Nov. 2, 1965 S. J. SUBIK 3,215,965

LAYER WOUND INDUCTANCE COIL

Filed June 4, 1962

FIG.1

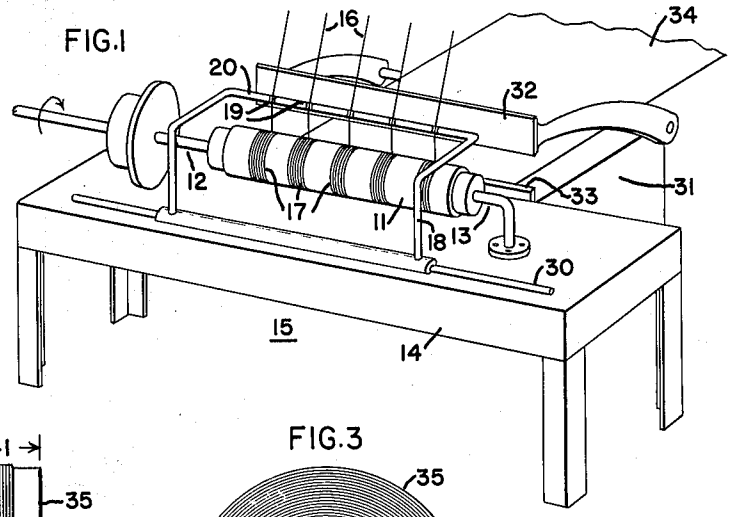


FIG.2

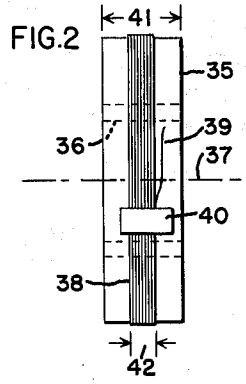


FIG.3

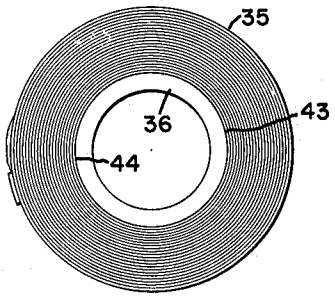


FIG.4

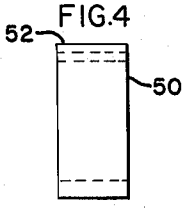


FIG.5

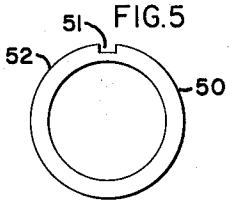


FIG.6

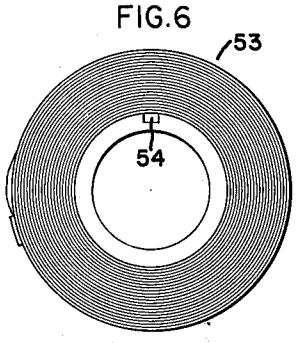


FIG.7

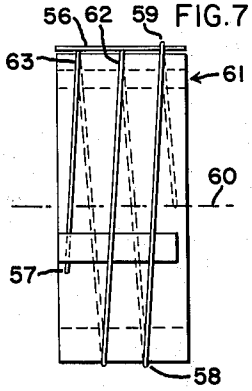
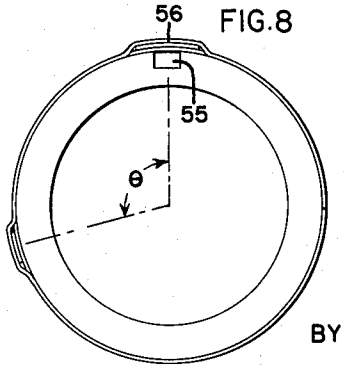


FIG.8



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3,215,965

LAYER WOUND INDUCTANCE COIL

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1 Claim. (Cl. 336—208)

This invention relates to layer wound inductance coils and more particularly to an improvement in layer wound inductance coils for facilitating the manufacture of such coils.

Layer wound inductance coils find advantageous use in many applications. Because of their reduced cost relative to the cost of pancake type coils having a universal winding, the layer wound coil has recently replaced the former type coil as the tertiary winding in the horizontal output transformer in some television receivers.

For this and other similar applications, a known economical arrangement of the layer wound coil comprises a narrow tubular pressed paper coil form having a continuously wound coil of relatively fine polyurethane insulated wire, such as No. 36 AWG gage, wound thereupon. The coil is arranged in multiple relatively narrow layers having a plurality of turns of wire in each layer. The layers are radially disposed from a longitudinal axis of the form and an insulating medium, such as a strip of paper, is positioned between each of the layers. The assembled coil, as described, resembles a thin disk.

A manufacturing difficulty is experienced when layer wound coils of the type described are machine fabricated in quantity. In one manufacturing arrangement, a plurality of coils are simultaneously wound side by side upon a single tubular coil form. The individual built up coils are subsequently separated by a cutting operation. An initial turn of fine wire of each coil, which is a terminal lead for the coil, lays adjacent to the form and is buried by the successively wound layers and burrs created on the form by the cutting operation. Prior attempts for recovering this lead have consisted in wedging a tool between the form and a first insulating paper layer and probing for the hidden lead. This method of recovering the hidden lead is undesirably costly both in the time required to recover the lead and in resulting damage done to the coil in making the recovery.

Accordingly, it is an object of the invention to provide an improved layer wound inductance coil.

Another object of this invention is to provide a layer wound inductance coil having means for facilitating the fabrication of the coil.

A further object of this invention is to provide a layer wound inductance coil in which a buried initial turn of wire representing a terminal lead may be easily recovered from beneath successively wound layers.

In accordance with the present invention, a layer wound coil is provided having a coil form and a coil of relatively fine insulated wire which is continuously wound upon the form in a plurality of radially disposed insulated layers. A pair of terminal leads for the coil consists of an easily accessible end turn on an outer layer of the coil and an initially wound turn of the coil which is buried by the coil layers. The coil form includes an access passageway to the buried turn for permitting insertion of a tool for grappling and leading out the buried turn to a point without the coil.

In one embodiment of the present invention, a tubular coil form is provided having a longitudinal groove in an outer surface of the form. A first turn is helically wound in a longitudinal direction upon the form and traverses the groove in the surface. A segregating medium for facilitating grappling of the lead is positioned on the turn in the area of the groove intermediate the lead and successively wound turns of the coil.

Further objects, features and the attending advantages of the invention will be apparent with reference to the following specification and drawings in which:

FIGURE 1 is a perspective view of an automatic coil winding machine for winding layer wound coils,

FIGURE 2 is a front view of a conventional layer wound coil which has been wound on the machine of FIGURE 1,

FIGURE 3 is a side view of the coil of FIGURE 2,

FIGURE 4 is a front view of a coil form utilized in an embodiment of the present invention,

FIGURE 5 is a side view of the form of FIGURE 4,

FIGURE 6 is a side view of a fabricated coil embodying the present invention,

FIGURE 7 is an enlarged front view of a coil form illustrating features of the present invention, and

FIGURE 8 is a side view of the form of FIGURE 7.

In order that the features of this invention may be fully appreciated, the fabrication of a layer wound coil of the type referred to will be briefly described with reference to FIGURE 1. In the manufacturing arrangement illustrated therein, a tubular stock **11** of pressed paper having a suitable length for fabricating a plurality of coil forms therefrom is mounted horizontally intermediate drive and support mandrels **12** and **13** on a bed **14** of a coil winding machine **15**. A plurality of spools of wire, not shown, are stationed relative to the machine for providing the necessary wire **16** for simultaneously winding individual coils **17** at equally spaced positions along the stock. A wire guide mechanism consisting of a support structure **18** and having multiple wire guides **19** positioned on a cross bar **20** for feeding wire to and guiding the winding of the coils **17** is positioned on a track **30**. The support **18** is driven with a slow reciprocating motion along the track by means, such as a rotating screw driven shaft, not shown. In addition, an apparatus for automatically measuring, cutting, and inserting a strip of insulating paper between successively wound layers of the coils being fabricated is provided. For purposes of clarity, FIGURE 1 illustrates only a cutting table **31**, two cutting blades **32** and **33** and a strip of paper **34** being fed to the apparatus.

In operation, a tubular stock is mounted between the mandrels **12** and **13** and a lead wire **16** from each spool of wire is initially secured at equally spaced positions along the stock by an adhesive medium. Sufficient spacing is provided between immediately adjacent positions for permitting the build up of a desired width of the coils and for allowing subsequently assembled coils to be separated by a cutting operation without damaging the fabricated windings. The stock **11** is automatically rotated about its axis by the drive mandrel **12** having a prime mover not shown, while the wire guide is simultaneously driven parallel to the axis of the stock, by a prime mover not shown, for causing a single layer of a desired number of turns to be wound at each coil position. When a layer has been wound, a strip of insulating paper having a width equal to the length of the stock is automatically measured, cut from the strip **34**, and positioned on the stock. The wire guide then reciprocates and a succeeding layer for each coil is wound upon the insulating paper as each of the wires **16** traverse the stock **11** in the opposite direction. The described winding operation is then successively repeated until a desired layer wound coil configuration has been built up. Each loose coil end-lead is taped to its coil body and the wires **16** are then severed. The entire assembly is removed and the individual coils are separated from the assembly by cutting the assembly in a plane perpendicular to the longitudinal axis of the stock.

A single coil **35** which has been manufactured by the above described procedure is shown in the views of FIG-

URES 2 and 3. The coil 35 includes a form **36**, the built up layers of wire and insulating papers which are radially disposed from a longitudinal axis **37** of the form, an outer layer of wire turns **38**, a terminal lead **39**, and a strip of tape **40** which secures the lead **39**. In order to satisfy a variety of requirements, namely, to provide structural coil support, to provide the desired electrical characteristics for the coil, and to provide the necessary clearance for severing individual coils from the above described assembly, the width of the assembled coil **41** is generally greater than the width of each layer of turns **42**. Consequently, the initial turn of fine wire **16** which constitutes a terminal lead for the coil **35** and which was secured to the stock **11** on the winding machine **15** is buried beneath the multiple layers of insulating paper and wire turns and behind a flared edge of the form created by the cutting operation. A pressure exerted on an outer surface **43** of the form by the successively built up layers of paper and wire turns makes this turn relatively inaccessible and difficult to retrieve. As previously indicated, prior attempts at recovering the buried lead have consisted in wedging a tool between the outer surface **43** of the form and an adjacent layer of paper and turns **44** and probing for the hidden lead.

In accordance with a feature of the present invention, a coil form is provided for the coil which includes access to the buried lead for a grappling tool. FIGURES 4 and 5 illustrate a coil form **50** for a single coil having a longitudinal groove **51** in a thickness of the form and which communicates with the outer surface **52** of the form. FIGURE 6 illustrates an assembled coil **53** of the type described embodying the invention. A grappling tool may be inserted in the groove **54** of the coil **53** to recover the buried lead in a minimum amount of time and without causing damage to the coil. The coil **53** may be conventionally manufactured by the above described procedure by providing the stock **11** of FIGURE 1 with a groove extending longitudinally on the length of the stock.

In accordance with another feature of this invention, a segregating means is provided for facilitating the grappling of the desired hidden lead without interfering with other turns of the coil. Referring to FIGURES 7 and 8, a single coil form is shown having a groove **55** and the first two and one-half turns of a coil wound upon the form. A segregating means **56**, which may consist of an adhesive tape preferably having an adhesive surface positioned away from the surface of the form, is positioned between a length of lead wire **57–58**, which is to be subsequently retrieved, and successively wound turns of other layers, not shown. The segregating tape **56** is positioned over the wire **57–58** in the vicinity of the groove **55** and covers the groove and that portion of the wire length **57–58** which traverses the groove **55**. The length of wire **58–59** and successive portions of the coil are wound over the segregating medium **56**. Thus, a grappling tool may be inserted in the groove **55** and drawn along the lower surface of medium **56** until a portion of wire **57–58** is grasped without interfering with or grasping other turns of the coil.

In accordance with another feature of this invention, the initial lead length **57–58** is wound helically along

the surface of the form **55** in the direction of the longitudinal axis **60** of the form. Thus, when a grappling tool is inserted in the groove **55** from side **61** of the form, wire section **62** will first be contacted and the entire lead **57–58** is retrieved by pulling wire section **62**. This is more advantageous than first grappling a segment **63** of wire lead **57–58**, in that the necessary operator motions for recovering the entire lead are consequently reduced.

The above described features may be incorporated into the automatic coil winding procedure which was described hereinbefore by utilizing a stock **11** with a groove running longitudinally for its length, already referred to, by taping the lead wires **16** on an outer surface of the stock **11** at an angle θ from the groove as indicated in FIGURE 8 and in FIGURE 7 by the tape **64**, by winding two and one-half turns of lead wire or as many turns as are necessary to provide a desired lead length, and by then positioning an insulating medium over the groove and securing it by any convenient method, as by winding additional turns over it to secure it in place.

Although I have described the present invention with relation to a pressed paper coil form, other coil form material may be utilized and incorporate the invention. For example, the coil form may consist of phenolic or plastic and the slot **51** indicated in FIGURE 5 may be incorporated into the form during a molding fabrication process.

While I have illustrated and described and have pointed out in the annexed claim certain novel features of my invention, it will be understood that various omissions, substitutions and changes in the forms and details of the system illustrated may be made by those skilled in the art without departing from the spirit of the invention and the scope of the claim.

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

An inductor comprising: a cylindrical tubular paper coil support element having an outer surface, said outer surface having a groove extending longitudinally in the surface; a coil of relatively fine insulated wire wound upon said support element, said coil comprising an initial turn wound adjacent to said surface and transverse to said groove and succeeding turns wound in insulated radially disposed layers, means for separating a segment of said initial turn from succeeding turns in the area of said groove comprising a strip of insulating material positioned upon said initial turn intermediate said initial and succeeding turns and covering a surface area of said support including said groove whereby said initial turn may be retrieved from said coil through said groove to form a terminal lead.

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