

May 14, 1946.

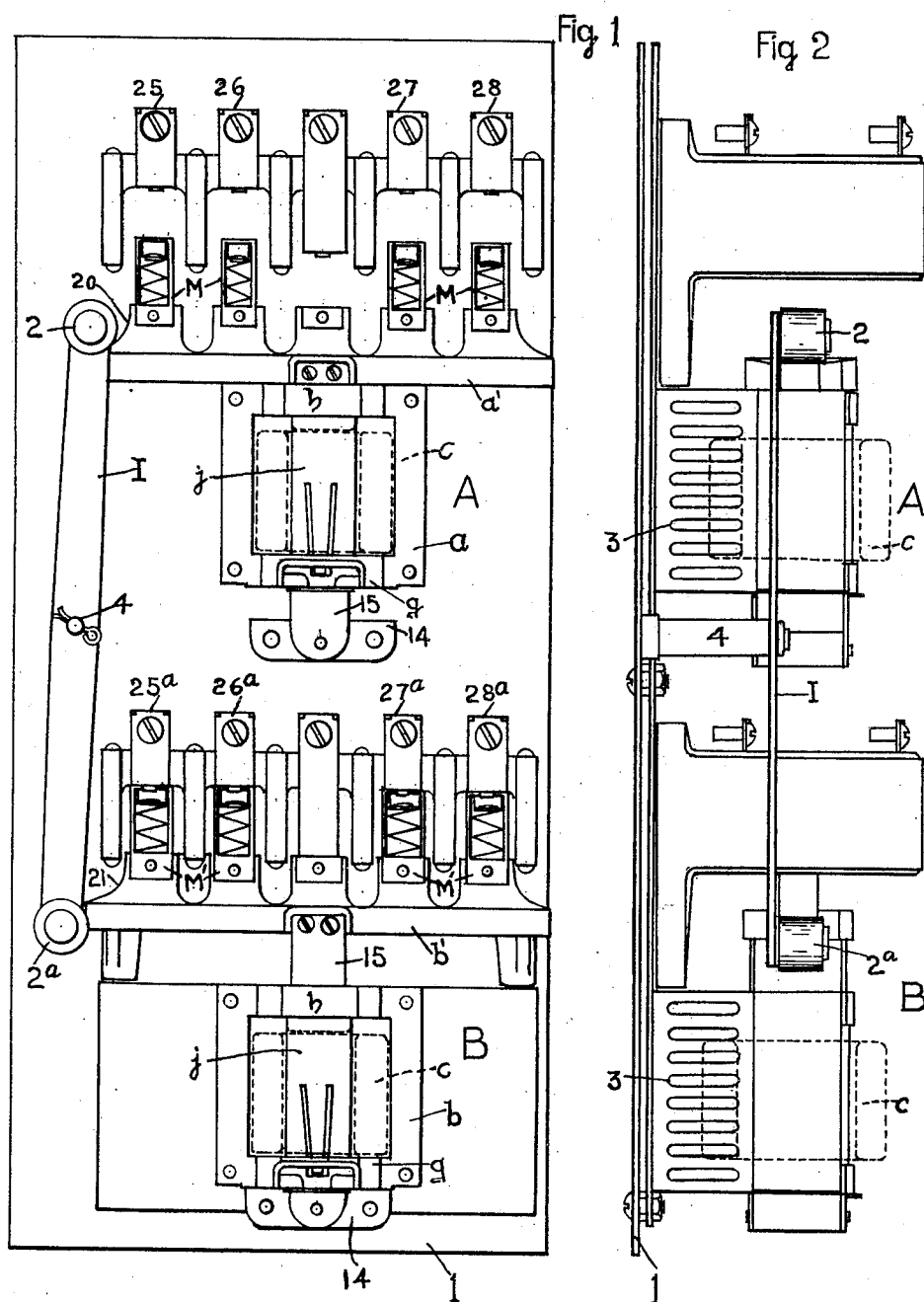
J. F. FRESE

2,400,344

ELECTROMAGNET

Filed Sept. 17, 1943

3 Sheets-Sheet 1



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ELECTROMAGNET

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3 Sheets-Sheet 2

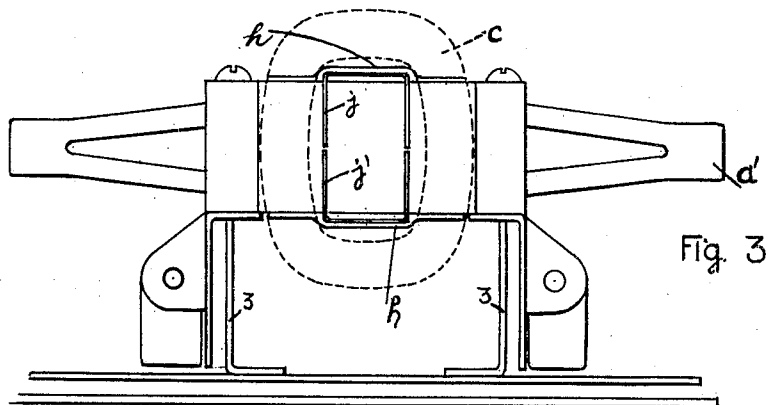


Fig. 3

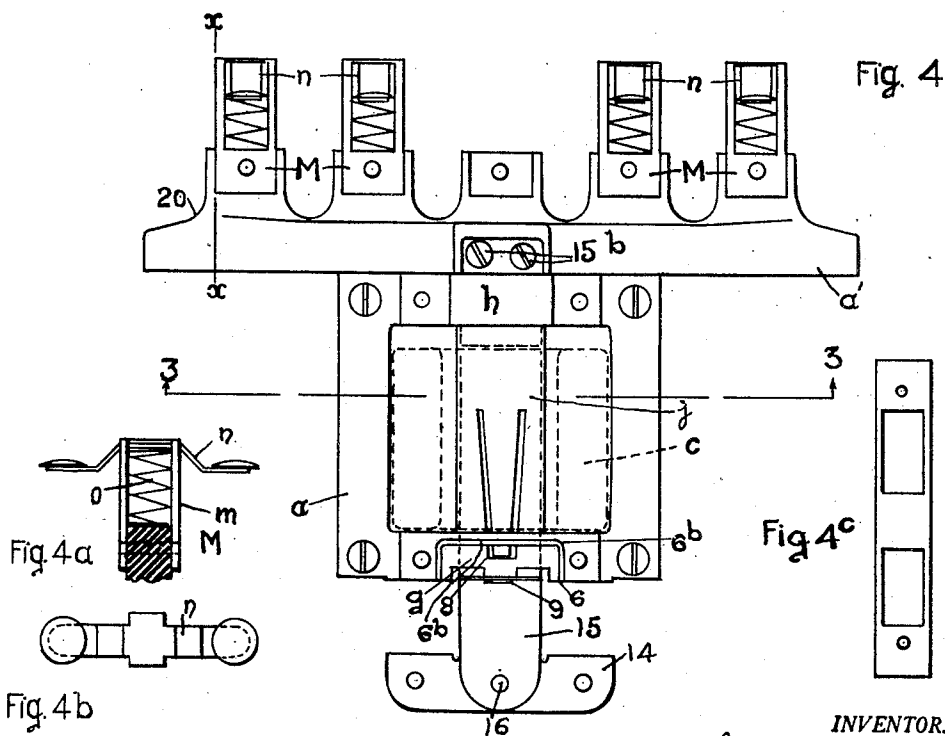


Fig. 4

Fig. 4a

Fig. 4b

Fig. 4c

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3 Sheets-Sheet 3

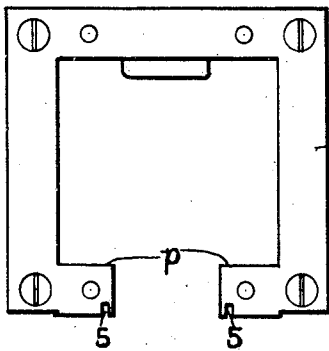


Fig. 5

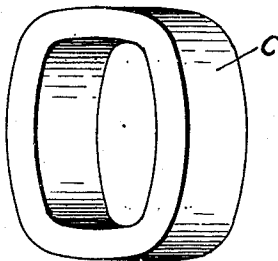


Fig. 6

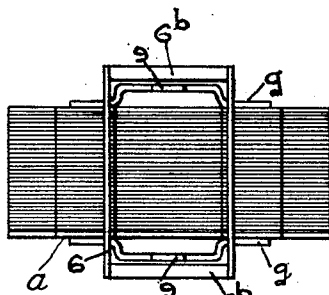


Fig. 7

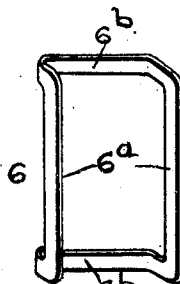


Fig. 8

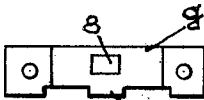


Fig. 9

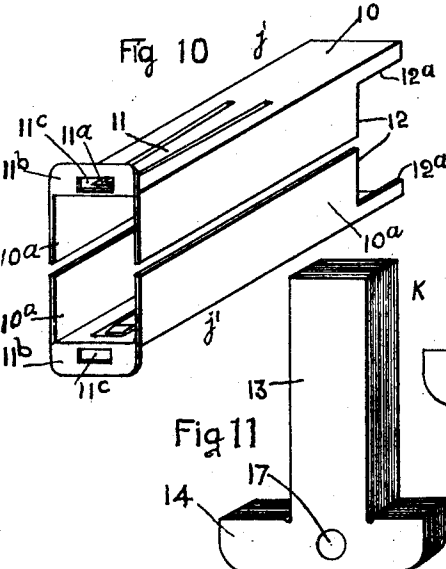


Fig. 10

Fig. 11

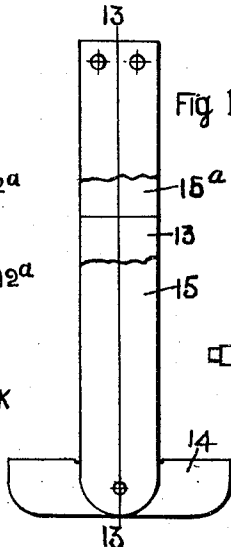


Fig. 12

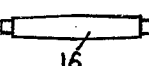


Fig. 13

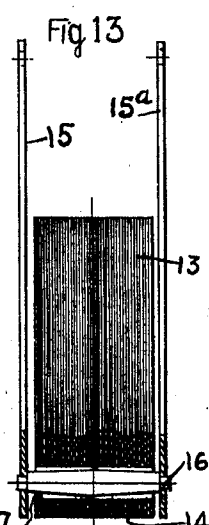


Fig. 14

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UNITED STATES PATENT OFFICE

2,400,344

ELECTROMAGNET

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Application September 17, 1943, Serial No. 502,803

3 Claims. (Cl. 175-336)

This invention relates to electromagnetically operated switches of the type wherein the magnet comprises a hollow field piece with the magnetizing coil arranged within the field piece. The invention comprises various features of construction which facilitate the assembling and taking apart of the various parts of the switch and which increases its efficiency and it also includes means whereby when two similar switches are arranged adjacent one another it is impossible to close either one of said switches while the other is closed. The details of construction of the switch mechanism will be clear from the following description, taken in connection with the accompanying drawings in which

Figure 1 is a front view of two similar electromagnetic switches with an interlocking device which prevents the closure of either switch while the other switch is closed, the magnet coils being shown in dotted lines;

Figure 2 is a side view of the same, looking from left to right in Figure 1;

Figure 3 is a section on the line 3-3 of Figure 4;

Figure 4 is a front view, on a larger scale, of the electromagnet, and movable contact carrying member shown in the upper part of Figure 1, the magnet coil being shown in dotted lines;

Figure 4^a is a side view of one of the contact assemblies, a part of the contact carrying bar being shown in section on the line x-x of Figure 4;

Figure 4^b is a plan view of one of the contact members;

Figure 4^c is a plan view of one of the metal blanks from which the housing for the contact and spring is formed;

Figure 5 is a front view of one of the magnet field pieces;

Figure 6 is a perspective view of the hollow coil which fits within the hollow field piece;

Figure 7 is a bottom plan view of the field piece with the shading coil and interlocking guides for the armature guide sections applied thereto;

Figure 8 is a perspective view of the shading coil;

Figure 9 is a plan view of one of the interlocking guide straps for the armature guide pieces;

Figure 10 is a perspective view of the parts which constitute guides for the armature and its supporting links and a means for holding the magnet coil in place;

Figure 11 is a perspective view of the armature;

Figure 12 is a side view of the armature and

its supporting links, one of the latter being shown partly broken away;

Figure 13 is a partial section on the line 13-13 of Figure 12, and

5 Figure 14 is a side view of the pivot pin which connects the armature with the supporting links.

Referring to Figures 1 and 2 of the drawings, A and B represent two similar electromagnetic switches arranged one above the other on a base plate 1 which is adapted to stand vertically. The magnets of the switches are spaced from the base plate by supporting members 3 such as are shown in Frese Patent #2,258,556, dated October 17, 1941. The lever I, centrally pivoted on a support 4, secured to the base plate, has rollers 2 and 2^a at its ends and these are adapted to engage the ends of the movable contact carriers of both switches and prevent the closure of either switch while the other switch is closed. The operation of this interlocking bar will be hereinafter described.

The switches A and B are alike in structure and a description of one switch will apply to the other. Therefore in Figure 4 is shown an electromagnet with its armature and the contact carrying member which it operates in the same positions as the armature and contact carrying member are shown in switch A, Figure 1, wherein the armature and said member are shown in the open position of the switch.

Figure 5 shows the field piece *a* of the magnet, which is a hollow laminated structure of rectangular form, having an opening in the center of its lower wall, forming opposed pole pieces 2, the opening being of sufficient width to permit the armature guide, hereinafter referred to, to pass through.

Transverse grooves 5 are formed in the bottom wall of the field pieces, adjacent the ends of the pole pieces, and a shading coil 6, shown in Figure 8, has its side portions 6^a embedded in these grooves, as shown in Figure 7, while its end portions 6^b are bent upwardly and extend across the gap in the bottom wall of the field piece and are spaced a short distance from said wall, as shown in Figures 4 and 7. Metal guide straps *g*, one of which is shown in Figure 9, are secured to the sides of the lower wall of the field piece and these extend across the gap in said wall, as shown in Figures 1, 4 and 7. Each of the metal guide straps *g* has an opening 8 in its central portion, and, opposite this opening, a lateral projection 9. These guide straps interlock with the armature guide pieces, as hereinafter explained. Metal guide straps *h*, Figures 1, 3 and

4, are secured to the opposite sides of the upper wall of the field piece in alignment with the guide straps *g* on the lower wall.

In Figure 10 is shown a guide for the armature comprising two identical complementary section *f* and *f'*, made of thin resilient non-magnetizable, metal, such as copper or brass, trough-like in cross section, each section of the guide having a flat central portion 10 and parallel side-walls 10^a of equal width, extending at a right angle to the central portion, the central portion being slotted longitudinally, forming a tongue 11, the free end of which is turned slightly outward from the plane of the central portion, as shown at 11^a. Each section of the armature guide has a flange 11^b extending outwardly at a right angle to the plane of its central portion at the end adjacent the free end of the tongue, and in each flange there is a slot 11^c adapted to receive the projection 9 on one of the metal guide straps *g*. The side walls 10^a of both armature guide sections are cut off at the ends opposite the flange, forming shoulders 12 and leaving narrow flanges 12^a at the margins of the central portion extending from said shoulders to the adjacent end of the section.

The armature *k*, as shown in Figures 11, 12, and 13, is a one-piece structure comprising a core 13, rectangular in cross section and a head 14 at a right angle to the core, the armature being composed of T-shaped laminations. The armature has a transverse bore 17 extending through the central part of its head as shown in Figures 11 and 13, and a pivot pin 16, tapering from its center toward both of its ends, extends through this bore. The pivot pin has pintles at its ends which are journaled in the lower ends of flat metal links, 15, 15^a which connect the armature with the contact-carrying member *a'* when the parts are assembled as shown in Figure 4. Each link is provided with screw holes at its upper end through which screws 15^b may be passed to fasten the upper ends of the links rigidly to the contact carrying member.

In assembling the parts thus far described, with the field piece held in a vertical plane, the coil *c* (Figure 6) is placed within it and the armature guide sections *f* and *f'* are then passed upwardly through the gap in the lower wall of the field piece within the guide straps *g* and *h* until the shoulders 12 engage the upper wall of the field piece which limits the upward movement of the guide sections. The guide sections extend through the central opening in the coil and hold the coil in place. As each armature guide section approaches its upward limit of movement the end 11^a of its tongue 11 enters the slot 8 in the adjacent guide strap *g* and the projection 9 on said guide strap enters the slot 11^c in the flange 11^b of the armature guide section. The engagement of the tongues of the armature guide sections with the guide straps *g* prevents accidental displacement of the armature sections and the projections 9 on the guide straps serve to hold the armature guide sections in parallel relation. The short side flanges 12^a on each armature guide section rest against the side of the upper wall of the field piece where they are retained by a guide strap *h*.

After the armature guide sections have been inserted in the field piece, as described, the links 15 and 15^a are applied to opposite sides of the armature, with the ends of the conical pivot pin 16 extending into the perforations in the lower ends of the links. Then the links with the arma-

ture attached are inserted upwardly through the armature guide sections and the upper ends of the links are securely fastened to the contact carrying member by the screws 15^b, Figure 4. The links fit freely within the armature guide and the armature, because of its pivotal connection with the links, has a limited rocking movement so that its head can make a flat contact with the lower wall of the field piece when the magnet is energized and the armature is drawn upwardly to the position of the armature shown in switch B in Figure 1. When the links are within the armature guide sections they lie close to the flat central positions of said sections, and so long as the links are in place it is impossible for the tongues 11 of the armature guide sections to become unhooked from the slots in the guide straps *g*, but when it is desired to remove the armature guide sections for any reason, such, for instance, as removing the coil, the guide links may be unfastened from the contact carrying member and pulled out of the armature guide, along with the armature, and the tongues on the armature guide sections can then be pushed inwardly to disengage them from the slots in the guide straps *g*. The armature guide sections can then be pulled downwardly by taking hold of their flanges 11^b and pressing downward to release them from engagement with the projections 9 on the guide straps.

On the contact carrying member *a'* are shown what might be called contact assemblages *M*, each including a housing *m*, open on four sides, each housing made from a blank shown in Figure 4^c and containing a spring *o* and a contact member *n*. The spring may be inserted in the housing by compressing it axially and inserting it through one of the open sides of the housing and then turning it to a right angle and releasing it so that it can expand axially and press the contact piece against the outer end of the housing. Each contact piece has a squared portion *n'* at its center which extends through openings in opposite sides of the housing, and the spring normally bears against the central part of the contact piece and holds it against the outer end of the housing. The contact piece can be removed by turning it edgewise in the housing and then drawing it outward through one of the openings.

Stationary contacts 25—29 and 25^a—29^a for the switches are shown only in front view, and not in detail, and the circuits which the switches control are not shown because the switches may be used for various purposes. Neither are the circuits for the magnets shown. These circuits can be closed or opened by switches operated manually or otherwise. Where it is desirable or necessary to have only one switch closed at a time, the interlocking bar *I* may be provided for preventing the possibility of one switch being closed during the period while the other switch is closed. For this purpose the ends of the contact carrying members *a'* and *b'* are formed with curved surfaces 20 and 21, respectively, on their upper sides and the centrally pivoted lever has rollers at its ends which engage the corresponding ends of the bar. When the switch B is closed, the roller 2^a bears against the end of the contact carrier *b'* below the curved surface 21 and this holds the roller 2 at the opposite end of the bar *I* inwardly over the curved surface 20, so that the magnet of the switch A can not lift the bar *a'* to closed position so long as the switch B is closed. Similarly, if both switches are open and the circuit of the magnet of the switch A is closed the con-

tact carrying member *a'* will be raised and the bar *I* will be rocked into position over the curved surface *21* on the contact carrying bar *b'* of switch *B* and prevent the closing of the latter switch while the switch *A* is closed.

What I claim is:

1. An electromagnetic switch comprising a hollow field piece having upper and lower walls, the lower wall having a gap therein, a magnetizing coil within the field piece, said coil having a central opening, strap guides on the upper and lower walls of the field piece, at each side thereof, each strap guide on the lower wall spanning the gap in said wall and each of the latter guides having an opening therein and a downward projection opposite said gap, a hollow armature guide comprising two opposing guide sections insertable through said gap, each guide section having a flange at its lower end, said flange having a slot therein, and having a tongue extending toward said flange, said tongue adapted to interlock with the strap guide and the projection on the strap guide adapted to enter the slot in the flange of the armature guide section when the latter is inserted upwardly through the gap in the field piece.

2. An electromagnetic switch mechanism comprising a hollow field piece having upper and lower walls, the lower wall having a gap therein, forming pole pieces at each side of the gap, a magnetizing coil within the field piece, said coil having a central opening therethrough, a hollow armature guide within the field piece, in line with said gap and extending through the opening in said coil, said guide comprising two complemen-

tary parts insertable and removable through said gap and each part attached to the upper and lower walls of the magnet core, a vertically movable member above the magnet field piece, links attached to said member and extending through said armature guide, and an armature comprising a core and a head between said links, the head being pivotally connected to the links below the field piece and the core extending upwardly between the links.

3. An electromagnetic switch mechanism comprising a hollow field piece having upper and lower walls, the lower wall having a gap therein, forming pole pieces at each side of the gap, a magnetizing coil within the field piece, said coil having a central opening therethrough, a hollow armature guide within the field piece in line with said gap and extending through the opening in said coil, said guide comprising two complementary parts insertable and removable through said gap and each part attached to the upper and lower walls of the magnet core, a vertically movable member above the magnet field piece, links attached to said member and extending through said armature guide, an armature, comprising a core and a head, between said links, the head having a central transverse bore, a pivot pin extending through said bore and connecting the head to the links, said pin tapering from its central portion toward its ends so as to permit a limited rocking motion of the armature when the head is drawn upwardly against the magnet pole pieces.

JOSEPH F. FRESE.