

Oct. 28, 1952

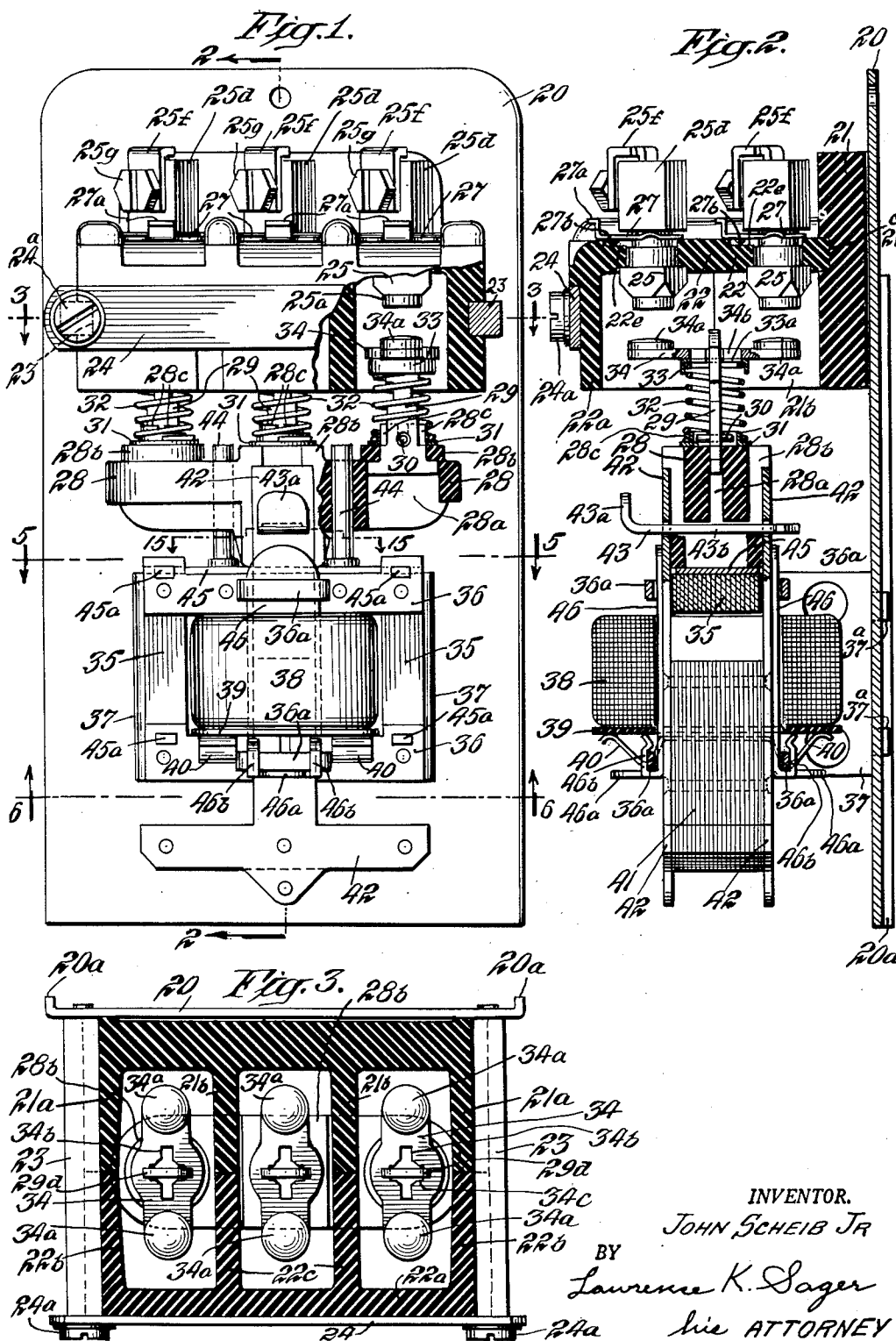
J. SCHEIB, JR

2,616,010

ELECTROMAGNETIC SWITCH

Filed Jan. 20, 1948

3 Sheets-Sheet 1



Oct. 28, 1952

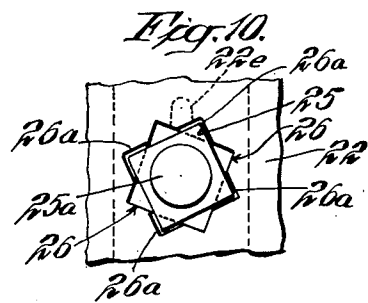
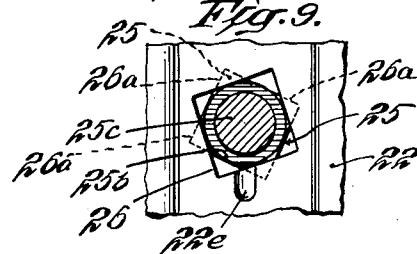
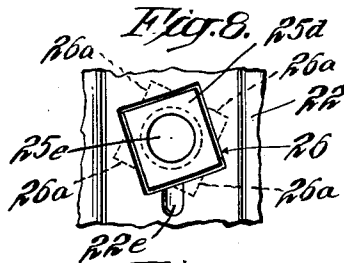
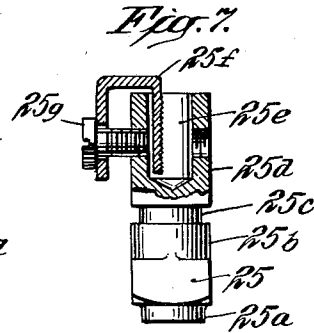
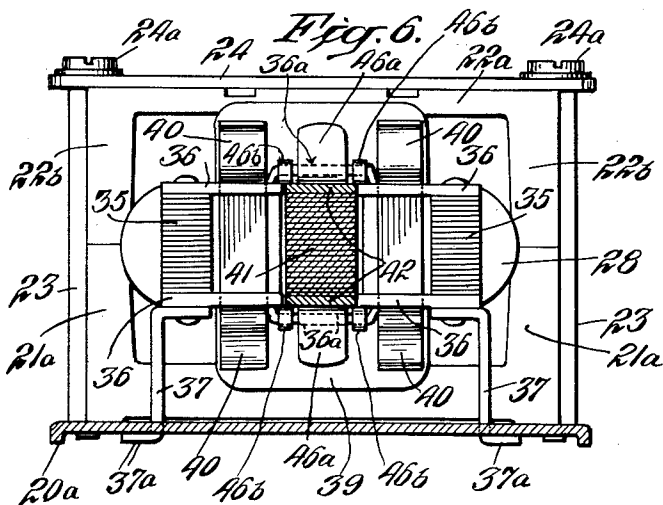
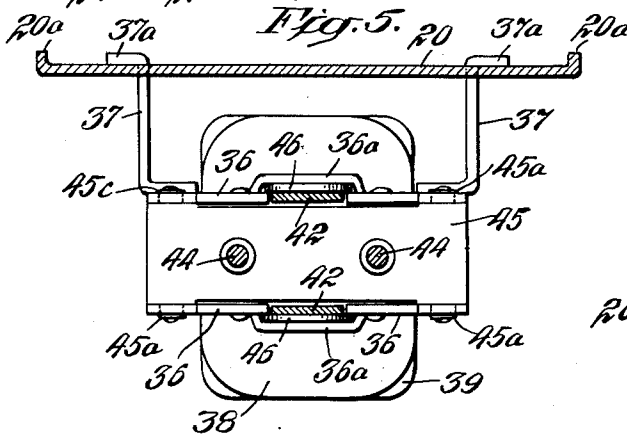
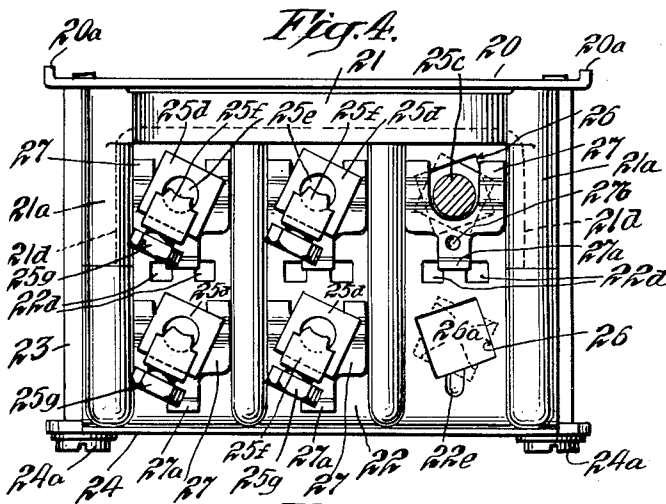
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3 Sheets-Sheet 2



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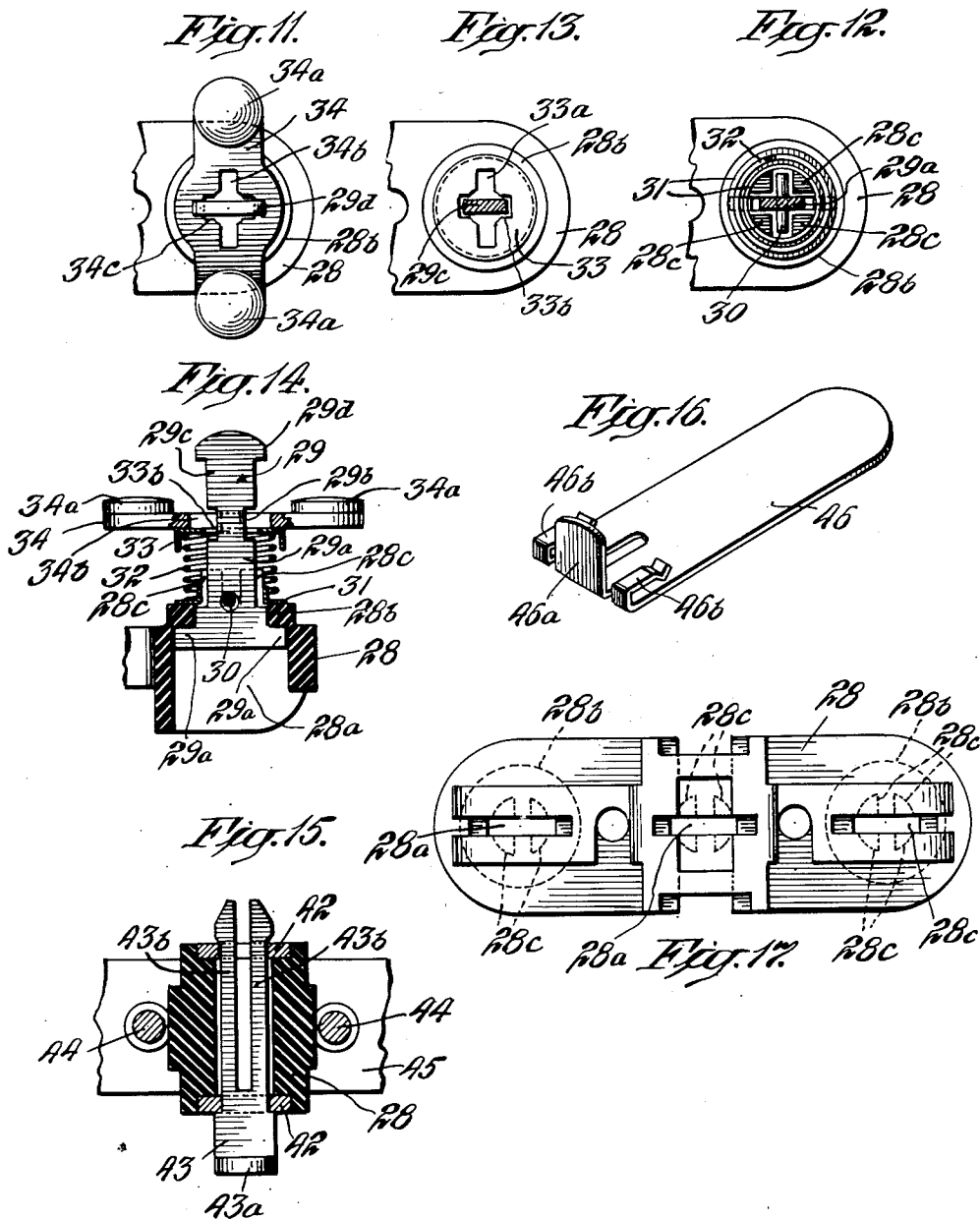
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ELECTROMAGNETIC SWITCH

Filed Jan. 20, 1948

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,616,010

ELECTROMAGNETIC SWITCH

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Application January 20, 1948, Serial No. 3,345

5 Claims. (Cl. 200—166)

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This invention relates to various features of improvement in electromagnetic switches.

An important object of the invention is to provide a structure which may be readily assembled and disassembled as to all of its parts, thereby reducing the cost of assembling and also making all parts readily available for inspection, repair, or replacement without the use of special tools. Another object is to provide a complete unit mounted on its individual panel which in turn may be mounted on a main panel or support as a unitary structure. A further object is to produce a compact structure of comparatively small size with reference to its current capacity and with reduction of arcing to a minimum.

A further feature is the form and mounting of the fixed contacts and terminals with the object of making them readily removable individually without the necessity of disconnecting the terminal leads and also the combining of the contact itself with the terminal in a manner to eliminate all joints therebetween. Another feature is the form of structure and method of mounting the movable contact parts in the movable contact carrier whereby the use of inserts moulded in the carrier is avoided and whereby the movable contact parts may be readily mounted on and removed from the carrier. A further feature is the provision of simple means for the connection and disconnection between the movable contact carrier and the plunger of the magnet. Another special feature is the relationship of the parts for the guiding of the movable plunger and the positioning of the controlling winding so that it may be easily assembled or removed simply and without the use of special tools. All of these features are interrelated to produce a unitary structure of small size to afford ready and convenient accessibility to all parts and to produce a serviceable, durable and dependable structure under long continued use. Various other objects and advantages will be understood from the following description and accompanying drawings which illustrate a preferred embodiment of the improvement.

Figure 1 is a front elevation, partly in section; Fig. 2 is a vertical section on the line 2—2 of Fig. 1; Fig. 3 is a horizontal section on the line 3—3 of Fig. 1; Fig. 4 is a top plan view with certain portions of the right terminals shown for the purpose of explanation; Fig. 5 is a horizontal section on the line 5—5 of Fig. 1; Fig. 6 is a horizontal section on the line 6—6 of Fig. 1; Fig. 7 is a side view, partly in section, of one of the combined fixed contact and terminal blocks; Fig.

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8 is a top view of the block in its initial inserted position in the carrier; Fig. 9 is a sectional view thereof after being turned angularly; Fig. 10 is a bottom view thereof showing the block in final position; Fig. 11 is a pair of top view of a pair of the movable contacts; Fig. 12 is a horizontal section showing the parts supporting the movable contacts taken on a line below the contact portion; Fig. 13 is a similar view after the removal of the contact spring and its retaining washer; Fig. 14 is a vertical section of one of the movable contact parts showing the contact part depressed and angularly turned for removal; Fig. 15 is a horizontal section on the line 15—15 of Fig. 1; Fig. 16 is a perspective view of one of the coil locking clamps and plunger guide; and Fig. 17 is a bottom view of the movable contact carrier with the movable contact parts removed.

Referring to Figs. 1, 2 and 3, the parts are supported on a small sheet steel panel 20 having inwardly turned edges 20a. This panel is adapted to be mounted as a unit on a main panel or other support in any desired manner. The assembly of the fixed contacts will first be described. There are shown three sets of fixed contacts, each set having a pair of contacts with their contact surfaces positioned within arc chambers open at the bottom and also having openings at the top for the free upward and outward passage of gases and vapors. The enclosing and supporting structure is divided in two main parts. One of these is of moulded insulating material having a back portion 21 positioned against the panel 20; and from this back portion extend forwardly its side wall portions 21a and intervening partitions 21b. The other main part is of moulded insulating material and has a horizontally extending portion 22 which carries the fixed contacts. This portion 22 extends over the partitions 21b and its rear edge fits within a notch 21c in the main back part. Its rear side edges fit within notches 21d in the side portions of the main back part, as indicated by dotted lines on Fig. 4. The main front part also has a downwardly extending front portion 22a, also downwardly extending side portions 22b and intervening partitions 22c which meet the side portions and partitions of the rear main part. An arc chamber is thus formed for each pair of contacts. Each chamber is afforded free ventilation for the outward passage of gases by openings 22d in the portion 22 above the middle portion of each arc chamber, as shown in Fig. 4.

In order to hold these main parts in fixed position on the panel and to permit ease of

assembling and removal, there is provided on each side of these main parts a forwardly projecting square shaped metal rod 23 riveted at its inner end to the panel 20. The outside of the side portions of the two main parts are recessed, as shown in Fig. 1 to receive the rods 23. A metal strap 24 extends across the front of the portion 22a and is fastened at its ends to the front ends of the rods by the screws 24a.

Each fixed contact and terminal is formed of one integral piece or block which avoids the necessity of any intervening joints or connections commonly required in adding the terminals to the fixed contacts. This improved block also provides a considerable mass for the absorption of heat; and is fixed in position in a novel manner. Each of the six terminal and contact blocks shown is similar and a description of one will suffice for all the others. Referring to Fig. 7 the block, preferably of brass or copper, is adapted to be formed from a rod of angular, rectangular or square cross-section. The lower portion 25 is shown of square cross-section, although it may be rectangular or of angular form; and from the lower portion downwardly projects a rounded portion 25a of reduced size on the lower face of which is brazed a thin layer of silver for forming a good contact surface. Above the square portion 25 is formed a cylindrical portion 25b having a diameter equal to or slightly less than the width of the square portion. Above the portion 25b is another cylindrical portion 25c forming a neck of somewhat less diameter than the portion 25b. Above the neck is a terminal portion 25d of square cross-section having a width larger than the diameter of the neck, being shown of the same width as the portion 25. A cylindrical opening 25e extends inwardly from the top of the portion 25d. The outside line or cable may be soldered directly within the socket or opening 25e or otherwise secured. Fig. 7 shows a solderless connection wherein a copper strip 25f of U form has one leg extending downwardly within the opening 25e and the other leg extending downwardly outside. A screw 25g passes freely through the outside leg and has a threaded engagement with the portion 25d. The inside face of the interior leg is serrated and when the external wire or cable is inserted and the screw 25g tightened, a firm connection under considerable pressure is secured.

These combined contact and terminal blocks are mounted on the horizontally extending portion 22 of the fixed contact support and are readily inserted in place and easily removable individually and without the necessity of disconnecting the outside leads. The drawings show six of these contact and terminal blocks mounted on the portion 22, one pair for each of the three arc chambers. A hole 26 conforming to the angular shape of the contact block is shown in the lower right-hand corner of Fig. 4, and is formed in the portion 22 extending downwardly through it for the reception of each block, as more particularly shown in Fig. 8. This hole which is square in this instance is slightly larger than the square portion 25 of the block and permits the lower end of the block to be inserted through it from the top. The thickness of the portion 22 of the fixed contact carrier is slightly less than the distance between the upper edge of the portion 25 of the block and the lower edge of the portion 25d. When these edges are about flush with the bottom and top surfaces of the carrier portion 22, it permits the block to be turned an-

gularly on its axis from the position shown in Fig. 8 to the position shown in Fig. 9, which shows the four corners of the portion 25 in dotted lines because they have now been turned under the lower surfaces of the carrier. The under side of the carrier portion 22 is provided with four angular indentations 26a, as indicated by dotted lines in Fig. 8, at an angle to the hole 26; and after the block has been turned angularly as just described, it may be pulled upwardly somewhat and permit the four corners of the portion 25 to seat in these indentations in the position shown in Fig. 9. This recessed position of the portion 25 of the blocks is indicated in Fig. 2 and serves to hold the blocks firmly from turning. The cylindrical portion 25b of the blocks engages the side portions of the square holes 26 which aids in securing a rigid position of the blocks.

After the blocks are inserted, turned and drawn upwardly as just described, the reduced neck 25c of each block is positioned slightly above the top surface of the carrier portion 22, as shown in Fig. 2. This block is then held in place by a retainer in the form of a U-shaped spring clip 27 shown in Figs. 1, 2 and 4. The arms of the clip are inserted to embrace the neck 25c of the block as particularly shown in the upper right-hand corner of Fig. 4, by being forced in between the lower edges of the portion 25d of the block and the top surface of the carrier portion 22. The arms of the clip are curved as shown in Fig. 2 for imposing a strong upward pressure on the block for holding it in place. The front end 27a of the clip is bent upwardly and outwardly to form a projection or handle for convenient insertion and withdrawal of the clip. It also has a downwardly indented portion 27b near its front end which, when the clip is in place, lodges in a small groove 22e formed in the portion 22 for preventing its accidental removal. It is apparent that this structure secures a firm, fixed position of each of the combined contact and terminal blocks in their insulating support.

The movable contact carrier 28 is of moulded insulating material and it is formed in relation to the parts carried thereby to avoid the use of moulded inserts and to permit ease in assembly and removal of the parts. Opposite and between each pair of fixed contacts, a slot 28a is formed in the movable carrier which extends vertically through the carrier and also longitudinally thereof, as shown in Figs. 1, 2, 14 and 17. The length of this slot is reduced at its upper portion and is there surrounded by an upwardly projecting boss 28b. A contact bar holder or element 29 in the form of a flat metal plate, shaped as well shown in Fig. 14, is inserted in the slot 28a from beneath and is limited in its upward movement by its extended lower ends 29a which engage the under surface of the boss 28b. The reduced width of the holder 29 above its lower end extensions fits within the slot in the projection 28b. Above this, the width of the holder plate is further reduced in a portion 29a, again further reduced in a neck portion 29b, then enlarged to a portion 29c having the same width as the portion 29a and at the top is further enlarged to a portion 29d. Another boss 28c projects upwardly from each of the bosses 28b and is cylindrical and of smaller size than the boss 28b. Each of the bosses 28c is slotted in a direction perpendicular to the panel and to the plane of the holder elements 29 for permitting a pin 30 to be inserted at the bottom of the slot and through a hole in the holders. This pin secures the hold-

er in fixed position on the carrier 28, as well shown in Fig. 14.

A metal washer 31 with an inner upturned edge is placed around the base of the boss 28c and holds the retaining pin 30 in place. A compression spring 32 seats at its lower end on the outwardly extending portion of the washer 31. The upper end of the spring engages an inverted cup washer 33. This washer has slots formed therein at right-angles to each other. One of these slots 33a, as shown in Figs. 2 and 13 is long enough to permit the wide upper end 29a of the holder to pass through it. The other slot 33b is only long enough to permit the portion 29c of the holder to pass through it, as shown in Figs. 13 and 14. This washer 33 is placed in position by first passing it down over the top 29d of the holder to the neck 29b, then turning it 90° at the neck, and letting the spring 32 force it upwardly on the portion 29c of the holder, which portion then occupies the shorter slot in the washer.

The bridging movable contact bar 34 is in the form of a flat plate, preferably of copper and is positioned under and opposite each pair of the fixed contacts. It carries on its upper surface a pair of contacts 34a, one contact at each end, preferably of silver brazed to the bar. In the middle portion of the bar are formed two slots at right-angles to each other, one longer than the other. The longer slot 34b, as shown in Figs. 2, 11 and 14, permits the top 29d of the holder to pass through it and the shorter slot 34c, as shown in Fig. 11 is only long enough to receive the portion 29c of the holder. This relationship permits the bar to be passed down over the top end of the holder to its neck portion 29b and to engage the washer 33 and compress the spring 32 to the position shown in Fig. 14. The contact bar is then turned 90° to bring its shorter slot 34c in alignment with the portion 29c of the holder. The spring then forces the washer 33 and the contact bar up until the ends of the top portion of the holder engage the bar. The parts then occupy the position shown in Figs. 1 and 2. When the movable carrier is raised, the movable contacts engage the fixed contacts and the springs 32 are compressed somewhat which permits the pressure against the fixed contacts to be equalized by self-adjustment of the contact bars. It is apparent that the parts may be dismantled from the movable carrier by following the reverse order of assembling. This improved structure not only secures the advantage of convenient assembly and disassembly, but avoids the use of moulded inserts. The use of inserts is costly, requires accuracy in positioning the parts and in moulding and requires extra finishing around the inserts.

The magnet frame is built up of laminae 35 of U form with the legs extending downwardly. They are clamped together by plates 36 extending cross-wise on opposite sides of the laminae at the top and also at the bottom, being held together by through rivets. The plates are cut away at their middle portions, as shown in Figs. 5 and 6 and the opposing ends of the plates are utilized to guide the plunger from side-wise movement. The inner end portions of each plate are, however, joined together by a strip 36a sprung outwardly from the main portion of the plate for a purpose later described. The frame is supported by a pair of brackets 37, one at each side, each having projecting lugs 37a which pass through slots in the supporting panel and bent against its rear face. The front of each bracket is bent at

right-angles and secured to the magnet frame by the same rivets which clamp the side plates 36.

The magnet winding 38 is positioned between the two legs of the magnet frame and is supported on a hollow rectangular disk 39 of insulating material. A pair of spring steel clamps 40 are inserted below the disk 39, one clamp at each side, and serves to force the winding or coil upwardly against the top portion of the magnet frame. Each clamp passes over and engages the lower clamping plates 36 and then turns downwardly at each end and extends diagonally upward to engage the disk resiliently at each end, as particularly shown in Fig. 2. In assembling, the spring clamps are first placed in position and then the disk 39 and coil are pushed in place which action causes the ends of the spring clamps to be depressed somewhat and thereby hold the coil firmly in position.

The plunger of the magnet is made up of laminae 41 of T form which are held together by side plates 42 and through rivets. These side plates extend upwardly a considerable distance beyond the laminae of the plunger and engage middle recessed portions of the front and rear sides of the movable contact carrier 28, as shown in Figs. 1 and 2. The lower middle portion of the carrier 28 is slotted from front to back and each of the plates 42 is correspondingly slotted. A spring clip 43 with an upturned front finger 43a is passed through these slots for connecting the plunger to the movable carrier. Fig. 15 shows the particular shape of the clip 43 as having a pair of rearwardly extending spaced spring arms 43b enlarged at their rear ends for avoiding accidental displacement. The plunger is thus simply and easily connected with the movable contact carrier and readily disconnected and removed therefrom.

There is a certain amount of play in the connection between the plunger and the movable carrier and owing to this lack of a rigid connection, the carrier may tilt appreciably with reference to the plunger, especially when auxiliary control contacts are mounted on it. In order to avoid any such tilting, a pair of fixed guide pins 44 extend upwardly through holes in the carrier. These pins are riveted at their lower ends to a brass plate 45 on the top of the magnet frame. The plate is secured in place by rearwardly and forwardly extending lugs 45a near the four corners of the plate, which extend within slots in extensions from the upper side plates 36. The plate 44 and its pins are assembled with the magnet frame when the latter is riveted together.

As already explained, the plunger is guided from sidewise movement by the inner ends of the plates 36. It is guided from movement forwardly or backwardly by guide plates 46, preferably made of Phosphor bronze. The form of these plates is shown in Fig. 16. Each plate has an upper rounded end and a forwardly extending finger piece 46a at its lower end. At the lower corners are spring clips 46b which have a portion extending from the plate, then a longer portion extending upwardly parallel with the plate and terminating in bent ends. These guide plates, as shown in Figs. 1, 2, 5 and 6 are inserted upwardly at the front and back of the magnet frame between the strips 36a and the face of the inner end portions of the lower clamping plates 36, then pass upwardly within the coil and then between the strips 36a and the face of the inner ends of the upper clamping plates 36. In their final position the guide plates are held from accidental displacement by the spring clips 46b

springing over the lower strips or bars 36a. These guide plates and inner end portions of the clamping plates not only serve to smoothly guide the plunger in its movement but also protect the interior of the coil from any rubbing action 5 thereon by the plunger.

It is apparent that all parts of this improved circuit breaker or contactor are of a form easily manufactured and adapted to be conveniently assembled and disassembled and mounted as a unit 10 on its individual panel for assembly on a larger panel or mounting on any other support.

Although a particular embodiment of this invention has been shown and described, it will be understood that various modifications may be 15 made without departing from the scope thereof.

I claim:

1. A contact mounting comprising an insulating support having a plurality of openings, a plurality of contact terminals carried thereby, said 20 contact terminals extending downwardly through said openings and each having a lower rectangular-shaped portion with a contact at one end and an upper holding portion integral therewith, said openings in said support for the passage of each of said contact terminals being of rectangular 25 shaped portion of said contact terminals, each of said contact terminals having an intermediate cylindrical portion so that when the intermediate portion is within the support it may be turned angularly and cause the rectangular portion of the contact terminals to be in engagement with one side of said support, and a spring clip on the opposite side of said support and pressing 30 upwardly against said holding portion for removably securing each of said contact terminals respectively to said support.

2. A contact mounting comprising an insulating support having a plurality of openings, a plurality of contact terminals carried thereby, said contact terminals extending downwardly through said openings and each having a lower rectangular-shaped portion with a contact at one end and an upper holding portion integral 35 therewith, said openings in said support for the passage of each of said contact terminals being of rectangular form corresponding to the rectangular-shaped portion of said contact terminals, each of said contact terminals having an intermediate cylindrical portion so that when the intermediate portion is within the support it may be turned angularly and cause the rectangular portion of the contact terminals to be in engagement with one side of said support, and resilient means positioned between said holding 40 portion and said support and pressing upwardly against said holding portion to firmly seat said rectangular-shaped portion against said support.

3. An electrical contact mounting comprising an 60 insulating support having an angularly-shaped opening therethrough, a terminal having a projecting portion and a holding portion and an intermediate portion between the holding portion and the projecting portion, said projecting portion having an angular shape corresponding to and insertable through said opening and turned angularly to engage the side of the support, said holding portion being spaced from said

support, and resilient means positioned between said holding portion and said support and pressing upwardly against said holding portion to firmly seat said projecting portion against said support.

4. An electrical contact mounting comprising an insulating support having an angularly-shaped opening with symmetrically arranged sides, a terminal having a projecting portion and a holding portion and an intermediate portion between the holding portion and the projecting portion, said projecting portion having an angular 5 shaped portion corresponding to and insertable through said opening and turned angularly to engage one side of the said support, said intermediate portion having a cylindrical shape engaging the sides of the opening, said holding portion being spaced from the other side of the support, and resilient means positioned between 10 said holding portion and said support and pressing against said holding portion to firmly seat said projecting portion against said support.

5. An electrical contact mounting comprising an insulating support having an opening there- 15 through, a terminal having a projecting portion, a holding portion and an intermediate portion, said projecting portion being insertable through said opening and having a diagonal dimension shorter than one cross dimension of the opening and longer than another cross dimension of the opening, said intermediate portion being located 20 within said opening and turnable therein to associate the diagonal with the shorter cross dimension so that the projecting portion engages the support, said holding portion being spaced from said support, and resilient means positioned between said holding portion and said support pressing against said holding portion to firmly 25 seat said projecting portion against said support along the shorter cross dimension.

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