March 23, 1943. H. K. KOUYOUMJIAN 2,314,714

ELECTRIC SWITCH

Filed Aug. 27, 1941 2 Sheets-Sheet 1

Fig. 2.

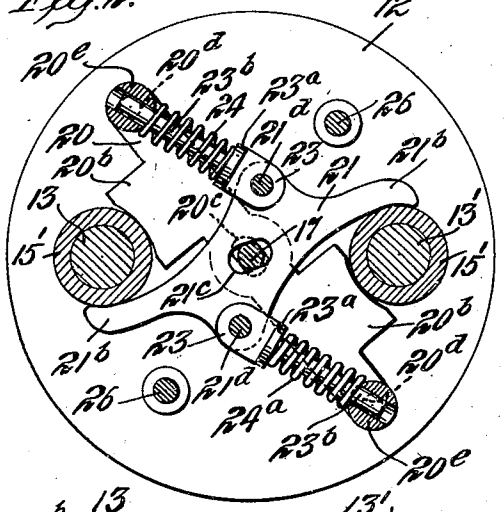
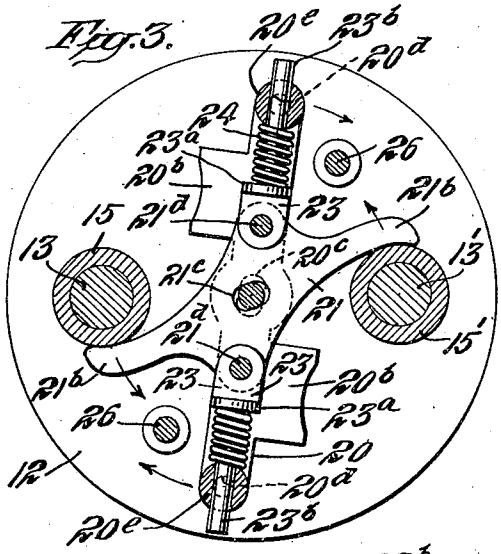


Fig. 3.



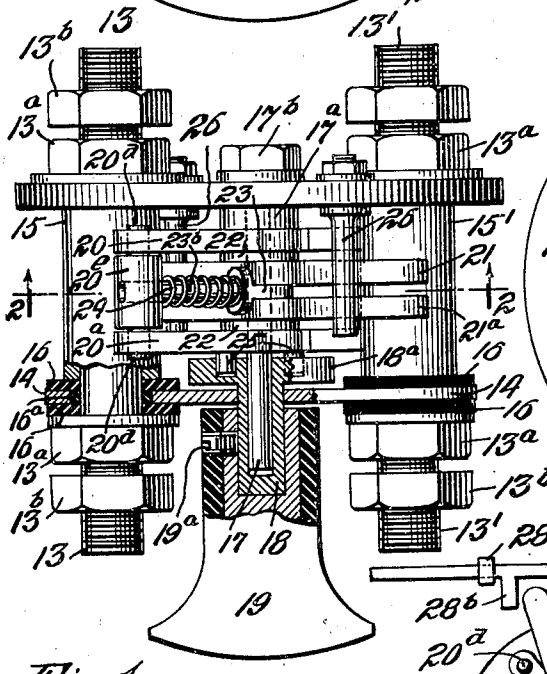


Fig. 1.

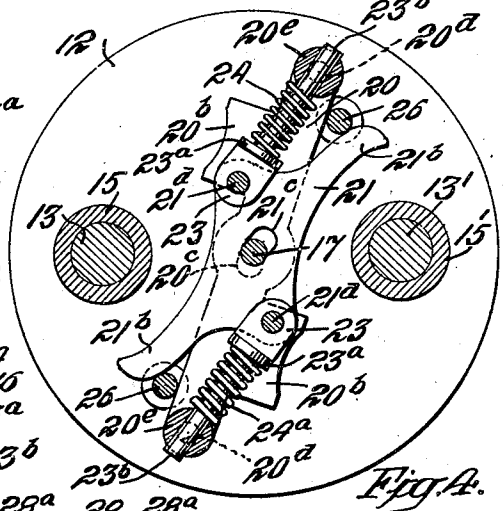


Fig. 4.

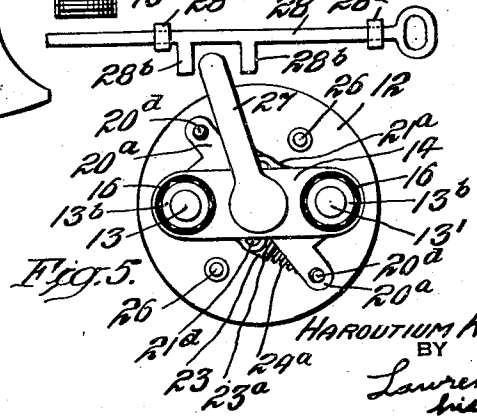


Fig. 5.

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Filed Aug. 27, 1941 2 Sheets-Sheet 2

Fig. 7.

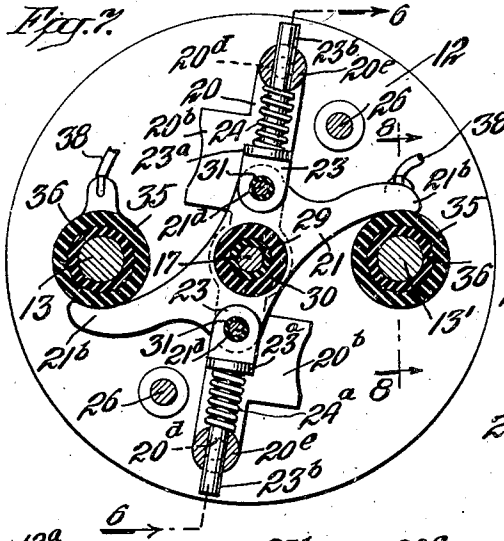


Fig. 6.

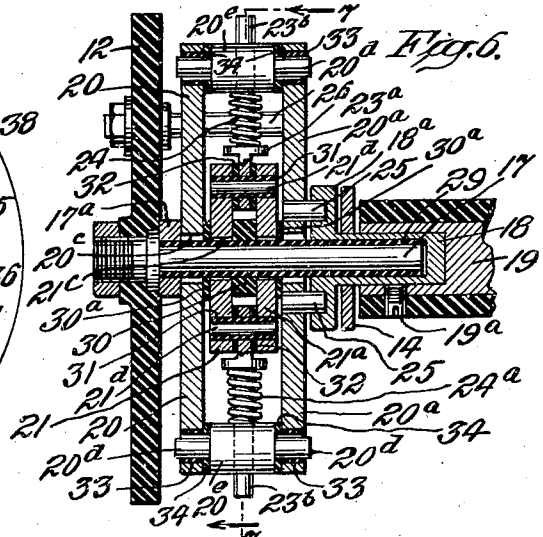


Fig. 9.

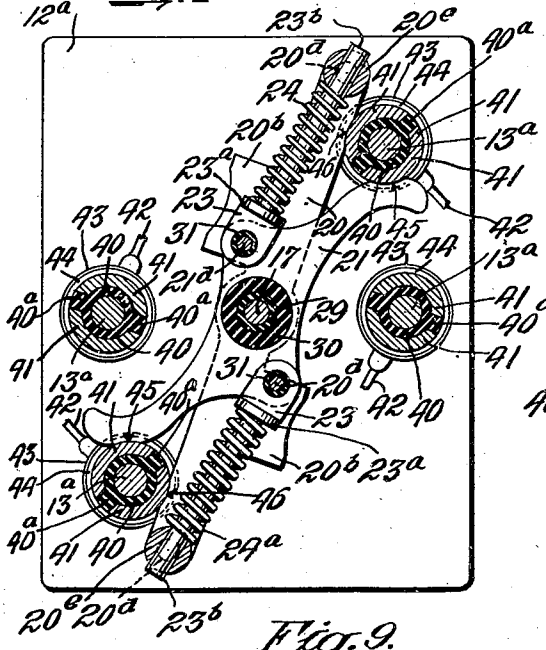


Fig. 8.

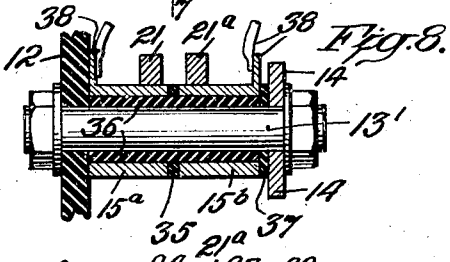


Fig. 10.

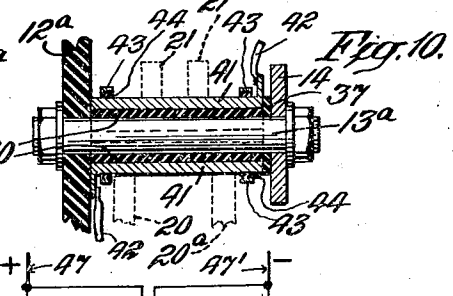
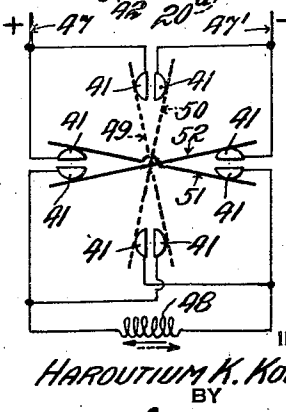


Fig. 11.



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UNITED STATES PATENT OFFICE

2,314,714

ELECTRIC SWITCH

Haroutium K. Kouyoumjian, Wakefield, R. I.

Application August 27, 1941, Serial No. 408,413

10 Claims. (Cl. 200—67)

The improved switches of this invention are applicable to various uses and for various purposes and are adapted to be modified readily for adaptation to particular requirements.

An important object of the invention is to produce an electric switch of comparatively small size having high current capacity and for use with moderately high voltages. Another object is to produce an improved form of structure in which the cost of material and the cost of manufacture will be comparatively inexpensive. Another object is to produce a switch in which the contacts are of the butt type with comparatively large contact areas and thereby avoid the disadvantages of the blade type of contact, particularly the deterioration of an effective contact engagement with continued use. Another object is to produce a quick make and quick break of the contacts in closing and in opening and to also provide a self-cleaning of the contacts in opening and in closing. A further object is to provide a switch with a multiplicity of contact making and current carrying parts in a compact form and to actuate the contacts in opening and closing by the use of a minimum number of springs; and also to secure by the spring action an equalization of pressure on all parts of the switch contacts with freedom of movement of each of the contacts for obtaining good contact engagement with all parts. Another object is to provide a number of breaks in series in opening the switch and to provide successive opening of contact elements so that one or more of the elements only is subjected to arcing while other of the contact elements are not subjected to arcing which insures the maintenance of good contact by the latter elements even if the former should develop an increase in contact resistance. Another object is to provide a switch which will not be affected by shocks or jars, that is, when the switch is closed shocks will not tend to open it and when the switch is open shocks will not tend to close it.

Other objects and advantages will be understood from the following description and accompanying drawings which disclose certain embodiments of the invention.

Fig. 1 is a side view partly in section of a switch embodying eight contact engagements with four movable contact elements and showing the switch in the closed position; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a similar view showing the parts in an intermediate position; Fig. 4 is a similar view showing the parts in the fully open position; Fig. 5 is an end view showing the switch adapted for operation by a push and pull rod; Fig. 6 is a section on the line 6—6 of Fig. 7 showing the switch modified for controlling two different circuits; Fig. 7 is a section on the line 7—7 of Fig. 6; Fig. 8 is a section on the line 8—8 of Fig. 7; Fig. 9 is a vertical section of a modification showing its adaptation for use as a reversing switch; Fig. 10 is a sectional view of one of the contact posts of Fig. 9; and Fig. 11 is a diagram of connections of the reversing switch of Fig. 9.

Referring to Figs. 1 to 4, the switch is mounted upon a supporting insulating plate or disk 12. The fixed contacts are in the form of two cylindrical sleeves 15 and 15' which are supported by a pair of bolts 13 and 13' passing through the plate 12 and through a front metal cross piece 14. Both ends of the bolts are threaded and the nuts 13a serve to clamp the plate 12 and cross piece 14 together against the ends of the contact sleeves, the bolts and the sleeves being insulated from the cross piece 14 by insulating disks 16 and insulating sleeves 16a, as shown in section in the lower left-hand portion of Fig. 1. The bolts are also provided with nuts 13b for clamping the terminals of the outside circuit between them and the nuts 13a. Provision of this means for affording double connection to each of the contact sleeves is for convenience in wiring so that the leads may be connected to the front or rear terminals of the switch, such as may be desired.

A supporting shaft 17 for the movable parts of the switch is provided with a collar or disk 17a fixed to the shaft which engages the inner side of the plate 12, the shaft 17 passing through the plate and secured in place by a clamping nut 17b on the rear threaded end of the shaft. On the front end of the shaft is a sleeve 18 which passes through the cross piece 14 and is provided with an enlarged portion at its inner end forming a disk 18a positioned at the inner side of the cross piece. The operating handle 19 is of insulating material, or covered with insulating material and is fixed, as by a set screw 19a, to the sleeve 18.

The four conducting movable contact elements in the form of contact plates are divided into pairs, the elements of each pair being similar to each other. The outer pair of contact elements 20 and 20a are of the general form shown in Fig. 2 and each of these contacts is provided with oppositely extending projections 20b which, when the switch is in the closed position as shown in Fig. 2, engage respectively the fixed contact sleeves 15, 15'. The contact plates are of substantial thickness, as shown in Fig. 1, and the engagement of the edges of the plates with the fixed

contacts gives a comparatively large contact engaging area, particularly because the curvature of the engaging edges of the plates conform with the curvature of the contact sleeves or post, as well shown in Fig. 2. The contact plates **20** and **20***a* are freely rotatable upon the shaft **17**; and the openings in these plates for the passage of the shaft are in the form of slots **20***c* for the purpose hereinafter explained. The inner pair of contact plates **21**, **21***a* are likewise freely movable upon the shaft **17**, the shaft passing through a slot **21***c* in each plate of this pair. Each of the plates **21** and **21***a* is similar in form to the other and of the form well shown in Fig. 2. The outer ends of each of these plates are in the form of extensions **21***b* which respectively engage the fixed contact sleeves when the switch is in the closed position, as shown in Fig. 2. The edges of these extensions where they engage the contact sleeves are curved to correspond with the curvature of the contact sleeves so as to give a large contact engaging area not only by the thickness of the plates but by the engaging faces being of corresponding curvature.

The actuation of the four movable contact elements is secured by the provision of two springs which serve to quickly snap the contacts to closed position and during the opening movement serve to snap the arcing contacts quickly to their open position after the movement of the other pair of contacts from the fixed contacts. Between each of the outer ends of the pair of contacts **20** and **20***a* extends a cross pin **20***d* which passes freely through the ends of the contact plates and is provided with an enlarged central portion **20***e* for spacing the plates from each other, as particularly shown in Fig. 1. The inner pair of contact plates **21** and **21***a* are spaced from the outer pair by washers **22**. The opposite sides of the contact plates **21** and **21***a* are provided at intermediate portions thereof with openings through which freely pass connecting pins **21***d* for operatively connecting the inner pair of contact plates. Each of these pins **21***d* is engaged at its central portion by an element **23** which serves to space the inner contact plates from each other and is provided with a head **23***a* having fixed thereto a rod or pin **23***b*. The outer ends of these pins pass into and freely engage openings in the central portion of the enlarged parts **20***e* of the pins **20***d*. Between each of these enlarged portions **20***e* and the heads **23***a* and encircling the pins **23***d* are springs **24** and **24***a*. The spring **24***a* is preferably made stronger than the pin **24** so as to exert a greater pressure upon the contact elements than the spring **24**. It is apparent from the consideration of Fig. 2 that this assembly and relationship of parts results in each of the contact elements being firmly held against and in contact with the fixed contact posts. This is apparent because the spring **24** forces the pin **21***d* in such a direction as to hold the two contact plates **21** and **21***a* firmly against the two contact posts while at the same time it exerts a force upon the pin **20***d* in a direction to hold the contact plates **20** and **20***a* against the contact posts on different portions thereof from that engaged by the contact plates **21** and **21***a*. Similarly the spring **24***a* cooperates with the spring **24** in forcing the respective contact plates in firm engagement with the contact posts. Moreover, by reason of the comparatively free movement of the contact elements on the central shaft and on the pins **20***d* and **21***d*, the four contact plates are self-adjusting individually with reference to each other so that the force of the springs is distributed individually upon each of the contact plates in a balanced relationship thereby insuring good contact pressure and engagement at each of the eight contacting areas; and this result is accomplished by the use of only two springs. In fact one of the springs could be omitted and the switch could still function properly, although not with the same degree of quick action or with the securing of the same degree of contact pressure.

The switch is actuated through the handle by the provision of a pair of pins **25** fixed to the front side of the contact plate **20***a* and positioned on opposite sides of the shaft **17**, as shown in Fig. 1. These pins project into openings in the disk **18***a*. It follows that when the handle **19** is turned, it will rotate the contact plate **20***a* and thereby actuate the pins **20***d* and contact plate **20** and also swing the outer ends of the pins **23***b*. On the supporting plate **12** is fixed two posts **26** which project forwardly and serve as stops for the contact plates when the switch is thrown from the closed to the open position.

In operation, the opening of the switch will be considered first and the movement of the parts from the closed position shown in Fig. 2. When the handle **19** is turned in a clockwise direction, the contact plate **20***a* will be similarly turned carrying with it the pins **20***d* and the plate **20**. This serves to separate the contact engaging parts of these plates from the contact posts without disturbing the contact plates **21**, **21***a* which remain in contact with the contact posts. The plates **20** and **20***a* are carried by the turning of the handle to the position shown in Fig. 3 when the two springs are then on a dead center line through the axis of the shaft **17**. Further movement of the contact plates **20** and **20***a* and of the pins **20***d* carries the line of action of the springs on the other side of the dead center line which results in the springs then taking control of the opening action which quickly snap the contact plates **21** and **21***a* from engagement with the contact posts and likewise react against the contact plates **20** and **20***a* and thereby throw all four contact plates against opposite sides of the stop posts **26**. The parts then assume the condition shown in Fig. 4 and in this position the pressure of the contact plates are imposed on opposite sides of the posts **26** preventing undue strain thereon.

In this opening action it is apparent that by reason of the contact plates **20** and **20***a* first separating from the fixed contacts there is no appreciable arcing at their contact surfaces because all of the current is then caused to pass through the contact plates **21** and **21***a*. Thus the contact engaging areas of the contact plates **20** and **20***a* by not being subjected to any appreciable arcing serves to maintain these contacting areas in good condition and secure good conductivity of the switch even though the contact areas of the other pair of contact plates may have a somewhat increased contact resistance after long continued use; but when the contact plates **21** and **21***a* are separated from the fixed contacts, the action is controlled by the springs which, as already explained, gives a quick opening action and thereby tends to minimize the arcing at the final opening of the switch. Also by reason of the fact that the switch is opened simultaneously at the two contact posts, there are two breaks in series with each other which further tends to reduce the arcing and in view of the two plates **21** and **21***a* being in parallel

with each other, this subdivision of the total current likewise tends to minimize the arcing upon the final opening of the switch.

By reason of the individual self-adjusting action of the individual contact plates and of their relative freedom of movement, there results a certain amount of cleaning action of the contact surfaces in the closing and opening movements of the switch. By making one of the springs, such as 24*a*, stronger than the other spring 24, this self-cleaning action is considerably increased. When the switch is in the open position, as shown in Fig. 4, the difference in pressure of the springs causes the contact elements to be shifted to one end of the slots 20*c* and 21*c*. When the handle is moved to close the switch, this relative position of the shaft 17 in the ends of the slots is maintained until the faces of the movable contacts engage the fixed contacts. But when this action occurs, then, by reason of the curvature of the contact surfaces of the movable contacts conforming in some degree to the curvature of the fixed contacts, the pressure of the movable contacts by the two springs against the fixed contacts causes the movable contacts to slide against the surface of the fixed contacts so that the movable contacts will seat against the fixed contacts with their contact areas conforming to each other. This latter sliding movement thereby gives a self-cleaning action in arriving at the best position for securing maximum contact areas. In fact in this action there is more or less of an over-movement of the parts tending to increase the cleaning action in arriving at the final position of the parts. In securing this result, it is desirable that the difference in pressure exerted by the two springs shall not be so great as to prevent this self-adjusting and cleaning action. In opening the switch the reverse action occurs, thereby securing a self-cleaning sliding action in both the closing and opening movements.

Another advantage of the structure disclosed resides in the fact that if the surfaces of the contact sleeves should show any deterioration due to arcing, the bolts 15*a* may be loosened and rotated slightly so as to bring new contact areas opposite the contact areas of the contact plates. Also, if desired, the sleeves 15 and 15' may be loosely carried on the bolts so as to permit them to turn on the bolts by the sliding action of the contacts in the opening and closing movements of the switch. In such a case it will, of course, be desirable to connect the sleeves by flexible leads to the bolts for securing good electrical connection therewith.

The arcing areas may be faced with materials of an arc suppressing character if desired and may be faced with silver or other material of high conductivity for improving the contact of the parts. Instead of making the contact engaging areas of a curved form, they may be of other shapes for insuring proper centering of the contacts and may have flat engaging surfaces, although the curved form is preferable in most uses. It is apparent that any number of these switches may be mounted upon a common shaft and arranged to operate in unison.

In Fig. 5 the handle 19 for operating the switch is replaced by an arm 27 attached to the sleeve 18 for the purpose of opening the switch by a push and pull actuator. Fig. 5 shows a rod 28 adapted to be manually operated in guides 28*a*. The rod is provided with a pair of spaced projections 28*b* adapted to engage the outer end of the arm 27. It is apparent that when the rod 28 is pulled it will turn the arm 27 and open the switch in the manner already described with reference to Figs. 1 to 4. When the springs have been caused to assume a position just beyond the dead center position, the switch will snap to the open position, the spacing of the projections 28*b* then allowing the arm 27 to move freely and quickly in the automatic opening of the switch, even if the operating rod 28 be manually held in a fixed position. In the closing of the switch the reverse action takes place, thereby securing a quick automatic opening and closing of the switch independently of the manually operated actuator.

In Figs. 6, 7 and 8, the switch is shown as applicable to the control of two circuits instead of one as in the figures previously described. In order to obtain the two circuit control, it is necessary to sub-divide the fixed contacts into two end portions insulated from each other and to sub-divide the four contact plates into two pairs of contacts, one of which comprises an outer and inner plate and the other of which comprises an inner and outer plate.

The parts of Figs. 6 to 8 corresponding to those of Figs. 1 to 4 are similarly numbered, the main difference in structure being the provision of insulation for certain parts. Thus the movable contact plates are shown insulated from each other by providing an insulating sleeve 29 around the supporting shaft 17; by providing an insulating washer 30 on the sleeve between the inner contact plates; and also insulating washers 30*a* between the inner and outer contact plates. They are further insulated by insulating sleeves 31 on the pins 21*d* and by insulating washers 32 between the element 23 and the inner plates; also by insulating sleeves 33 on each end of the two pins 20*d* and by insulating washers 34 between the parts 20*e* and the two outside contact plates. The fixed contacts, as shown in Fig. 8, are each divided into two portions 15*a* and 15*b* insulated from each other by a central washer 35 and from the supporting bolts by an insulating sleeve 36. The front section 15*b* is also insulated from the cross piece 14 by an insulating washer 37. Each divided portion of the contacts is connected to the outside circuit by contact lugs 38 which are soldered to extensions from the fixed contact portions as indicated in Fig. 8, although the outside circuit connections to these contacts may be made in any convenient manner. In this modification the bolts 13 and 13' merely serve as supporting bolts instead of serving as connections to the outside circuit.

In utilizing the switch disclosed in Figs. 6 to 8 as a two circuit switch, the lead of one circuit is connected to one of the fixed contact portions 15*a* while the other lead will be connected to the other contact portion 15*a* on the opposite bolt; and one of the leads of the other circuit is connected to one of the contacts 15*b* and the other lead to the contact 15*b* on the other bolt. The operation of the different parts of the switch is the same as described with reference to Figs. 1 to 4 as regards the opening and closing of each circuit. In the closed position the current in one circuit passes to one of the contacts 15*a* and then through the contact plates 20 and 21 in parallel to the opposite contact 15*a* and thence to the other terminal of the circuit. The current through the other circuit passes to one of the fixed contacts 15*b* and then through the contact plates 20*a* and 21*a* in parallel to the other fixed contact 15*b* and

thence to the other terminal of this circuit. In opening the switch, the contact plates 20 and 20a are first separated from their fixed contacts, as indicated in Fig. 7 and then the final breaking of the current in the two circuits occurs when the contact plates 21 and 21a are snapped to their open positions, the action being the same as already described with reference to Figs. 1 and 4 in securing the final interruption of the circuits by a quick separation of the contact plates 21 and 21a from their fixed contacts and in this final interruption of the circuits there are two breaks in series with each other in each circuit. The closing action is with a quick snapping of the contacts to their closed position as already described. Also the same sliding and self-cleaning action occurs in this structure.

In Figs. 9 and 10 the structure of the movable portions of the switch is the same as that already described with reference to Figs. 6 to 7 except that the contact plates are adapted to engage fixed contacts on opposite end portions of each of the contact plates. As shown in Fig. 9, the supporting insulating plate 12a is provided with four fixed contact posts, two of these taking the place of the stop posts 26 of the former figures. Thus in Fig. 9 there are provided supporting bolts 13a for the fixed contacts. Each of these bolts is surrounded by an insulating sleeve 40 and at diametrically opposite portions thereof are provided longitudinal extensions 40a. Each of the fixed contacts 41 is in the form of approximately half a cylinder and engages the sleeve 40 and extends from one of the extensions 40a to the opposite extension 40a. Thus there are formed eight separately insulated fixed contacts, each of which is provided with an extension to which is secured a lead 42 for connection to the outside circuit. The fixed contacts are held in place on the sleeves 40 by metal bands 43 which encircle the contacts of each post at opposite ends thereof and provided with an intervening band 44 of insulation, such as mica. The movable contact plates are similar to those already described except an additional contact surface 45 is provided near the end of each of the contact plates 21 and 21a so as to form contact engaging surfaces with the added fixed contacts. Likewise the contact plates 20 and 20a are provided with contact surfaces 46 on their back portions near the ends so as to engage the fixed contacts of the additional contact posts.

Fig. 11 shows the connections of a circuit to the fixed contacts for the purpose of using the switch as a reversing switch. The source is indicated by the incoming lines 47, 47' and a translating device is indicated at 48 in which the current is to be reversed. The line 47 is connected to a pair of fixed contacts 41 on the adjoining side of two posts. The line 47' is similarly connected to two contacts 41, one of which is the contact of another post and the other of which is the contact mounted on a post which carries a contact connected to the line 47. One terminal of the translating device 48 is connected to one contact of the post which has its other contact connected to the line 47 and is also connected to a contact of the fourth post. The other terminal of the translating device is connected to the other contact of the fourth post and to a contact of a post having its other contact connected to the line 47'.

When the contact plates are in the position shown in Fig. 9 which corresponds to the open position of the switch of the previously described figures, the inner contact plates make a connection in parallel between a contact 41 of the upper post and a contact 41 of the lower post. At the same time, the outer contact plates make a connection in parallel from the other contact 41 of the upper post to the other contact 41 of the lower post. This connection corresponds to the condition represented by the dotted line connections in Fig. 11 wherein the dotted line 49 corresponds to the connection made by the outer contact plates and the dotted line 50 corresponds to the connection made by the inner contact plates. This gives a circuit from the positive line 47 to a contact 41, the connection 49 to another contact 41 and then through the translating device in the direction indicated by the dotted arrow to another contact 41 and through the connection 50 to another contact 41 and then to the negative line 47'. When the switch is thrown from the position shown in Fig. 9 to a position such that the contact plates engage the contacts 41 of the left and right-hand posts, the condition corresponds to that shown in Fig. 11 by the full lines. The circuit through the translating device is then from the positive line 47 to a contact 41 and then through the full line connection 51, obtained by the outer contact plates, to a contact of the right-hand post and then through the translating device in the direction indicated by the full line arrow to a contact 41 of the left-hand post and then through the connection 52, obtained by the inner contact plates, to a contact 41 of the right-hand post and then to the negative line 47'. It is therefore apparent that when the switch is thrown from one extreme position to the other, it serves as a reversing switch.

Although certain embodiments of this invention have been shown and described, it will be understood that various modifications may be made therein and likewise the connections may be changed for adaptation to particular uses according to particular requirements.

I claim:

1. An electric switch comprising a pair of fixed contacts of cylindrical form, a pair of pivoted rotatable contact plates each simultaneously engaging the fixed pair of contacts by portions of each plate at opposite sides of the pivot by the edges of each plate by a butt contact, a pair of springs connected respectively between portions of said plates and opposite each other with reference to the axis of the plates for exerting pressure on both of the plates in the closed position in a direction to hold them in closed position, and means for first moving one of the plates from the contacts and for moving the springs over their dead center positions for thereby causing the other plate to be snapped from its closed position to its open position and for moving the springs over their dead center positions in the opposite direction for thereby causing both of said plates to be snapped from their open position to their closed position, said plates being rotated in opposite directions with reference to each other in the opening and in the closing movements.

2. A two circuit switch comprising two supporting posts, a pair of fixed contacts on each of said posts, the contacts on each post being insulated from each other, four rotatable contact plates divided into an inner pair and an outer pair, said contact plates engaging the fixed contacts on opposite portions of each plate in the closed position of the switch, the outer plate of one pair and the adjoining inner plate of the other pair being insulated from the other two

plates and the outer plate of one pair and the adjoining inner plate of the other pair making engagement respectively with one of the fixed contacts on one of the posts and one of the fixed contacts on the other of the posts and the other outer plate and inner plate making contact engagement respectively with the other two contacts on the two posts, a spring connected between the plates of the outer pair and the plates of the inner pair for exerting pressure on the two pairs in opposite directions for holding the four plates in engagement with their respective fixed contacts, and means for first moving the outer pair of contact plates from engagement with their fixed contacts and moving said spring over its dead center position for snapping the inner pair of plates from their closed position to their open position and for exerting pressure for holding both pairs of contact plates in their open position.

3. A reversing switch comprising four fixed posts, a pair of fixed contacts on opposite sides of each of said posts and insulated from each other, a pair of rotatable outer contact plates for making engagement respectively between contacts on two opposite posts in one position and between contacts on the other two of said posts in another position, a pair of inner contact plates for making connection between the other contacts of said first named two posts in one position and between contacts of the other two posts in another position, the inner pair of contact plates being insulated from the outer pair of contact plates, a spring exerting pressure between the pairs of contact plates in opposite directions for holding said plates in engagement with their respective contacts in each of the two positions of said plates, and means for first moving one of said pairs of contact plates out of engagement from its contacts in one position and for moving said spring over the dead center position for snapping the other pair of contact plates from engagement with its respective contacts and for actuating both of said pairs of contact plates into engagement with the other of said fixed contacts.

4. An electric switch comprising a fixed contact having a curved contact surface, a pivoted movable contact in the form of a plate having a curved contact edge surface corresponding to the curvature of the contact surface of the fixed contact and engaging the fixed contact by the edge of the plate by a butt contact between said surfaces, said plate having an enlarged opening at its pivot for permitting movement of the plate in a direction at right-angles to its pivot, a spring for actuating the movable contact, and means for moving the spring over its dead center position for thereby causing the movable contact to be snapped by the spring from its closed position to its open position and to shift said plate in a direction at right-angles to its pivot in its opening movement for causing a wiping action of the contacts.

5. An electric switch comprising a fixed contact having a curved contact surface, a pivoted movable contact in the form of a plate having a curved contact edge surface corresponding to the curvature of the contact surface of the fixed contact and engaging the fixed contact by the edge of the plate by a butt contact between said surfaces, a spring for actuating the movable contact, and means for moving the spring over its dead center position in opposite directions for thereby causing the movable contact to be snapped by the spring to its open and closed positions respectively and to shift said plate in a direction at right-angles to its pivot in the opening movement for securing a wiping action of the contacts.

6. An electric switch comprising a pair of fixed contacts, a pair of pivoted rotatable contact elements each simultaneously engaging the pair of fixed contacts in the closed position by portions of each element at opposite sides of the pivot, a spring exerting pressure on both of the elements in the closed position in a direction to hold them in closed position, and means for first moving one of the elements from the pair of fixed contacts in one direction and for moving the spring over its dead center for thereby causing the other movable element to be snapped in the opposite direction from its engagement with the pair of fixed contacts to its open position.

7. An electric switch comprising a pair of fixed contacts, a pair of pivoted rotatable contact plates each simultaneously engaging the pair of fixed contacts in the closed position by portions of each plate at the opposite sides of the pivot by the edges of each plate by a butt contact, the spring exerting pressure on both of the plates in the closed position in a direction to hold them closed and in the open position in a direction to hold them open, and means for first moving one of the plates from the pair of fixed contacts in one direction and for moving the spring over its dead center position for thereby causing the other plate to be snapped in the opposite direction from its engagement with the pair of fixed contacts to its open position.

8. An electric switch comprising a pair of fixed contacts, a pair of pivoted rotatable contact plates each simultaneously engaging the pair of fixed contacts in the closed position by portions of each plate at the opposite sides of the pivot by the edges of each plate by a butt contact, a spring exerting pressure on both of the plates in the closed position in a direction to hold them closed and in the open position in a direction to hold them open, and means for first moving one of the plates from the pair of fixed contacts in one direction and for moving the spring over its dead center position for thereby causing the other plate to be snapped in the opposite direction from its engagement with the pair of fixed contacts to its open position and for moving the spring over its dead center position for thereby causing both of said plates to be snapped from open position to closed position.

9. An electric switch comprising a pair of fixed contacts having curved contact surfaces, a pair of rotatable contact elements each having oppositely positioned curved contact surfaces corresponding to the curvature of the contact surfaces of the fixed contacts and engaging the fixed contacts by said opposite portions of each element by butt contacts between said surfaces, a supporting shaft for said elements, said elements being shiftable on said shaft in a direction at right-angles to the axis of the shaft, a pair of springs connected respectively between said elements and opposite to each other with respect to said shaft for exerting pressure on each of said elements for holding each of them in engagement with the fixed contacts, one of said springs exerting greater pressure than the other of said springs for shifting said elements in a direction at right-angles to said shaft for obtaining a wiping action of the contact engaging surfaces, and means for moving said springs

over their dead center positions for moving said elements from the closed position to the open position.

10. An electric switch comprising a pair of fixed contacts, two pairs of pivoted rotatable contact elements, each element simultaneously engaging the pair of fixed contacts in the closed position by portions of each element at the opposite sides of the pivot, one pair of said elements being between the elements of the other pair, a cross piece connecting the outer pair of elements, a cross piece connecting the inner pair of elements, a spring positioned between said two cross pieces for exerting pressure in opposite directions on said pairs of elements respectively for holding the contact elements in engagement with the fixed contacts, and means for moving one of said pairs of elements in one direction from engagement with the fixed contacts for moving said spring over its dead center position for thereby causing the other pair of contact elements to be snapped in the opposite direction from its closed position to its open position and for moving said spring in the reverse direction over its dead center position to snap both pairs of contact elements in opposite directions to their closed position.

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