Feb. 20, 1962 A. N. GROTZ 3,022,394

SINGLE POLE PROGRESSIVE SWITCH

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Fig. 4.

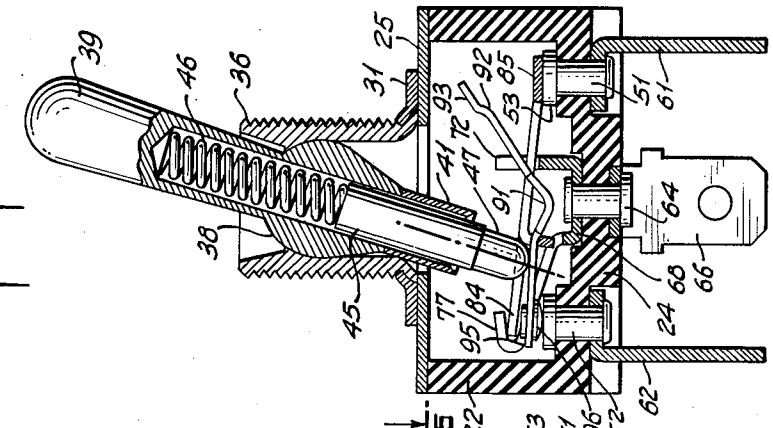


Fig. 3.

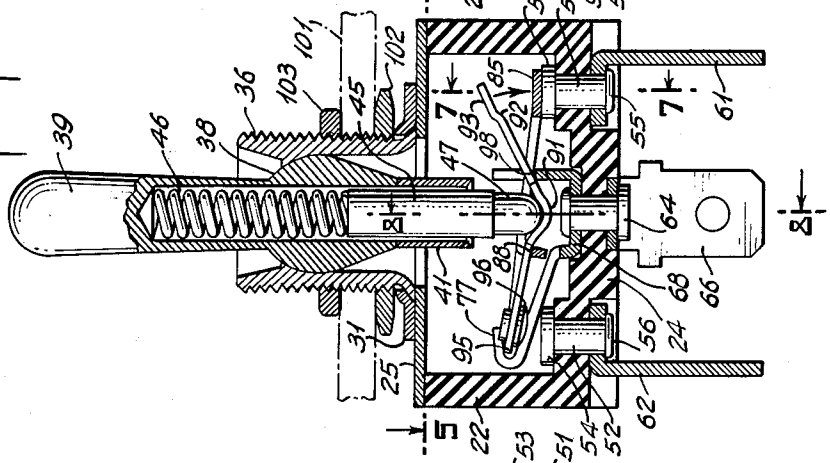


Fig. 2.

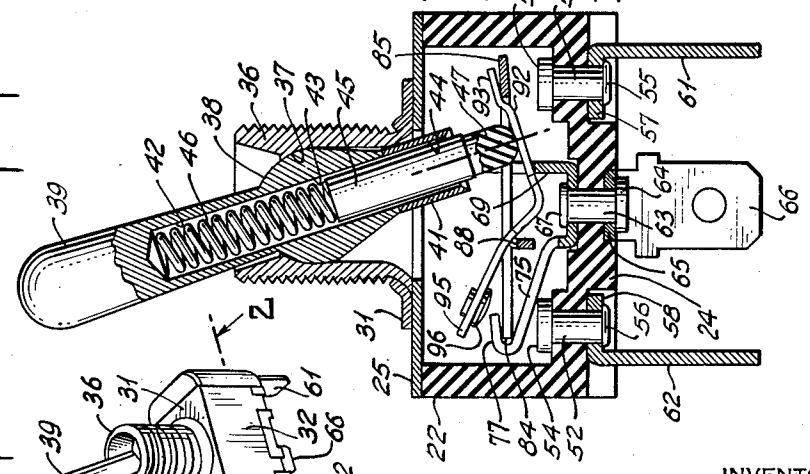
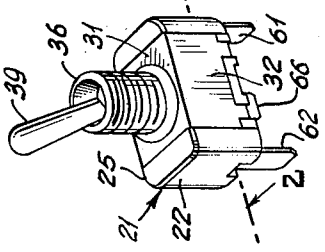


Fig. 1.



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Fig. 5.

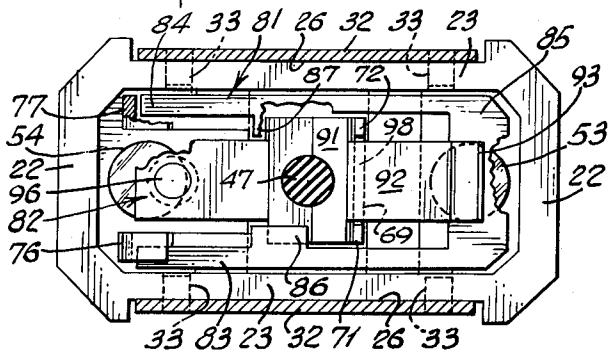


Fig. 7.

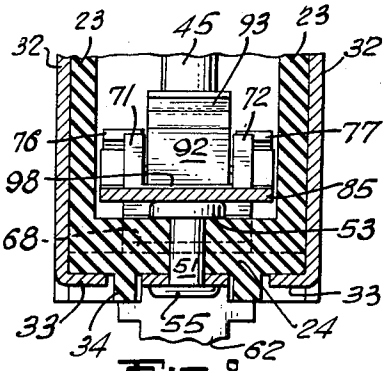


Fig. 6.

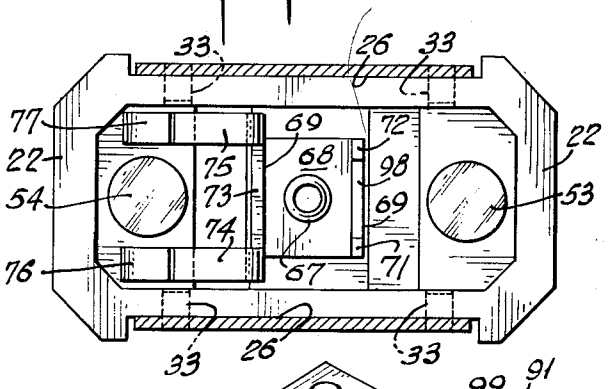


Fig. 8.

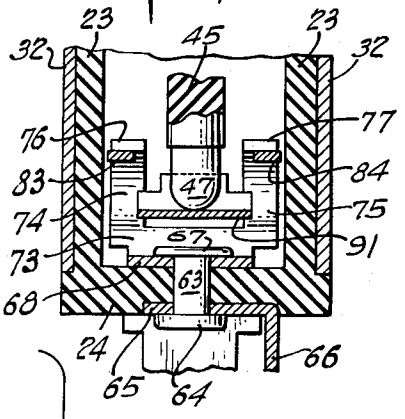
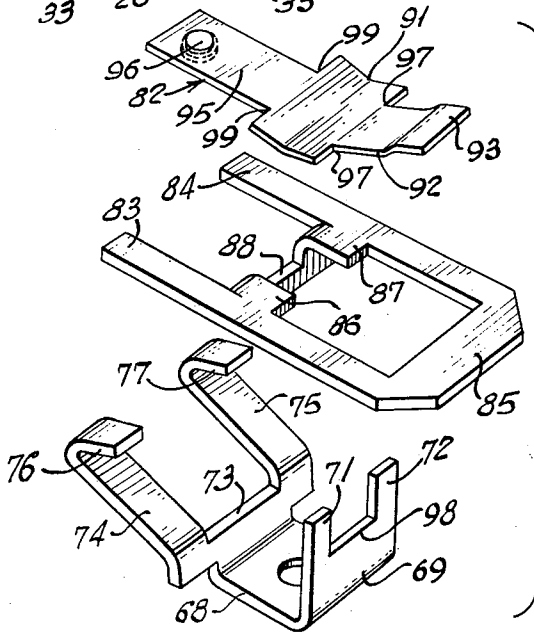


Fig. 9.



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3,022,394

SINGLE POLE PROGRESSIVE SWITCH

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Filed Oct. 2, 1959, Ser. No. 844,111
19 Claims. (Cl. 200—68)

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

The salient feature of the present invention is the provision of a single pole progressive switch arranged to control two electrical circuits in a sequence as follows: both circuits "off," one circuit "on," two circuits "on," said electrical conditions being selectable in forward, reverse or mixed sequence. This function of the invention is accomplished by a pair of interengaging circuit levers which cooperate with each other and with a support yoke to pass from one circuit position to another by pivoting on interrelated fulcrums formed by the levers and yoke. The circuit levers are moved from one circuit position to succeeding circuit positions by operation of a toggle containing a spring actuated pin which yieldably maintains the interengaging circuit levers in any selected one of the various circuit positions until the pin is moved into other selected circuit positions.

The switch of the present invention comprises an arrangement of simple stamped 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 unusually 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 a position where both circuits are open;

FIG. 3 is similar to FIG. 2, wherein the toggle element has moved the control pin into a position where one circuit is closed;

FIG. 4 is similar to FIGS. 1 and 2, wherein the toggle element has moved the control pin into a position where two circuits are closed;

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

FIG. 6 is a view similar to FIG. 5, with some additional parts being omitted;

FIG. 7 is a view taken on line 7—7 of FIG. 3, further enlarged, some parts being omitted;

FIG. 8 is a view taken on line 8—8 of FIG. 3, further enlarged, some parts being omitted; and

FIG. 9 is a greatly enlarged exploded view of the yoke and circuit lever elements comprising part of the mechanism of the present invention.

Referring now to the drawings in detail, the switch of the present invention comprises the 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 top of case 21 is covered by a top plate 25, made of a siutable material such as sheet metal, or the like, and whose ends are coextensive 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, FIGS. 5 and 6. Top plate 25 has a central aperture through which various switch 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 having substantially the same diameter as and being positioned substantially coaxially in respect of the aperture of top plate 25. Bracket 31 has a pair of 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 extend into respective recesses 34 in the bottom of floor 24 to cause bracket 31 to secure top plate 25 firmly in the top of case 21.

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. 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 longitudinally accommodating an elongated control pin 45 which is normally urged outwardly from bore 44 by captive spring 46. 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 levers of the switch, as will be described hereinbelow. While nib 47 is being urged downwardly against the circuit levers, 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. Each of said studs has an electrically conducting contact head 53 and 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 electrical circuitry is connectible.

Positioned intermediate studs 51 and 52 is an electrically conducting stud 63 which also extends through floor 24 and is incorporated securely therin 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 an 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 has a rivet head 67 which secures an electrically conducting support or yoke 68 firmly to floor 24.

One side of yoke 68 has an upwardly extending arm

69 which terminates in a pair of spaced apart short fingers 71 and 72. The other side of yoke 68 has a short riser 73 which terminates in a pair of long upwardly and outwardly extending spaced apart fingers 74 and 75, the upper ends of which are formed into inwardly extending hooks 76 and 77. FIGS. 2, 3, 4 and 9.

Positioned in interengaging relationship with each other and with yoke 68 are electrically conducting circuit levers, generally designated 81 and 82, respectively. Circuit lever 81 comprises a pair of spaced apart elongated bars 83 and 84 which are connected together at one end by means of contact bar 85. Intermediate the ends of bars 83 and 84 is a pair of inwardly extending shoulders 86 and 87. A portion of each shoulder 86 and 87 curves downwardly and are joined integrally by bridge bar 88. The free ends of bars 83 and 84 are engaged by hooks 76 and 7, respectively. FIGS. 2, 3 and 4.

Circuit lever 82 comprises a V-shaped outwardly extending intermediate portion 91, one side of which has an integral blade 92 of reduced width terminating in a slightly bent lip 93. The other side of portion 91 has an outwardly extending blade 95 of reduced width to tthe outer end portion of which is connected a contact button 96.

Circuit levers 81 and 82 are assembled in relation to each other and to yoke 68 in a manner whereby lever 82 is pivotable into three different positions. At junctures 97 between V-portion 91 and blade 92, lever 82 is pivotable on the fulcrum formed by shoulder 98 between fingers 71 and 72 of yoke 68. At junctures 99 between V-portion 91 and blade 95 lever 82 is also pivotable on the fulcrum formed by bridge bar 88 of lever 81.

The pivoting action of lever 82 is produced by nib 47 traversing from blade 92 to V-shaped portion 91, thence to blade 95, and in reverse sequence, as desired, according as handle 39 of toggle 38 is manipulated by the operator of the switch.

Assuming, for example, that terminal 61 is connectible to a "first" circuit, terminal 62 is connectible to a "second" circuit, and terminal 66 is connectible to an electric power source, it will be noted that FIGS. 2, 3 and 4 represent, respectively: (*a*) both circuits open; (*b*) "first" circuit closed; and (*c*) "first" and "second" circuits closed.

Since yoke 68 and circuit levers 81 and 82 are made of electrically conductive metal, and are in contact with each other in all of the positions described herein, said levers are capable of establishing electrical connection from terminal 66 to terminal 61, or to both terminals 61 and 62 by way of contact heads 53 and 54.

Referring to FIG. 2, toggle 38 is in its first position where nib 47 of pin 45 bears down upon blade 92 of circuit lever 82, causing blade 95 to extend upwardly. In this position V-shaped portion 91 at juncture 97—97 engages shoulders 86 and 87, and urges the latter upwardly causing lever 81 to pivot upwardly on a fulcrum formed between the ends of bars 83, 84, and hooks 76, 77 of yoke 68. The upward pivotal motion of lever 81 is limited by its contact bar 85 being engaged by lip 93 of lever 82. In the FIG. 2 position, neither of the circuit levers are in contact with contact heads 53 and 54, and thus both circuits are in the open condition.

When handle 39 of toggle 38 is manipulated to cause nib 47 of pin 45 to move into the apex of the V-shaped portion 91 of circuit lever 82 (FIG. 3), circuit lever 82 is pivoted on the shoulder 98 of upwardly extending arm 69 of yoke 68 and causes lip 93 to lift away from contact bar 84. At the same time blade 95 of lever 82 at juncture 99—99 bears down upon bridge 88 of lever 81 whereby the latter pivots downwardly causing contact bar 85 to establish electrical connection with contact head 53 of stud 51, thereby closing the circuit to which terminal 61 is connected. In this position as shown in FIG. 3, contact button 96 of circuit lever 82 is still spaced apart from contact head 54 of rivet 52 whereby the circuit to which terminal 62 is connected remains in the open condition.

When arm 39 is further manipulated to cause toggle 38 to assume the third position shown in FIG. 4, nib 47 of pin 45 has moved along blade 95 of lever 82 across the fulcrum formed by bridge 88, thereby causing circuit lever 82 to pivot thereon into the position where contact button 96 is brought to bear upon contact head 54 of rivet 52, thereby closing the circuit with which terminal 62 is connected. In this position the pressure of nib 47 through blade 95 upon bridge 88 of lever 81 maintains the closed circuit position between contact head 53 and contact bar 85 of lever 81.

Any of the three circuit conditions shown in FIGS. 2, 3 and 4, may be established at will by manipulation of toggle arm 39 in any desired sequence. If nib 47 is made of nylon, for example, its rounded tip slides smoothly along various parts of lever 82 from one position to another. Captive spring 46 provides sufficient yieldable pressure upon nib 47 to maintain levers 81 and 82 in their different selected circuit positions while at the same time said nib is permitted to retract slightly when passing over the location of the fulcrums defined by shoulder 98 of yoke 68 and by bridge 88 of lever 81.

The switch assembly illustrated and described herein may be connected to a suitable mounting board 101, or the like (FIG. 3), secured between nut 102 and threaded ring 103 cooperating with the peripheral threads of bushing 36. Mountings other than the threaded bushing may be utilized, depending upon the structure of the apparatus to which it is connected.

It is understood that the switch described and claimed herein may be formed wtih multiple sets of yoke 68, lever 81 and lever 82, in order to provide for the control of a corresponding plural number of electrical circuit sets.

It is also contemplated that instead of toggle arm 39 operating a yieldable nib 47, for pivoting the contact levers 81 and 82, other means for operating these elements, such as sliders, rollers or cams, may be yieldably urged along the surface of lever 82 to perform the requisite sequence of contact lever pivoting actions as illustrated in FIGS. 2, 3 and 4.

In the specification, there are explained the principles of the invention, and the best mode in which it is contemplated applying those principles, so as to distinguish the invention from other inventions; and there is particularly pointed out and distinctly claimed the part, mode or combination which is claimed as the invention or discovery.

While there is shown and described certain proferred embodiments of the invention, it will be understood that modifications and changes may be made without departing from the function and scope thereof, as will be clear to those skilled in the art.

It is claimed:

1. A progressive switch comprising a case, first and second spaced apart circuit contacts in said case, a support in said case intermediate said circuit contacts, first and second circuit levers pivotally mounted on said support, said first lever being adapted to make electrical connection with said first contact, said second lever being adapted to make electrical connection with said second contact, said two levers also being operable pivotally relative to each other, said second lever in one pivotal action on said support bearing against said first circuit lever and urging it pivotally into electrical connection with said first contact and in a second pivotal action pivoting on said first lever and coming into electrical connection with said second contact.

2. A switch according to claim 1 wherein said second lever in said second pivotal action maintains said first lever electrically connected to said first contact.

3. A swtich according to claim 1 wherein said case is made of insulating material and said two levers and said support are made of electrically conductive material.

4. A switch according to claim 1 wherein in one posi-

tion neither of said levers make electrical connection with their respective contacts.

5. A switch according to claim 1 wherein said levers are positionable in any one of three different positions to bring about any selected one of the following electrical conditions: (*a*) neither lever is in electrical connection with its respective contact; (*b*) said first lever only is in electrical connection with said first contact; and (*c*) said second lever is in electrical connection with said second contact while said first lever is maintained in electrical connection with said first contact.

6. A switch according to claim 1 wherein said levers are positionable in any one of three different positions to bring about any selected one of the following electrical conditions: (*a*) neither lever is in electrical connection with its respective contact; (*b*) said first lever only is in electrical connection with said first contact; and (*c*) said second lever is in electrical connection with said second contact while said first lever is maintained in electrical connection with said first contact, and further comprising a pivotable toggle element mounted in said frame, said element bearing yieldably on said second lever and movable thereon into selected positions to produce any one of said electrical conditions of said levers.

7. A switch according to claim 1 wherein said support comprises an electrically conductive yoke positioned intermediate said first and second contacts, an upwardly extending arm on one side of said yoke, a pair of obliquely upwardly extending elements on the other side of said yoke, a hook on the respective ends of each of said oblique elements, and further comprising a bridge element on said first circuit lever intermediate the ends thereof, one end of said first circuit lever being pivotally engaged by said hooks, said second circuit lever being pivotable on said arm of said yoke and upon said bridge element of said first circuit lever, a portion of said second circuit lever engaging a portion of said first circuit lever to produce pivotable motion of the latter relative to said hooks, said levers being movable into any of three selected circuit positions as follows: (*a*) neither lever is in electrical connection with its respective contact; (*b*) said first lever only is in electrical connection with said first contact; and (*c*) said second lever is in electrical connection wtih said second contact while said first lever is maintained in electrical connection with said first contact.

8. A switch according to claim 7, and further comprising a toggle mounted on said case, a spring loaded control pin mounted in said toggle, said pin yieldably engaging said second circuit lever and upon movement of said toggle causing said circuit levers to assume any selected one of said electrical conditions.

9. A switch according to claim 1 wherein said first lever comprises a pair of spaced apart elements and a bridge connecting said elements intermediate the ends thereof and wherein said second lever comprises a V-shaped portion intermediate its ends, said V-shaped portion being broader than the remainder of said second lever, said second lever being pivotable at one edge of said V-shaped portion on said support and being pivotable at the other edge of said V-shaped portion on said bridge.

10. A switch according to claim 9 wherein said support comprises an arm, and a pair of spaced apart hook elements spaced apart from said arm, said second lever being pivotable on said arm and the spaced apart elements of said first lever being pivotally engaged by said hooks.

11. A switch according to claim 10 wherein in one position of said two levers a portion of said second lever engages a portion of said first lever to cause said first lever to be spaced apart from said first circuit contact.

12. A switch according to claim 11, and further comprising a cross bar connecting said two elements of said first lever, said cross bar being engageable by a portion of said second lever to limit the pivotal motion of said first lever away from said first circuit contact.

13. A progressive comprising a case, first and second spaced apart circuit contacts in said case, a yoke in said case intermediate said contacts, first and second circuit levers pivotally mounted on said yoke, said levers being pivotally connected to each other, a control pin pivotally mounted in said case and bearing yieldably upon said second lever, said pin in various selected positions, according as it is pivoted, producing the following lever and contact conditions: (*a*) bearing upon a first portion of said second lever whereby the latter is spaced apart from said second contact and said second lever bears against and maintains said first lever spaced apart from said first contact; (*b*) bearing upon a second portion of said second lever whereby the latter bears upon said first lever and causes it to connect with said first contact; and (*c*) bearing upon a third portion of said second lever and causing the latter to connect with said second contact while said second lever still causes said first lever to maintain connection with said first contact.

14. A switch according to claim 13, comprising first and second pivot junctures on said second lever, said second lever being pivotable at its first juncture on one portion of said yoke and being pivotable at said second juncture on a portion of said first lever, said first lever being pivotable on another portion of said yoke spaced apart from said first portion of said yoke.

15. A progressive switch comprising a case, first and second spaced apart circuit contacts in said case, a third circuit element in said case intermediate said first and second contacts, first and second circuit levers electrically connected to each other and positioned pivotably on said third circuit element and pivotally mounted relative to each other in said case, elements on said first lever and elements on said second lever cooperating with each other whereby predetermined pivotal motion of said second lever produces predetermined pivotal motion of said first lever, said first lever being adapted to make electrical connection with said first contact, said second lever being adapted to make electrical connection with said second contact, an actuating element mounted in said frame and yieldably biased against said second lever and movable into selected positions along said second lever to produce selected pivotal motion on said second lever and in turn upon said first lever.

16. A progressive switch comprising a case, first and second spaced apart circuit contacts in said case, a third circuit element in said case intermediate said first and second contacts, first and second circuit levers electrically connected to each other and positioned pivotably on said third circuit element and pivotally mounted relative to each other in said case, said two levers being interconnected with each other whereby selected pivotal motion of said second lever produces selected pivotal motion of said first lever, said levers being positionable in any one of three different positions to bring about any selected one of the following electrical conditions: (*a*) neither lever is in electrical connection with a circuit contact; (*b*) said first lever only is in electrical connection with said first contact; and (*c*) said second lever is in electrical connection with said second contact while said first lever is maintained in electrical connection with said first contact.

17. A switch according to claim 16, and further comprising an actuating element mounted in said case and yieldably biased against said second lever and movable into selected positions along said second lever to produce said electrical conditions.

18. A progressive switch comprising a case, first and second spaced apart circuit contacts in said case, a third circuit element in said case intermediate said first and second contacts, first and second circuit levers electrically connected to each other and positioned pivotably on said third circuit element and pivotally mounted relative to

each other in said case, first means on said first circuit lever, second means on said second circuit lever cooperating with said first means whereby selected pivotal motion of said second lever produces selected pivotal motion of said first lever, and third means mounted in said case and operative upon said second lever to produce selected pivotal actions upon said second lever and in turn upon said first lever to bring about any selected one of the following electrical conditions: (*a*) neither lever is in electrical connection with a circuit contact; (*b*) said first lever only is in electrical connection with said first contact; and (*c*) said second lever is in electrical connection with said second contact while said first lever is maintained in electrical connection with said first contact.

19. A progressive switch comprising a case, a pair of spaced apart first and second circuit contacts in said case, a third circuit contact positioned in said case intermediate said first two contacts, an electrically conducting yoke connected to said third circuit contact, an integral upwardly extending arm on one side of said yoke, a pair of upwardly obliquely extending circuit element on the other side of said yoke, a hook on each of said oblique elements, an electrically conducting first circuit lever, one end of said first circuit lever being pivotally engaged by said hooks, a bridge element on said first circuit lever, a pair of shoulders on said first circuit lever near said bridge element, the other end of said first circuit lever being pivotable toward and away from said first circuit contact, an electrically conducting second circuit lever, said second lever resting on said bridge element of said first circuit lever and on said arm of said yoke, said bridge element and said arm serving as spaced apart separate fulcrums on which said second circuit lever is selectively pivotable, one end of said second

circuit lever being adapted to establish contact with said second circuit contact, the other end of said second circuit lever being adapted in one position thereof to be engaged by said other end of said first circuit lever whereby the upward pivotal movement of the latter is limited, a toggle on said case, a spring loaded control pin in said toggle, said pin being adapted, when said toggle is moved, to move into various selected positions along said second circuit lever and producing selected pivotal motion of the latter relative to said fulcrums, said control pin in one of its positions bearing upon one portion of said second circuit lever whereby the other portion thereof is spaced apart from the second circuit contact and at the same time bears against the shoulders of said first circuit lever maintaining the latter spaced apart from said first circuit contact, said control pin in a second position bearing against an intermediate portion of said second circuit lever whereby the latter has pivoted on said yoke arm and by its other portion bearing down upon the bridge element of said first circuit lever causing the latter to pivot in said hooks so that its other end establishes contact with said first circuit contact, said control pin in a third position bearing against the other portion of said second circuit lever whereby the latter has moved pivotally around said bridge element and its other end has established contact with said second circuit contact while said other end of said first circuit lever maintains electrical connection with said first circuit contact.

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