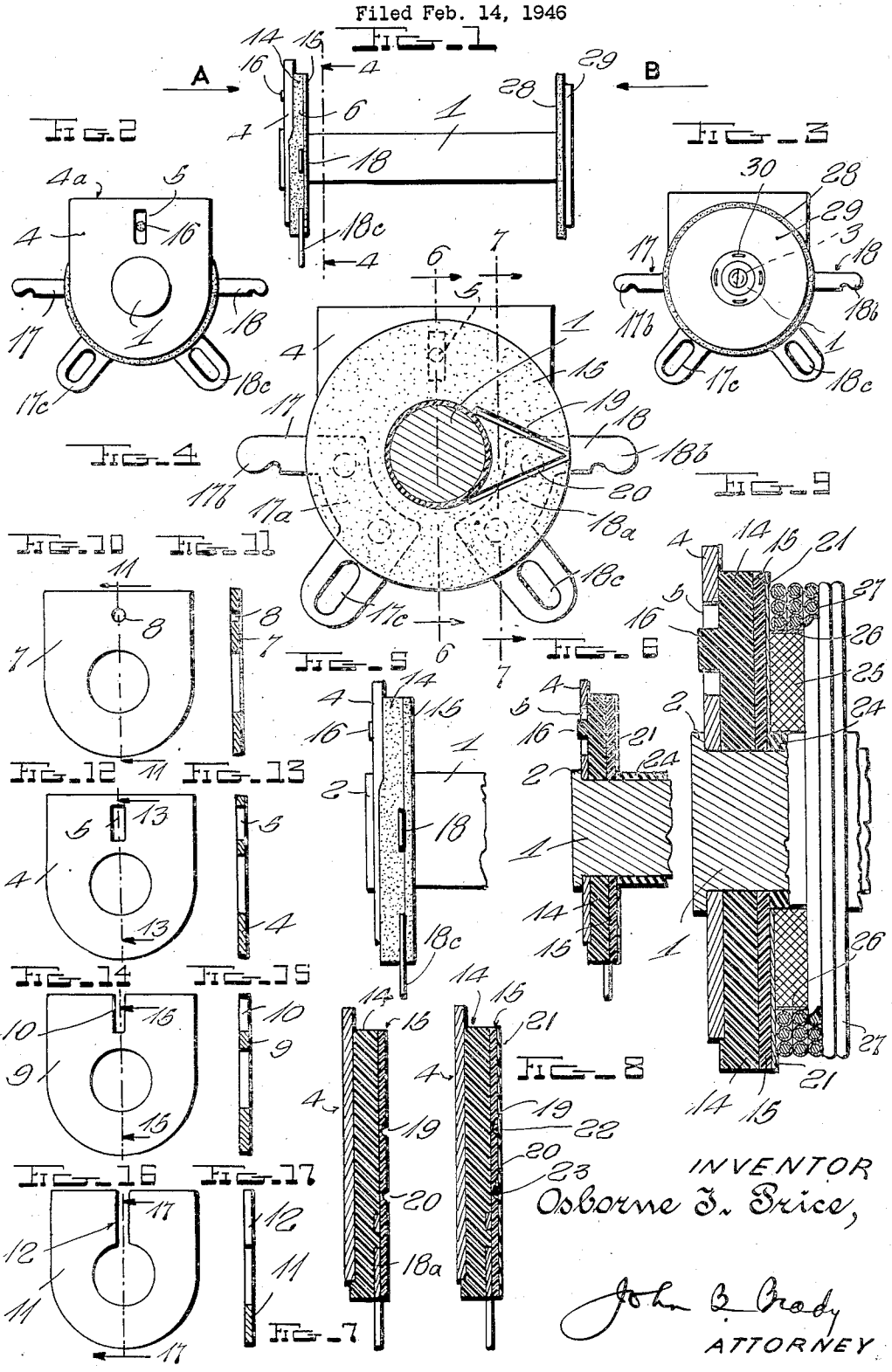
Nov. 16, 1948. O. I. PRICE 2,453,725

COIL-SUPPORTING STRUCTURE

Filed Feb. 14, 1946




INVENTOR
Osborne I. Price,

John B. Brady
ATTORNEY

Patented Nov. 16, 1948 2,453,725

# UNITED STATES PATENT OFFICE

2,453,725

## COIL-SUPPORTING STRUCTURE

Osborne I. Price, Frederick, Md., assignor to Magnetic Devices, Inc., Frederick, Md., a corporation of Maryland.

Application February 14, 1946, Serial No. 647,464

12 Claims. (Cl. 175—21)

1

My invention relates broadly to electromagnetic devices and more particularly to a coil supporting structure for electromagnetic devices.

One of the objects of my invention is to provide an improved arrangement of coil supporting structure for facilitating mass production of electromagnetic devices at minimum cost.

Another object of my invention is to provide a construction of insulated spool head for electromagnetic devices having terminal members for the coil winding molded directly into the insulation material of the spool head.

Still another object of my invention is to provide a construction of spool support for electromagnetic windings embodying both an insulation head and an adjacent metallic reinforcing head in which the metallic reinforcing head may be formed to electrically control a path for eddy currents immediately adjacent the field of the electromagnetic winding carried by the spool support.

A further object of my invention is to provide means for keying a spool head of insulation material with a reinforcing head of metallic material wherein the head of insulation material serves to support terminal lugs in a position for establishing electric connection with an electromagnetic winding carried by the associated spool.

Still another object of my invention is to provide a construction of insulated head for electromagnetic bobbins having means molded into the head for starting the winding on the bobbin in either a clockwise or counterclockwise direction.

Other and further objects of my invention reside in the improved construction of metallic reinforced insulation head and terminal lug support and electromagnetic bobbins as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a side elevational view illustrating the assembly of the bobbin support including the spool heads of my invention; Fig. 2 is an end view of the bobbin shown in Figure 1 looking in the direction of arrow A; Fig. 3 is an end view of the electromagnetic bobbin looking in the direction of arrow B of Figure 1; Fig. 4 is an enlarged transverse sectional view taken on line 4—4 of Fig. 1; Fig. 5 is a fragmentary side elevational view on an enlarged scale showing the composite spool head of insulation and metallic material with the terminal lugs for the electromagnetic winding extending therefrom; Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 4; Fig. 7 is a transverse sectional view taken

2

on line 7—7 of Fig. 4; Fig. 8 is a view similar to the view shown in Fig. 7 after the coil winding is in place and showing the layer of insulation material provided for substantially sealing the conductor constituting the electromagnetic winding in position; Fig. 9 is a fragmentary sectional view of a portion of the completed electromagnetic winding illustrated adjacent the spool head construction of my invention; Fig. 10 is an elevational view of a metallic insert for the spool head constituting a completely closed eddy current ring in the field of electromagnetic winding; Fig. 11 is a vertical sectional view taken on line 11—11 of Fig. 10; Fig. 12 is an elevational view of the metallic insert for the insulated spool head slotted to reduce the conductive path of the metallic spool head for eddy current; Fig. 13 is a vertical sectional view on line 13—13 of Fig. 12; Fig. 14 is an elevational view of another modified form of metallic spool head having an end slot therein for controlling an eddy current path adjacent the magnetic winding; Fig. 15 is a vertical sectional view on line 15—15 of Fig. 14; Fig. 16 is an elevational view of a further modified form of metallic spool head slotted for interrupting the eddy current path adjacent the electromagnetic winding and Fig. 17 is a vertical sectional view taken on line 17—17 of Fig. 16.

Referring to the drawings in detail, the magnetic core for the electromagnetic device of my invention is represented by reference character 1, having annular flanged head 2 thereon at one end and having a screw threaded recess 3 in the opposite end thereof for the entry of a screw member serving to support the core. Immediately adjacent the abutment provided by the annular flange 2 on magnetic core 1, I position the metallic head 4. The metallic head 4 is constructed in a variety of forms to regulate the amplitude of the eddy currents which may be set up in the metallic head. The metallic head is formed from nonmagnetic material, generally of brass which may be nickel plated. As shown in Fig. 2 the metallic head 4 is slotted at 5 which restricts the eddy current path and tends to slow down the operation of the electromagnetic device by controlling the counteraction of the magnetic field developed from the eddy current with respect to the magnetic field of the magnetic winding carried by the bobbin of the electromagnetic device. The slot 5 also serves as a centering and keying means between the metallic head 4 and the insulation head 6. For electromagnetic devices having a magnetic core of approximately .25" diameter and a metallic spool head extending approxi-

mately ⅜'' from the center of the magnetic core to the terminating edge 4a, the slot 5 is approximately ⅛'' in length and .064'' in width centered between the periphery of the core 1 and the edge 4a of the metallic head 4.

The structure of the metallic head 4 is one of the determining factors respecting the time or operation of the electromagnetic devices. For example, in the form illustrated in Figs. 10–11 the metallic head 7 provides the slowest time constant of operation of all of the head structures, as the head 7 forms a substantially closed toroidal path for eddy currents. There is a small perforation 8 in the metallic head for purposes of keying the metallic head 7 to the insulation head 6 as heretofore explained. Figs. 12 and 13 are illustrative of the metallic head 4 heretofore discussed in Fig. 2 in which a time factor of operation, which is not as slow as the factor obtained with the structure of Figs. 10–11, is secured. In Figs. 14–15 a metallic head 9 is illustrated having a radial slot 10 at one side thereof which serves to increase the speed factor of operation of the associated electromagnetic device by reducing the eddy current path. Figs. 16–17 illustrate the metallic end member 11 which is wholly slotted at 12 to provide the fastest operation for the associated electromagnetic devices of all of the structures illustrated, in that the eddy current path is wholly interrupted.

The insulation head 6, referred to in Fig. 1, is illustrated more clearly in Figs. 4–9 and comprises two sheets of insulation material represented at 14 and 15, arranged face to face and immediately adjacent the metallic head 4. The insulation head 14 is provided with a projecting lug 16 which extends through the perforation 8, slot 5, slot 10 or the slot 12 in any one of the forms of the metallic heads 7, 4, 9 or 11, respectively, for keying the insulation head with respect to the metallic head. The insulation head 14 serves as a support for the terminal members 17 and 18, which are molded into the material of the insulation head 14. The terminal members 17 and 18 each include segmental portions 17a and 18a which are perforated for the passage of the moldable material of the head 14 for keying the terminal members in position. The terminal members include solder lugs 17b and 18b for effecting connection with the electromagnetic winding carried by the bobbin and terminal lugs 17c and 18c for establishing electrical connection between the external circuit and the winding carried by the bobbin. The insulation head 15, which is assembled in abutment with the insulation head 14, is provided with grooves 19 and 20 which are molded therein in directions which permit the electromagnetic winding to be started either in a clockwise or a counterclockwise direction.

In Fig. 6 I have illustrated in section the manner in which the projecting lug 16 extends through the slot 5 in the metallic head 4 from the head of insulation material 14. The insulation head 15 is illustrated in immediate abutment with the head of insulation material 14. The insulation head 15, as heretofore described, contains the wire ways or grooves 19 and 20. A sheet of insulation material 21 extends over the insulated head 15 and maintains the electrical conductors which are designated at 22 and 23 in position. A tubular member of insulation material 24 extends over the magnetic core 1 and through the insulation sheet 21 to a position in abutment with the insulation head 15.



The bobbin thus prepared is wound with the electrical conductor designated generally at 25 in Fig. 9 with the inner wire end thereof brought out through either groove 19 or 20 as designated by either reference character 22 or 23 in Fig. 8, depending upon the direction in which the winding of the bobbin is commenced. The end of the wire leading from the commencement of the winding and extending through either slot 19 or 20, is electrically connected and soldered to the lug 18b. The outside end of the electrical conductor is electrically connected and soldered to the opposite lug 17b. A tape, represented at 26, is wound over the winding. Upon completion of the winding of the bobbin, the electrical conductor is wound with a serving of cellulose acetate thread or other good insulating thread, such as, glass thread represented generally at 27. The serving of thread 27 is wrapped or wound over the layer of tape 26 and winding 25 and the bent lugs 18b and 17b.

A coat of varnish or insulating compound is generally placed on the winding and over the tape 26 before serving with the thread 27. Additional varnish is generally added while the thread 27 is being wound over the coil. The varnish or insulating compound may contain fungicide which will render the coil in its completed form fungus-resistant. Bakelite varnish has been used to good advantage in this construction. After the serving is completed the coil is baked or dried thoroughly.

I have found that it is entirely practicable to produce a coil which will withstand approximately 700 hours or more in 95% humidity with positive current on the winding and negative current on the core, and after approximately 700 hours find the resistance between the core and the winding to be not less than 20,000 megohms.

The opposite end of the coil support is formed in a manner similar to the coil support end heretofore described, and includes the disc-like end of insulation material represented at 28 backed by the metallic end 29. The metallic end 29 is staked upon the end of the core 1, as represented by the stake punchings 30 in Fig. 3, tending to expand the end of the core 1 to grip the metallic disc-like end 29 of the coil support.

The ability of the coil support of my invention to provide for the timing of the electrical operation of the winding due to the controlled eddy current path resulting from variations in the structure of the metallic end shown in Figs. 10–17, is one of the outstanding advantages in the coil structure of my invention. The maintenance of the insulated coil ends in spaced parallel planes, where the tendency for the insulation ends to curl or distort is a minimum, is another of the important advantages in the structure of my invention. The protection of the wire ends, the keying of the insulation end with respect to the metallic end, and the grooving of the insulation end for the passage of the electrical conductor, all contribute to the advantages arising out of the structure of my invention.

While I have described my invention in one of its preferred embodiments, I realize that modifications may be made, and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

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

1. A coil-supporting structure comprising a

magnetic core, an envelope of insulation material extending over said core, a metallic end plate secured to said core, said metallic end plate being perforated adjacent one edge thereof and a head of insulation material interposed between said envelope and said metallic end plate, and a projection of insulation material extending from said head of insulation material disposed from said magnetic core and extending through the perforation in said metallic end plate for keying said head of insulation material with said metallic end plate.

2. A coil-supporting structure comprising a magnetic core having a headed end, a metallic end plate disposed on said magnetic core and confined in abutting relation with said headed end, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core and abutting against said metallic end plate, and a lug of insulation material projecting from said head of insulation material and extending through the perforation in said metallic end plate for keying said insulated head with said metallic end plate.

3. A coil-supporting structure comprising a core having a headed end, a metallic end plate extending over said magnetic core and abutting said headed end, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core, terminal members carried by said head of insulation material, a projection of insulation material on said head of insulation material extending in the direction of the headed end of said core through said metallic end plate, means carried by said magnetic core for insulatingly supporting a winding on said magnetic core, and insulation means disposed between said last-mentioned means and said insulated head.

4. A coil supporting structure comprising a magnetic core having a headed end, a metallic end plate abutting said headed end, said metallic end plate being perforated for controlling the circulation of eddy currents through magnetic fields adjacent said plate, a head of insulation material extending over said magnetic core in abutting relation to said metallic end plate, said head of insulation material having a projection thereon extending in the direction of the headed end of said magnetic core and through the perforated end metallic plate for keying said head with said metallic end plate, terminals carried by said head of insulation material, means on said core for supporting a coil winding thereon, and means interposed between said last-mentioned means and said head of insulation material for insulatingly separating the coil winding from said head of insulation material.

5. A coil-supporting structure comprising a magnetic core having a headed end, a metallic end plate extending over said magnetic core and abutting said headed end, said metallic end plate having a perforation therein for controlling the circulation of eddy currents in said metallic end plate, a head of insulation material extending over said magnetic core in abutting relation with said metallic end plate, said head of insulation material having a transversely extending tongue projecting in the direction of the headed end of said magnetic core through the perforated metallic end plate, terminal lugs imbedded in said head of insulation material, means for mounting coil winding on said magnetic core, and a sheet of insulation material extending between said last-mentioned means and said head of insulation material.



6. A coil-supporting structure comprising a magnetic core having a headed end thereon, a metallic end plate extending over said magnetic core in abutting relation to said metallic end plate, a head of insulation material extending over said magnetic core in abutting relation to said metallic end plate, said metallic end plate being perforated adjacent one edge thereof a projecting lug of insulation material integrally connected with said head of insulation material and projecting in the direction of the headed end of said magnetic core through the perforation in said metallic end plate, a coil winding carried by said magnetic core, and laminations of insulation material interposed between said coil winding and said insulated head, one of the laminations serving as a protector for the wire leads from said coil winding and another of said laminations serving as a separator between said coil winding and said terminal lugs.

7. A coil-supporting structure comprising a magnetic core having a headed end thereon, a metallic and plate extending over said magnetic core in abutting relation to said metallic end plate, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core in abutting relation to said metallic end plate, a projecting lug of insulation material integrally connected with said head of insulation material and extending through the perforation in said metallic end plate, a coil winding carried by said magnetic core, and laminations of insulation material interposed between said coil winding and said head of insulation material, one of said laminations having angularly disposed grooves therein extending substantially tangentially to said magnetic core and terminating at the periphery thereof, and serving as protective channel ways for the passage of leads from the inner portion of the coil winding to one of said terminals and another of said laminations extending over the aforesaid lamination adjacent said coil winding for protecting the coil lead within the said groove.

8. A coil-supporting means comprising a magnetic core having a headed end, a metallic end plate extending over said magnetic core and abutting the headed end of said core, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core and abutting said metallic end plate, a key member of insulation material integrally connected with said head of insulation material and projecting through the perforation in said metallic end plate, a coil winding carried by said magnetic core and having an inner lead extending therefrom, the head of insulation material having a pair of angularly disposed grooves in the face thereof extending substantially tangential to opposite points on said magnetic core for the passage of the inner lead from said coil winding, and terminal lugs carried by said head of insulation material for connection with the inner lead extending from said coil winding.

9. A coil-supporting means comprising a magnetic core having a headed end, a metallic end plate extending over said magnetic core and abutting the headed end of the core, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core and abutting said metal-

lic end plate, a key member of insulation material integrally connected with said head of insulation material and projecting through the perforation in said metallic end plate, and a coil winding carried by said magnetic core and having an inner lead extending therefrom, the head of insulation material having a V-shaped groove recessed into the face thereof adjacent said coil winding with portions of the V-shaped groove extending substantially tangential to opposite points of said magnetic core for the passage of the inner lead from said coil winding in the said V-shaped groove.

10. A coil-supporting means comprising a magnetic core having a headed end, a metallic end plate extending over said magnetic core and abutting the headed end of the core, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core and abutting said metallic end plate, a key member of insulation material integrally connected with said head of insulation material and projecting through the perforation in said metallic end plate, a coil winding carried by said magnetic core and having an inner lead extending therefrom, the head of insulation material having a V-shaped groove recessed into the face thereof adjacent said coil winding with portions of the V-shaped groove extending substantially tangential to opposite points of said magnetic core for the passage of the inner lead from said coil winding in the said V-shaped groove of said coil winding, terminal lugs carried by said head of insulation material, at least one of said terminal lugs being located adjacent said V-shaped groove for receiving and providing a terminal connection for the inner lead from said coil winding, and a sheet of insulation material extending adjacent said coil winding and serving to cover said V-shaped grooves for protecting the inner lead from said coil winding.

11. A coil-supporting means comprising a magnetic core having a headed end, an electromagnetic winding carried by said core, a metallic



end plate extending over said magnetic core and abutting the headed end of said core, said metallic end plate being perforated adjacent one side thereof for controlling the circulatory conductive path for eddy currents therein adjacent said magnetic core in the field of the electro-magnetic winding carried by said core, and a head of insulation material disposed between the electromagnetic winding on said core and said metallic end plate, said head of insulation material having a key member of insulation material projecting normal therefrom and extending through the perforation in the metallic end plate.

12. In a coil-supporting structure a magnetic core having a headed end, a metallic end plate extending over said magnetic core and abutting the headed end of said core, said metallic end plate being perforated adjacent one edge thereof a head of insulation material extending over said magnetic core and abutting said metallic end plate, a key member of insulation material integrally connected with said head of insulation material and projecting through the perforation in said metallic end plate, and a pair of terminal members imbedded in said head of insulation material, each of said members including an arcuate-shaped portion having a connecting lug on one end and a connecting eyelet on the other end, said arcuate-shaped portions being insulatingly spaced from each other through the insulation material of said headed end.

OSBORNE I. PRICE.


REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 332,559 | Robinson | Dec. 15, 1885 |
| 936,669 | Rypinski | Oct. 12, 1909 |
| 1,616,207 | Wardell | Feb. 1, 1927 |
| 1,815,212 | Ogg | July 21, 1931 |
| 2,214,151 | Wagar | Sept. 10, 1940 |