

Dec. 14, 1965

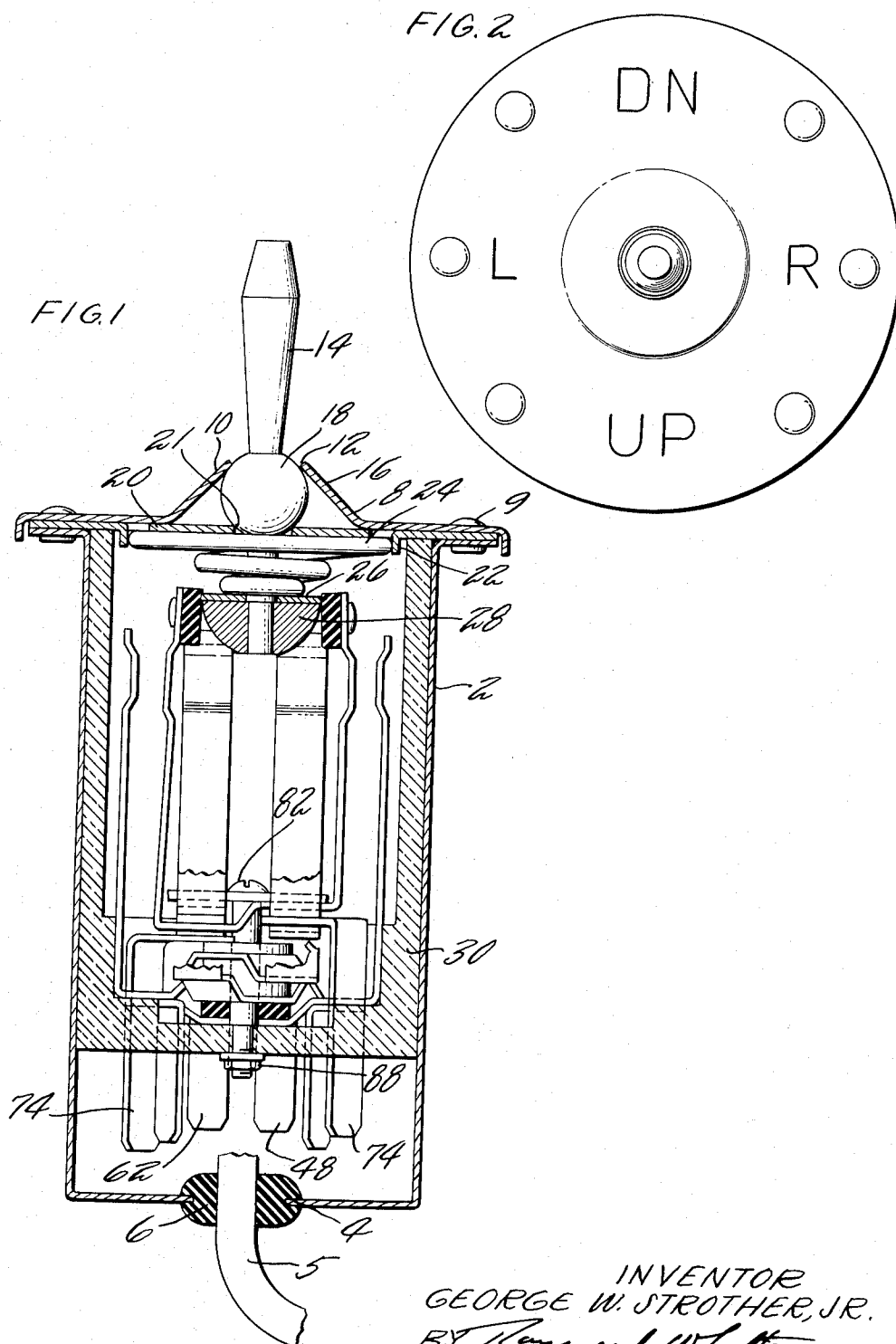
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3,223,792

ELECTRIC SWITCH WITH UNIVERSAL PIVOT ACTUATOR

Filed Dec. 12, 1963

4 Sheets-Sheet 1



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FIG. 3

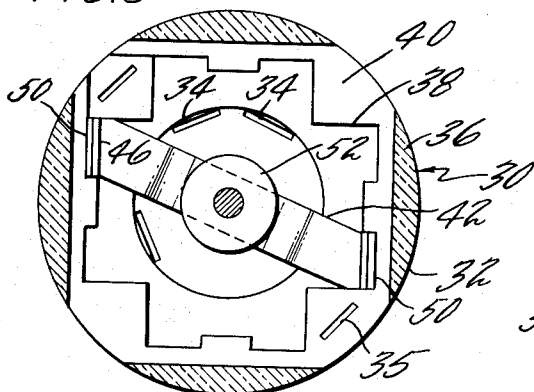


FIG. 4

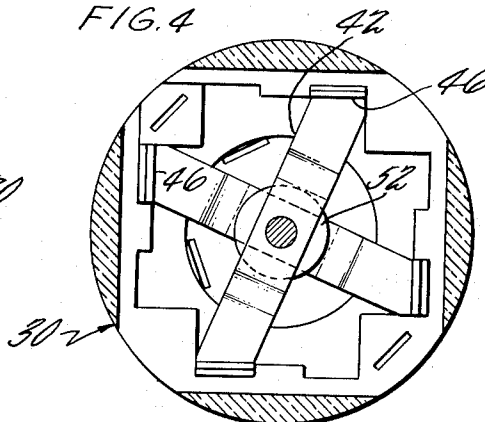


FIG. 5

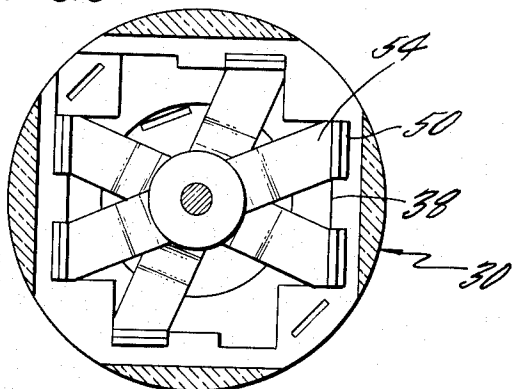


FIG. 6

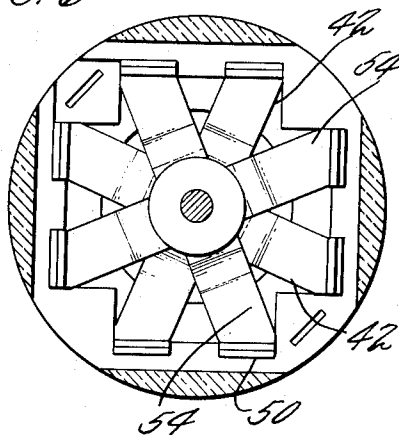


FIG. 7

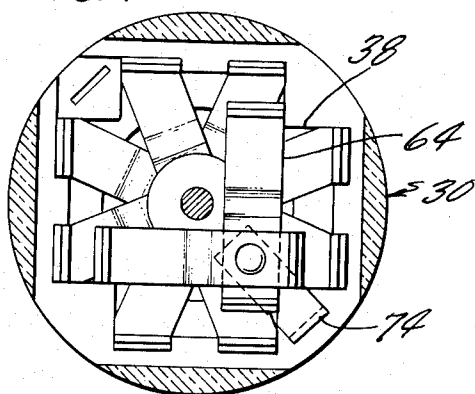
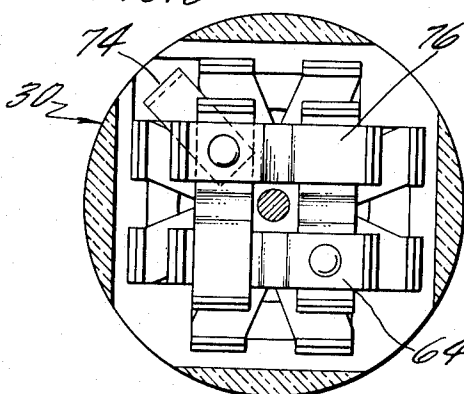


FIG. 8



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FIG. 9

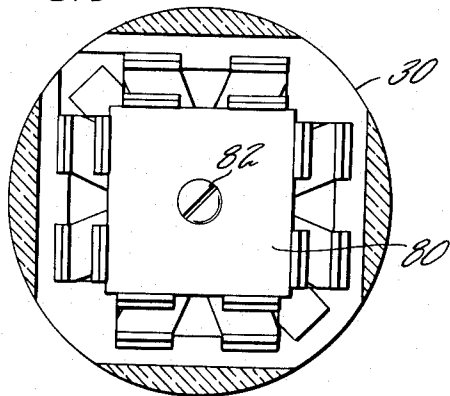


FIG. 10

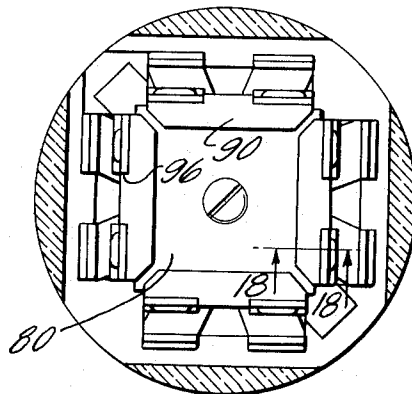


FIG. 11

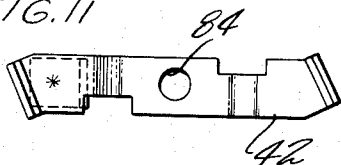


FIG. 13

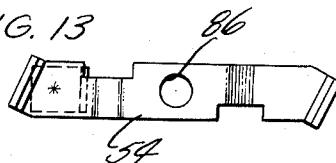


FIG. 12

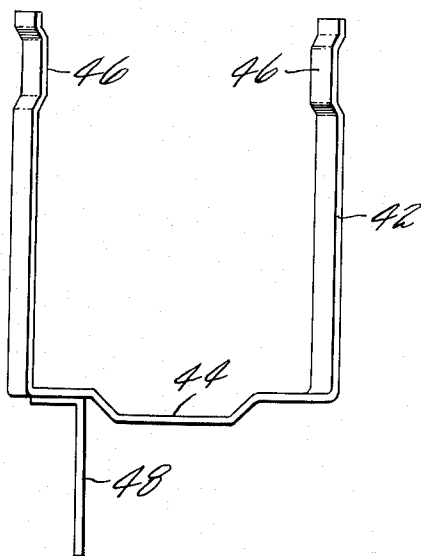
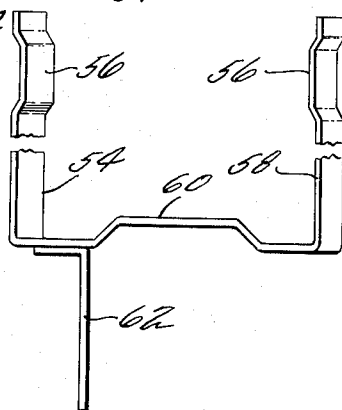


FIG. 14



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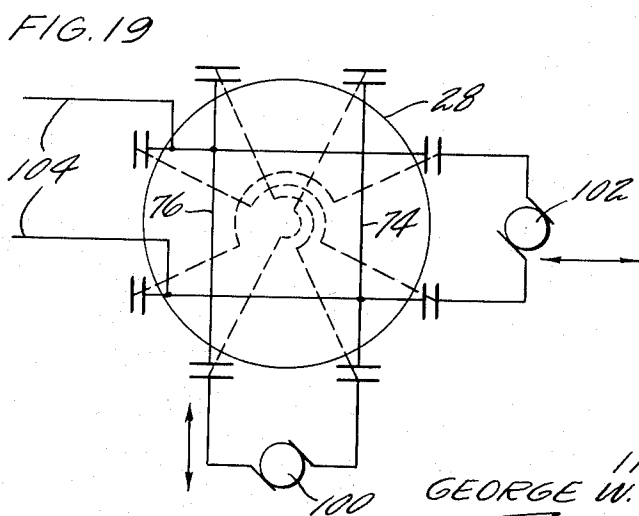
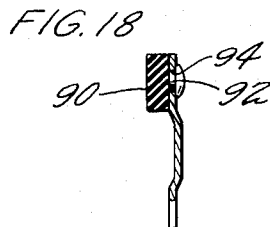
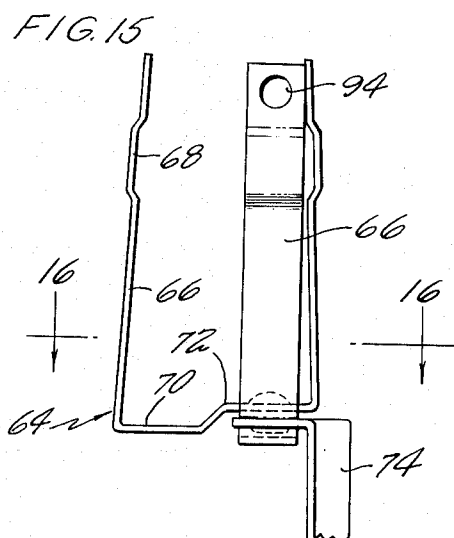
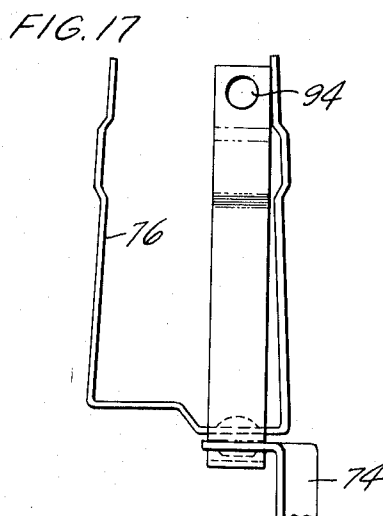
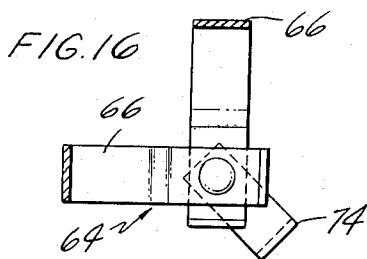
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ELECTRIC SWITCH WITH UNIVERSAL PIVOT ACTUATOR

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4 Sheets-Sheet 4



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ELECTRIC SWITCH WITH UNIVERSAL PIVOT ACTUATOR

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16 Claims. (Cl. 200—6)

This invention relates to a joy stick type of switch by which to control a plurality of circuits separately or in combination from a single switch lever.

One feature of the invention is a simply constructed switch mechanism of readily formed and assembled parts to produce the joy stick type of control. Another feature is an electrical switch that is inexpensive to manufacture and capable of selectively controlling at one time one or more of a prearranged combination of circuits.

One feature of the invention is a switch assembly for obtaining motion in either of two directions in one or both of a pair of angularly related planes. More specifically another feature is a switch mechanism for controlling the rotation of a pair of motors selectively in either direction, one at a time or in combination.

One feature is a switch assembly requiring a small number of parts and being capable of assembly on its supporting base without the necessity of added assembly jigs since the base forms its own jig.

Other features and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate an embodiment of the invention.

FIG. 1 is a vertical sectional view through the switch assembly.

FIG. 2 is a plan view of the assembly.

FIG. 3 is a plan view of the supporting base removed from the casing, with the first pair of contacts installed.

FIGS. 4 to 10 inclusive are successive steps in the assembly.

FIG. 11 is a plan view of the first pair of contacts to be assembled.

FIG. 12 is an elevation of the contacts of FIG. 11.

FIGS. 13 and 14 correspond to FIGS. 11 and 12 and show the next pair of contacts.

FIG. 15 is an elevation of one set of the movable contacts.

FIG. 16 is a sectional view along line 16—16 of FIG. 15.

FIG. 17 is a view similar to FIG. 15 showing the other set of movable contacts.

FIG. 18 is a fragmentary sectional view along line 18—18 of FIG. 10.

FIG. 19 is a wiring diagram.

Referring first to FIGS. 1 and 2, the switch assembly is enclosed within a cup-shaped container 2 which has an opening 4 in the base to receive the electrical cable 5 from the switch. An insulating grommet 6 may protect the cable at the opening 4 and prevent leakage into the container. A cap 8 is secured as by rivets 9 to the flanged rim of the cup to enclose the switch assembly. The cover is a two-piece cover, the top piece 10 having a central opening 12 to receive the control lever or joy stick 14 and a conical portion 16 surrounding the opening to support the spherical pivot 18 on the lever, between its ends. This spherical pivot is held in position by an inner plate 20 having a central opening 21 for the joy

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stick and detents 22 to retain a helical spring 24 in position on the underside of the cap. The spring is positioned to engage the flat top surface 26 of a hemispherical actuator 28 on the inner end of the control lever or joy stick 14. The spring tends to center the lever and hold it in an upright position at right angles to the cover plate as shown. If desired, the cover plate may have notations such as the "down," "up," "right," and "left" indicia shown in FIG. 2, where the joy stick controls both up and down movement and movement to right and left in a horizontal plane, as will be described in detail.

The switch is assembled in a plastic base 30 which may be molded to shape from suitable insulating plastic many of which are well known. The base has a cylindrical portion 32 at the bottom through which there are four vertical holes 34 for the reception of terminals on the fixed contact assemblies, and other holes 35 for the movable contact assembly terminals. The base also has four upright supports 36 that in plan are segments of a circle and form backing supports for the contacts as will be described. The base is of such a dimension as to fit securely within the container with the uprights 36 engaging the side walls. The cylindrical portion 32 also has a top recess 38 therein to receive the bases of the fixed contacts, this recess being substantially square with elevated corner portions 40 for a purpose to appear later.

The switch assembly is completed in the plastic base, the latter constituting a jig in which the contact elements are retained until they can all be secured together. The assembly is shown step-by-step in FIGS. 3 to 10, inclusive. The first contact assembly 42 is a fixed contact assembly and as shown in detail in FIGS. 11 and 12 is substantially U-shaped in cross section with a downward offset 44 centrally of the base and with inwardly extending contact offsets 46 near the top ends of the U. Attached to the base of the U is a contact terminal 48 extending downwardly. This contact assembly is placed in the plastic base 30 in the position shown, the offset 44 resting on the bottom of the top recess 38 and with the corners of the base of the U fitting in small notches 50 formed in the proper position in the sides of the recess 38, and the terminal 48 projecting downwardly through one of the openings 34. An insulating washer 52 is placed centrally over the offset 44 to complete the first assembly step.

The second assembly step, FIG. 4, involves placing a second contact assembly, the same in shape as the first, at right angles thereto, as shown in FIG. 4. This assembly has the base of the U located in in other small notches 50 and its contact terminal extends through the vertical opening 34 located below this contact assembly. Another insulating washer is placed centrally on the base of this contact assembly. These insulating washers are preferably selected to be equal in outer diameter to the offset in the assembly so as to be retained thereby centrally of the assembly.

The next contact assemblies 54 to be placed on the plastic base are shaped as in FIGS. 13 and 14. These assemblies are similar to those of FIGS. 11 and 12 except that the contact offsets 56, located in the legs 58 of the U are twisted in a direction opposite to the offsets of the first contact assembly in order that the contact offsets in the pairs of contacts, as shown in FIGS. 5 and 6, will be parallel to each other even though the base of the U extends at an acute angle thereto. These

contact assemblies 54 have the offsets 60 in the base of the U extending upwardly so that the contact offsets of the several assemblies will not be substantially out of alignment with one another. Each of these assemblies has a contact terminal 62 attached to the base.

As shown in FIG. 5, the contact assembly in the third assembly step is one of the contact assemblies of FIGS. 13 and 14 and is placed as indicated with the terminal 62 extending through the appropriate opening 34 and with the ends of the base of the U fitting in opposite notches 50. This third contact assembly cooperates with the first contact assembly to make up opposite pairs of fixed contacts at opposite sides of the plastic base. Another insulating washer 52 is placed on the offset 60 of this contact assembly.

The fourth assembly step, FIG. 6, involves placing another contact assembly 54 at right angles to the previously placed contact assembly 54 directly beneath it. This second contact assembly 54 cooperates with the second contact assembly 42 of FIG. 4 to make up the opposite pairs of contacts at top and bottom of the assemblage as viewed in FIG. 6. This step completes the assemblage of the fixed contacts after a top insulating washer 52 is placed as shown.

The fifth assembly step, that shown in FIG. 7, is the insertion of the first movable contact assembly 64, shown in FIGS. 15 and 16. This assembly is made up of two U-shaped contact elements 66, the legs of which have outwardly projecting contact offsets 68 and the base of each of which element is offset midway between the ends of the base to provide lower and upper steps 70 and 72. The assembly of FIG. 15 is made by attaching two of the elements 66 together with the upper steps 72 in contact and with the elements at right angles to each other as shown. The elements are connected together and to a control terminal 74 as by a rivet 76. This assemblage is positioned in the plastic base as shown in FIG. 7, the contact terminal extending through one of the holes 35 and serving to hold the assemblage in the position shown. The corner portion 40 serves to support this contact assembly 64 above the previously positioned fixed contact assemblies, being also spaced by the insulating washer 50.

The sixth assembly step shown in FIG. 8, uses the movable contact assembly 76 of FIG. 17 which differs from that of FIG. 15 in that the U-shaped contact elements 66 are positioned with the lower steps 72 in contact and with the elements 66 at right angles to one another. The contact terminal 74 is attached to the assemblage by the rivet 78 that holds the elements 66 together. This assemblage is placed as shown in FIG. 8 with the contact terminal projecting downwardly through the other hole 35 in the opposite corner portion 40 which serves to support this assemblage in position above and out of contact with the previously positioned movable contact assembly of FIG. 7.

The contact assemblies are all then held in position by a square plate 80, FIG. 9, overlying the bases of the U-shaped elements 66 and held to the plastic base by a bolt 82 extending downwardly through the plate 80, the insulating washers and the bases of the fixed contact assemblies, the latter having central openings 84 in the bases of the U, as shown in FIG. 11 and openings 86, FIG. 13, as will be apparent. A nut 88 engages the underside of the base 30 to retain the bolt in position.

The pairs of movable contacts are interconnected by insulating contact connectors 90, FIGS. 10 and 18, which extend between the movable contacts of each pair. Each connector is in the form of a bar of plastic material having projections 92 thereon to fit in openings 94, FIGS. 15 and 17, in the contact elements. The material is such that these projections may readily be headed over as shown in FIG. 18 by softening the projecting end with heat as from a soldering iron. The bar may have a central projection 96, FIG. 10, to be positioned between

the contact elements to which the connector is secured, as indicated in FIG. 10.

When the assemblage is completed, the individual wires of the cable 5 are secured to the appropriate contact terminals as will be apparent and the plastic base with the assemblage bolted thereto is slid into the container until the top ends of the upright supports 36 are level with the top of the container. The top is then placed in position with the hemispherical actuator 28 located within the group of contact connectors 90 and in a position to engage these connectors for selectively moving the connectors singly or in unison to close the several contacts.

With the arrangement shown, the wiring diagram is relatively simple. The contacts of FIG. 19 are in much the same arrangement as in FIGS. 3 to 10, inclusive. The dotted lines represent the interconnection of diagonally opposite contacts since the opposite contacts on each U-shaped element are obviously interconnected. For convenience, the pairs of contacts of FIG. 19 will be referred to as the top contacts, the bottom contacts and the left and right contacts. The wiring diagram is merely exemplary as other devices than motors could be used. The arrangement shown provides for up or down movement of a device, not shown by rotation of the motor 100 as represented by the arrow, the direction of motor rotation determining whether the device is moved up or down. The movement to left or right is controlled by a motor 102 and its direction of rotation determines the direction of movement. With the power input 104 connected respectively to the two movable contact assemblies 64 and 76, as shown, it will be apparent that movement of the hemispherical actuator 28 (represented by the circle) to the right, FIG. 19, will move the movable contacts at the right to engage the fixed contacts at the right and energize motor 102. Movement of the same actuator 28 to the left will engage the movable contacts at the left with the fixed contacts at the left and reverse the direction of rotation of the motor 102. This will occur since the fixed top contact at the left and the bottom fixed contact at the right are interconnected and the top fixed contact at the right and the bottom fixed contact at the left are also interconnected, whereas the two top movable contacts of the left and right pairs are interconnected, as will be apparent from FIG. 8, and the two bottom movable contacts of these pairs are also interconnected.

Similarly, if the actuator 28 is moved upwardly, as seen in FIG. 19, motor 100 will be energized to provide vertical movement to the device actuated thereby. Downward movement of the actuator 28 to engage the contacts at the bottom of this figure will reverse the direction of the motor and reverse the vertical direction of motion by reason of the interconnections between the fixed contacts as above described. Suitable connections for the motor terminals will assure proper movement of the device to be consistent with the markings on the cover, it being understood that movement of the joy stick 14 causes pivotal movement about its pivot 18 and thus causes movement of the actuator 28 in the opposite direction, such that as the joy stick moves to the right the actuator will move to the left and similarly in other directions of movement of the joy stick.

It will be apparent that the arrangement shown permits energizing of both motors at once. If the actuator is moved diagonally, FIG. 19, it will provide contact with both one set of lateral contacts as well as one set of bottom or top contacts. Thus, movement of the actuator diagonally upward and to the right, FIG. 19, will close the top two pairs of contacts as well as two pairs of contacts at the right. It will be apparent that both movable contacts at the top are caused to move in unison into engagement with the opposing fixed contacts by the connector 90, FIG. 10, that connects the movable contacts together and this will occur even when the actuator moves

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diagonally. Similarly, the two movable contacts at the right are caused to move in unison by the connector 90 for these two contact even when the actuator moves diagonally. This is equally true of the pairs of movable contacts at the bottom, FIGS. 10 and 19, and at the left. The connector 90 has been omitted from FIG. 19 to avoid confusion of the wiring diagram. In this way both motors can be in operation with either direction of rotation selected by the appropriate diagonal direction of motion of the joy stick.

The fixed contacts are arranged in pairs in a ring about a central axis and the movable contacts are arranged in pairs in a smaller ring about the same axis, as will be apparent. The actuator is centrally positioned within the ring of movable contacts and causes operating contact between any pair of fixed contacts and the cooperating pair of movable contacts, or, if the actuator is moved diagonally, two pairs of movable contacts are moved into engagement with the cooperating two pairs of fixed contacts.

The above described assemblage permits very simple manufacture and assembly. Obviously all the movable contact elements 66 are duplicates and require only one set of dies. All the contact terminals are alike and can be made from one set of dies. The fixed contact elements 42 and 54 are similar, the flat plan being identical, and one being bent in the reverse of the other when formed so that reversal of the dies will easily permit the formation of all these elements. The plastic base is easily molded to the desired shape with the openings 34 and 35 and the recess 38 formed therein during the molding process thus eliminating any machining steps. Further, the base serves as a jig for holding the parts together during assembly so that no additional assembly devices are necessary.

The switch assembly may be used, for example, in connection with the search light shown in the copending United States application Serial No. 323,940, filed November 15, 1963, in which the movement of the search light beam to right or left in a horizontal plane would be controlled by movement of the joy stick to right or left and the change in the angle of the beam with respect to the horizontal could be changed by movement of the joy stick in the "down" or "up" direction. Movement of the joy stick diagonally between these directions would obtain both a movement in a horizontal plane and a change in the vertical angle of the beam. Other uses for this type of switch will be apparent.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. A multiple switch including a container having a cover, a base within the container, four pairs of fixed contact fingers extending upwardly from the base with the free ends arranged in a ring about the axis of the base, said pairs being spaced substantially 90° apart around said axis, another four pairs of contact fingers extending upwardly from the base and arranged within the ring formed by the first fingers, and an actuating lever extending through and pivoted in said cap and having on its inner end an actuator for moving said second pairs of contacts selectively into contact with the first pairs of fingers, diagonally opposite fingers of said first contact fingers being electrically interconnected.

2. A multiple switch including a container having a cover, a base within the container, four pairs of fixed contact fingers extending upwardly from the base with the free ends arranged in a ring about the axis of the base, said pairs being spaced substantially 90° apart around said axis, another four pairs of contact fingers extending upwardly from the base and arranged within the ring formed by the first fingers, and an actuating lever extending through and pivoted in said cap and having on its in-

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ner end an actuator for moving said second pairs of contacts selectively into contact with the first pairs of fingers, the fingers of each pair of movable contact fingers being interconnected by an insulating contact bar for engagement by the actuator.

3. A multiple switch including a container having a cover, a base within the container, four pairs of fixed contact fingers extending upwardly from the base with the free ends arranged in a ring about the axis of the base, said pairs being spaced substantially 90° apart around said axis, another four pairs of contact fingers extending upwardly from the base and arranged within the ring formed by the first fingers, and an actuating lever extending through and pivoted in said cap and having on its inner end an actuator for moving said second pairs of contacts selectively into contact with the first pairs of fingers, the actuator being hemispherical in shape.

4. A multiple switch including a base, a plurality of fixed contact assemblies successively mounted on said base, each assembly being U-shaped with a base portion and upwardly extending contact fingers, each assembly being angularly offset at the base with respect to the preceding assembly, said base having notches therein to locate the ends of the base portions of each assembly in position, and a bolt through the base and the bases of the assemblies holding the several assemblies on the base.

5. A multiple switch including a base, a plurality of fixed contact assemblies successively mounted on said base, each assembly being U-shaped with a base portion and upwardly extending contact fingers, each assembly being angularly offset at the base with respect to the preceding assembly, said base having notches therein to locate the ends of the base portions of each assembly in position, and circumferentially spaced fingers extending upwardly from said base in parallel relation to the contact fingers.

6. A multiple switch including an insulating base, a plurality of fixed contact assemblies mounted on the base, each assembly being U-shaped with a base portion and upwardly extending fingers, each assembly being angularly offset at the base with respect to each of the other assemblies, and with the assemblies arranged in pairs to provide a plurality of pairs of contacts circumferentially spaced about the base, and a plurality of movable contact assemblies also mounted on the base and insulated from one another to provide contact fingers cooperating with the fixed contact assembly fingers.

7. A switch as in claim 6 in which each movable contact assembly includes a pair of U-shaped elements with the bases of the elements secured together.

8. A switch as in claim 7 in which the base of each of U-shaped elements has offsets formed therein to define lower and upper steps, and similar steps of the bases are secured together.

9. A switch as in claim 8 in which a contact terminal is also secured to the pair of U-shaped elements and extends downwardly through the base.

10. A switch as in claim 8 in which one movable contact assembly is formed by securing the pair of U-shaped elements together on their lower steps and the other assembly is formed by securing the pair of U-shaped elements together on their upper steps.

11. A switch as in claim 10 in which each movable contact assembly has a contact terminal secured to the assembly where the U-shaped elements intersect, said terminals extending through the base.

12. A multiple electric switch including a base member having a plurality of pairs of fixed contacts arranged around the periphery of the base in circumferentially spaced relation, a plurality of pairs of movable contacts arranged inwardly of the fixed contacts and in alignment therewith, and an actuator positioned inwardly of the movable contacts for moving the pairs of movable contacts selectively outwardly to engage the fixed contacts, diagonally opposite fixed contacts being integrally connected together.

13. A switch as in claim 12 in which the base is cylindrical and is positioned within a cylindrical container.

14. A switch as in claim 13 in which the container has a cover, and the actuator is swivelled in the cover.

15. A switch as in claim 13 in which the contacts are carried by upwardly extending fingers on the base and the base has upwardly extending elements outwardly of each pair of fixed contacts and located between the fixed contacts and the container.

16. A switch as in claim 13 in which a cover is provided on the container, and a joy-stick type of control

lever is swivelled in the cover and carries the actuator on its inner end.

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