June 30, 1936. J. J. MUCHER 2,046,129

RESISTANCE UNIT

Filed Oct. 4, 1935

Fig. 1.

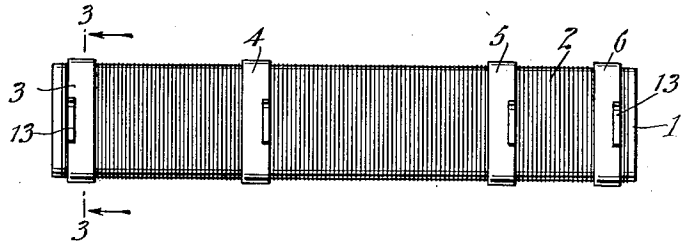


Fig. 2.

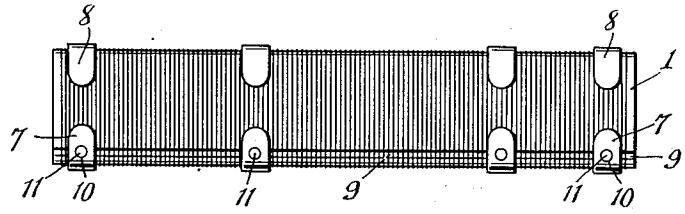


Fig. 6.

Fig. 3.

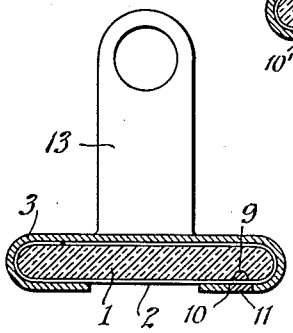


Fig. 4.

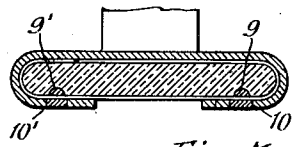
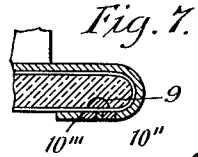


Fig. 7.



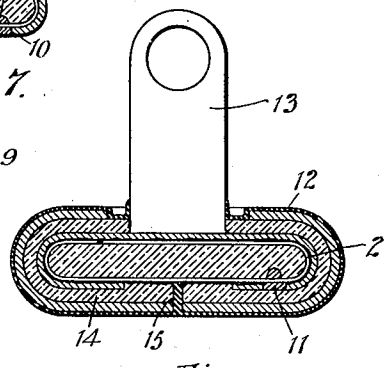


Fig. 8.

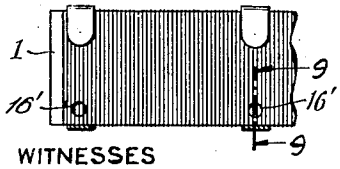


Fig. 5.

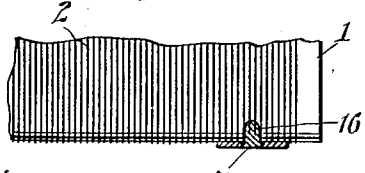


Fig. 9.

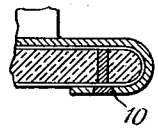
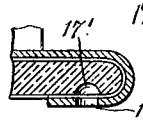


Fig. 10.



WITNESSES

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RESISTANCE UNIT

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9 Claims. (Cl. 201—67)

This invention relates to resistance units, and has for an object an improved construction wherein the resistance element is enclosed in an insulating and also a metal casing.

Another object of the invention is to provide a resistance unit wherein the parts are metal clad and wherein a coating of moisture resistance material has been applied.

A further and more specific object of the invention is to provide a resistant unit which may have the parts coated with a varnish or other moisture resistant material, and yet leave the resistance wire of the unit properly electrically connected with the respective terminals.

In the accompanying drawing—

Figure 1 is a plan view of a resistance unit with terminals thereon embodying certain features of the invention;

Figure 2 is a view of the opposite side of the resistance member shown in Figure 1;

Figure 3 is a transverse sectional view through Figure 1 on line 3—3, the same being on an enlarged scale;

Figure 4 is a view similar to Figure 3 but showing the completed resistance unit with its enclosing insulating members, enclosing metal casing and coating of moisture resistant material;

Figure 5 is a fragmentary view similar to one end of the structure shown in Figure 4, but disclosing a slightly modified form of the invention;

Figure 6 is a view similar to Figure 3 but showing a modified form of invention wherein there is provided two longitudinal grooves instead of one;

Figure 7 is a fragmentary view similar to the righthand portion of Figure 3, but showing a modified form of invention wherein two apertures are provided instead of one;

Figure 8 is a fragmentary bottom view similar to the lefthand end of Figure 2 except that the structure has been modified by the omission of the groove and the addition of apertures;

Figure 9 is a sectional view through Figure 8 approximately on the line 9—9;

Figure 10 is a view similar to Figure 7, but showing a modified form wherein there is provided a depression rather than a groove.

In forming resistance units heretofore, it has been customary to clamp terminals to a base having resistant wires wound thereon. This wire is usually made from chromium alloy though it may be made from other metal. Where the terminals are clamped in position, the connection is satisfactory and remains satisfactory usually for a long time. However, in the course of time moisture enters even where the wire has been covered with asbestos or other insulating material. This moisture in time disturbs the connection between the resistant wires and the terminals. This disturbance produces what is known as a noisy connection and affects in an objectionable way the action of the unit. Also in the metal clad resistance units now on the market the metal casing formed around the resistor or resistant element does not enclose the resistant element sufficiently tightly to prevent the entrance of moisture as there is always an open space left at the edges along the line where the metal is folded. Although the insulating jacket within the metal casing seems to cover up these spaces moisture will in the course of time creep into it and create a path from the resistant element to the casing and from the casing to the ground. In addition to these objections, leakage may develop by reason of the presence of moisture between the terminals of resistant units where terminals are in close proximity to each other. In order to overcome these objections it has been proposed to protect the parts against the action of the moisture by applying one or more coatings of varnish over the entire element. This may be done by dipping or applying with a brush and after the varnish has been applied it is proposed to subject the coated resistant unit to a drying heat at approximately 250 degrees Fahrenheit. This dries or bakes the varnish which may be any suitable varnish, as, for instance, a varnish on the market which uses asphalt as a base, though other forms of varnish may be used. This form of water proofing a resistance unit of the metal clad type is satisfactory so far as the moisture is concerned, but unfortunately the varnish creeps in between the resistant wires and the terminals clamped thereto and produces high resistance contact. To overcome all of these difficulties, namely, the difficulty of the action of moisture and the difficulty of the action of varnish, an improved construction of connection has been provided and illustrated in the accompanying drawing.

Referring to the accompanying drawing by numerals, 1 indicates a base of any suitable material, for instance a phenol condensation product, and on this base is provided a winding 2 of fine wire which may be of any desired material, as, for instance, chromium alloy wire. As illustrated in Figure 1, there has been provided terminals 3, 4, 5, and 6, terminals 3 and 6 being the respective ends, while terminals 4 and 5 are positioned at desired points intermediate the ends. All of these terminals have their respective ex-

tensions 7 and 8 turned over and clamped tightly in place so that if the unit was used with merely this clamping action to hold the terminals in contact with the wire it would work satisfactorily. However, if the varnish was applied, the same would find its way beneath the turned-over ends 7 and 8 and almost immediately produce a poor connection in all or most of the terminals. To obviate this condition, base 1 has been provided with a groove 9, and, if desired, a groove on each edge could be provided without departing from the spirit of the invention. In addition, the respective bent-over ends or extensions 7 of the respective terminals are each formed with one or more apertures 10 which is directly above or opposite the groove 9. As it is almost impossible to solder chromium alloy wire to metal terminals, the addition of solder around the terminals would be of no effect. However, as the respective apertures 10 are directly opposite the groove 9, a drop of solder may be placed in these apertures and then melted by having a soldering iron applied thereto. This will cause the solder to flow downwardly into the groove 9 and surround a number of wires of the coil 2 as illustrated by the solder 11 in Figure 3. It will be noted that this solder fills the aperture 10 and also fills the groove 9 and a number of the wires are embedded therein. The characteristic of solder similar to many other metals is to slightly shrink when it is cold. By reason of this characteristic the solder after it has been melted and flowed in place will chill and will shrink slightly so as to firmly grip the wires embedded therein. This gripping action is sufficient to provide a perfect electrical contact and also sufficiently strong and close as to prevent the entrance of varnish between the solder and the wires. As indicated in Figure 4, the varnish penetrates and contacts with the winding 2 at substantially all points except where these wires are embedded in the respective lumps of solder 11. As indicated in Figure 4, the coating 12 is intended to represent the varnish which has been baked and which covers not only the outside of the unit except the upper end 13 of the respective terminals, but passes into and around the insulation 14 and through the opening 15 where it spreads so as to cover winding 2 and even penetrate beneath all the turned-over extensions 7 and 8 except where the solder 11 is positioned. As heretofore mentioned, one groove 9 has been found to be entirely satisfactory though a groove coacting with the ends 8 could be used if necessary. Also other variations of the same idea could be utilized, as, for instance, base 1 could be provided with a notch 16 (Fig. 5) at the edge opposite each of the terminals and solder 17 applied in this notch in the same way that the solder 11 is applied in notch 10 whereby some of the solder will enter the notch 16 and embed all of the wires extending therein so as to provide a good electrical connection and one which can not be penetrated by the varnish. In operation, ordinarily a piece of cold solder and a suitable flux is applied to each of the apertures 10, the same being provided in the proper amount so that when a soldering iron contacts therewith the solder will melt and flow as illustrated in Figure 3. As is well known, solder will flow freely only on a solid heated surface and therefore it will not go beyond the edges of the respective terminals and onto the adjacent wires unless the solder is in excessive amount which can never happen as a correct amount is always applied before the soldering iron is used.

Instead of having a single groove as shown in Figure 2 of preferred form, two or more grooves might be used, and also an ordinary plain hole for each terminal. In addition, if desired, a depression may be made in the base material on which the wire is wound. These and other structures may be utilized without departing from the spirit of the invention. In order to bring out more clearly how the same inventive idea may be differently embodied, Figure 6 has been presented and illustrates 9 and 9' which are identical as shown in Figure 3 except they are on opposite sides of the base 1. In this form of invention, there are provided apertures 10 and 10' as the case may be for each of the respective bent-over ends 7 and 8. A solder filling is provided for each aperture above each groove. Instead of having the arrangement as shown in Figures 3 and 6, another arrangement might be used, namely, the groove 9 with a pair of apertures 10'' and 10'''.

In Figures 8 and 9, it will be observed that the base 1 is provided with spaced apertures 16', said apertures being positioned opposite the respective apertures 10 so that solder or lead may be used, as illustrated in Figure 9. Sufficient solder may be used to fill the respective apertures, and, if desired, to extend entirely through base 1 so as to impinge against and surround the wires on the opposite side as well as the wires on the side of the aperture 10.

A further embodiment is shown in Figure 10 wherein is provided merely a depression 17', said depression being opposite the aperture 10 so that solder may be applied as heretofore described. In all of these forms of invention, the action of the solder is the same and produces a good mechanical, as well as an electrical connection, between the terminal and the resistance wire. This connection is such that varnish can not enter between the solder and the wire.

I claim:

1. A resistance unit comprising a base of insulating material, a wire resistant element wound on the base, a plurality of terminals, each terminal being formed with an upstanding member and a base member having extensions bent over and clamped to the underside of the resistance element and first mentioned base, one of the bent-over extensions of each of said terminals having an aperture, said first mentioned base having a groove extending opposite said apertures and a filling of solder for each of the apertures, said solder surrounding and embedding certain of the turns of said unit resistance element.

2. A resistance unit, including a resistance element formed with an insulating base and winding of resistance wire, a plurality of terminals carried by said resistance element, each of said terminals having an aperture, said base having a groove extending beneath each of said apertures and a filling of solder filling each of said apertures and the groove adjacent thereto, said respective fillings of solder surrounding and embedding certain of the turns of said wire for electrically and mechanically connecting the wire with the respective terminals.

3. A resistance unit, including a resistance element having a base of insulating material and a resistance wire wound thereon, and a terminal applied to said base, said terminal having an aperture therein, said base having a depression opposite said aperture and a filling up of solder-

ing filling said aperture and the depression opposite the aperture, said filling of solder surrounding and embedding certain of the turns of said wire for electrically connecting the wire with the terminal.

4. A resistance unit, comprising a resistance element having a base and winding a resistance wire thereon, said base having a groove extending longitudinal thereof whereby each turn of said wire extends across the groove, a plurality of terminal members carried by said resistance element and extending across said groove while resting on a number of turns of said wire, each of said terminals having an aperture opposite said groove, a filling of solder filling each of the apertures and that portion of said groove adjacent thereto, each of said fillings of solder completely surrounding and embedding a section of a number of turns of said wire, an insulating covering for said element, said insulating covering also enclosing that part of the terminals which engage said resistance element, a metal sheathing for said insulating covering and a water-proof coating for said sheathing said coating penetrating to a position within the insulating covering, and covering all of said resistance elements and terminals in contact therewith except the parts of the wire surrounded and embedded in said solder.

5. A resistance unit, including a resistance element comprising the base and a winding of resistance wire, said base having a notch in one edge into which certain turns of said wire extend, a terminal member positioned so that a part will fit over said notch, said part having an aperture opposite said notch and a filling of solder filling said aperture and said notch, said solder surrounding and embedding that portion of said winding which extends into said notch.

6. A resistance unit comprising a piece of insulating material, having a groove in one face thereof, a winding of resistance wire on said base positioned so as to extend across said groove, a terminal with an apertured extension positioned on said base so that said aperture will be positioned opposite said groove, a filling of solder filling said aperture and said groove adjacent the aperture and surround and embed that portion of said wire between said aperture and said groove.

7. A resistance unit, including a resistance element formed with an insulating base and a winding of resistance wire, said base being formed with a depressed portion or portions over which the wire extends, a plurality of terminals carried by said resistance element, each terminal being formed with a base portion gripping said resistance element and having a part overlapping the depressed portion or portions of said base, said overlapping part having an aperture and a filling of solder filling each of said apertures and said depressed part or parts adjacent thereto, the respective fillings of solder surrounding and embedding certain turns of said wire for electrically and mechanically connecting the wire with the respective terminals.

8. A resistance unit, including a resistance element formed with a rectangular insulating base and a winding of resistance wire thereon extending from one end of the base to the other, a plurality of metallic terminals carried by said resistance element, each of said terminals having a terminal extension and a base partly surrounding and clamping said resistance element, said insulating base having a groove on one face adjacent each longitudinal edge, the base of the respective terminal overlapping said grooves, said overlapping part for each terminal having an aperture arranged in line with the respective grooves and a filling of solder for each aperture, each of said fillings of solder surrounding and completely embedding certain turns of said wire for electrically and mechanically connecting the wire with the respective terminals.

9. A resistance unit, including a resistance element formed with a rectangular insulating base and a winding of resistance wire thereon, said base having a number of spaced apertures extending therethrough, a terminal for each of said apertures, each of said terminals having a gripping portion gripping said resistance element and overlapping the respective apertures, the overlapping parts of said terminals having apertures in line with the apertures in said insulating base and a filling of solder for each of said apertures, said filling of solder completely filling the apertures and surrounding and embedding completely short sections of certain turns of said wire for electrically and mechanically connecting the wire with respective terminals.

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