Jan. 20, 1959 C. W. MERCHANT 2,870,273

ELECTRICAL SWITCHING MECHANISM

Filed Sept. 24, 1956 2 Sheets-Sheet 1

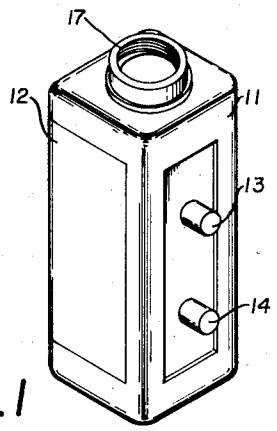


Fig. 1

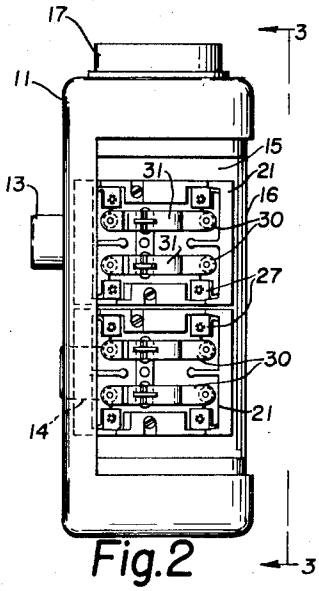


Fig. 2

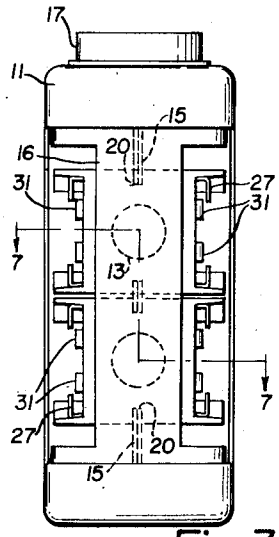


Fig. 3

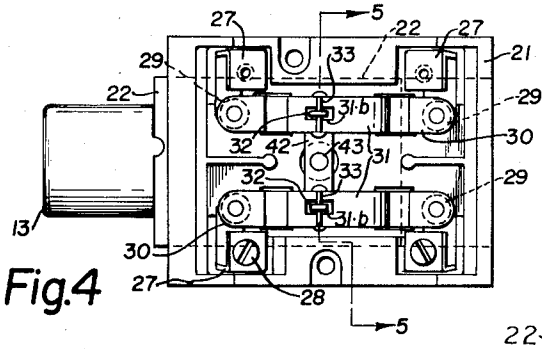


Fig. 4

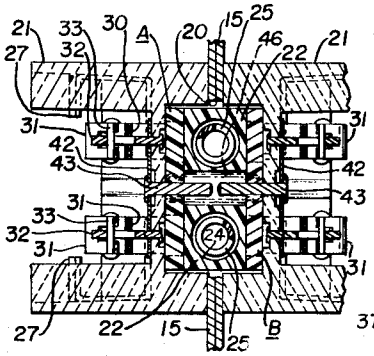


Fig. 5

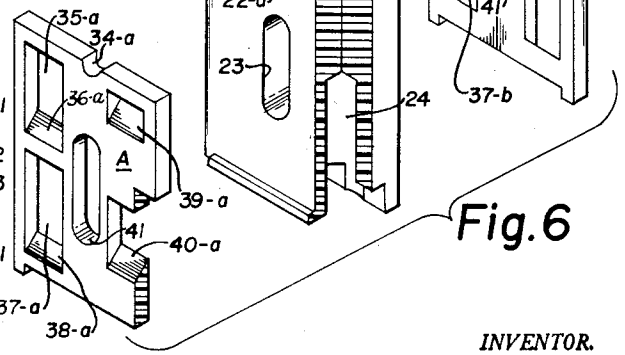


Fig. 6

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ELECTRICAL SWITCHING MECHANISM

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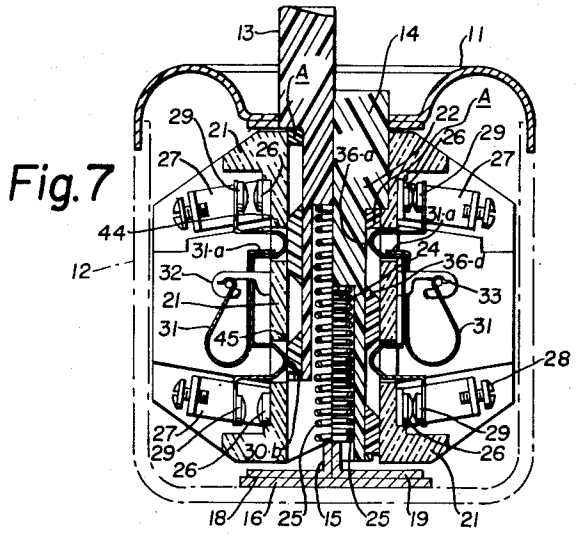


Fig. 7

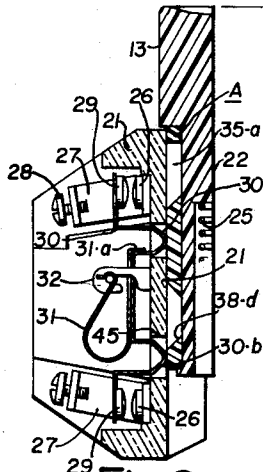


Fig. 8

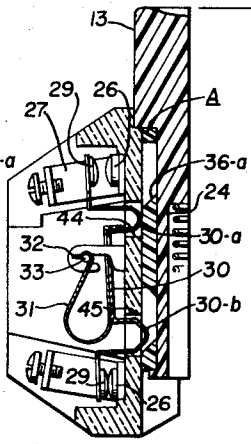


Fig. 9

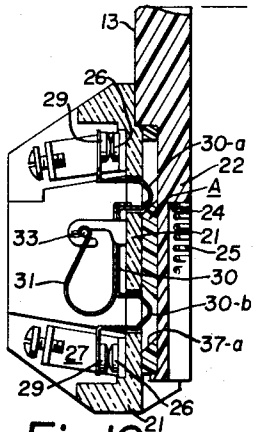


Fig. 10

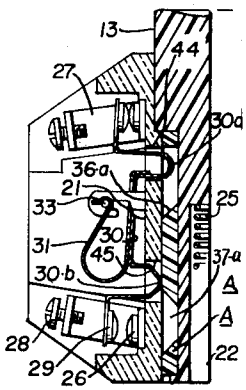


Fig. 11

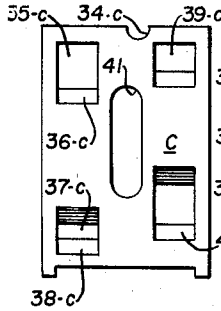


Fig. 12

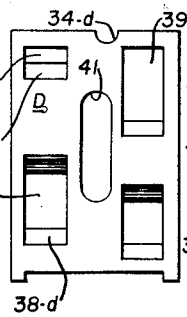


Fig. 13

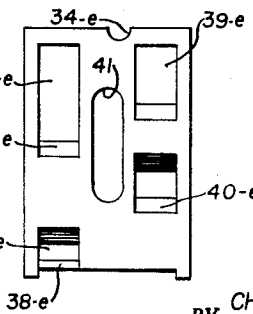


Fig. 14

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2,870,273

ELECTRICAL SWITCHING MECHANISM

Charles W. Merchant, Mentor, Ohio, assignor to The Euclid Electric & Manufacturing Co., a corporation of Ohio

Application September 24, 1956, Serial No. 611,627

12 Claims. (Cl. 200—5)

My invention relates to electrical switches for opening and closing electrical contacts in desired sequence.

An object of my invention is the provision of improved mechanism for opening and closing electrical contacts in a desired order or sequence.

Another object is the provision for opening and closing contacts of an electrical switch in such manner as to provide desired operating characteristics.

Another object is the provision for flexibility in the operation of an electrical switch.

Another object is the provision of alternate parts of a switching mechanism so as to alter the operating characteristics of the switching mechanism.

Another object is the provision for a unique camming arrangement in an electrical switch to obtain the opening and closing of contacts in a desired timing sequence.

Another object is the provision of a novel construction to provide results heretofore not obtainable.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of a switch housing embodying my invention;

Figure 2 is a side view of a switch housing embodying my invention with the cover removed to disclose working parts of the switch mechanism;

Figure 3 is a rear view of the housing embodying my switch mechanism shown in Figure 2 and looking in the direction of the arrows 3—3 of Figure 2;

Figure 4 is an enlarged side view of one of the switch mechanisms embodying my invention and shown removed from the housing;

Figure 5 is a cross-sectional view taken through the line 5—5 of Figure 4;

Figure 6 is an exploded or separated view showing actuating parts of my switching mechanism;

Figure 7 is an enlarged cross-sectional view of my switching mechanism taken through the line 7—7 of Figure 3 and illustrating the relative position of parts of the switching mechanism at different locations in the mechanism;

Figures 8, 9, 10 and 11 illustrate typical relative positions of the parts in varying phases of the cycle of operation of a switch included in my switching mechanism; and

Figures 12, 13 and 14 illustrate a typical series of alternate forms of camming plates that may be utilized in my mechanism.

A typical use of my switching mechanism is for incorporation in the control box suspended by cables from a hoist or other overhead mechanism and in which push buttons protrude from the control box whereby manual operation of the push buttons actuates the switching mechanism. For purposes of illustration, my invention is described in connection with such a control box.

As seen in the drawings, there is provided a rectangular hollow housing 11 in which are positioned parts of the

switching mechanism. The housing has a flanged port 17 at its upper end through which electrical conductors extend down from a hoist or other such device and enter the housing and are there connected to suitable posts or clips of the switching mechanism. Electrical conductors are preferably encased with suitable insulation and contained in a flexible supporting cable, this cable being threadably secured to the internal threads of the flange 17 so as to properly support the housing 11.

A three-sided cover 12 is removable to make accessible the sides and rear of the housing. The cover is flush with the walls of the housing so as to form a continuous and smooth outer surface on the housing 11. In Figures 2 and 3, the housing 11 is shown with the cover 12 removed.

Protruding from the housing is a button 13 and a button 14. In use on a hoist, the upper button 13 may be labeled "Up" and the lower button 14 may be labeled "Down." In a connection so made, upon pressing the button 13, the switching connections are made to cause the hoist motor to operate in an upward direction. Upon pressing the button 14, the hoist motor is electrically connected to operate in a downward direction.

There is an upright vertical center wall 15 extending longitudinally in the housing 11, this vertical wall 15 being made up of the bases of two steel channels 18 and 19 secured back to back. This vertical wall 16 provides a support upon which the components of the switching mechanism may be mounted. There is an upright back wall 16 on the rear side of the housing 11 which is welded to the rearwardmost legs of the two channels 18 and 19.

Provided in the vertical center wall 15 are two rectangular openings 20, one above the other. Mounted on opposite sides of the vertical wall 15 and in axial alignment with each of the rectangular openings 20 are a pair of electric insulating bodies or supports 21 of ceramic material. As there are two rectangular openings 20, one above the other, there are in the illustration given four of the ceramic bodies or supports 21. These ceramic bodies or supports are arranged in pairs, one pair over the other. The bottom or base of each ceramic body 21 of each pair of bodies faces the back or base of the other of the pair of bodies 21. These ceramic bodies 21 are electrical insulators and are formed as illustrated in the drawings to provide support and guidance to the parts carried thereby.

Integrally formed with each of the push buttons is an actuating block 22 preferably made of a suitable plastic material of an electrical insulating character. The form of this actuating block 22 is shown in detail in Figure 6. There is a longitudinally extending slot 23 formed in the block 22 and extending therethrough. There are a pair of cylindrical recesses 24 extending longitudinally of the block from the rearward end thereof. A coil spring 25 positioned in each of these recesses 24 is biased to resiliently urge the block 22 and push button carried thereby outwardly from the housing 11, that is, to a non-operating position. Upon manually pressing a push button inwardly, the resilient resistance of the coil springs 25 is overcome and the block 22 with parts carried thereby is moved inwardly. Upon removal of external pressure on the end of the push button, the coil springs 25 immediately return the block 22 and move the push button outwardly. Thus, the actuating block 22 is longitudinally reciprocated by the combination of manual operating and the resilient springs 25.

Suitably riveted to each of the ceramic bodies 21 are four fixed contact elements 26. These contact elements 26 are in the form of small buttons of suitable electrical conducting characteristics and are wear-resistant to provide good electrical contacts in a switch. Because the elements 26 are independently attached to the insulating

body 21, they are electrically separated from each other. Extending outwardly from each fixed contact element 26 is a post or connecting element 27, these posts having a connecting screw 28 secured thereto. Electrical leads or wires may be electrically connected to the posts by means of the screws 27 in the usual manner to provide the desired circuit incorporating the fixed contact elements 26.

A pair of movable bridging members 30 of suitable electrical conducting material are carried by each of the ceramic bodies 21. Each bridging member has secured thereto and carried adjacent its opposite ends movable contact elements 29, each contact element 29 being directed to face a fxed contact element 26. One of the bridging members 30 carrying a pair of movable contact elements 29 is arranged in juxtaposition to one pair of fixed contact elements 26 and the other bridging member 30 carrying a pair of movable contact elements is arranged in juxtaposition to the other pair of fixed contact elements carried by the ceramic body 21. The movable contact elements 29 are also of suitable electrical conducting material providing wear-resistance suitable for a good electrical contact in a switch.

Each bridging member 30 is carried by a ceramic body 21 in such a manner that it may rock or tilt and also may move wholly away from the pair of fixed contact elements with which it is mated. To provide support and guidance for each bridging member, there is a fulcrum supporting member 32 extending outwardly from the ceramic body 21 through an opening in the bridging member, there being a support 32 for each of the two bridging members 30 carried by a ceramic body 21. This support 32 has a hooked outer end and a pivot pin 33 is positioned in this hooked end of the support 32 in such a manner that the pivot pin 33 may pivot or rock in the hooked end of the support 32.

A spring 31 of suitable spring steel or other resilient material in ribbon form and which will conduct electricity is bent in the form of a loop, as shown in the drawings. One end of the ribbon spring 31 has a bent-over portion 31–*a* which anchors against a bridging member 30 as illustrated to resist displacement in the one direction. An opening in the spring 31 accommodates the support 32 to permit the support to extend beyond the spring. The other and outer end of the ribbon spring 31 has a cut-out portion 31–*b* which permits the spring 31 to straddle the hooked end of the support 32. The pivot pin 33 is anchored to the outer end of the spring 31 by having the outer end bent around the pivot pin 33. The pivot pin 33 extends across the cut-out portion 31–*b* and under the hooked end of the support 32. The bias of the spring 31 is such that the loop thereof tends to straighten out and thus to provide a resilient force urging the bridging member 30 against the ceramic body 21. This resilient force urging the bridging member toward the ceramic body, that is, toward the right in Figures 8, 9, 10 and 11, urges the movable contact elements 29 toward and into firm engagement with the fixed contact elements 26.

The pivoting or rocking of the pin 33 in the hooked end of the support 32 also permits the bridging member 30 to rock or tilt relative to the ceramic body 21. Also, the position of the spring 31 intermediate the ends of the relatively rigid bridging member 30 and its engagement by pin 33 facilitates the ready rocking of the bridging member relative to the support provided by pin 33. Also the bridging member may be laterally moved without such tilting or rocking. A compound movement of the bridging member is permitted by the arrangement. The rocking permits the movable contact element 29 at one end of the bridging member 30 to be spaced relative to its opposed fixed contact element 26 differently from the spacing of the movable contact element 29 carried by the other end of the bridging member 30 relative to its opposed fixed contact element 26. The rocking movement and the lateral movement that may be imparted to the bridging member 30 by the camming action permits the pair of movable contact elements carried by a bridging member each to individually and separately engage an opposed fixed contact element 26 or both to simultaneously engage both of the opposed contact elements 26.

The bridging member 30 is bent at two spaced locations so as to provide a cam-follower surface 30–*a* adjacent one end of the bridging member and a cam-follower surface 30–*b* adjacent the other end of the bridging member These cam follower surfaces are on the outer surface of portions displaced away from the body of the bridging member 30 and have the contour or curvature illustrated in the drawings and particularly in Figures 7 to 11, inclusive. These bends providing the cam-follower surfaces 30–*a* and 30–*b* are adapted to extend through spaced openings 44 and 45 in the base 21. When both the movable contact elements 29 carried by a bridging member 30 are in engagement with their opposed fixed contact elements 26, then the bends forming the cam-follower surfaces 30–*a* and 30–*b* protrude through and beyond the respective openings 44 and 45 to transverse the reference plane adjoining and parallel to the back or base of the ceramic body 21.

There is carried by each actuating block 22 a pair of camming plates, preferably of nylon material. Nylon material is particularly desirable because besides being an electrical insulator, it is wear-resistant and provides a minimum of friction to sliding engagement of other parts therewith. Because the camming plates may have different forms to provide different operating characteristics for my switch mechanism and thus may be alternately used in the mechanism as desired, some alternative forms of camming plates are shown as plates A, B, C, D and E. In Figure 6, camming plates A and B are shown ready to be assembled with an actuating block 22 carrying the push button 13. The camming plates differ in respect to the openings extending therethrough and the disposition of the camming surfaces which border the openings extending through the plates

To provide that the camming plates are correctly assembled with the actuating block, there is provided a tongue 22–*a* protruding from the block 22 on each of its opposite sides. This tongue 22–*a* is adapted to fit in a groove or recess provided in the top edge of a plate. This groove in camming plate A is designated by the reference character 34–*a*, the groove in plate B is designated by the reference character 34–*b*, the groove in plate C is designated 34–*c*, the groove in plate D is designated 34–*d* and the groove in plate E is designated 34–*e*.

In the camming plates illustrated, there are four rectangular openings extending through the camming plates, each of these rectangular openings being adapted to accommodate a displaced bent portion providing the cam-follower surfaces on each bridging member 30. The rectangular openings in the camming plates have inclined or sloping walls which provide camming surfaces. For example, in camming plate A, the opening 35–*a* has a camming surface 36–*a*. Also in camming plate A the opening 37–*a* has an inclined camming surface 38–*a*. The opening 39–*a* in camming plate A also has an appropriate camming surface bordering the same end below the opening 39–*a* and there is a fourth rectangular opening having camming surface 40–*a*. As seen by comparing the camming plates A, B, C, D and E shown in Figures 6, 12, 13 and 14, each of the alternate camming plates has a different arrangement of rectangular openings and a different arrangement and spacing of the camming surfaces. For example, in camming plate D, the camming surface 36–*d* is positioned differently from the camming surface 36–*e* of camming plate E. Also the spacing between the camming surface 36–*d* and the camming surface 38–*d* of camming plate D is different from the spacing between camming surface 36–*e* and the camming surface 38–*e* of camming plate E.

There is a longitudinal slot 41 extending through the camming plates A, B, C, D and E, this slot being the same for all of the respective camming plates.

The supports **32** are riveted to or otherwise suitably secured to the ceramic body **21**. Extending between and electrically connecting the supports **32** carried by each ceramic body **21** is a cross-piece **42**. A pin **43** extending through and electrically connected to the cross-piece **42** extends through the ceramic body **21** and protrudes from its rearward face or back. The pins **43** carried by each pair of ceramic bodies **21** arranged back to back are of electrically conducting material and extend toward each other as seen in Figure 5. The pins **43** of each pair are in axial alignment but do not abut each other. To electrically connect the two pins **43** opposed to each other, a small sleeve **46** of electric conducting material is disposed on the adjacent ends of the opposed pins **43** so as to electrically interconnect the opposed pins **43** carried by the pair of ceramic bodies **21**.

The different movements of the bridging member **30** and hence of the movable contact elements **29** that may be obtained with my device are illustrated in Figures 8, 9, 10 and 11.

In Figure 8, the push button **13** is in its outermost position so that the actuating block **22** and camming plate A carried thereby are in their outermost position relative to the housing **11**. In this position of Figure 8, the camming plate A engages the outermost portion of the cam-follower surfaces **30**–*a* and **30**–*b* of the bridging member **30**. Thus, both of the movable contact elements **29** carried on the ends of the bridging member **30** are held out of engagement with, that is, away from, the fixed contact elements **26**. Thus, there is no electrical communication between the opposed contact elements **29** and **26** at the opposite ends of the bridging member **30**.

In Figure 9, the push button **13** has been moved partially inward so as to change the position of the camming plate A. In this position, the cam-follower surface **30**–*b* of the bridging member **30** has been permitted under the urging of the spring **31** to move to the right. This has brought the lower movable contact elements **29** into engagement with the lower fixed contact element **26**. However, inasmuch as the cam-follower surface **30**–*a* in Figure 9 is still held inward, that is, toward the left, by the camming plate A, the upper movable contact element **29** is held out of engagement with the upper fixed contact element **26**. The bridging member has been rocked or tilted by the camming plate A. Therefore, in this movement of the camming member there is electrical connection provided through one set of opposed contact elements but not through the other set of opposed contact elements.

In Figure 10, the push button **13** has been moved downwardly still further so that the camming plate A has been moved down to the position illustrated. Here the camming plate has cleared and disengaged both the cam-follower surface **30**–*a* and the cam-follower surface **30**–*b* of the bridging member **30**. Under the resilient urging of the spring **31**, the bridging member **30** has been moved to its extreme position to the right so that both the movable contact elements **29** are in engagement with their opposed mating fixed contact elements **26**.

In Figure 11, the push button **13** has been moved still further downwardly to its inward limit so that the camming plate A has been moved downwardly to its inward extreme limit. Here the cam-follower surface **30**–*a* is still permitted to remain in its position to the right as it is unobstructed by the camming plate A. However, in Figure 11 the cam-follower surface **30**–*b* has moved outwardly, that is, to the left, to the position shown. The cam-follower surface **30**–*b* was cammingly moved to this position by the upper inclined edge of the lower rectangular opening **37**–*a* of the camming plate A. Thus, by a camming action, the reciprocal movement of the camming plate A moves the bridging member to the left, that is, out of the rectangular openings in the camming plate.

It is therefore seen in Figures 8, 9, 10 and 11 that a variety of sequences of engagement of the mating contact

elements are possible. Among the combinations that may be obtained is the combination of having both opposed contact elements out of interengagement as in Figure 8, the combination of having both opposed contact elements in interengagement as in Figure 10, the combination of having one pair of opposed contact elements out of interengagement and the other pair of opposed contact elements in interengagement as in Figure 9, and the combination which is the reverse of that shown in Figure 9 and as illustrated in Figure 11.

In Figure 7 there is illustrated the fact that as to one pair of movable contact elements **29** carried by a bridging member **30** there may be one combination of interengagements by the opposed contact elements, whereas at the same time as to another pair of movable contact elements carried by another bridging member **30**, there may be another combination of relationships between opposed contact elements. For example, in Figure 7 the movable contact elements **29** carried by the bridging member **30** on the left side and actuated by push button **13** are disengaged or separated from their opposed contact elements **26**, whereas on the right-hand side both of the movable contact elements **29** carried by the bridging member **30** on this right-hand side are in interengagement with their opposed fixed contact elements **26**. Similarly, there may be a different combination as to engagement and disengagement of contact elements for each pair of movable contact elements carried by a bridging member. These combinations at any one time may vary among the plurality of bridging members.

Different sequences or orders of interengagements of contact elements may be obtained by substituting different camming plates. For example, for camming plate A there may be substituted camming plates B, C, D or E, these camming plates varying as to the spacing and disposition of the rectangular openings and the camming surfaces at the upper and lower edges of the rectangular openings. Whether both contact elements carried by a bridging member move inwardly together, whether one precedes the other in moving inwardly, or whether one precedes the other in moving outwardly, depends upon the disposition and spacing of the camming surfaces of the camming plate cammingly engaging the cam-follower surfaces **30**–*a* and **30**–*b*.

In the housing **11** illustrated in Figures 1, 2 and 3, it is seen that there is provision for four ceramic bodies **21**, that is, two on each side of the housing. As each ceramic body **21** is adapted to carry a pair of bridging members **30**, a total of 8 bridging members may be incorporated in the one housing. The number of bridging members and movable contact elements carried thereby to be utilized in one housing, of course, depends upon the circuits to be controlled. For example, some of the ceramic bodies **21** and bridging members and movable contact elements carried thereby may be eliminated so as to have a fewer number of movable contact elements for controlling the circuits. Also, of course, the housing may be enlarged to accommodate a larger number of ceramic bodies and of the movable contact elements and bridging members carried thereby, so as to provide a greater number of switching operations.

The wires or electrical conductors entering the housing **11** may extend downwardly through the open spaces provided at the four corners of the housing and there branch off to be connected to selected posts **27** by means of the connecting screws **28**. Also wires or electrical conductors may extend down centrally through the housing to electrically connect with the pins **43** as may be desired. A great variety and flexibility in interconnections may be obtained by my construction. As an example of an arrangement that may be utilized, the post **27** on the upper left-hand side of the view shown in Figure 5 might be connected with the lead from one side of an electrical circuit and the other three posts of the four posts shown in Figure 5 could each be connected with

the leads, respectively, of different circuits. After contact is made between the movable contact elements at the upper left side of the four pairs shown in Figure 5, then current may be diverted in three alternate paths in a desired sequence, that is, through mating contact elements brought into interengagement in a desired sequence. In such an arrangement, there is an electrical connection provided between the pins 43 so as to interconnect the bridging members 30 on the opposite sides of the pair of ceramic members 21. Many other variations in the operation of my switching mechanism may be obtained by making the desired electrical connections, by choice of the desired alternate camming plates, and by manual operation of the push buttons.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. An electrical switching device comprising in combination a plurality of fixed contact elements, a plurality of movable contact elements, a bridging member carrying said movable contact elements and adapted to conduct electrical current therebetween, said bridging member having cam-follower portions extending therefrom and spaced from each other along said bridging member, resilient means operatively engaging said bridging member to urge said movable contact members toward and into contact with said fixed contact members and simultaneously to urge said cam-follower portions toward a reference plane spaced beyond a substantially parallel plane passing through the contact surfaces of said fixed contact elements, and a camming member slidable in said reference plane, said camming member having spaced camming surfaces slidably engageable by said cam-follower portions, respectively, said camming surfaces being spaced and arranged relative to each other and to said cam-follower portions as to cammingly move said cam-follower portions away from said reference plane in sequence upon movement of the camming surfaces in the same direction whereby said movable contact elements are moved away from said fixed contact elements, respectively, in a corresponding sequence.

2. An electrical switching device comprising in combination a plurality of fixed contact elements, a plurality of movable contact elements adapted to engage said fixed contact elements, respectively, a bridging member carrying said movable contact elements and electrically connecting the same, said bridging member being formed with cam-follower surfaces disposed on a side thereof and at spaced locations therealong, biasing means biasing said bridging element in a direction to urge the movable contact elements toward and into engagement with said fixed contact elements and simultaneously to urge said cam-follower surfaces into positions athwart a reference plane, and a camming member slidably reciprocal in said reference plane, said camming member having camming surfaces disposed at spaced locations therealong and athwart said reference plane to meet said cam-follower surfaces in said reference plane, said camming surfaces including at least two camming surfaces inclined in the same general direction athwart said reference plane, movement of said camming member in said reference plane causing the engagement of said cam-follower surfaces by said camming surfaces and the movement of said cam-follower surfaces away from said reference plane in a sequence determined by the spacing of said camming surfaces relative to each other and to said cam-follower surfaces, the movement of said cam-follower surfaces in said sequence moving said movable contact elements relative to said fixed contact elements in a corresponding sequence.

3. An electrical switch comprising the combination of a support, a plurality of fixed contact elements carried by the support and positioned at spaced locations on said support, a movable bridging member carried by said support, movable contact elements carried by the movable bridging element in position to engage said fixed contact elements, said movable contact elements being electrically connected by said bridging member, resilient means carried by said support biasing said bridging member toward a position of holding said movable contact elements in engagement with said fixed contact members, said bridging member having spaced portions extending therefrom toward a reference plane on one side of said bridging member, said spaced portions having cam-follower surfaces disposed at angles to said reference plane, a camming member longitudinally movable in said reference plane, said camming member having cut-away portions to accommodate said spaced portions in said reference plane, said camming member having camming surfaces bordering said cut-away portions, said camming surfaces being disposed transversely of said reference plane to meet said cam-follower surfaces in said reference plane upon longitudinal movement of said camming member in said reference plane, said camming surfaces in the said longitudinal movement cammingly engaging said cam-follower surfaces to move said spaced portions of the bridging element away from said reference plane, the sequence of the movements of said spaced portions relative to said reference plane being in accordance with the relative spacing of said camming surfaces and the relative spacing of said cam-follower surfaces, said movement of the spaced portions in sequence providing movement of said movable contact elements relative to said fixed contact elements in a corresponding sequence.

4. An electrical switch mechanism for making and breaking electrical connections in desired sequence, comprising in combination, a supporting body of electrical insulating material, said body having a plurality of open spaces provided therein at spaced locations therealong, a plurality of fixed contact elements carried by said body at spaced locations therealong and on a first side of said body, a bridging member of electrical conducting material disposed on said one side of said body, a plurality of movable contact elements corresponding in number with said fixed contact elements and carried by said bridging member, said movable contact elements being directed toward said fixed contact elements for engagement therewith upon movement of the movable contact elements to said fixed contact elements, respectively, said bridging member having a plurality of portions at spaced locations therealong disposed in said open spaces, respectively, in said body, said spaced portions having cam-follower surfaces thereon, a fulcrum-support member carried by said body, a resilient member connecting said fulcrum-support member and said bridging member, said fulcrum-support member and resilient member being arranged to permit tilting of said bridging member and to urge said bridging member toward an opposite side of said body, and a camming member recurrently movable in a path along said body on said opposite side, said camming member having camming surfaces disposed athwart said path, the cam-follower surfaces on said bridging member portions being biased by said resilient member to extend into said path to meet said camming surfaces of said camming member, said cam-follower surfaces and camming surfaces being spatially arranged to provide camming movement of said cam-follower surfaces in a fixed sequence by the movement of the camming member in said path, movement of said cam-follower surfaces in said sequence tilting said bridging member to move said

movable contact elements relative to said fixed contact elements in a corresponding sequence.

5. In an electrical switch, the combination of a plurality of pairs of interengageable contact elements adapted to control flow of electrical current between the contact elements of each pair of elements, a movable bridging member carrying and electrically interconnecting a contact element of each pair of contact elements, mounting means including resilient means for supporting said bridging member and resiliently biasing the bridging member in such direction as to urge the contact elements of each pair of contact members toward each other and into interengagement, said mounting means holding said bridging member to permit rocking of the bridging member to simultaneously swing the contact elements carried by the bridging member for sequential interengagement of the contact elements of said pair of contact elements, and camming means slidably movable in a plane substantially parallel to planes common to said pairs of contact elements in interengagement, said camming means, including spaced camming elements, being disposed to move said bridging member against said resilient means in an opposite direction at spaced locations along said bridging member and to rock said bridging member for said sequential interengagement of the said contact elements, said camming elements being arranged relative to each other to move and rock said bridging member by movement of the camming means in one direction and whereby in said sequence of interengagements of a first interengagement of contact elements may persist during a subsequent interengagement of other contact elements.

6. An electrical switching device comprising a base of electrical insulating material, a plate member slidably movable in a plane along a first side of said base, a resiliently biased push button member for slidably moving said plate member, said plate member having a plurality of spaced camming surfaces inclined to said plane, a pair of fixed contact elements carried by said base at spaced locations therealong, a pair of movable contact elements adapted to engage said fixed contact elements, respectively, to conduct current therebetween, a movable bridging member electrically connecting said movable contact elements and carrying the movable contact elements to move the same in and out of engagement with said fixed contact elements, said bridging member having cam-follower surfaces adapted to extend transversely of said plane in the path of said camming surfaces to be sequentially engaged thereby upon movement of the plate member in one direction in said plane, a pivot support carrying said bridging member to permit rocking movement of the bridging member relative to said fixed contact elements, and a resilient member operatively connecting said pivot support and said bridging member to urge the bridging member in such direction as to interengage the movable contact elements and fixed contact elements, respectively, the movement of said plate member in said one direction in said plane cammingly moving the bridging member against the bias of the resilient member and relative to said fixed contact elements in accordance with the spacing of said camming surfaces of said plate member.

7. In an electrical switch mechanism, the combination of a pair of spaced fixed contact elements, a pair of spaced movable contact elements disposed opposite said fixed contact elements, respectively, and movable in and out of engagement with said fixed contact elements, respectively, a bridging member of electrical conducting material carrying said movable contact elements, a spring operatively connected to said bridging member to resiliently urge said bridging member in such direction as to bias the movable contact elements into engagement with said fixed contact elements, said bridging member being rockable in opposition to the resilient urging of said spring to shift the position of one of said movable contact elements relative to its opposing fixed contact element differently from the position of the other of said movable contact elements relative to its opposing contact elements, said bridging member having spaced cam-follower surfaces disposed along a side thereof, and a camming member movable in a plane adjacent said side of the bridging member, said camming member having spaced camming surfaces adapted to engage said cam-follower surfaces, respectively, of the bridging member and to move said bridging member away from said plane in opposition to the resilient urging of said spring, the relative spacing of said camming surfaces and said cam-follower surfaces providing for the sequence of engagement of the fixed contact elements by the movable contact elements upon movement of said camming.

8. In an electrical switch mechanism, the combination of a pair of spaced fixed contact elements, a pair of spaced movable contact elements opposed to said fixed contact elements and adapted to engage the same, respectively, bridging means carrying said movable contact elements, resilient means carrying said bridging means to urge the movable contact elements toward and into engagement with said fixed contact elements and to permit said bridging means to tilt for differential spacing of the movable contact elements relative to the respective fixed contact elements, and camming means movable in a plane substantially parallel to a plane passing through said fixed contact elements and disposed for operatively engaging said bridging means for cammingly moving said bridging means in opposition to said resilient means and the movable contact elements carried thereby, said camming means including spaced camming surfaces adapted to simultaneously engage spaced portions, respectively, of the bridging means to permit both said movable contact elements to be moved to simultaneously engage said fixed contact elements, respectively.

9. In an electrical switch mechanism, a pair of fixed contact elements, a pair of movable contact elements opposed to said fixed contact elements, respectively, said movable elements upon being moved in a first direction engaging said fixed contact elements, respectively, and upon being moved in an opposite direction disengaging said fixed contact elements, a carrier member carrying said movable contact elements at locations spaced from each other, resilient supporting means supporting said carrier member to resiliently urge the movable contact elements carried thereby in said first direction, said resilient supporting means being adapted to permit tilting of said carrier member to provide a differential in the engagement and disengagement of said opposed contact elements, said carrier member having spaced cam-follower portions carried thereby, and a camming member slidably movable in a plane substantially normal to the lines of movement of the movable contact elements relative to the fixed contact elements and having spaced camming surfaces adaped to cammingly engage both said cam-follower surfaces, respectively, upon movement of the camming member in a single direction, movement of said camming member relative to said cam-follower portions moving said carrier member to move the movable contact elements relative to said fixed contact elements in said opposite direction, the sequence of movements of said movable contact elements relative to the fixed contact elements being governed by the relative arrangement of said camming surfaces and cam-follower portions.

10. In an electrical switch mechanism, the combination of a pair of sets of mating contact elements, resilient mounting means biasing the contact elements of each set of contact elements together and permitting a difference in the engagement and disengagement of one pair of mating elements relative to the other pair of mating elements, and camming means movable in a plane substantially normal to the lines of movement between said mating contact elements upon engagement and disengagement, said camming means opposing said resilient mounting means to provide separation of the contact elements of each set of contact elements, said camming means including a plural-

ity of spaced cam surfaces and a plurality of spaced cam-follower surfaces arranged to provide differences in the relative movements provided between the contact elements of the respective pair of elements upon movement of the spaced cam surfaces in the same general direction against the spaced cam-follower surfaces in the sequence provided by the spacing between the spaced cam surfaces.

11. In an electrical switch mechanism, the combination of a movable bridging member carrying a pair of spaced contact elements, said bridging member having a pair of spaced protruding portions extending toward a reference plane, resilient means urging both said protruding portions athwart said reference plane, an actuating member for moving said bridging member, a camming plate carried by said actuating member and removable therefrom to permit substitution of alternately constructed camming plates, said camming plate having a pair of spaced openings adapted to accommodate said protruding portions, respectively, said camming plate having inclined surfaces sloping in the same general direction and bordering said openings and adapted to cammingly engage and move said protruding portions, respectively, away from said reference plane, said camming plate upon being moved in said reference plane in a single direction by said actuating member providing for movement of said bridging member as the said inclined surfaces cammingly engage and move said protruding portions, respectively, in an order determined by the spacing of said inclined surfaces from each other.

12. In an electrical switching device having a plurality of resiliently movable cam-follower portions resiliently biased to protrude toward a reference plane, the combination of an actuating member for moving said portions, a spring urging said actuating member in one direction and being manually movable in an opposite direction, and a cam-follower plate of nylon carried by said actuating member along a side thereof, said plate and actuating member having interlocking tongue and recess portions to provide assured assembly of the plate and actuating member in aligned position, said plate having a plurality of openings provided therein for accommodating in said reference plane the said cam-follower portions, respectively, each of said openings having an inclined edge portion adapted to engage a said cam-follower portion and to cammingly move the same away from said plane upon movement of said plate in said plane, at least two of said inclined edge portions being similarly inclined to cammingly engage and move different of said cam-follower portions upon movement of the actuating member and plate in one of said directions.

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