June 13, 1939. W. VAN GUILDER 2,162,465

ELECTRIC MAGNET

Filed Sept. 5, 1936

Fig. 1.

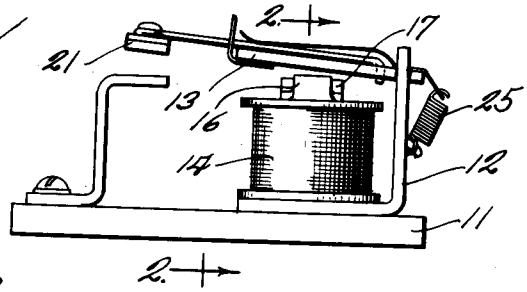


Fig. 2.

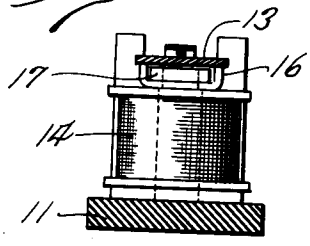
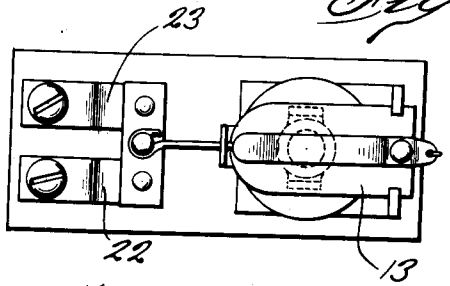


Fig. 3.



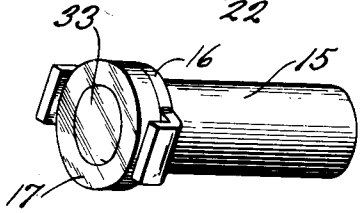


Fig. 4.



Fig. 5.

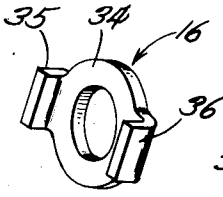


Fig. 6.

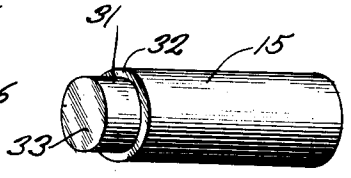


Fig. 7.

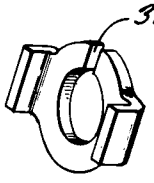


Fig. 8.

Inventor:
Walter Van Guilder
By Karl A. Sommermeyer
Atty

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ELECTRIC MAGNET

Walter Van Guilder, Oak Park, Ill., assignor to G-M Laboratories, Inc., Chicago, Ill., a corporation of Illinois

Application September 5, 1936, Serial No. 99,673

5 Claims. (Cl. 175—338)

The present invention relates generally to electric magnets and more particularly to shading coils for alternating current magnets.

Shading coils commonly are used on alternating current magnets to provide a phase shift of a portion of the magnetic flux so as to provide either (1) a moving magnetic field for the purpose of driving a motor or (2) a continuous pull for attracting and holding an armature or core. While the magnet of the present invention is suitable for use in motors which rotate continuously in one direction, it is primarily intended for use in magnets of the type which attract armatures or cores and move them through limited distances. In order to provide a shading coil on a magnet, it is necessary to divide the magnetic path and to surround one part of the magnetic path with a conducting loop. It has been the practice heretofore to mill slots in the faces of magnets and imbed copper loops therein. This process has been expensive and the straight sided loops which it has been necessary to employ therewith also have been comparatively expensive.

In according with my present invention, I provide a construction for a shading coil which avoids the necessity of milling slots in the magnet faces and which permits the use of round shading coils, which may be cheaply turned on a lathe or which may be punched cheaply from flat stock by the use of standard washer dies. Instead of making expensive mill cuts in the faces of the iron pole pieces, I provide an extra iron piece which shunts a part of the magnetic flux around the shading coil. Preferably, this extra piece is in the form of a yoke which fits onto the iron core of the magnet along with the conducting loop which constitutes the shading coil.

In order better to acquaint those skilled in the art with the teachings and practice of my present invention, I now shall describe a specific embodiment thereof, reference being had to the accompanying drawing which form a part of this specification and in which:

Fig. 1 is an elevation of a relay which includes an alternating current magnet embodying my present invention:

Fig. 2 is a sectional view taken along the line 2—2 of the Fig. 1;

Fig. 3 is a plan view of the relay of Fig. 1;

Fig. 4 is an enlarged view in perspective of the assembled core and shading coil of the relay of Fig. 1;

Figs. 5, 6 and 7 are views in perspective of the separate parts of the assembly illustrated in Fig. 4; and,

Fig. 8 illustrates an alternative construction of the yoke shown in Fig. 6.

The relay of Fig. 1 comprises a base member 11 on which is mounted a magnet comprising a frame 12, an armature 13, and a coil 14. Coil 14 contains a core which carries thereon a yoke 16 and a shading coil 17. The core, yoke, and shading coil are illustrated in Figs. 4, 5, 6 and 7. The armature 13 (Fig. 1) carries a bridge contact 21 which is adapted to engage a pair of stationary contact pieces 22 and 23 when the armature 13 is attracted to the core 15 of the magnet. Any known construction may be employed for mounting the bridge contact 21 on the armature 13. The armature 13 is provided with a spring 25 for holding the armature normally in a position slightly removed from the face of the core 15.

The core 15 of the magnet consists of a bar of iron or magnetic material. One end thereof is turned in a lathe to provide a turned portion 31 with a shoulder 32 between the turned portion 31 and the rest of the core 15.

The yoke 16 also is constructed of iron or magnetic material and comprises a collar portion 34 and ears 35 and 36 extending out of the plane of the collar portion 34 at opposite sides thereof. The hole of the collar is adapted to fit the turned portion 31 of the core 15. The yoke 16 is fitted over the turned portion 31 and lies against the shoulder 32. Preferably the yoke 16 is punched and formed in a punch press.

The conducting loop 17 may consist of a copper washer or perforated slug, the hole of which fits the turned portion 31 of the core 15. The conducting ring 17 is fitted over the turned portion 31 and lies between the ears 35 and 36 of the yoke 16. The ends or faces of the ears 35 and 36 lie approximately in the plane of the end face 33 of the core 15. Preferably, the ears 35 and 36 extend slightly beyond the end face 33 of the core 15, and also beyond the face of the conducting ring 17 so that the armature 13 engages the faces of the ears 35 and 36 and avoids touching the end of the core 15, as shown in the sectional view of Fig. 2.

Also, the core is oriented in the magnet with respect to the axis of rotation of the armature 13 so that a line passing approximately through the centers of the faces of the ears 35 and 36 lies approximately parallel to the axis about which the armature 13 turns. This is shown in Figs. 1, 2 and 3. The force exerted on the armature 13 by the magnet consists of a periodic at-

traction at the core 15 and another periodic attraction at the ears 35 and 36. During the greater part of the time the armature experiences a pull at all three places, but the pull exerted at each place reduces to zero twice during each cycle of the alternating current in the coil 14.

The two pull components at the faces of the ears 35 and 36 of the yoke 16 increase and decrease together. That is, they are in phase. Their resultant is fixed in position and is located approximately midway between the ears 35 and 36, or at the face 33 of the core 15. Consequently, the arrangement of the coil 17 and yoke 16 shown and described herein causes the resultant of the pulls at the two ears 35 and 36 to have substantially the same location as the pull exerted at the face 33 of the core 15 itself. This reduces the tendency of the relay to buzz or chatter because it reduces the tendency of the relay armature 13 to move or rock under the action of the periodically changing forces exerted on the armature. Since the total force exerted on the armature by the magnet acts in substantially the same place at all times, the armature will show little or no tendency to roll or rock under the action of the magnet, such as it would exhibit if the separate out-of-phase attractive forces should act in different locations.

If desired, the yoke 16 may be provided with a slot 38 as shown in Fig. 8. This will prevent current from flowing around the collar portion thereof as a result of the alternating voltage induced therein by the flux in the core 15. Such of the current in the collar as flows outside of the path taken by the flux which traverses the ears 35 and 36, constitutes a power loss. Only that electric current which flows between the two divided branches of the magnetic circuit, namely, between (1) the flux through the reduced portion 31 of the core, (which constitutes one branch) and (2) that through the ears 35 and 36 (which constitutes the other branch), is effective to produce the difference in phase between the flux in the two branches.

While I have shown and described a specific embodiment of my present invention, it will be apparent to those skilled in the art that the same is by way of illustration only. Therefore, I do not wish to be limited except by the scope of the appended claims.

I claim:

1. In combination in an electromagnet, a core consisting of a bar of magnetic material, a magnetic yoke and a conducting ring, said yoke having a planar portion with an opening therein for fitting onto said core, said magnetic yoke having also an ear of magnetic material extending out of the plane of said planar portion, the opening in said conducting ring being of such size as to admit the end of said core, said ring and yoke being positioned on said core with said ring at the end of said core and said yoke next to said ring on the side thereof away from said end of said core, said ear extending outside of and around said ring towards said end of said core.

2. In combination in an electromagnet, an elongated magnetic core having a reduced end portion and a shoulder at the boundary between said reduced end portion and the rest of said core, a magnetic yoke on said reduced end portion and abutting said shoulder, said yoke comprising a planar portion engaging said reduced end portion and comprising also an ear extending out of the plane of said planar portion towards the end of said core, said ear occupying a position alongside said reduced end portion and spaced therefrom, and a conducting ring surrounding said reduced end portion and passing between said ear and said reduced end portion.

3. In combination in an electromagnet, an elongated magnetic core having a reduced end portion of circular cross section and having a shoulder at the boundary between said reduced end portion and the rest of said core, a magnetic yoke on said reduced end portion and abutting said shoulder, said yoke comprising a planar portion having a circular opening for engaging said reduced end portion and comprising also an ear extending out of the plane of said planar portion towards the end of said core, said ear occupying a position alongside said reduced end portion and spaced therefrom, and a circular conducting ring surrounding said reduced end portion and passing between said ear and said reduced end portion, said ring and yoke substantially covering said reduced end portion and the end of said ring and the end of said ear being approximately flush with the end of said core.

4. In combination in a shaded pole electromagnet, a continuous elongated magnetic core, a ring of conducting material surrounding said core at one end thereof, and a unitary magnetic yoke separate from said core engaging said core next to said ring at the side thereof away from said one end of said core, and having two ears passing outside of said ring on opposite sides of said core and extending slightly beyond said ring and the end of said core, said core having a shoulder for preventing said yoke from moving in a direction away from said ring.

5. In combination in a shaded pole electromagnet for operation with alternating current, a core consisting of a bar of magnetic material, a magnetic yoke, and a conducting ring, each of said elements constituting a separate piece, said conducting ring being fitted onto one end of said core to encircle said core, said magnetic yoke having a body portion fitted over said core, said yoke engaging the core next to said ring to that side thereof away from the end face of said core and engaging said core along only a small part of the length of said core, said magnetic yoke having also a portion thereof extending outside of and around said ring so that said conducting ring lies between said portion of said yoke and said end of said core, all of the magnetic material for shunting magnetic flux around said conducting ring being included in said yoke.

WALTER VAN GUILDER.