

Sept. 24, 1963

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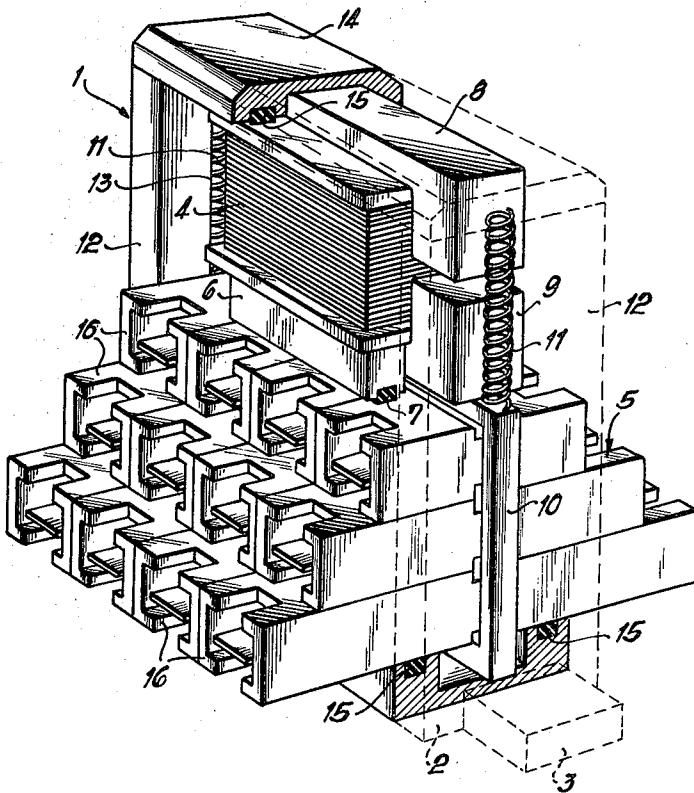
3,105,128

ELECTROMAGNETICALLY OPERATED REVERSIBLE SWITCH

Filed Dec. 21, 1959

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FIG. 1



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FIG. 2

FIG. 3

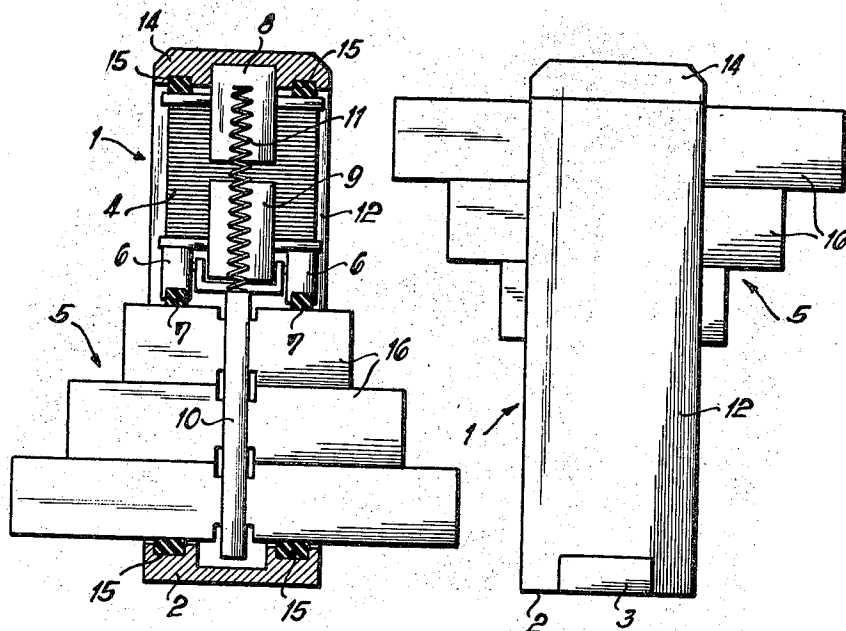
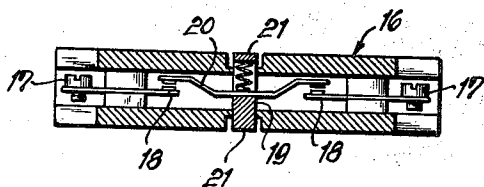


FIG. 4



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FIG. 5

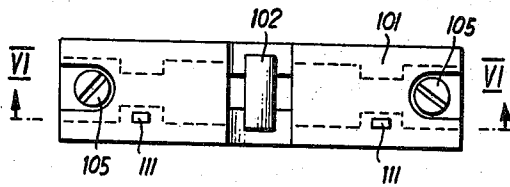


FIG. 7

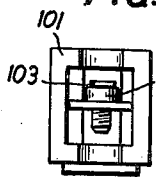


FIG. 6

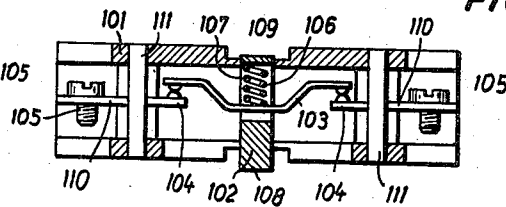
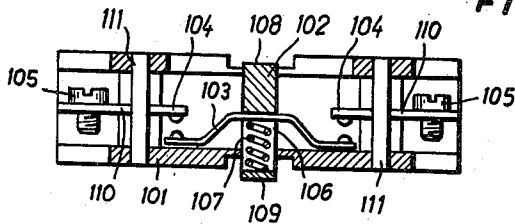


FIG. 8



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Filed Dec. 21, 1959

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FIG. 9

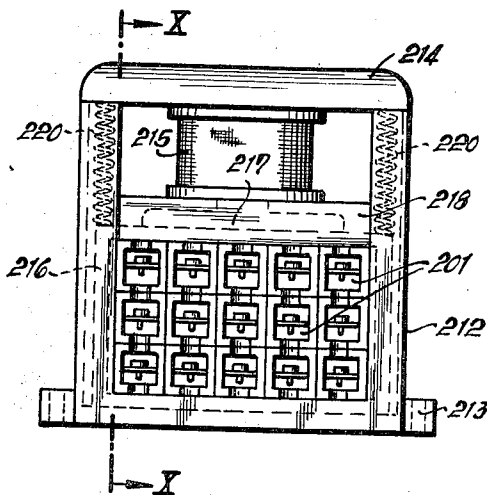
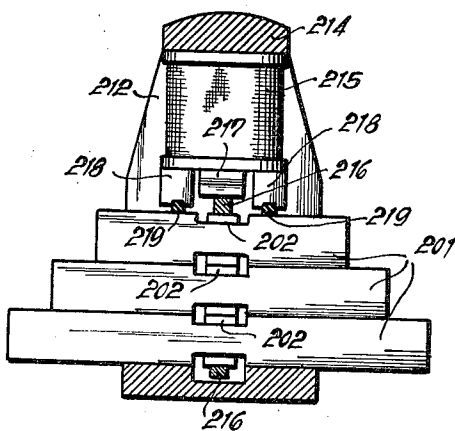


FIG. 10



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FIG. 11

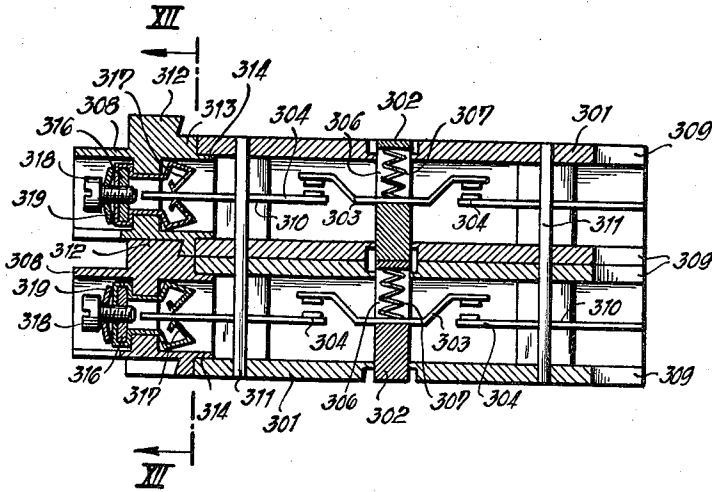
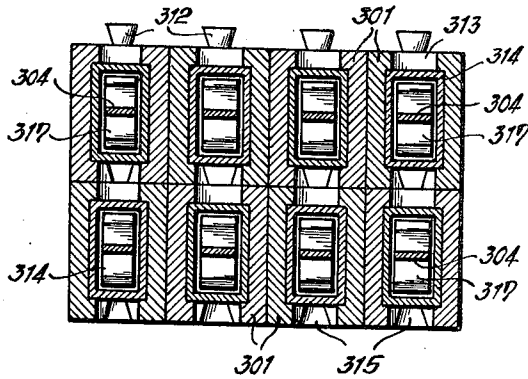


FIG. 12



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**ELECTROMAGNETICALLY OPERATED
REVERSIBLE SWITCH**

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Filed Dec. 21, 1959, Ser. No. 860,836

Claims priority, application Germany Dec. 24, 1958

11 Claims. (Cl. 200-87)

The present invention relates to an electric switch mechanism for installation in switch boxes or for mounting on switch boards, which comprises a housing and a switch block in said housing as well as an electromagnet for actuating said switch block.

With switch mechanisms of the above general type it is customary to mount the electric conductors or cables either directly on the mounting plate or at a certain distance from the mounting plate in special passages or in exposed manner. These types of mounting the cables are possible, however, with certain switch types only in which the terminals end near the mounting plates or in which the terminals are located in an elevated position. Such arrangements require additional manufacturing costs and also increase the stock keeping costs. Furthermore, the customer will have to keep a sufficient number of these switch types at hand in order to be able to effect prompt replacements when necessary. If it is necessary due to damages occurring to the respective switch mechanism to exchange the same, and if the required switch type is not at hand, replacement deliveries will considerably delay the installation.

It is, therefore, an object of the present invention to provide a switch which can easily be connected to cables or the like mounted in any one of the above mentioned manners.

It is another object of this invention to provide a switch as set forth in the preceding paragraph which is relatively simple in construction and can easily be effected by a few minor changes be connected to cables mounted in any of the above mentioned ways.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 illustrates a perspective view, partly in section, of a switch mechanism according to the invention with a switch block arranged at the lower portion of the mechanism.

FIG. 2 illustrates a switch mechanism according to FIG. 1, partly in section and partly in side view.

FIG. 3 illustrates a side view of a switch mechanism with the switch block arranged at the upper portion of the mechanism.

FIG. 4 illustrates a longitudinal section through one of the switch elements of the switch block, said switch element being designed as push button switch.

FIG. 5 is a top view of the switch element of FIG. 4.

FIG. 6 is a section taken along the line VI—VI of FIG. 5.

FIG. 7 is an end view of the push button switch of FIG. 6.

FIG. 8 represents a section similar to that of FIG. 6 through a push button switch but rotated by 180° about its longitudinal axis with regard to FIG. 6.

FIG. 9 represents a view of a relay with a plurality of push buttons assembled to a switch block.

FIG. 10 is a section taken along the line X—X of FIG. 9.

FIG. 11 is a longitudinal section through a switch block of a switch mechanism with inserted coupling block.

FIG. 12 represents a section taken along the line XII—XII of FIG. 11.

General Arrangement

The switch mechanism according to the present invention is characterized primarily in that the housing is provided with an opening for inserting the switch block composed of a plurality of push button switches and for inserting the electromagnet. This opening makes it possible to install the switch block and the electromagnet in such a way that the switch block will rest either against that housing wall which faces the connecting surface of the housing or will rest against the housing wall located opposite said first mentioned housing wall. The housing furthermore comprises openings which correspond to the various possible positions of the switch block and through which the electric conductors or cables will lead to the outside.

According to a specific embodiment of the invention, the housing comprises a U-shaped frame the lower leg portion of which is adapted to be connected to the mounting plate. The said U-shaped frame is provided with guiding means for receiving the switch block composed of individual push button switches and for further receiving the electromagnet, said switch block and electromagnet being inserted between the lateral legs of said frame and being braced relative to each other by means of a yoke connected to the lateral legs. Due to a corresponding arrangement of the push button switches, the switch block with its connecting terminals for the electric cables protrudes at both sides beyond the frame.

The switch mechanism according to the present invention may in a simple manner after removal of the yoke be disassembled and may be assembled in reverse sequence so that the switch block with its connecting terminals will according to the installation sequence be located either in the neighborhood of the mounting plate or at a certain distance above the same.

According to a further development of the invention, push button switches to be described further below will be employed to which a movable contact bridge is mounted in a switch housing common to and surrounding all individual elements, the contact bridge being adapted by means of a switch bolt to be engaged with stationary contacts or to be withdrawn therefrom.

Such push button switches forming the starting point of the present invention may be composed to form a switch block as mentioned above. Inasmuch as the housing of such individual switches also comprises lateral extensions usually located diagrammatically opposite to each other for receiving connecting screws, and since such housing has a non-symmetric shape, a plurality of the above mentioned switches can be composed only in a certain manner, namely either above each other or side by side. Particular space conditions where the switch blocks have to be installed will prevent the employment of push button switches composed in the said manner to that special switch types have to be employed in conformity with the prevailing space conditions. The last mentioned push button switches have the drawback that they are either designed as opening or closing members. This in turn makes it necessary to produce two different switch types both of which have to be kept in stock. The customer again is forced to keep in stock both said switch types in order to have them available whenever required. If one of the said switch types is not in stock and if the replacement delivery takes a long time, the customer will be forced to convert a closing switch into an opening switch or vice versa which in turn requires a relatively long time.

For the above reasons, the push button switches employed in conformity with the present invention are so designed that a plurality of these push button switches

may be composed to a switch block by arranging the same in superimposed position or side by side.

Furthermore, in order to allow the push button switch to operate as closing switch or as opening switch without the necessity of changing individual elements, the outer contour of the switch housing is designed in the shape of a rectangle. The connecting terminals of the cooperating contacts are located within the housing and are accessible through the open end sides of said housing. The switch bolt located along the central longitudinal plane of the housing and extending to the housing walls perpendicular to the longitudinal movement of said switch bolt will have its contacting surfaces flush with the outer walls of the housing when the contact bridge is in its lifted-off condition.

According to a further development of the invention, the ends of the push button switches are designed as an easily detachable plug coupling for the conductors to and from the terminals of the push button switches. Advantageously, the push button switches are so designed that the plug elements of the plug coupling may be connected with further similar coupling parts to coupling strips which in turn may be composed to a coupling block. These coupling strips or coupling blocks can easily be plugged into the push button switches composed to a switch block or switch mechanism without the individual push button switches requiring any material changes. Such an arrangement has the advantage that the individual conductors can be mounted outside the switch block which is of particular importance when the individual push button switches of the switch block at one time work as closing switch and at another time work as opening switch, i.e. when considerable switch problems have to be solved by the switch block.

Furthermore, inasmuch as such a switch block has relatively small dimensions so that in view thereof and wherever only a limited space is available as for instance on switch boards or in switch boxes, the connection of the conductors to the connecting terminals will be materially facilitated and the installation time will be considerably reduced.

This advantageous design of the switch mechanism and in particular of the push button switches is obtained in conformity with the present invention by the fact that for making the plug coupling, one or both open end sides of each push button switch is or are provided with conducting coupling elements and designed in such a way that a plug housing may be inserted in which the housing walls facing each other along the longitudinal central plane of the push button switch positively engage corresponding recesses in the housing of the push button switches. The arrangement is such that at the outside of the upper housing wall of the coupling there is provided a strip extending in the direction of insertion of the plug housing, whereas the lower housing wall has a recess corresponding to the dimensions of said strip.

According to a further development of the invention, the said strip is provided with conical inwardly inclined lateral surfaces, while the recess in the lower housing wall is dovetailed. This will make it possible to compose a plurality of couplings to a coupling block by merely inserting said strips into the dovetailed guides whereby a firm coupling connection will be obtained.

According to a still further development of the invention the oppositely located inner surfaces of the housing walls facing each other are provided with abutment surfaces which protrude beyond the lateral surfaces of said oppositely located housing walls and rest against the inner walls of the push button switch. The conducting coupling elements are located between said abutment surfaces.

According to a further feature of the invention, a plurality of couplings are composed to a coupling strip, and a plurality of coupling strips are composed to a coupling block, the strips of one coupling strip being in-

serted into the dovetailed guides of another coupling strip.

Structural Arrangement

Referring now to the drawings in detail and FIGS. 1 to 3 thereof in particular, the housing of the switch mechanism is formed by a U-shaped frame 1. The lower leg portions 2 support the plates 3 for receiving the connecting screws (not shown in the drawings). Mounted in frame 1 are the electromagnet 4 designed as lifting magnet, and the switch block generally designated 5. The iron core 8 of the lifting magnet 4 is supported by the switch block 5 through the intervention of a bracket 6 and a rubber strip 7 inserted in the latter. The movable armature 9 of the lifting magnet 4 has linked thereto a yoke 10 which embraces the switch block 5. The legs of yoke 10, which extend parallel to the lower leg portions 2 of frame 1, rest against the contact bolts which protrude from those sides of the switch block 5 which face said legs of yoke 10. Compression springs 11 rest against those legs of yoke 10 which are linked to the armature 9 of the lifting magnet 4. These springs 11 rest against frame 1 and hold the armature 9 in a lifted-off position from magnet 8 when lifting magnet 4 is not actuated. The inner walls of the lateral legs 12 of frame 1 are provided with grooves 13 in which the lateral legs of yoke 10 are slidably guided and in which the compression springs 11 are inserted.

As will be evident from FIGS. 1 and 2, the unit composed of switch block 5 and lifting magnet 4 has, after yoke 14 was removed, been inserted together with switch block 5 into the frame 1 whereupon the said unit has, together with the yoke 14, been clamped relative to each other and with regard to the lower leg portion 2 of frame 1. The switch block 5 with its terminals protruding beyond both sides of frame 1 is in this instance located in the lower frame range and is thus adapted directly to be connected to conductors mounted on the mounting plate. In order to provide for an elastic clamping, the inner sides of yoke 14 and of the lower leg portion 2 have rubber strips 15 inserted therein.

If the switch mechanism is to be made suitable for connection with conductors mounted on a mounting plate, first the lifting magnet 4 and then the switch block 5 are inserted into frame 1 and are clamped into frame 1 by means of yoke 14.

In the particular embodiment shown in the drawing, switch block 5 is composed of twelve switch elements 16 designed as push button switches, said switch elements 16 will be described in detail further below. The outer contour of the switch housing has the shape of a rectangle, and the connecting terminals 17 (FIG. 4) of the counter contacts 18 are located inside the housing and are accessible from the outside through the open end faces of the housing. The switch knob or rod 19 provided in the longitudinal central plane of the housing by means of which the contact bridge 20 is brought into contact with the contacts 18 or is lifted therefrom, extends from the housing at both sides thereof and has its length so dimensioned that the contacting surfaces 21 will be flush with the outer walls of the housing when the contact bridge 20 is in its lifted-off condition.

A switch element 16 of this type has the advantage that it can easily be converted from an opening switch into a closing switch and vice versa by rotating the switch element about its longitudinal axis by 180°. It will be appreciated that this is possible due to the completely symmetrical switch block and the switch rod 19 which is operable from both sides.

Switch block 5 may also be composed of less than 12 switch elements. The then vacant spaces will be filled by dead elements so that the outer dimensions of the switch block 5 will be retained. Consequently, the full switching force will not be required so that magnets with different pulling force may be employed. In this connection it is

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merely essential that the same magnet width be retained.

Referring now to FIGS. 5 to 8, these figures illustrate an individual push button switch having a housing 101. This housing 101 contains the switch bolt 102, a contact bridge 103 and counter contacts 104 with terminals 105. The contact bridge 103 extends through a window 106 provided in the switch bolt 102. It will also be evident that contact bridge 103 is pressed against the lower window edge by means of a spring 107. The terminals 105 of the counter contacts 104 are located within the housing and are accessible from the outside through the open end faces of the housing. Switch bolt 102 is arranged in the longitudinal central plane of the housing and extends through that housing wall which is perpendicular to the direction of movement of the switch bolt 102. The length of switch bolt 102 is so selected that in lifted-off condition of the contact bridge 103 the surfaces 108 and 109 will be flush with the housing walls.

The terminals 105 with the counter contacts 104 are inserted through the open end faces of the housing into corresponding guiding grooves 110 on the inner walls of housing 101 and are retained in housing 101 by strips 111 which extend through the housing walls in a direction parallel to the longitudinal direction of the switch bolt 102. A compression spring not shown in the drawing rests against the surface 108 of switch bolt 102 (FIG. 8) and holds the contact bridge 103 in its opening position. The surface 109 of switch bolt 102 is acted upon for instance by a pressure magnet the actuation of which moves switch bolt 102 and thereby contact bridge 103 into closing position. The push button switch shown in FIG. 6 thus works as an opener, or a normally closed, switch. When rotating this switch by 180° about its longitudinal axis, it will as shown in FIG. 8 become a closer, or a normally open, switch.

FIG. 9 illustrates by way of example how a plurality of push button switches can be assembled into a switch block in a relay. The switch block of FIG. 9 comprises 15 individual switches. The relay consists primarily of a frame 212 and has a detachable yoke 214. Arranged between the switch block formed by the switches 201 on one hand and yoke 214 on the other hand is an electric lifting magnet 215. This magnet 215 rests upon the switch block through the intervention of supporting strips 218 and rubber strips 219 inserted thereinto. The armature 217 of the lifting magnet 215 is fixedly connected to a yoke 216 which embraces the switch block. Yoke 216 is guided in corresponding guiding grooves in frame 212 and is maintained in opening position by means of spring 220 shown in FIG. 9. The contact bolts of the individual push button switches rest against the lower and upper portion of yoke 216. Similarly, all switch bolts 202 are power-locked to each other. When the control circuit of lifting magnet 215 is closed, the armature 217 is attracted into said lifting magnet 215 and yoke 216 will be lifted whereby all push button switches will be actuated. When interrupting the control circuit, springs 220 again press yoke 216 into its starting position, so that all push button switches will be actuated in the other direction.

The strips 111 (FIGS. 5 to 8) furnish the possibility of holding not only the terminals 105 with counter contacts 104 in housing 1 but make it also possible to interconnect a plurality of push button switches. In this connection it is, of course, a prerequisite that the strips 111 be correspondingly longer.

FIGS. 11 and 12 illustrate a further embodiment of a switch block with two rows of four push button switches each. In the switch housing 301 of each push button switch there is arranged, as described above in connection with FIGS. 5 to 8, a switch bolt 302, a contact bridge 303 and counter contacts 304. The contact bridge 303 extends through a window 306 in switch bolt 302 and is pressed against the lower window edge by means of a spring 307. The terminals of the counter contacts 304

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are located inside the housing 301 and are accessible from the outside through the open end faces of the housing. Switch bolt 302 is arranged in the longitudinal central plane of the housing and extends through the housing walls arranged perpendicular to the direction of movement of switch bolt 302. The length of switch bolt 302 is so selected that when the contact bridge 303 is in its lifted-off position, the push button switch surfaces will be flush with the housing walls. The terminals with the counter contacts 304 are inserted through the open housing end walls into corresponding guiding grooves 310 on the inside of housing 301 and are held in housing 301 by means of strips 311 which extend through the housing walls parallel to the longitudinal direction of the switch bolt 302.

The coupling consists of a housing 308 within which the conducting coupling elements 317 are located. Those housing walls which are located opposite to each other in the longitudinal plane of the push button switch positively engage recesses 309 in the push button switch housing. The outside of the upper housing wall of the coupling is provided with a strip 312 extending in the direction of insertion, and in the lower housing wall there is provided a recess 315 corresponding to the dimensions of strip 312. Recess 315 may in its horizontal cross sectional plane either have a pointed corner or a round corner. The side surfaces of strip 312 are inclined toward the inside, and the recesses 315 of the lower housing wall are designed as dovetailed guides. In the drawings, strip 312 is inserted into the dovetailed guide 315. Those inner surfaces of the oppositely located housing walls which face each other are provided with abutment surfaces 314 resting against the inner walls of the push button switch and protruding beyond the side wall surfaces of the oppositely located housing walls.

As has been illustrated in the drawings, a plurality of couplings have been composed to a coupling strip, and a plurality of coupling strips have been composed to a coupling block. The strips 312 of one coupling strip have been inserted into the dovetailed guides of the other coupling strip. The conducting coupling members 317 are designed as terminal yokes which engage the lower and upper sides of the terminals of the stationary contacts 304. By means of screws 318, the nuts 316, and the discs 319 the terminal yokes are maintained in the housing 308 of the coupling.

As will be evident from the above, by means of the push button switch according to the present invention it is possible to replace the heretofore customary switch combinations of switch relays, according to which a certain number of switches is combined as closing switches or opening switches to fixed groups. Such limitations of the heretofore known switch combinations in which for instance two opening and two closing switches or four opening and two closing switches etc. are combined to structural units, prevent the switches from being fully exploited. Moreover, the number of switches of one unit might not suffice so that a plurality of structural units will have to be mounted in parallel arrangement.

It will be evident from the preceding description that the just mentioned drawbacks will be obviated by the push button switches according to the present invention. The individual switches may depending on the respective requirements be combined to a unit.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In an electric switch arrangement for installation in switch boxes and for building up switch boards: a housing having a rectangular opening, a plurality of pushbutton switches each having a reciprocable actuating element in about the middle thereof, said switch bodies being composed to form a switch block and mounted in said

opening of said housing, each said switch being rectangular in cross section from end to end and said actuating element having a length equal to the height of said housing, an electromagnet element likewise mounted in said opening in said housing adjacent said switch block for actuating said switches of said switch block, said switch block and said electromagnet making up a unit having the same overall dimensions as said opening so as to be insertable into said housing through said opening, said switch block engaging one wall of the opening of said housing and said electromagnet engaging the opposite wall thereof, said switches including means for connecting electric conductors thereto, each of said switches being invertable in said housing to occupying either of two respectively inverted positions therein, and each of said switches comprising contact elements under the control of the respective said actuating element, said switches being normally closed or normally open depending on the position in which they are placed in said housing, said electromagnet including an armature portion engaging said actuating elements and spring means urging the armature in one direction.

2. In an electric switch arrangement for installation in switch boxes and for building up switch boards: a housing having a U-shaped frame with the inner sides of the legs of said U-shaped frame provided with guiding means, a plurality of pushbutton switches each having a body and a reciprocable actuating element therein and composed to form a switch block, each said switch being rectangular in cross-section, the length of said actuating element corresponding to the height of said body, an electromagnet for actuating said switch block operatively associated with said actuating elements, said switch block and said electromagnet being received in said guiding means, and yoke means mounted in said frame legs and firmly securing said switch block and said electromagnet in said frame, said pushbutton switches having their end portions provided with terminals and forming groups of different lengths, said groups of pushbutton switches being arranged so as to form steps with each other and protruding from opposite sides of said U-shaped frame.

3. In an electric switch arrangement for installation in switch boxes and for building up switch boards: a housing having a U-shaped frame with one of its legs forming the bottom portion of said frame, a plurality of pushbutton switches each having a body and a reciprocable actuating element therein and composed to form a switch block and mounted in said frame, each said switch being rectangular in cross-section, the length of said actuating element corresponding to the height of said body, an electromagnet designed as lifting magnet and likewise mounted in said frame, said electromagnet comprising a stationary core supported by said frame and also comprising a movable armature operatively associated with said actuating elements and stationary means, said armature being spaced from said core in non-energized condition of said electromagnet, supporting means supporting said stationary means on said switch block, yoke means extending around said switch block and linked to said armature, said yoke means comprising legs substantially parallel to said bottom portion of said frame and engaging the respective adjacent actuating elements of said pushbutton switches, and spring means continuously urging said armature away from said magnet core, said springs resting against said yoke means and said frame.

4. In an electric switch arrangement for installation in switch boxes and for building up switch boards: a housing having a U-shaped frame with one of its legs forming the bottom portion of said frame, a plurality of pushbutton switches each having a body and a reciprocable actuating element therein and composed to form a switch block and mounted in said frame, each said switch being rectangular in cross-section, the length of said actuating element corresponding to the height of

said body, an electromagnet designed as lifting magnet and likewise mounted in said frame, said electromagnet comprising a stationary core supported by said frame and also comprising a movable armature operatively associated with said actuating elements and stationary means, said armature being spaced from said core in non-energized condition of said electromagnet, supporting means supporting said stationary means on said switch block, yoke means extending around said switch block and linked to said armature, said yoke means comprising legs substantially parallel to said bottom portion of said frame and engaging the respective adjacent actuating elements of said pushbutton switches, and spring means continuously urging said armature away from said magnet core, said spring means resting against said yoke means and said frame, the legs of said U-shaped frame being provided with grooves extending in longitudinal direction of said legs and slidably guiding said yoke means.

5. A switch arrangement according to claim 4, in which said spring means are likewise located in said grooves.

6. In an electric switch arrangement for installation in switch boxes and for building up switch boards: a housing having a U-shaped frame with one of its legs forming the bottom portion of said frame; a plurality of pushbutton switches composed to form a switch block and mounted in said frame; said pushbutton switch each comprising a pushbutton; an electromagnet designed as lifting magnet and likewise mounted in said frame; said electromagnet comprising a stationary core supported by said frame and also comprising a movable armature operatively associated with said actuating elements and stationary means; said armature being spaced from said core in non-energized condition of said electromagnet; supporting means supporting said stationary means on said switch block; yoke means extending around said switch block and linked to said armature; said yoke means comprising legs substantially parallel to said bottom portion of said frame and engaging the respective adjacent push buttons of said pushbutton switches; spring means continuously urging said armature away from said magnet core; said spring means resting against said yoke means and said frame; the legs of said U-shaped frame being provided with grooves extending in longitudinal direction of said legs and slidably guiding said yoke means; each of said pushbutton switches comprising a body having a different longitudinal and transverse cross-section respectively of substantially rectangular contour, a plurality of stationary contact elements provided with stationary contacts, a contact bridge movably mounted in said body and provided with a plurality of contacts for selective engagement with said stationary contacts, said push button being movably mounted in a bore extending completely through said body and located in the central longitudinal plane of said body with the length thereof being substantially the same as the distance between the respective adjacent major outer surfaces of said body; said stationary contact elements being provided with terminals located within said body and accessible from the outside thereof, said push buttons operatively engaging the respective contact bridges of the switches pertaining thereto.

7. A switch arrangement according to claim 6, in which the inner surfaces of the sidewalls of each switch body are provided with guiding grooves extending in longitudinal direction of said switch body and receiving said contact members pertaining thereto, and in which securing means are provided respectively supported by said body and stationarily supporting said contact members.

8. A switch mechanism according to claim 6, in which each switch body and the supporting means pertaining thereto are of electric current non-conducting material.

9. A switch arrangement comprising: a housing, an electromagnetic actuator in said housing having a portion stationary in said housing and also having a movable armature, said housing and the stationary portion of said

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electromagnetic actuator forming a rectangular space, a switch block in said space composed of a plurality of individual switches in side by side and superposed relation each switch being rectangular in cross section, each switch having stationary contact means therein and also having movable contact means therein for movement relative to the stationary contact means, an actuating element extending through each switch operatively associated with the movable contact means therein, and each actuating element in length corresponding to the height of the switch and said actuating element being in alignment with the actuating elements of the next adjacent switches in the direction of movement of the actuating element whereby a stack of superimposed switches of the switch block can be actuated in unison by actuation of the actuating elements at the ends of the stack of switches and whereby each individual switch can be selectively drawn endwise out from or inserted endwise into the switch block, and in either of two respectively mounted positions, said armature engaging the actuating elements at both ends of the stack of switches.

10. A switch arrangement according to claim 9 in which said switches are provided with bores therein parallel with said actuating elements which bores are aligned when the switches are stacked with their actuating elements in register, and members extending through said

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bores traversing the stack of switches and holding them in assembled relation.

11. A switch arrangement according to claim 9 in which the said armature is in the form of a yoke which extends completely around the switch block and engages the actuating elements at both sides of the stack for positive movement thereof in both directions in conformity to the movement of the armature.

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