April 30, 1946. H. E. SCHLEICHER 2,399,575

ELECTROMAGNETIC SWITCH

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FIG. 1

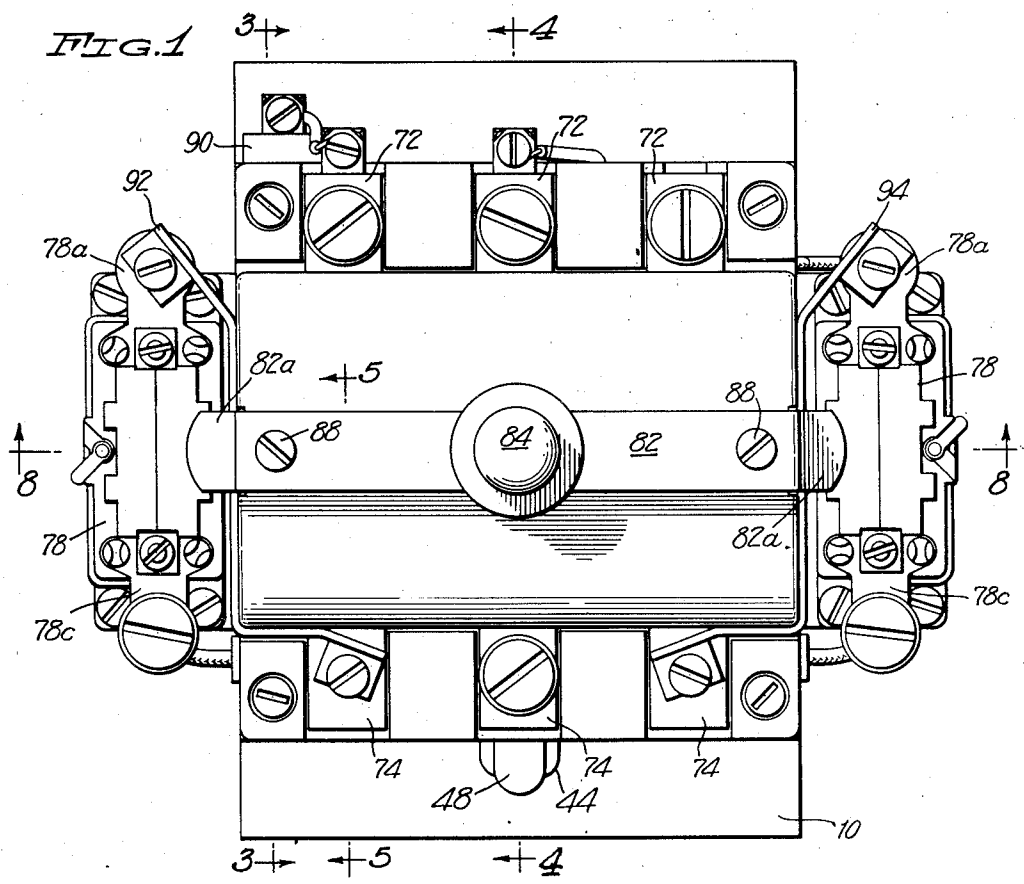
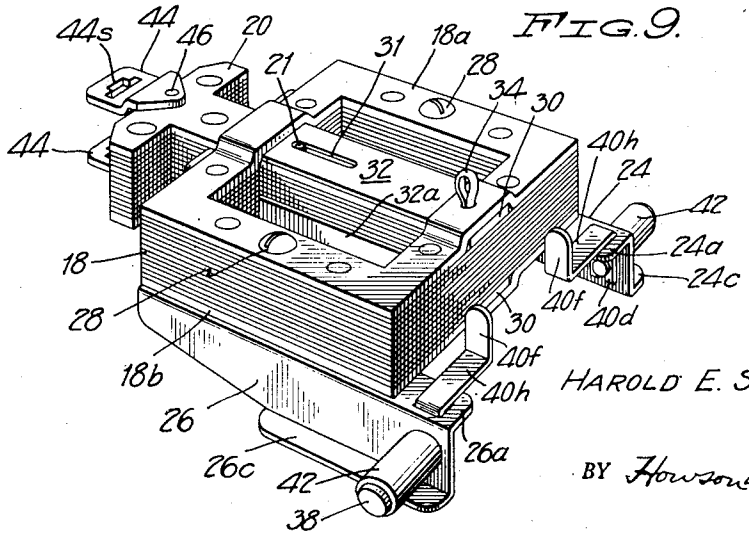


FIG. 9.



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FIG. 2.

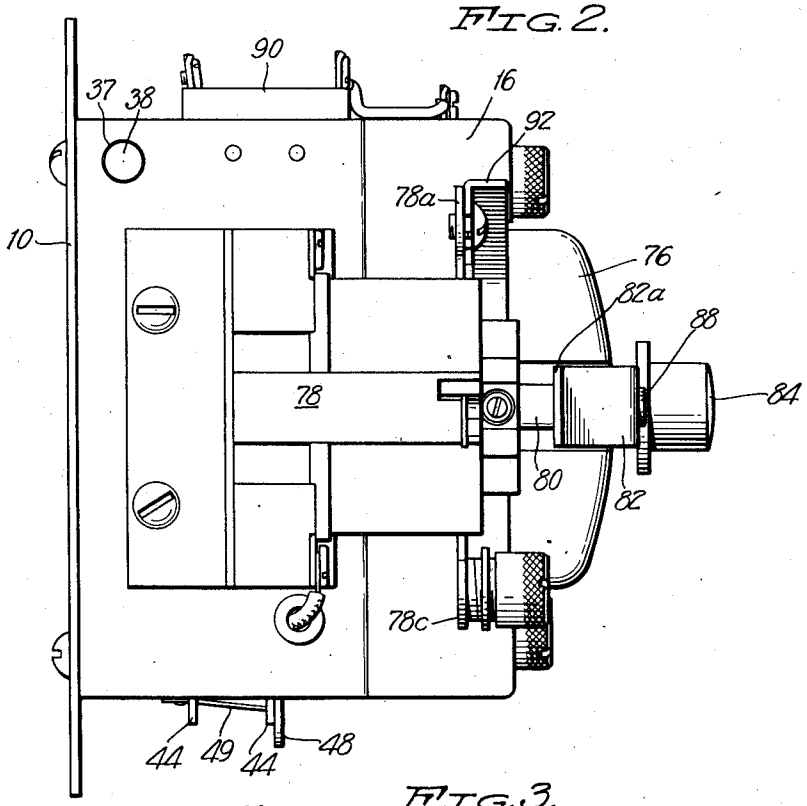
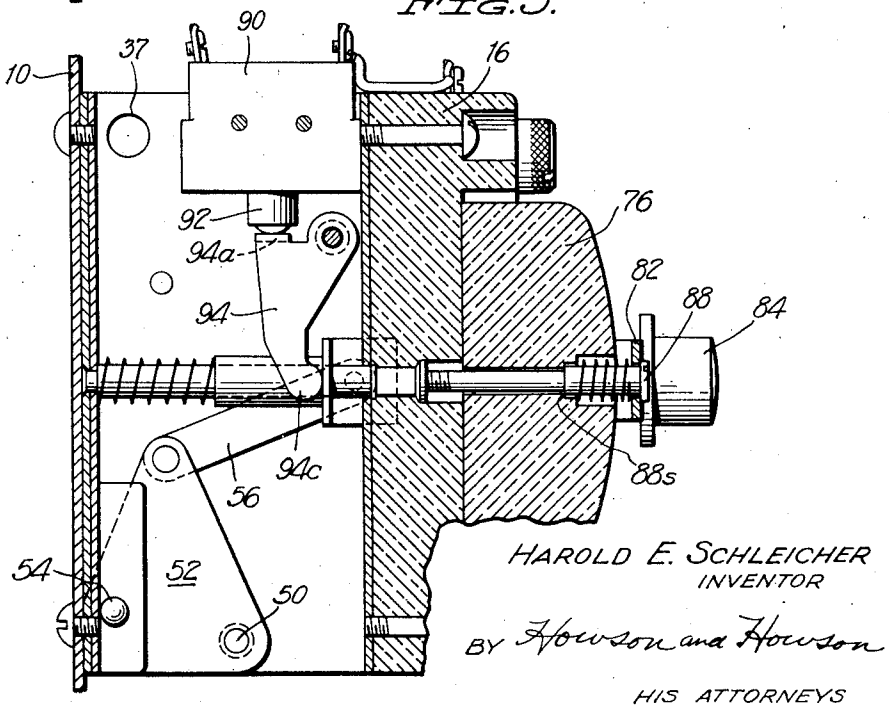


FIG. 3.



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ELECTROMAGNETIC SWITCH

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FIG. 4.

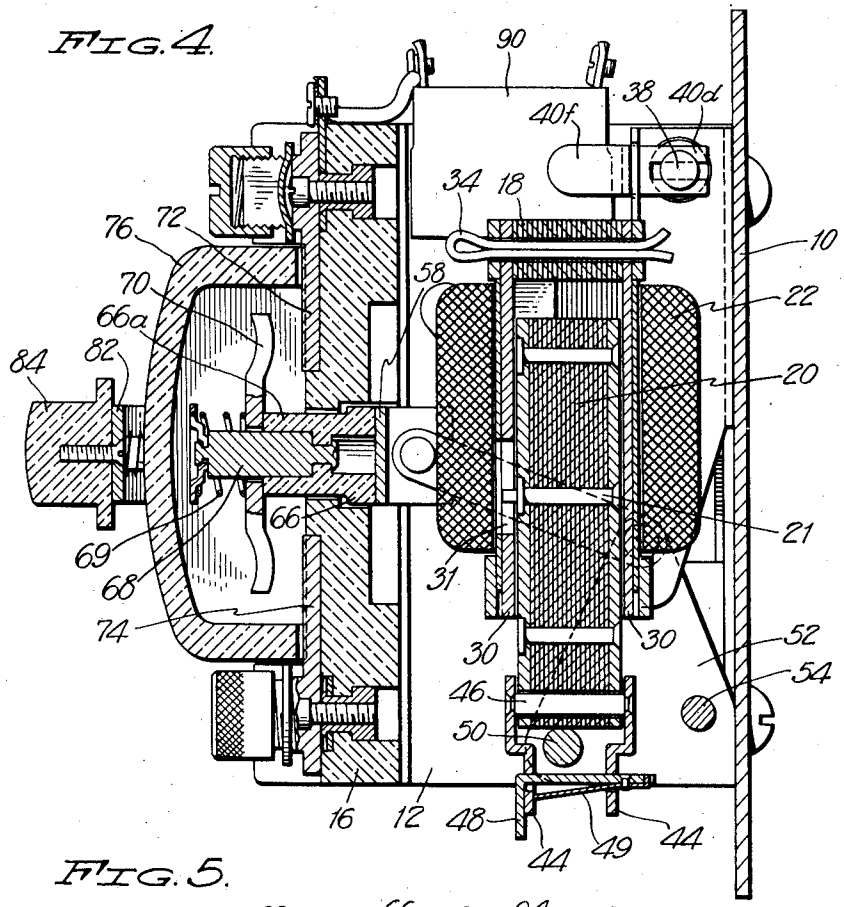
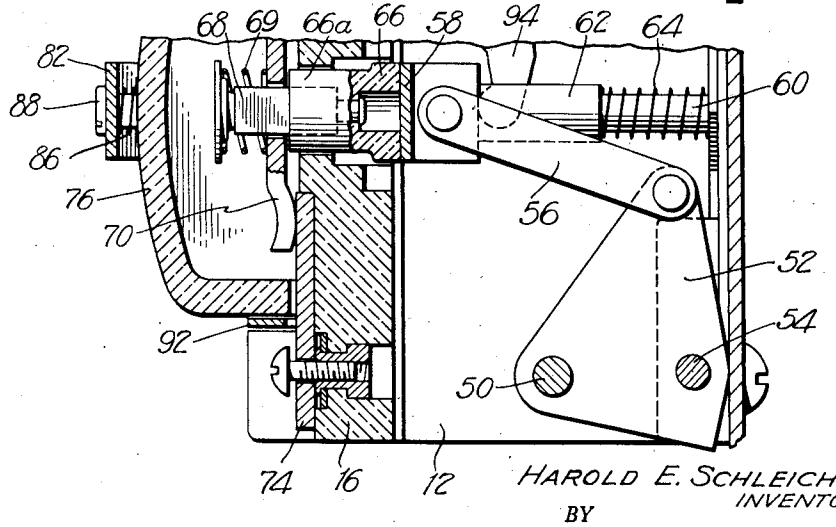


FIG. 5.



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FIG. 6.

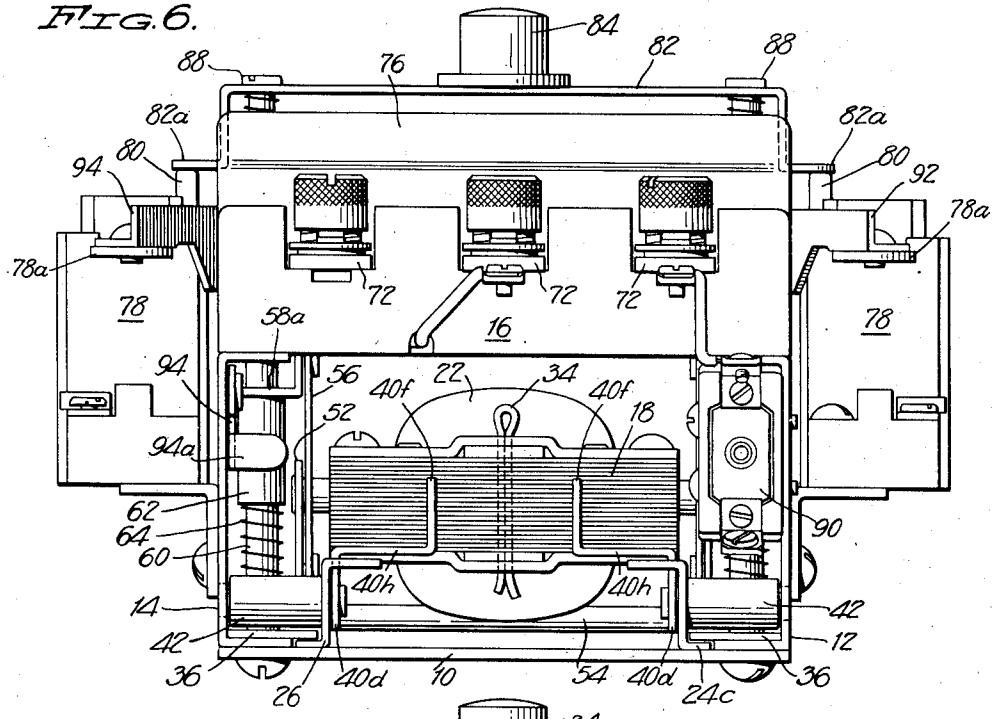
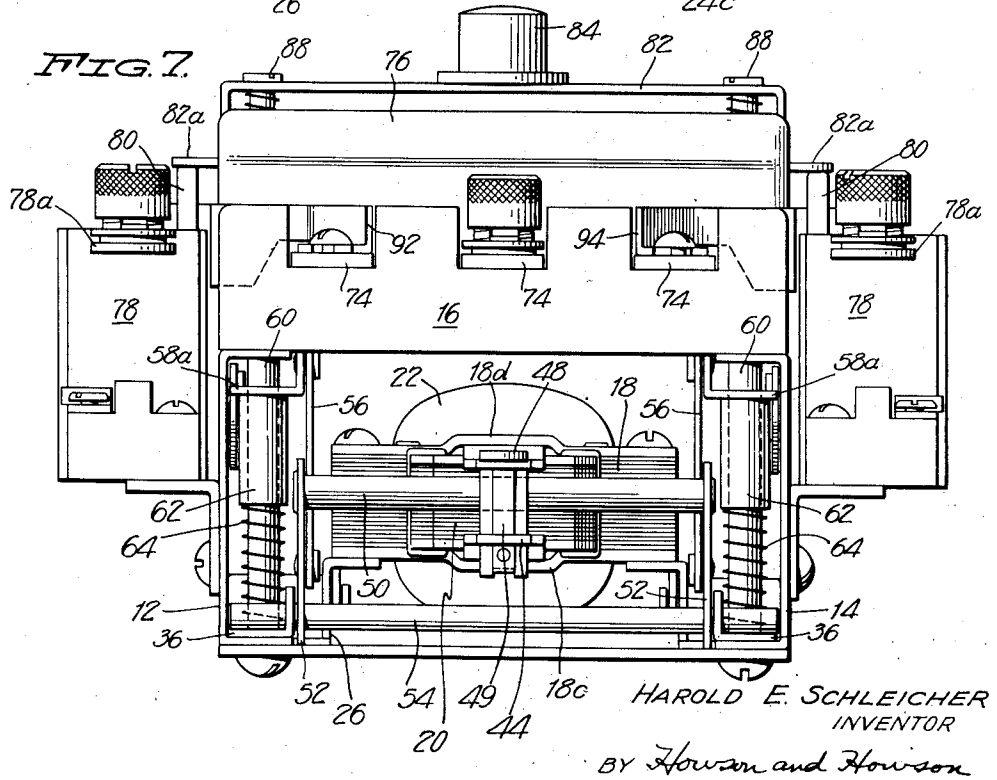


FIG. 7.



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ELECTROMAGNETIC SWITCH

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FIG. 8.

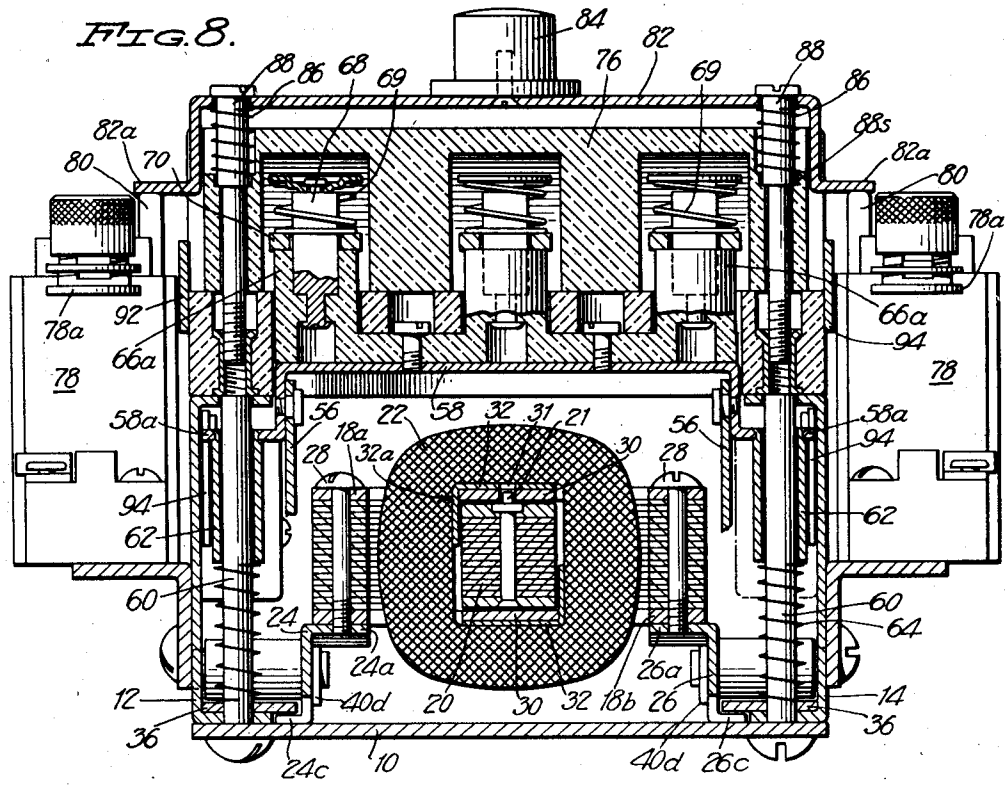
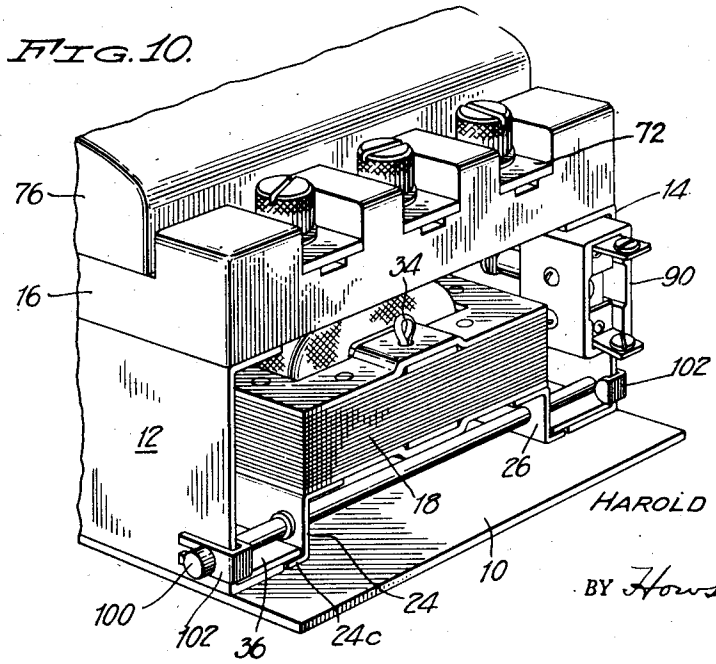


FIG. 10.



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Patented Apr. 30, 1946 2,399,575

UNITED STATES PATENT OFFICE

2,399,575

ELECTROMAGNETIC SWITCH

Harold E. Schleicher, West Hartford, Conn., assignor to The Arrow-Hart & Hegeman Electric Company, Hartford, Conn., a corporation of Connecticut

Application May 6, 1943, Serial No. 485,929

14 Claims. (Cl. 200—104)

This invention relates to electromagnetic switches. More particularly it relates to certain novel details of construction providing for straight through wiring; for placing the contacts on the top or front of the device; for reversing connections within the device to enable load wires to enter at either side of the device; for adapting the device to universal mounting or mounting in any position; for making the device more compact than others of the same capacity or rating. The invention further relates to certain novel details of electromagnet structure providing for quickly detachable electromagnet parts; for slidably mounting the electromagnet field piece; for slotting the armature track to facilitate assembling the electromagnet; and other novel improvements in structure of electromagnetic switch structure, as will more fully appear as the device is described in connection with the drawings.

In the drawings—

Fig. 1 is a plan view of an electromagnetic switch device embodying my invention;

Fig. 2 is a left side elevation view of the device illustrated in Fig. 1;

Figs. 3, 4 and 5 are longitudinal section views taken along lines 3—3, 4—4 and 5—5 of Fig. 1, respectively, a portion of the device being broken away in Figs. 3 and 5;

Figs. 6 and 7 are end elevation views of opposite ends of the device illustrated in Fig. 1;

Fig. 8 is a transverse section view taken along line 8—8 of Fig. 1;

Fig. 9 is a perspective view of the electromagnet and its mounting parts, with the coil omitted for clarity; and

Fig. 10 is a perspective view illustrating a modified form of means to secure the electromagnet in position.

The device is mounted on a flat plate 10. An insulating base 16 is supported directly in front of this back plate and spaced therefrom upon the forward flanges of parallel, spaced, channel-shaped side plates 12, 14, that are located at opposite sides of the back plate. The rear flanges of the side plates are secured to the back plate.

Between the insulating base 16 and back plate 10 an electromagnet structure and contact operating mechanism is located. The electromagnet comprises a laminated field piece 18, a coil of wire 22, and a T-shaped laminated armature 20 whose leg is slidable between two non-magnetic tracks on top of and under the field piece. The tracks are composed of two parallel bars 30 to which are secured L-shaped plates 32 overlying and underlying the bars with sides 32*a* extending down and up, respectively, along the sides of the armature. The armature and tracks are slidable into position at the top and bottom of the field piece through the center of the coil 22, the tracks being then secured by a cotter pin 34, or like fastener. To keep the armature from then sliding entirely out of the tracks, a pin 21 extends out from the armature surface into a slot 31 in one of the bars 30.

The field piece 18 is supported upon the upper flanges 24*a*, 26*a*, of angle plates 24, 26 which have out-turned feet 24*c*, 26*c*, that may slide between the surface of the back plate 10 and guide bars 36 secured on and overlapping the bottom flanges of the side plates 12, 14. The electromagnet structure may thus be slid into place, being guided laterally by the edges of the bottom flanges of the side bars 12 and 14, and above and below by the back plate 10 and guide plates 36.

To secure the electromagnet field piece in position in such manner as to permit its quick assembly or disassembly, aligned apertures 37 (Fig. 2) are provided in the side plates 12 and 14 to receive the ends of spring-pressed plungers 38 (Fig. 9) movable within bearing cylinders 42 attached to and extending laterally from the end portions of the angle plates 26 that support the field piece. The plungers 38 are normally spring-pressed outwardly into the apertures but may be retracted by squeezing toward each other a pair of angled finger pieces having parallel forwardly-extending finger portions 40*f*, engageable by the fingers of a man's hand, and joined by transverse portions 40*h* to rearwardly-extending portions 40*d* which are secured to the inner ends of the plungers. Upon retraction of the plungers, the electromagnet structure may be pulled and slid out of the switch.

For connecting the armature 20 to operating mechanism for the contacts, connecting links 44 above and below the T-portion of the armature, are secured fixedly on the upper and lower ends of a pivoting pin 46 passing transversely through the laminations of the armature. An inverted L-shaped lock bar 48 with a locking leaf-spring tongue 49 attached to the long leg of the lock bar is slidable through T-slots 44*s* in the connecting links 44 and will lock in position (see Figs. 4 and 7) with the locking tongue engaging the inner surface of the connecting links 44 and the short leg of the lock bar 48 lying on the outer surface of the connecting link 44.

Between the lock bar 48 and the armature 20

is a transverse rod 50 (Fig. 4) of the contact operating mechanism whereby movements of the armature are transmitted to said mechanism as follows: The operating mechanism comprises a pair of parallel triangular metal plates 52 parallel and adjacent to, but spaced from and between the side plates 12, 14, and rigidly connected at one corner to the ends of the rod 50, so that the plates 52 and rod 50 may rock as a unit about a fixed axle 54 that passes through other corners of the plates 52 near and parallel to the back plate 10 to afford a pivotal mounting for said triangular plates 52. To the third and innermost corners of plates 52 are pivotally connected one end of links 56, whose other ends are pivotally connected to a U-shaped stamped sheet metal bridge bar 58 that extends transversely between the side plates 12 and 14 (see Fig. 8) and supports, on its transverse or bridging portion, a contact carrying insulating member 66. For guiding the movement of the contact carrier perpendicularly to the base plate 10, a pair of guide posts 60 are mounted in the flanges of the side plates 12, 14, at the middle thereof. Sliding on the guide posts are sleeves 62, to whose upper ends the out-turned ends 58*a* of the contact carrying bridge 58 are affixed.

Normally urging the sleeves and contact carrier upward to hold the switch in open circuit condition, are coiled springs 64 around the bottom of the posts 60 and resting on the inner flanges of the side plates 12 and 14 pressing the sleeve away from the base.

Referring to Figs. 4 and 5, it may be seen that as the armature is attracted, it pulls the rod 50 and plate 52 in clockwise direction about fixed axle 54, thus causing the link 56 to pull toward the back plate the contact-carrying bridge 58 and contact carrier 66. On release of the armature, by deenergization of the electromagnet, the springs 64 pressing on the sleeves 62 cause the bridge 58 and carrier 66 to move from the base, and also cause the armature to be withdrawn partially from the field piece through reverse movement of the operating mechanism.

The reciprocating of the contact carrier causes engagement and disengagement of three parallel movable bridging contacts 70 with three aligned pairs of fixed contacts 72, 74, which are countersunk into and secured on the surface of the insulating base 16 furthest from the back plate. The movable contacts are in the form of metal bars mounted on cylindrical bosses 66*a* formed on the contact carrier 66. Square posts 68 extend through the bosses and have washers on their ends holding thereon compression springs 69 which press upon the movable contacts to resiliently mount them. Covering the contacts is a hollow hood or cover 76 of insulating material.

The fixed contacts 72, 74, are arranged to have an end of each extend outside their cover and these extending ends are, or may be, secured to the insulating base 16 by hollow internally-threaded rivets, or by bolts, or otherwise, and may be provided with terminals or binding posts for line and load connections. The described arrangement enables straight through wiring, i. e., load wires, to enter or be connected at one end of the device and line wires to be connected at the other end, with the current passing straight through by the three parallel paths afforded by the fixed and movable contact sets (see Fig. 1).

It is frequently desirable to provide overload protection associated with electromagnetic devices. In the present instance, two overload relay switches 78, preferably of the type disclosed in my co-pending application Serial No. 340,587, which became Patent No. 2,322,161 on June 15, 1943, are or may be attached to the outside of the sides of the side plates 12 and 14. When the relay switches 78 are used, bus bars 92, 94, may be used to connect two contacts to the terminals 78*a* of the relay and the other terminal of each relay 78*c* then becomes a main terminal of the device. The bus bars 92, 94, are so shaped that, on removal, they may be reversed so that terminal 78*c* of the right relay may be connected to contact 72 by bus bar 92, and terminal 78*c* of the left relay may be connected to contact 72 by bus bar 94. These overload relays have reciprocative plungers 80 that may be depressed to manually reset the relays after an overload has caused their mechanisms to trip open.

For manually resetting the overload relays, means available at the front of the device are provided comprising a U-shaped metal bar 82 straddling the cover or hood 76 and having out-turned ends 82*a* overlying the ends of the relay-resetting plungers 80. The resetting bar 82 is preferably provided at its center and at the center of the switch with an insulating resetting button 84 and is resiliently supported in inactive or raised position upon a pair of springs 86 coiled about bolts 88 located at opposite sides of the devices. The bolts 88 may have smooth shanks loosely passing through apertures in the bar 82 to permit sliding reciprocative movement thereon by the bar. The bolts also perform the additional function (see Fig. 8) of holding the cover or hood 76 in place by reason of the provision of a shoulder engaging the cover 76, so that by merely removing these two bolts 88, the resetting bar 82 and cover 76 may be removed. The bolts thread into the insulating base 16.

In the event the control of auxiliary circuits may be desired, one or more push button switch devices 90 of conventional form and function may be attached to the inner surface of side plates 12 and 14 in position for its conventional spring-pressed operating button 92 (Fig. 3) to be engaged and operated by an inturned finger 94*a* on a plate member 94 parallel to and pivotally mounted on the side plate and having an extension 94*c* located for operation by and engagement with the out-turned end 58*a* of the bridge bar 58 that carries and operates the main switch contacts as described.

An alternative method of positioning the electromagnet is illustrated in Fig. 10, wherein a rod 100 is passed through aligned apertures, such as 37, in the side plates 12 and 14, and through similar holes in the supporting angle plates 24 and 26 for the field piece. To hold the rod 100 in place, a cylindrical groove is cut near one end to be engaged by the bifurcated end of a U-shaped clip 102 that straddles the end of the side plate 12 to engage the groove in the rod. The bifurcations being slightly resilient and somewhat larger at their ends than at their junction will hold the clip in place and lock the rod 100 and electromagnet 18 in position. One clip will usually suffice, but clips may be applied to both ends if needed.

From the foregoing, it may be observed that I have provided a compact electromagnet structure, in which the contacts are separated by movement of the bridging contact perpendicularly to the base, although the electromagnet operates in a plane parallel to the base and within the same area, as viewed in plan. These details,

coupled with the automatic spring return of the armature to deenergized position, make it possible to mount the device in any position, without limitation to the direction of gravitational pull on the moving parts. My invention also enables carrying the electric circuit straight through the device by having the load terminals on one side and the line terminals on the other, which facilitates wiring and circuit arrangements. It also enables easy reversal of connecting elements to overload relays in case such relays are used, whereby the load and line entrance terminals may be reversed without removing the device from its mounting.

It may also be observed that my invention provides for quickly detaching the electromagnet from the device by manipulation of the latching devices and sliding the electromagnet assembly out of its mounting without dismembering any portion of the switch assembly. By this means, the assembling of the device is made less costly and the disassembling of the device for replacement, inspection or repair of assemblies or of parts is made easy.

The open end arrangement with the contacts on top of the base which is over the electromagnet allows circulation of air to keep the magnet coil from over-heating.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore I do not limit the invention to the specific embodiment illustrated and described.

I claim:

1. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate, a plurality of sets of switch contacts on said base, a reciprocating contact carrier below the base and moving between the base and back plate, movable contacts mounted on said carrier, linkage means connecting said carrier with said electromagnet and including a pair of spaced pivoted members for translating the motion of said electromagnet from one plane to another perpendicular to it for operating said movable contacts, and a transverse member rigidly affixed to said pivoted members, said electromagnetic device acting on the central portion of said transverse member to move said transverse and pivoted members as a unit.

2. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnet between said base and plate and operating in a plane parallel to said plate, a plurality of sets of contacts on said base, a plurality of movable contacts engaging said sets and operating means located entirely between said base and plate and pulled by said electromagnet and moving said movable contacts in a plane perpendicular to said plate to cause contact engagement, posts on said back plate guiding the movement of said contacts, and spring means operative on deenergization of said magnet to disengage said contacts.

3. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnet between said base and plate and operating in a plane parallel to said plate, a plurality of sets of contacts on the upper surface of said base, insulating supporting means for the movable contacts extending through said base, said contacts being shielded from the electromagnet by said base and supporting means, and operating means located entirely below said base and extending through said base and operated by said electromagnet, a plurality of movable contacts engageable with said sets, said operating means moving said movable contacts in a plane perpendicular to said plate to cause contact engagement, and spring means operative on deenergization of said magnet to disengage said contacts.

4. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, a plurality of sets of switch contacts, an electromagnet between said base and plate, means guiding the sliding movement of said electromagnetic device parallel to the back plate in or from its position beneath said base, manually detachable connecting means for quickly attaching and detaching said electromagnet in and from its position between said plate and base, said connecting means including manually operable resilient means which in normal condition locks the magnet in place.

5. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, a plurality of sets of switch contacts, an electromagnet comprising an armature and field piece between said base and plate, manually detachable connecting means for quickly attaching and detaching said armature and field piece in and from position between said plate and base, said connecting means including manually operable self-locking compressible devices which normally lock the armature and field piece in position but are compressible to release them for removal.

6. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, a plurality of sets of switch contacts, an electromagnet movable parallel to said back plate into an operative position between said base and plate, manually detachable connecting means for quickly attaching and detaching said electromagnet in and from said position, said connecting means including a lock bar and clip combination which normally lock the magnet in position, said clip and bar being manually removable to permit removal of the magnet.

7. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, a plurality of sets of switch contacts, an electromagnet between said base and plate, means on said plate and magnet to guide said magnet slidably parallel to said back plate into position during assembly, manually detachable connecting means for quickly attaching and detaching said electromagnet in and from its position within the switch, said connecting means including manually operable resilient means which in normal condition locks the magnet in place.

8. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device comprising a field piece and an armature between said base and plate, a plurality of sets of switch contacts operated by said electromagnet, means on said plate and magnetic device to guide said magnet slidably into position while the remainder of the device remains assembled.

9. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate, a plurality of sets of switch contacts operated by said electromagnet comprising a separate armature and field piece, means on said plate and magnetic device to guide said magnet slidably parallel to said back plate into position as a unit while the remainder of the device remains assembled, and manually-releasable self-locking

means to secure the magnetic device when it comes into position.

10. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate and operating in a plane parallel to said plate, a plurality of sets of contacts on said base, a plurality of movable contacts engageable with said sets, operating means operated by said electromagnetic device and located entirely between the base and back plate and moving said movable contacts in a plane perpendicular to said plate, a movable transverse support beneath said base for certain of said contacts and operating through the base to move them, and guide posts on said back plate guiding the movement of said support.

11. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate, a plurality of sets of contacts on the upper surface of said base, a plurality of movable contacts engageable with said sets, said fixed and movable contacts being directly above said electromagnetic device, a supporting bar beneath said base moving between said electromagnet and base, means on said bar for insulatingly supporting the movable contacts and cooperating with said base to form a continuous insulating wall between said electromagnetic device and said contacts, and means operating said bar by said electromagnetic device, and stationary insulating means forming an enclosed arcing chamber separate from and unconnected with the area around said electromagnetic device.

12. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate moving in a plane parallel to said plate, a plurality of sets of contacts on the upper surface of said base, a plurality of movable contacts engageable with said sets, a supporting bar beneath said base and moving between said electromagnet and base, means on said bar for insulatingly supporting the movable contacts to operate the movable contacts through the base, and means operating said bar comprising a pair of pivoted members, a transverse bar rigidly affixed to said pivoted members, said electromagnetic device acting on the central portion of said transverse member to move said pivoted members as a unit.

13. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate and operating in a plane parallel to said plate, a plurality of sets of contacts on said base, a plurality of movable contacts engageable with said sets, operating means located between said base and plate entirely and operated by said electromagnetic device and moving said contacts in a plane perpendicular to said plate, and guide posts below the base mounted on said back plate for guiding the movement of said contacts.

14. In an electromagnetic switch, a back plate, an insulating base spaced from said plate, an electromagnetic device between said base and plate, a plurality of sets of contacts on the upper surface of said base, a plurality of movable contacts engageable with said sets, said fixed and movable contacts being directly above said electromagnetic device, a supporting bar beneath said base moving between said electromagnet and said base, means on said bar for insulatingly supporting the movable contacts and cooperating with said base to form a continuous insulating wall between said electromagnetic device and said contacts, and means operating said bar by said electromagnetic device.

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