May 12, 1942. J. L. BONANNO 2,283,037

ADJUSTABLE TRANSFORMER COIL

Filed Dec. 7, 1940

Fig. 1.

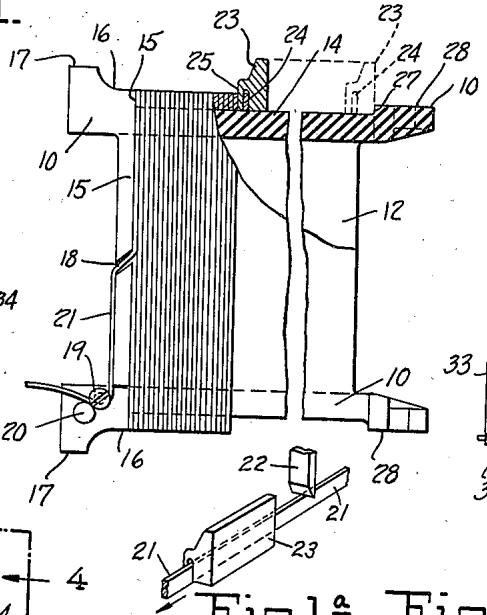


Fig. 4.

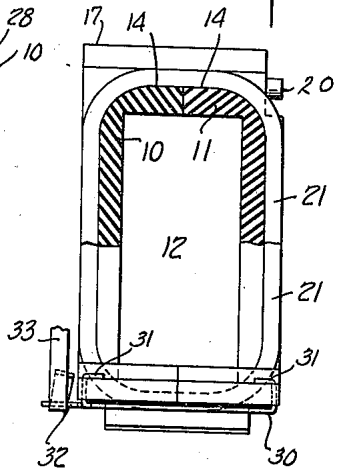


Fig. 3.

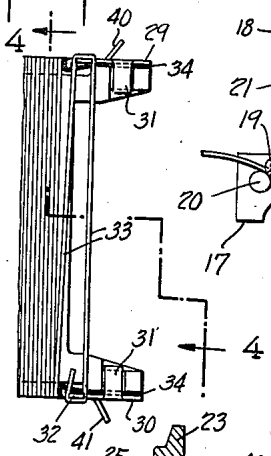


Fig. 1a

Fig. 5.

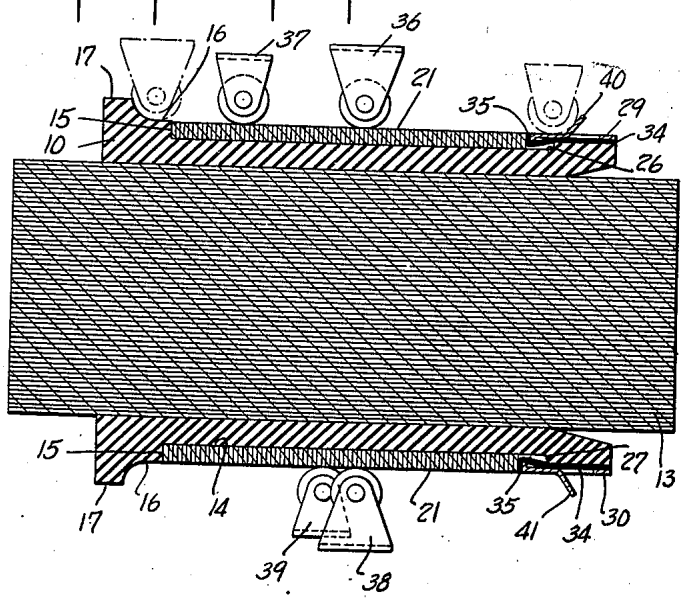


Fig. 2.

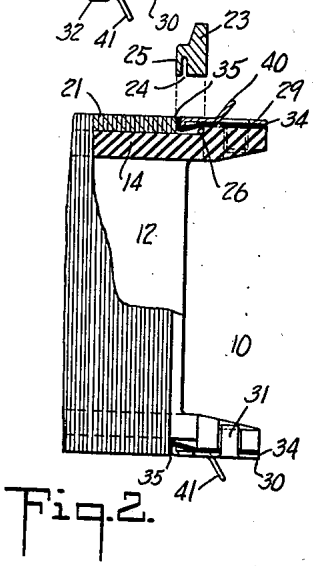
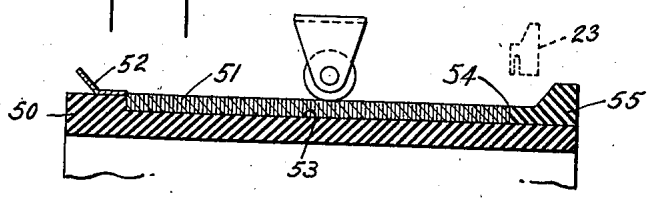


Fig. 6.



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ADJUSTABLE TRANSFORMER COIL

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3 Claims. (Cl. 171—119)

The present invention relates to transformer coils, and is more particularly directed toward coils adapted for use in transformers and to the making of coils.

Transformers designed to produce variable output voltages by means of movable contacts cooperating with a portion of the surface of the winding have usually employed multiple layer windings and it was necessary to bring out taps from the inner coils wherever it was desired to obtain voltage variation over a wider range than afforded by the exposed layer of the winding.

According to the present invention the entire coil is made out of flat, edgewise wound magnet wire having a high space factor and a much larger number of turns in a given length than possible with ordinary round wire of the same current carrying capacity. This makes it possible to expose the surface of each turn of the coil for cooperation with one or more contacting elements. In practice it has been found difficult to wind a flat wire tightly and maintain it on edge during the winding operation, and the present invention contemplates a method of winding such wire for these purposes according to which the wire is kept on edge and a compact winding made.

According to the present invention the wire is held in proper position by a guide adapted to move across the face of the spool on which the wire is wound and keep the coil compact. In practising the present invention the spool on which the coil is wound is provided with suitable anchoring means for both ends of the winding and has suitable configuration at one end of the coil to provide an off position for a movable contact and has at the other end at least one metallic contact to which the adjacent end of the coil is secured, this metallic contact being in a position to receive the movable contact as it is moved beyond the coil surface.

Other and further objects will appear as the description proceeds.

The accompanying drawing illustrates the method employed in making the coil and two embodiments in which the invention may take form, it being understood that the drawing is illustrative of the invention rather than limiting the same.

In the drawing:

Figure 1 is a front elevational view of a spool and partially wound coil;

Figure 1*a* is a perspective view illustrating the guide and scraper used;

Figure 2 illustrates the completely wound spool with the contacts secured in place on the spool;

Figure 3 is a side elevational view of the spool showing the end of the wire secured to the contacts;

Figure 4 is a sectional view taken on the line 4—4 of Figure 3 with parts in elevation;

Figure 5 is a longitudinal sectional view through the coil mounted on a transformer core; and

Figure 6 is a fragmentary sectional view showing a modification.

The form about which the coil is to be wound is here shown in the form of a spool made up in two like pieces of molded material 10 and 11. Their configuration is such as to provide a rectangular opening 12 to receive the portion 13 of the core of the transformer. Each of the pieces 10 and 11 making up the form or spool has a central portion 14 of uniform cross section to receive the winding. To the left of this central portion of uniform cross section the spool has an outwardly extending shoulder, indicated at 15, which extends completely around the form or spool. On the upper and lower faces of the device, as shown in the drawing, the left ends of the insulating pieces have flat areas 16, 16 and upwardly and downwardly extending stop elements 17, 17 for a purpose to be described.

The front face of the element 10 is slotted, as indicated at 18, and it is provided with an opening adapted to receive a screw 19 adjacent a lug 20. The flat magnet wire 21 to be used in winding the coil is secured under the screw head 19 and then passed through the slot 18 as indicated. The insulation on one edge of the wire is removed, by a convenient device, such as a scraper 22, and the wire is then passed through guide 23 having a slot 24 which presses the wire down against the spool as the spool is being revolved and holds the wire against turning over on to its flat face. The outer or left surface 25 of the guide 23 presses the coil to the left, and holds it against collapsing as the winding continues. As the winding progresses the guide 23 moves across the face of the spool and it is held against the face of the spool by convenient mechanism so that the coil can be crowded to the left during winding operation. The central portion of uniform cross section is made somewhat longer than the overall length of the coil, as will be more apparent from Figures 2 and 5. This leaves a gap 26 between the last turn and the shoulder 27 on the insulating form. This gap is sufficient to accommodate the guide 23. After the coil is thus wound the guide and scraper are moved

away from the wire and a length of wire cut off to provide leads.

The right-hand ends of the insulators **10** and **11** making up the spool are provided with flat surfaces **28**, **28** and comparatively heavy brass contacts **29** and **30** are secured to these projecting ends of the insulators. The metal contacts have ears **31**, **31** which are bent around the insulating pieces to anchor the sheet metal contacts in place. These contact elements have outwardly extending lugs **32** which receive the end **33** of the wire employed in making the coil. Paper insulation **34** is placed between the contact elements **29** and **30** and the insulating supports. The edge of this paper is carried under the edge of the sheet metal contacts and brought out, as indicated at **35**, adjacent the last turn of the wire on the form. These pieces of paper insulate the contacts from the coil and prevent the short circuiting of a turn which would occur if the insulation on the wire were broken and the paper insulation were omitted. The outer surface of the coil is exposed to provide the contact surface. This may be accomplished by scratch brushing the insulation instead of using the scraper but at the risk of burnishing the turns together.

In coils such as described herein the entire range of voltage is provided in an exposed coil, the maximum voltage between turns is constant, and it is not necessary to insulate one layer from another further increasing the space factor. The coils are particularly suitable for use with variable output transformers as above indicated and when so used contact rollers, such as indicated at **36**, **37**, **38**, **39**, may be employed to pick off various voltages. When the contact rollers are moved to the left they ride over the flat areas **16**, **16** and come against the enlargements **17**, **17** to provide stops. They also open the load circuit. When the contacts are moved to the right, as indicated in Figure 5, they ride off the coil on to the corresponding sheet metal contacts **29** or **30** and come against upwardly or downwardly bent stops **40** and **41**.

In Figure 6 a fragment of a form is indicated at **50**. It may be similar to the insulating forms previously described. Instead of having the winding start at the off position, the winding **51** is here shown as starting close to a metal plate **52** similar to the metal plates **29** and **30**. The winding is continued across the central portion **53** of the form for the required distance and stops, as indicated at **54**, some distance from the end of the form, the guide **23** being used as above described. The end of the winding is held in place by an insulating run-off member **55** which may have the same effective contour as shown at the left of Figure 5 so that in use the coil would function the same as that shown and described above. In this figure no insulation is shown underneath the metal plate **52** for it is possible to avoid using the insulation where only one metal plate is employed, or where the two metal plates are connected to the winding in such a way that there is no possibility of short circuiting the last turn of the coil.

It is obvious that the invention may be embodied in many forms and carried out in various ways within the scope of the claims and I wish it to be understood that the particular forms shown are but a few of the many forms. Various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. A coil for a variable voltage output transformer, comprising an insulating spool having a central portion of uniform cross section along the axis and an abrupt shoulder at one end, a winding comprising turns of flat enamelled wire compactly wound on edge on the said portion of uniform cross section with its outer surface exposed and extending from said shoulder to a predetermined distance from the other end, so that a part of said portion of uniform cross section is unoccupied, contact members fixedly secured to the said other end of the spool and extending over the unoccupied portion to engage the winding and keep the turns thereof from collapsing, at least one of the fixed contact members being connected with the end of the winding and having a surface even with the exposed surface of the winding so that a movable contact may pass over the exposed surface of the winding and onto the contact member.

2. A coil such as claimed in claim 1, wherein two fixed contact members are connected to the winding and having insulation between the contact members and end turn of the winding so that no portion of said end turn is short circuited.

3. A coil such as claimed in claim 1, wherein the shouldered end of the spool has a flat area even with the winding onto which the movable contact may pass.

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