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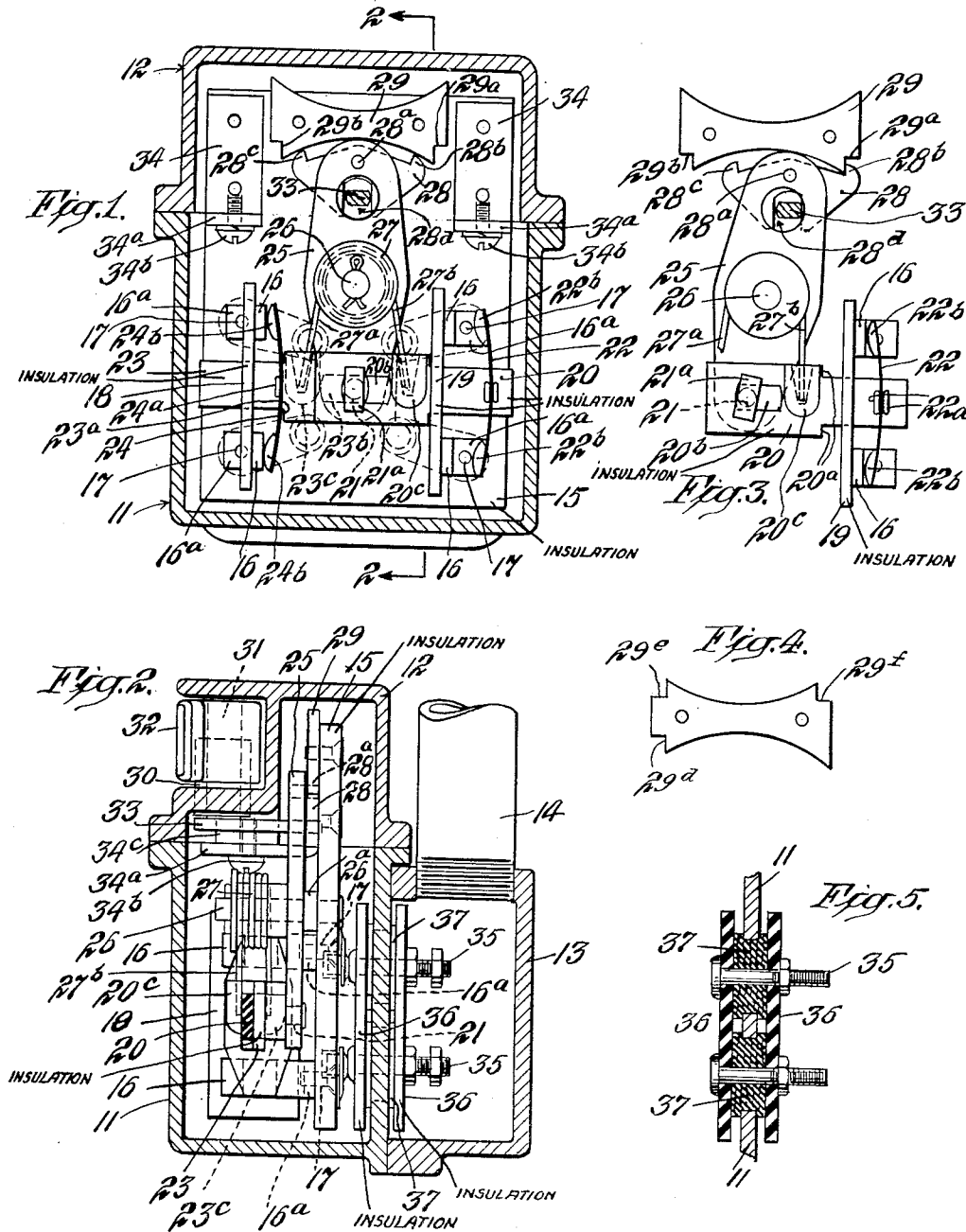
F. A. TALBOT

2,593,072

MULTIPLE SWITCH

Filed Oct. 23, 1947

2 SHEETS—SHEET 1



INVENTOR.
FRANK A. TALBOT
BY Lawrence K. Sager
his ATTORNEY

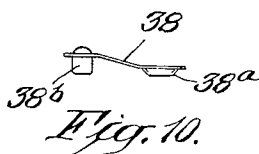
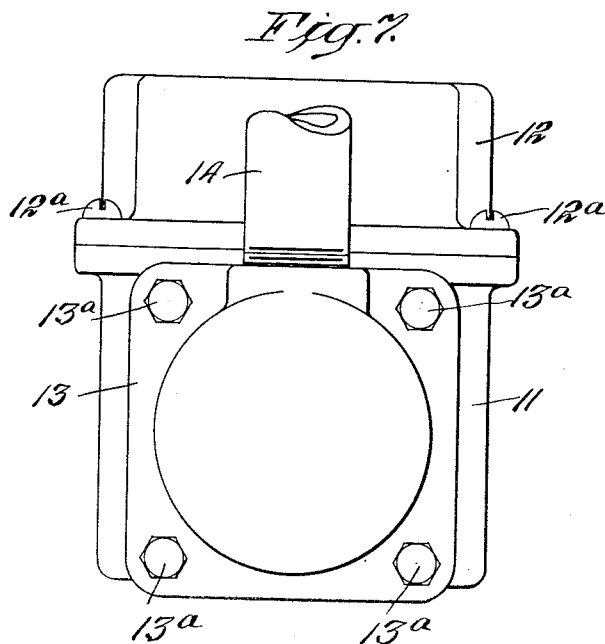
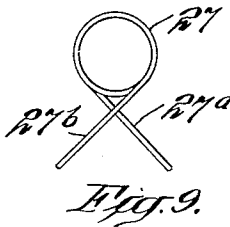
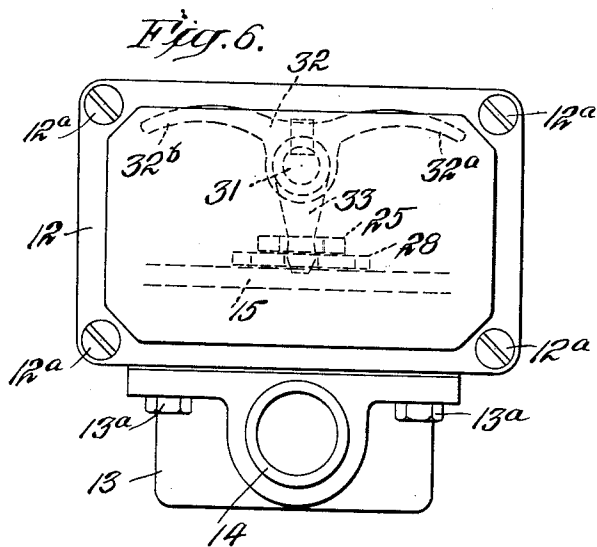
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2 SHEETS—SHEET 2



INVENTOR.
FRANK A. TALBOT
BY Lawrence K. Sager
his ATTORNEY

UNITED STATES PATENT OFFICE

2,593,072

MULTIPLE SWITCH

Frank A. Talbot, Baltimore, Md.

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10 Claims. (Cl. 200—5)

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This invention relates to combined multiple switches selectively actuated by a single member or lever and to the mounting and enclosing of the parts.

The main object of the invention is to provide a simple form of structure with a minimum number of parts adapted for fulfilling the required functions. In starting an electric motor for example, it is desirable to have one control switch closed and to momentarily close another control switch; and in stopping the motor the former switch is then opened. In the present invention these two control switches are combined and are actuated by a single member or lever. In other uses of the combined switch, the two control switches may be normally open and each closed momentarily successively, or normally closed and opened momentarily successively; or in either of these cases it may be desired to have one or the other, or both, of the switches held closed or held open after actuation. It is one object of this invention to make provision for readily adapting the combined switch to any such required function.

Another object is to so relate the parts as to require only a single spring for the actuation of the contacts of both switches. Another object is to relate and mount the parts in a manner that they may be enclosed and immersed in oil if desired and be readily removable as a unit for inspection or repair and without disturbing the lead connections. Another object is to seal the connections from the interior to the outside of the enclosure for preventing any spark or flame from passing from the enclosure to the outside, or from the outside to within the enclosure. Another object is to provide a structure which shall be durable and dependable under long continued use. These and other objects and advantages will be understood from the following description and accompanying drawings which illustrate preferred embodiments of the invention.

Fig. 1 is a front view of the multiple switch, the enclosing box being shown in section; Fig. 2 is a side view partly in section on the line 2—2 of Fig. 1; Fig. 3 is a front view of a portion of the mechanism showing the right-hand switch contacts latched in position; Fig. 4 is a front view of a modified form of the latch plate; Fig. 5 is a vertical section showing the sealed connection for the lead wires from the outside of the enclosing box to the interior; Fig. 6 is a top plan view of the enclosing box and adjoining conduit showing certain parts in dotted lines; Fig. 7 is a rear view of the box and conduit; Fig. 8 is a

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front view of the contact pressure spring when not under tension; Fig. 9 is a similar view of a spring for tensioning the contacts inwardly instead of outwardly; and Fig. 10 is a detailed view of the yieldable and separable connections between the fixed contacts of the switch and the connection to the leads outside of the enclosure.

The multiple switch is shown mounted within an enclosing box or casing having a lower portion 11 and an upper portion 12. The two portions are secured together by screw bolts 12a at the corners of the flanges on the two portions as shown in Figs. 6 and 7. A suitably supported conduit box 13 is shown bolted to the lower portion 11 by the bolts 13a; and extending from the upper part of the box 13 is shown a conduit 14 for containing the leads to the switch.

The multiple switch is mounted on a back plate 15 of insulating material as shown in Figs. 1 and 2. There are four fixed contacts 16 formed of copper or brass strips having their rear ends bent at right-angles to form supporting feet 16a. The fixed contacts are held in position on the plate 15 by screws 17 which pass through the plate from the rear and have a threaded engagement with the feet of the contacts. A cross plate 18 of insulating material is secured to the outside faces of the left-hand pair of contacts 16 and is secured thereto by screws or rivets. A similar cross plate 19 of insulating material is secured to the right-hand pair of contacts 16 on the inside faces thereof. A slidable plate or bar 20 of insulating material which is more particularly shown in Fig. 3 passes freely through a vertical slot in the plate 19 and is guided thereby. The bar 20 is provided with shoulders 20a adapted to engage the plate 19 for limiting the outward movement of the bar. In the inner portion of the bar or plate 20 is a slot 20b through which extends a pin 21 for actuating the bar in one direction as later explained. A conducting leaf of spring 22 is mounted on the outer end portion of the bar 20, the end portion projecting through a slot in the spring. A cotter pin 22a is passed through the bar on each side of the spring for holding the spring on the bar. Contacts 22b are secured to opposite ends of the spring on its inside face for engaging the right-hand pair of contacts 16 respectively. A similar slidable bar or plate 23 of insulating material passes through a vertical slot in the plate 18 and is guided by the plate 18. The bar 23 overlaps the bar 20 at its inner portion, the bar 23 being back of the bar 20, as shown in Fig. 2. The inner portion of the bar 23 is provided with a longi-

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tudinal slot 23b similar to the slot 20b of the bar 20 through which the pin 21 also passes. A conducting leaf spring 24 is provided with a slot through which is passed the outer end portion of the bar 23, the spring being held in place on the bar by a cotter pin 24a on one side and by shoulders 23a of the bar 23 on the other side of the spring. Contacts 24b are fixed to the outer ends of the spring respectively for engaging the left-hand pair of fixed contacts 16.

The pin 21 serves to actuate the contact bars or plates 20 and 23 in directions against their biased positions. This pin has an enlarged outer end 21a and an enlarged inner portion for properly holding the inner portions of the contact bars in slidable relation to each other. The inner end of the pin is secured to the lower end of a plate lever 25 which extends upwardly and is pivoted at its central portion on a pin or stud 26 which is fixed at its inner end to the plate or panel 15, as shown in Fig. 2. The stud has a portion 26a of enlarged diameter for spacing the lever 25 from the main supporting panel 15. Mounted on the front portion of the stud 26 is a spool on which is mounted in turn a coiled spring 27 having downwardly extending ends 27a and 27b. When these ends are not forced toward each other they assume a position as shown in Fig. 8. The end 27a is forced inwardly and engages a V-shaped slot in a boss 23c formed on the inner side of the contact bar 23 for biasing the bar 23 and leaf spring 24 to the left, thereby tending to force the contacts 24b in engagement with their fixed contacts 16. The end 27b engages a V-shaped slot in a boss 20c formed on the outer side of the contact bar 20 for biasing the bar 20 and leaf spring 22 to the right, thereby tending to force the contacts 22b out of engagement with their contacts 16.

A latch 28 of metal is pivoted near its top central portion, on a pin 28a fixed to the upper end of the lever 25. The latch is provided with projections 28b and 28c at the opposite ends of its upper portion. The latch also has a slot or opening 28d in its lower central portion below its pivot. Above the latch and fixed to the panel 15 is a metal plate 29. At the lower opposite ends of the plate are formed notches 29a and 29b which are adapted to be engaged respectively by the projections 28b and 28c of the latch 28. The lower edge of the plate 29 between its notches is curved on a radius having the axis of the lever 25 as its center. The upper edge of the plate 29 is curved on the same radius as the lower edge.

As shown in Fig. 2, the top 12 of the casing is shaped to have a longitudinal external recess at its upper portion for the reception and housing of the manual means for operating the switch. In the central lower portion of this recess is tightly fitted in the top cover a sleeve 30 extending upwardly within the recess. The sleeve serves as a bearing for a shaft 31 which extends upwardly above the sleeve 30 and downwardly through the sleeve to within the casing. A push lever 32 within the recess of the top cover has two sidewise extending arms 32a and 32b, as shown in Fig. 6. This lever is fixed at its central portion to the shaft 31. When the operator pushes the arm 32a or 32b by his thumb or finger, it turns the shaft 31 in one direction or the other. On the lower end of the shaft 31 within the casing is fixed an arm 33 which extends rearwardly and passes freely through an opening in the lever 25 and its inner end extends within the slot 28d in the latch.

The panel 15 and the parts carried thereby are

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entirely supported by the top 12 of the casing. This is accomplished by a pair of metal angle brackets 34 secured to the panel at its upper corner portions. The forwardly extending portions 34a of these brackets are secured to the front portion of the top casing under the recess by the screws 34b which pass upwardly through spacing sleeves 34c, as shown in Fig. 2. Thus the entire switch mechanism is removable with the top cover of the casing for inspection or repair when removed from the lower part 11 of the casing or enclosure. The lower part of the casing may be filled with oil when desired for use as an oil switch.

In operation, each of the two switches is actuated independently of each other according to which direction the lever 25 is turned. In Fig. 1 the lever 25 is shown in its mid-position with the left-hand contacts closed and the right-hand contacts open. Now assume that the operator pushes the arm 32b of the manual lever inwardly. This will move the inner end of its inner arm 33 to the right when looking at Fig. 1, forcing the latch 28 bodily to the right and causes the latch to turn the lever 25 clockwise. The pin 21 on the lower end of the lever being in engagement with the left-hand edge of the slot 20b in its mid-position, slides the contact bar 20 to the left to the position shown in Fig. 3 and thus closes its contacts against the pressure of the arm 27b of the biasing spring. In the meantime the latch 28 has traveled the lower edge of the guiding and latching plate 29 and at the end of the stroke the projection 28b of the latch is forced by the arm 33 into the notch 29a of the plate, thus holding the parts in this position after the operator releases the manual lever. During the foregoing operation, the position of the left-hand switch is not affected because when the pin 21 moves to the left, it moves freely in the slot 23b from the right-hand end to the left-hand end. When it is desired to open the right-hand switch, the operator pushes the right-hand arm 32a of the manual lever inwardly to normal position. This forces the arm 33 from the position shown in Fig. 3 to the left which releases the latch from the plate 29 and then the biasing spring forces the contact bar 20 quickly to the right and opens the right-hand switch with a snap action to the position shown in Fig. 1.

Now assume that the right-hand arm 32a of the manual lever is pushed inwardly. This moves the inner end of the arm 32 to the left forcing the latch and in turn the upper end of lever 25 to the left until the projection 28c of the latch engages the notch 29b of the guide plate which then locks the parts in this position. During this movement the pin 21 has been carried by the lever 25 to the right. The pin being in engagement with the right-hand end of the slot 23b of the contact bar, shifts the bar to the right and opens the left-hand contacts. The contacts are then held open. During this action the right-hand pair of contacts are not affected in their position because the pin 21 moves freely in the slot 20b of the contact bar 20 from the left-hand end of the slot to the right-hand end. When the operator pushes the arm 32b of the manual lever inwardly, the arm 33 turns the latch on its pivot and releases it which permits the spring 27 to snap the left-hand contacts to their closed position.

It is apparent that a single operating arm serves to open or close either switch selectively and independently of the other and that a single

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spring controls both switches in any position and actuates each switch with a snap action when released by the latch. Also no spring is required on the latch as it is latched and unlatched by the arm 33 as moved by the operator.

In the foregoing description each of the switches was latched in the position to which it was manually moved. However, the guide plate 29 is shown shaped on its upper edge with an arc of a circle extending to the ends of the plate, this outer arc having the same radius as the inner arc. By merely unfastening the plate from the panel 15 by removing the holding screws of the plate, and reversing the plate so that the upper guiding edge is down and the lower guiding edge is up and then refastening the plate, the switch is changed from the latched type to an unlatched type. When the guide plate is thus reversed from the position shown and the operator depresses either of the manual arms, the new position of either switch will be maintained only as long as the operator holds one or the other arm depressed. Upon release, the spring will return the actuated switch to the position shown because no latching takes place. The switch is then adapted for the momentary closing or opening of the respective switches in instances when such control is desired.

In some cases it may be desired to latch one of the switches in its manually actuated position and not the other. This is readily accomplished by providing only one notch in the corner of the guide plate. Such a plate is shown in Fig. 4 where the plate 29c is provided with only one notch 29d on its lower side. The right-hand switch will then be momentarily closed as long as the operator holds the manual arm 32b depressed; but the left-hand switch will be latched open when the manual arm 32a is depressed. This structure is desirable, for example, in the push-button control for starting and stopping a motor, the right-hand switch serving as the start and the left-hand switch serving as the stop. If it be desired to latch the right-hand switch in its closed position and adapt the left-hand switch for momentary opening, it is merely necessary to turn the plate 29c of Fig. 4 over endwise for accomplishing such result. Fig. 4 also shows two notches 29e and 29f on the upper side of the guide plate at the corners. When this plate is reversed with the upper side down, the latch will then lock the parts in each of the limiting positions until manually released.

The structure likewise is readily adapted for mounting the switches to secure any desired relationship in their neutral or in their manually operated positions. In Fig. 1 the neutral position shows the right-hand switch open and the left-hand switch closed. The reversed arrangement is readily obtained by mounting the switch parts in the reversed direction by turning the fixed contacts and the contact bars around 180°. Furthermore, the structure may be arranged to have both the right and left-hand switches closed in their neutral position by changing the right-hand switch of Fig. 1 to a duplication of the left-hand switch mounting. Likewise both switches may be made open in the neutral position by changing the left-hand switch to a duplication of the mounting of the right-hand switch. Thus the structure is readily adapted to provide any desired relationship of the switches in their different positions as well as the latching or the not latching of either or

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both in their positions when displaced from the neutral position.

In Fig. 1 the spring biases the contact bars outwardly. If desired for certain purposes the contact bars may be biased inwardly by merely changing the relationship of the untensioned position of the legs 27a and 27b of the spring 27 to the position shown in Fig. 9. In this case the leg 27a of Fig. 9 is hooked onto the left-hand contact bar 23 and the leg 27b is hooked onto the right-hand contact bar 25, thus biasing both contact bars inwardly.

In this improvement the switch unit may be removed with the top cover from the lower casing, as already explained. This does not disturb the connections of the outside leads; and it is important that no spark or flame should be transmitted outside the casing to any adjoining parts or connections. This is particularly important where the leads are connected in a conduit box 13 and extend through a conduit 14 back of the switch unit enclosure. Referring to Fig. 2, the leads are connected respectively to the four bolt and nut terminals 35 extending within the conduit box. These bolts pass through a pair of plates 36 of stiff insulating material on opposite sides of the back wall of the casing 11, as more particularly shown in Fig. 5. These plates are spaced from the wall of the casing. Where the bolts 35 pass through the casing they are surrounded by insulating bushings 37 which extend beyond the thickness of the wall. These bushings are of soft rubber, or other suitable compressible, resilient insulation; and in case oil is used in the container 11, the material of the bushings should be not only compressible and resilient but impervious to the action of the oil. Such material is commercially available. The inside heads of the bolts 35 engage the inner plate 36; and when the units on the bolts are tightened they draw the plates 36 toward each other and compress the bushings 37. This forms a sealed joint between the inside of the switch enclosure and the outside and prevents any arc or flame from passing out of the casing or any outside arc or flame from passing within the casing. The four fixed contacts 16 are electrically connected to the heads of the bolts 35 when the top cover of the casing is placed in position. This is accomplished by the resilient conductors 38 shown in Fig. 10. One end thereof is perforated with the edges 38a depressed. The other end carries a contact button 38b, or may be shaped to form a contact. The perforated ends of these conductors are placed under the heads of the screws 17 which firmly electrically connect these conductors to the feet 16a of the fixed contacts. The conductors are inclined in such directions from the screws 17 that when the switch unit is in position, the contact ends 38b of the conductors will engage the heads of the bolts 35 under spring pressure, giving good electrical connection therewith. The switch unit when removed or inserted in place thus breaks or makes the connection to the outside leads without disturbing them and without affecting the sealed joint of the casing.

Although a preferred embodiment of this invention and various adaptations thereof have been described, it will be understood that various modifications may be made without departing from the scope thereof.

I claim:

1. A unitary switch structure comprising a

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fixed contact and a movable contact cooperating therewith, a second fixed contact and a second movable contact cooperating with said second fixed contact, a pivoted element for actuating said movable contacts selectively and independently of each other, a latch movably mounted on said pivoted element and actuating said element, a fixed guide engaged by said latch and holding said latch in a force transmitting position in its movement, and means for applying force to move said latch along said guide and to cause the latch to move said element on which it is mounted, said guide having a portion engaged by said latch in one of its limiting positions for restraining said latch when said latch is moved in one direction.

2. A unitary switch structure comprising a fixed contact and a movable contact cooperating therewith, a second fixed contact and a second movable contact cooperating with said second fixed contact, a pivoted element for actuating said movable contacts selectively and independently of each other, a latch movably mounted on said pivoted element and actuating said element, a fixed guide engaged by said latch and holding said latch in a force transmitting position in its movement, and means for applying force to move said latch along said guide and to cause the latch to move said element on which it is mounted, said guide having portions engaged by said latch respectively in each of its limiting positions for restraining said latch when said latch is moved in opposite directions.

3. A unitary switch structure comprising a fixed contact and a movable contact cooperating therewith, a second fixed contact and a second movable contact cooperating with said second fixed contact, a pivoted element for actuating said movable contacts selectively and independently of each other, a latch movably mounted on said pivoted element and actuating said element, a fixed guide engaged by said latch and holding said latch in a force transmitting position in its movement, and means for applying force to move said latch along said guide and to cause the latch to move said element on which it is mounted, said guide being reversible in its position and having two guiding sides, at least one of said sides having at least one portion engaged by said latch in one of its limiting positions for restraining said latch when said latch is moved in one direction.

4. A unitary switch structure comprising a fixed contact and a movable contact cooperating therewith, a second fixed contact and a movable contact cooperating with said second fixed contact, said contacts being biased to move in opposite directions to each other, a slidable bar for supporting one of said movable contacts, a second slidable bar for supporting the other of said movable contacts, and a pivoted element for actuating said bars selectively and independently of each other against the biased positions of said movable contacts.

5. A unitary switch structure comprising a pair of fixed contacts, a pair of movable bridging contacts cooperating therewith, a second pair of fixed contacts, a second pair of movable bridging contacts cooperating with said second pair of fixed contacts, a cross-piece of insulating material mounted on said first named fixed contacts, a second cross-piece of insulating material mounted on said second pair of fixed contacts, a slidable bar of insulating material for supporting said first named bridging contacts and

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guided in its movement by one of said cross-pieces, a second slidable bar of insulating material for supporting said second bridging contacts and guided in its movement by the other of said cross-pieces, and a movable element in engagement with said slidable bars for selectively and independently actuating said bridging contacts.

6. A unitary switch structure comprising a pair of fixed contacts, a pair of movable bridging contacts cooperating therewith, a second pair of fixed contacts, a second pair of movable bridging contacts cooperating with said second pair of fixed contacts, a cross-piece of insulating material mounted on said first named fixed contacts, a second cross-piece of insulating material mounted on said second pair of fixed contacts, a slidable bar of insulating material for supporting said first named bridging contacts and guided in its movement by one of said cross-pieces, a second slidable bar of insulating material for supporting said second bridging contacts and guided in its movement by the other of said cross-pieces, a movable element in engagement with said slidable bars for selectively and independently actuating said bridging contacts, a latch movably mounted on said element, a fixed guide for said latch, said guide having at least one portion engaged by said latch in one of its limiting positions for restraining said latch when said latch is moved in one direction, and a movable member for moving said latch in opposite directions and thereby moving said element.

7. An enclosed switch comprising a casing having a lower portion and a top portion removable from the lower portion, a panel of insulating material secured to and removable with said top portion, fixed and movable contacts supported on the lower portion of said panel, a vertically extending lever pivoted on said panel for actuating said movable contacts, a latch on the top portion of said lever and movably mounted on said lever, a stationery guide for said latch fixed to said panel and having at least one portion engaged by said latch in one of its limiting positions for restraining said latch, said guide holding said latch in a force transmitting position during its movement, and means outside the top portion of the casing and extending within the top portion for moving said latch and thereby said lever in opposite directions.

8. A unitary switch structure comprising a fixed contact and a movable contact cooperating therewith, a second fixed contact and a second movable contact cooperating with said second fixed contact, independently movable elements for carrying said movable contacts respectively, a single coiled spring having extended ends for engaging said elements respectively for biasing said movable elements in opposite directions to each other, and a pivoted element engaging said movable elements selectively and for actuating said elements and movable contacts selectively and independently of each other.

9. A unitary switch structure comprising a fixed contact and a movable contact cooperating therewith, a second fixed contact and a second movable contact cooperating with said second fixed contact, a pivoted element for actuating said movable contacts selectively and independently of each other, a latch movably mounted on said pivoted element and actuating said element, a fixed guide engaged by said latch and holding said latch in a force transmitting position in its movement and for locking said latch in its

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limiting position, and means for applying force to move said latch along said guide and to cause the latch to move said element and to cause said latch to be locked on said guide in its limiting position.

10. A unitary switch structure comprising a fixed contact and a movable contact cooperating therewith, a force applying member transmitting an actuating force to move said movable contact to and from a secured position, a pivoted element for actuating said contact, a latch movably mounted on said element and in engagement with said member to receive the actuating force and transmit the actuating force to said pivoted element, a fixed guide adapted to engage said latch through its arc of movement to and from the secured position and to arrange said latch in a force transmitting position, and said guide having a catch adjacent an end thereof into

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which said latch after disengagement from said guide is moved by the force applying member to hold said element and said movable contact in a secured position.

FRANK A. TALBOT.

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