July 29, 1924. 1,503,090

E. R. CARICHOFF

ELECTROMAGNET

Filed Feb. 27, 1920

Fig. 1.

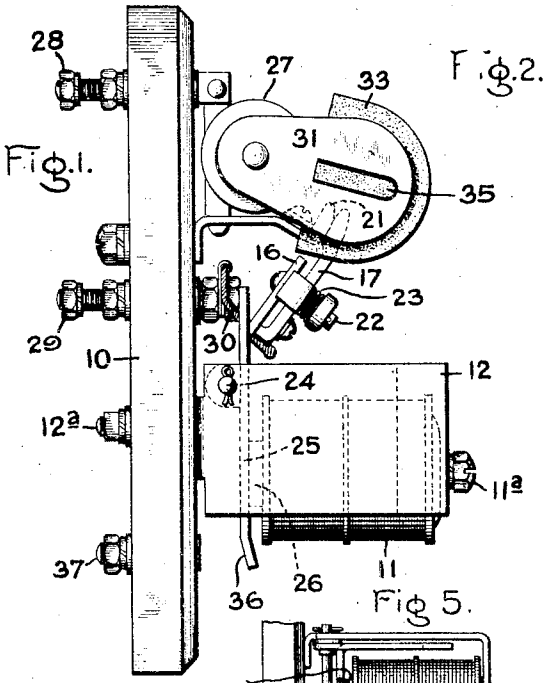


Fig. 2.

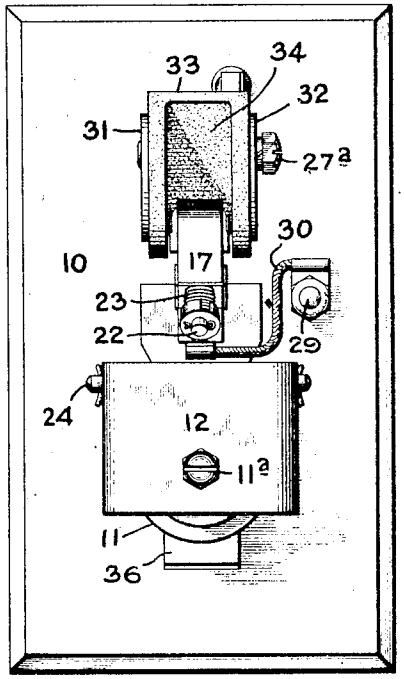


Fig 5.

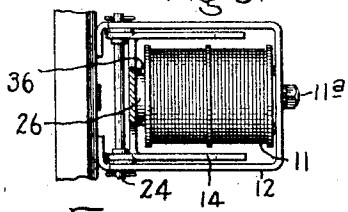


Fig. 3.

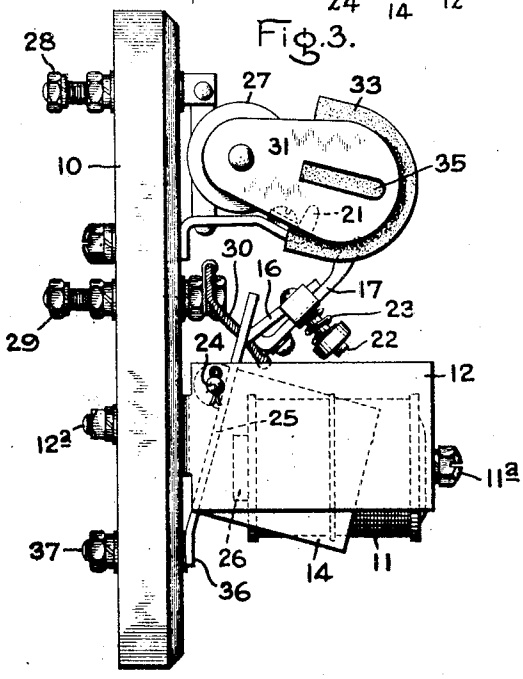
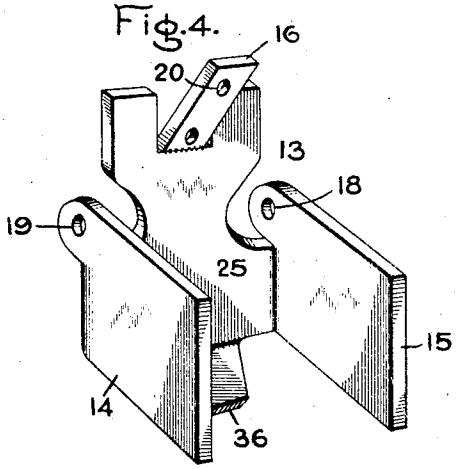


Fig. 4.



Inventor:
Eugene R. Carichoff
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His Attorney.

Patented July 29, 1924. 1,503,990

UNITED STATES PATENT OFFICE.

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

ELECTROMAGNET.

Application filed February 27, 1920. Serial No. 361,694.

To all whom it may concern:

Be it known that I, EUGENE R. CARICHOFF, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electromagnets, of which the following is a specification.

My invention relates to improvements in operating electromagnets for electric switches and the like. One of the objects of my invention is to provide an improved electromagnet, which shall be simple, rugged and effective, and which can be manufactured cheaply.

Other objects of my invention will be apparent from an understanding of the invention.

For an understanding of my invention, reference is had to the accompanying drawing wherein Fig. 1 is a side view of an electromagnetic switch embodying my improved electromagnet with the switch in the closed position; Fig. 2 is a plan view of the same; Fig. 3 is a view similar to Fig. 1 with the switch in open position; Fig. 4 is a perspective view of the electromagnet armature; and Fig. 5 is a top view of Fig. 2 drawn to a smaller scale of the electromagnetic operating means for the switch with certain parts removed for the sake of clearness.

Referring to the drawings, the switch mechanism is mounted on a suitable base 10 of insulating material. The operating winding 11 of the electromagnet is supported within a substantially U-shaped frame 12 of magnetic material by means of a bolt 11^a which secures the core of the electromagnet to the end of the frame in a mid-position. The frame is stamped out of a strip of flat metal and then bent into the shape of a U with the ends of the U bent inward to provide means for securing the frame to the support. If desired, of course, the frame may be bent up from a strip of metal of standard section and the ends of the U secured directly to the support without being bent inward as shown. The ends of the U-shaped frame 12 are secured to the base 10 by means of bolts 12^a, only one of which can be seen.

The armature 13 is made of a stamping of a flat strip of metal having magnetic properties. After the armature is stamped out of the flat strip of metal, the arms 14 and 15 are bent into the position shown so as to form a U-shaped armature. The projection 16 is also "kicked up" to the position shown so as to form a support for the movable switch contact member 17. Before the armature is bent into the shape shown, holes 18 and 19 are punched out to provide means for pivotally supporting the armature, and the hole 20 is punched out to provide means whereby the switch contact finger 17 is secured to the armature. The contact finger 17 is given a wiping action with the stationary contact 21. When the switch closes by means comprising the pin 22 which passes through the hole 20 in the armature and a corresponding hole in the contact finger, and a spring 23 which biases the contact toward the projection 16. The armature 13 is pivotally supported within the frame 12, embracing the winding 11, by means of a pin 24 which passes through the holes 18 and 19 in the projections on the legs of the armature and corresponding holes near the upper edges of the ends of the legs of the frame. The armature telescopes or nests within the frame with the legs 14 and 15 of the armature disposed oppositely to the legs of the frame in planes parallel to the planes of the legs of the frame with suitable clearances provided between the frame and the armature. The clearances provided are maintained by means of spacers or washers (not shown). The armature is mounted within the frame so as to be biased by gravity to the position shown in Fig. 3, at which the legs 14 and 15 are out of alignment with the axis of the magnet 11 and the parallel sides of frame 12, since the pivoted support is at the back of the armature and the switch can therefore be tilted to a very great angle before the switch contacts will close by gravity. This feature is of great importance in switches for use on switch-board, for example. The armature moves away from the supporting base to make engagement with the core of the operating electromagnet instead of the usual construction in which the armature when attracted moves toward the supporting base. It will also be observed that the pivoted support is at such a place that substantially none of the magnetic flux passes through the support and that the wear on the pivot pin 24 all comes on the upper periphery on the pin. The armature

has no vertical movement with respect to its pivotal support when the switch is closed or opened. When the armature is in its biased position the legs 14 and 15 are out of the path of least reluctance for the magnetic flux set up by the winding. The part 25 connecting the two legs of the U is adapted to come into substantial engagement with the one pole piece 26 of the electromagnet when the magnet winding is energized and the armature is in the attracted position, as shown in Fig. 1. When the armature is in its attracted position, a path of least reluctance for the flux set up by the winding is found through the U-shaped armature, the greater part of the legs of the U-shaped frame, and the end of the frame. The broad cooperating surfaces between the armature and the frame on both sides of the electromagnet afford paths of low reluctance for the passage of the magnetic lines across the gap between the armature and the frame.

In order to remove the winding 11, it is necessary to merely unscrew the bolt 11ª which secures the winding and the core therefor to the magnet frame 12. The winding and its core can then be dropped out of position and a new winding can be readily substituted if desired.

Means are provided for interrupting the arc formed between the switch contacts 17 and 21. This means comprises a magnetic blowout winding 27, having one terminal connected to the stationary contact 21 and the other terminal connected to the terminal post 28. The other terminal post 29 of the switch is connected to the wiping contact 17 by means of a flexible conductor 30. Metallic plates 31 and 32 which serve as pole pieces for the winding are clamped to the ends of the winding by means of a bolt 27ª, and a block of insulating refractory material 33, having a chute 34 through which the arc stream passes, is removably held between the pole pieces by the clamping action of the bolt. The bolt is screwed into the one end of the core for the winding 27, so as to clamp the pole piece 32 to the core and the pole piece 31 is riveted to the other end of the core. A pin and slot connection between the plates and the arc chute is provided so as to positively hold the chute in proper position. Thus, an elongated pin or projection 35 is formed on the end of the arc chute and this projection cooperates with a slot of similar shape in the pole piece. A similar pin and slot connection is provided on the other end of the arc chute. When it is desired to remove the arc chute to replace the chute or to inspect the contacts, the bolt 27ª is backed off slightly and the chute is then freely removable. In a divisional application, Ser. No. 481,422, filed June 29, 1921, I have claimed specifically this improved magnetic blow-out. A "kicked up" portion 36 on the armature 13 is provided as a stop for the armature, and the position of the armature with respect to the winding and the frame 12 may be adjusted by means of the bolt 37.

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

1. An electromagnet comprising a magnet winding, and a magnetic structure therefor including two similarly shaped telescoping members, one of which is movable into and out of a position of alignment with reference to the other under the control of the magnet winding.

2. An electromagnet comprising a magnet winding, and a magnetic structure therefor including two substantially U-shaped telescoping members enclosing the winding, one of which is movable with reference to the other under the control of the magnet winding.

3. An electromagnet comprising a magnet winding, and a magnetic structure therefor including two nesting members movable into and out of alignment with each other under the control of the magnet winding.

4. An electromagnet comprising a magnet winding, and a magnetic structure therefor including two relatively movable cooperating members one of which is pivotally mounted within and nests with the other member.

5. An electromagnet comprising a magnet winding, and a magnetic structure therefor including two substantially U-shaped cooperating members, one of which nests with the other.

6. An electromagnet comprising a magnet winding, and a magnetic structure therefor including two substantially U-shaped relatively movable cooperating members, one of which is pivotally supported in the legs of the other U-shaped member and nests with said other member.

7. An electromagnet comprising a substantially U-shaped frame of magnetic material, a substantially U-shaped armature of magnetic material pivotally supported within the frame with the legs of the armature nesting with the legs of the frame, and an operating magnet winding positioned within said frame.

8. The combination in an electromagnet, of a substantially U-shaped frame of magnetic material to which one end of the core of the electromagnet is secured between the legs of the frame, and a substantially U-shaped armature, the said armature pivotally mounted within the said frame with the legs of the frame and the legs of the armature nesting and oppositely disposed to each other.

9. The combination in an electromagnet, of a substantially U-shaped metallic frame

to which one end of the core of the electromagnet is secured between the legs of the frame, and an armature having a pivotal support in each leg of the frame and movable toward the other end of the core of the electromagnet.

10. The combination in an electromagnet of a magnet frame to which one end of the core of the electromagnet is secured, a support for the said frame to which the frame is secured with the axis of the electromagnet disposed at an angle to the support, and an armature for the electromagnet movable in the space between the said support and the other end of the electromagnet.

11. The combination in an electromagnet, of a substantially U-shaped metallic frame to which one end of the core of the electromagnet is secured between the legs of the frame, a support for the electromagnet to which the frame is secured with the axis of the electromagnet at right angles to the support, and an armature pivotally mounted in the frame and movable in the space between the said support and the other end of the core of the electromagnet.

12. The combination in an electromagnet of a magnet frame to which one end of the core of the electromagnet is secured, a support for the said frame to which the frame is secured with the axis of the electromagnet disposed at an angle to the support, and a pivotally mounted armature in the space between the support and the other end of the core of the electromagnet, the pivotal support for the armature being disposed with respect to the frame so that the armature is biased away from the said other end of the electromagnet by gravity and the armature is movable about its pivot away from the support toward the said other end of the electromagnet.

13. The combination in an electromagnet, of a pivoted substantially U-shaped armature adapted to embrace the electromagnet with the legs of the armature disposed along the axis of the magnet and biased to a position at which the legs are out of alignment with the axis of the magnet, whereby upon the energization of the electromagnet the armature is operated toward a position at which its legs are in substantial alignment with the axis of the electromagnet.

14. The combination in an electromagnet of a magnet winding and a pivoted substantially U-shaped armature adapted to embrace the winding, the legs of the armature disposed along the axis of the magnet so as to be movable into and out of a position at which the reluctance of the magnetic flux set up by the winding is the least.

15. The combination in an electromagnet, of a pivoted substantially U-shaped armature adapted to embrace the winding of the electromagnet, the legs of the armature disposed along the axis of the magnet core and out of alignment therewith so as to be movable in response to the energization of the magnet toward a position at which its legs are in substantial alignment with the axis of the core with the part of the said armature connecting the legs in close proximity to one pole of the electromagnet.

16. The combination in an electromagnet of a support of magnetic material for the electromagnet having legs embracing the electromagnet, and a pivoted substantially U-shaped armature adapted to embrace the electromagnet, the legs of the armature disposed in planes parallel to the planes of the legs of the support and movable into and out of substantial alignment with the legs of the support.

17. The combination in an electromagnet of a pivoted U-shaped armature of magnetic material with lugs on the legs of the U to provide supporting means therefor, a circuit making contact carried by said armature, the said armature mounted so as to embrace the winding of the electromagnet, biased to a position at which said contact is in one position and movable about its pivotal support upon the energization of the winding into a position at which the flux set up by the winding has a path of least reluctance through the legs of the armature, whereby the contact is moved to another position.

18. The combination in an electromagnet of a frame of magnetic material having flat parallel portions, a winding for the electromagnet supported within the frame with the axis of the winding disposed midway between the flat parallel portions of the frame, a pivoted substantially U-shaped armature supported within the frame and a switch contact carried thereby, the said armature having flat legs disposed parallel with the flat portions of the frame and biased to a position at which the legs of the armature are out of alignment with the flat portions of the frame, whereby upon the energization of said winding the armature is moved toward a position at which the legs of the armature and the flat portions of the supporting frame are in substantial alignment.

19. The combination in an electromagnet of a frame made up of a flat strip of magnetic material bent into U-shape, means for securing one end of the electromagnet to the frame so that the axis of the electromagnet is disposed midway between the legs of the U-shaped frame, an armature made up of a flat strip of magnetic material bent into U-shape with lugs on the back of the U to provide supporting means therefor, and means for pivotally supporting the armature within the frame with the legs of the armature and the frame nesting and oppositely disposed to each other, the loca-

tion of the pivotal support being such that the armature is biased by gravity to a position at which the legs of the armature are out of substantial alignment with the legs of the frame and the axis of the electromagnet, whereby upon energization of the winding of the electromagnet the armature is moved toward a position at which the part of the armature connecting the legs of the armature is in substantial engagement with the other end of the core of the electromagnet and the legs of the armature are in substantial alignment with the axis of the said core and the legs of the frame.

In witness whereof, I have hereunto set my hand this 24th day of February, 1920.

EUGENE R. CARICHOFF.