

Feb. 16, 1932.

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1,845,514

ELECTRIC SWITCH HAVING LOCKOUT MECHANISM

Filed Jan. 19, 1931

3 Sheets-Sheet 1

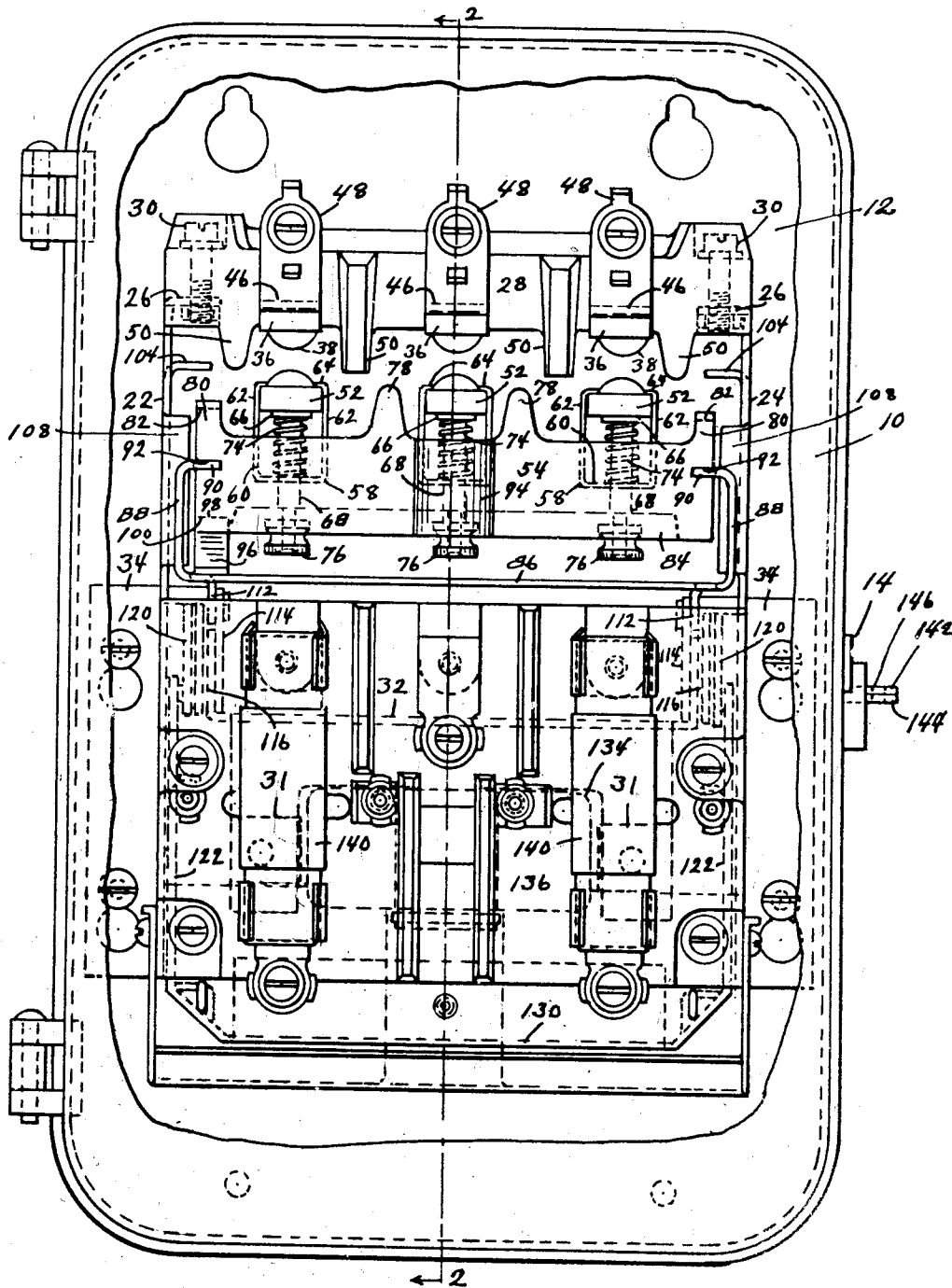


Fig. 1.

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3 Sheets-Sheet 2

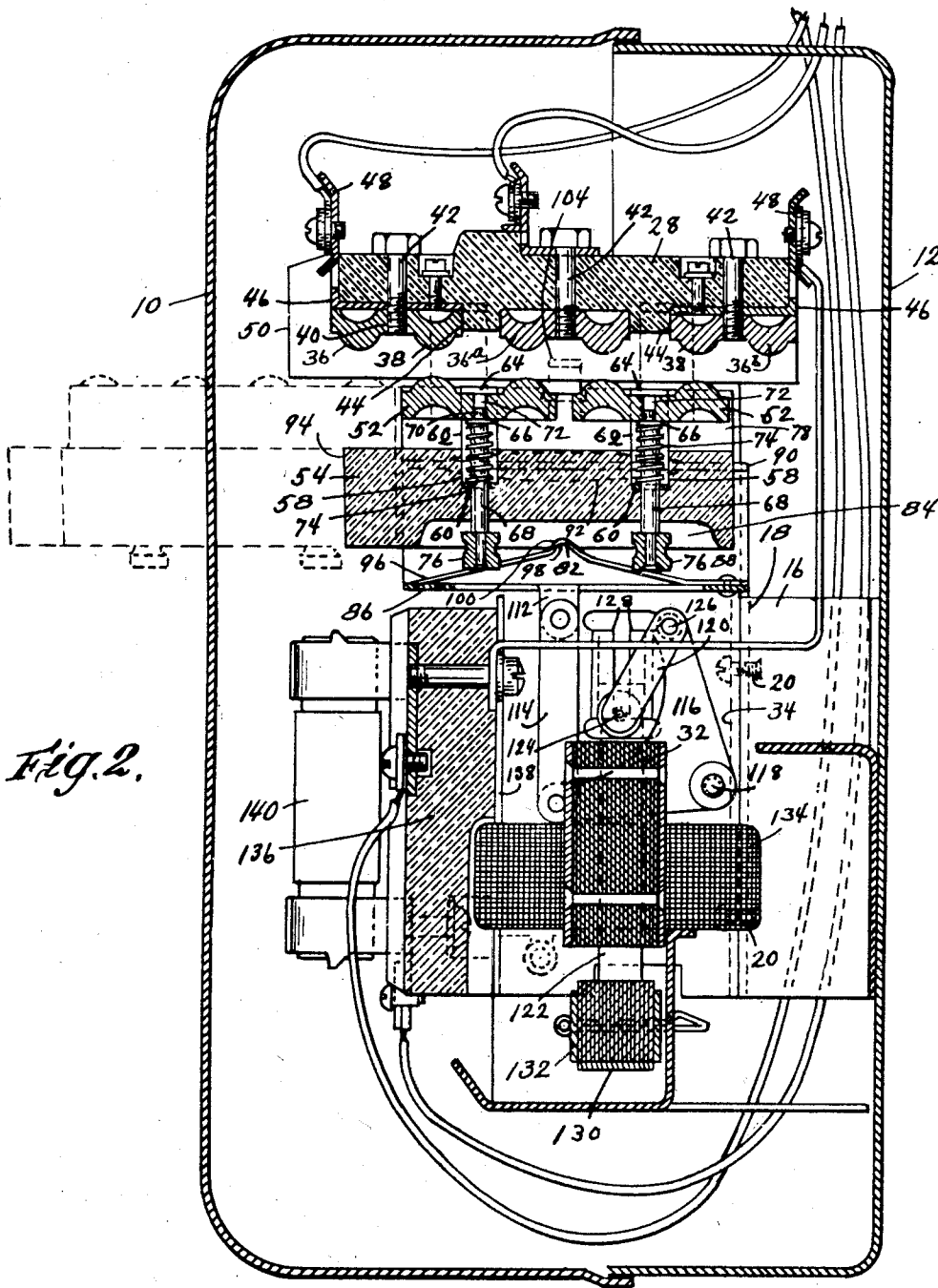


Fig. 2.

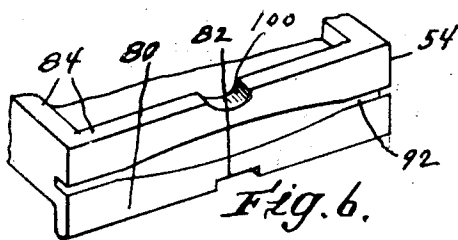


Fig. 6.

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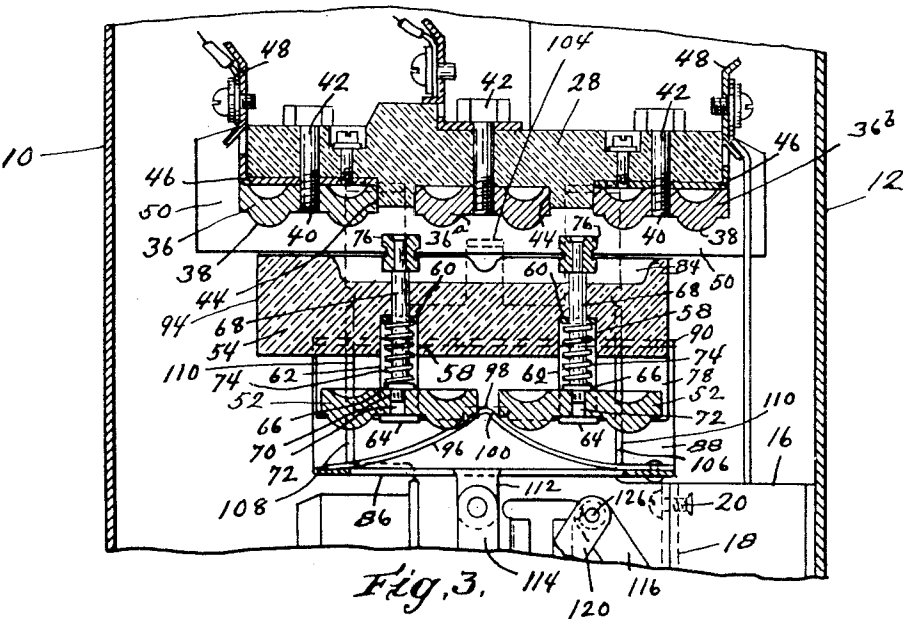
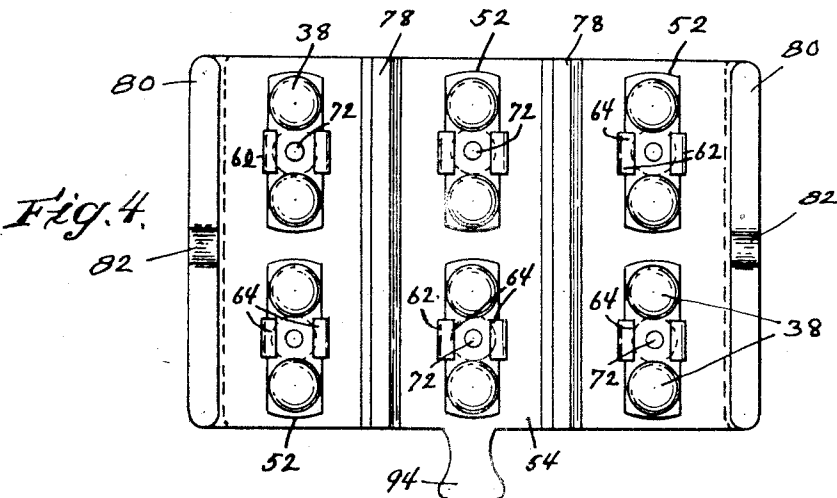
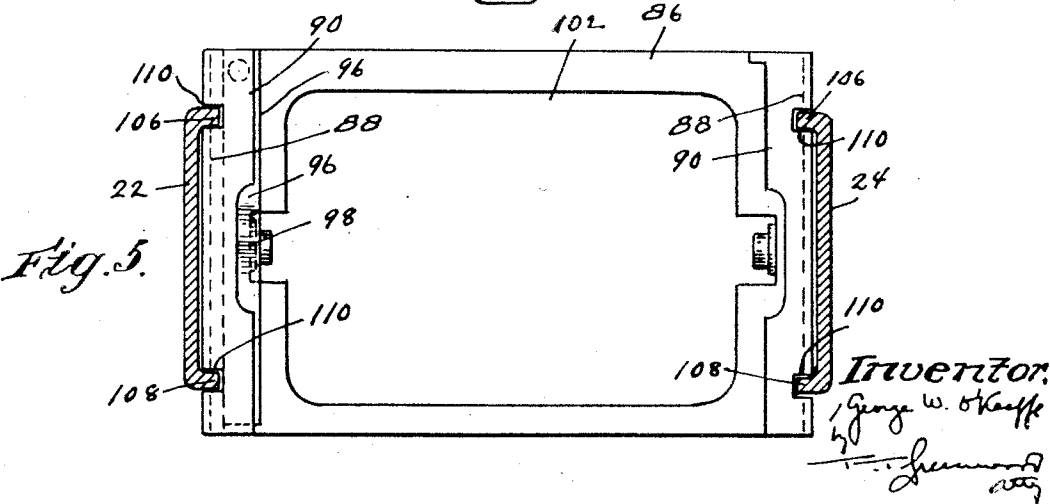
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH HAVING LOCKOUT MECHANISM

Application filed January 19, 1931. Serial No. 509,726.

This invention is a continuation in part of my copending application Serial No. 334,783, filed January 24, 1929, which relates to electromagnetically operated electric switches especially adapted for the control of small power circuits, as electric motor circuits.

An electromagnetic switch such as is described in my prior application includes an electromagnet winding, or coil, which is initially energized to close the switch by the closing of a control switch and is thereafter energized from a holding coil circuit that is completed by the closing of the switch, whereby to maintain the coil energized and thus the switch closed until such time as the holding coil circuit is interrupted by opening a second control switch which is included in said holding circuit.

Switches of this type are commonly used for the control of electric motor driven machines which may be located at a distance from the control switches. A dangerous situation arises when the motors or the machines driven thereby are being repaired, or when workmen are engaged in setting up work to be performed thereon, particularly when the control switches are located at a distance from the machine since the motor switch can be closed by some one not aware of the situation, and thus cause an accident. The control switches for the electromagnetic switch may also be located at a point remote therefrom. Thus there is danger that the control switch may be operated to close the electromagnetic switch while an operative is inspecting or working on the switch.

Various safe guards have been proposed, as providing a lock for the control switches, to prevent inadvertent operation thereof. This does not prevent manual movement of the electromagnet armature of the motor switch to switch closed position, however, and is open to the objection that it is so inconvenient that workmen will neglect the safeguard provided. It is, therefore, an object of the present invention to provide a lockout means for electric switches which is convenient and effective both when it is attempted to close the switch electrically and

also manually; and also which does not add to the cost of the switch.

A further object of the invention is to provide a lockout device which is adapted to be associated directly with an electromagnetic switch and which prevents closing thereof to complete its circuit either through operation of the control switches or by manipulation of the electromagnetic switch itself.

A yet further object of the invention is to provide means for locking out an electric switch which constitutes an essential part of the switch.

Another object of the invention is the provision of a switch having an insulating carrier for one of the sets of contact members and which can be held in the switch structure in a position that is reversed from its normal position and which then constitutes an insulating barrier between the stationary and movable contacts that prevents them from becoming engaged upon attempts to close the switch either by electrical or manual operation of the switch operating mechanism.

A yet further object is generally to improve the construction and performance of electric switches.

Fig. 1 is a front elevation of an electric switch embodying the invention, part of the casing being broken away.

Fig. 2 is a section taken along line 2-2 of Fig. 1.

Fig. 3 is a sectional detail illustrating the lockout position of the movable contact carrier.

Fig. 4 is a plan view of the movable contact carrier.

Fig. 5 is a plan view of the supporting frame for the movable contact carrier and illustrating the vertical guiding means therefor.

Fig. 6 is a perspective detail of the contact carrier, illustrating especially one of the guide slots that are in the opposite ends thereof.

As here shown the switch embodying the invention is contained within an enclosing casing having complementary front and back parts 10 and 12 which are open at the back

and front respectively. Said front part 10 is hinged to and forms a closure for the back part and is held in closing relation therewith by suitable means as a latch 14. An attaching bracket 16 is secured to the inner face of the rear part 12 of the casing and has forwardly-extended outwardly-reflexed flanges 18 to which the switch is secured by means including attaching screws 20 carried by said flanges 18.

The switch includes the left and right hand side plates 22 and 24 respectively which are provided with pairs of inwardly reflexed ears 26 upon which a horizontal contact carrier 28 rests and to which it is secured by screws 30. Said plates 22 and 24 are provided near the bottoms thereof with inwardly directed flanges 31, Fig. 1, on which the horizontally extended M-shaped core 32 of the operating and holding electromagnet is supported. Said core 32 and said carrier 28 constitute the means which secures said side plates 22 and 24 rigidly in spaced relation at the top and bottom. Said side plates are also provided at the bottom rear edges thereof with outstanding flanges 34 which bear against and are attached to the flanges 18 of said supporting bracket 16.

The stationary contact carrier 28 comprises a rigid rectangular plate of insulating material and is provided on its under face with three sets of stationary contact members 36, 36a, 36b, which are arranged in spaced relation in a line running from the front to the rear of said plate. Three such lines of stationary contact members are provided one for each phase of the switch and said lines are arranged in parallel and spaced relation across said plate. Said contact members, which are identical and interchangeable, each consists of a thick elongated copper bar having spheroidally shaped expressed bosses or contact faces 38 at the ends and on the under face thereof. Each of said bars is provided with a central screw-threaded passage 40 into which is removably screw-threaded a bolt 42 which passes through said carrier 28. Said stationary contact members are received in parallel transverse grooves 44 formed in the underside of said carrier plate whereby the contact members are held in alignment by the single bolt; and terminal plates 46 are received in said channels beneath the contact members 36 and 36b which are provided with upstanding terminal attaching ears 48.

The plate 28 is also provided with integral depending insulating ribs constituting barriers 50 which are located on opposite sides of and between the sets of stationary contact members and also in front and in the rear of the end contact members of the sets and which extend in parallel spaced relation from the front to the rear of said plate.

The movable contact members 52 are carried by a horizontal carrier 54 which com-

prises a rigid rectangular insulating plate. Said carrier is provided with three horizontally spaced sets of contact members, each set of which consists of two spaced and insulated contact members 52 that are identical with the stationary contact members of the switch. Said movable contact members are located beneath the stationary contact members and in position each to engage an inner boss of the outer contact members 36 and 36b, and a separate boss of a common inner contact member 36a, thus to control the circuit between the contact members 36 and 36b and to provide four points of circuit interruption in series for each phase conductor.

Each movable contact member is supported resiliently and removably on and above its carrier plate 54. For this purpose the carrier plate is provided under each contact member with a rectangular recess 58 in the upper face thereof in which U-shaped brackets 60 are located. Said brackets have upstanding parallel arms 62 which overlie the opposite sides of the movable contact members and are inwardly reflexed at their upper ends to provide opposed horizontal seats 64 against which the upper flat faces of the movable contact members which lie between the contact bosses thereof are pressed yieldingly and removably. Said movable contact members are each supported on the enlarged flange 66 of a vertical supporting pin 68 which is slidably extended through an opening in the carrier at the bottom of the recess 58 and which has a reduced upper end 70 that is located removably in the passage 72 in the contact member. A compression spring 74 encircles the pin 68 and bears against the bottom connecting portion of the U-shaped bracket 60 and also against the flange 66 of said pin whereby to hold the contact member yieldingly against the seats 64. A button 76 is provided at the lower end of said pin beneath the carrier plate 54 which is adapted to be grasped between the fingers and pulled downwardly to compress the spring 74 and withdraw the pin 68 and release the contact member, thus permitting the contact member to be freely removed from the carrier. The button 76 also constitutes an abutment to limit the upward movement of the pin 68 when the contact member is removed from the bracket 60.

Insulating barriers 78 are provided that upstand above the upper face of and are integral with said movable contact carrier and extend in spaced parallel relation from the front to the rear of said carrier between the sets of movable contact members, and other upstanding ribs or barriers 80 are provided at the ends of said plate which are parallel with said barriers 78 and which are formed with central notches 82 in the top faces thereof for purposes hereinafter to be described. Said movable carrier is further

formed with an integral depending flange 84 which extends about the bottom periphery thereof.

The movable contact carrier 54 is removably supported in a holding frame that is movable vertically to open and close the switch. Said frame, Fig. 5, consists of a horizontal metal plate 86 having upwardly reflexed and parallel end walls 88 which terminate in horizontal parallel inwardly-reflexed edges 90. Said edges 90 constitute confronting horizontal tracks that support the movable contact carrier 54. Said carrier 54 is accordingly provided at the opposite faces thereof with horizontal kerfs or grooves 92 that extend entirely across said faces and are open at the opposite ends and in which said tracks 90 are loosely slidably received. The forward edge of said carrier is provided with an integral knob 94 by which the contact carrier can be moved forwardly on said tracks and removed entirely from the switch as shown in dotted lines in Fig. 1. A leaf spring 96 is secured to said plate 86 at one end thereof beneath a track 90 and has an upwardly directed intermediate projection 98 which is adapted to be received in a notch 100 in the bottom edge of the flange 84 of said contact carrier, whereby normally to hold said carrier releasably in a position in said frame in which the cooperating stationary and movable contact members are in vertical alignment. The horizontal portion of the carrier plate 86 is provided with an extensive central and generally rectangular cut-away portion 102 which permits the pins 68, and the knobs 76, carried thereby, to be depressed in the closed position of the switch. The left and right hand side plates 22 and 24 are provided with mutually inwardly directed ears 104 which enter into the notches 82 in the end barriers 80 of said carrier when the carrier is in switch closed position, thus to prevent withdrawal of the movable contact carrier. When the carrier is in switch open position, however, said ears 104 are above and free from engagement with said notches and the carrier plate can be freely removed from the switch.

Said carrier holding frame is guided for vertical movement between switch open and closed positions by inwardly directed parallel ears 106 and 108 of said left and right hand side plates which are located near the back and front of said frame and which are slidably received in parallel vertical grooves 110 formed in the upstanding side walls 88 of said frame. The frame is thus guided at its opposite ends for vertical movement in parallel lines and is also prevented from undue lateral movement by the engagement of said ears with the bottoms of said slots.

Said frame is reciprocated by duplicate operating mechanisms that are carried by said side walls 22 and 24. The bottom plate

86 of said movable frame is provided with struck out downwardly reflexed ears 112, each of which is pivotally connected to the upper end of a vertical link 114. Said link is pivotally connected at its lower end to the horizontally extended leg of a bell crank 116 which is pivoted on a pin 118 carried by the adjacent side plate. Said bell crank levers are operated in a clockwise direction, Fig. 2, to close the switch by operating toggles comprising the upper and lower toggle links 120 and 122 which have a common pivotal connection at 124. The upper toggle links 120 are pivotally connected at 126 with the vertically extended arm of a bell crank lever. Each of the side plates 22 and 24 is provided with inwardly reflexed parallel vertically extended ears 128 which constitute means to guide the common pivotal point of said toggles for straight line vertical movement. Said lower toggle links 122 are provided with a common horizontal connecting member 130 which extends beneath and constitutes a support for an armature 132.

The magnet core 32 is provided with an energizing winding 134 which is adapted to be energized to raise the armature and the supporting frame therefor which includes said toggle links 122 thus to close the switch and is adapted to remain energized to hold the switch in closed position.

A relay panel 136 is carried by inwardly reflexed ears 138 at the front edge of said side plates and constitutes a support for overload relays 140 at the front of the switch.

In accordance with the present invention, means are provided which also constitutes an essential part of the switch structure to lock the switch against closing, and thereby to prevent the completion of the circuit through the switch. To this end the horizontal kerfs or grooves 92 in the end faces of the movable contact carrier 54 are so located between the top and bottom faces of the plate comprising the carrier so that the carrier is receivable in the vertically movable supporting frame 86 in two horizontal positions in one of which, the normal position of the carrier, the movable contact members are uppermost and consequently upon vertical movement of the carrier will engage and bridge the cooperating stationary contact members and, in another and inverted or lockout position of the carrier, in which the contact members are under the insulating plate and the bottom flanged face of said carrier is uppermost and confronts the stationary contact members. The inverted or locked out position of the movable contact carrier is shown in Fig. 3. From an inspection of this figure, which shows the operating mechanism of the switch in switch open position, it will be evident that under no circumstance can the electrical circuit through the switch between the stationary contact members 36 and 36b be com-

pleted, since in this inverted position of the carrier plate those portions of the peripheral flange 84 thereof which lie at the front and back edge of the carrier plate extend transversely across the depending barriers 50 of the stationary contact carrier 28, thus to prevent upward movement of the movable contact carrier in a switch closing direction. The barriers 50 are below the stationary contacts sufficiently so that no part of the movable contact structure can engage the stationary contacts. Thus when the carrier is inverted it becomes an insulating barrier that prevents the sets of contacts from becoming engaged, and which holds the switch against movement into closed position, whether the closing of the switch is attempted electrically or manually.

The movable contact carrier is maintained against displacement in its inverted position by means of the spring 96, the upstanding projection 98 of which engages the corresponding notch 82 of the left hand barrier 80.

The latch 14 carried by the back casing portion 12 has an outstanding ear 142 which overlies a similar outstanding ear 144 carried by the cover portion 10. Said ears 142 and 144 are provided with aligned apertures 146 to receive a pad lock whereby the casing can be locked in either the operative or inoperative condition of the switch, to prevent access thereto by an unauthorized person.

By virtue of the construction and arrangement of the parts, and particularly of the movable contact carrier, an electromagnetic switch is provided having provisions by which it can be locked out both against manual operation of the switch and electrical operation by remote controlled means and which locking means is not dependent upon special parts which can become misplaced and lost.

Various changes may be made in the construction and arrangement of the parts without departing from the scope of the invention.

I claim:

1. In an electric switch, stationary and movable switch members, mechanism for effecting engagement and disengagement of said members, and an insulating carrier for one of said switch members which has means by which it can be located in one position to effect the engagement of the switch members, and in another position to prevent such engagement.

2. In an electric switch, cooperating stationary and movable switch members, mechanism for effecting engagement and disengagement of said switch members, and an insulating carrier for one of said switch members which has means by which it can be located in one position to effect the engagement of the switch members and in another and inverted position in which said insulating carrier

is interposed between and prevents the engagement of said switch members.

3. In an electric switch, cooperating stationary and movable switch members, an insulating carrier for one of said switch members, and operating mechanism for moving said carrier to effect engagement and disengagement of said switch members, said carrier having provision for supporting it in one position in which its switch member is located in confronting relation with its cooperating stationary switch member and in another and inverted position in which its switch member is separated from said cooperating stationary switch member by the insulating material of said carrier.

4. In an electric switch, stationary and movable switch members including fixed and movable parallel insulating plates, aligned stationary and movable contact members carried by the confronting faces of said plates, and mechanism including a movable frame for moving said movable plate toward and away from said stationary plate to effect engagement and disengagement of said contact members, said movable plate having a detachable connection with said frame and said frame having provision for receiving said movable plate in an alternative position in which the insulation of said movable plate is interposed between said cooperating contact members.

5. In an electric switch an upper stationary and horizontal insulating plate, a lower movable horizontal insulating plate, vertically aligned contact members mounted on the confronting faces of said plates, and means including a vertically reciprocable frame for moving said lower plate toward and away from said upper plate to effect engagement and disengagement of said contact members, said lower insulating plate having a detachable connection with said frame and having means by which it can be located in an alternative position on said frame in which the insulating material thereof is interposed between said stationary and movable contact members.

6. In an electric switch an upper stationary and horizontal insulating plate, a lower movable horizontal insulating plate, vertically aligned contact members mounted on the confronting faces of said plates, and means including a vertically reciprocable frame for moving said lower plate toward and away from said upper plate to effect engagement and disengagement of said contact members, said frame having horizontal tracks on which said lower plate is slidably and removably received, and said lower plate having provision by which it can be located in a normal position on said frame in which the top contact carrying face thereof is adjacent said fixed plate and also in an inverted lock-out

position in which said top face is remote from said fixed plate.

7. In an electric switch, the combination of a plurality of stationarily supported contact members, a frame which is movable vertically between switch open and closed positions, a contact member supporting plate carried by and movable with said frame, a plurality of contact members carried by said plate and movable therewith into and out of engagement with said stationarily supported contact members, said plate being free from positive connection with said frame and having means by which it can be withdrawn with its contact members from said frame and removed from the switch, and also having means by which it can be returned to said frame in an alternative position in which the contact members thereof are free from engagement from said stationarily supported contact members in the switch closed position of said frame.

8. In an electric switch, the combination of a plurality of stationarily supported contact members, a frame which is movable vertically between switch open and closed positions, a contact member supporting plate carried by and movable with said frame, a plurality of contact members carried by said plate and movable therewith into and out of engagement with said stationarily supported contact members, said plate being free from positive connection with said frame and having means by which it can be withdrawn with its contact members from said frame and removed from the switch, and also having means by which it can be returned to said frame in an alternative position in which the contact members thereof are free from engagement from said stationarily supported contact members in the switch closed position of said frame, and means releasably holding said plate in position on said frame in either of said positions.

9. In an electric switch, the combination of a plurality of stationarily supported contact members and a movable contact structure including a frame which is vertically movable between switch open and closed positions and has a horizontal track, and a contact supporting plate having opposed end faces which cooperate with said track and by which said plate is removably supported on said frame in two positions in one of which the contact members carried thereby are disposed in position to cooperate with said stationarily supported contact members in the switch closed position of said frame and in the other of which the contact members thereof are remote from said stationarily supported contact members in a like position of said frame.

10. In an electric switch, the combination of a plurality of horizontally disposed stationarily supported contact members and a movable contact structure including a frame

which is vertically movable between open and closed positions, a horizontal insulating plate which is slidably supported removably in said frame having horizontally disposed contact members mounted on one face thereof and movable therewith into and out of engagement with said stationarily supported contact members in response to vertical movements of said frame between switch closed and open positions, said frame also having provision for receiving said plate in an inverted position in which the contact members thereof are separated from said stationarily supported contact members by the insulation of said plate.

11. In an electric switch, the combination of a horizontal insulating plate having a plurality of stationary contact members which are located in recesses in the lower faces thereof, a cooperating movable contact structure including a vertically movable frame, a horizontal insulating plate horizontally slidably receivable within and removable from said frame, contact members mounted on one side of said plate and movable vertically therewith, said movable contact members adapted to project above said plate whereby to engage said stationary contact members in the switch closed position of said frame, said frame having provisions to receive said movable plate in a second and alternative position in which the insulation of said movable plate engages said stationary plate upon vertical movement of said frame and prevents engagement of said cooperating contact members.

12. In an electric switch, the combination of stationarily supported horizontally disposed contact members and a movable contact structure including a vertically movable frame having a pair of inwardly directed horizontal flanges at the opposite sides thereof, a horizontal contact carrying plate having horizontal grooves in its opposite side edges midway between the top and bottom thereof, said grooves being loosely received on said flanges, whereby to permit the horizontal removal of said plate from the switch and also to permit re-insertion of said plate in an inverted position on said frame in which position the contact members thereof are located beneath said plate.

13. In an electric switch, separable contact members, and a reversible support for one of said contact members that has means which when reversed prevents the engagement of said contact members.

14. In an electric switch, separable contact members, stationary and movable parts carrying said contact members, and cooperating abutments carried by said parts which engage and hold said movable part in switch open position, one of said abutments being movable out of said cooperative relation with said other abutment.

15. In an electric switch, a fixed contact

support having an abutment, a stationary contact member carried by said support, a movable support having an abutment which can cooperate with the aforesaid abutment, a contact member carried by said movable support, and a supporting structure for said movable support having means which receives said movable support in a position to effect the engagement of said contact member and in another position wherein said abutments are engaged.

16. In an electric switch, a fixed support having a contact member, a movable support also having a contact member, and means to hold said movable support selectively in positions when said contacts are engaged and also when said supports are engaged and said contacts are out of engagement.

17. In an electric switch, a fixed supporting plate having a fixed contact member and an abutment which projects beyond said contact member, a movable supporting plate having a contact member which projects beyond said plate in position normally to engage said fixed contact member, and means arranged to hold said movable plate in a position wherein it is between said contact members and in position to engage said abutment.

In testimony whereof, I have signed my name to this specification.

GEORGE W. O'KEEFFE.

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