United States Patent [19]

Osika

[11] **3,814,871**

[45] **June 4, 1974**

[54] **JOYSTICK CONTROLLER FOR MULTIPLE SWITCH ASSEMBLY**

[75] Inventor: **Thomas F. Osika,** Gary, Ind.

[73] Assignee: **McGill Manufacturing Company Inc.,** Valparaiso, Ind.

[22] Filed: **Mar. 21, 1973**

[21] Appl. No.: **343,352**

[52] **U.S. Cl.** ..... **200/6 A,** 200/16 C, 200/17 R

[51] **Int. Cl.** **H01h 25/00,** H01h 15/10

[58] **Field of Search** ..... 200/6 A, 16 C, 16 D, 17 R; 74/471 R, 471 XY

[56] **References Cited**

UNITED STATES PATENTS

2,683,193	7/1954	Barcus	200/16 C
2,916,567	12/1959	Floam et al.	200/16 C
3,030,459	4/1962	Elliott et al.	200/16 C X
3,235,679	2/1966	Schaad et al.	200/16 C
3,632,910	1/1972	Rushton	200/16 C
3,666,900	5/1972	Rothweiler et al.	200/17 R X

Primary Examiner—James R. Scott

Attorney, Agent, or Firm—Mueller, Aichele & Ptak

[57] **ABSTRACT**

A switch assembly for controlling a plurality of circuit connections includes a first switch section controlled by a joystick actuator which moves a carriage having a plurality of conducting bridge contacts, and a second switch section controlled by a selector knob which moves a carriage having a further conducting bridge contact. The contacts are selectively engageable with a plurality of separate conductors positioned on one side of an insulated circuit board to provide the switch action.

14 Claims, 5 Drawing Figures

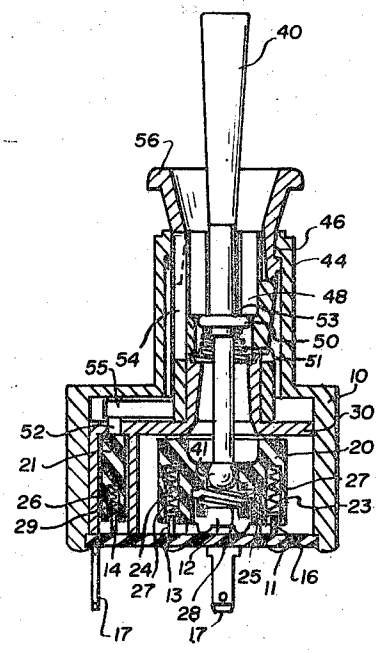


FIG.2

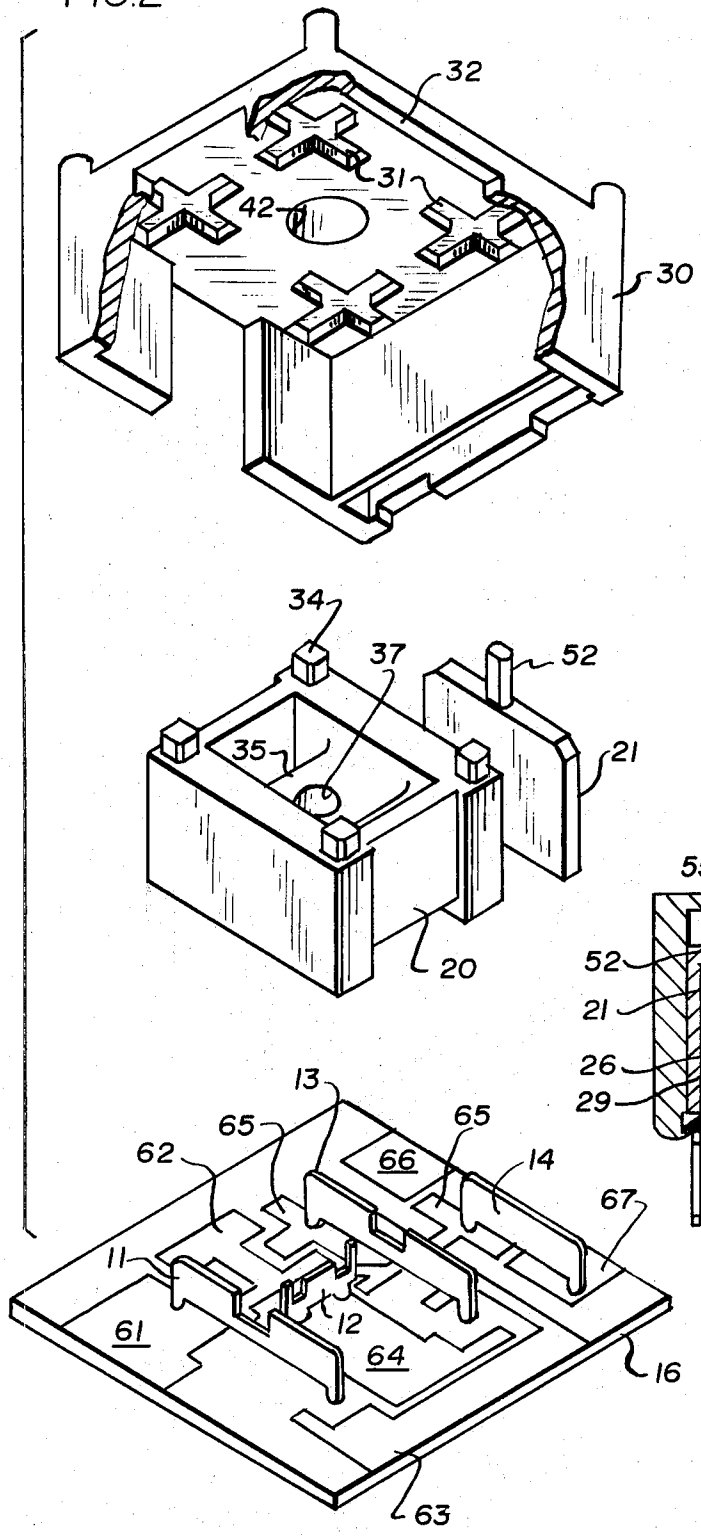

32
31
42
30
34
37
52
35
21
20
13
65
65
62
66
14
67
11
12
61
64
16
63

FIG.1

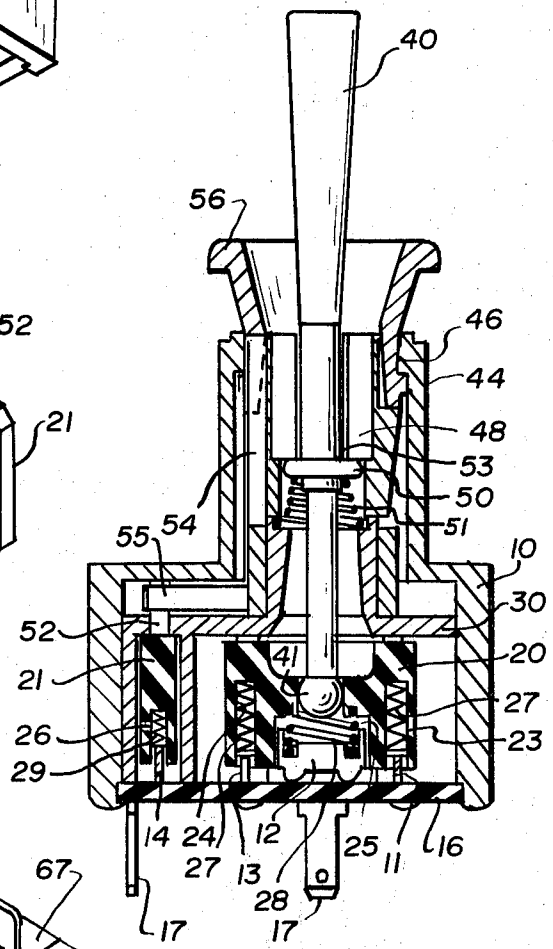

40
56
46
44
48
53
50
51
54
55
10
30
52
20
21
41
27
26
23
29
14
24
12
25
11
16
27
13
28
17
17

FIG.3

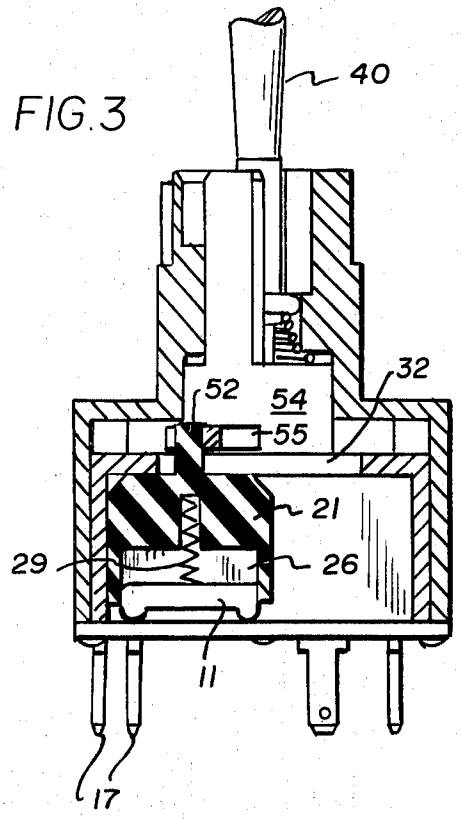


FIG.4

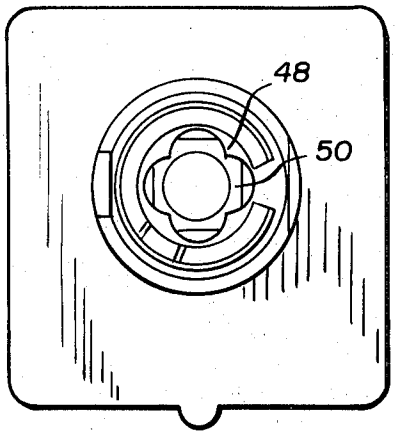
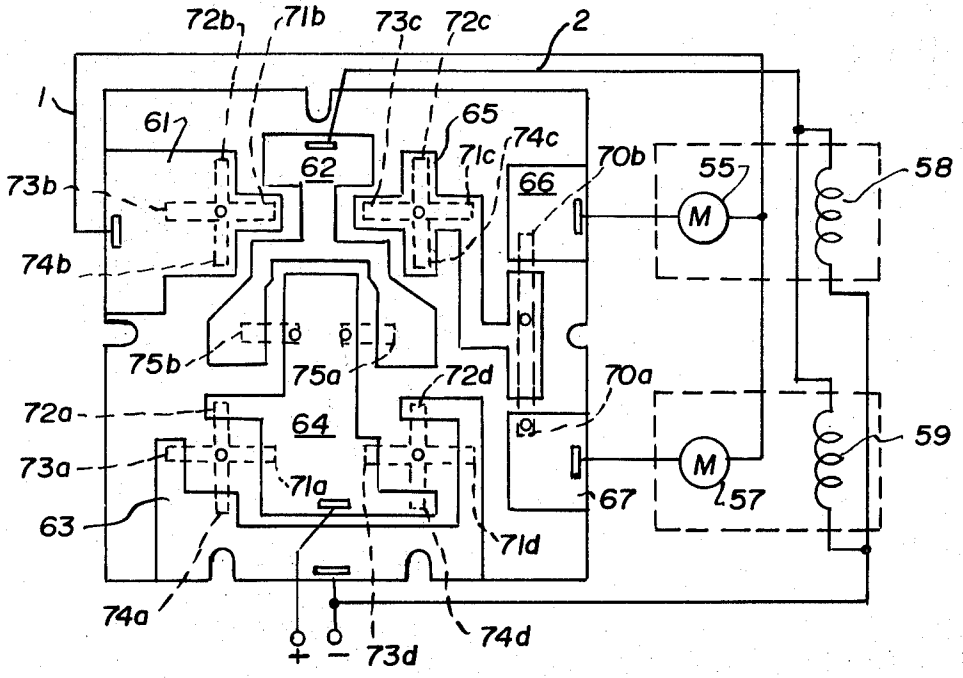


FIG.5



JOYSTICK CONTROLLER FOR MULTIPLE SWITCH ASSEMBLY

BACKGROUND OF THE INVENTION

Although joystick switch assemblies which actuate contacts within a switch housing to open or close switch contacts are known in the art, such switch assemblies have been relatively large and complex, and consequently have been expensive. For example, when such switches include spring leaf contacts, the size of the switch housing required to enclose such assemblies has presented problems particularly with reference to mounting assemblies in close quarters. Moreover, when it has been desired to utilize such switches to perform multiple switching functions, such as operating a plurality of devices in different manners, and switching devices in synchronization, the design problems and the attendant costs in manufacturing such switches have precluded their use in many applications. Furthermore, whereas it would be highly desirable to provide a single switch assembly capable of simultaneously performing a plurality of switching functions, separately and simultaneously, the prior art switch assemblies have been too large for many control applications.

SUMMARY OF THE INVENTION

It is one object of this invention to provide an improved multiple operation switch assembly utilizing an insulating circuit board having a plurality of conductors positioned thereon, and movable bridge contacts for selectively interconnecting the conductors.

It is another object of this invention to provide a switch assembly which permits precise cooperation between a plurality of conductors positioned in a known manner on one side of an insulating circuit board and a plurality of movable conducting bridge contacts for controlling a plurality of switching functions.

It is a further object of this invention to provide a switch assembly having a first switch section controlled by a joystick actuator and a second switch section controlled by a selector knob actuator.

It is still another object of this invention to provide a switch assembly having a joystick actuated carriage movable only in right angle directions for controlling a plurality of switching functions.

In one embodiment of this invention, a multiple operation switch assembly includes a switch housing which encloses a plurality of bridge contacts and which has an insulated circuit board end plate having a plurality of separate conductors positioned in a known manner on one side thereof. A first switch section is formed by a first movable carriage member within the switch housing having a plurality of conducting bridge contacts fitted in recesses in the bottom thereof. The contacts are resiliently biased outwardly from the recesses such that they selectively engage the separate conductors positioned on the insulated circuit board end plate. The first carriage member is positioned within the housing such that projections on the carriage member cooperate with cross-recesses on a support chamber positioned within the housing to cause the carriage to track freely in right angle directions controlled by the cross-recesses. The first carriage member is coupled to and actuated by a joystick actuator member which extends outwardly from the top of the switch housing. Movement of the joystick actuator results in a corresponding opposite movement of the carriage member and the bridge contacts, thereby selectively engaging the separate conductors on the insulated circuit board to complete the electrical circuit.

A second switch section is formed by a second movable carriage having a conducting bridge contact fitted in a recess in the bottom thereof, which contact is resiliently biased outwardly therefrom to selectively engage separate conductors positioned on the same insulated circuit board end plate. The second movable carrier has a projection which extends through a slot in the support chamber and is actuated by a selector knob actuator member positioned on the top of the switch housing. The positioning of separate conductors on one side of the printed circuit board enables the two switch sections to cooperate to perform the intended multiple switching functions of the multiple operation switch assembly.

DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation view in cross-section of the multiple operation switch assembly in accordance with this invention;

FIG. 2 is an exploded view showing the support chamber, the two carriages, the movable conducting bridge contacts, and the circuit board in accordance with this invention;

FIG. 3 is a side elevation view partially in cross-section, of the switch of the invention taken at right angles to the view of FIG. 1;

FIG. 4 is a top elevation view of the switch of FIG. 3; and

FIG. 5 is a top plan view showing the conductor layout on the circuit board of the switch of one embodiment of this invention and the electrical circuitry connected thereto.

DETAILED DESCRIPTION

Referring to the drawings, in FIGS. 1 and 2 there is shown a switch having a housing 10 containing a switch mechanism therein which includes bridge contacts 11, 12, 13 and 14, which selectively engage conductors on an insulated circuit board 16. As shown by FIG. 2, the circuit board 16 has a plurality of separate conductors positioned on the inside surface thereof, and has terminals extending outwardly therefrom, which may be provided in a known manner. A first insulating carriage member 20 and a second insulating carriage member 21 (FIG. 2) have recesses 23, 24, 25 and 26 on the bottom thereof, which recesses receive the conducting bridge contacts 11, 12, 13 and 14. Conducting bridges 11 and 13 are aligned parallel to one another in recesses 23 and 24 and are resiliently biased outwardly by springs 27. Conducting bridge 12 is positioned intermediate and perpendicular to said conducting bridges 11 and 13 in recess 25, and is also biased outwardly by spring 28.

Positioned within the switch housing 10 is a chamber member 30 (FIG. 2) having cross-recesses 31 on the underside thereof and a slotted opening 32 extending along the top of the chamber. The first carriage member 20 has a plurality of projections 34 such that when the carriage member is inserted within the support chamber 30, said projections 34 rest in cross-recesses 31 which permit the projections, and the attendant carriage member 20, to track freely at right angle directions. Additionally, the first carriage member 20 includes an enlarged rectangular carriage head 35 which

is molded integral to and formed centrally thereon with a conical seat having a circular bore 37.

As seen in FIG. 1, the joystick actuator 40 extends inwardly into the switch housing through an opening 42 in the top of chamber member 30 and rests in circular bore 37 in the top of carriage 20. Bore 37 is of a cross-section appropriate to receive an actuating ball 41 molded integral to and positioned at one end of the joystick actuator 40. The switch housing 10 has a neck portion 44 molded integral to and extending outwardly therefrom, which includes an edge lip portion 46 defining an opening. Molded integral within the neck portion and part of the switch housing is a collar 48 through which the joystick actuator 40 extends outwardly. The collar opening (FIG. 4) is in the shape of four lobes which confines the movement of the joystick actuator to right angle directions from the vertical unactuated position.

Intermediate the ends of the joystick actuator 40, a rectangular sleeve 50 having a shoulder 53 is molded integral thereto. The joystick actuator is pivotally mounted within the switch housing by seating the joystick within spring 51 such that the spring engages the sleeve 50 and biases outwardly the sleeve and shoulder to the vertical unactuated position flushed against the base of the collar 48. As the joystick 40 is actuated away from its normal vertical unactuated position, the spring tension on the sleeve 50 is increased, such that when the pressure is removed from the joystick, the spring tension on the sleeve returns the joystick to its normal position. This coaction among the spring, joystick, sleeve and shoulder and collar base, provides a relative quick make or break to the circuit connections, and provides a proper feel to the switch.

Thus, when the joystick 40 is actuated to the up position, the resultant downward movement of the first carriage member 20, guided by projections 34 in recesses 31 of the chamber member 30, results in the selective engagement of the bridge contacts 11, 12 and 13 with the separate conductors positioned on the circuit board end plate, therefore completing the first switch section.

The second switch section includes a second carriage member 21 having a recess 26 for receiving a spring 29 which biases outwardly the conducting bridge 14. Carriage member 21 has a projection 52 (FIG. 2) molded integral to and centrally positioned thereon which projection is inserted through the slotted opening 32 of chamber member 30. Coupled to projection 52 is the arm 55 of a bushing lever 54 which is actuated by selector knob 56, which is inserted in a snap fit engagement between the lip portion 46 and collar 48 of the neck portion 44 of the switch housing 10 around the joystick 40. When rotated, the selector knob 56 engages the bushing lever 54 to move the carriage member 21 thereby positioning bridge contact 14 on the separate conductors on printed board 16.

The insulating circuit board 16 which forms one end of the switch housing 10 includes a plurality of separator conductors 61, 62, 63, 64, 65, 66 and 67 (FIG. 2) which are positioned on one side thereof in a known manner. FIG. 5 shows these conductors, and illustrates one example of an electrical circuit that can be connected to the switch of the invention.

For example, conductor 61 is connected to lead 2 to motors 55 and 57, conductor 62 is connected to solenoids, conductor 63 is connected to a negative supply terminal, conductor 64 is connected to the positive supply terminal, conductor 65 is connected to lead 1 to either motors 55 or 57, conductor 66 is connected to lead 1 to motor 55, and conductor 67 is connected to lead 1 to motor 57.

A typical sequence of operations will now be described to facilitate a more thorough understanding of the present invention. Although numerous applications are intended for the instant switch assembly, there is illustrated in FIG. 5 one representative application.

The application of the switch illustrated involves an electrical circuit having two motors 55 and 57 and two solenoids 58 and 59. As is generally understood, the instant switch assembly provides switching control over the operation of the motors and the solenoids, as desired. For example, in an operating condition the movement or position of selector knob 56 determines the relative position of carriage member 21 and the corresponding position of conducting bridge 14 with respect to the separate conductor areas located on insulating board 16. As depicted in FIG. 2, the position of conducting bridge 14 connects conductor 65 on circuit board 16 with conductor 67, which represents lead 1 to motor 57. By simply rotating the selector knob 56, the carriage 21 and conducting bridge 14 are positioned to bridge separate conductors 65 and 66 to contact lead 1 to motor 55. This is illustrated as position 70b in FIG. 5. This sequence of operations represents the second switch section of the instant invention.

Now assuming the position of conducting bridge 14 is to connect conductor 65 and conductor 67, as shown in FIG. 5, it will be appreciated that when the joystick 40 is moved to the left position, the movement of conducting bridges 11, 12 and 13 will establish the following connections. Conducting bridge contact 11 will connect the positive conductor 64 to conductor 61 which is connected to lead 2 of motor 57, and will rest at points 71*a* and 71*b*. Conducting bridge contact 13 will rest at positions 71*d* and 71*c* to connect the negative conductor 63 to conductor 65 and through bridge 14 to conductor 67, thereby completing the negative connection to lead 1 of motor 57. Conducting bridge contact 12 will move to a position at 75*a* thereby completing the circuit from positive conductor 64 to conductor 62 connected to the solenoids 58 and 59. When the pressure is released on the joystick actuator, the carriage member 20 and associated conducting bridge contacts and the joystick will return to the vertical unactuated position.

When the joystick is moved to the right position, bridge contact 11 is moved to position 73*a* and 73*b* thereby conducting the negative conductor 63 to lead 2 to motor 57, bridge contact 13 is moved to positions 73*d* and 73*c* thereby connecting the positive conductor 64 to lead 1 of motor 57 and bridge contact 12 is moved to position 75*b* thereby completing the connection from the positive conductor 64 to the conductor 62 which is connected to the solenoids 58 and 59.

Conversely, when the joystick actuator 40 is moved to the up or down position, the conducting bridge contact 11 and 13 are moved to rest at 74*a*, 74*b*, 74*c* and 74*d* and 72*a*, 72*b*, 72*c* and 72*d* respectively, thereby completing the electrical circuit to the particular motors as desired. Importantly, in this particular circuit configuration the up or down movement of the joystick actuator 40 and the resultant movement of car-

riage 20 and conducting bridge 12 will not affect a change or energization of solenoids 58 and 59.

From the foregoing, it will be appreciated that the entire switching mechanism is accomplished by the simple expedient of combining a joystick actuated switch mechanism with a selector knob actuated switch mechanism in a compact switch housing, with the two switch mechanisms moving bridge contacts which engage on a single conductor circuit board. The particular design of the switching mechanism and the assembly of the components within the switch housing eliminates the requirement of close tolerances on the switch components. All electric contacts between the conducting contact bridges recessed in the first and second carriage members and the circuit board conductors are under controlled pressure established by the spring biased conducting bridge contacts in contact with the conductor surfaces of the circuit board. The construction and configuration of the instant switching mechanism is advantageous in the utilization of space and, accordingly, relatively small switching units may be fabricated which offer multiple switching positions for the particular intended purpose.

I claim:

1. A switch for controlling a plurality of circuit connections, including in combination,

housing means having an open end,

a substantially flat insulating board secured to said housing means and having on one side thereof a plurality of separate conductors having spaced portions,

a plurality of movable conducting bridge contacts selectively engaging said conductors,

support means for said bridge contacts including an insulating carriage having recesses for receiving said contacts, and springs engaging said contacts and resiliently holding the same against said conductors,

frame means positioned in said housing means for receiving said carriage and cooperating with said carriage to limit the movement thereof to cause said bridge contacts to move in predetermined paths whereby said ends thereof selectively engage said conductors, and

actuating means extending outwardly from said housing means and operatively connected to said carriage for moving the same and for positioning said bridge contacts with respect to said separate conductors on said insulating board.

2. The switch of claim 1 wherein said insulating board has first, second, third and fourth conductors thereon, and said carriage is movable only in first and second directions at right angles to each other, and including a first bridge contact which operates to selectively connect said first conductor to said second and third conductors in response to movement of said carriage, and a second bridge contact which selectively connects said fourth conductor to said second conductor when said carriage moves in said first direction.

3. The switch of claim 2 wherein said insulating board has a fifth conductor thereon, and including a third bridge contact which selectively connects said fifth conductor to said second and third conductors in response to movement of said carriage.

4. The switch of claim 2 wherein said first bridge contact has a first end in engagement with said first conductor during movement of said carriage in said first and second directions, and said second conductor has portions engaged by a second end of said first bridge when such bridge is at one end of movement in both said first and second directions, and said third conductor has portions engaged by said second end of said first bridge when such bridge is in the opposite end of movement in both said first and second directions.

5. The switch according to claim 1 wherein said housing means further includes an opening on the side opposite said open end and wherein said actuating means further includes a joystick type actuator pivotally mounted in the opening of said housing means and operatively connected to said carriage for moving the same to change the position of said bridge contacts with respect to said conductors.

6. The switch of claim 1 wherein said insulating board has a further conductor on said one side thereof, and including a further conducting bridge contact for selectively connecting said further conductor to one of said separate conductors, support means for said further conducting bridge contact including a second insulating carriage having a recess for receiving said contact, and a spring engaging said further conducting bridge contact and resiliently holding the same against said conductors, and including a first actuating member for moving said insulating carriage for moving said bridge contacts coupled thereto, and a second actuating member coupled to said further bridge contact for moving the same.

7. The switch according to claim 6 wherein said housing means further includes an opening and wherein said first actuating member is a joystick type actuator pivotally mounted in the opening of said housing means and movable in right angle directions from a vertical unactuated position for moving said insulating carriage and said bridge contacts coupled thereto to selectively complete electrical circuits.

8. The switch according to claim 6 wherein said housing means further includes an opening and wherein said second actuating member is a selector knob type actuator rotatably mounted in the opening of said housing means and operatively connected to said second insulating carriage for moving the same to change the position of said further bridge contacts with respect to said further conductor to complete electrical circuits.

9. A switch for controlling a plurality of circuit connections including in combination,

a housing having an open end and a neck portion opposite thereto,

a substantially flat insulating board secured to said housing at said open end thereof and having on one side thereof a plurality of separate conductors having spaced portions,

a plurality of movable conducting bridge contacts selectively engaging said conductors,

first and second switch sections each having a carriage member,

support means for each of said bridge contacts within each of said carriage members including recesses for receiving said contacts and springs engaging said contacts and resiliently holding the contacts against said conductors, and

actuating means operatively connected to each carriage member of said first and said second switch sections for moving the same to change the posi-

tion of said bridge contacts with respect to said conductors.

10. The switch of claim **9** wherein said actuating means includes a joystick type actuator, and said first switch section carriage member is connected to said joystick type actuator for moving said carriage member and for positioning said bridge contacts with respect to said separate conductors, and collar means having four lobes therein coupled to said joystick actuator means for restraining the movement of the same to right angle directions from the vertical unactuated position.

11. A switch for controlling a plurality of circuit connections including in combination,

a housing having an open end and a neck portion molded integral with said housing on the side opposite said open end,

a plurality of movable conducting bridge contacts positioned within said housing,

a plurality of springs for biasing said bridge contacts,

a chamber member positioned within said housing,

insulating carriage means for said bridge contacts positioned within the chamber member having recesses for receiving said contacts and springs engaging said contacts,

an insulating board secured to the housing open end, said insulating board having on the inside surface thereof a plurality of separate conductors having spaced portions adapted to be selectively engaged by said spring biased bridge contacts, and

actuating means positioned in said neck portion of the housing and engagable with said insulating carriage means for moving said carriage means and said conducting bridge contacts to selectively complete electrical circuits.

12. The switch of claim **11** wherein said insulating carriage means has projections thereon and said chamber member has right angled cross-recesses therein such that when the carriage means is positioned within the chamber member, the projections fit in the cross-recesses to permit the carriage means to track freely at right angle directions.

13. The switch of claim **11** wherein the actuating means further includes a joystick type actuator pivotally mounted in the neck portion of the housing and engaging said insulating carriage means for moving said carriage means and said conducting bridge contacts.

14. The switch assembly of claim **11** wherein the actuating means includes a selector type actuator extending within said neck portion, and wherein said carriage means has a projection thereon and said chamber member has a slot therein, such that when said carriage means is positioned within said chamber, said projection extends through said slot, said selector type actuator being operatively coupled to said carriage means for moving the same and said bridge contact coupled thereto to selectively complete electrical circuits.

* * * * *