May 13, 1930. E. R. CARICHOFF 1,758,782

ELECTROMAGNET

Filed Dec. 1, 1927

Fig. 1.

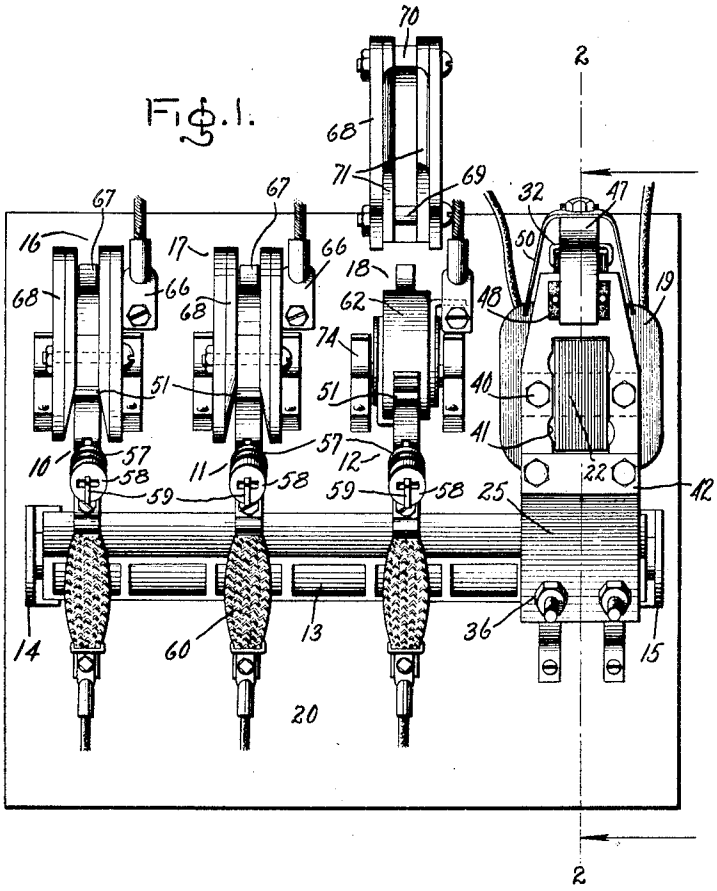
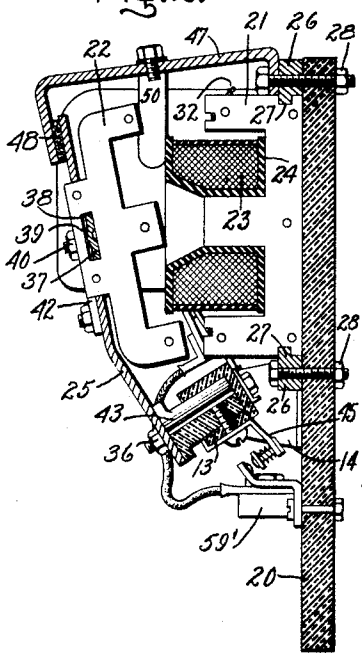


Fig. 2.



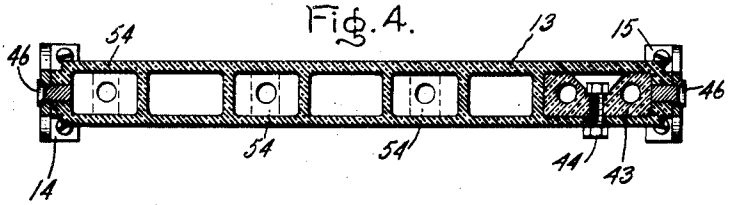


Fig. 4.

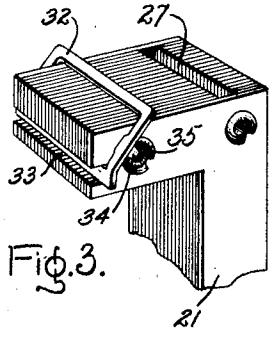
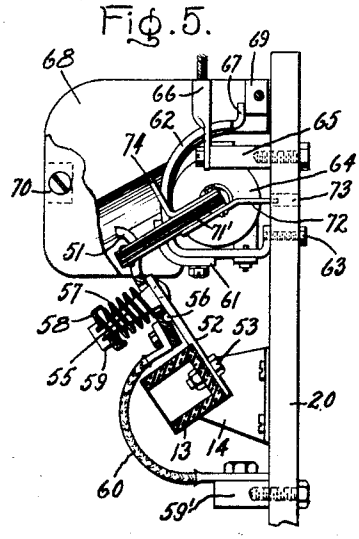


Fig. 3.

Fig. 5.



Inventor:
Eugene R. Carichoff,
by Alexander S. Kenton
His Attorney.

Patented May 13, 1930 1,758,782

UNITED STATES PATENT OFFICE

EUGENE R. CARICHOFF, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

ELECTROMAGNET

Application filed December 1, 1927. Serial No. 237,075.

My present invention relates to electromagnets, particularly for operating circuit controlling devices, and the invention comprises various new and useful improvements in the magnetic structure and the windings therefor, as well as in the mounting arrangement of both the stationary and movable parts of the operating electro-magnet.

Among the principal objects of the invention are to increase the power, efficiency and quietness of the operating electro-magnet, particularly for alternating current service, and to improve the construction of the operating electro-magnet so as to render both manufacture and maintenance of the same in service relatively simple and inexpensive.

The operating electromagnet embodying the several improvements of the present invention is particularly advantageous when applied to an alternating current contactor such as illustrated in the accompanying drawing, although various features of the invention may be utilized separately in other forms of operating electromagnets or other devices with equal advantage whenever desired.

In the drawing, Fig. 1, is a front view of a three pole alternating current contactor having an operating electromagnet embodying the improvements of the present invention in their preferred form. Fig. 2 is a sectional view of the contactor shown in Fig. 1 along the lines 2—2 and reveals the details of construction of the operating electro-magnet. Fig. 3 is an enlarged perspective view of one of the poles of the contactor operating electro-magnet showing more clearly the construction of the pole shading winding used in alternating current service. Fig. 4 is a sectional view of the rotatable shaft which carries the movable switch members and the movable magnetic member of the electromagnet. And Fig. 5 is a side view showing the detailed construction of the contact fingers and the magnetic blowout provided for each pole of the contactor with certain parts broken away in order to more clearly illustrate the details of construction.

The contactor shown in Fig. 1 comprises the movable switch members 10, 11 and 12 which are mounted upon the rotatable shaft 13 to form a three pole switch particularly adapted for alternating current service. The pivotal supports 14 and 15 for the contactor shaft 13 together with the magnetic blowouts 16, 17 and 18 for the movable contacts 10, 11 and 12 and also the operating electro-magnet 19 all are mounted upon the base 20. Base 20 is preferably formed of suitable insulating material. The several novel features of the switch mechanism itself are described and claimed in my divisional application Serial No. 313,118, filed October 17, 1929.

The operating electro-magnet 19 is designed to be energized with alternating current. As is more clearly shown in Fig. 2 the operating electro-magnet has a stationary frame 21 and a movable armature 22, each of which is E shaped. The energizing windings 23 of the electro-magnet are located on a spool 24 preferably formed of molded insulating material such as bakelite and the like. The spool 24 is formed to be seated upon the middle leg of the E shaped frame 21 and is provided with a bell shaped space within the winding 23 for receiving the cooperating middle leg of the E shaped armature 22. The stationary core 21 is secured to the base 20 by means of the blocks 26 which have lugs projecting into slots 27 formed in the stationary core. Thus by tightening the bolts 28 the stationary core 21 is clamped firmly in engagement with base 20 without the necessity of passing fastening bolts through the laminated core structure itself.

The slot 27 in the core 21 is shown more fully in Fig. 3. This figure also shows the pole shading winding 32 which is located upon each of the outside legs of the E shaped frame 21. As shown in Fig. 3 the pole shading winding 32 is in the form of a closed loop of current conducting material, preferably brass. One side of the loop is located in the slot 33 formed in the pole face of the core. The pole shading winding 32, preferably is loosely mounted on the core 21 and is held in position by means of lugs or fingers 34 extending from the side of the pole shading winding loop into the center of the hollow rivet 35 which maintains the lamination of

the frame 21 together. The advantage of this pole shader arrangement is the loose mounting which prevents injury to the pole shading winding due to the shocks and jars inherently accompanying the operation of the armature 22 into the engagement with frame 21. Moreover it is a relatively simple matter to remove and replace the pole shading winding whenever necessary.

The armature 22 of the electro-magnet is mounted upon the arm 25 which is removably secured to the shaft 13 by means of the bolts 36. In order to provide mounting for the armature 22 that will permit pivotal and twisting movement thereof so as to insure proper alinement of the armature with the frame the armature 22 is loosely mounted upon a bar 37 which extends through the slot 38 formed in the armature 22. The bar 37 is provided with a centrally located hump 39 to permit more readily the tilting and twisting movement of the armature 22. The bar 37 is removably secured to the arm 25 by means of the bolts 40 with the back of the armature 22 extending through the opening 41 provided in the arm 25. In order to relieve the bar 37 of the weight of the armature 22, an additional bar 42 may be provided at the bottom of the opening in the arm 25.

The arm 25 is mounted upon the shaft 13 by means of a spacing plug 43. It will be observed from Fig. 4 that the shaft 13 is formed of molded insulating material in truss shape. The spacing plug 43 is arranged to fit snugly into one of the end pockets of shaft 13 and provided with suitable holes through which the holding bolts 36 previously referred to are passed. An additional bolt 44 is provided for more firmly securing the plug 43 to the shaft 13 and at the same time fastening the auxiliary switch mechanism 45 to the shaft.

It will be noted in Fig. 4 that the contactor shaft 13 is provided with shoulders at each end with a central opening formed therein to receive the pivotal bearing pins 46 which are secured to the supports 14 preferably by riveting thereto. With the switch shaft 13 formed of molded insulating material this bearing construction requires no oil and will withstand long service without appreciable wear.

The movement of the armature 22 away from the core 21 is limited by the stop 47 which is secured at one end by the bolt 28 and preferably is provided with a buffer 48 of a wear resisting and resilient material such as fibre. The stop 47 also carries the clamp 50 which serves to hold the winding spool 24 securely seated upon the middle leg of the core 21. With this construction the removal of the stop 47 by loosening the bolt 28 readily permits the operating winding 23 to be removed for repair.

The construction of the contact fingers and of the magnetic blowout provided for each pole of the contactor is shown in Fig. 5. In this figure the movable contact finger 51 is carried upon an arm 52 which is removably secured to the shaft 13 by the bolt 53. Preferably shallow channels as indicated by the dotted lines 54 in Fig. 4 are provided on the back side of the shaft 13 for receiving the arms 52. In this way the single bolt 53 serves to hold the arm 52 in proper alignment on the shaft 13. The finger 51 has a slot for receiving the guide 55 which is fixedly secured to the free end of arm 52 so as to project at right angles thereto. The arm 52 also is provided with a pointed pivot pin 56 which fits into a corresponding notch or depression in the contact 51 so as to form a pivotal bearing for the latter. The end of the guide 55 is formed in T shape and the compression spring 57 is of sufficient diameter to pass freely over the laterally extending tongues at the end of the guide into engagement with the contact finger 51. To maintain the spring 57 under compression, the cup shaped washer 58 is arranged to seat the outer end of the spring 57. As shown in Fig. 1 the washer 58 is provided with an elongated slot which permits the T end of the guide 55 to pass therethrough. Thereupon the washer 58 is given a half turn to bring the slot out of alinement with the T head of the guide 55. Preferably holding lugs 59 are punched up from the edges of the slot in the washer 58 so as to prevent accidental return of the slot in the washer into alinement with the T head of the guide 55. This arrangement permits ready removal of the compression spring 15 as well as the contact 51 from the guide 55 in case the contact 51 should become worn or damaged in the service. The contact 51 is connected to the stationary terminal 59′ by means of the flexible shunt or connector 60.

The stationary contact 61 which cooperates with the contact finger 51 in closing and opening the circuit controlled by the contactor is removably mounted upon the support 62 which is secured to the base 20 by the bolt 63. The support 62 also is rigidly connected to one end of the blowout coil 64. The other end of the blowout coil is connected to the terminal 65 from which the line conductor 66 extends. It will be observed that support 62 is substantially of C shape. The support 62 is of sufficient width as shown in Fig. 1 to almost completely surround the blowout coil 64. The upper end of the C shaped support 62 is provided with an upturned finger 67. The arc chute 68 is arranged to be secured in position by means of the upturned finger 67 and the curved portion of the support 62. As shown in Fig. 1 the arc chute 68 is formed of spaced apart walls of good insulating material. Suitable spacing lugs 69 and 70 are interposed between the walls forming the arc chute and

the bolts which hold the walls together pass through these lugs. The interior surfaces of the walls forming the arc chute are each provided with a curved shoulder 71 adjacent the lug 69. The relation of the lug 69 and the curved shoulder 71 are such that the arc chute fits snugly upon the curved portion of the support 62 with the upturned finger 67 thereon engaging with the lugs 69 and extending between the side walls of the arc chute. In this way the arc chute 68 is firmly maintained in its proper position to receive any arc which may occur upon the separation of the contact 51 from the contact 61. The support 62 also serves as an arc horn extending entirely along one edge of the arc chute.

The blowout flux set up by the coil 64 is conducted in the region of the arc by means of the laminated magnetic pole pieces 71′ which extend from the magnetic core passing through the blowout coil 64. As shown in Figure 1 the laminated pole pieces 71′ extend on either side of the arc chute 68 adjacent to the point of operation of the contacts 51 and 61. In order to maintain the pole pieces 71′ in the proper operating position, the guide 72 is secured to the pole pieces and extends into a hole 73 provided in the base 20. The upturned portion 74 of the pole pieces is provided in order to obtain a wider distribution of the blowout flux through the arcing region.

With the arc chute constructed as described it will be evident that the arc chute may be readily lifted out of engagement with the support 62 as indicated in Fig. 1 thereby exposing the contact fingers 51 and the contact 61 for inspection and any necessary repairs.

The operation of the electro-magnetic switch just described will be apparent. Upon energization of the operating windings 23 the movable armature 22 is attracted into engagement with the frame 21. The relative length of the legs of the armature and core are so proportioned that only the outer legs are carried into abutting engagement. This leaves a slight air gap between the centre legs of the core and the armature. Also the loose mounting of the armature 22 upon the arm 25 the armature permits freedom of adjustment into intimate contact with the core 21 irrespective of any slight misalinement that may exist therebetween. This method of mounting the armature 22 together with the arrangement of the pole shading winding 32 results in very quiet operating of the electromagnet when energized with alternating current.

Upon de-energization of the operating winding 23 the out of balance weight of the armature 22 and the finger springs insure a quick opening of the switch. The blowout coils and arc chutes associated therewith insure the rapid disruption of any arcs that may occur upon the separation of the contacts.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. An electromagnetic device comprising a base, an electromagnet having a frame provided with slots therein and provided with a winding, clamping fingers secured to the base and engaging said slots to hold the frame in position, and an armature therefor cooperating with said frame and loosely mounted so as to be free to adjust itself in proper alignment with the frame.

2. The combination with an alternating current electromagnet having a laminated magnetic frame of substantially E shape, said frame having slots transverse the laminations oppositely disposed in the outer legs thereof, a supporting base for the frame, clamping members having fingers for engaging said slots, and means for removably securing the clamping members with the frame clamped therebetween to said base.

3. In an alternating current electromagnet, the combination of a laminated magnetic structure having a slot formed in the pole face thereof to divide the pole face into two areas, a pole shading winding in the form of a loop substantially larger than one of said areas, and means for loosely supporting said pole shading winding to surround said one area with one portion of the loop movable in said slot.

4. In an alternating current electromagnet, the combination of a laminated magnetic structure having a slot formed in the pole face thereof, a loop-shaped pole shading winding having a portion thereof disposed in said slot, and separate connections from each end of the looped pole shading winding engaging with said magnetic structure for loosely maintaining the pole shading winding in operating relation therewith.

5. In an alternating current electromagnet, the combination of a laminated magnetic structure having a slot formed transverse the laminations in a pole face thereof, a hollow rivet extending through the frame laminations adjacent said pole face for maintaining the same together, a loop-shaped pole shading winding having one side of the loop disposed in said slot and provided with extensions from each end of the loop adapted to engage with the ends of said rivet for loosely maintaining the pole shading winding in operating position.

6. An electromagnet having a movable magnetic member provided with a non-circular opening therein, and means for removably supporting said magnetic member including a non-circular supporting member loosely disposed in said opening to freely permit relative movement between the supporting means and the movable magnetic member.

7. An electromagnet having a movable electromagnetic member provided with a non-circular opening therethrough, a pivoted supporting arm for the magnetic member, and means for loosely mounting the magnetic member on the support including a non-circular member loosely passing through said opening in the magnetic member and secured to said supporting arm.

8. An electromagnet having a movable electromagnetic member provided with a non-circular opening therein, a pivotally mounted arm having spaced-apart portions for receiving the magnetic member loosely therebetween, and a non-circular support loosely extending through said opening in the magnetic member and secured at each end to said spaced-apart portions whereby limited relative movement of the armature with respect to the support in all directions is secured.

9. An alternating current electromagnet having a movable laminated magnetic member of substantially **E** shape and provided with a non-circular opening transverse the laminations opposite the middle leg thereof, a pivoted shaft having an arm extending therefrom with portions disposed on either side of the magnetic member for supporting the same, and a bar extending between said portions through said opening in the magnetic member for loosely supporting the same to permit relative movement thereof with respect to the arm in all directions.

10. An electromagnet having relatively movable magnetic members, a magnetizing winding having a spool with a core formed therein arranged to closely surround one of said members with the end of said member intermediate the ends of the spool and providing a core space of increased area for receiving the other relatively movable member therein.

11. An electromagnet comprising a magnetizing winding having a spool provided with a core space of different area at the opposite ends thereof, a magnetic member arranged to substantially fill said core space with the end of said member intermediate the ends of the spool, and second magnetic member freely operable within the remaining core space of the spool into engagement with said first member.

12. An electromagnet comprising a magnetizing winding having a spool provided with a bell-shaped core space, a magnetic member, and cooperating relatively movable magnetic members one disposed in said core space with the end of the member extending intermediate the ends of the core space and another magnetic member freely operable into engagement therewith.

13. An electromagnet comprising a magnetic member; a magnetizing winding having a spool disposed on said magnetic member with the end of the member intermediate the ends of the spool, said spool providing a bell-shaped core space extending from the end of said magnetic member, and a pivotally mounted magnetic member operable in said bell-shaped core space into engagement with said first magnetic member.

14. An electromagnet comprising an **E**-shaped magnetic frame, a magnetizing winding having a spool providing a bell-shaped core space for mounting the winding upon the middle leg of said structure with the end of said middle leg intermediate the ends of the core space, and a cooperating movable magnetic member of substantially **E** shape pivotally mounted for movement into aligned attracted relation with said **E**-shaped frame with the middle leg of the movable magnetic member operable in said bell-shaped core space.

In witness whereof, I have hereunto set my hand this 30th day of November, 1927.

EUGENE R. CARICHOFF.