March 20, 1956 C. ULLRICH 2,739,208

ELECTRIC SWITCH

Filed March 16, 1953 2 Sheets-Sheet 1

Fig. 1.

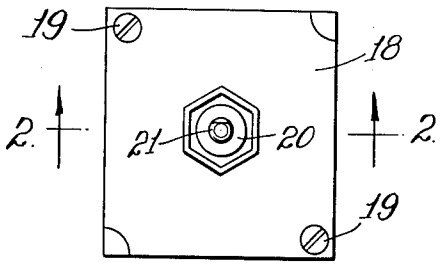


Fig. 2.

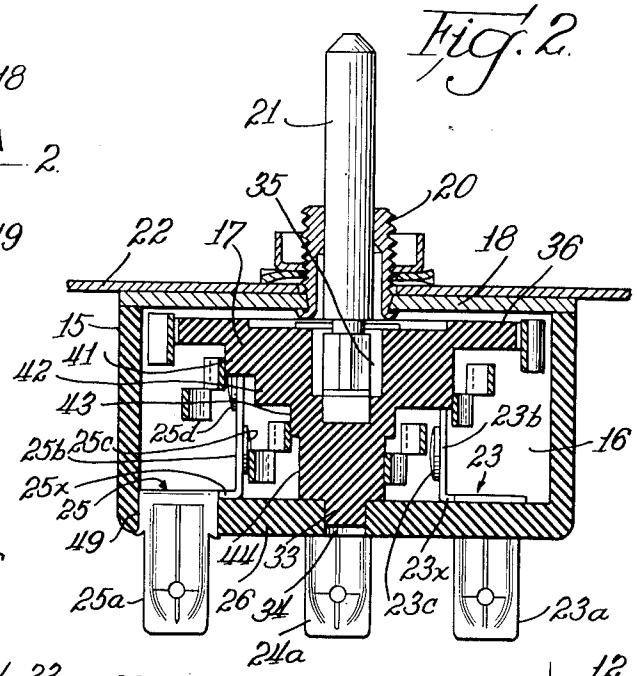
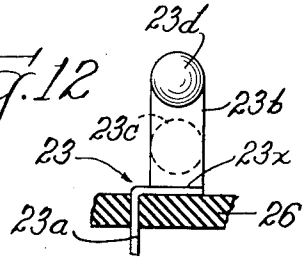


Fig. 12



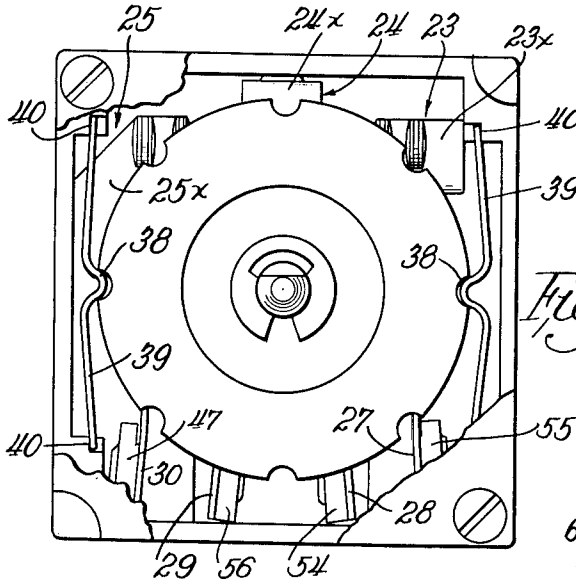


Fig. 3.

Fig. 11

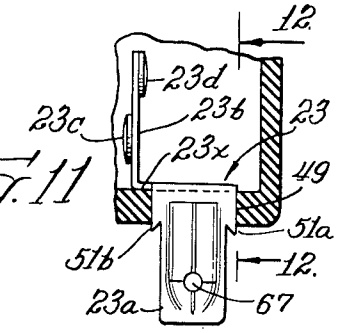
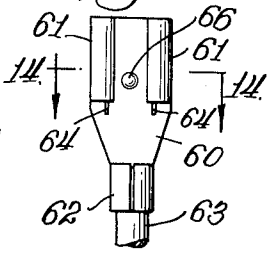


Fig. 13



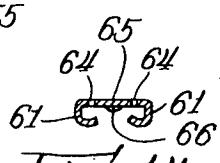
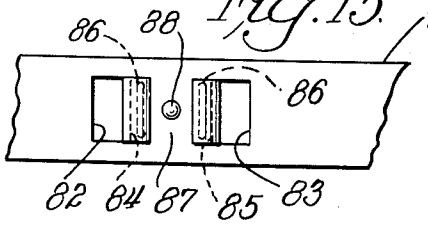


Fig. 14

Fig. 15.



INVENTOR.

Clarence Ullrich

BY

Eugene M. Giles Atty.

March 20, 1956 C. ULLRICH 2,739,208

ELECTRIC SWITCH

Filed March 16, 1953 2 Sheets-Sheet 2

Fig. 4

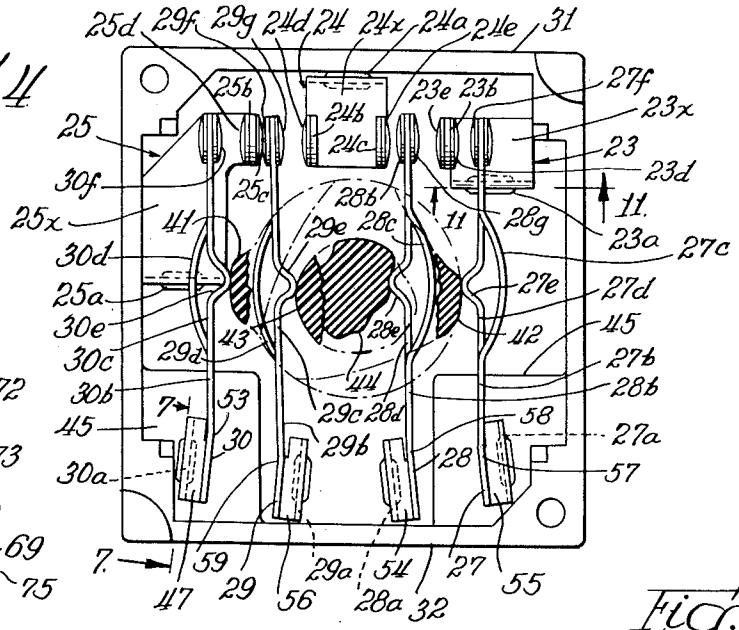


Fig. 9

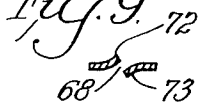


Fig. 10



Fig. 7

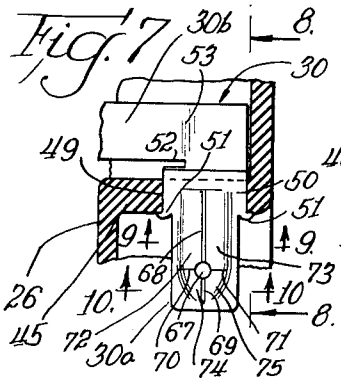


Fig. 8

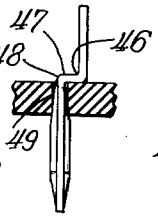
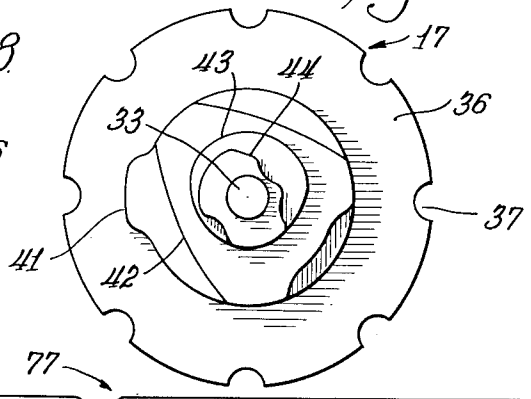


Fig. 6



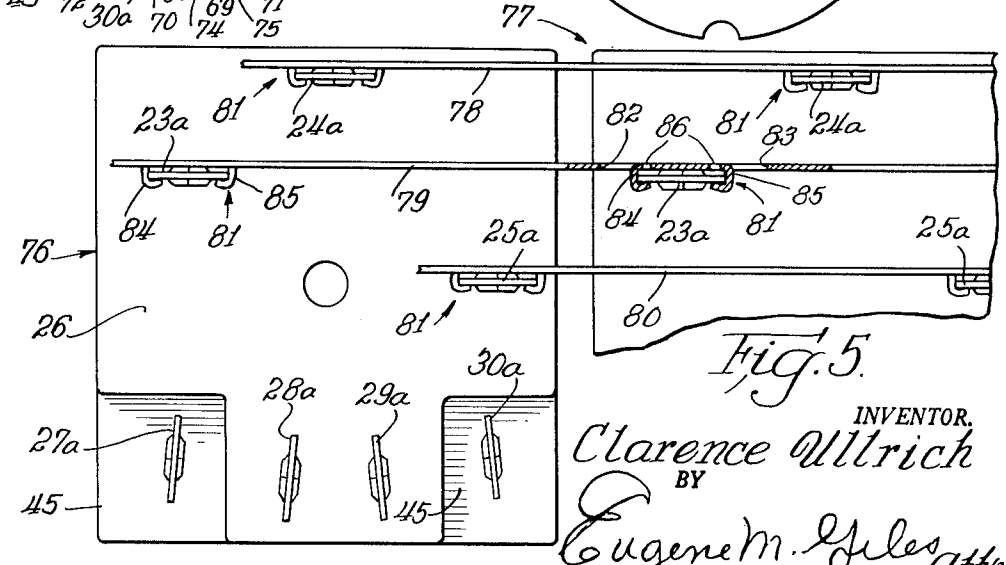


Fig. 5.

INVENTOR.
Clarence Ullrich
BY
Eugene M. Giles Atty.

United States Patent Office 2,739,208
Patented Mar. 20, 1956

2,739,208

ELECTRIC SWITCH

Clarence Ullrich, Oak Park, Ill., assignor, by mesne assignments, to Ferro Electric Products, Inc., Kirkland, Ill., a corporation of Illinois

Application March 16, 1953, Serial No. 342,450

8 Claims. (Cl. 200—166)

My invention relates to electric switches wherein movable contacts are operated by an actuator to engage other contacts, usually referred to as the stationary contacts, to provide the desired electrical connections for controlling the supply of current to an electrical appliance or the like, and the invention has reference more particularly to to the construction and mounting of the switch parts on which the contacts are located and through which the current is supplied to and from the contacts.

In practice these switches are generally enclosed in a case which has terminals at the exterior to which connections are made for supply of current to and from the switch, and this case is usually made of molded electrical insulating material so that the case is non-conducting and the current conducting parts may be mounted directly thereon and are thereby electrically insulated from one another.

In such switches the movable contacts are usually carried by flexible arms of leaf spring type which are flexed by the switch actuator to different positions to provide the contact engagements which may be required for the particular purpose for which the switch is employed, and these switch arms are generally made of a conductive material and serve as the conductors through which current is supplied to and from the contacts.

These leaf spring type arms are necessarily of relatively thin stock, in order to have the required flexibility, and it has been customary, heretofore, for the purpose of insuring a firm substantial mounting of such arms, to employ a mounting part of a heavier and more substantial stock and to secure the flexible arm thereto. Moreover, current is usually supplied to or from the arm at the place of mounting thereof and the heavier and more substantial stock of the mounting part was also considered essential to insure adequate strength and rigidity for the attachment of connectors of input or output leads for supplying current to or from the flexible switch arm.

Similar heavier and more substantial stock has also been employed heretofore for mounting the above mentioned stationary contacts and for the connector attachment facilities by which input or output leads were connected to supply current to or from such contacts.

These so-called stationary contacts are not necessarily immovable and in fact may have some flexibility, but are considered as stationary to distinguish them from the contacts which are directly operated by the actuator and are adjustable thereby to effect the desired connections or changes of connections through the switch.

The employment of heavier stock, as aforesaid, was disadvantageous, not only because of the greater cost of the heavier stock and the several different kinds of stock which it was necessary to have available, but it also increased the manufacturing operations and the number of pieces to be handled. It also increased the number of electrically conductive joints which it was necessary to make and which could cause dissatisfaction and annoyance if inadequately conductive or improperly made.

The principal objects of my invention are to eliminate the necessity of employing different stocks in the construction of switches and the like; to permit the employment of lighter stock for the mounting portions of switch parts and for the portions thereof to which connectors are attached; to minimize the number of separate parts as well as the number of electrically conductive joints required in switch structures; to insure ample strength for mounting of such lighter stock switch parts and for attachment of connectors thereto; and, in general, to simplify and improve the construction of electric switches and minimize the cost thereof, these and other objects being accomplished as explained more particularly hereinafter and as shown in the accompanying drawings in which:

Fig. 1 is a top view of a switch embodying the improvements of the present invention;

Fig. 2 is an enlarged cross sectional view of the switch taken on the line **2—2** of Fig. 1;

Fig. 3 is a similarly enlarged top view of the switch of Fig. 1 with most of the switch cover broken away to disclose details of construction;

Fig. 4 is a view similar to Fig. 3 but having portions of the switch mechanism removed and fragmentary portions only of the switch actuator shown;

Fig. 5 is an enlarged bottom view of the switch of Fig. 1 and shows bus bars for connecting the input terminals of the switch to corresponding input terminals of other switches;

Fig. 6 is a view of the switch actuator looking at the underside thereof;

Fig. 7 is a fragmentary sectional view on the line **7—7** of Fig. 4 showing the mounting of one of the movable contact supports;

Fig. 8 is another sectional view of the Fig. 7 parts but taken on the line **8—8** of Fig. 7;

Fig. 9 is a sectional view on the line **9—9** of Fig. 7 of the terminal portion of the contact support;

Fig. 10 is a sectional view similar to that of Fig. 9 but taken on the line **10—10** of Fig. 7;

Fig. 11 is a fragmentary sectional view on the line **11—11** of Fig. 4 showing the mounting of one of the stationary contact supports;

Fig. 12 is another sectional view of the Fig. 11 parts but taken on the line **12—12** of Fig. 11;

Fig. 13 is a side view of a connector for attachment to a terminal portion such as shown in Figs. 7 to 12;

Fig. 14 is a cross sectional view of the connector of Fig. 13 taken on the line **14—14** thereof; and

Fig. 15 is a side view of a fragmentary portion of one of the bus bars of Figs. 5.

Referring to the drawing, which shows a switch of a type adapted for use in controlling current supply to heating units of electric ranges and the like, the reference numeral **15** indicates a molded switch case which is made of electrical insulating material and has a cavity **16** therein containing switch parts which are operable by an actuator **17** therein to interconnect current input terminals with current output terminals in the various relationships required to impart the desired number of variations of heat intensity to the heating unit controlled by the switch.

A cover **18** is secured to the open side of the switch case **15**, for example by corner screws **19**, and has a central bearing member **20** for a stem **21** which projects from the case and at its inner end is connected with the actuator **17** so that the latter is rotatable by the stem **21**.

This bearing member **20** also serves to mount the switch assembly on a support **22**, which may be a panel of the range on which the switch is employed, and the projecting end of the stem **21** is provided with the customary knob or dial (not shown) for conveniently rotat-

ing the stem 21 to the various positions thereof required for the switch operation.

The illustrated switch has three current input terminals 23^a, 24^a and 25^a which project through the bottom wall 26 of the switch case 15 and are adapted to be connected respectively to three current supply lines, for example the three wires of the conventional 110–220 volt three wire feed, and the switch also has four output terminals 27^a, 28^a, 29^a and 30^a which likewise project through the bottom wall 26 of the switch case and are adapted to be connected with the resistances or parts of resistances of the heating unit to which current is suppliable through the switch.

The input terminal 24^a, which is adapted to be connected to the neutral or return wire of the 110–220 volt current supply lines, is part of a conductor 24 which is located in the switch case cavity 16 and has two laterally spaced upwardly projecting portions 24^b and 24^c, each of which has a contact thereon, indicated respectively at 24^d and 24^e, which said contacts 24^d and 24^e face oppositely away from one another and are at the same relatively low elevation above the bottom wall 26 of the switch case.

The input terminals 23^a and 25a are parts respectively of the conductors 23 and 25 which are also located in the switch case cavity 16 and each conductor 23 and 25 has a similar upwardly projecting portion with two contacts thereon at opposite sides thereof and at different elevations.

The said upwardly projecting portion of the conductor 23 is indicated at 23^b and the contacts thereof at 23^c and 23^d and the contact 23^c is at the same elevation as the contacts 24^d and 24^e of the conductor 24 whereas the contact 23^d is at a higher elevation, as shown particularly in Fig. 11, and the said upwardly projecting portion of the conductor 25 is indicated at 25^b and the contacts thereof at 25^c and 25^d, and these contacts 25^c and 25^d are at the same elevations respectively as the said contacts 23^c and 23^d, and all of the contacts 24^d, 24^e, 23^c, 23^d, 25^c and 25^d are at one side of the switch case cavity 16 near the side wall 31 thereof, as shown in Fig. 4, and all of the contacts 24^d, 24^e, 23^c and 25^c are at the same elevation and the two contacts 23^d and 25^d are at the higher elevation.

All of the output terminals 27^a, 28^a, 29^a and 30^a project through the switch case bottom wall 26 at spaced apart locations near to the switch case side wall 32, which is at the opposite side of the cavity 16 from the above mentioned side wall 31, and each of said terminals 27^a, 28^a, 29^a and 30^a is part of a separate conductor, indicated respectively at 27, 28, 29 and 30, each of which has a flexible arm portion 27^b, 28^b, 29^b and 30^b extending across the switch case cavity 16 nearly to the opposite side wall 31 and provided at the free end with one or more contacts, herein considered the movable contacts, which are adapted to engage certain ones of the contacts 23^c, 23^d, 24^d, 24^e, 25^c and 25^d, which are herein considered the stationary contacts, said flexible arm portions being located for engagement between their fixed and free ends by parts of the actuator 17 so that the latter, in the rotative adjustment thereof effects a variety of different contact relationships of the said movable contacts with said stationary contacts.

This actuator 17 which is of molded electrical insulating material has a bearing portion 33 at the bottom engaged in a bearing opening 34 in the bottom wall 26 of the switch case 15 and aligned with the bearing 20 through which the stem 21 extends, and said actuator 17 has at the top thereof a socket 35 in which the inner end of the stem 21 engages with a sliding keyway connection which insures rotation of the actuator 17 in unison with the stem 21 and at the same time permits removal of the switch case cover 18 and stem 21 without disturbing the actuator 17 in the switch case.

The top portion of the actuator 17 is of disk shape with relatively thin peripheral portion, as indicated at 36, which has series of peripheral notches 37, eight in the illustrated structure, for indexing engagement by mid-bent portions 38 of leaf springs 39, the ends of which are engaged in seats 40 of the switch case 15 so that the mid-bent portions 38 bear resiliently against the periphery of the thin portion 36 of the actuator 17 and in the notches 37 thereof, and below this thin peripheral portion, the actuator 17 is formed at four successive levels, indicated respectively at 41, 42, 43 and 44 with cam formations, which are shown particularly in Fig. 6, and serve, in the rotation of the actuator 17 to the eight different positions thereof, determined by the indexing notches 37 thereof, to effect eight different relationships of the movable contacts of the switch with the stationary contacts thereof, in one of which positions, which is considered the "off" position, there is no electrical connection between the input terminals 23^a, 24^a and 25^a and the output terminals 27^a, 28^a, 29^a and 30^a and in the other seven of which said positions different electrical connections are established between the said input terminals and the output terminals.

The switch arms 28^b and 29^b are at opposite sides respectively of the actuator 17 and at the same level in the cavity 16 and are adapted to be engaged and operated respectively by the two lowermost cam portions 44 and 43 thereof which, as above indicated, are at successively higher elevations and each of these arms is split midway between the ends thereof to provide upper and lower strip portions, one of which is bent to provide a hump portion which engages the respective cam portion 44 or 43, and the other of which is bent arcuately away from the respective cam portion to provide a reinforcing of the arm at this place.

Thus the switch arm 28^b is split to provide the upper strip portion 28^c and the lower strip portion 28^d, and the lower strip portion 28^d is formed with a hump offset 28^e which engages the cam 44 whereas the upper strip portion 28^c is rounded outwardly as indicated particularly in Fig. 4.

The switch arm 29^b is similarly split and has upper and lower strip portions 29^c and 29^d respectively, but in this switch arm 29^b the upper strip portion 29^c is formed with the hump offset 29^e and it is the lower strip portion 29^d which is rounded outwardly, this reversal of the hump and arcuate shaping of the switch arms 28^b and 29^b being for the purpose of locating the hump offsets 28^e and 29^e thereof at the different elevations thereof required for cooperation with their respective cam portions 44 and 43 which, as above indicated, are at successive higher elevations.

The switch arms 27^b and 30^b are likewise at opposite sides respectively of the actuator 17 and both at the same level in the cavity 16 but are at a higher level therein than the switch arms 28^b and 29^b to correspond to the higher level of the cam formations 42 and 41 with which they cooperate.

Accordingly, it is preferred to mount the respective conductors 27 and 30 of which these switch arms 27^b and 30^b are a part at a higher level in the cavity 16 and for this purpose the switch case 15 is formed with corner portions 45 of the bottom wall 26 thereof elevated and the conductors 27 and 30 are mounted on these elevated portions 45 of the switch case bottom 26.

These switch arms 27^b and 30^b are also split, the switch arm 27^b having the lower split portion 27^d formed with the hump offset 27^e to cooperate with the cam 42 and having the upper split portion 27^c rounded outwardly away from the actuator 17, whereas the switch arm 30^b has the upper split portion 30^c formed with the hump offset 30^e to cooperate with the higher cam portion 41 and has the lower split portion 30^d thereof rounded outwardly away from the actuator 17.

The switch arm 27^b has a contact 27^f at its free end which is engageable with the stationary contact 23^d of

the conductor 23 and the switch arm 27^b is biased so that said contact 27^f is normally engaged with the contact 23^d and is separated therefrom at appropriate times by the cam 42, and the switch arm 30^b has a contact 30^f at its free end which is engageable with the stationary contact 25^d of the conductor 25 and the switch arm 30^b is biased so that said contact 30^f is normally engaged with the contact 25^d and is separated therefrom at appropriate times by the cam 41.

The switch arm 28^b has two contacts 28^f and 28^g at its free end which are engageable respectively with the stationary contacts 24^e and 23^c and the switch arm 28^b is biased so that the contact 28^f is normally engaged with the stationary contact 24^e, at which time the contact 28^g is separated from its mating stationary contact 23^c and said switch arm 28^b is operable at appropriate times by the cam 44 to separate the contact 28^b from the contact 24^e and also at appropriate times to engage the contact 28^g with the contact 23^c.

The switch arm 29^b also has two contacts at its free end, indicated respectively at 29^f and 29^g, which are engageable respectively with the stationary contacts 25^c and and 24^d and the switch arm 29^b is biased so that the contact 29^g thereof is normally engaged with the stationary contact 24^d, at which time the contact 29^f is separated from its mating stationary contact 25^c, and said switch arm 29^b is operable at appropriate times by the cam 43 to separate the contact 29^g from the contact 24^d and also at appropriate times to engage the contact 29^f with the contact 25^c.

The switch arms 27^b, 28^b, 29^b and 30^b are necessarily made of relatively thin flexible spring like stock in order that they may be flexed from one position to another and also in order to resiliently engage their respective mating stationary contact or contacts at a substantial contacting pressure, and it is an important feature of the present invention that the same relatively thin flexible stock may be employed for the entire conductor of which the switch arm is a part, so that the entire conductor (excepting the switch contacts thereof) is of one piece construction with the mounting facilities thereof and also the terminal connector facilities thereof of the same relatively light thin stock as the switch arm.

The mounting and terminal facilities of the conductors 27, 28, 29 and 30 are substantially the same, and Figs. 7, 8, 9 and 10 which show the mounting and terminal facilities of the conductor 30, are typical of the mounting and terminal facilities of all of the conductors 27, 28, 29 and 30 except in the particular respects hereinafter pointed out.

As shown in Figs. 7 and 8, the conductor 30 is provided at the fixed end of the switch arm 30^b with a lateral extension which constitutes the mounting portion of the switch arm 30^b and is also of sufficient length to project through the elevated portion 45 of the bottom wall of the switch case 15 to provide the terminal 30^a to which a connector may be attached from the heating unit or resistance thereof to which current is to be supplied through the switch.

This extension is at the lower edge of the switch arm 30^b and is bent laterally therefrom, as indicated at 46 to provide a mounting base portion 47 which is clamped against the portion 45 of the bottom wall 26, and said extension is also bent, as at 48, to extend through a slit 49, which is provided therefor in the bottom wall portion 45, and said extension is continued outwardly beyond the wall portion 45 to form the terminal 30^a.

The part 50 of this extension which is engaged in the slit 49 is wider than the terminal portion 30^a and this wider portion 50 is formed, at the outer end of the slit 49, with a projecting spur 51 at each edge which is mashed down against and into the material of the bottom wall portion 45 at each end of the slit 49 to stake the aforesaid extension securely in the slit 49 with the base portion 47 thereof clamped tightly against the inner face of the wall portion 45.

Preferably a slit 52 is provided in the conductor 30 at the juncture of the base portion 47 with the switch arm 30^b and the conductor 30 may have a slight bend 53 extending across the fixed end of the switch arm at the inner end of this slit 2, as shown particularly in Fig. 7.

The slit 49 in the bottom wall 26 of the case 15 is of such width that the part 50 of the extension fits closely therein and a secure and substantial mounting of the switch arm 30^b is provided with the thin light weight stock of the switch arm 30^b and the latter is rigidly and firmly secured in place.

In the conductor 28, the extension which constitutes the mounting and the terminal 28^a is bent away from the lower edge of the switch arm 28^b at the same side thereof as in the Figs. 7 and 8 construction, as indicated at 54 in Fig. 4, whereas in the conductors 27 and 29 the said extensions thereof are bent away from the lower edge of the switch arm at the opposite side of the switch arm, as indicated respectively at 55 and 56 in Fig. 4, and moreover in the conductors 27, 28 and 29 the bend in the respective switch arm which corresponds to the bend 53 of the conductor 30, differs somewhat from the bend 53, as indicated respectively at 57, 58 and 59 in Fig. 4.

It is desirable that the terminals 27^a, 28^a, 29^a and 30^a be adapted for detachable slip on attachment thereto of terminal connectors of a type, such a shown in Figs. 13 and 14, which are commonly used on wires for separable electrical connection thereof with terminals of switches and the like, the particular form thereof shown in Figs. 13 and 14, comprising a plate 60 having opposed inturned portions 61 along the lateral margins providing a female connector to accommodate a mating flat male terminal endwise therein between the inturned portions 61, said plate 60 usually having a tubular clip 62 at one end within which is secured the end of the wire conductor 63 which is to be connected to the switch or the like.

For holding the flat male terminal in the female connector 60 the portion of the latter between the inturned portions 61 is commonly slitted at two spaced apart places, as indicated at 64, to provide a yieldable section 65 therebetween and this section 65 is formed with a small hump 66 midway between the inturned marginal portions to interengage with a corresponding recess in the mating male terminal that is engaged in the connector 60 so as to retain the male terminal in the female connector.

Generally, the male connector or terminal employed with such female connectors is of a relatively thick stock for ample strength and rigidity and is correspondingly indented at both sides, or has an opening therethrough, so that it is reversibly securable by means of the hump 66 in the female connector.

I have found, however, that a male terminal of ample strength and rigidity may be provided with the same thin light weight stock employed herein for the switch arms 27^b, 28^b, 29^b and 30^b and the mountings thereof, and that the terminals 27^a, 28^a, 29^a and 30^a may thus be of one piece construction with the respective switch arm and mounting.

To this end the terminal 30^a of Figs. 7 and 8, and each of the terminals 27^a, 28^a and 29^a of the respective conductors 27, 28 and 29, is provided near the outer end with an opening 67 therethrough and is slitted longitudinally at opposite sides of the opening 67, as indicated at 68 and 69, and is also slitted transversely at opposite sides of said opening 67, as indicated at 70 and 71, and the portion 72 between the slits 68 and 70 is pressed outwardly at one side of the terminal, and the portion 73 between the slits 68 and 71 is pressed outwardly at the opposite side of the terminal, as indicated particularly in Fig. 9, whereas the portion 74 between the slits 69 and 70 is pressed outwardly to the same side of the terminal as the portion 73 and the portion 75 between the slits 69 and

71 is pressed outwardly to the same side of the terminals as the portion 72, as shown particularly in Fig. 10.

Thus each portion 72, 73, 74 and 75 is pressed outwardly from the side of the terminal in a direction opposite to that of the two next adjoining portions and the opening 67 is bordered by two diametrically opposed portions 72 and 75 pressed outwardly at one side of the terminal and by two other diametrically opposed portions 69 and 73 pressed outwardly at the other side of the terminal.

With the terminal constructed as explained above, the opposite bending of the portions 72 and 73 and of the portions 74 and 75 gives the terminal great strength and rigidity and moreover the above mentioned bending of the two diametrically opposed portions 72 and 75 toward one side of the terminal and the other two diametrically opposed portions 73 and 74 toward the opposite side of the terminal, provides facilities at each side of the terminal for such interengagement with the hump 66 of the connector of Figs. 13 and 14 that the terminal will engage the female connector of Figs. 13 and 14 in reversed positions and interlock therewith in each reversed position.

Preferably the slit 68 is extended so that it terminates at its inner end well within the slit 49 of the switch case bottom wall and the aforesaid bending of the portions 72 and 73 at the opposite sides of this slit 68 is also extended well into the said slit 49, as indicated in Figs. 7 and 8, so that the terminal is reinforced and stiffened thereby sufficiently within the switch case bottom wall 26 to insure adequate rigidity of the terminal where it emerges from the slit 49.

The terminal portions 27^a, 28^a, 29^a and 30^a are preferably punched at 67 and slitted at 68, 69, 70 and 71 and the portions 72, 73, 74 and 75 bent as above described before mounting the conductor 27, 28, 29 or 30 in the respective slit 49, and thus the bent portions 72 and 73 have a tight bearing engagement with the opposite sides of the slit 49 which enhances the security and rigidity of the conductor mounting and the terminal.

It is also an important feature of the present invention that the conductors 23, 24 and 25 of which the input terminals 23^a, 24^a and 25^a are a part, and the mounting portions thereof may be made of the same thin light weight stock as that of the conductors 27, 28, 29 and 30 and also, like the conductors 27, 28, 29 and 30, of one piece construction.

Each conductor 23, 24 and 25 is secured to the bottom wall 26 of the switch case 15 in the same manner as the conductors 27, 28, 29 and 30 are secured thereto as explained above, each of said conductors 23, 24 and 25 having a base portion which is clamped against the inner face of the switch case bottom wall 26 in the same manner as the base portions 47, 54, 55 and 56 of the switch arm conductors 30, 28, 27 and 29 are clamped against the wall 26.

These base portions of the conductors 23, 24 and 25 are indicated at 23^x, 24^x and 25^x respectively and each is of a different shape and size, as shown particularly in Fig. 4, according to the required arrangement of the contacts thereof and the location of the respective terminals 23^a, 24^a and 25^a thereof.

Each base portion 23^x, 24^x and 25^x, however, has an integral outturned portion, like the portion 50 of Figs. 7 and 8, which extends through and is secured in a slit 49 in the bottom wall 26 of the switch case by spurs, like those at 51 in Fig. 7, which are mashed down against and into the wall 26 at the opposite ends of the slit 46, such spurs being shown before mashing down at 51^a in Fig. 11, and each such integral outturned portion of the base portions 23^x, 24^x and 25^x is continued outwardly beyond the bottom wall 26 to provide the input terminals 23^a, 24^a and 25^a which are exactly like the terminal 30^a of Figs. 7, 8, 9 and 10.

The base portions 23^x, 24^x and 25^x are provided at appropriate places along their margins with the respective integral upturned extensions 23^b, 24^b and 24^c, and 25^b which carry the stationary contacts 23^c and 23^d, 24^c and 24^d, and 25^c and 25^d.

Thus the conductors 23, 24 and 25, like the conductors 27, 28, 29 and 30 are each of one piece construction and of thin light weight stock suitably shaped and mounted to insure adequate strength and rigidity thereof.

The input terminals 23^a, 24^a and 25^a of the switch are preferably arranged as indicated in Figs. 4 and 5 with the flat sides thereof parallel or substantially parallel with the two opposite side walls 31 and 32 of the switch case 15 and at different distances from the side wall 31 so that bus bars may be conveniently employed, when a number of such switches are arranged in series side by side, to connect the corresponding input terminals of all of the switches conjointly to the same current supply lead.

For example, the switch which is indicated at 76 in Fig. 5, may have another similar switch mounted in side by side relation thereto, as indicated fragmentarily at 77 in Fig. 5, and also additional switches likewise in similar sidewise adjoining relation beyond the switch 77 so that there is a series of such switches similarly arranged in such side by side relation, and all of the terminals 24^a of the series of switches may be connected to a bus bar 78 which has one conductor of a three wire feed connected thereto, and all of the terminals 23^a of the series of switches may be connected to another bus bar 79 which has another conductor of the three wire feed connected thereto, and all of the terminals 25^a of the series of switches may be connected to still another bus bar 80 which has still another conductor of the three wire feed connected thereto.

All of the bus bars 78, 79 and 80 are alike and each is provided at appropriate intervals with female connector facilities 81, similar to those of the connector of Figs. 13 and 14, and which are adapted to receive the respective terminals 23^a, 24^a or 25^a therein.

Preferably the connector facilities 81 of the bus bars 78, 79 and 80 are made from the bus bar strip, as indicated in Fig. 15, by cutting from the bus bar strip, for example at 82 and 83, sections which are folded over toward one another as at 84 and 85 respectively to accommodate a terminal 23^a, 24^a or 25^a edgewise therebetween, as shown in Fig. 5, and the bus bar stock between the folded over portions 84 and 85 is provided with spaced apart slits 86 providing a springy intermediate section 87 between the slits 86, and this intermediate section 87 is provided with a bump or projection 88 which is adapted to engage the opening 67 (see Fig. 11) of the particular terminal 23^a, 24^a or 25^a that is inserted between the folded over portions 84 and 85.

While I have shown and described my invention in a preferred form, I am aware that various changes and modifications may be made without departing from the principles of the invention, the scope of which is to be determined by the appended claims.

What is claimed is:

1. An electric switch comprising a switch case having a cavity therein with a bottom wall of electrical insulating material which has an opening therethrough and said switch case having a terminal at the exterior thereof and projecting outwardly from said bottom wall for attachment of an electrical conductor thereto, a switch operating cam in said cavity, a pair of mating contacts in said cavity one of which is operable by said cam and movable to and from engagement with the other, and a single piece of electrically conductive thin flexible sheet metal of substantially uniform thickness throughout which provides a continuous jointless path of electrical conductivity from said terminal to said movable contact and has a leaf spring like narrow elongated portion thereof in the cavity presented edgewise toward said bottom wall and extending in a direction from side to side of the cavity and having said movable contact at one end thereof and said single piece of thin flexible sheet metal having another portion

thereof which extends laterally from the other end of said narrow flexible portion at one of the longitudinal edges thereof and projects through and is secured in the aforesaid opening of the bottom wall and has a portion thereof continued outwardly from the bottom wall and serving as the aforesaid terminal at the exterior of the case.

2. An electric switch comprising a switch case having a cavity therein with a bottom wall of electrical insulating material which has an opening therethrough and said switch case having a terminal at the exterior thereof and projecting outwardly from said bottom wall for attachment of an electrical conductor thereto, a switch operating cam in said cavity, a pair of mating contacts in said cavity one of which is operable by said cam and movable to and from engagement with the other, and a single piece of electrically conductive thin flexible sheet metal of substantially uniform thickness throughout which provides a continuous jointless path of electrical conductivity from said terminal to said movable contact and has a leaf spring like narrow elongated portion thereof in the cavity presented edgewise toward said bottom wall and extending in a direction from side to side of the cavity and having said movable contact at one end thereof and said single piece of thin flexible sheet metal having another portion thereof which extends laterally from the other end of said narrow flexible portion at that longitudinal edge thereof nearest the bottom wall of the switch case and projects through and is secured in the aforesaid opening of the bottom wall and has a portion thereof continued outwardly from the bottom wall and serving as the aforesaid terminal at the exterior of the case.

3. An electric switch comprising a switch case having a cavity therein with a bottom wall of electrical insulating material which has an opening therethrough and said switch case having a terminal at the exterior thereof and projecting outwardly from said bottom wall for attachment of an electrical conductor thereto, a switch operating cam in said cavity, a pair of mating contacts in said cavity one of which is operable by said cam and movable to and from engagement with the other, and a single piece of electrically conductive thin flexible sheet metal of substantially uniform thickness throughout which provides a continuous jointless path of electrical conductivity from said terminal to said movable contact and has a leaf spring like narrow elongated portion thereof in the cavity presented edgewise toward said bottom wall and extending in a direction from side to side of the cavity and having said movable contact at one end thereof and said single piece of thin flexible sheet metal having another portion thereof which extends laterally from the other end of said narrow flexible portion at that longitudinal edge thereof nearest the bottom wall of the switch case and projects through and is secured in the aforesaid opening of the bottom wall and has a portion thereof continued outwardly from the bottom wall and serving as the aforesaid terminal at the exterior of the case, the said portion which projects through said opening of the bottom wall as aforesaid being secured in said opening by portions of the single piece of thin flexible sheet metal which are offset respectively at the inner and outer ends of said opening and clamped respectively against the inner and outer sides of said bottom wall.

4. An electric switch comprising a switch case having a cavity therein with a wall of electrical insulating material, said cavity having therein an elongated leaf spring switch arm which extends crosswise of the cavity and is fixed at one end and free at the other end, a pair of mating contacts one of which is at the free end of the switch arm and movable therewith to and from engagement with the other contact, and a switch operating cam by which said free end is movable, said switch arm being an integral part of a single piece of thin sheet metal which has a portion thereof at the fixed end of the arm extending through and secured in said wall of insulating material and terminating in a tongue which projects outwardly from said wall at the exterior of the case for attachment of a current supply conductor thereto, said tongue having a slit extending lengthwise thereof between the lateral margins of the tongue and the portions of the tongue along the opposite sides of the slit being offset sidewise from the plane of the tongue and said sheet metal piece providing a continuous jointless electrically conductive path from said tongue to the said contact at the free end of the arm.

5. An electric switch comprising a switch case having a cavity therein with a wall of electrical insulating material, said cavity having therein an elongated leaf spring switch arm which extends crosswise of the cavity and is fixed at one end and free at the other end, a pair of mating contacts one of which is at the free end of the switch arm and movable therewith to and from engagement with the other contact, and a switch operating cam by which said free end is movable, said switch arm being an integral part of a single piece of thin sheet metal which has a portion thereof at the fixed end of the arm extending through and secured in said wall of insulating material and terminating in a tongue which projects outwardly from said wall at the exterior of the case for attachment of a current supply conductor thereto, said tongue having adjoining portions thereof which are between the lateral margins of the tongue and extend lengthwise thereof from said wall bent respectively in opposite directions from the plane of the tongue and said sheet metal piece providing a continuous jointless electrically conductive path from said tongue to the said contact at the free end of the arm.

6. An electric switch comprising a switch case having a cavity therein with a wall of electrical insulating material, said cavity having therein an elongated leaf spring switch arm which extends crosswise of the cavity and is fixed at one end and free at the other end, a pair of mating contacts one of which is at the free end of the switch arm and movable therewith to and from engagement with the other contact, and a switch operating cam by which said free end is movable, said switch arm being an integral part of a single piece of thin sheet metal which has a portion thereof at the fixed end of the arm extending through and secured in said wall of insulating material and terminating in a tongue which projects outwardly from said wall at the exterior of the case for attachment of a current supply conductor thereto, said tongue having a slit substantially midway between the lateral margins of the tongue and extending lengthwise thereof from said wall with the portions of the tongue along the sides of the slit bent respectively in opposite directions from the plane of the tongue, and said sheet metal piece providing a continuous jointless electrically conductive path from said tongue to the said contact at the free end of the arm.

7. An electric switch or the like comprising a case having a cavity therein and a wall of electrical insulating material which has a narrow internal slit extending therethrough from the cavity to the exterior of the case, and a thin sheet metal switch part in the cavity and having a tongue like portion thereof extending through and secured in said slit of the aforesaid wall and having a part thereof projecting outwardly from said wall at the exterior of the case to provide a terminal to which an electrical conductor is attachable, said outwardly projecting part being provided with at least four radial slits and having the portions thereof at the opposite sides of each said radial slit bent respectively in opposite directions from the plane of said outwardly projecting part.

8. An electric switch comprising a switch case having a cavity therein with a wall of electrical insulating material, said cavity having therein an elongated leaf spring switch arm which extends crosswise of the cavity and

is fixed at one end and free at the other end, a pair of mating contacts one of which is at the free end of the switch arm and movable therewith to and from engagement with the other contact, and a switch operating cam by which said free end is movable, said switch arm being an integral part of a single piece of thin sheet metal which has a portion thereof at the fixed end of the arm extending through and secured in said wall of insulating material and terminating in a tongue which projects outwardly from said wall at the exterior of the case for attachment of a current supply conductor thereto, the said tongue and the switch arm each having a slit extending lengthwise thereof and closed at each end with the portions at the opposite sides of each slit offset in opposite directions from the plane of the respective

tongue and switch arm and said sheet metal piece providing a continuous jointless electrically conductive path from said tongue to the said contact at the free end of the arm.

References Cited in the file of this patent

UNITED STATES PATENTS

1,635,256	Carter	July 12, 1927
1,670,189	Christie	May 15, 1928
1,918,282	Meuer	July 18, 1933
2,462,594	Beal	Feb. 22, 1949
2,495,266	Kruger	Jan. 24, 1950
2,549,998	Allison	Apr. 24, 1951
2,626,334	Koenig	Jan. 20, 1953
2,647,962	Batcheller	Aug. 4, 1953