

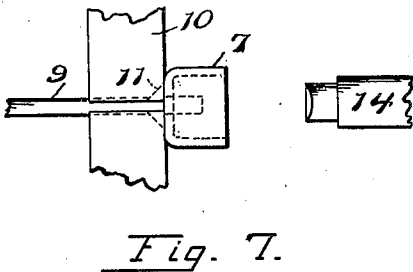
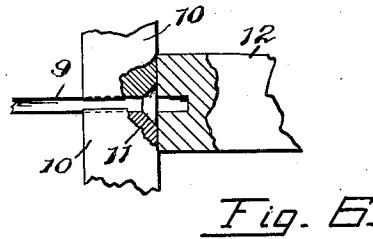
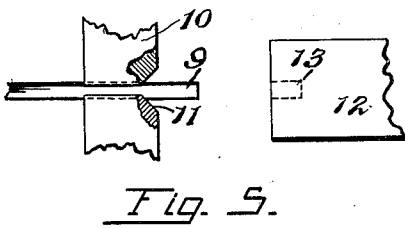
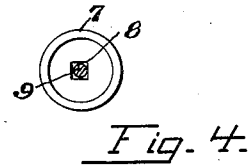
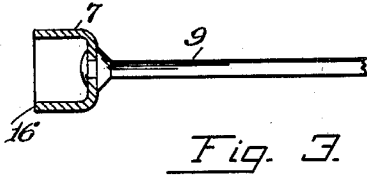
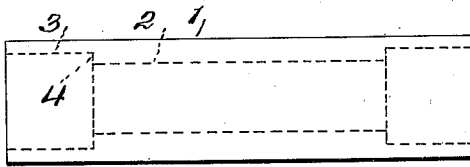
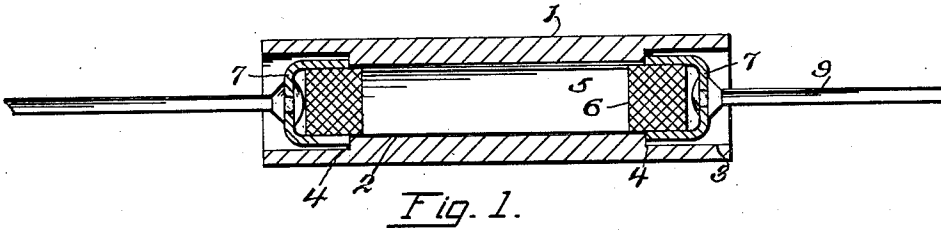
July 7, 1936.

B. B. MINNIUM

2,046,922

RESISTOR UNIT

Filed Nov. 22, 1934



Inventor

Hyron B. Minnium

By *W. J. Swire*

Attorney

UNITED STATES PATENT OFFICE

2,046,922

RESISTOR UNIT

Byron B. Minnium, Erie, Pa., assignor to Erie Resistor Corporation, Erie, Pa., a corporation of Pennsylvania

Application November 22, 1934, Serial No. 754,356

14 Claims. (Cl. 201—63)

This invention is directed to an improved electrical resistance unit wherein provision is made for connecting the wire leads to the resistance unit proper while at the same time insuring and maintaining the proper assembly and relation of the resistance unit parts.

The primary object of the present invention is the provision of a conventional resistance unit made up of an insulating casing and an independent resistor wherein the wire lead terminals are in the form of caps designed for frictional cooperation with the ends of the resistor core and serve, when in position, to prevent relative endwise movement of the insulating casing whereby, through the application of the caps, the terminal leads are connected and the resistance unit parts held in assembled relation.

A further object of the invention is the provision of means for connecting the terminal lead to the cap of the resistance unit to insure positive electrical conductivity and rigid relation between the cap and wire.

The invention is illustrated in the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view through the improved unit, the resistance element proper being shown in elevation.

Figure 2 is a view in elevation of the insulating tube or casing.

Figure 3 is a longitudinal section view of the cap and connected lead wire.

Figure 4 is an elevation of the cap, showing the wire in place prior to the heading operation.

Figure 5 is an elevation of the means for initially forming the terminal lead for connection with the cap.

Figure 6 is a similar view showing the completion of the end of the terminal lead.

Figure 7 is a view in elevation showing the completion of the connection between the terminal lead and the cap.

The improved resistance unit assembly includes a tubular casing 1 which is, of course, insulated and may be constructed of any appropriate material, such as "bakelite", porcelain or the like. The tube has a longitudinal bore 2 for the convenient reception of the resistance element, the bore at the ends of the tube being enlarged at 3 to provide, with the main length of the bore, shoulders 4.

The resistor, indicated at 5, is of any conventional or desired construction having low resistance ends 6 provided in any appropriate or desired manner, the sole requisite for the purpose of the present invention being that the diameter of

the resistor be such as to be conveniently fitted within the bore 2 of the tube and the length of the resistor such that the low resistance ends project into the enlarged portions 3 of the bore.

The resistor is completed through the application of caps to the ends of the resistor proper, which caps form permanent terminals of the lead wires. These caps are of cup-like shape, as indicated at 7, provided with axial openings 8 in the end wall, which openings are of non-circular form in outline. The wire leads 9 are, in the application of the caps thereto, held between the jaws 10, which jaws at one end are formed with a conical enlargement 11 of the wire gripping channel between the jaws.

The wire lead is held between the jaws with one end projecting an appropriate distance beyond the conical enlarged recess and a forming die 12 having a central recess 13 corresponding in diameter to the normal diameter of the wire and in length to whatever length is desired as an unformed projection for heading purposes, is forced against the projecting end of the wire, causing such projecting end to be forced to the desired length with the excess metal forced into the conical enlargement 11 of the holding recess between the jaws. The end of the wire is thus provided with a conical enlargement and with a projection beyond the enlargement of a determinate length and of the normal round shape of the wire.

As the opening 8 in the cap is non-circular in form and as the normal dimensions of this opening 8 are such as to conveniently permit the passage of the rounded end of the wire therethrough, as indicated in Figure 4, it will be apparent that with the wire passed through the opening 8 and projecting within the interior of the cap a determinate distance, the use of a riveting tool, as 14, which is preferably rounded in active surface, will cause the projecting end of the wire within the cap to be headed on the inner surface of the head of the cap and during the heading excess wire incident to the heading displacement operation will fill the opening 8 in the cap end.

Thus, the cap end is held between offsets or enlargements of the wire and the wire within the plane of the opening 8 is forced to assume a shape corresponding to that of the opening. The wire and cap will thus be rigidly connected and prevented from any relative rotative movement, as will be obvious.

The wire leads with the terminal caps are then applied to the resistance unit within the tube. The relative diameters of the open ends of the

caps and of the ends of the resistance unit are such that the caps are forced onto the resistor ends with sufficient pressure to maintain a substantially rigid frictional grip of the caps on the ends of the resistance unit.

The maximum diameter of the caps, that is more particularly the thickness of the wall of the cap, is such that when the caps are in place on the ends of the resistance unit, the ends of the walls of the caps, indicated at 16, will abut the shoulders 4 at the juncture of the enlarged portions 3 in the main bore 2 of the tube.

Thus, the caps practically lock the resistance unit and tube in desired relation, holding the resistance unit and tube against possibility of endwise relative movement while at the same time providing for simple disconnection of the parts when necessary by the removal of one cap or the other which will obviously permit free endwise movement of the resistance unit within the tube for separation.

Thus, by the mere assembly or association of the particular caps on the ends of the resistance unit proper, the assembly is completed and held against disconnection and the wire leads are rigid with respect to the assembly by reason of their rigid relation with the caps. Of course, the caps are of conducting material but, aside from this requisite, may be made up as desired, so long as they present the characteristics above noted.

The insulating tube 1 may be coded to indicate resistance value and/or type of resistance prior to assembly of the parts.

It is to be noted from the above description that, by reason of the stepped formation of the bore of the casing 1, provision is made for receiving the thickness of the cap, in addition to utilizing the cap for cooperation with the shoulders 4, as previously described. By this arrangement, the resistor proper 5 is permitted to closely fit the main length of the longitudinal bore 2, as clearly shown in Figure 1. This presents an important and desirable advantage in resistors of this type, for by this construction the body of the resistor proper is in more intimate contact with the wall of the casing, permitting better heat conduction to the casing and thus better heat radiation from its outer surface. In this respect, the invention is clearly to be distinguished over that type of resistor in which the resistor proper with end caps is inserted in the tube or casing, for in the latter case the thickness of the caps compels a material spacing of the body of the resistor proper from the wall of the bore of the tube. This, of course, interposes an air space between the resistor and tube which reduces heat conduction through and radiation beyond the tube.

What is claimed to be new is:

1. A resistance unit assembly including an insulating tube formed with a bore enlarged at the ends to present shoulders, a resistance element fitting within said bore and having its ends projecting within the enlargements of the bore, and caps frictionally engaging the projecting ends of the element and overlying and bearing against the shoulders.

2. A resistance unit assembly including an insulating tube having a main bore, a resistance element freely slidable in and with substantial contact with the wall of the main bore of the tube, caps fitted over the ends of the element and frictionally held therewith, and cooperating means on the caps and within and beyond the main bore of the tube to prevent relative endwise

movement of the tube with respect to the element when the caps are in place.

3. A resistance element including an insulating tube having a main bore, a resistance element freely slidable within and substantially in contact with the main bore of the tube, caps engaging the ends of the element within the tube and interlocking with the tube and beyond the main bore to prevent relative endwise movement of the tube and element, and wire leads rigidly connected with the caps.

4. A resistance element including an insulating tube having a main bore, a resistance element freely slidable within and substantially in contact with the main bore of the tube, caps engaging the ends of the element within the tube and interlocking with the tube and beyond the main bore to prevent relative endwise movement of the tube and element, and wire leads rigidly connected with the caps, said wire leads having a non-turning connection with the caps.

5. A resistance unit assembly including an insulating tube, a resistance element of less length than the tube and slidably fitted therein in substantial contact with the tube, and terminal members engaging and carried solely by the resistance element and interlocking with the tube within and inwardly of the ends of the tube.

6. A resistance unit assembly including an insulating tube and a resistance unit arranged in said tube, said resistance unit including a resistance element and end members carried solely thereby, the interior of the tube being formed to receive the resistance element and maintain it in substantial contact with the tube and to receive the end members of such resistance unit to interlock the resistance element against endwise movement in either direction relative to the tube without interfering with the substantial contact between the resistance element and tube.

7. A resistance unit assembly including an insulating tube formed with a main bore circumferentially enlarged at its ends to provide shoulders, a resistance unit including a resistance element slidably fitting within the main bore in substantial contact with the wall thereof, and terminal members carried solely by such element and fitted within the main bore enlargements to provide an interlock within the tube to prevent relative endwise movement of the resistance unit in either direction relative to the tube.

8. A resistance unit assembly including an insulating tube, a resistance element fitting within the bore of the tube and in substantial contact with the wall thereof, and means carried by the ends of the element to interlock with the tube circumferentially and outwardly beyond that part of the tube receiving the resistance element, said means frictionally engaging the resistance element.

9. A resistance unit assembly including an insulating tube formed with a bore, a resistance element slidably fitting within and in substantial contact with the wall of the bore, and locking means to prevent relative endwise movement of the resistance element with respect to the tube, said locking means being frictionally held to the resistance element and interlocked with the tube at points beyond the bore of the tube and within the length thereof.

10. A resistance element including a resistor, end members carried solely by the resistor, and an insulating tube surrounding the end members and resistor, said tube being in substantial contact with the resistor intermediate the end mem-

bers and being interiorly formed to engage the end members and prevent the movement of either in a direction toward the other, whereby the resistor is held within the tube against longitudinal movement in either direction.

11. A resistor element including a resistor, conducting members fitted over the ends of and carried solely by the resistor, and an insulating tube within which the resistor and conducting ends are housed, the tube being in substantial contact with the resistor intermediate the conducting end members and formed beyond the resistor engaging portion to interlock with the respective end members and prevent their independent movement, one toward the other, whereby through the engagement of the end members with the resistor and the interlocking of the end members in the tube, movement of the resistor in either direction longitudinally of the tube is prevented.

12. A construction as defined in claim 11, wherein the overall length of the tube is at least commensurate with the overall length of the resistor including the end members.

13. A resistor unit including an insulating tube, the main bore of which is engaged at the ends, and a resistance element complete in itself and including a resistor body and end members mechanically connected with the body, said resistance element being fitted within the tube, with the resistor body substantially fitting the normal bore of the tube and the end members fitted within the enlarged portion of the bore to prevent longitudinal movement of the resistor body in the normal bore of the tube in either direction.

14. A construction as defined in claim 13, wherein the end members are wholly free of mechanical connection with the tube.

BYRON B. MINNIUM. 20