April 18, 1933. C. L. LYON ET AL 1,904,487

RESISTANCE UNIT

Filed May 1, 1929

Fig. 1.

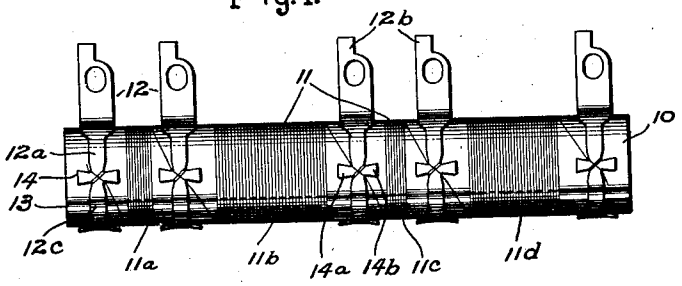
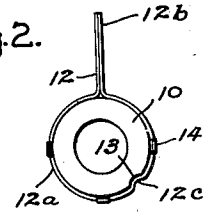


Fig. 2.



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UNITED STATES PATENT OFFICE

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RESISTANCE UNIT

Application filed May 1, 1929. Serial No. 359,650.

Our invention relates to resistance units or the like, more particularly to resistance units in which can electrical conductor is wound upon a cylindrical supporting member, and has for its object the provision of an improved resistance unit of this character wherein the terminal members are secured so that there will be no danger of their being displaced about the cylindrical support.

Although it obviously has other applications, our invention is particularly useful in connection with resistance units of the tubular type, such as used in radio apparatus, wherein a resistance conductor is wound upon a tubular insulating support and covered with a protective insulating coating, such as vitreous enamel, which is fused at a comparatively high temperature.

It has heretofore been customary in many instances to provide the resistance unit with ring or band-like terminal members spaced longitudinally of the tube, the resistance conductor being secured to the terminals and wound with the required number of turns between adjacent terminals. Generally the entire resistance unit is covered with the protective insulating coating, such as a coating of vitreous enamel.

It will be understood that in applying this coating it is necessary to fuse or bake the enamel in an oven at a comparatively high temperature. Heretofore it has been found that band or ring-like terminals would slip or turn about the cylindrical support during this fusing operation. Thus, during the fusing operation the bands expand to such an extent that they practically float upon the cylindrical support. By reason of the uneven surface tension of the vitreous enamel or of the spring action of the coiled conductor or by reason of both of these forces acting jointly, the floating terminals would be displaced about the tubular support. As a result of this action, the terminals of the finished unit would be displaced and moreover, the conductor was very apt to be torn, particularly where a very fine high resistance conductor was used. Moreover, it has been found heretofore that when a large conductor was used, the spring action of the coiled conductor would turn the terminals about the tubular support particularly those located adjacent the ends of the unit. As a result, the conductor was no longer secured against the outer surface of the support and the terminals were permanently displaced.

In carrying our invention into effect in one form thereof, we provide each of the terminals with an inwardly projecting portion which will be received by a cooperating depression in the cylindrical support. To accommodate conveniently a number of terminals and to provide for their ready adjustment lengthwise of the unit, we provide the support with a longitudinally extending recess for receiving the terminal projections.

For a more complete understanding of our invention, reference should be had to the accompanying drawing in which Fig. 1 is an elevation of a resistance unit embodying our invention; and Fig. 2 is an end elevation of the resistance unit.

Referring to the drawing, we have shown our invention in one form in connection with a resistance unit of relatively high resistance and low current carrying capacity for use in radio and like circuits. As shown, the resistance unit comprises a tubular electrically insulating support 10 upon which a resistance conductor 11 is wound so as to provide a plurality of longitudinally spaced resistance sections 11*a*, 11*b*, 11*c* and 11*d*. It will be understood that the number of conductor turns in each section will determine the amount of resistance in the section.

Preferably, the tubular support 10 will be formed of a suitable ceramic compound such as porcelain. The resistance conductor 11 will be formed of a material suitable to give the desired resistance characteristics. Thus, if a very high resistance is desired, the conductor may be formed of a nickel-chromium-iron alloy having an iron content of approximately 25% and a chromium content of approximately 11% If a lower resistance is desired, the conductor may be formed of a copper-nickel alloy having a copper content of approximately 55%. If a still lower resistance is desired, a nickel-man-

ganese alloy having a 1 to 2% manganese content may be used.

The resistance unit is provided with a plurality of terminals 12, a terminal being positioned adjacent each end of the unit and a terminal being positioned between each resistance section. Thus, it will be observed that each resistance section is provided with a pair of end terminals.

Preferably, the terminals will be stamped from a suitable ductible, sheet, electrical conducting material such as copper. Each terminal is provided with a ring-like portion 12*a*, which will be encircled about the resistance conductor, and with a projecting terminal portion 12*b*. The stamped terminal strip will be of such length that in mounting it upon the tubular support, its intermediate portion will form the ring-like connection portion while its two end portions will be bent outwardly substantially at right angles to the ring connection portion. These outwardly projecting end portions may be secured together in any suitable manner. Thus, these ends may be spot welded. Preferably, the terminal portion 12*b* will be suitably apertured so that the external connections may be effected conveniently.

In order to prevent the terminals from turning or slipping about the cylindrical support, I provide the ring-like portion 12*a* of each terminal with an inwardly projecting portion 12*c*. In order to accommodate the inwardly projecting portions 12*c* of the terminals, the tubular support 10 is provided in its outer surface with a recess 13 extending longitudinally of the tube. This recess 13 will serve to receive the projecting portions 12*c* of the terminals so that the terminals will be securely interlocked with the support. It will be observed, therefore, that each terminal will be locked against rotation upon the tubular support. It will be understood that the support is provided with a recess extending longitudinally throughout its length in order that the terminals may be readily adjusted longitudinally of the unit, and because the manufacturing process is facilitated. However, the tubular support 10 may be provided with a number of recesses or depressions, each depression being provided for receiving the lug 12*c* of one of the terminals.

Each terminal is also provided with a plurality of circumferentially spaced conductor securing means such as projections or lugs 14. Thus, the conductor may be secured to any of the circumferentially spaced lugs as is necessary to afford the proper resistance of the conductor section. It will be observed that by reason of these circumferentially spaced lugs, the conductor may be connected at any of a plurality of points within the length of a single turn of the conductor thereby affording a ready means for accurately fixing the resistance per section. Preferably, and as shown, each of the terminal securing means 14 will comprise a pair of ears or lugs 14*a*, 14*b* arranged in juxtaposition lengthwise of the unit, in other words projecting lugs extend from opposite sides of the terminal ring-like portion. The conductor will be secured to these ears or lugs so that the conductor lengths leading to and from the securing means will be held closely against the outer surface of the tubular support. Moreover, the conductor will be secured so that its entire length will be properly covered with the insulating coating.

Thus for instance, the conductor length leading from the resistance section 11*b* toward the right of the unit, as viewed in the figure, will be passed under the nearest lug 14*a*, thence upwardly and over the outer surface of the ring-like portion 12*a* in a diagonal direction to the upper edge of the lug 14*b*, thence downwardly and under the lug 14*b*, thence upwardly and diagonally across the outer surface of the ring-like portion 12*a* to the upper edge of the lug 14*a* and thence under this lug and back across the ring-like portion 12*a* to the upper edge of the lug 14*b* from which it will be passed under the lug 14*b* to the next resistance section 11*c*. Thus, the conductor will be wound or wrapped about the juxtaposed lugs so as to form a reverse loop simulating a figure 8, the opposite end portions of this loop being secured between the lugs 14*a* and 14*b*, respectively, and the outer surface of the tubular support. It will be understood that the lugs will be spaced from the outer surface of the tubular support so that while permitting conductor to pass beneath them, the conductor will be pressed closely against the tubular surface. It will be observed that by reason of this arrangement, the conductor lengths leading to and from the securing means will be forced into intimate contact with the outer surface of the tubular support and moreover, that the portion of the conductor length forming the loop will be secured in closed contact with the terminal member. It is desirable although not indispensable to solder the conductor lengths which cross the terminal member. Preferably, silver solder should be used. It will be understood that the solder by completely covering this portion of the conductor prevents oxidation of the conductor during the enameling process and thereby insures good electrical contact between the conductor and the terminal.

The entire resistance unit is provided with the vitreous enamel coating. As has been pointed out, resistance units of this character were more or less objectionable because often-times the terminal bands slipped or

turned about the tubular support while the vitreous enamel was being fired. By reason of this, the terminals of the finished unit were displaced and moreover, often-times the resistance conductor was broken.

It will be observed that we have securely locked our terminals 12 so that it is impossible for them to be rotated about the tubular support. Thus, by reason of the inwardly projecting portion 12c formed upon the ring-like portion of each terminal together with the recess 13 provided to receive these inwardly projecting portions, any rotation or turning of the terminals is prevented. Thus, there is no likelihood of the resistance conductor being torn during the enamel firing process and, moreover, in the finished resistance unit the terminals will be secured in their proper positions upon the tubular support and the conductor will be rigidly secured throughout its entire length.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. A resistance unit or the like comprising a substantially cylindrical support provided with a longitudinal recess and a terminal for said unit comprising a portion embracing said cylindrical support so that it is secured thereon and a portion projecting into said recess whereby the terminal is secured against rotation on said support but can be readily adjusted longitudinally thereof.

2. The method of making a resistance unit or the like which comprises forming a cylindrical support with a depression therein, winding on said support an electrical conductor, providing a cylindrical terminal for said support formed with a reentrant portion to fit in said depression and placing said terminal on said support with its reentrant portion fitted in said depression, securing said conductor to said terminal, then covering said conductor and terminal with an insulating enamel and then heating said enamel to fuse it to said support while preventing movement of said terminal on said support.

3. The method of making a resistance unit or the like which comprises providing an electrically insulating cylindrical supporting member formed with a groove extending lengthwise thereof, providing ring-like terminals formed with a reentrant projecting portion to fit said recess, arranging said terminals on said support in spaced relation with said projecting portions fitted in said recess, winding a resistance conductor on said support in the spaces between said terminals and securing intermediate portions of said conductor to said terminals, covering said conductor and terminals with a vitreous insulating enamel and then heating said enamel to fuse it on said support.

4. A resistance unit or the like comprising a tubular support provided with a recess in its outer surface extending longitudinally thereof, a plurality of terminals mounted in spaced relation upon said tubular support, each of said terminals being provided with a portion projecting into said recess whereby each terminal can be readily adjusted longitudinally of said support, and an electrical conductor wound upon said support and secured to each of said terminals.

5. A resistance unit or the like comprising a tubular electrically insulating support provided with a recess in its outer surface extending longitudinally thereof, a plurality of terminals spaced longitudinally of said support, each terminal being encircled about said tubular support and having a portion projecting inwardly so as to be received by said recess whereby the terminal is secured against rotation but can be readily adjusted longitudinally of said support, and an electrical conductor wound upon said support and secured to said terminals.

6. A resistance unit or the like comprising a tubular electrically insulating supporting member provided with a recess in its outer surface extending longitudinally thereof, a plurality of terminal members spaced longitudinally of said tubular supporting member, each of said terminals being provided with a ring-like portion encircling said cylindrical support and having a portion projecting within said recess whereby each terminal is secured against rotation on said support but can be readily adjusted longitudinally thereof and a resistance conductor wound upon said tubular supporting member so as to form a plurality of longitudinally spaced sections between said terminal members.

7. The method of making a resistance unit or the like which comprises forming a cylindrical support with a depression in its surface, providing a substantially cylindrical terminal with a reentrant portion arranged to fit in said depression, placing said terminal on said support with its reentrant portion fitted within said depression and then winding said conductor on said support and securing the conductor to said terminal.

In witness whereof, we have hereunto set our hands this 30th day of April, 1929.

CLINTON L. LYON.
CLAUDE A. JAGGER.