

"METHOD OF CONNECTING A TERMINAL PORTION OF A COIL
OF LEAD WIRE TO A CONDUCTOR"

The present invention relates to a method of connecting a terminal portion of a coil of lead wire to a conductor, e.g. for use in an electric clock.

5 The term "lead" as used herein is to be understood to refer to electrical conduction and not to the metal lead.

10 One prior method of effecting such a connection consists in providing a bobbin from which two terminal pins extend upright for connection to the terminal portions of a coil of lead wire; winding a lead wire on the bobbin using an automatic winder to form the said coil; winding the terminal portions of the coil on the terminal pins; dipping the wound terminal pins into solder; inserting the wound terminal pins into a printed circuit board; and soldering
15 the wound terminal pins to the board.

20 Another prior method consists in bonding a printed circuit board, which is to be connected to a coil, to a bobbin; winding a lead wire on the bobbin using a winder to form said coil and bonding the terminal portions of the coil to the printed board by thermal welding using a small welding robot.

The first mentioned prior method requires that two terminal pins for connecting the terminal portions are mounted on the bobbin so as to extend upright therefrom. This increases the number of components. Moreover, the connection operation is laborious to perform.

In the second-mentioned prior method, when the lead wire is wound on the bobbin, the latter is connected to the printed-circuit board. Therefore, the operation of the said winder limits the size, shape and so on of the printed circuit board. Further, it is difficult to wind the lead wire in this case.

According therefore to the present invention there is provided a method of electrically connecting a terminal portion of a coil of lead wire to a conductor comprising causing the said terminal portion to traverse the conductor; attaching the end of the terminal portion of the lead wire to an anchoring member disposed near and insulated from the conductor; and electrically connecting the terminal portion to the conductor at a position where it traverses the latter.

Preferably, the coil has two terminal portions each of which is traversed over a respective conductor or conductor portion and has its end attached to a respective anchoring member, each terminal portion being electrically connected to the respective conductor or conductor portion at a respective said position.

Thus in the case of the present invention, the terminal portions of the coil may be easily connected so as to facilitate the wiring of an electric circuit.

The or each terminal portion may be connected to its conductor or conductor portion by a heat seal, or by soldering.

The lead wire may be wound on a bobbin which is secured to a circuit board, the conductor or conductor

portions being disposed on said circuit board.

The invention also comprises an assembly comprising a coil of lead wire having a terminal portion which has been connected to a conductor by the method set forth above. Such an assembly may form part of an electrical timepiece.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a plan view of one embodiment of an assembly which may be made by the method of the present invention;

Figure 2 is an enlarged front elevation of the assembly shown in Figure 1;

Figure 3 is an enlarged cross section taken on line III-III of Figure 1;

Figure 4 is a plan view of another assembly which may be made by the method of the present invention; and

Figure 5 is an enlarged cross section taken on line V-V of Figure 4.

Referring to Figures 1 and 2, a lead wire 2c is wound on a bobbin 1 to form a coil 2. The bobbin 1 is made from a synthetic resin, and has anchoring portions 1a and 1b. The ends of the terminal portions 2a and 2b of the lead wire 2c forming the coil 2 are wound on the anchoring portions 1a, 1b. These operations can be automated by supplying the lead wire 2c to the bobbin 1 by means of a part feeder (not shown) and an ordinary NC winder (not shown).

The assembly shown in Figures 1 and 2 comprises a conductor 3 which is constituted by a lead frame stamped from a conductive plate. The conductor 3 has interconnecting portions 3a each of which includes a plurality of lead portions 3b to which an integrated circuit 4 is connected. The lead portions 3b are coated

with bonding resin 5 so as to hold them together. Also shown are a crystal oscillator 6 and a capacitor 7.

Pins 1c to which the conductor 3 is attached are formed integrally with the bobbin 1. The conductor 3 is provided with holes into which the pins 1c are fitted, and then the front end of each pin 1c is flattened. Thus, the pins 1c are connected to the conductor 3 so as not to be detachable therefrom.

The terminal portions 2a, 2b of the coil 2 are drawn out so as to traverse the lead portions of 3b of the conductor 3 and so as to engage the anchoring portions 1a, 1b which are disposed near the lead portions 3b. Then, the lead wire 2c which passes over the lead portions 3b near the terminal portions 2a, 2b is connected to the lead portions 3b. The lead wire 2c has an outer coating of polyurethane. The coating is melted by applying heat, and the lead wire 2c is then bonded to the lead portion 3b of the conductor 3 by spot welding at locations 8a and 8b.

The lead wire 2c crosses the lead portions 3b of the conductor 3 on its way to the anchoring portions 1a and 1b which are disposed near to and are insulated from the conductor 3. Electrode rods 9 and 10 (Figure 3) are pressed against the overlapping lead wire 2c and the lead portions of 3b of the conductor 3 from above and below to bond them together by spot welding at the locations 8a and 8b. The lead wire 2c can also be connected to the lead portions 3b at the locations 8a, 8b by soldering. In this case, the outer coating of the lead wire 2c is melted by the heat produced by the soldering, and the lead wire 2c is bonded to the lead portions 3b of the conductor 3.

Figures 4 and 5 show another example of the invention. A bobbin 11 has three anchoring portions

soldering, and the lead wire 2c is bonded to the lead portions 3b of the conductor 3.

Figures 4 and 5 show another example of the invention. A bobbin 11 has three anchoring portions 11a, 11b, 11c each of which has a claw at its front end. A coil 12 has terminal portions 12a and 12b which are brought out from the body of the coil and attached to the anchoring portions 11a and 11b. A circuit board 14 is provided with holes 14a, 14b, 14c in which the anchoring portions 11a, 11b, 11c are respectively engaged. Thus, the bobbin 11 is connected to the board 14. Conductors 13a and 13b forming a circuit pattern are formed on the board 14. The terminal portions 12a and 12b of the coil 12 are anchored to the anchoring portions 11a and 11b which are located near the conductors 13a and 13b. The lead wire 12c traverses the conductors 13a and 13b on its way to the anchoring portions 11a and 11b. The lead wire 12c passing over the conductors 13a and 13b is bonded to the conductors 13a and 13b by soldering at locations 18a and 18b.

In the constructions described above, the lead wire is made to cross a conductor near the terminal portions of a coil, the wire being bonded to the conductor at the intersections. Therefore, the parts can be very easily bonded together by a heat seal or by soldering. The coil is, moreover, formed by winding the lead wire onto the bobbin before the coil is bonded to the conductor. This makes it easy to wind without limitations being imposed on the shape or size of the conductor.

C L A I M S

1. A method of electrically connecting a terminal portion of a coil of lead wire to a conductor comprising causing the said terminal portion to traverse the conductor; attaching the end of the terminal portion of the lead wire to an anchoring member disposed near to and insulated from the conductor; and electrically connecting the terminal portion to the conductor at a position where it traverses the latter.
2. A method as claimed in claim 1 in which the coil has two terminal portions each of which is traversed over a respective conductor or conductor portion and has its end attached to a respective anchoring member, each terminal portion being electrically connected to the respective conductor or conductor portion at a respective said position.
3. A method as claimed in claim 1 or 2 in which the or each terminal portion is connected to its conductor or conductor portion by a heat seal.
4. A method as claimed in claim 1 or 2 in which the or each terminal portion is connected to its conductor or conductor portion by soldering.
5. A method as claimed in any preceding claim in which the lead wire is wound on a bobbin which is secured to a circuit board, the conductor or conductor portions being disposed on said circuit board.
6. A method of connecting a terminal portion of a coil of lead wire to a conductor substantially as hereinbefore described with reference to the accompanying drawings.
7. An assembly comprising a coil of lead wire having



a terminal portion which has been connected to a conductor by the method claimed in any preceding claim.

8. An assembly as claimed in claim 7 in which the assembly forms part of an electrical timepiece.

5 9. An assembly comprising a coil of lead wire having a terminal portion, connected to a conductor substantially as hereinbefore described with reference to and as shown in the accompanying drawings.
