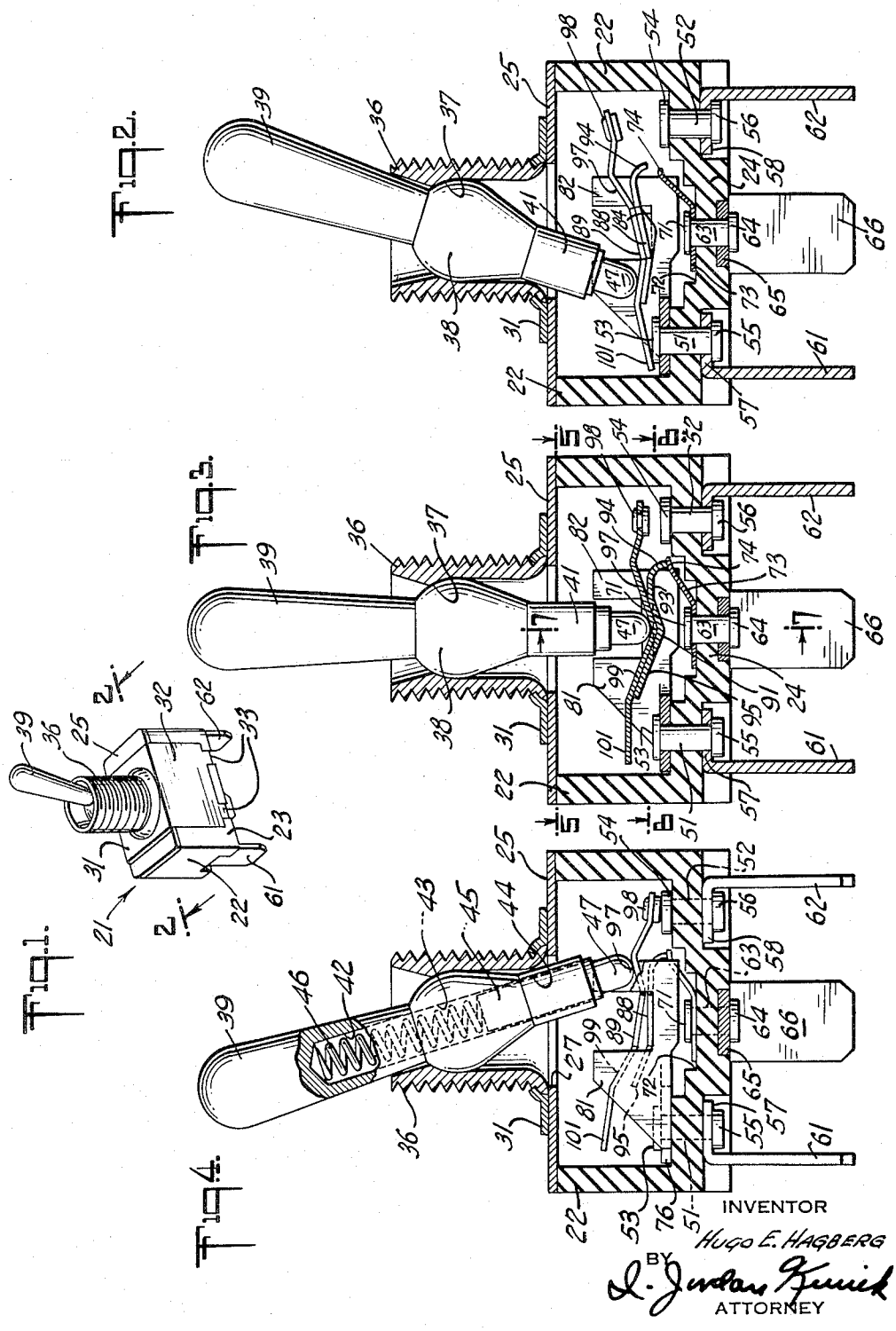
Feb. 9, 1965 H. E. HAGBERG 3,169,172

SINGLE POLE PROGRESSIVE SWITCH FOR ELECTRICAL CIRCUITS

Filed July 13, 1961 2 Sheets-Sheet 1



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Fig. 5.

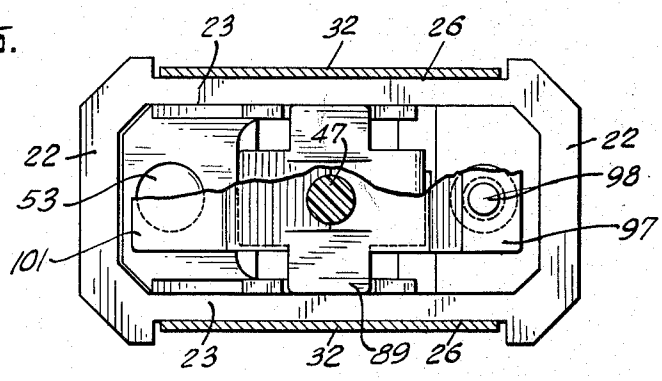


Fig. 6.

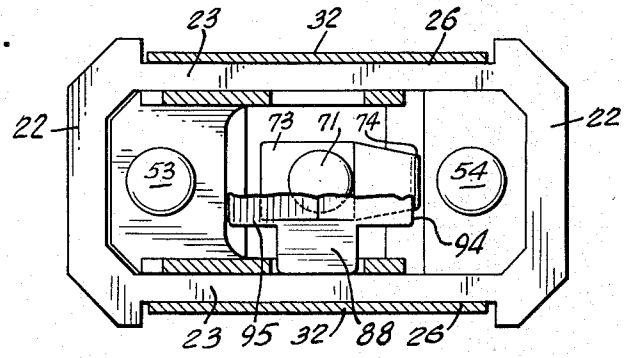


Fig. 8.

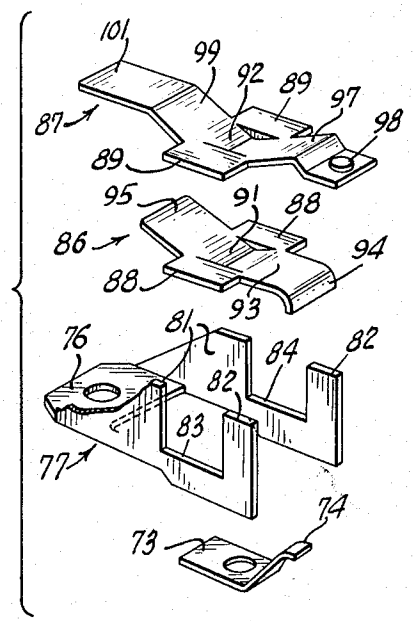
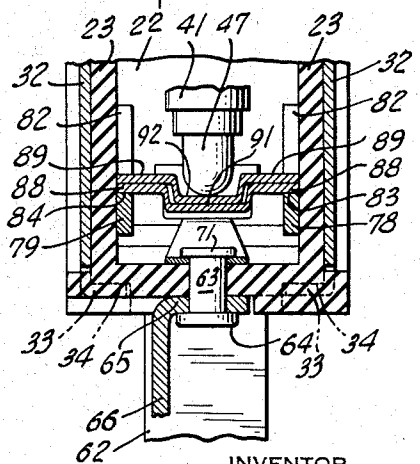


Fig. 7.



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SINGLE POLE PROGRESSIVE SWITCH FOR ELECTRICAL CIRCUITS

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This invention relates generally to switches, and particularly to an improved single pole progressive switch capable of controlling at least two electrical circuits.

The present invention constitutes a single pole progressive switch arranged to control at least two electrical circuits in a sequence as follows: both circuits "off"; one circuit "on"; and two circuits "on"; said electrical conditions being selectable in forward, reverse or mixed sequence.

These functions of the invention are performed, in one embodiment, by a pair of first and second contact levers acting pivotably on a yoke positioned between first and second circuit elements, said yoke being electrically connected to said first element which is common to both of the circuits controlled by the switch. A third circuit element is positioned in the region of said yoke but is electrically isolated therefrom. One of the circuit levers is pivotably movable into contact with and away from the third circuit element connected to one controllable circuit. The second circuit lever is pivotably movable into contact with and away from the second circuit element connected to the other controllable circuit. In order to maintain a desirable symmetrical array of connecting terminal lugs on the switch body, and to position the actuating element substantially centrally in relation thereto, an arrangement of the circuit elements on the interior of the switch case is provided by means of the novel bridging connection for the yoke and by its electrical isolation from the third circuit element positioned from said yoke while still maintaining its position in the same general region within the switch case.

In order to accomplish this symmetrical array and to provide the proper operating conditions therefor, there is provided, in one embodiment, an extension or tongue on the third circuit element that extends into a region of the switch case where it is readily contacted by the first contact lever. Since one of the requisite functions of a progressive switch requires the maintenance of a closed circuit for one of the circuits during two separate circuit controlling conditions of the switch, the tongue extension has, in one embodiment, a characteristic of resilience so that contact between said tongue and said first circuit lever is maintained continuously during two positions of the actuating mechanism of the switch.

The circuit lever is moved from one circuit position to a succeeding circuit position by operation of a toggle, slide, push, tipper or other type of actuator mechanism containing a spring actuated element which yieldably maintains the lever in any selected one of the various circuit positions until the element is moved into another selected circuit position.

The switch of the present invention comprises an arrangement of simple stamped and molded parts which are inexpensive to fabricate and which are easily assembled. Since the working parts are subjected to comparatively little stress, the switch is capable of performing for long periods of time without failure.

Still other objects and advantages of the invention will be apparent from the specification.

The features of novelty which are believed to be characteristic of the invention are set forth herein and will best be understood, both as to their fundamental principles and as to their particular embodiments by reference

to the specification and accompanying drawings, in which:

FIGURE 1 is a perspective view of a typical switch assembly embodying the present invention;

FIG. 2 is a greatly enlarged vertical section view, taken on line 2—2 of FIG. 1, some parts being shown in elevation, and showing the circuit levers in respective positions where both electrical circuits to be controlled are open;

FIG. 3 is similar to FIG. 2 except that the toggle element has moved the circuit lever elements into a position where only one of said circuits is closed;

FIG. 4 is similar to FIGS. 2 and 3, except that the toggle element has moved the circuit levers into respective positions where both circuits are closed;

FIG. 5 is a further enlarged view, taken on line 5—5 of FIG. 3, some parts being omitted, some parts being broken away and some parts being shown in outline;

FIG. 6, similar to FIG. 5, is taken on line 6—6 of FIG. 3;

FIG. 7 is an enlarged fragmentary view taken on line 7—7 of FIG. 3, some parts being shown in outline form; and

FIG. 8 is a greatly enlarged, exploded view, in perspective, of some of the components of the switch mechanism.

Referring now to the drawings in detail, particularly FIGS. 1–4, the switch of the present invention comprises a box-like molded case, generally designated 21, made of a suitable electrically insulating material such as synthetic resin, Bakelite, or the like, and having a pair of opposing end walls 22, and a pair of side walls 23. The bottom of case 21 is enclosed by a floor 24.

The open top of case 21 is covered by top plate 25 made of a suitable material such as sheet metal, or the like, and whose ends are substantially co-extensive with the outer surfaces of respective end walls 22. The sides of top plate 25 are recessed to coincide with recesses 26 in the outer surfaces of side walls 23 of case 21. See FIGS. 5 and 6. Top plate 25 has a central aperture 27 through which various switch actuating elements project, as will be described hereinbelow.

Positioned over top plate 25 is a bracket 31 of sheet metal, which has a central, circular aperture, coaxial with aperture 27 in plate 25. Bracket 31 has a pair of opposed downwardly extending leaves 32 which fit within respective recesses 26 of side walls 23. The lower end of each leaf 32 is provided with a pair of spaced apart lugs 33 which tensionally grasp respective recesses 34, in the bottom surface of floor 24 to cause bracket 31 to secure top plate 25 firmly on the top of case 21. See FIGS. 1 and 7.

A tubular threaded bushing 36 is secured at its lower end by suitable means, such as a force fit or the like, between top plate 25 and bracket 31 at the inner peripheral areas surrounding their respective central apertures for firm connection to case 21.

The interior wall of bushing 36 has an inwardly curving annular shoulder 37 intermediate its ends, said shoulder being adapted to cooperate with a toggle element 38, a portion of whose surface is curved to mate movably with said shoulder, whereby said toggle may move pivotally relative to said bushing. Toggle 38 has an upwardly extending handle 39 for manual operation, and a lower tubular extension 41 which extends through aperture 27 of plate 25 and into the interior of case 21. Handle 39 has a bore 42, toggle 38 has a bore 43, and tube 41 has a bore 44, all of said bores being axially aligned and the latter two longitudinally accommodating an elongated control pin 45 which is normally urged outwardly from bore 44 by captive spring 46 positioned in bores 42 and 43. Control pin 45 is made of a suitable electrically insulating material, such as Bakelite, nylon, or the like, and has an outer end of slightly reduced diameter in the

form of a smoothly rounded nib 47 extending downwardly to actuate the movable circuit contact levers of the switch, as will be described hereinbelow. While nib 47 is being urged downwardly against the circuit lever, spring 46 acting upon the inner end of bore 42 urges toggle 38 upwardly and snugly against shoulder 37 without preventing pivotal motion of said toggle relative to bushing 36.

Positioned in floor 24 of case 21 is a pair of spaced apart, electrically conducting studs 51 and 52 which extend through said floor and are incorporated securely therein by means of molding or the like. Stud 51 has a rivet head 53 and stud 52 has an electrically conducting contact head 54, respectively, which extend into the interior of case 21. The lower ends of said studs on the outer surface of floor 24 have rivet heads 55 and 56, respectively, which firmly secure electrically conductive brackets 57 and 58, to the bottom of said case. Brackets 57 and 58 have downwardly extending electrically conducting lugs 61 and 62, respectively, which serve as terminals to which separate electrical circuits are connectible.

Positioned intermediate studs 51 and 52 is an electrically conducting stud 63 which also extends through floor 24 and is incorporated securely therein by means of molding or the like. The lower end of stud 63 extends downwardly to the exterior of case 21 and has a rivet head 64 which firmly secures electrically conductive bracket 65 to the bottom of said case. Bracket 65 has a downwardly extending lug 66 which serves as a terminal to which an electrical circuit is connectible.

The upper end of stud 63 extends into the interior of case 21 and terminates in a rivet head 71 which is positioned within a lowered recess 72 in floor 24 of case 21. Secured to floor 24 by head 71 of stud 63 in an electrically conductive contact element 73 having an integral extension or tongue portion 74 which extends upwardly and obliquely into the interior of case 21.

Securely firmly to floor 24 of case 21 by means of rivet head 53 of stud 51 is a base 76 of a bridge yoke element, generally designated 77. Integrally formed with base 76 is a pair of identical, opposing, longitudinally extending, substantially parallel, spans 78 and 79 which are aligned against the respective interior surfaces of walls 23. See FIGS. 7 and 8. Each span 78 and 79 has a pair of upwardly extending spaced apart fingers 81 and 82 forming therebetween a U-shaped recess, and defiing horizontal yoke shoulders 83 and 84, respectively.

Although the outer ends of spans 78 and 79 are shown sustained in cantilever fashion in FIGS. 2, 3 and 4, said outer ends may, in other embodiments, rest upon suitable portions of floor 24 of case 21.

Pivotally supported on bridge yoke 77 is a pair of elongated, electrically conductive contact levers 86 and 87, the latter being positioned contiguously above and resting upon the former. Intermediate the ends of each lever 86 and 87, is a pair of laterally extending integral ears 88 and 89, respectively, said ears extending between fingers 81 and 82 of spans 78 and 79, with ears 88 of lever 86 resting pivotably upon shoulders 83 and 84 of said spans. In the region between ears 88, lever 86 has a downwardly extending recess 91 and in the region between ears 89 of lever 87, has a similar downwardly extending recess 92, both of which nest with each other so that said levers lie adjacent each other when suspended by bridge yoke 77.

Lever 86 has a longitudinally extending integral contact arm 93 which terminates in a downwardly curving lip 94 which, when lever 88 is moved pivotally, comes in contact with the outer portion of tongue 74 to close the electrical circuit between terminal lugs 66 and 61. Lever 86 has an integral blade 95 extending in a direction opposite to, and arrayed at an angle from, contact arm 93.

Lever 87 has an integral contact arm 97 to the outer end of which is connected contact button 98. When lever 87 is moved pivotally, button 98 comes in contact with contact head 54 of stud 52 to close an electrical circuit between terminal lugs 62 and 61.

Lever 87 has an integral blade 99 extending in a direction opposite to and arrayed at an angle from an inner portion of contact arm 97. Blade 99 has an extension 101 which serves to stabilize both levers 86 and 87 when they are both in the open circuit position, by resting upon rivet head 53. Alternatively, lever 86 may be provided with an integral extension formed on blade 95, similar to or in place of extension 101 on blade 99, and extending in such manner as to rest upon rivet head 53 or any other suitable part of case 21 so that the positions of levers 86 and 87 would be stabilized when nib 47 of toggle 38 bears down upon blades 99 and 95 of said levers, as shown in FIG. 1.

By virtue of the V-shaped array between arm 93 and blade 95 of lever 86, and of arm 97 and inner portion of blade 99 of lever 87, said elements nesting adjacent each other, the operation of yieldable nib 47, moving longitudinally along the top of lever 87, causes both of said levers to move pivotally in relation to bridge yoke 77.

In the first position of toggle 38, as exemplified in FIG. 2, when nib 47 is moved to the left by the movement of toggle handle 39 to the right, said nib bears downwardly upon blades 95 and 99 of levers 86 and 87, respectively, causing said levers to tilt into a position where contact button 98 is spaced apart from contact head 54 of stud 52 and contact lip 94 is spaced apart from tongue 74 of circuit element 73.

It should be noted that whether spans 78 and 79 are cantilevered, as illustrated in the drawings, or rest on the floor 24 of case 21, all of bridge yoke 77 is itself electrically isolated from stud 63 and its rivet head 71, as well as from contact head 54 of stud 52. Spans 78 and 79 are spaced apart from each other a sufficient distance (FIG. 7) so that even if stud 63 extended further into the interior of case 21, nevertheless, said spans would be electrically isolated from rivet head 71 and, accordingly, from the circuit to which stud 63 is connected by way of terminal lug 66. Thus, in the position of the elements in FIG. 2, both circuits to which terminal lugs 66 and 62 are connected are in the "off" or open condition.

In a second position of toggle 38, as exemplified in FIG. 3, when nib 47 has been moved to a central position by the movement of toggle handle 39 to a vertical position, said nib bears downwardly upon recesses 91 and 92 of levers 86 and 87, respectively. In this position, the pivotal motion of lever 86 from its previous position as shown in FIG. 2 has now caused lip 94 to come into contact with tongue 74, thereby closing the electrical circuit between terminal lugs 66 and 61. In this position of toggle arm 39 (FIG. 3), contact button 98 still remains spaced apart from contact head 54 of rivet 52 so that the circuit to which terminal lug 62 is connected remains in the "off" or open condition.

In a third position of toggle 38, as exemplified in FIG. 4, when nib 47 is moved to the right by the movement of toggle handle 39 to the left, said nib bears downwardly upon contact arm 97 of lever 87. In this position (FIG. 4), contact button 98 has been caused by the pivoting action of lever 87 to come into contact with contact head 54 of stud 52 whereby the circuit between terminal lugs 61 and 62 is now closed. While this action has taken place, lever 87 has pivoted independently of lever 86, and at the same time, lever 86 is maintained in a position where lip 94 still remains in contact with tongue 74. Thus, according to the positions of the component parts of the switch as shown in FIG. 4, both circuits to which terminal lugs 62 and 66 are connected are in the "on" or closed condition in relation to the common circuit to which terminal lug 61 is connected.

The particular array of component parts of the switch as illustrated in the drawings and described herein is conductive to the manufacture of swtiches having a sym-

metrical array of circuit elements and terminal lugs to which various circuits may be readily and conveniently connected. In some embodiments within the purview of the invention herein, extension or tongue element **74** may be dispensed with and the head **71** of element **63** may be extended across the floor **24** of case **21** toward contact head **54** so that lip **94** of element **93** can come in contact with head **71** in the same manner and in the same sequence of operation as shown in FIGS. 2, 3 and 4, suitable adjustments in dimensions of these elements being made to accomplish this result. Thus, even with such variations in the array of the circuit elements, and with the bridging yoke extending across the center of the case so that it may accommodate a pivoting actuating element such as a toggle or the like, the switch assembly will still possess a substantial symmetry in respect of the actuating member in relation to the terminal lugs.

It is claimed:

1. A progressive switch comprising a case, first and second spaced apart circuit elements in said case, a third circuit element in said case positioned intermediate said first and second elements, an electrically conductive yoke in said case connected to said first circuit element, said yoke extending into the region of but spaced apart from said third circuit element, a first electrically conductive circuit lever, a second electrically conductive circuit lever, both of said levers being pivotally mounted on said yoke, and means for pivotally moving said first and second levers, said first lever being movable into a position to make electrical connection with said third circuit element, said second lever being movable into a position to make electrical connection with said second element.

2. A switch according to claim 1 wherein said yoke comprises a base connected to said first circuit element, a pair of spaced apart integral spans formed on said base and extending into the region of said third circuit element, a shoulder on each of said spans, both of said shoulders jointly forming a support for both of said circuit levers.

3. A switch according to claim 1 wherein said levers are movable into any selected one of the three following positions: (*a*) neither of said levers is in contact with said third and said second circuit elements, respectively; (*b*) said first lever only is in contact with said third circuit element; and (*c*) said first lever is in contact with said third circuit element and said second lever is in contact with said second circuit element.

4. A switch according to claim 3 wherein both of said levers are in electrical connection with each other, and further comprising an actuator element movably mounted in said case, said element when moved causing said levers to assume said three positions.

5. A progressive switch comprising a case, first and second spaced apart circuit elements in said case, a third circuit element in said case positioned intermediate said first and second elements, an electrically conductive yoke in said case connected to said first circuit element, said yoke extending into the region of but spaced apart from said third circuit element, a first electrically conductive circuit lever, a second electrically conductive circuit lever, both of said levers being pivotally mounted on said yoke, said first lever being movable into a position to make electrical connection with said third circuit element, said second lever being movable into a position to make electrical connection with said second element, mating indentations on both said first and second levers whereby said second lever is nested against said first lever, and an actuator element pivotally mounted in said case, said actuator element being operative to urge both of said levers simultaneously into different positions according as said actuator is manipulated.

6. A progressive switch comprising a case, first and second spaced apart circuit elements in said case, a third circuit element in said case positioned intermediate said first and second elements, a resiliently electrically conductive extension on said third circuit element, an electrically conductive yoke in said case connected to said first circuit element, said yoke extending into the region of but spaced apart from said third circuit element and said extension, a first electrically conductive circuit lever, a second electrically conductive circuit lever, both of said levers being pivotally mounted on said yoke, means for moving said first lever by pivotable action into contact with and apart from said extension and for moving said second lever by pivotal action into contact with and apart from said second element.

7. A switch according to claim 6 wherein said levers are movable into any selected one of the three following positions: (*a*) neither of said levers is in contact with said third and second circuit elements, respectively; (*b*) said first lever only is in contact with said extension on said third circuit element; and (*c*) said first lever is in contact with said extension on said third circuit element and said second lever is in contact with said second circuit element.

8. A progressive switch comprising a case, first and second spaced apart circuit elements in said case, a third circuit element in said case positioned intermediate said first and second elements, an electrically conductive yoke in said case connected to said first circuit element, said yoke extending into the region of but spaced apart from said third circuit element, a contact element connected to said third circuit element and extending into the interior of said case, a first electrically conductive circuit lever, a second electrically conductive circuit lever, both of said levers being mounted on said yoke and being jointly pivotable relative thereto, and means for moving said first lever into contact with and apart from said contact element and for moving said second lever into contact with and apart from said second circuit element.

9. A progressive switch comprising a case, first and second spaced apart circuit elements in said case, a third circuit element in said case positioned intermediate said first and second elements, an electrically conductive yoke in said case connected to said first circuit element, said yoke extending into the region of and electrically isolated from said third circuit element, a first electrically conductive circuit lever, a second electrically conductive circuit lever, both of said levers being in electrical connection with each other and being mounted on said yoke and jointly pivotable relative thereto, and means for pivotally moving said first and second levers, said first lever being pivotable into contact with and apart from said third circuit element, said second lever being pivotable into contact with and apart from said second circuit element, said first and second levers being movable into: (1) a first circuit condition where both said levers are spaced from said third and second circuit elements, respectively; (2) a second circuit condition where only said first lever is in electrical connection with said third circuit element; and (3) in a third circuit condition where said first lever continues to remain in electrical connection with said third circuit element and said second lever is in electrical connection with said second circuit element.

10. A switch according to claim 9 wherein said third circuit element has the characteristics of resilience whereby, during the positions of said first circuit lever in said second and third circuit conditions, there is continued electrical connection between said first lever and said third circuit element.

11. A switch according to claim 9 wherein both of said levers are at least partially V-shaped and nested one in the other, and wherein the means for pivoting the levers further comprises an actuator element mounted in said case and operative resiliently upon both of said levers simultaneously to move the latter selectively into any of said three circuit positions.

12. A switch according to claim 9 and further comprising a resilient electrically conductive extension on said third circuit element, said extension being located in a position on the interior of said case where it maintains

contact with said first circuit lever in the second and third circuit conditions.

13. A progressive switch comprising a case, first and second spaced apart circuit elements in said case, a third circuit element in said case positioned intermediate said first and second elements, an electrically conductive yoke in said case connected to said first circuit element, said yoke extending into the region of but spaced apart from said third circuit element, a first electrically conductive circuit lever, a second electrically conductive circuit lever, both of said levers being mounted on said yoke and being pivotable relative thereto, and means for moving said first lever into contact with and apart from said third circuit element and for moving said second lever into contact with and apart from said second circuit element, both of said levers being pivotable jointly when both are moved apart from their respective contact elements, both of said

levers being pivotable jointly when said first lever only is brought into contact with said third circuit element, and said second lever being pivotable individually when the latter is brought into contact with said second circuit element while said first lever is maintained in contact with said third circuit element.

References Cited by the Examiner

UNITED STATES PATENTS

3,031,547 4/62 Sorenson ---------- 200—67

FOREIGN PATENTS

1,108,438 1/56 France.

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