

July 28, 1931.

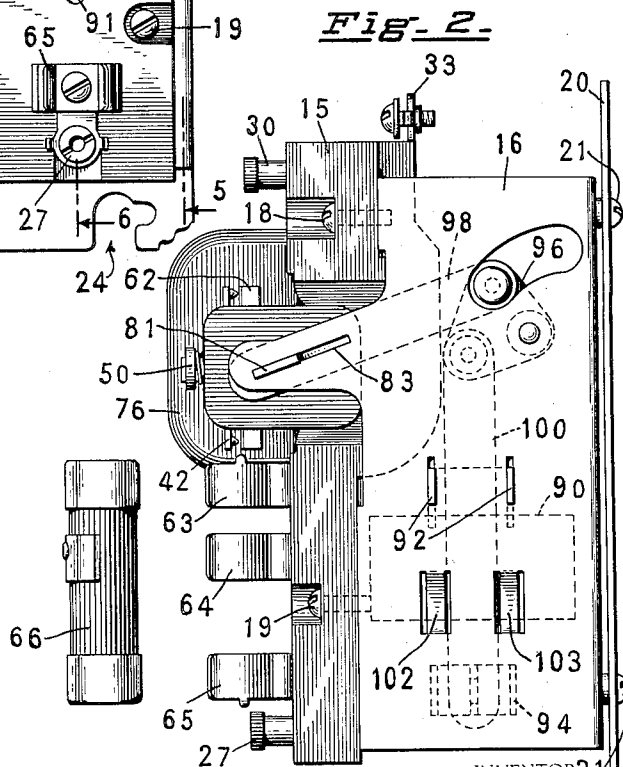
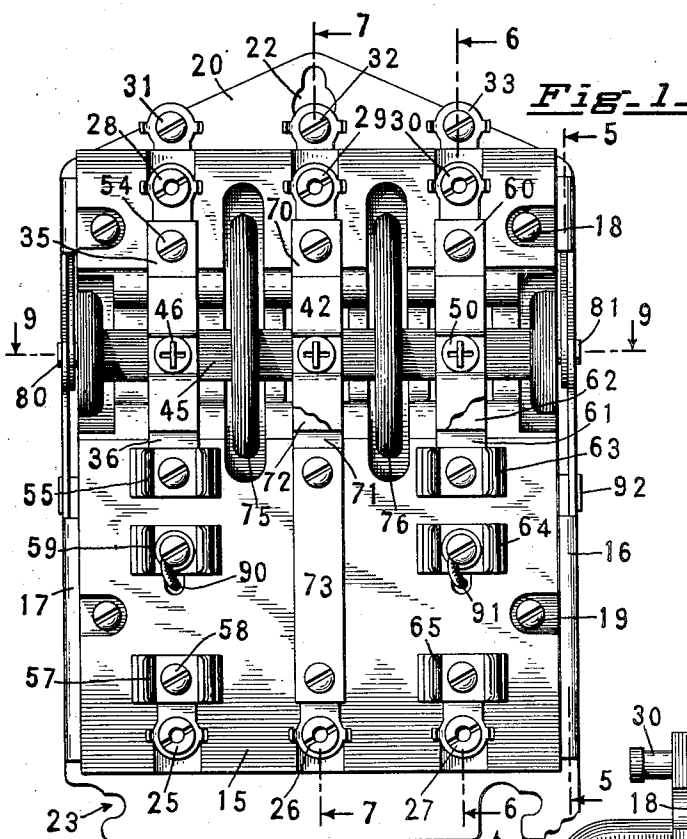
B. E. GETCHELL

1,816,429

ELECTRIC SWITCH

Filed Sept. 22, 1927

5 Sheets-Sheet 1



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July 28, 1931.

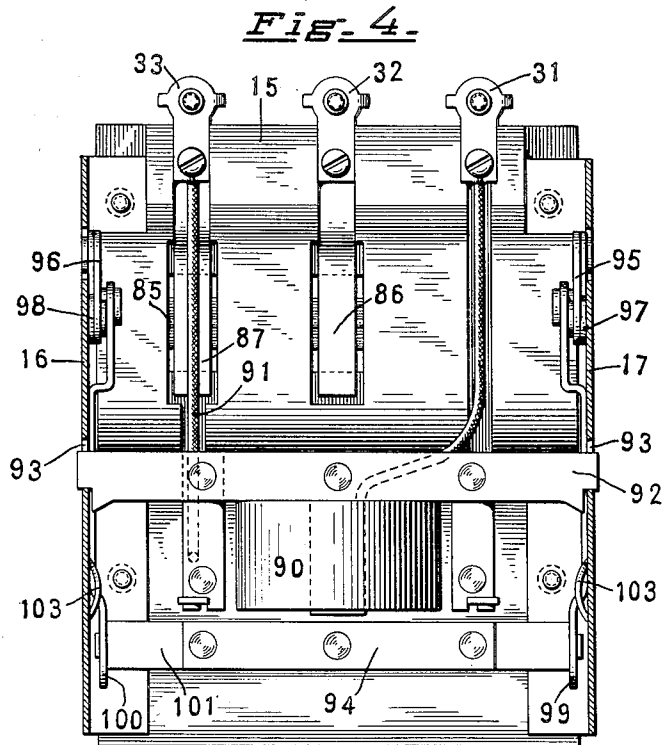
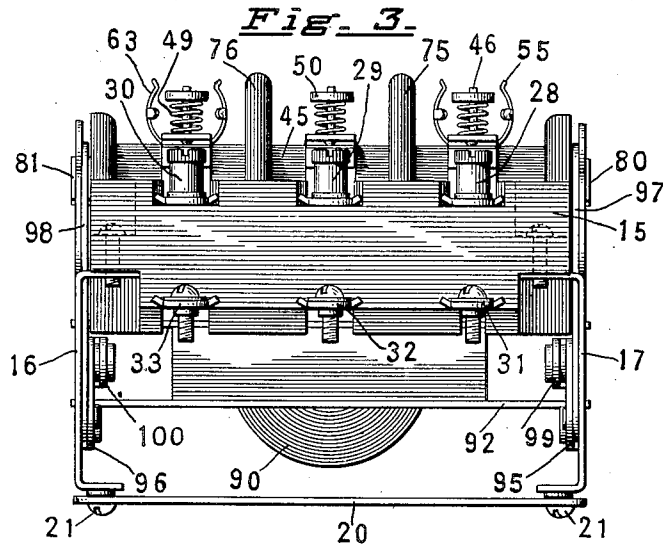
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Fig. 6.

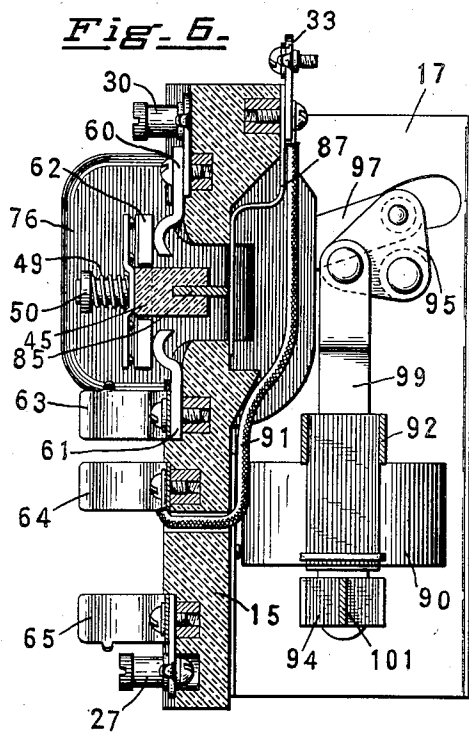


Fig. 7.

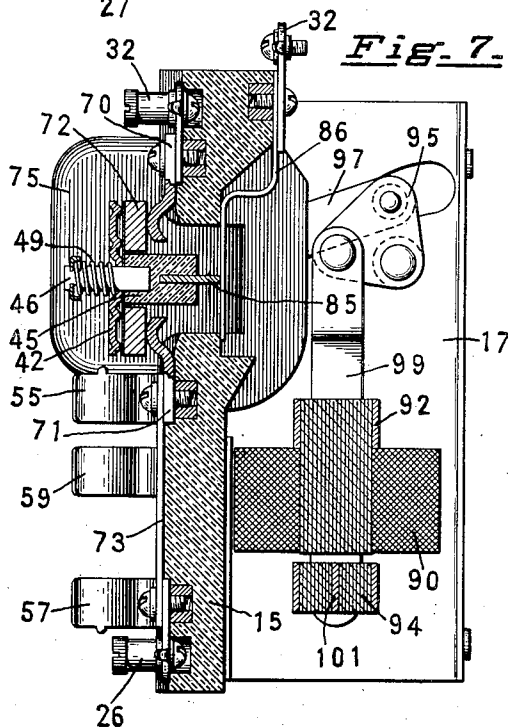
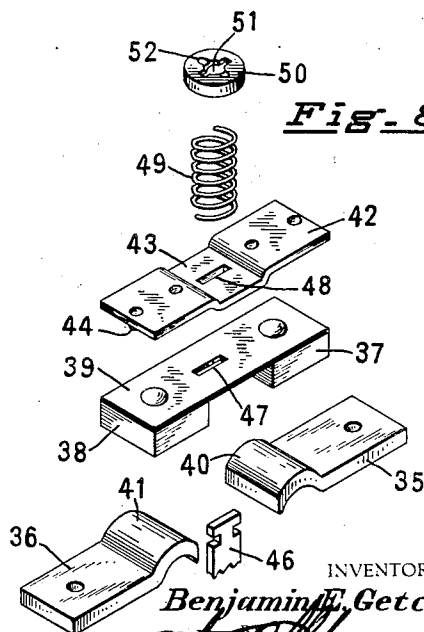


Fig- 8-



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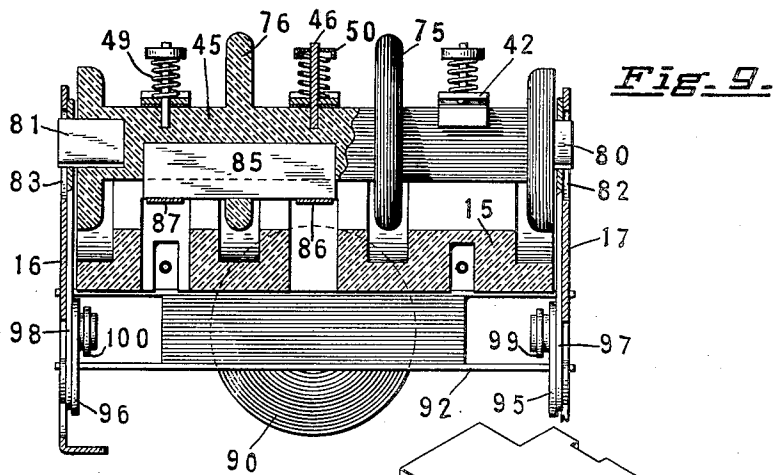


Fig. 9.

Fig. 10.

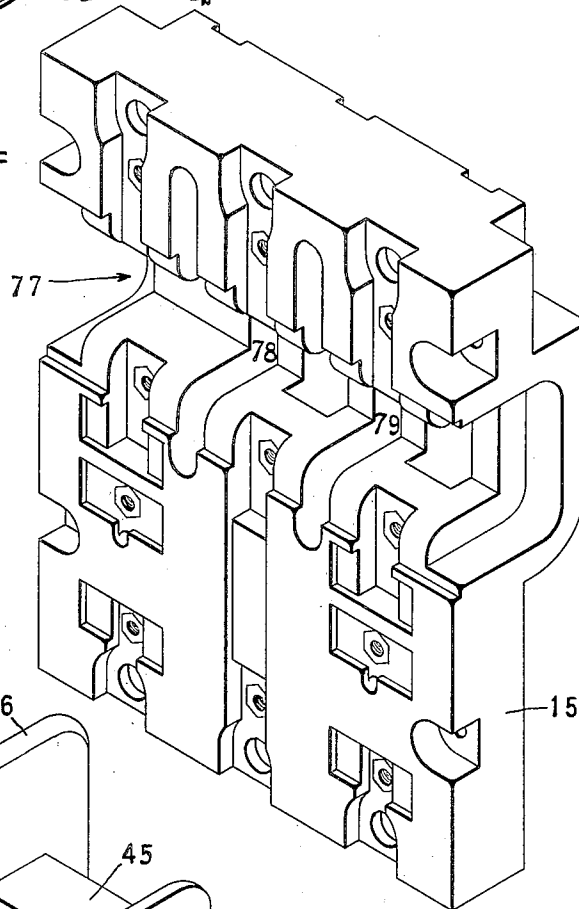
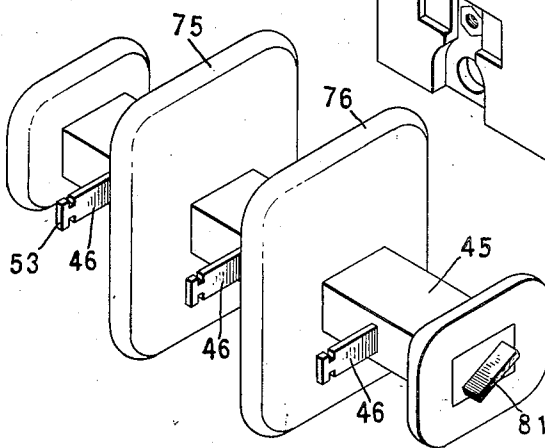


Fig. 11.



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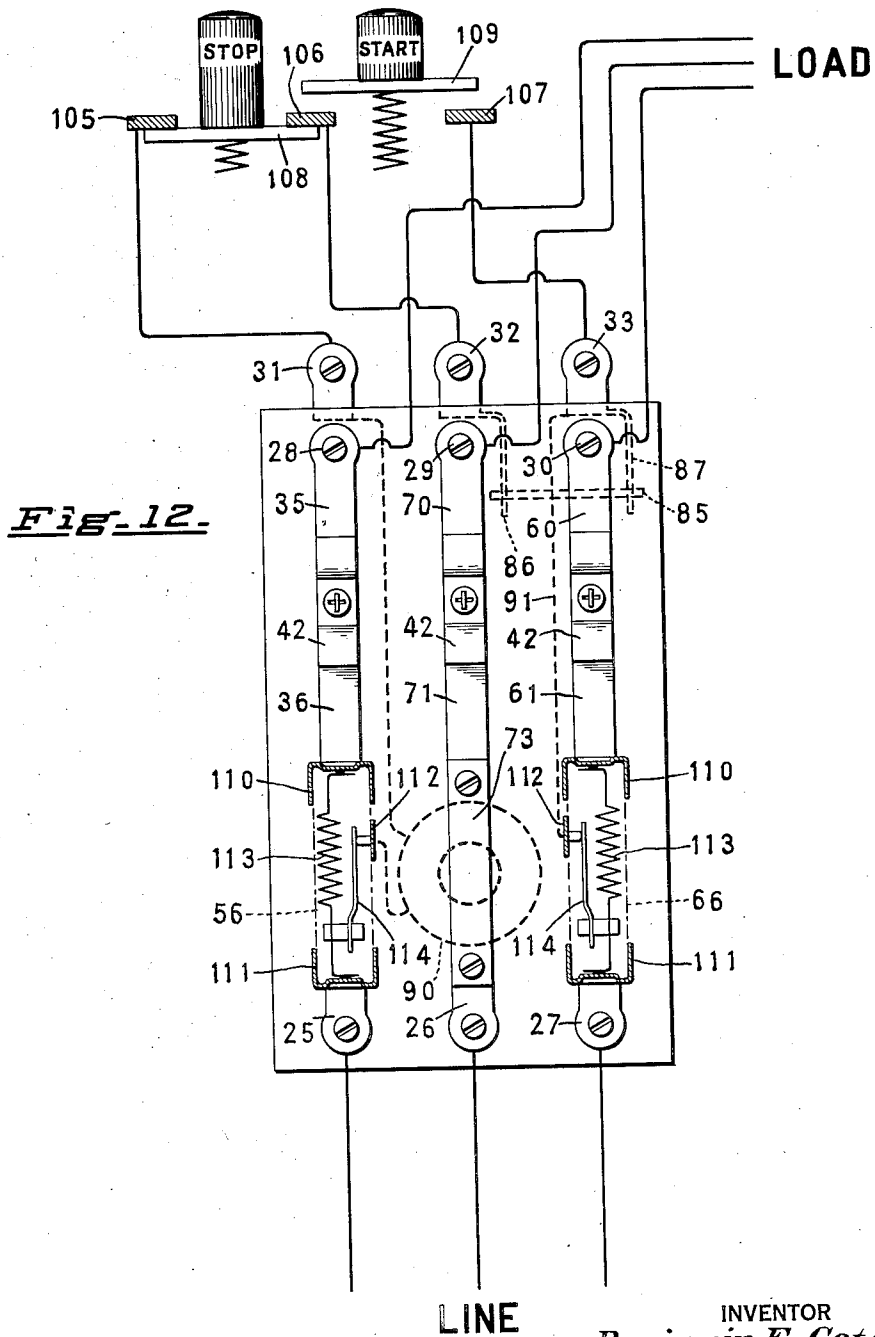
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ELECTRIC SWITCH

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5 Sheets-Sheet 5



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ELECTRIC SWITCH

Application filed September 22, 1927. Serial No. 221,215.

One object of my invention is to provide an extremely compact and efficient double break switch of the remote control type.

Another object is to provide a double break switch of the magnetically controlled type in which the circuit is carried through the switch without the necessity of flexible leads.

Another object is to provide a double break switch in which the movable contact members are freely removable for inspection or replacement without the use of tools of any description.

Another object is to provide a double break switch having a movable contact member for simultaneously engaging its corresponding stationary contacts and in which the respective contact ends are flexible with respect to each other and independently self-adjustable with respect to the stationary contacts.

Another object is to provide a remote control switch in which all of the line and load wire connecting means are positioned on one level on the base and all of the remote control wire connecting means are positioned on another level in order to facilitate wiring or to identify the circuits.

Another object is to provide an electric switch having a slotted base and a series of pairs of stationary contacts together with a movable insulating contact-carrying bar positioned between the two members of each pair of stationary contacts and having insulating flanges co-operating with the slots in the base to electrically separate the respective pairs of stationary contacts as well as the respective movable contacts. Another object is to provide an electric switch construction including a molded insulating bar having insulating barriers and having contact positioning studs and movement guiding plates molded in the material of the bar to form a unit.

Another object is to provide an insulating bar of the preceding description and having an independent circuit connecting strip molded in the material of the bar.

Another object is to provide a unitary carrier for all the movable contacts of a remote-controlled switch.

A further, and an important object is to

provide a switch construction of the remote control type in which a single magnet is utilized (1) to close the load circuit in response to the movement of a co-operating push button, (2) to retain the switch in closed position under normal load conditions, (3) to open the load circuit in response to the movement of a second push button and (4) to automatically open the circuit in response to overload conditions. It is designed particularly for the use of standard relays which are included in the circuit and by the use of which it is possible to accurately fix or to vary the exact point at which the switch will be automatically operated on overload conditions.

An important object is to provide a construction in which the movable switch contacts are connected to the movable member of an electro-magnet so as to move simultaneously with the magnet member and for a proportionate relative distance as required.

Another object is to provide a construction in which the movable switch contacts and the movable member of an electro-magnet are so connected as to move simultaneously and so that the switch contacts may be moved at any desired angle relative to the lineal path of movement of the magnet member.

A particular object of my invention is to provide a construction in which the movable contacts of a switch are so connected with the movable member of an electro-magnet that the movement of the magnet member will simultaneously move the switch contact at an angle relative to the corresponding stationary contact so as to engage the latter with an angular or wiping movement.

Another object is to provide a construction in which the movable contacts of a switch, or a similar construction, are connected with the movable member of an electro-magnet so as to move simultaneously with the magnet member and to further provide a guiding means whereby the switch contacts will be moved in a predetermined angular path of movement with respect to the lineal movement of the magnet member.

This invention applies particularly to the class of electric switches and similar devices

in which an electro-magnet and an armature are arranged to co-operate, under certain circuit conditions to open or close a circuit or to operate co-related parts of the construction.

Devices of this class are usually build up of a comparatively large number of parts mounted on a base, the base being supported by a frame or its equivalent which is in turn secured in an enclosing box.

The magnetically operated armature moves rapidly and stops with considerable impact against the magnet or some part of the construction provided for that purpose. Such constructions usually include a considerable number of screws for holding the parts in position in addition to the usual screws for connecting the circuit wires and the repeated stopping impact of the magnetically operated member against any part of the construction tends to loosen the parts, especially the screws and it is my particular object to guard against such danger by providing a construction which will allow for the full and complete movement of the magnetically operated parts in such a manner that the operating impact will not be transmitted to the screws or other co-related parts.

In the specific form shown herein, the armature is arranged to be moved to effect the desired result although in some cases it may be desirable to provide a movable magnet coil to co-operate with a relatively stationary armature but, in either case, it is my purpose to provide for a certain relative movement between the magnet and its co-operating armature.

In reducing my invention to actual practice, I preferably provide an electro-magnet (together with its core and pole pieces as a unit) with a form of mounting which will permit a limited free movement and a co-operating movable armature which has an operable connection with movable switch contacts or other parts which are to be operated.

The magnet unit, the armature and the switch contacts are so co-related that, when the armature is attracted by the magnet it will cause a simultaneous movement of the switch contacts and, when the armature strikes against the poles of the magnet unit, the free movement mounting of the latter will permit it to move in response to the impact but, due to this free movement mounting, no shock or impact will be transmitted to the screws or other parts of the construction.

In other words, the operating shock of the armature will be absorbed by the magnet unit because of its free movement mounting.

After receiving the operating impact of the armature, the magnet is returned to its normal "on" position by the pressure of the contact springs and gravity.

The foregoing describes the basic ideas of the invention, but in practice, certain refine-

ments of detail are desirable; for instance, it is desirable that some of the shock of the fast moving armature be cushioned or absorbed by a suitable yielding means before the armature actually strikes against the poles of the magnet and it is also desirable that the switch contacts close with a yielding pressure. These two requirements are provided for by using spring contacts which engage the corresponding stationary contacts before the armature reaches the poles of the magnet and, for the reason that the spring contacts are connected with the armature, the closing impact of the latter is checked.

When the armature has completed its switch closing movement, it rests against the pole pieces of the magnet and will remain in that position against the tension of the spring contacts which however will operate to cause a rapid separation of the armature from the magnet when the circuit is broken. These spring contacts also operate to move the magnet back into its normal position as it stood before being struck by the moving armature.

The accompanying drawings show one form of mechanism embodying all of the improvements of my invention.

Fig. 1 is a front view of the construction but omitting the relay elements.

Fig. 2 is a side view showing one of the relays preferably intended to be used with the construction. Such a relay is shown in my former Patent No. 1,569,364, dated January 12, 1926.

Fig. 3 is an end view.

Fig. 4 is a rear view, some of the parts being shown in section.

Fig. 5 is a view from the right hand side, the right hand side plate being omitted and parts being shown in section.

Fig. 6 is a vertical sectional view on the plane of the line 6—6 of Fig. 1.

Fig. 7 is a vertical sectional view on the plane of the line 7—7 of Fig. 1.

Fig. 8 is an exploded perspective view of the contact members and details of one of the switch units.

Fig. 9 is an inverted horizontal sectional view and plan on the plane of the line 9—9 of Fig. 1.

Fig. 10 is a perspective view of the insulating base which carries all of the conducting parts except the magnet.

Fig. 11 is a perspective view of the insulating contact carrying cross bar.

Fig. 12 is a diagrammatic view of parts of the switch in an operating circuit.

The base or body 15 may be formed of insulating material, such as molded composition. In the form shown the side plates 16 and 17 are of metal and provided with flanges which are secured to the base by screws, such as 18 and 19. The back plate 20 may be se-

cured to the side plates by screws such as 21. This particular form of side plate is adapted for convenient attachment to a back board or in a switch box (not shown). For convenience this back plate 20 is provided with a keyhole slot 22 at the top by means of which it may be conveniently hung on a screw (not shown). The lower corners of this plate 20 are provided with notches 23 and 24 which open toward one side and toward the bottom for convenience in mounting the plate under the heads of screws (not shown) in an enclosing box.

The line terminals 25, 26 and 27 are mounted on the front face of the base along its lower edge. The load terminals 28, 29 and 30 are mounted in the same plane along the upper edge of the base. The terminals 31, 32 and 33 adapted to be connected to a control station or switch are mounted along the upper edge of the base at its rear. The load may be, for instance, a motor (not shown).

The switch has three circuit controlling units in the particular form shown. The left hand unit has stationary contacts 35 and 36 and a movable switch member composed of contact members 37 and 38 connected together by a flexible strip 39 which may be formed of thin laminations so that the two contact members 37 and 38 are free to tilt and rock so as to assure perfect contact with the raised portions 40 and 41 of the stationary contacts. The details of this construction are shown particularly in Fig. 8.

The back plate 42 has its ends offset from the plane of its central portion 43 and is provided with small bosses 44 adapted to rest against the back of the connecting strip 39 so as to permit relative tilting of the contact pieces 37 and 38. The movable contact parts just described and the corresponding movable contacts for the other switch units are all carried by the insulating member 45 which extends across the base of the switch in the form of a cross bar. This cross bar has set in it a flat stud 46, the end of which extends through slots 47 and 48 (Fig. 8) and supports a spring 49 and a cup-like washer 50. This washer has a central slot 51 to permit it to be slipped on to the end of the stud 46. It also has notches 52 adapted to receive the ends of the T-shaped head 53 of the stud when the washer 50 is rotated through 90 degrees. In this way the movable contact parts may be readily removed and replaced when desired by the simple operation of pressing down upon the washer and turning it with the fingers.

The upper contact 35 of the left hand switch unit is electrically and mechanically secured to the terminal 28 by a screw 54. The lower contact 36 is secured to the clip 55 for the relay 56 (Fig. 12). The lower clip 57 for the relay is electrically and mechanically connected to the lower terminal 25 by

screw 58 which may be seated in a suitable insert in the base in any suitable manner. The intermediate clip 59 for the relay is similarly secured to the base.

The right hand switch unit is constructed in the same manner as the one previously described and has stationary contacts 60 and 61 and a movable contact 62. Relay clips 63, 64 and 65 for the relay 66 are similarly mounted to those previously described. The central switch unit also has stationary contacts 70 and 71 and a movable contact 72. This unit, however, requires no relay and hence the contact 71 is connected directly to the terminal 26 by a strip 73.

The carrier bar 45 is provided with insulating flanges 75 and 76 on opposite sides of the central switch unit to serve as barriers between the switch members of the respective units. The base 15 is provided with a transverse groove 77 to receive the cross bar 45 which also serves as a barrier between the contacts of each respective pair of the stationary contacts. The base is also grooved at 78 and 79 to receive the ends of the flanges 75 and 76, respectively. The opposite ends of the switch carrier 45 are provided with projecting lugs 80 and 81 which are movably mounted in grooves 82 and 83 in the side plates 17 and 16 respectively.

A cross connecting contact 85 is mounted in the back of the cross bar 45 and adapted to connect the resilient contact members 86 and 87. The two latter contacts are connected respectively to the control switch terminals 32 and 33 and the operation will be explained hereinafter.

At the back of the base 15 is mounted an electro-magnet and armature. This magnet has a coil 90 one terminal of which is connected to the control switch terminal 31 and the other terminal of the coil is connected to the intermediate clip 59 for the left hand relay 56. The control switch terminal 33 is connected by wire 91 to the intermediate clip 64 for the right hand relay 66. The core of the magnet is preferably laminated in the customary manner and secured to laterally extending cross bars 92 which are slidably supported in the side plates 16 and 17. The magnet core frame is mounted so that it may move vertically in the slots 93 a limited amount. The armature 94 may also be laminated and movable vertically with respect to the magnet coil and core. The armature is connected to the insulating cross bar or contact carrier 45 by a link motion which is supported by the side plates 16 and 17. Lever plates 95 and 96 of substantially bell crank form are pivoted to the side plates 17 and 16 respectively, and connected to the lugs 80 and 81 of the insulating cross bar by links 97 and 98. Extending from these levers 95 and 96 are connecting rods 99 and 100, the lower ends of which are connected to

the ends of the cross bar 101 which carries the armature 94. The connecting rods and links 99 and 100 may be guided between lugs or projections 102 and 103 formed in the side plates 16 and 17.

When the magnet is energized it lifts the armature 94 and, through the medium of the connecting links 99 and 100, tilts the lever plates 95 and 96, and thus through the pull of the links 97 and 98 draws the contact carrier 45 toward the base so as to cause the movable contacts to engage the stationary contacts. On account of the inclination of the guide slots 82 and 83 the movable contacts slide upwardly on the stationary contacts until fully seated, thus affording a wiping contact which insures perfect electrical connection. As the contact carrier 45 is drawn backward and upward toward the base, the springs 49 are compressed, thus insuring an even pressure between the contacts and affording a yielding engagement which prevents shock to the parts of the switch. As the cross piece 85 engages the resilient contacts 86 and 87 additional resiliency is provided to bring the parts to rest without shock. In the form shown the electromagnet is vertically movable being guided in the slots 93 so that even the inertia of the moving armature cannot apply a direct blow on the stationary parts of the mechanism.

The control switch may be of any suitable construction. One form is illustrated diagrammatically in Fig. 12 in order to facilitate a complete understanding of the method of operation of the invention. In this form the control switch has stationary contacts 105, 106 and 107 and movable switch members 108 and 109 which are spring pressed in any suitable manner. Normally the switch member 108 connects the contacts 105 and 106 and the switch member 109 is normally out of contact. The contact 105 is connected to the terminal 31. The contact 106 is connected to the terminal 32 and contact 107 is connected to the terminal 33.

The relay preferably employed in the switch has end caps 110 and 111 adapted respectively to the upper and lower relay clips, and a central external contact 112 connected to the intermediate relay clip. The end caps are connected together by a heating element 113 arranged along side of a bi-metallic spring arm 114 whose end normally engages part of the contact 112.

When the apparatus is assembled and in operation the load circuit may be traced from the left hand line terminal 25, through the heater strip 113 of the relay 56 to the stationary switch contact 36, thence through the movable switch member of the left hand switch unit to the stationary contact 35 and the load terminal 28 to the load. In a similar way the circuit may be traced from the

right hand line terminal 27 through the relay 66 to the load terminal 30 and the load. The intermediate line may be traced from the terminal 26 through the strip 73, the central switch unit to the load terminal 29 and the load.

The operation of the switch and the resultant circuits are as follows: Let us consider Fig. 12 as showing the circuit in the "off" position. The opening and closing of the switch is accomplished by the circuits which control the magnet. To close the switch the operator presses the button carried by the contact 109 when the circuit will be as follows: Line terminal 25 to elements 111, 114, 112 (of relay 56) coil 90, 31, 105, 108, 106, 109, 107, 33, 91, 112 (of relay 66) 114, 111 to terminal 27.

The above operation has energized the magnet which operates to close the switch and, in this position, a holding circuit is established by the connecting of contacts 86 and 87 by the connector 85, so that the starting button may be released without interrupting the magnet circuit. The circuit is now as follows: Terminal 25 to elements 111, 114, 112, coil 90, 31, 105, 108, 106, 32, 86, 85, 87, 33, 91, 112, 114, 111 to terminal 27. The switch is now automatically held in closed position by the magnet and, normally, can only be opened by interrupting or reducing the strength of the current in the coil current.

Normally the circuit may be opened by pressing the button attached to contact 108, which, of course, breaks the "running" circuit through the magnet coil and allows the armature to drop and open the switch.

In case of overload the magnet circuit will automatically be opened between 112 and 114 of one or both of the relays. In case of failure of line voltage or abnormal drop of line voltage, the magnet will become weakened and unable to hold the armature against gravity and the force of the springs and the armature will drop away from the magnet thus opening the load and magnet switches. After the switch is once opened, it cannot normally be closed again except by manually pressing the button carried by contact 109. This feature is of great value in that it protects the operator against the unexpected starting of the motor or other device after it has once been stopped.

Although I have described the preferred form of the complete apparatus and its method of operation, it should be understood that some of the features may be employed independently of others, for instance, the shock absorbing features herein set forth are applicable to other types of switches, so also it should be understood that invention is not limited to the use of the particular thermostatic relay herein set forth. It should also be understood that although I

have described the invention as particularly applicable to control from a remote point, certain features may be employed without such limitations, for instance, in some cases the control buttons may be mounted directly upon the box which encloses the main switch. I intend that the claims shall be interpreted broadly as they may appear except as may be required by the state of the art or by the terms thereof.

Certain features and combinations of the construction disclosed herein are claimed in my Patents 1,714,085, 1,714,086, 1,783,421 and in my pending application #432,107 filed February 28, 1930.

I claim:

1. Apparatus of the character described comprising an insulating base, line terminals arranged in one plane along one edge, load terminals arranged in substantially the same plane along another edge, control circuit terminals arranged along the latter edge in another plane, pairs of oppositely disposed switch contacts connected between the respective line and load terminals, a carrier bar having movable switch members adapted to bridge the contacts of the respective pairs of switch contacts and means for moving said carrier bar connected between the line and the load terminals.

2. Switch apparatus comprising an insulating base, line terminals arranged in one plane along one edge, load terminals arranged in substantially the same plane along one edge, control circuit terminals carried by said base, pairs of oppositely disposed stationary switch contacts positioned between the respective line and load terminals, a movable carrier bar having switch members adapted to bridge the contacts of the respective pairs of stationary contacts, auxiliary contacts connected to two of said control circuit terminals, a cross connecting contact for said auxiliary contacts carried by said bar and means for moving said carrier bar.

3. An electric switch construction including an insulating base, pairs of stationary contacts mounted on the front of said base, a movable contact carrier at the front of said base and between the members of each respective pair of stationary contacts, contact members carried by said contact carrier for bridging the members of each respective pair of stationary contacts, an electromagnet at the rear of said base, and an armature for said magnet at the rear of said base, said armature having a connection with said contact carrier to move said carrier in a direction substantially at right angles to the front of said base to open or close the circuit.

4. An electric switch construction including an insulating base, stationary contacts mounted on the front of said base, a movable contact carrier at the front of said base,

bridging contacts for said stationary contacts carried by said contact carrier, an electromagnet member and an armature member therefor mounted at the rear of said base, one of said members being movable and means connecting said movable member with said contact carrier for moving said carrier in a direction substantially at right angles to said base in response to the normal energization of said electromagnet.

5. An electric switch including line terminals, load terminals and remote-switch terminals, a double break main switch having movable contacts between the line and load terminals, an electro-magnet normally holding the main switch closed, and a double break auxiliary switch having a movable contact normally held in series with the magnet by means of the magnet when the main switch is closed, spring means for actuating the main and auxiliary switches in opposition to the magnet and a single support for all of the foregoing elements.

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