

Sept. 20, 1960

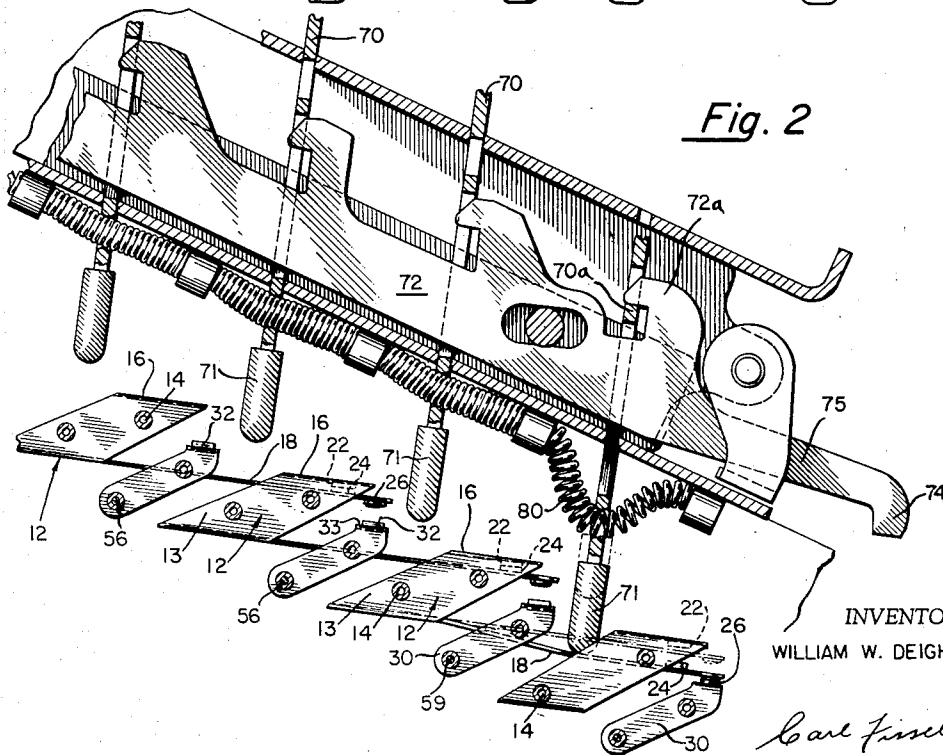
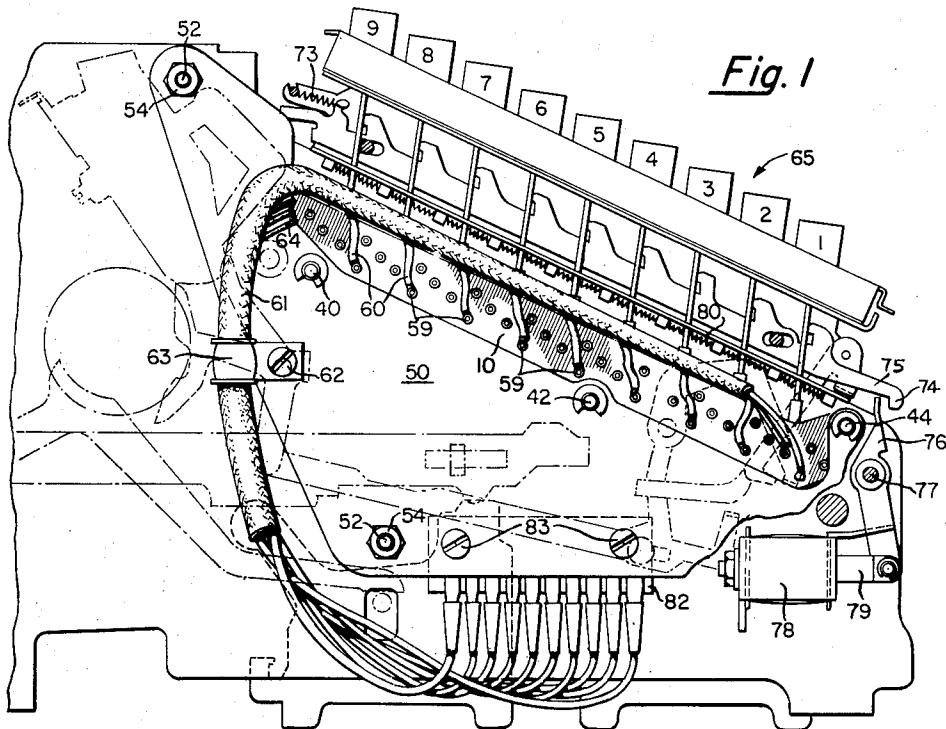
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2,953,649

ELECTRICAL SWITCH APPARATUS

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

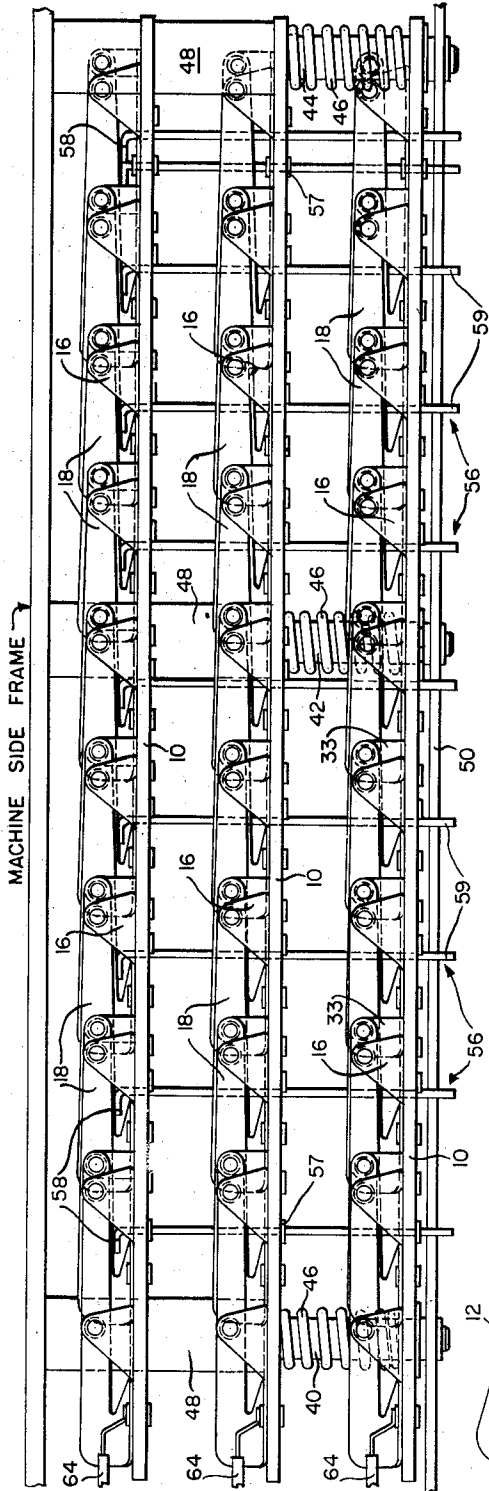


Fig. 4

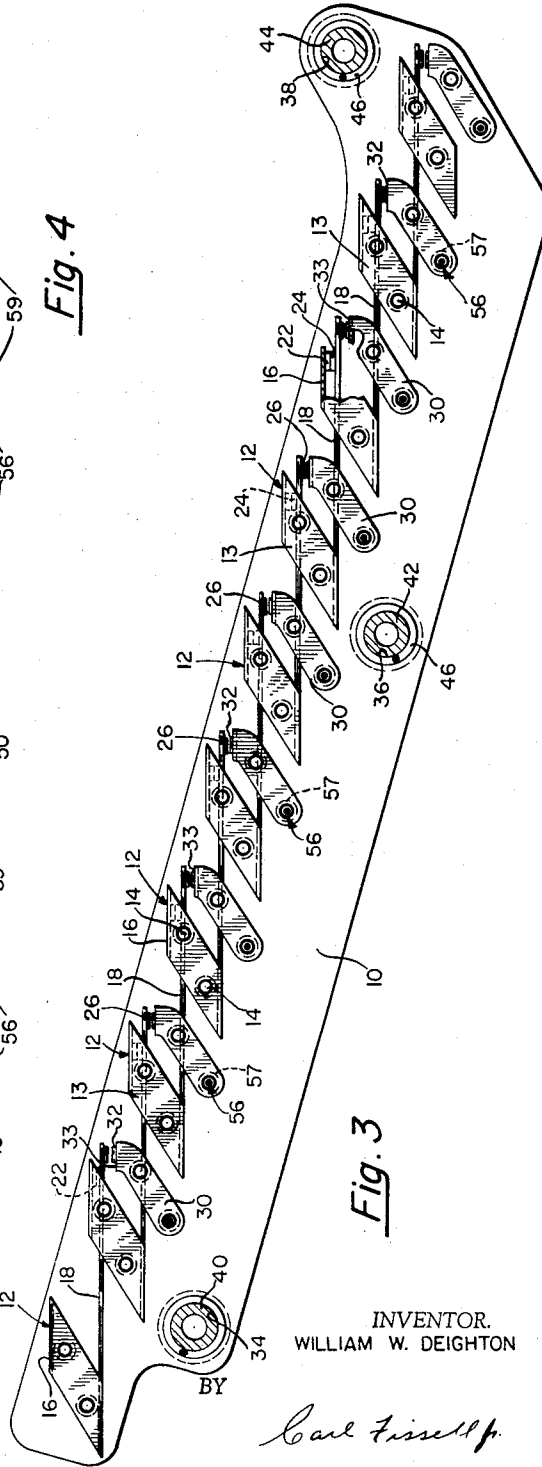


Fig. 3

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ELECTRICAL SWITCH APPARATUS

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4 Claims. (Cl. 200—5)

This invention relates to improvements in electrical switches and switch mechanisms and more particularly, although not necessarily exclusively to multiple pole, double throw switch structures.

Single and double pole switches having a large number of electrical contacts are well known in the art. They are used for a variety of applications. An extremely important use for such switches is in the accounting machine and telephone art respectively, to cite two of many examples. Push button and relay stepping switch control circuits employed in the automatic accounting machine art usually require large numbers of relays to afford proper storage capacity and/or time control features necessary to such applications. Accounting apparatus of the type described and claimed in U.S. patent application S.N. 518,454, filed July 17, 1956, in the name of W. W. Deighton et al. for an "Automatic Accounting Machine" and assigned to the same assignee as the present invention, rely heavily on the use of such relays. Electrical control circuits for accounting machine relay systems are frequently energized by means of multipole switches mounted in various portions of the machine. Some of these switches are of the cam driven variety while others are of the push button plunger type.

Multiple pole electrical switches known to the art are comparatively large, cumbersome and expensive mechanisms. A control panel fitted with such a mechanism occupies a relatively large area. Frequently the wiring required with such switches limits their employment in small or confined quarters rather stringently. Furthermore, since many of the prior art switch mechanisms are hermetically sealed blocks or units of two or more, each block being wired to each other block in the unit, individual service of any particular switch often necessitates disassembly of a number of switch blocks in order to locate the single faulty switch unit.

It is an important object therefore of the present invention to provide an improved, multipole, multiple throw electrical switch structure of simple construction, compact configuration, permitting easy and efficient service and operation.

It is another important object of this invention to provide an improved, multiple contact electrical switch structure which occupies a reduced space, whereby a large number of electrical contacts can be mounted in a comparatively small area.

A further object of this invention is to provide an improved electrical switch wherein the contacts of each switch form the interconnecting wiring buses for the switch assembly.

Another object of this invention is to provide an improved switch structure which is inexpensive to manufacture and simple to wire.

Another object of the invention is to provide a switch mechanism in which a plurality of individual switch members are operable directly from the respective key stems of an accounting machine.

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In accordance with a preferred embodiment of the invention, there is provided a nine pole, double throw electrical switch structure comprising, a plurality of dielectric members supported in side by side parallel relationship with one another. A plurality of substantially I-shaped switch elements and a plurality of substantially L-shaped members are secured to each of said dielectric members, said I and L-shaped members being alternately disposed with respect to each other on each of said dielectric members in step-like rows. Electrical switch contacts are disposed on each of said I and L-shaped elements, and means is provided for inter-engaging the L with the I-shaped elements selectively, thereby to complete a desired electrical circuit therethrough.

Other and further objects of the present invention will appear from the following specification and claims when read in connection with the accompanying drawings in which:

Fig. 1 is a side elevational view of a switch structure embodying the invention as incorporated in an accounting machine;

Fig. 2 is a sectional view in side elevation of an enlarged fragmentary portion of the switch and its locking slide structure;

Fig. 3 is a side view of the switch elements as assembled in the present invention; and

Fig. 4 is a top plan view of the apparatus shown in Fig. 3.

Referring now more particularly to the drawings and particularly to Fig. 3 thereof, there is shown a dielectric member 10, provided with a plurality of first switch elements 12. Each of the switch elements 12 is substantially L-shaped and is constructed of a relatively resilient electrically conductive material. Each L-shaped member 12 comprises a portion 13 by which the member is attached to the dielectric member 10, as by hollow rivets 14, and upper and lower portions bent outwardly substantially at right angles to portion 13 thus to provide an ear or tab 16 and a flexible flat arm portion 18 respectively.

Tab 16 carries an electrical contact 22 at the end thereof, and the flexible arm 18 is provided with upper and lower contacts 24 and 26 respectively, slightly displaced with respect to each other, as shown, with the upper contact 24 normally biased by arm 18 into contact with contact 22 of tab 16 of the next successive L-shaped member, to the right as seen in Fig. 3. The members 12 preferably are disposed on their respective panels 10 in stair step fashion (Fig. 3) to provide greater simplicity and flexibility in interconnecting each arm 18 to its respective output as will be explained presently, and in order to permit indexing mechanism to engage the flexible portion of the switch perpendicularly, as will be described later on.

Disposed intermediate each pair of members 12 is an individual substantially I-shaped switch output member 30 having an electrical contact 32 disposed on an outwardly turned ear portion 33. It will be noted that contacts 26 of arms 18 are slightly spaced from and above contacts 32. Thus it is seen that the apparatus described provides aligned pairs of fixed contacts (22 and 32) having a flexible member 18 therebetween and in electrically conductive contact with successive contacts 22 thus to provide a complete electrical circuit starting at the leftmost contact member 12, Fig. 3, which is used as the input, and passing back and forth from resilient element to resilient element, terminating at the rightmost or output contact 30.

As shown, the structural configuration of the switch assembly is such that a complete electrical circuit is provided without the need for any wiring busses from

one contact to another along the dielectric member. It is apparent therefore that the foregoing construction eliminates the need for skilled wiring and also eliminates the additional requirement of soldering multiple source interconnecting electrical lead wires to the various contacts of the assembly. Advantage is thus taken of the integral wiring supplied by means of the structural configuration of each of the interengaging elements forming the present switch package.

According to the teaching of the present invention only three stampings are required in order to fabricate a complete switch package having ten electrical outputs from nine electrical inputs, Fig. 1. Each stamping is simple and easy to fabricate, having no complex bends or other unusual configurational details. Where, as in an accounting machine of the type earlier referred to herein, a total of 27 switches is required, this number is easily obtained by the means hereinafter set forth.

Each one of the dielectric panel members 10 as seen in Fig. 4 is provided with its respective series of switch elements. The members 10 are adapted to be secured together in three parallel separated rows, as will now be explained. Each panel is provided with a number of holes 34, 36 and 38, Fig. 3, through which pass supporting shafts 40-42 and 44. Since the commercial thickness tolerances of the dielectric material forming members 10 varies from member to member a compensating device is utilized to provide the desired spacing between adjacent members. To this end a compression spring 46 is inserted between the outermost panel members and the middle member, while the innermost member is maintained separate, but in parallel side by side relationship with respect to the middle member by means of a shouldered collar 43. An E-ring on the inboard and outboard ends of each of the shafts 40-42-44 secure the assembly to the outrigger side plate 50 which is attached to the accounting machine outer side plates by means of bolts 52 and nuts 54, Fig. 1.

As a means of providing common interconnecting lead wires for the corresponding output contact elements 30 of the boards a number of relatively rigid rod like wires 56 are passed through the horizontally aligned rivets 57 securing switch elements 30 to the three board members 10. The inboard ends 58 of the wires 56 are bent at right angles to retain the wires against removal from the assembly. The outer ends 59 of the wires form terminal attachment means for the leads 60 (Fig. 1) one of which is secured to each wire. The leads are then cabled together within a cover member 61 and the cover is fixed to the outrigger frame 50 as by screw 62 and clip 63. The electrical input conductors or lines 64, Fig. 4, are attached to each one of the leftmost switch elements 12.

The switch mechanism embodying the present invention is illustrated as incorporated in an accounting machine of the Butler type, as before mentioned, for use as account number verification means up to three digits. The Butler machine utilizes a standard keyboard, the left side of which has been extended to accommodate three additional rows of depressible keys, one for each account number, only one key row being shown in Fig. 1 and being identified by the reference character 65. The keys are numbered starting with "one" at the lower right side of this figure and terminating with "nine" at the upper left side thereof.

Referring to Figs. 1 and 2, it can be seen that each of the parts of the keyboard controls of the present application is substantially identical to those of Butler 2,629,549 and that the construction and operation of the keys of the three added key rows is similar to that shown in Figs. 29 to 32 and 37 to 41, and described, beginning at column 23 of the Butler patent.

Automatic key resetting mechanism

Each key latch slide 70 is provided at its depending end portion with an electrical insulating element 71 form-

ing a rounded projection thereon. This latter projection prevents accidental short circuiting of the switches disposed therebelow. Each latch plate 72 is biased leftwardly by means of spring 73 (Fig. 1) as described in Butler 2,629,549, columns 38 to 40, and is provided with a hook portion 74, projecting downwardly from the rightward end 75 of the plate. A reset bail or latching member 76 extends upwardly from rock shaft 77 which is journaled in the side plates of the accounting machine.

Each of the depressed keys in the added rows is locked in its depressed condition (Fig. 2) by engagement of hook 72a over key portion 70a and is adapted to be automatically reset by means of a solenoid 78 operatively associated with the reset bail 76 (Fig. 1). As can be seen in Fig. 2, when a key is depressed, the hook 72a is drawn slightly to the left since the slide is biased leftwardly by the spring 73. When the solenoid is pulsed by means not shown, the plunger 79 is retracted leftwardly to cause the latch 76 to move clockwise about the pivot 77, thus pulling the hook 74 of each key slide 72 rightwardly releasing hook 72a from key portion 70a thus permitting the depressed keys to return to a reset position as shown in Fig. 1, and as urged by spring 80.

As can be seen from Fig. 2, each key stem is disposed substantially perpendicular to the resilient portion 18 of each contact member 12. Each resilient portion, due to its novel structural configuration, is normally urging its contact 24 into engagement with the upper contact 22 and to be deflected into engagement with the lower electrical contact 32 as shown. The upper, normally closed set of contacts provides an electrical circuit including each switch element 12 in the assembly package, which circuit may be shortened by depression of any of the keys 65 thus moving the switch outlet from element 30 at the extreme right end of the assembly to the outlet contact element 30 beneath the arm 18 being deflected by depression of the selected key.

Connecting the three columns of switches are the ten bus bar wires 56 that extend directly through the hollow rivets 57 as described above. These ten wires are separately secured to a terminal board 82 also mounted as by screws 83 to the frame 50. These ten bus wires along with bus wires 64 attached to the end of each column, make a total of 13 bus wires used with the present switch package. It is apparent from the foregoing that the switch package considerably reduces the wiring which would otherwise be required if conventional switches were employed at the base of each key stem. Also it can be seen that if it were necessary to interwire such switches to provide the desired electrical circuits, a considerably involved and confusing overlay of wires would be necessary.

An important feature of the present invention is that the flexible blades 18 of each individual contact member 12 overlap the blade of the next adjacent member so that even though the pitch between the key stems is on the order of $\frac{3}{4}$ ", the blade has the desired degree of flexibility and resilience to permit the key stems to close the switches without interference with each other and without undue stress being built up on the blades.

Thus it can be seen that this invention provides a novel multipole, multiple throw electrical switch structure which occupies a reduced space while providing a large number of electrical contacts. Additionally this invention provides a switch structure fabricated from die stampings wherein the contacts and operating elements thereof form the electrical interconnections therefor thus reducing the wiring requirements to the barest minimum. The switch of the present invention is thus inexpensive to manufacture and assemble and simple to wire into other associated equipment.

What is claimed is:

1. An electrical switch structure comprising, a plurality of electrically insulating panels, means mounting said panels in spaced apart parallel relation, a plurality

of first switch elements mounted in alignment on each of said panels, each first switch element comprising a base portion by which said element is secured to its respective panel, and first and second outwardly turned portions at opposite edges respectively of each base portion, said second outwardly turned portion extending laterally beyond said base portion and comprising an elongated resilient finger extending between the first and second outwardly turned portions of the next adjacent one of said first switch elements, each of said first outwardly turned portions having an electrical contact on its inner side facing the finger of the adjacent switch element, first and second electrical contacts on opposite sides respectively of each of said fingers, said first contact normally being biased against the contact on said first outwardly turned portion of the next adjacent first switch element thus to interconnect said plurality of first contact elements in a series circuit, a plurality of second switch elements mounted on each of said insulating panels, one of said second switch elements being interposed between each adjacent pair of said first switch elements, each of said second switch elements comprising a base portion by which it is mounted upon each of said panels, and an outwardly turned tab portion, having an electrical contact thereon adjacent to and facing the second contact of the finger of an adjacent first switch element, means for moving each of said fingers to break the electrical contact thereof with said first contact of the next adjacent first switch element and to make contact with said facing contact of the adjacent one of said second contact elements, and means operably associated with said mounting means for biasing one of said insulating panels relative to the other of said plurality of insulating panels.

2. An electrical switch structure comprising, a plurality of electrically insulating panels, means mounting said panels in spaced apart parallel relation, a plurality of electrically conductive first switch elements mounted in alignment on each of said panels, each first switch element comprising a base portion by which said element is secured to its respective panel, and first and second outwardly turned portions at opposite edges respectively of each base portion, said second outwardly turned portion extending laterally beyond said base portion and comprising an elongated resilient finger extending between the first and second outwardly turned portions of the next adjacent one of said first switch elements, the inner side of each of said first outwardly turned portions facing the finger of the adjacent switch element and normally being biased into electrical contact with said first outwardly turned portion of the next adjacent first switch element thus to electrically interconnect said plurality of first switch elements in a series circuit, a plurality of electrically conductive second switch elements mounted

on each of said insulating panels, one of said second switch elements mounted on each of said insulating panels, one of said second switch elements being interposed between each adjacent pair of said first switch elements, each of said second switch elements comprising a base portion by which it is mounted upon each of said panels, and an outwardly turned tab portion, adjacent to and facing the outer side of the finger of an adjacent first switch element, and means for moving each of said fingers to break the electrical contact thereof with said next adjacent first switch element to make electrical contact with said adjacent one of said second switch elements.

3. An electrical switch comprising, an electrically insulating panel, a plurality of first switch elements mounted in alignment on said panel, each element comprising a base portion by which said element is secured to said panel, and first and second outwardly turned portions at opposite edges respectively of said base portion, said second outwardly turned portion extending laterally beyond said base portion and comprising a resilient finger extending between the first and second outwardly turned portions of the next adjacent one of said first switch elements, each of said first outwardly turned portions having an electrical contact on its inner side facing the finger of the adjacent switch element, first and second electrical contacts on opposite sides respectively of each of said fingers, said first contact normally being biased against the contact on said first outwardly turned portion of the next adjacent first switch element thus to interconnect said plurality of first contact elements in series circuit, a plurality of second switch elements mounted on said panel, one of said second switch elements being interposed between each adjacent pair of said first switch elements, each of said second switch elements comprising a base portion by which it is mounted upon said panel, and an outwardly turned tab portion, having an electrical contact thereon adjacent to and facing the second contact of the finger of an adjacent first switch element, and means for moving each of said fingers to break the electrical contact thereof with said first contact of the next adjacent first switch element and to make contact with said facing contact of the adjacent one of said second contact elements.

4. A construction in accordance with claim 3 wherein a plurality of such switches are provided in parallel arrangement, and further including connector means for electrically interconnecting corresponding ones of said second switch elements from one switch to another.

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