July 16, 1929. E. CHAPMAN 1,720,943

ELECTROMAGNETIC DEVICE

Filed July 2, 1927

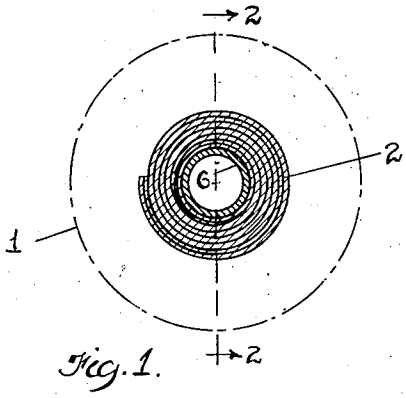


Fig. 1.

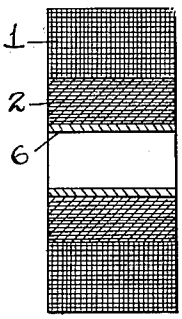


Fig. 2

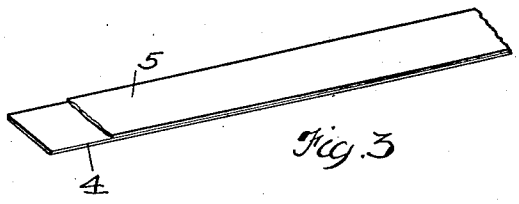


Fig. 3

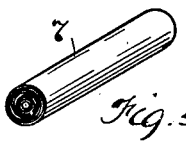


Fig. 4

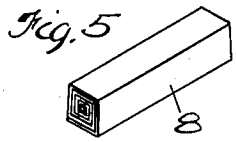


Fig. 5

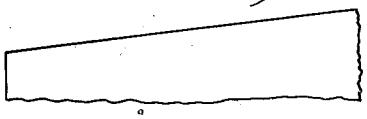


Fig. 14

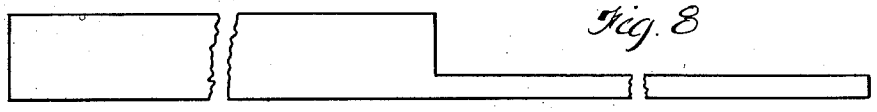


Fig. 8



Fig. 9

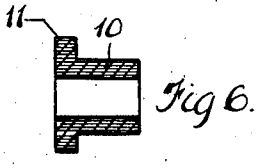


Fig 6.

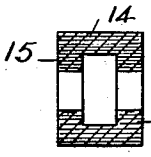


Fig. 11

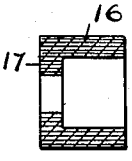


Fig. 12

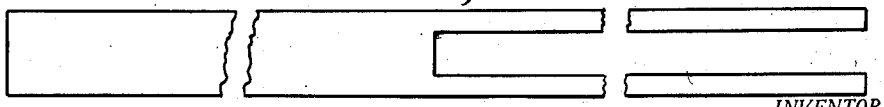


Fig. 10

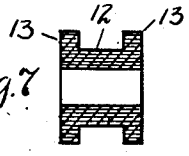


Fig. 7

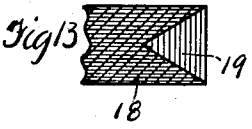


Fig 13

INVENTOR.

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BY

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ATTORNEYS.

Patented July 16, 1929. 1,720,943

UNITED STATES PATENT OFFICE.

EVERETT CHAPMAN, OF CLEVELAND, OHIO, ASSIGNOR TO THE LINCOLN ELECTRIC COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTROMAGNETIC DEVICE.

Application filed July 2, 1927. Serial No. 203,067.

The present improvements have more particular regard to the construction of the core, or supporting tube or bobbin, of a solenoid or equivalent support for an electro-magnetic coil. The principle of the invention is also applicable to the construction of the plunger in such device as well as of the core. Solid cores as well as plungers have heretofore been made of laminations, that is, of superimposed plates suitably secured together, to form an assembled body of desired shape and size. The object of the present invention is to obtain the effect of such a laminated metallic core or plunger without thus actually making the same of separate plates. My improved construction is also adapted for use in place of a tubular core, i. e., to take the place of the split meal tube which is ordinarily employed in this connection. It is well known that such split metal tube is unsatisfactory in that it is difficult to maintain it of a fixed diameter and since the ends of the bobbin are usually attached to such split tubular core, difficulty is encountered in assembling the parts in the completed device.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the means and steps hereinafter fully described and particularly pointed out in the claims, the annexed drawing illustrating but several of the various ways in which the principle of the invention may be carried out.

In said annexed drawing:—

Fig. 1 is a transverse section of a solenoid wherein the winding is mounted on a tubular core of my present improved construction; Fig. 2 is a longitudinal, i. e. axial section, of the same taken on the plane indicated by the line 2—2, Fig. 1; Fig. 3 is a broken perspective view of the sheet or strip of metal with accompanying insulating strip whereof my improved core is made; Fig. 4 is a perspective view of a solid core or plunger made in accordance with my improved method, the part in question being of cylindrical form; Fig. 5 similarly illustrates such part where of general rectangular form, i. e., specifically of square cross-section; Fig. 6 illustrates in axial section a modified form of tubular core having a flange or shoulder at one end; Fig. 7 illustrates still another form of tubular core having a shoulder at each end; Fig. 8 is a broken plan view and Fig. 9 a side elevation of the strips of material from which the core of Fig. 6 is fashioned; Fig. 10 is similarly a plan view of the strips of material from which the core of Fig. 7 is fashioned; Figs. 11 and 12 are axial sections of two forms of outer shells designed for use in so-called iron-clad magnets, such shells being made in a fashion similar to the aforesaid cores; Fig. 13 is an axial section of a core of a solenoid of the so-called long pull type; and Fig. 14 is a plan view of the sheets of material from which such core is made.

Referring to the solenoid device illustrated in Figs. 1 and 2, it will be seen that the coil 1 is built up or wound upon a metallic core 2, which latter constitutes the feature of present interest. Such core is formed of two superimposed strips of material, one such strip 4 (see Fig. 3) being of metal and the other strip 5 being of paper or equivalent flexible insulating material. The core is then built up by winding such superimposed strips of material around a tube 6 of fiber or equivalent insulating material until a tube or shell of desired thickness is provided. The sheet of paper 5 is so disposed as to insulate the successive turns of the metal strip 4 from each other and prevent a closed metallic circuit, and may be extended to permit its being wrapped one or more times around the completed core to assist in insulating the coil winding 1 therefrom. As a result of the foregoing construction, a core is obtained having the electrical characteristics of a split metal tube and at the same time that of a laminated core structure. Not only may such core be readily fabricated from sheet or strip metal in the fashion described, but it also contributes to the ready assembly of the solenoid device as a whole.

Instead of winding the strips 4 and 5 to form a tubular member, as illustrated in the case of the core 2 just described, such strips may be wound together to form either a solid cylindrical body 7, as shown in Fig. 4, or a rectangular body 8, as shown in Fig. 5. Either of the latter is obviously adapted to serve as a solid laminated core or solid laminated plunger in an electro-magnetic device.

Where it is desired to form a tubular core 10 with a shoulder or flange 11 at one end, as illustrated in Fig. 6, this is readily accomplished by making the composite sheets of two different widths, as shown in Figs. 8 and 9. In other words, when sheets such as shown in the last mentioned figures are rolled up about a tube or mandrel beginning at the left-

hand end of such sheets, the narrower portion thereof will obviously be wound up last and thus provide the desired shoulder at one end.

Similarly, by making the sheets of material of the form illustrated in Fig. 10 and then winding them up beginning at the left-hand end, a core 12 having the form of a spool or bobbin, i. e., with a shoulder or flange 13 at each end thereof, is provided.

An outer shell of laminated construction for so-called iron-clad magnets may likewise be readily made in the fashion hereinbefore described for the fabrication of the cores and plungers of solenoids. Thus, a shell 14 having inwardly directed flanges 15 at its respective ends may be formed from strips of material cut as shown in Fig. 10, by simply winding such strips up in the reverse direction from that observed in forming the core illustrated in Fig. 7. In case a shell 16 with an inwardly directed flange 17 at one end thereof only, as illustrated in Fig. 12, is desired, this may be readily fashioned from strips of material cut as shown in Fig. 8, by winding such strips up beginning at the right-hand end thereof instead of the left.

My present improved construction also lends itself readily to the fabrication of the cores for so-called long pull solenoids in which a tapered effect is desired. Such an element 18 may be formed from a sheet cut to the shape illustrated in Fig. 14, by rolling such sheet beginning at the left-hand end thereof. The resulting element, in other words, will then have a recess 19 of conical shape in the one end thereof. By rolling up the sheet from the opposite end, the element formed therefrom instead of being recessed will itself have a conical pointed end.

Other forms may be employed embodying the features of my invention instead of the one here explained, change being made in the form or construction, provided the elements stated by any of the following claims or the equivalent of such stated elements be employed, whether produced by my preferred method or by others embodying steps equivalent to those stated in the following claims.

I therefore particularly point out and distinctly claim as my invention:—

1. As a new article of manufacture, a core or like element for an electro-magnetic device comprising a strip of sheet metal rolled upon itself in closely contacting turns with insulating material interposed between successive turns, said strip having a portion extending further than the midline portion of the strip whereby the element is formed with a shoulder or flange.

2. As a new article of manufacture, a core or like element for an electro-magnetic device comprising a strip of sheet metal rolled upon itself in closely contacting turns with insulating material interposed between successive turns, said strip having spaced plural parallel narrow portions extensive from another portion, whereby the element is formed with corresponding shoulders or flanges.

Signed by me this 30th day of June, 1927.

EVERETT CHAPMAN.