

Feb. 24, 1948.

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2,436,742

LINE CORD TRANSFORMER

Filed Sept. 13, 1945

Fig. 3

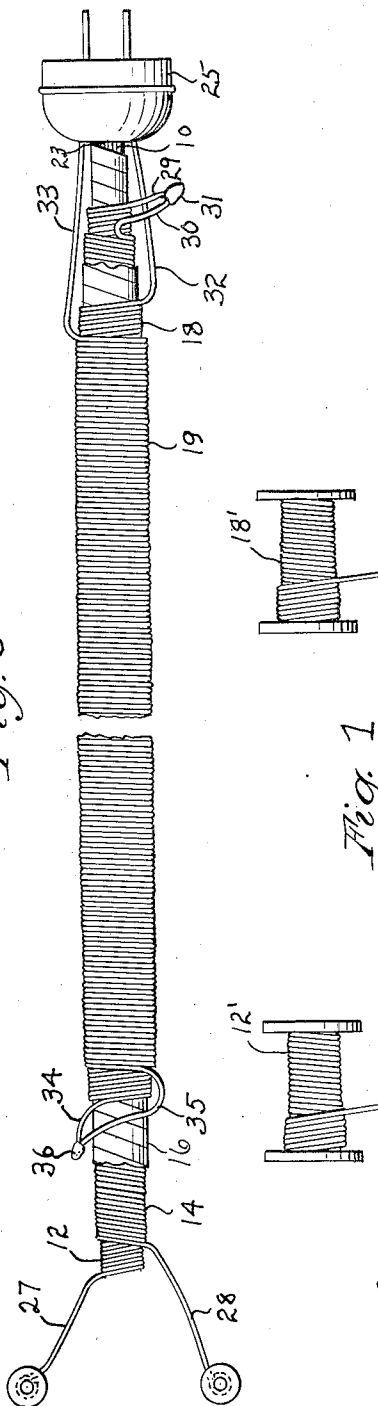


Fig. 1

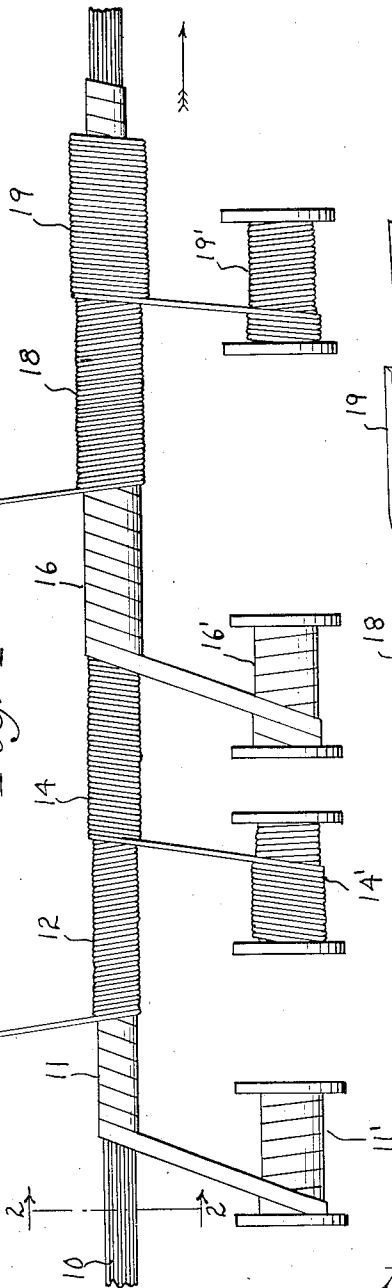
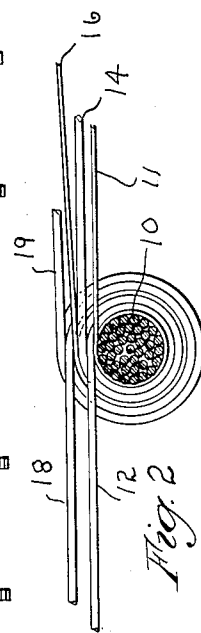


Fig. 2



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UNITED STATES PATENT OFFICE

2,436,742

LINE CORD TRANSFORMER

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Application September 13, 1945, Serial No. 615,989

4 Claims. (Cl. 175—356)

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This invention relates to an electrical apparatus and particularly to a combined transformer and line cord. In certain low power types of apparatus energized from the customary alternating current supply circuit, it is desirable to obtain either electrical isolation from the supply circuit or a voltage change or both. Thus, with fluorescent type of lights on the market, it is desirable to provide a high starting voltage of the order of 180 and reduce this to around 75 for normal operation.

Also, low power electric lamps which may be used in various ways may advantageously be operated from 110 volt lines. Such lamps are made to operate at low voltage of the order of one or more volts and operate from small dry cells. To operate such lamps from a 110 volt supply circuit requires either a transformer or a resistance.

Low voltages are necessary for door bells, buzzers and annunciators. Transformers for these purposes are commonly used and require special connections.

In addition to the above fields of use, small portable radio receivers operating from alternating current supply circuits require different voltages for energizing the cathodes of vacuum tubes and also energizing the plate circuits. As a rule, the transformer in such a device is bulky and constitutes a heavy space consuming item.

In accordance with the invention herein, there is provided a transformer fashioned to constitute a line cord. The transformer line cord may be manufactured in continuous lengths and cut to use. A transformer embodying this invention has highly desirable characteristics. Thus, the transformer has poor voltage regulation so that short circuiting the transformer secondary will not blow ordinary house fuses or damage any wiring. Any desired number of windings may be provided on the transformer and complete electrical isolation from the house supply circuit is assured. By providing connectors at the ends of the transformer line cord, inconvenient bulky transformers within any article such as radio receiver may be eliminated. A transformer in the form of a line cord has the further advantage of having a high ratio of surface to mass so that heat dissipation is efficient.

For a more thorough understanding of the invention, reference will now be made to the drawings wherein Figure 1 shows a view of a transformer line cord in the process of manufacture. Figure 2 is a section on line 2—2. Figure 3 shows a length of transformer line cord with parts broken away but provided with plugs and connected for use.

Referring first to Figures 1 and 2, the magnetic core of the transformer line cord comprises bundle 10 of flexible magnetizable wire. The wire

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may be of any suitable gauge and preferably should be fine enough so that flexibility of the cord is assured. The wire itself should be of suitable material for use in the transformer and preferably is of soft iron having a high degree of flexibility. The individual strands of wire may be insulated from each other to reduce eddy currents in any manner well known in the art. Thus, the wires may have a fine coating of enamel or other flexible film, or reliance may be had upon the oxide coating for insulation. Thus as an example, I have successfully used a bundle of number 26 wire, which bundle had a diameter of one-fourth inch.

Immediately around core 10 is insulation 11 in any form whatsoever, here shown as a spiral of thin flexible material. Thus, a ribbon of paper or any of the various tapes on the market may be provided. Varnish or other film forming insulation may be used.

Around insulation 11, copper wire 12 is wound. Wire 12 may have any desired gauge suitable for the purpose desired and, if heavy current carrying capacity is necessary, wire 12 may be stranded or may be formed of a flat ribbon.

Looking from the left of Figure 1 down along wire core 10, layer 12 of copper wire may be wound around in the direction corresponding to a right-hand screw thread. Above layer 12 is copper wire layer 14 wound with a pitch opposite to layer 12, so that this would be according to a left-hand screw thread. In order to have the two terminals of one transformer winding terminate at the same end of the cord, it is advisable to divide a winding into two or any even number of layers. Thus, layers 12 and 14 may form one winding.

Above winding 14 may be insulating layer 16 of tape, paper, varnish or any other material. Above layer 16 are successive layers 13 and 19 wound with opposing pitch, these two being of any suitable wire and forming the two portions of another winding. Additional windings may be added if desired, and the outside of the cord may be covered with a layer of any material such as rubber or tubular knitted cotton or any other material used as the outer covering of conventional line cords.

In the manufacture of such cord, core 10 may be fed continuously with the various layers being wound around. Thus, annularly moving spools whirling around a long central core to wind a layer of wire, thread, tape or other material are well known in the winding art. By feeding wire 10 forward in the direction of the arrow, namely from left to right and having the different layers fed in the order shown in Figure 1, the entire transformer core may be manufactured in indefinite lengths. Thus, the supply of insulation 11 will go on core 10 first, followed in succession

by the various other layers. The places where winding of the various layers occur are staggered along the length of core 10.

It is evident that adjacent spools containing the material for forming the various layers will turn in opposing directions. Thus, spool 11' for tape 11 may revolve clockwise around core 10 looking at the core from left to right. Spool 12' for feeding layer 12 will therefore revolve anti-clockwise. Spools 14', 16', 18' and 19' will follow successively.

In Figure 3, a length of cord is shown. It is assumed that this length has been wound with all the various layers. Thus, end 23 of iron wire 10 may be anchored in a suitable connector 25. The ends of windings 12 and 14, for example, may be formed as leads 27 and 28 and provided with suitable terminals. Windings 12 and 14 have ends 29 and 30 remote from connector 25, which ends are electrically connected together at 31. It is understood that these ends and joint 31 are suitably insulated and tied down to the cord proper. Thus, these two layers form one transformer winding.

Similarly, layers 18 and 19 have leads 32 and 33 respectively going to connector 25. This connector is shown as the standard type for use in 110 volt lines. Remote ends 34 and 35 of these windings are connected together at 36 to form a through circuit for layers 18 and 19. The finished cord would have tape or other finishing material around the ends of the cord adjacent the two connectors to provide a finished material and prevent breakage and unravelling of wire. It is not necessary that adjacent windings be used to form a winding. Thus, layer 12 and layer 19 could form a complete winding. Any even number of layers may be connected together so that the two leads are at the same end of the cord providing the pitch is such as to have magnetically additive action. A connector plug for ends 27 and 28 may be provided in which case the end of core 10 would be anchored.

If additional windings are provided, leads to other terminals may be made at one or both ends. Separable connectors accommodating any desired number of wires are well known. Hence, additional leads from windings may be provided at either end of the cord and led to suitable terminals to connectors if desired.

It is, of course, possible to have one transformer winding consisting, for example, of layers 12 and 14 as shown, and have layer 18 as one complete winding and layer 19 as another complete winding. It is also possible to break any layer into two separate windings. Thus, a cord six feet long may have a primary winding consisting of layers 12 and 14. The third and fourth wire layers, here numbered as 18 and 19, may then be connected for a portion of the length, say four feet of cord, while another winding electrically separate from 18 and 19 but consisting of the third and fourth layers of wire may be provided. Thus, different windings may be provided along the same layers of wire along a length of cord.

As shown here, the outer layers are the primary. This is unimportant. For some purposes, it may be desirable to have the primary on the inside. It is evident that the core and windings have a length which is great in comparison to the transverse dimension of the transformer cord.

It is obvious that, instead of transformers, reactors and autotransformers may be made without departing from the spirit of the invention.

What is claimed is:

1. A transformer comprising a magnetizable core in flexible filamentary form, windings helically disposed around said core and having superposed layers with adjacent layers of opposing pitch, said windings and core having an axial length great in comparison to the maximum transverse dimension, said core and windings being flexible and forming a line cord, and primary and secondary connections at the ends of said windings.

2. A transformer comprising an elongated bundle of flexible magnetizable wire, a plurality of windings helically disposed around said bundle to form therewith a flexible cord-like structure, said windings having superposed layers with opposing pitch, a connector at one end of said bundle and anchored thereto, said connector having terminals to which the ends of one of the windings may be connected, and terminals for other windings at the other end of said bundle.

3. A transformer comprising a long thin bundle of flexible magnetizable wire, a plurality of layers of wire helically wound around said wire along the length thereof to form windings and having superposed layers with adjacent layers of opposing pitch, said bundle and windings forming a flexible cord-like structure having a length great in comparison to any transverse dimension, at least one connector anchored to one end of said magnetizable wire, said connector having terminals to which one of the windings is connected for establishing circuit connections, and terminals for the remaining windings at the other end of said magnetizable wire.

4. A transformer comprising a long bundle of magnetizable wire, an even number of four or more superposed wire layers wound around said bundle, at least two wire layers being wound with opposing pitch, the ends of two layers at one end of said bundle forming leads for connection to a circuit, the remaining ends of said two layers of wire at the other end of said bundle being an electrically continuous winding, said layers being magnetically aiding, the remaining layers being similarly connected to form continuous electrical windings, said bundle and windings forming a long flexible cord, leads for one winding at one end of the bundle and leads for the remaining windings at the other end of the bundle whereby said transformer may be used as a line cord between a power source and a load.

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