

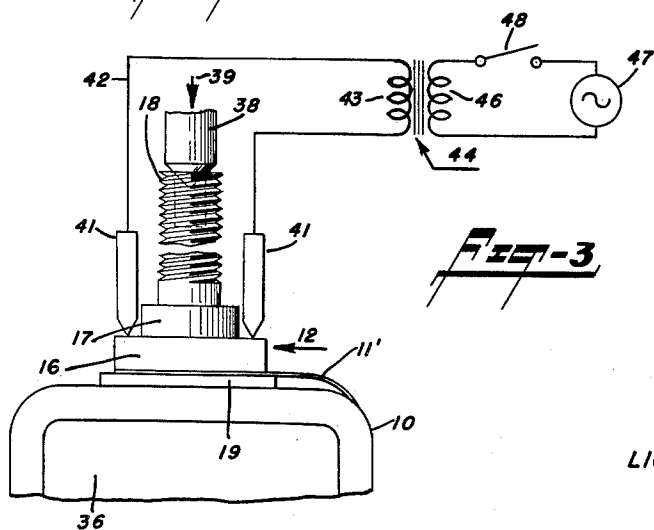
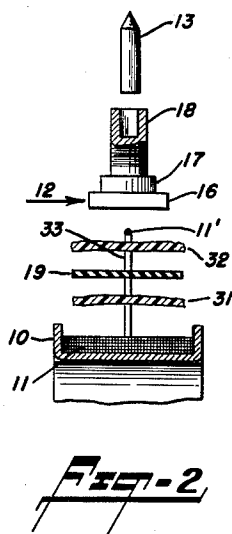
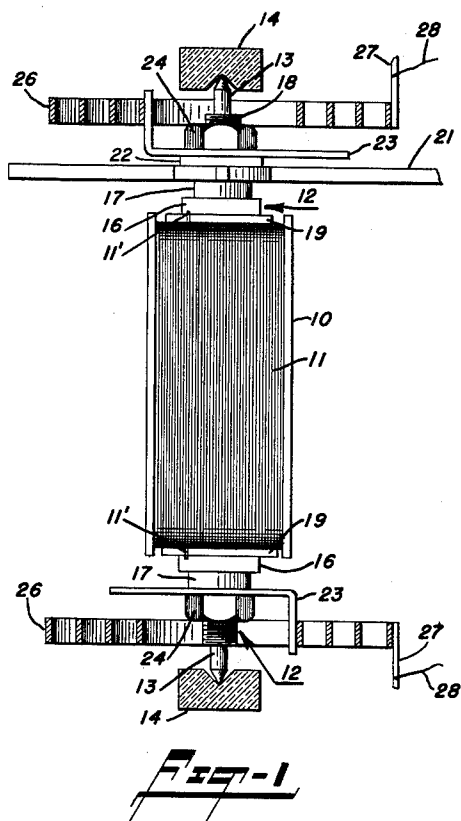
Dec. 11, 1962

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3,068,412

ELECTRICAL CONTACT AND METHOD OF MAKING THE SAME

Filed May 9, 1960



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ELECTRICAL CONTACT AND METHOD OF
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Filed May 9, 1960, Ser. No. 27,573

7 Claims. (Cl. 324—155)

This invention relates to an electrical instrument and more particularly to a method and means for securing the ends of a movable coil winding to the pivot bases attached to the coil.

Electrical instruments such as ammeters, voltmeters, and the like, include a wire wound movable coil which coil may be wound upon a generally rectangular-shaped coil frame. Two pivot assemblies, each including a pivot base and a pivot pin mounted on the base, are secured to the outer sides of the opposite ends of the coil, with the pivot pins projecting outwardly along an axis extending through the center of the coil. The pivots are carried in suitable bearings for pivotable support of the coil.

In a typical permanent magnet, movable coil instrument, a pair of spiral springs are employed to provide a calibrated force opposing the moving coil torque; one spring surrounding each pivot base and connected thereto through suitable spring abutment members secured to the said pivot bases. The outer ends of the spiral springs are secured to outer abutments and, in accordance with established practice, the springs not only bias the moving coil to a predetermined zero position, but also are employed to conduct current to the coil; the ends of the coil windings being electrically connected to the pivot bases to provide an electrical connection from the coil through the said spiral springs to the outer spring abutments.

In a co-pending patent application Serial No. 23,228 of Raymond G. Drewes and Wallace W. MacIntosh, filed April 19, 1960, now abandoned, and assigned to the same assignee as the present application, a method and means for securing a pivot base to an instrument coil are shown, which may be employed in the practice of this invention. Disclosed therein is a resistance heating method wherein an electrical current is passed through the pivot base to heat the pivot base and adjacent cement used in securing the base to the coil thereby at least partially curing or polymerizing the cement. The disclosure of such co-pending application is incorporated herein by reference thereto.

My invention includes a novel method and means of securing the coil leads to the pivot bases whereby the coil leads are electrically connected to the pivot bases without soldering and without the necessity of first removing the insulation from the said leads. The coil winding ends, with the enamel or other insulating material thereon, are placed under the pivot bases in electrical contact therewith, and the pivot bases are cemented to the coils. Heat is applied to the pivot bases to activate the cement, and the heated cement, or solvents used in diluting the cement, sufficiently displace the enamel coating on the wire to provide a good electrical contact between the wire and pivot bases.

An object of this invention is the provision of a connection between a pair of conducting members comprising epoxy resin cement for obtaining both an electrical connection and a mechanical bond therebetween.

An object of this invention is the provision of a method of mechanically and electrically securing a lead wire to a base member by use of an epoxy resin cement.

An object of this invention is the provision of a mechanical and electrical connection between a lead wire and a base member comprising epoxy resin cement securing the base member to a support with the lead wire in

the cement in contact with the base member between said member and support.

An object of this invention is the provision of a method of mechanically and electrically securing a lead wire to a base member while simultaneously securing the said base member to a support, the said method comprising spreading epoxy resin cement on the support, placing the base member on the cement on the support with the lead wire between said base member and support, and heating the said base member to cure the cement.

An object of this invention is the provision of a coil assembly comprising a wire wound movable coil with coil lead wires and pivot bases, and means cementing the pivot base to the coil and simultaneously cementing the coil lead to the pivot base for an electrical and mechanical connection therebetween.

These and other objects and advantages will become apparent from the following description when taken with the accompanying drawings. It will be understood that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the appended claims.

In the drawings wherein like reference characters denote like parts in the several views:

FIGURE 1 is a side elevational view of a coil assembly embodying my invention, parts being shown broken away for clarity;

FIGURE 2 is an exploded fragmentary sectional view showing the connection between one end of a coil wire and pivot base; and

FIGURE 3 is a fragmentary, semi-diagrammatical, view of a positioning fixture with a coil assembly mounted thereon, which arrangement may be used in the electrical and mechanical fastening method and means of my invention.

Reference is first made to FIGURE 1 of the drawings wherein there is shown a coil assembly comprising a generally rectangular-shaped coil frame 10 with a wire-wound movable coil 11 wound therein. A pivot assembly comprising a pivot base 12 and a pointed pivot 13 is mounted at each end of the coil, which pivots are shown rotatably supported in pivot bearings 14.

Each of the pivot bases may comprise, for example, a flat base portion 16, an upstanding rectangular boss 17 and an externally-threaded cylindrical portion 18, the latter having an axial bore not shown in FIGURE 1 for accommodating the pointed pivot 13. A piece of insulating material, such as fiber glass cloth, paper, or the like, is positioned between the coil 11 and base portion 16 of the pivot base to serve as insulation therebetween and also to prevent excessive heating of the coil upon heating the pivot base in the practice of my invention. Suitable cement secures the pivot base and insulating member to the coil winding, as described in detail hereinbelow.

A conventional pointer 21 with a hub portion having a hole therethrough is mounted on the pivot base, the cylindrical portion 18 of the base extending through the hole with the pointer hub resting on the boss 17. A washer 22 is located between the pointer 21 and an inner spring abutment 23. At the lower end of the coil assembly, the spring abutment 23 abuts the boss 17; no pointer being included at that end. Nuts 24 threaded to the externally-threaded portion 18 of the pivot bases secure the pointer and inner abutments thereto.

The inner ends of spiral springs 26 are secured to the abutments 23, while the outer ends of the said springs are mounted on relatively fixed outer abutments 27 fragmentarily shown in FIGURE 1. In accordance with established practice, the spiral springs not only bias the coil to a predetermined position, but also provide a con-

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ducting current path to the coil. Lead wires 28 are shown secured to the abutments 27 for connection to a source to be measured, which source is not shown in the drawings. The current path from the lead wires 28 may be traced through the spiral springs 26, abutments 23, and pivot bases 12 to the ends of the coil winding which are cemented to the pivot bases in a novel manner in accordance with my invention.

Reference is now also made to FIGURE 2 of the drawings showing an exploded view of a joint between a coil and a pivot base. For clarity, the parts and elements of the connection have not been shown in proper relative size; the drawing being intended merely to aid in an understanding of the invention. In securing the pivot base to the coil, a thin layer of suitable cement 31 is first brushed onto the end turns of the coil 11 and the insulating member 19 is placed in position thereon. A thin coating of cement, designated 32, is then spread over the insulating member. The coil wire includes an insulating coat of enamel, varnish, plastic, or the like, which insulation is designated 33 in the drawings. The end of the coil wire, here designated 11', with the insulation still thereon, is placed on the insulating member upon which the cement has been spread. The flat bottom surface, designated 34, of the pivot base is then placed on the insulating member 19 upon which the cement 32 and insulated wire end 11' have been placed. With the pivot base positioned on the insulating member 19, in contact with the wire end 11', heat is applied to the pivot base to cure the cement. During such heating process, the cement, or probably more particularly the solvents (such as acetone) for diluting the cement react with the insulation on the wire end to sufficiently displace the insulating material whereby electrical contact is made between the pivot base and wire end. As the cement cures, or polymerizes, a good electrical and mechanical bond is provided between the pivot base and lead wire while, simultaneously, a good mechanical connection is provided between the pivot base and coil.

A suitable method and apparatus for properly locating the pivot base on the coil and of heating the pivot base to activate the cement thereby securing the pivot base to the coil and simultaneously electrically and mechanically connect the coil lead to the said base are shown and described in the above-mentioned co-pending patent application Serial No. 23,228. A fragmentary, semi-diagrammatical, view of a means for locating the pivot base on the coil and including means for passing an electrical current through the base to heat the same is shown in FIGURE 3. In FIGURE 3 the coil 10 is shown positioned upon a pedestal 36 of a positioning fixture. A plunger element 38, spring biased in the direction of the arrow designated 38 and comprising a portion of the positioning fixture, accurately locates the pivot base 12 on the end turns of the coil. A pair of electrodes 41, 41 are shown in contact with the pivot base at spaced points thereon, the said electrodes being connected through lead wires 42, 42 to the secondary winding 43 of a transformer 44. The transformer primary winding 46 is connected to a suitable A.-C. source 47 through a switch 48. As described above, a thin layer of suitable cement is applied to the coil, the insulating member 19 is placed thereon, a thin layer of suitable cement is applied to the insulating member, and the pivot base is placed thereon with the coil lead wire in contact with the bottom of the pivot base. In accordance with my invention, the enamel, varnish, or other insulating coating on the coil lead wire is left thereon. The coil assembly is then placed in the positioning fixture to properly locate the pivot base (or both bases simultaneously) on the coil. With the electrodes 41, 41 in place on the pivot base, as illustrated in FIGURE 3, the switch 48 is closed and an electric current is passed through the said pivot base. A current flow of 20 amperes for about 0.5 seconds has been found to provide the necessary amount of heat to properly gel one particular

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epoxy resin type cement suitable for use in my invention. The cement, or solvents such as acetone used in diluting the cement, when activated by the relatively intense heat provided by the electrical current flow through the pivot base, sufficiently displaces the insulating coating on the wire to permit a good electrical and mechanical contact between the wire and pivot base. Although the same cement is used on the coil windings between the insulating member 19 and coil, there are no damaging effects since the heat developed thereat is much less than directly adjacent the pivot base due to the heat shielding effect of the insulating member 19. An insulating member 19 made of fiber glass has been found to protect the coil turns from excessive heat while applying the pivot bases and simultaneously connecting the coil leads to the said bases.

With the coil lead 11' positioned beneath the pivot base, my invention is particularly applicable to an arrangement wherein the coil wire is of a small size since a large size wire would possibly permit "rocking" of the pivot base thereon. In one application, a coil wire of .001" diameter is used with a fiber glass insulating member 19 having a thickness of .003", which wire is sufficiently small to embed in the cement and insulating member to thereby permit a stable mounting of the pivot base on the coil.

It will be understood that my invention is not limited to any particular type of cement since any suitable heat reactive cement which functions to displace the insulation on the coil leads when sufficiently heated may be used. The cement may be of the thermoplastic or thermosetting type. With certain epoxy resin cements and with sufficient heat provided by the current flow through the pivot base, the cement may be finally gelled or cured without further baking. With some cements, a further oven baking subsequent to the above-described resistance heating process may be required. Obviously, both pivot bases may be simultaneously secured to the movable coil, and at the same time that the coil leads electrically and mechanically secured to the pivot bases. Since connection of the lead wires to the pivot bases and the securing of the pivot bases to the coil are simultaneously effected, it will be apparent that the prior art step of securing (as by soldering, generally) the coil leads to the pivot bases after the pivot bases are secured to the coil is eliminated. My novel method eliminates the prior art steps of cleaning the pivot bases to remove oxidation therefrom and the removal of the insulation from the fine coil lead wires preparatory to soldering the same together. Obviously, both the use of fluxes and of solder are eliminated, as well as the need for post-soldering cleaning to remove corrosive elements left after the soldering process. Besides providing a strong mechanical connection of the pivot base to the coil, an electrical connection of low resistance and inert from chemical or temperature effects is provided between the pivot base and coil end lead. The coil assembly of my invention and the method of making the same involve substantially reduced labor and material costs.

Having now described my invention in detail in accordance with the requirements of the Patent statutes, various other changes and modifications will suggest themselves to those skilled in this art and it is intended that such changes and modifications may be made without departing from the scope and spirit of the invention as set forth in the following claims.

I claim:

1. In an electrical instrument of the type having a movable coil assembly comprising a movable coil with a pair of pivot assemblies each including a pivot base having a bottom surface, said coil having insulated leads, means cementing the bottom surfaces of said pivot bases to opposite ends of the coil, the said last-mentioned means also mechanically and electrically connecting the coil leads to the bottom surfaces of said pivot bases, said

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cementing means being an epoxy resin cement having a solvent which reacts, when heated, with the insulation on the coil leads, thereby to displace the insulation and make electrical contact between the pivot bases and the coil leads.

2. An electrical instrument of the type including a movable coil having insulated leads and a pair of pivot bases secured to the coil, sheets of insulating material, means cementing the said sheets to the ends of the coil, the said pivot bases including a flat bottom surface, means cementing the said bottom surfaces of the pivot bases to the insulating material, the said coil leads being embedded in the cementing means securing the pivot bases to the insulating material and in electrical contact with the said pivot bases, said cementing means being an epoxy resin cement having a solvent which reacts, when heated, with the insulation on the coil leads, thereby to displace the insulation and make electrical contact between the pivot bases and the coil leads.

3. A method of electrically and mechanically connecting the end of a wire coil winding of a movable-coil type instrument to a pivot base which method includes placing the insulated winding end in cement under the bottom of the pivot base in contact therewith between the said base and coil, and heating the said pivot base thereby activating the cement and simultaneously displacing the insulation on the wire winding end to provide an electrical connection between the winding end and pivot base.

4. The invention as recited in claim 3 wherein the method includes the use of an epoxy resin cement having a solvent which reacts, when heated, with the insulation on the coil winding end to displace the insulation on the wire.

5. The invention as recited in claim 3 wherein the heat-

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ing of the pivot base is effected by passing an electric current therethrough.

6. A method of manufacturing a movable coil assembly which includes a wire-wound movable coil with leads and a pivot base secured to the coil, the said method including spreading a heat reactive cement on the coil, placing an insulating member on the cement, spreading a heat reactive cement over the insulating member, placing the bottom surface of the pivot base on the cement spread on the insulating member with the insulated wire lead in contact with the bottom surface of the pivot base, and heating the pivot base thereby simultaneously displacing the insulation on the wire lead and gelling the cement.

7. The invention as recited in claim 6 wherein the pivot base is heated by passing an electric current there-through.

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