Oct. 14, 1941. J. EATON 2,259,127

ELECTROMAGNET

Filed Aug. 28, 1939

Fig. 1.

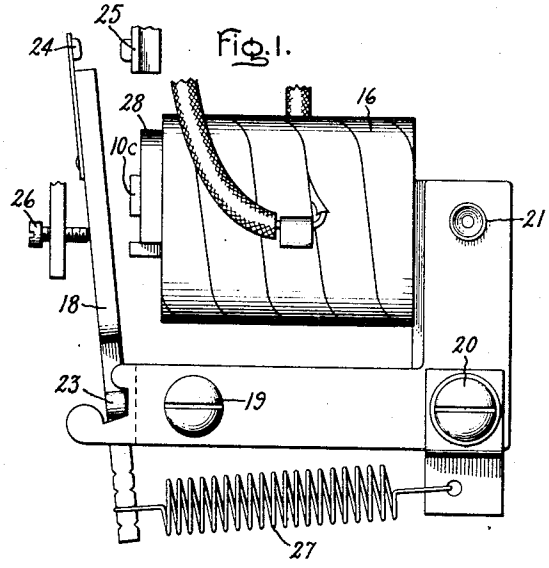


Fig. 2.

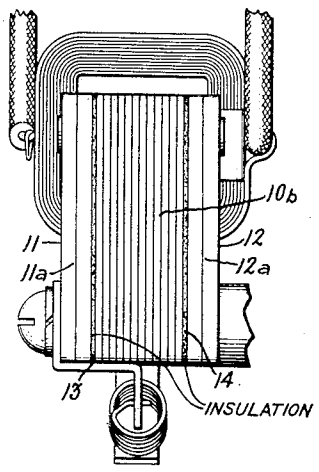


Fig. 3.

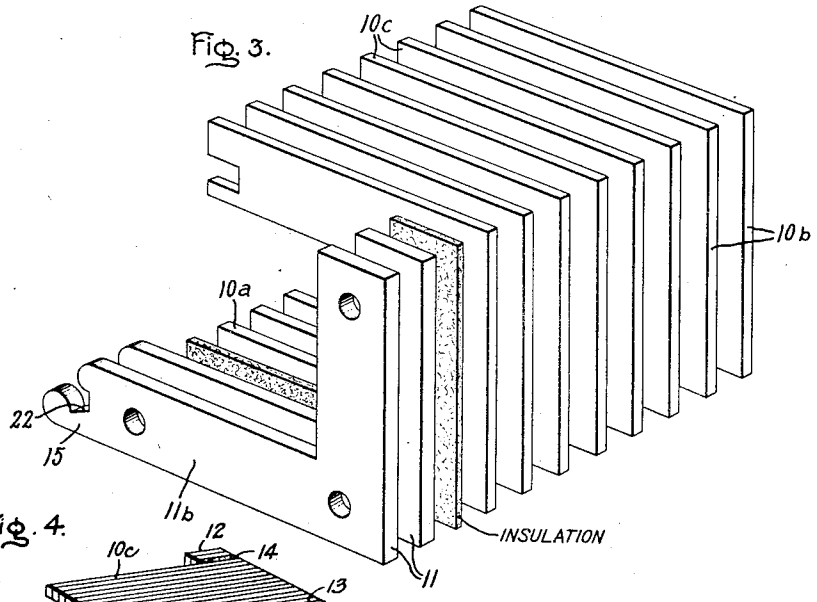
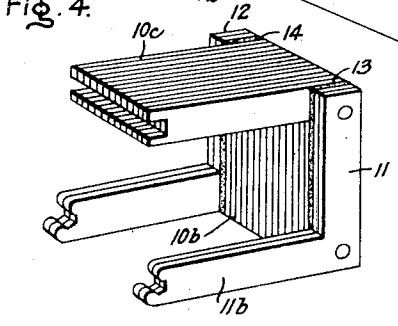


Fig. 4.



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John Eaton,
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Patented Oct. 14, 1941

2,259,127

UNITED STATES PATENT OFFICE

2,259,127

ELECTROMAGNET

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Application August 28, 1939, Serial No. 292,205

2 Claims. (Cl. 175—336)

My invention relates to electromagnets and has for its object a simple, rugged and inexpensive magnet core structure.

To assure the release of the armature member and avoid the possibility of its being held in place by residual magnetism when the coil is deenergized, electromagnets are conventionally provided with an air gap in the core structure or between the armature and the core. My invention relates particularly to a core structure which is provided with an air gap. In carrying out my invention in one form, I provide magnet core members having portions secured together in side by side relation with an air gap between them.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a side elevation view of an electromagnetic relay embodying my invention; Fig. 2 is an end elevation view of Fig. 1; Fig. 3 is an enlarged fragmentary exploded view of the magnet core structure; while Fig. 4 is a perspective view of a modified form of my invention.

Referring to the drawing in one form of my invention I provide three core members or groups of laminations 10, 11 and 12 secured together in overlapping side by side relation, the group 10 being arranged between the other two groups and separated therefrom by relatively thick layers or sheets of a suitable electrically insulating material 13 and 14, such as mica or a fiber, on each side of the group 10 and forming an air gap between this group and each of the two other groups. The central group 10 is formed from a plurality of laminations made of magnet core iron of U-shape. The laminations of the other outer groups 11 and 12 are L-shaped and clamped against the lower leg 10*a* and the middle portion 10*b* of the central group 10. Preferably as shown, the upright legs or arms 11*a* and 12*a* of the two outer groups are of the same length as the middle portion or arm 10*b* of the group 10 to which the legs 11*a* and 12*a* are secured. The other lower legs of the groups 11 and 12 are longer than the leg 10*a* of the group 10 secured between them. As shown in Fig. 3, the horizontal leg 11*b* of the group 11 has a projection 15 extending toward the left-hand beyond the end of the leg 10*a*, i. e. the inner end of the central core member. Likewise, the horizontal leg (not shown) of the group 12 projects beyond the central leg 10*a* in the same manner as the leg 11*b*. It will be understood that the laminations in group 10 are identical in size with each other as are also the laminations in the other two groups.

The projecting end 15 forms a continuation of the magnet core beyond the end of the central group the same being true of the projecting end (not shown) of the group 12. As shown in Figs. 1 and 2, the exciting coil 16 for the magnet is mounted on the upper horizontal leg 10*c* of the central group and induces a magnetic flux, when it is energized, in the central group. It will be noted that the ends 15 form one pole of the magnet and the end of the leg 10*c*, i. e. the projecting end of the central core member forms another pole of the magnet. This flux, however, because of the short lower leg 10*a* of this group and the air gap between the end of this leg and the armature 18 must jump across the air gaps formed by the layers of insulation 13 and 14 to the two outside groups, then pass to the outer ends 15 to which the armature 18 is secured and thence to the armature.

By means of this construction, it will be observed that an air gap of relatively large area in a direction at right angles to the flow of flux is provided by each of the layers of insulation. This provides for efficiency in the flux conducting characteristics of the core. Moreover, this arrangement provides for rigidity of assembly by means of the rivets 19, 20 and 21 passing through the groups.

Preferably as shown the projecting ends 15 are each provided with a suitable notch 22 forming a pivot bearing in which a lateral projection 23 on each side of the armature 18 is pivoted. As shown, the armature 18 carries an electric contact 24 arranged to engage, when the armature is picked up, with a stationary contact 25. A stop 26 limits the movement of the armature in its unattracted position, shown in the drawing, the armature being biased to this position by a suitable tension spring 27. A suitable shading coil 28 is provided on the upper end portion of the central group.

It will be understood, of course, that the core in certain instances may not be laminated and, as shown, relatively thin laminations are provided in the central group only, the two outer groups being each formed of two relatively thick laminations while the armature 18 is not laminated. Also, the combined cross sectional area of the magnetic flux conducting material in the two outer groups of laminations 11 and 12 equals a major portion of the cross sectional area of magnetic flux conducting material in the central group of laminations 10. It will also be un-

derstood that these parts are all made of magnet core iron. For example, each group may be made of a single unlaminated piece.

Thus the three groups of laminations are joined together by their first overlapping arms while their second arms extend from the overlapping arms in parallel relation with each other to form with the overlapping arms a U-shaped magnet core, one leg of which is the central leg 10c and the other leg is constituted by the two horizontal legs of the two outer groups 11 and 12.

Also it will be noted that if the lower leg 10a of the central section were omitted, the magnet core would be magnetically complete by reason of the side by side engagement of the leg remaining formed by the present central section 10b and the two outer groups. A construction of that type is shown in Fig. 4. This construction may be satisfactory in certain applications.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto, since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

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

1. An electromagnet comprising three L-shaped core members of magnetic flux conducting material having first arms secured together in side by side overlapping relation with each other, and with the second arm of the middle core member and the second arms of the two outer core members extending from opposite ends of said overlapping arms thereby to form two substantially parallel legs of a U-shaped magnet core, one leg being constituted by the second arm of said middle core member and the other leg being constituted by the second arms of said outer core members, the combined cross sectional areas of magnetic flux conducting material in said two outer core members being equal to at least a major portion of the cross sectional area of magnetic flux conducting material in said middle core member, and said two legs forming each a sole magnetic flux conducting path through said magnet core at its free end and throughout a substantial portion of its length, relatively thick sheets of electrically insulating material structurally separate from said core members between said overlapping first arms thereby to form an air gap between said middle core member and each of said outer core members, an exciting coil mounted on said magnet core, an armature mounted for movement to an attracted position adjacent the ends of said legs upon energization of said coil, and means biasing said armature to an unattracted position, said air gaps being of sufficient length to prevent holding of said armature in its attracted position by residual magnetism in said magnet core.

2. An electromagnet comprising three L-shaped core members of magnetic flux conducting material having first arms secured together in side by side overlapping relation with each other, and with the second arm of the middle core member and the second arms of the two outer core members extending from opposite ends of said overlapping arms thereby to form two substantially parallel legs of a U-shaped magnet core, one leg being constituted by the second arm of said middle core member and the other leg being constituted by the second arms of said outer core members, the combined cross sectional areas of magnetic flux conducting material in said two outer core members being equal to at least a major portion of the cross sectional area of magnetic flux conducting material in said middle core member, and said two parallel legs forming each a sole magnetic flux conducting path through said magnet core at its free end and throughout substantially its entire length, relatively thick sheets of electrically insulating material structurally separate from said core members between said overlapping first arms thereby to form an air gap between said middle core member and each of said outer core members, an exciting coil on said magnet core, an armature pivotally mounted on the end of one of said legs for movement toward the end of said other leg to an attracted position upon energization of said coil, and means for biasing said armature to an unattracted position, said air gaps being of sufficient length to prevent holding of said armature in its attracted position by residual magnetism in said magnet core.

JOHN EATON.