

March 14, 1933.

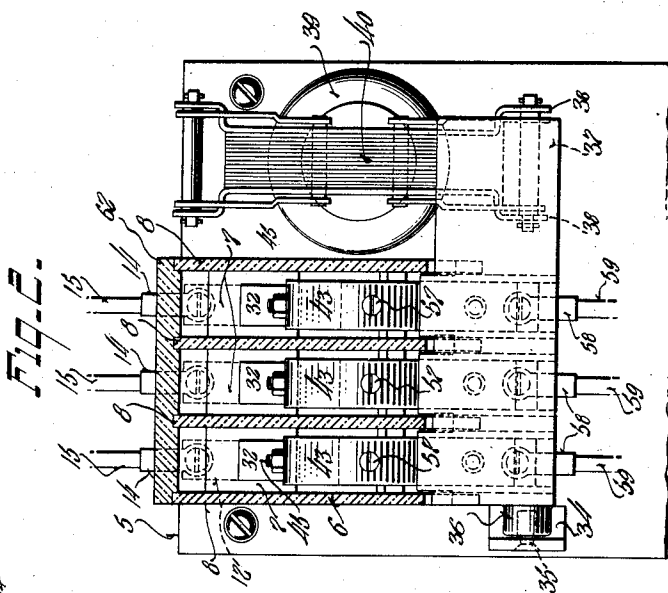
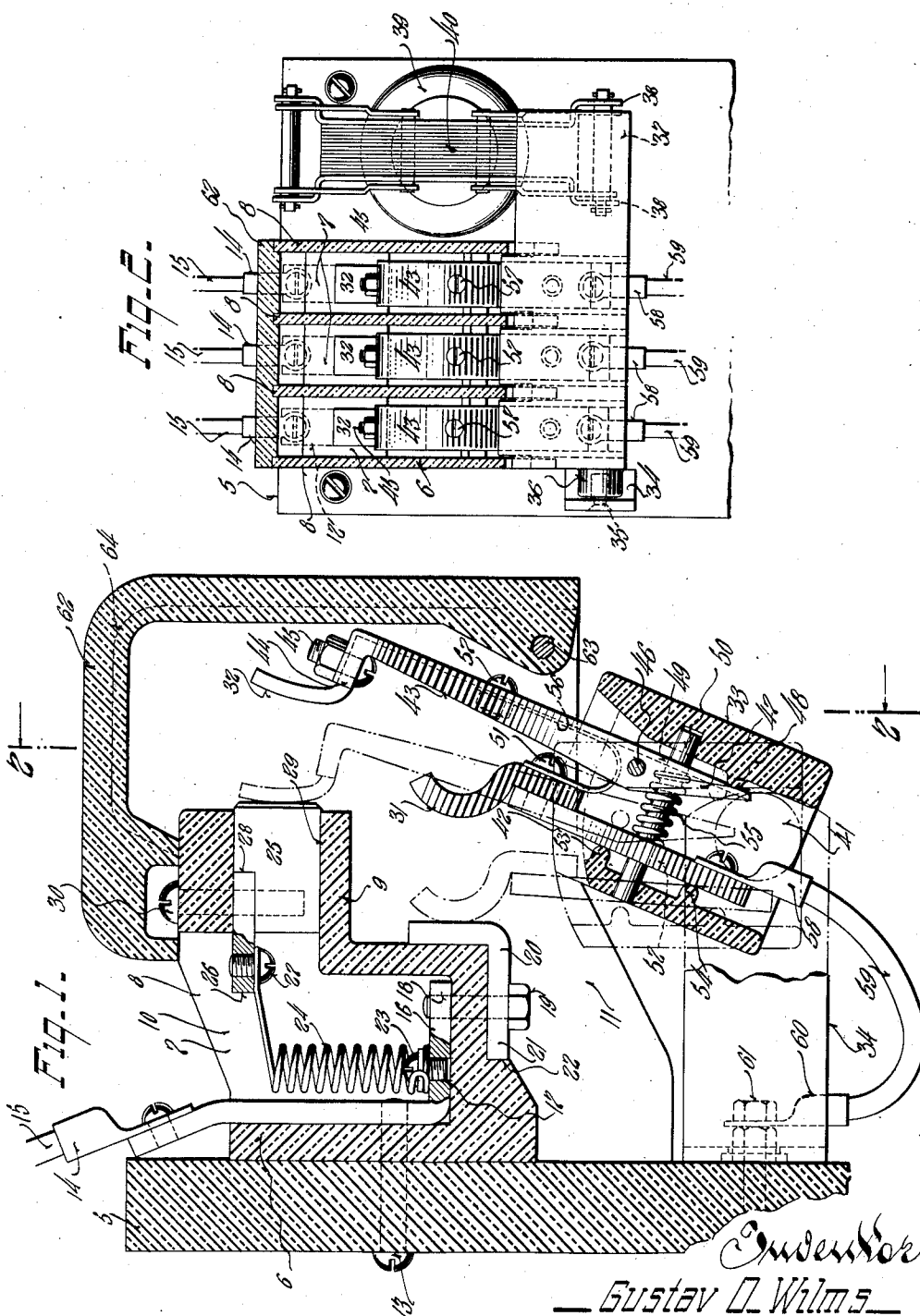
G. O. WILMS

1,901,573

ELECTRIC SWITCH

Filed Nov. 21, 1928

2 Sheets-Sheet 1



March 14, 1933.

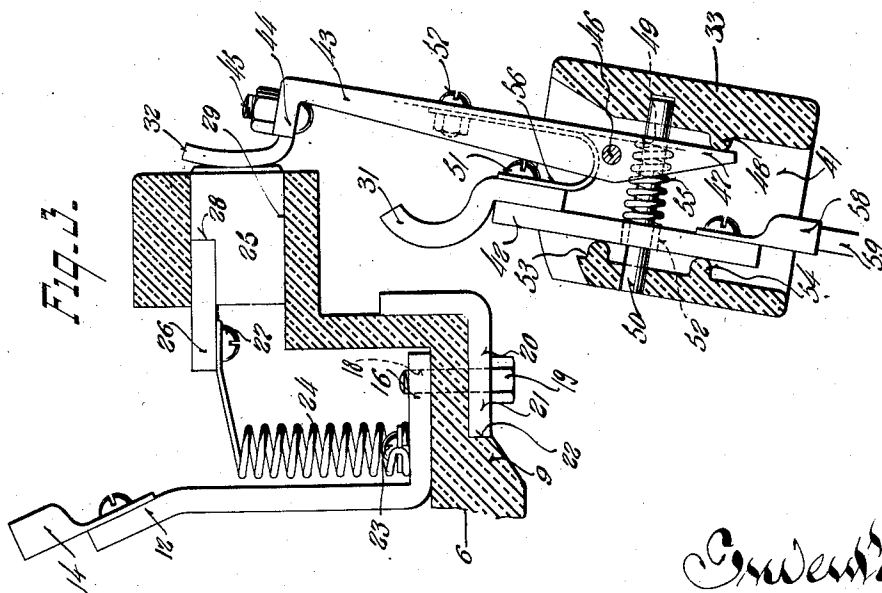
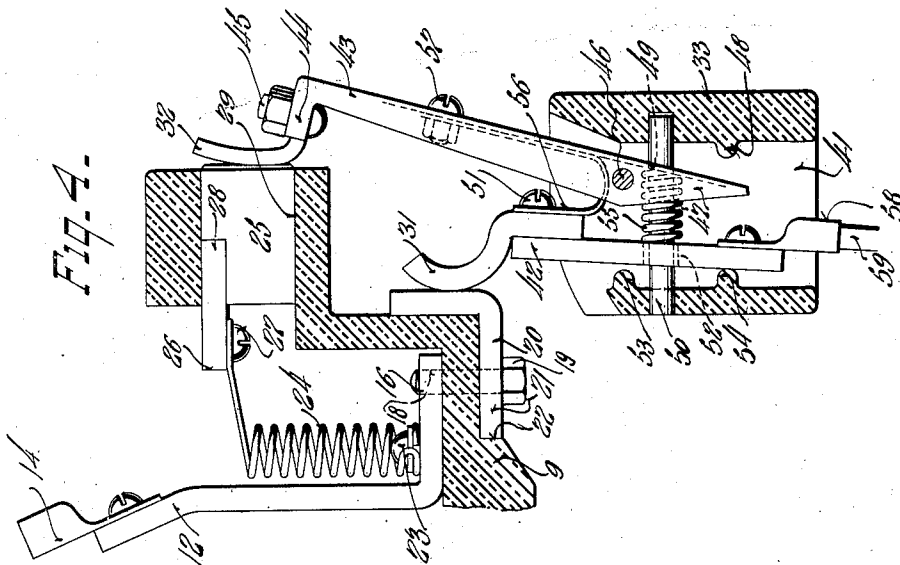
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

GUSTAV O. WILMS, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO ALLEN-BRADLEY COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF
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ELECTRIC SWITCH

Application filed November 21, 1928. Serial No. 320,866.

This invention relates particularly to an electric switch for connecting a motor or other electrical device with a source of energy and contemplates as an object the provision of means for increasing the capacity of a switch of this type without increasing its size.

Another object of this invention resides in the provision of means whereby a resistance is momentarily interposed between the source of energy and the motor or the like as the switch closes whereby the voltage imposed on the motor or the like at the initial closing of the switch is less than the line voltage.

Another object of this invention resides in the provision of means whereby the switch acts substantially as a circuit breaker when opened by inserting a resistance in the circuit before it is broken, thus breaking the arc in multiple steps.

A further object of this invention resides in the provision of a pair of movable contacts adapted to be engaged with a pair of cooperating stationary contacts, one of which engages its contact before the other to include a resistance in series therewith whereby the normal voltage surge occurring at the time of closing and opening the switch is throttled.

And a still further object of this invention resides in the provision of a switch of the character described having a pair of movable contacts and a pair of cooperating stationary contacts, the movable contacts being yieldably mounted in an actuating member whereby one engages its stationary contact before the other and by which continued movement of the actuating member engages the second movable contact with its stationary contact, both movable contacts being maintained in engagement with their stationary contacts under pressure.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such

changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings, I have illustrated one complete example of the physical embodiment of my invention constructed according to the best mode I have so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a sectional view through a switch structure embodying my invention with parts in elevation;

Figure 2 is a sectional view taken through Figure 1 on the plane of the line 2—2;

Figure 3 is a diagrammatic view illustrating the parts with one movable contact engaged with its stationary contact, and

Figure 4 is a view similar to Figure 3 with both movable contacts engaging their respective stationary contacts.

Referring now more particularly to the accompanying drawings, in which like numerals designate like parts throughout the several views, 5 represents a base or panel of suitable insulating material upon which the switch structure is mounted and which may also provide a support for other cooperating mechanisms, not shown, as they form no part of this invention.

The switch illustrated is of the three pole type and comprises a mounting member 6 formed of insulating material and divided into three compartments 7 by partitions 8 and each compartment is divided by an irregularly shaped division wall 9 into an upper recess or chamber 10 and a lower recess or chamber 11. Substantially L-shaped members 12 are secured in the upper recesses or chambers 10 by screws 13 extending through aligned apertures in the base 5 and the mounting member 6 to be threaded in apertures in the members 12, thereby securing the mounting member 6 to the panel 5 and at the same time maintaining the members 12 in position. Each member 12 has its upper end preferably bent toward the panel 5 and is provided with a terminal 14 with which a line conductor 15 is connected.

The lower or short legs 16 of the members 12 rest on the bottom of their respective re-

cesses or chambers 10 and are provided with a pair of threaded apertures 17 and 18. Cap screws 19 passing through apertures in the bottoms of the recesses or chambers 10 formed by the adjacent portion of the division wall 9 are threaded in the apertures 18 and electrically connect a stationary contact 20 with each member 12. The stationary contacts 20 are preferably angular and are restrained against movement about their cap screws 19 by having their lower legs 21 engaged with abutments 22 formed in the wall 9.

Screws 23 threaded in the apertures 17 connect the adjacent ends of resistance units 24 with each member 12 and consequently with the line conductors 15, the other ends thereof being connected with second stationary contacts 25 through arms 26 to which they are secured by screws 27. Each arm 26 is received in a stepped portion 28 formed in the adjacent contact 25 which may consist of a block of metal secured in an opening 29 in the wall by a screw 30 passing through aligned apertures in the wall 9 and the arm 26 and threaded in the contact block 25.

From the description thus far, it is apparent that the contacts 25 and 20 are offset with respect to each other with a contact 25 above and forwardly of the contact 20; and it is also observed that the division wall 9 of the mounting member 6 is offset or stepped to afford the stated relative positions of the contacts, and that this offset or stepped formation of the division wall 9 results in an overhanging ledge above the contact 20. This ledge being formed of insulating material affords an effective arc barrier to deflect the arc which forms at the contact 20 upon disengagement of its cooperating movable contactor, to be later described, away from the contact 25. In other words, the intervening portion of the division wall 9 between the contacts 20 and 25 together with the walls 11 forms substantially an arc confining chamber.

The stepped formation of the division wall 9 also provides a convenient space for the pockets or chambers 10 in which the resistance elements 24 are received. In this manner an exceptionally compact construction is produced.

Cooperating with the stationary contacts 20 and 25 and positioned in the lower recesses or chambers 11 are movable contactors 31 and 32 which are carried by an actuating member 33 pivotally mounted in any suitable manner and adapted to be actuated to engage the contactors 31 and 32 with the contacts 20 and 25.

The mounting for the member 33 is substantially as shown and described in my copending application Serial No. 295,693 filed July 27, 1928, and includes a supporting member 34 carrying a pivot stud 35 at its

outer end which is rotatable in a recess formed in a boss 36 extended from the member 33 at one end thereof, the other end being provided with an inwardly extended arm 37 which is positioned between ears or lugs 38 extended from the frame of the core of a magnet 39.

The arm 37 is pivotally mounted between the ears or lugs 38 in line with the pivot 35 and the outer end thereof has links connected therewith which are connected with an armature 40 adapted to be attracted to the magnet 39 to move member 33 to engage its contactors 31 and 32 with the stationary contacts 20 and 25.

The member 33 which is preferably formed of insulating material similar to that of the mounting member 6 has three recesses or openings 41 in line with the chambers 11 of the mounting member in which the supporting arms 42 and 43 of the movable contactors 31 and 32, respectively, are positioned. The arms 43 have their contactors 32 secured to their outer, laterally directed ends 44 by bolts 45 and are pivotally mounted in the recesses 41 by pivot pins 46 arranged in axial alignment. The inner ends 47 of the arms 43 extend beyond their pivots 46 and normally engage projections 48 extended into the recesses 41 and are provided with apertures 49 through which pass rods 50 carried by the member 33.

The contactors 31 are secured to the upper ends of the arms 42 by screws 51, the arms being maintained in position by the rods 50 which also pass through apertures 52 therein. A pair of projections 53 and 54 extend into each recess 41 and the arms 42 are normally yieldably urged into engagement with the projections by expansile springs 55 mounted on the medial portions of the rods 50 and confined between the arms 42 and 43. Flexible ribbon conductors 56 having one end secured to the contactors 31 by the screws 51 and their other ends secured to the arms 43 by screws 57, electrically connect the contactors 31 and 32, as will be readily apparent.

The specific construction of the switch arms forms the subject matter of my copending application, Serial Number 349,130 filed March 22, 1929.

The lower portions of the arms 42 have terminals 58 secured thereto from which conductors 59 lead to terminals 60 fixed on screws 61 which may be connected directly to a motor or other like device not shown, or to any other portion of an electric circuit whereby the engagement of the contactors 31 and 32 with their respective stationary contacts 20 and 25 bridges the line conductors 15 and the terminal screws 61.

As the switch is closed by the energization of the magnet 39, the member 33 moves to first engage its contactors 32 with the stationary contacts 25 thus connecting the mo-

tor or other device with which the switch is used with the line conductors 15 through the resistance elements 24, as a result, the voltage applied to the motor or other device at its start is lower than the line voltage to permit the same to pick up speed before being connected directly across the line by the engagement of the contactors 31 with their stationary contacts 20, as shown in Figure 4.

As the contactors 32 are engaged with their contacts 25 and as the member 33 continues its closing movement, the arms 43 pivot on the mounting rods 46, moving their ends 47 towards the arms 42 and compressing the springs 35. This added pressure insures a perfect contact between the contactors 32 and contacts 25 and upon further closing movement of the member 33, the contactors 31 are engaged with their stationary contacts 20 whereupon the spring 55 is still further compressed, the arms 42 of the contactors 31 pivoting about the projections 54, as illustrated in Figure 4.

In opening the switch, the contactors 31 and the contacts 20 are first disengaged and the current to the motor is reduced due to the fact that the resistances 24 are again incorporated in the circuit whereby the voltage at the time of the final opening of the switch is relatively smaller than the line voltage. In this manner the load is divided between the two sets of contacts with the result that the arc incidental to opening at each set of contacts is considerably minimized, and as hereinbefore brought out, the arc formed at the lower contacts 20 is cooled by the pocket or chamber formed by the side walls 11 with the overhanging portion of the division wall 9. The overhanging portion of the division wall 9 also serves to effectively prevent an arc at the contacts 20 from reaching up to the contacts 25.

The arc incidental to the disengagement of the contactors 32 from the contacts 25 are cooled or quenched by a cover member 62.

The cover member 62 is pivoted to the partitions 8, as at 63, closes the pockets or chambers 11 and thus totally encloses both the stationary and the movable contacts to insure maximum protection against arcing and to reduce the possibility of creepage. As illustrated in Figure 2, the cover may be formed with grooves 64 in which the edges of the partitions 8 are received to provide a tight fit therebetween; the top face of the member 33 being likewise grooved, as at 65, in alignment with the partitions 8 so that when the switch is closed the recesses 41 form unbroken continuations of the chambers 11.

From the foregoing description, taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art to which an invention of this character appertains, that a switch of

the character described is provided with means for first applying a reduced voltage to a motor or other device and then connecting it directly with the full voltage and in which the switch, in opening, functions substantially as a circuit breaker stepping down the voltage so that at the final opening of the switch, it is relatively less than the line voltage.

It is also apparent that this invention greatly increases the capacity of switches of the character described without in any way increasing their overall size, and that by this invention, one of the most urgent requirements of the industry is fulfilled, i. e. a switch of increased capacity with maximum compactness.

What I claim as my invention is:

1. In an electric switch, a mounting member adapted to be connected with a support panel and having a compartment divided into separated chambers by a division wall, stationary contacts carried by the division wall and disposed on one side thereof to be within one chamber, a resistance element disposed on the other side of the division wall within the other chamber and electrically bridging the stationary contacts, and contactors substantially within the first-mentioned chamber and movable to engage-ment with the stationary contacts.

2. In an electric switch including spaced stationary contacts and a plurality of co-operating movable contactors engageable therewith, means for mounting the stationary contacts comprising a member of insulating material adapted for attachment to a support panel and having portions offset one in advance of the other and one above the other to form an overhanging ledge providing a barrier of insulating material, between the contacts and a baffle for deflecting an arc formed at the contact beneath the ledge away from the other contact, and means mounting the movable contactors for successive engagement with the stationary contacts.

3. In an electric switch including spaced stationary contacts and a plurality of co-operating movable contactors engageable therewith, means for mounting the stationary contacts comprising a member of insulating material adapted for attachment to a support panel and having a stepped wall to provide portions offset one in advance of the other, means for securing one stationary contact to each offset portion whereby their contact surfaces are one in advance of the other and the intervening wall portion between the offset portions provides an arc barrier between the stationary contacts and increases the creepage distance therebetween, and means mounting the movable contactors for successive engagement with the stationary contacts, the arc barrier provided by

the stepped wall deflecting an arc formed at the contact having its contact surface innermost away from the other contact.

4. In an electric switch including spaced stationary contacts and cooperating movable contactors successively engageable therewith, means for mounting the stationary contacts comprising a substantially integral member of insulating material having contact supporting portions offset one in advance of the other, with the intervening mounting member portion forming an insulating arc barrier to direct an arc drawn between one stationary contact and its cooperating movable contactor away from the other stationary contact.

5. In an electric switch including a plurality of stationary contacts and a plurality of cooperating movable contactors successively engageable therewith, a resistance element bridging the stationary contacts, and a member of insulating material recessed to receive the resistance element and mounting the stationary contacts, said member having its portions which carry the stationary contacts offset one in advance of the other to facilitate the successive engagement of the contactors with the contacts and to provide an arc barrier between the stationary contacts, whereby an arc drawn between one of the contacts and its cooperating contactor is deflected away from the other contact.

6. In an electric switch including stationary contacts, a resistance bridging the stationary contacts and movable contactors successively engageable with the stationary contacts to interpose the resistance in a circuit controlled by the switch during closing and opening of the switch, means for mounting the stationary contacts comprising a member of insulating material adapted to be mounted as a unit from a support panel, said member having spaced portions offset one in advance of the other, to form a ledge of insulating material, the contacts being mounted from said offset portions, so that the ledge of insulating material forms an arc barrier therebetween, and means mounting the movable contactors for rocking movement about a common axis and for successive engagement with the stationary contacts, the barrier afforded by the ledge between the contacts deflecting an arc formed at the contact beneath the ledge away from the other contact.

7. In an electric switch including stationary contacts and movable contactors successively engageable with the stationary contacts, means for mounting the stationary contacts comprising a member of insulating material adapted to be mounted as a unit from a support panel and having its wall portions which carry the stationary contacts offset one in advance of the other with an in-

termediate wall portion therebetween and at an abrupt angle to one of said contact carrying wall portions to provide an insulating barrier between the stationary contacts.

8. In an electric switch, a mounting member adapted for attachment to a support panel and having spaced side walls connected by a wall having portions offset with respect to each other, said offset portions being connected by an intermediate wall portion at an abrupt angle to each of said offset wall portions, stationary contacts mounted on said offset wall portions to be disposed one in advance of the other with the intermediate wall portion overhanging one of the stationary contacts to form an arc barrier between the contacts to cooperate with the spaced side walls and form an arc confining chamber for said contact beneath the overhanging wall portion and its cooperating contactor, and movable contactors mounted between the side walls of said mounting member and adapted to successively engage the contacts.

9. In an electric switch, a mounting member adapted for attachment to a support panel and having spaced side walls connected by a wall having portions offset with respect to each other, said offset portions being connected by an intermediate wall portion at an abrupt angle to each of said offset wall portions, stationary contacts mounted on said offset wall portions to be disposed one in advance of the other with the intermediate wall portion overhanging one of the stationary contacts to form an arc barrier between the contacts, movable contactors mounted between the side walls of said mounting member and adapted to successively engage the contacts, and a cover cooperating with the mounting member side walls and one of the offset wall portions to define a chamber open only at its bottom and in which the movable contactors are disposed.

10. In an electric switch, a panel, a plurality of stationary contacts, a resistance element electrically bridging the stationary contacts, an insulating member on the panel to mount the stationary contacts and recessed to receive the resistance element whereby the resistance element is substantially enclosed by said insulating member, and a plurality of movable contactors successively engageable with the stationary contacts to interpose the resistance element in a circuit controlled by the switch during closing and opening of the switch.

11. In an electric switch including stationary contacts and movable contactors successively engageable with the stationary contacts, means for mounting the stationary contacts comprising a member of insulating material adapted to be mounted as a unit from a support panel and having its wall portions

which carry the stationary contacts offset one in advance of the other with an intermediate wall portion therebetween and at an abrupt angle to one of said contact carrying wall portions to provide an insulating barrier between the stationary contacts, said member of insulating material having a recess inwardly of its offset portions, and a resistance element disposed in said recess electrically bridging the stationary contacts.

12. In an electric switch, a panel, a plurality of vertically spaced fixed contacts mounted from the panel with their contact surfaces one in advance of the other with respect to the plane of the panel, a plurality of movable contactors, one engageable with each fixed contact, and means for moving the contactors in unison toward and away from the fixed contacts, the offset relation of the contact surfaces of the fixed contacts causing one of the contactors to engage its respective contact first and to disengage its respective contact last.

13. In an electric switch, a panel, a plurality of vertically spaced fixed contacts mounted from the panel with their contact surfaces one in advance of the other with respect to the plane of the panel, a plurality of movable contactors, one engageable with each fixed contact, means for moving the contactors in unison toward and away from the fixed contacts, the offset relation of the contact surfaces of the fixed contacts causing one of the contactors to engage its respective contact first and to disengage its respective contact last, and an arc barrier interposed between the fixed contacts and against which an arc formed at the innermost fixed contact rebounds to be deflected away from the other fixed contact.

14. An electric switch comprising a member of insulating material having a stepped wall to provide offset portions, one in advance of the other and having a recess behind the stepped wall, a stationary contact mounted on each offset portion of the stepped wall so that the contact surface of one contact is in advance of the contact surface of the other and the intervening portion forms an arc barrier therebetween, a resistance element in the recess behind the stepped wall and electrically connecting the stationary contacts, a pair of electrically connected contactors engageable with the stationary contacts, and means mounting the contactors for movement in unison toward and away from the stationary contacts, the offset relation of the contact surfaces of the stationary contacts causing the advanced contact surface to be engaged before the other and disengaged after the other.

15. An electric switch comprising a member of insulating material having a stepped wall to provide offset portions one in ad-

vance of the other and having a recess inwardly of the stepped wall, a stationary contact mounted on each offset portion of the stepped wall to be disposed one in advance of the other with the intervening wall portion forming an arc barrier between the stationary contacts to deflect an arc formed at the innermost contact away from the other contact, a resistance element in the said recess electrically bridging the stationary contacts, a terminal member also extended into the recess and having direct electrical connection with the innermost contact and electrical connection with the advanced contact through the resistance element, a pair of electrically connected contactors, movable in unison toward and away from the contacts and successively engageable therewith by reason of the offset relation of the stationary contacts so that the advanced contact is engaged first and disengaged last, and a terminal connected with the contactors whereby said terminal is electrically connected with the first mentioned terminal during closing of the switch first through the resistance element and then directly, and in opening the switch the resistance is interposed.

16. An electric switch comprising, a member of insulating material having a stepped wall to provide offset portions one in advance of the other, a stationary contact mounted on each offset portion of said stepped wall so that the contact surface of one is in advance of the other and the intervening wall portion overlies said other contact, movable contactors engageable with the stationary contacts, means mounting the contactors for movement in unison toward and away from the contacts, the offset relation of the contacts causing one contactor to engage before the other and to disengage after the other, sidewise spaced walls substantially perpendicular to the stepped wall and cooperating with the said intervening wall portion overlying one of the contact surfaces to form an arc confining chamber to minimize an arc drawn between said contact surface and its cooperating contactor, and a cover cooperating with the stepped wall and the sidewise spaced walls to form an arc confining chamber for the other contact and its contactor.

In testimony whereof I have hereunto affixed my signature.

GUSTAV O. WILMS.