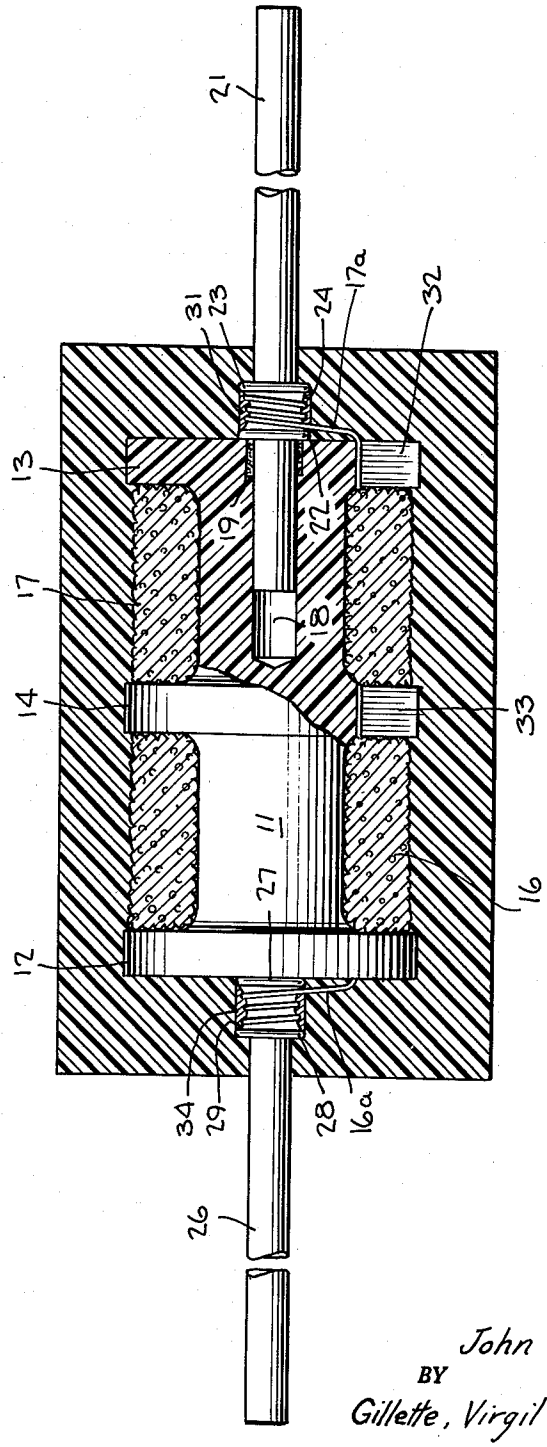
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WOUND RESISTOR

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WOUND RESISTOR

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This invention relates to terminals for wirewound resistors and the like.

The wire in wirewound resistors is usually a special alloy selected because of certain characteristics, such as its strength, its relatively high resistivity, and the fact that the resistivity of a given length of it varies but little, if at all, with changes in temperature. One such alloy is made of nickel, chromium, and aluminum. However, this alloy cannot be soldered with the usual soft solder made of tin and lead. Therefore, when a quantity of the resistance wire is wound on a spool, or bobbin, to form a resistor, the only way that the ends of the wire can be soft-soldered to terminals that are made of tinned copper wire is to wrap the resistance wire around the terminal and then apply enough molten solder to cover the area and hold the resistance wire fast by mechanical force.

The amount of solder required to grip the resistance wire securely is difficult to control. For one thing, it tends to flow along the terminal wire, thereby increasing the length of the termination. For another, the solder may be melted by heat applied to the terminal wire later when the resistor is connected in an electrical circuit. Both of these difficulties are compounded in the case of resistors that are encapsulated by molding a plastic, such as an epoxy resin, around them.

It is one of the objects of the present invention to provide an improved terminal that will result in stronger, neater, and more permanent attachment of resistance wire.

In accordance with the invention a wire terminal is formed or provided with a pair of flanges near one end. This end is inserted into the resistor bobbin in the usual manner, and one end of the resistance wire is then wound around the terminal between the two flanges. Thereafter a quantity of solder is placed on top of the resistance wire in the remainder of the space between the flanges.

The invention will be more completely described in connection with the drawing in which the only figure is a cutaway view of the interior of a resistor constructed according to the invention.

The base of the resistor is a bobbin 11, which normally has at least the two end flanges 12 and 13 but, in the particular embodiment shown, also has a central flange 14 to divide the winding space between the end flanges into two equal parts. Among other things this permits half of the total winding, i.e. the section 16 between flanges 12 and 14, to be wound in one direction and the other half indicated by reference character 17, to be wound in the opposite direction, thus canceling out the inductive effect of section 16 to a large extent and making the resistor substantially non-inductive.

Each end of the bobbin 11 is bored so that one end of a so-called pigtail wire terminal may be inserted therein. Only the right-hand bore 18 is indicated in the partially cutaway view in the drawing, but a substantially identical bore is also made in the left-hand end. Each bore has an enlarged diameter at its outer end, as indicated by reference character 19, to receive a suitable glue or other retaining means to hold the terminal in place within the bore.

The right-hand terminal 21 is a wire or rod, usually of a relatively highly conductive material, such as copper, which has been coated with tin so as to cause molten solder to adhere to it readily. One end of the wire is inserted in the bore 18 and held there. Adjacent to this end, and forming a stop that fixes the depth of penetration of the wire 21 into the bore 18, is a flange 22. This flange and an adjacent flange 23 determine the location of the area 24 of contact between the end of the resistant wire 17*a* and the terminal 21. The area 24 between the two flanges is preferably not of uniform diameter but is, instead, filleted at each end to make sure that no pockets, or voids, are formed in the corners.

A corresponding terminal 26 is attached to the opposite end of the resistor. The terminal 26 has a pair of flanges 27 and 28 and a filleted area 29 therebetween.

In making the resistor the wire terminals 21 and 26 are first inserted in the ends of the bobbin 11 until their respective inner flanges 22 and 27 strike the ends of the bobbin. Both terminals are held in place by cement in the enlarged bore space as indicated by reference number 19.

Thereafter one end of the resistance wire, for example the right-hand end 17*a*, is wound around the wire terminal area 24 between the flanges 22 and 23. Solder 31 can be added either at that time or later to cover the wire end 17*a*. In any case the wire end 17*a* is held in place while the wire is led through a slot, indicated by reference character 32, in the flange 13 and is then wound around and around the bobbin 11 between the flanges 13 and 14 to build up a desired resistance in section 17. Thereafter the wire is led through a slot 33 in the center flange 14 and the other section 16 of the resistor is wound between the flanges 14 and 12. The direction of winding of section 16 is opposite to that of section 17, that is, one is wound clockwise and the other counterclockwise to make the whole resistor substantially non-inductive. At the completion of section 16 the end 16*a* of the resistance wire is led through a slot (not shown) in the flange 12 and attached to the section 29 of the terminal 26. Solder 34 is melted into place around the space between flanges 27 and 28 to hold the wire end 16*a* in place.

Subsequently the entire resistor may be placed in a mold and a quantity of encapsulating fluid, such as epoxy resin, poured into place to form a complete, watertight jacket 36 around the bobbin 11 and winding sections 16 and 17 and the inner portions of the wires 21 and 26, including the outer flanges 23 and 28 and a little bit beyond. The encapsulating material not only seals the resistance wire from the atmosphere but flows around and solidifies to the ends and flanges of the bobbin 11 so as to make a monolithic structure which is very rugged.

In order to seal in the resistance wire, the encapsulating material must flow directly into contact with the wire terminals 21 and 26. Prior to the present invention molten solder would run some little distance along the wire terminals, in the absence of flanges, with the result that this section of the wire would be thicker than the section farther out toward the end. Thus, the encapsulating material would flow against and seal to the solder rather than the wire, itself. Subsequently, when the end of the wire terminal was heated in order to connect the resistor in an electrical circuit, the original solder would also melt and flow out from under the solidified jacket of encapsulating material, leaving an annular space between the wire terminal and the jacket through which atmospheric moisture could reach the resistance wire.

The flanges 23 and 28 prevent this from happening. The solder 31 and 34 is restrained by these flanges and is prevented from flowing outward along the terminals 21 and 26. Furthermore, the two flanges 22 and 23 on terminal 21 and the flanges 27 and 28 on terminal 26 serve as retaining dams to hold a predetermined amount of solder directly on top of, or around, the wire ends 16*a* and 17*a*. This assures that the wire ends will be held

firmly when the molten solder 31 and 34 solidifies and shrinks down upon the resistance wire ends.

While this invention has been described in terms of a specific embodiment, it will be apparent to those skilled in the art that there are other embodiments which will still fall within the proper scope of the invention as defined by the following claims.

What is claimed is:

1. A wire wound resistor comprising a generally cylindrical bobbin; a pair of conductive, rod-like end terminals inserted into opposite ends of said bobbin, each of said terminals having a pair of integral, radially extending, axially spaced flanges adjacent to said bobbin; a resistive element comprising resistance wire wound around said bobbin with end portions of said wire wound around said rod-like terminals in the regions thereof between the respective pairs of flanges; means covering said end portions of said wire to grip the same mechanically and to hold the same in firm electrical contact wtih said terminals, said means comprising solder covering said end portions and adherently affixed to the surface of said terminals in said regions, said solder being limited to said regions and not extending away from said bobbin beyond the outermost of said flanges, whereby the surfaces of said rod-like terminals beyond said outermost flanges are substantially free of solder; and insulating encapsulating material surrounding said wire and the portions of said terminals adjacent to said bobbin and including both of said flanges of each of said terminals and a portion of each of said terminals beyond said outermost flanges.

2. A wire wound resistor comprising a generally cylindrical bobbin; a pair of conductive, rod-like wire end terminals inserted into opposite ends of said bobbin, each of said terminals having a pair of integral, radially extending, axially spaced flanges, one flange of each of said terminals being immediately adjacent to said bobbin; a resistive element comprising resistance wire wound around said bobbin with end portions of said wire wound around said rod-like terminals in the regions thereof between the respective pairs of flanges; means covering said end portions of said wire to grip the same mechanically and to hold the same in firm electrical contact with said terminals, said means comprising solder covering said end portions and adherently affixed to the surface of said terminals in said regions and substantially filling the space between said flanges, said solder being limited to said regions and not extending away from said bobbin beyond the outermost of said flanges, whereby the surfaces of said rod-like terminals beyond said outermost flanges are substantially free of solder; and insulating encapsulating material surrounding said wire and the portions of said terminals adjacent to said bobbin and including both of said flanges of each of said terminals and a portion of each of said terminals beyond said outermost flanges.

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