Jan. 17, 1933. A. B. STARR 1,894,429

ELECTROMAGNET

Filed Feb. 12, 1930

FIG. 1

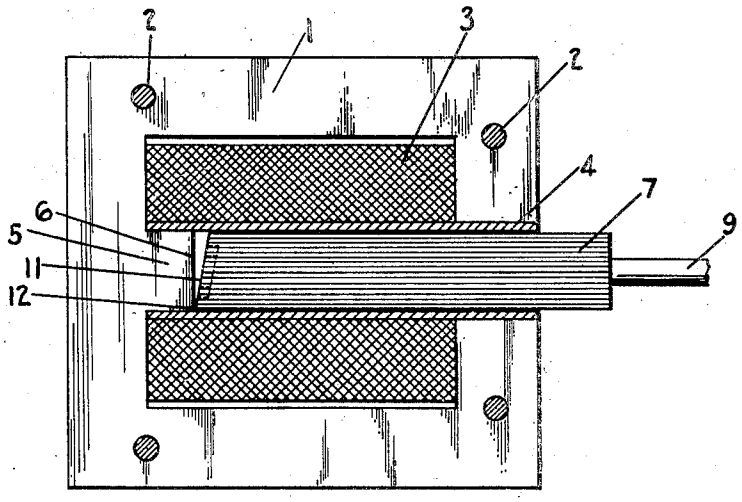
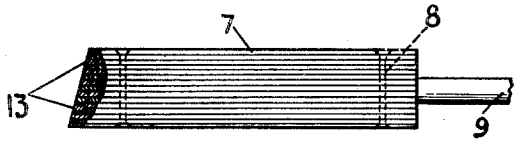


FIG. 2



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ELECTROMAGNET

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My invention relates to electromagnets, and particularly to magnets of the solenoid type.

My invention has for an object the production of an electromagnet adapted to have a strong pull over a substantial distance and which is adapted to be operated from either direct or alternating current; when operated upon alternating current, the operation is substantially silent.

Another object of my invention is the production of an electromagnet adapted to have a high pulling power, without the necessity for a great weight of metal.

A further object of my invention is the provision of a new arrangement of shading or damping coil in a high power electromagnet structure.

A still further object of my invention is the provision of new and useful means for reducing the noise and vibration usually incident to the operation of electromagnets, particularly when the electromagnets are operated intermittently with more or less regularity.

My invention thus produces an electromagnet or solenoid structure capable of silent operation under adverse conditions and adapted to the production of a maximum amount of pull with a minimum of metal and current supply.

Other objects and the structural details of my invention will be apparent from the following description when read in connection with the accompanying drawing, wherein—

Figure 1 is a side view of an embodiment of my invention, partly in section, and

Fig. 2 is a view of the core or plunger of the electromagnet structure of my invention.

Referring to the drawing, I provide a member 1 of magnetic material and which is desirably formed of a stack of laminations, of suitable thickness, of magnet steel, the laminations being clamped together as by means of bolts 2, shown in Fig. 1. A coil of wire 3, comprising the winding of the electromagnet is also provided. The coil is wound upon a tube member 4, which may be of suitable non-conductive material such as fibre, paper, bakelite and so forth, and which is desirably of such a length as to extend beyond one end of the coil 3 a distance equal to the width of the laminations 1. The extended portion fits into an appropriate aperture formed in the stack of laminations 1, as indicated in Fig. 1.

The laminations 1 are desirably provided with a central extension 5, which is of such a size as to enter one end of the tube 4 within the coil of wire 3. The length and other dimensions of the stampings are such that the ends of the stack of projections 5 terminate in a substantially plane or flat surface 6 at right angles to the center line of the tube 3. The surface 6 may be ground off if desired.

I further provide a core or plunger member 7, which is also desirably formed of stacks of laminations of suitable magnet or transformer steel and formed into a firm structure by suitable means, such as rivets 8, shown in Fig. 2. A rod 9 may be attached to the end of the core 7, by any convenient means, such as riveting, or by drilling and threading the stack of laminations in a manner well known in the art. Rod 9 is connected to whatever is to be actuated by the operation of the electromagnet.

The plunger 7 is housed in the tube 4 and is free to move back and forth therein in accordance with the energization of the winding 3. The end 11 of the plunger 7, which enters the tube 4, is desirably finished to a smooth plane surface and ground off so that it is at an angle to the center line of the core, and so that as the plunger approaches the end of the projection 5, contact is made therewith substantially only in a thin line, as indicated at 12. The line of contact is desirably positioned near one side of the tube 4, as shown. By this arrangement a high unit pressure of contact between the plunger and tube is obtained, because the tendency of the pull upon the plunger 7 is to seat the whole surface 11 upon the surface 6, which is prevented by the engagement of the plunger 7 with the tube 4. The result of this arrangement is the substantial elimination of all noise of operation and all hum, alternating cycle or otherwise, when the electromagnet is operating.

In order to reduce still further any tendency toward hum, a shading coil 13, shown in Fig. 2, may be used. This may consist of a copper ring which I have found is desirably mounted within the metal of the plunger 7 as indicated in the figure. The ring may surround a portion of the core or plunger 7 at the center thereof, as shown, or may surround a portion of one side of the core, according to the user's choice.

In operation of the above described electromagnet the terminals of the coil 3 (not shown) are connected to the source of alternating current through an appropriate means of making and breaking the circuit to the coil in accordance with the demand of the operation to which the electromagnet is being applied. When the coil is energized, the plunger 7 will be drawn into the tube 4 and caused to abut against the stop 5. The contacts between the plunger 7 and the stop 5 will be along a line indicated at 12 and the binding of the sides of the plunger 7 on the sides of the tube 4 will keep the surfaces 6 and 11 of the stop and plunger respectively from engaging over the entire area of the surfaces. This arrangement will prevent hum and other noises usually incident to the operation of an electromagnet. Of course, a spring (not shown) connected to the mechanism actuated from the connection 9 of the plunger 7 will withdraw the plunger from the tube 4 when the electromagnet is deenergized. The result is that I have produced an electromagnet capable of operation either from alternating or direct current power sources, that is substantially silent in operation and yet has a construction that is inexpensive and extremely rugged.

Of course, electromagnets of varying pulling strengths may be had by varying the sizes of the coils 3, for the particular load upon the electromagnet. The showing of the angle of surface 11 is somewhat exaggerated for facility in illustrating this portion of the construction.

While I have shown but a single embodiment of the device of my invention, it is capable of various modifications without departure from the spirit of my invention, and it is desired therefore that only such limitation shall be imposed upon the appended claims as is stated therein or required by the prior art.

I claim:

1. A solenoid construction comprising a frame member having a flat surface portion, and a core member having an end surface inclined from one side thereof to the other side and cooperating with said flat surface.

2. A solenoid construction comprising a frame member, a stop having a substantially flat surface, and a core member having an end surface inclined from side to side and cooperating with said flat surface so that contact between the two is at one side only of said core member.

3. A solenoid construction comprising a frame having an aperture therein and a projecting stop therein, a tube positioned about said stop, a plunger slidable in said tube and having an inclined end surface terminating at one edge and engaging with said stop, and a winding for moving said plunger.

4. A solenoid construction comprising a frame member having a bore and a stop surface ad a core member in said bore having an end surface cooperating with said stop surface, said surfaces being inclined relative to each other and thereby resulting in a straight line contact between the two off center of said surfaces whereby said core member, when engaged with said stop surface by magnetic pull, will be urged to assume an inclined position relative to said bore of said frame member.

5. A solenoid construction comprising a frame member, a winding positioned thereon, a movable armature, a tubular sheath in which said armature is guided and means constraining the armature to assume a longitudinally inclined position relative to said tubular sheath at one end of the movement of the armature to prevent chattering thereof.

6. A solenoid construction comprising a frame member, a winding positioned thereon, a movable armature, a tubular sheath in which said armature is guided and means constraining the armature to assume a longitudinally inclined position relative to said tubular sheath near one end of the movement of the armature to prevent chattering thereof, said means being operable in conjunction with the magnetic pull of said winding on said armature.

7. A solenoid construction comprising a frame member having a surface portion and a core member having an end surface, said surface portion and said end surface being inclined relative to each other whereby contact of said surfaces is at one side only of said core member to thereby incline said core member upon contact caused by energization of said solenoid occurring.

In testimony whereof I affix my signature.

ALDEN B. STARR.