March 22, 1960 M. WOHLHIETER 2,929,132

METHOD OF FABRICATING COILS

Filed May 19, 1953

FIG. 1

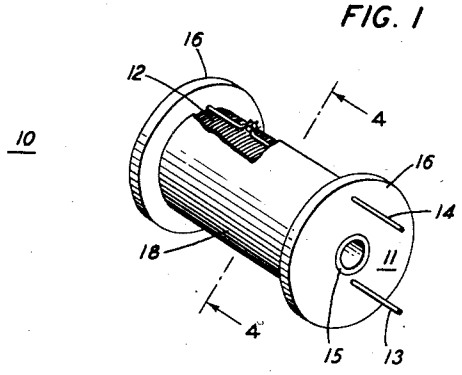


FIG. 1A

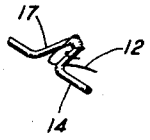


FIG. 2

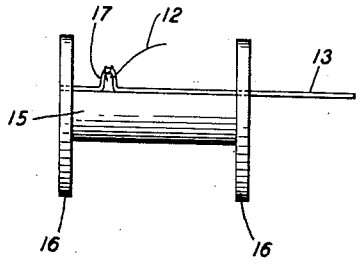


FIG. 3

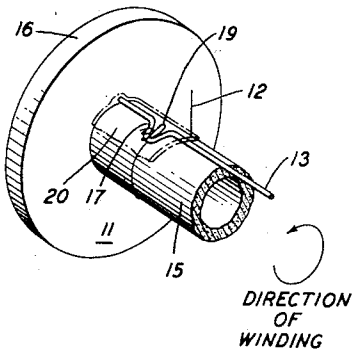
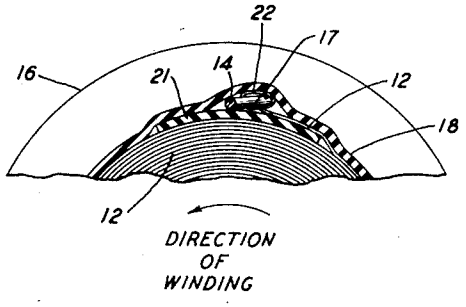


FIG. 4



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METHOD OF FABRICATING COILS

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This invention relates to miniature inductive devices and more particularly to electrical terminals and their attachment to such devices.

In order to accomplish the objective of miniaturization of coils and transformers it is eminently desirable that simplified terminal assemblies and methods of terminal attachment be used. With the development of such inductive devices which may have a total volume of 0.05 cubic inch or less and employed wire in the order of 40 gauge or smaller, the attachment of terminals becomes a major problem. Use of conventional terminals and attachment methods fails to gain the space advantage possible with these minute devices and may leave the fragile winding wire exposed. Improved reliability of the terminal connections is essential, first, because of the difficulties in repairing devices of such small size, and secondly, because many miniature coils and transformers are potted or cast in resin so that a failure of a single terminal connection results in complete loss of the component.

An object of this invention is to realize an inexpensive reliable terminal connection for miniature inductive devices.

Another object of this invention is to enable a simple, efficient attachment of such terminals to miniature inductive devices.

A further object of this invention is to expedite the attachment of terminals to miniature inductive devices without increasing the size or decreasing the efficiency of the device.

Still another object of this invention is to insure freedom from strain of fragile windings of components both during and after terminal attachment.

One embodiment of this invention includes a spool or bobbin type coil form including fusible spool heads on each side of a central hub about which the turns of the coil are wound. The terminals are comparatively rigid wires extending parallel to the axis of the coil form and through the fusible spool heads.

Each terminal includes a bow or kink adjacent the winding, to which the initial or final turn is soldered. The bow of the inner terminal lies against the coil form while the corresponding kink of the outer terminal lies against the outer layer of the winding. A free length of winding lies within each bow, allowing some relative movement between the terminal and the coil without introducing undue tension into the coil wire. The entire winding assembly, including the bow portion of the terminals, is covered with a turn or two of pressure sensitive tape or the device potted or cast in resin to secure the winding and terminals. The connection between the ends of the coil and the terminals are completely within the device so not subject to damage due to abrasion or rough handling.

The terminals are attached in accordance with this invention by inserting each one, when heated, through the fusible spool heads, forming an upright bow or kink in the portion of the terminals lying between the spool

heads, attaching the end turns to the bow of each terminal and turning the terminals to lie one against the bobbin and the other against the winding.

A feature of this invention involves the mounting of a terminal by inserting it through fusible portions of a coil form.

Another feature of this invention lies in the attachment of the terminal leads to the winding of inductive devices at a bow portion of each terminal where soldering may be readily accomplished without danger to the winding or insulation and which subsequently prevents rotation of the terminal.

Still another feature of this invention relates to the formation in each end of the winding a free length or loop soldered to and enclosed by a portion of the terminal.

A full understanding of these and other features of this invention may be had from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a view in perspective of an inductive device embodying this invention with portions broken away for clarity;

Fig. 1A is a magnified view of the terminal-winding attachment detail of the device of Fig. 1;

Fig. 2 is an elevational view of a coil bobbin with one terminal attached and the initial turn of the winding in position for soldering to the terminal;

Fig. 3 is a perspective view of a portion of the bobbin of Fig. 2 with one terminal and the initial turn of the winding in place; and

Fig. 4 is a sectional view of the terminal detail of the device of Fig. 1 taken along line 4—4.

Referring now to Fig. 1 an inductive device may be seen generally designated as coil **10** which includes a bobbin **11**, winding **12**, and a pair of terminals **13** and **14**. The bobbin **11** includes a tube **15** of insulating material, such as, paper, upon the ends of which are mounted a pair of flanges **16** of a fusible or thermoplastic material, such as, cellulose acetate. The flanges **16** may be punched from a sheet of cellulose acetate and press-fit over the ends of the tube **15** or the entire bobbin **11** may be a single thermoplastic resin unit. Inner terminal **13** extends through both flanges **16** and along tube **15**. The initial turn of the winding **12** is soldered to terminal **13** as is best seen in Figs. 2 and 3. The final turn of the winding **12** is soldered to the outer terminal **14** which, similar to the inner terminal **13**, extends through both flanges **16**. Both terminals include a bow or kink **17** in the section lying between the flanges **16**. The ends of the winding **12** are each soldered to the apex of the bow of terminals **13** and **14** which lie against the periphery of the tube **15** and the winding **12**, respectively. A turn or two of pressure sensitive tape **18** surrounds the outermost turn and terminals securing both from movement.

Referring now to Figs. 2, 3 and 4, the method of attaching this terminal to inductive devices may be more clearly understood. The terminals **13** and **14** may include a preformed bow or kink or that part may be formed in the terminal after it is mounted on the coil bobbin. In either case the terminal is heated to a temperature sufficient to pierce the fusible flanges **16**. If the bow **17** is preformed, the terminal is inserted with the bow upright, that is, extending radially from the tube **15**. If a straight terminal wire is used, it is bent after insertion and cooling to form an upstanding bow, as seen in Fig. 2. Although either a straight terminal wire or one including a preformed bow may be inserted through the flanges **16** in accordance with this invention, it has been found that the straight wire offers less resistance to insertion, does not form an internal burr on the flanges which in some cases must be removed before proceeding with the winding process and therefore is preferred.

After the inner terminal 13 with its upstanding bow 17 is inserted through the flanges 16, an end of the winding wire is stripped of insulation, looped about the bow 17 and soldered in place. The terminal 13 is then turned toward the winding direction until it lies against the tube 15. As the terminal is turned it forms a bight 19 of winding wire which falls within the terminal bow. A strip 20 of pressure sensitive tape is laid over the terminal 13 and bight 19 and the requisite number of turns of winding is wound about the bobbin 11 and terminal 13. The outer terminal 14 is then heated and inserted through both flanges in the same manner as was used for the terminal 13; however, it is advisable to apply a strip 21 of pressure sensitive tape between the outer layer of the winding 12 and the terminal 14 to protect the winding insulation. After insertion of terminal 14 and formation of the bow 17, the outer end of winding 12 is stripped of insulation and looped about the apex of the bow or kink 17 and soldered thereto. The outer terminal 14 is then turned opposite of the direction of winding to form a bight 22. In turning terminal 14, a bight 22 falls within the bow 17. A turn or two of pressure sensitive tape 18 is laid over the entire winding assembly. The device may readily be potted or cast in a resinous material if a hermetic seal is desired. In such a case the outer turns of tape may prove unnecessary.

The terminal of this invention has the advantage of being simple in design and equally simple in attachment to inductive devices. No auxiliary mounting member is required, for each terminal is fused directly to the bobbin. Furthermore, the bow or kink portion offers a readily accessible point for solder in the winding ends. Accessibility for soldering is an extremely important factor of such devices which may have a greatest dimension in the order of three-eighths of an inch. Turning the terminals after attachment of the winding to the bow portions, forms a bight or loop which constitutes a short free length of the winding between the turns and each terminal. This free length of the winding allows some movement of the terminal both during manufacture and afterwards without danger of rupturing the winding. This free length of winding also allows the device to be suspended by its terminals in a mounting or a mold for encapsulation without endangering the winding.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. The method of fabricating strain relieving terminal connections to fragile windings of bobbin wound electrical components comprising rotatably securing a first terminal wire to at least one end flange of a bobbin including a portion of the terminal wire extending through the end flange into the winding area of the bobbin, forming an upright kink in a portion of the terminal wire extending through the end flange, connecting an end of the fragile winding to the upright kink of said terminal wire, rotating said terminal wire in the direction of the winding while temporarily restraining all but a free length adjacent to said terminal wire of the first turn of said winding whereby a strain relieving bight of the winding wire is formed and enclosed within the kink of the terminal wire, winding a series of turns of the winding wire about the bobbin, rotatably securing a second terminal wire to an end flange of the bobbin including a portion of the terminal wire extending through the end flange into the winding area of the bobbin, forming an upright kink in the portion of the second terminal wire extending through the end flange, connecting the second end of said winding wire to the upright kink of said terminal wire, and rotating said second terminal wire in the direction opposite to the direction of winding while temporarily restraining all but a free length adjacent to the terminal wire of the final turn of said winding to form a strain relief bight of the winding enclosed within the kink of the terminal wire.

2. The method of fabricating coil assemblies including a coil bobbin having a winding area encompassed by a pair of spaced thermoplastic flange portions comprising heating a first terminal wire to at least the fusion temperature of said flange portions, inserting the first heated terminal through one of said fusible thermoplastic flange portions of the coil bobbin along said winding area and into the other of said fusible flanges, forming an upright kink in said terminal wire between said flange portions, attaching an initial turn of a winding to the apex of said kink, turning said terminal in the direction of winding of said initial turn so the kink lies against said bobbin while temporarily restraining all but a free length adjacent to said terminal wire of the initial turn of said coil whereby said terminal encompasses an untensioned strain relief portion of the initial turn of said coil, winding a coil about said bobbin and terminal, heating a second terminal wire to at least the fusion temperature of said fusible flanges, inserting said second heated terminal wire through one of said flange portions over said coil into the second of said fusible flanges, forming an upright kink in said second terminal wire between said flange portions, attaching the final turn of said coil to the apex of said kink, and turning said second terminal wire in the direction opposite to the direction of winding of the coil while temporarily restraining all but a free length adjacent to said second terminal wire of final turn of said coil so the kink lies against the outer layer of said series of turns and said terminal encompasses an untensioned strain relief portion of the final turn of said coil.

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