 15. This causes the engagement of the stationary contacts 19 by the movable contacts 16 and 17 when the cam faces 31 engage the cam followers 32. With the arrangement shown in Fig. 1, this occurs when the long dimension of the cams 31 is vertical as will be more clearly apparent from Figs. 3 and 4.

In order to provide an adjustment for effecting a desired contact controlling action at a given angular position of the shaft and, corollary to this, to provide a given sequence of operations in a multistage switch, the shaft center openings 32', the cams 27, 29 and 30 may be made of a reentrant polygonal form such that the cams may be slipped over the shaft 14 in a desired angular relation. If the shaft is a square shaft, as shown, then the holes in the cams may be of a regular eight-pointed star shape which will give adjustments in steps of 45° each. These adjustments, however, are, in general, obtained only by disturbing the mounting and assembly of the switch.

In order to obtain the desired coordination between circuit controlling operations and the angular position of the shaft 14 and particularly refinements in such coordination without any disturbance to the mounting or assembly of the switch, I provide an adjustment of the contacts which can be accomplished, for example, by moving the support 15 relatively to the shaft 14 so that it is possible after assembly of the switch and mounting thereof to change the points in the travel or rotation of the shaft at which circuit opening and closing movements of the contacts are effected. For this purpose, the support 15 may be provided with suitable actuating means such as a movable crosshead 33 which engages the support 15 in any suitable manner as, for example, by a spheroidal head 34 projecting into a slot 35 in one end of the support 15 where it projects through the web of one of the channel members 10. For moving the crosshead 33, there may be provided any suitable means such as a threaded member or bolt 36 which passes through the flanges of the channel member 10 and engages the crosshead 33 which is suitably threaded for the purpose. The bolt 36 may normally be locked in position against movement by suitable means such as nuts 37 and 38, the latter of which may be secured to the bolt as by a pin 38'. Upon backing off the nut 37 sufficiently to permit the turning of the bolt 36 in one direction or the other, the crosshead 33 will be caused to travel along the bolt 36 whereby to shift the suport 15 angularly with respect to the axis 14 in a direction dependent upon the direction in which the bolt is turned. Such a shifted position of the crosshead 33, the support 15, and the bearing heads 34 is shown by the dash-dot lines in Fig. 2. Obviously, the greater the depth of the channel frame the greater the angular adjustment possible with the crosshead and screw mechanism. Inasmuch as each contact assembly has its own individual adjustment, it is obvious that any one of the contact arrangements can be adjusted independently of all the others so as to fit in with any desired sequence of operation of the other stages and to be adjusted to any given angular position of the switch within the range of movement of the crosshead adjustment, all without disturbance to the mounting or assembly of the switch. Switches embodying my invention, accordingly, provide a compact, unitary structure whereby a rough adjustment may be obtained over the whole angular range of movement by fixed steps of predetermined amounts with disassembly and reassembly of the switch and further refinements or nicety of adjustment can then be obtained over a desired angular range without the necessity of dismounting or disassembling the switch.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

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

1. An electric switch comprising a support, two cooperating contacts mounted on said support one stationary and the other movable relatively to the support, means for effecting relative movement of said contacts including a shaft extending through said support and constituting a pivot for angular movement of the support and two cams mounted on said shaft for movement therewith one for effecting the circuit opening

movement of said contacts and the other for effecting the circuit closing movement of the contacts, and means for turning said support on said shaft relatively to the operating faces of said cams whereby to cause the circuit opening and closing movements of said contacts at different angular positions of the cams relatively to the support.

2. A multiple stage electric switch, each stage comprising relatively movable cooperating contacts and a support of insulating material for said contacts each support constituting a barrier between successive stages of the switch, means for actuating said contacts including a common operating shaft for all stages extending through said supports and constituting a pivot for angular movement of the supports and separate actuating means for each stage carried by said shaft and movable therewith, and means for turning the contact support of each stage on said shaft relatively to the actuating means of that stage and independently of the supports and actuating means of the other stages whereby to control the sequence of the circuit opening and closing movements of the contacts of all the stages.

3. A multiple stage electric switch, each stage comprising relatively movable cooperating contacts and a support of insulating material for said contacts each support constituting a barrier between successive stages of the switch, means for actuating said contacts including a common operating shaft for all stages extending through said supports and constituting a pivot for angular movement of the supports and cam means for each contact stage carried by said shaft and movable therewith, and means for turning the contact support of each stage on said shaft relatively to the operating faces of the cam means of that stage and independently of the contact supports and cam means of the other stages whereby to control the sequence of the circuit opening and closing movements of the contacts of all the stages.

4. A multiple stage electric switch, each stage comprising three cooperating contacts and a support of insulating material for said contacts two of said contacts being movably mounted on said support and the third contact being mounted intermediate the other two contacts for engagement by both and each support constituting a barrier between successive stages of the switch, means for actuating said contacts including a common operating shaft for all stages extending through said supports and constituting a pivot for angular movement of the supports and two cams for each contact stage mountable on said shaft in a plurality of different angular positions in the direction of rotation of the shaft one for positively effecting a circuit opening movement of said contacts and the other for positively effecting a circuit closing movement of the contacts whereby to control the sequence of the circuit opening and closing movements of the contacts of all the stages, and means operable after assembly of the switch for turning the contact support of each stage on said shaft relatively to the faces of the cam means of that stage and independently of the supports and cams of the other stages whereby further to control the sequence of the circuit opening and closing movements of the contacts of all the stages.

ISAAC R. LATTA.