Dec. 12, 1950 J. J. CERNY 2,533,876

ELECTRICAL RESISTOR CONSTRUCTION

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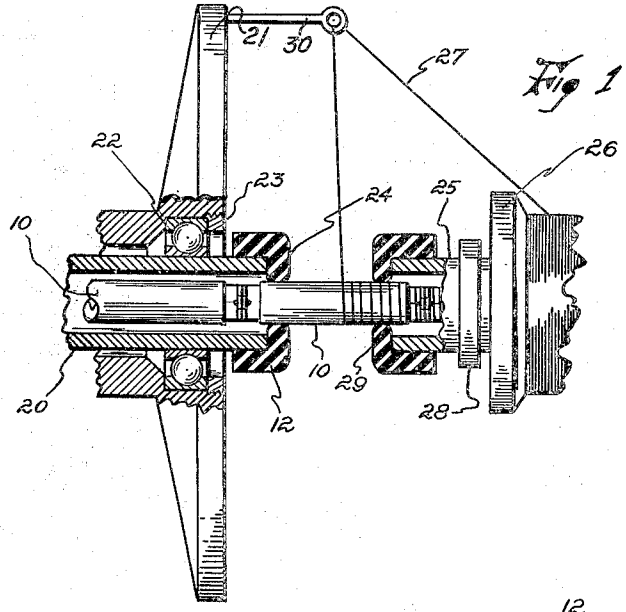


Fig 1

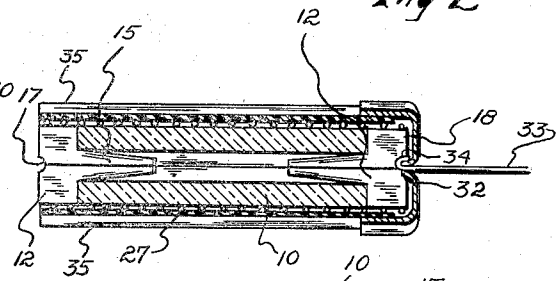


Fig 2

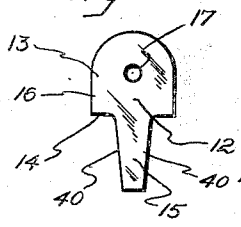


Fig 3

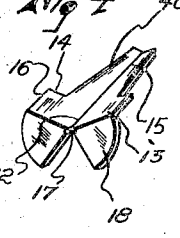


Fig 4

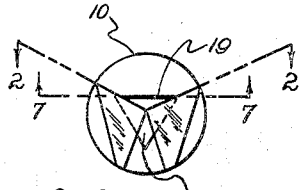


Fig 5

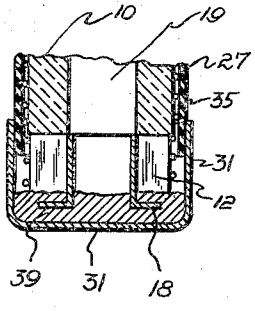


Fig 7

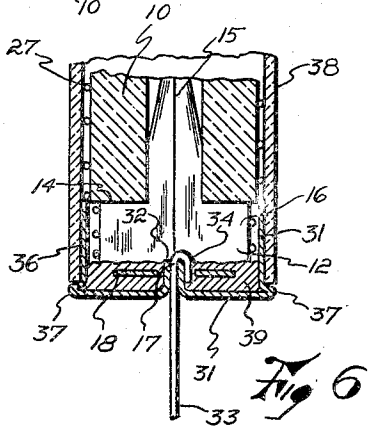


Fig 6

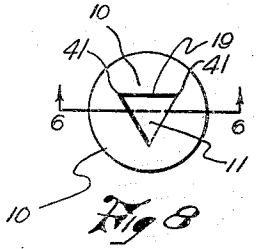


Fig 8

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ELECTRICAL RESISTOR CONSTRUCTION

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9 Claims. (Cl. 201—67)

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This invention is directed to novel resistors, particularly of the type adapted for use in a wide variety of electrical devices, electrical apparatus, electrical circuits and appliances. It is more primarily directed to novel structural features which provide a more suitable adaptation of the elementary, unfinished structure to the process of mechanically winding convolutions of a resistance wire thereon.

It is an important object of my invention to provide resistors which have an elongated, rounded or cylindrical body, which is composed of a non-conductive material, on the ends of which are terminal end units having a length which is equivalent to the diameter of the core.

It is a further object of my invention to provide resistors in which a novel end unit is mounted on the ends of the resistor core and retained thereon due to the cooperation of the structure of said end unit and said core.

A further object of my invention is the provision of a means for precluding the slipping off of the resistance wire from the core of said resistor by employing terminal end members of unique design.

It is a further object of my invention to provide a resistor in which there is a core body composed of suitable non-conductive material with terminal end members mounted therein, in which the terminal end members provide the means for anchoring the ends of a resistance wire which is wound around said core body.

A further object of my invention is to provide a core body which may be laid in an end to end relation with other core bodies, separated only by the terminal end members mounted on the ends thereof, so that production line method of producing resistors is facilitated thereby.

It is a further object of my invention to provide a resistor having a uniform length of effective resistance wire wound upon the core body thereof; and precluding the unwinding of the resistance wire wound upon the core body by providing metal end caps in which the terminal end members are mounted.

A further object of my invention is to provide a novel resistor which includes a core body; a uniform length of resistance wire wound thereon; terminal end members mounted on the ends of said core body, and which provide temporary anchoring means for the ends of the resistance wire; metal end caps which are mounted on the terminal end members and secured thereto by means of a fusible metal of predetermined size.

It is a further object of my invention to provide

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a novel resistor having the herein recited structures and in one form thereof which is provided with a metal end cap having an integral, peripheral flange thereon which provides an abutment for a glass or other non-conductive sleeve placed over the core of said resistor, and the resistance wire wound thereon.

It is a further object of my invention to provide a resistor which includes terminal end caps mounted on the ends thereof, and in each of which cap a terminal circuit wire has been securely mounted, said circuit wires being retained by a fusible metal. It is a further object of my invention to provide, in a resistor, metal end caps mounted on the ends thereof which has an inwardly projecting flange so as to create a reservoir between said inwardly projecting flange and the wall of said metal end cap so that a pigtail wire may be anchored in said cap by using a pellet of a fusible metal.

It is a further object of my invention to provide a method for making resistors in which the unexposed ends of circuit wires are each mounted in a terminal end cap having an inwardly projecting annular flange, by means of a fusible metal, which in its fused state will not flow out of the cap through the opening defined by said annular flange.

Other and further important objects of my invention will be apparent from the following descriptions and appended claims.

Referring to the drawings:

Fig. 1 is a partial elevational view of one mechanism to which my core and terminal end assembly is adaptable for winding of resistance wire thereon.

Fig. 2 is a sectional view of the core after winding of the resistance wire thereon with one end cap mounted on the core taken substantially on the line 2—2 of Fig. 5.

Fig. 3 is a view of the terminal end member before being shaped for use.

Fig. 4 is an oblique detail view showing my end member ready for insertion into the core.

Fig. 5 is an end view of the core with an end member inserted.

Fig. 6 is a detail central longitudinal sectional view of one end of my resistor taken substantially on the line 6—6 of Fig. 8, after mounting the end members and caps thereon.

Fig. 7 is a detail eccentric longitudinal sectional view of one end of one modified form of my resistor, taken substantially on the line 7—7 of Fig. 5, after mounting the end caps thereon.

Fig. 8 is an end view of the core.

Referring to the drawings, numeral 10 represents a core, body or member which is preferable cylindrical or rounded. The core 10 is preferably composed of a suitable non-conductive material such as porcelain. As illustrated in Fig. 8 in cross section, preferably an equilateral triangular passage is positioned substantially centrally with respect to the longitudinal axis of said core 10 so that a triangular hole 11 is present at each end of said core. It is to be understood that the holes 11 need not be triangular, but I have found that this shape is better adapted to the purpose for which it is used, and to be hereinafter described.

Numeral 12 represents an electrically conductive terminal end member or unit. After stamping, before it has been bent and shaped to adapt said member 12 for the purpose and function it is to perform and to be hereinafter described, said member preferably is of a form illustrated in Fig. 3. In its initial form, the end member 12 is preferably flat and preferably includes an upper ovate-like body portion 13 with a rounded upper edge. The rounded edge of the ovate-like body portion 13 preferably merges into two parallel integral edges 16, which edges 16 in turn merge into oppositely extending shoulders 14. An integrally formed shank or portion or holding member 15 extends inward from the body portion 13. A hole or space 17 is preferably formed at the geometric center of the body portion 13.

The procedure I employ in the preparation of the end member 12 for use is to cut the ovate body portion 13 substantially along its longitudinal axis down to the hole 17, and bend the portion thus cut substantially 90° from the longitudinal axis so that substantially one half of the hole 17 is at a right angle to the other half thereof. I also bend the member 12 along its entire central longitudinal axis so that an angle sufficiently small is formed at the inner end of the shank 15 to facilitate ease of insertion of said shank into said core; and one of which is sufficiently large at the outermost end of said shank, where said shank merges with the shoulders 14 to cause each of said members 12 to be frictionally retained in the respective ends of the core 10 when said members 12 are inserted in the holes 11 respectively so that the shoulders 14 are in abutment with the annular end faces of the cores 10 respectively. It is to be understood that the inherent nature of the metal causes the bent shank 15 to produce a spring-like tension which aids in retaining end members 12 in their respective core openings. In its employed form, each member 12 has preferably two integral extensions or outer portions or members 18 which are parts of the body 13 which have been bent the above stated 90°.

After the core 10 and end member 12 assembly is completed, so that one end member is positioned in each of holes 11, said assemblies are normally moved through a wire winding device in an end-to-end relation.

For the purpose of illustrating the manner in which the end members 12 cooperate to insure an exact length of and uniformly spaced resistance wire being wound on the core 10, I shall show one method of winding to which the above described assemblies are adapted for winding.

It is to be understood that the herein described positioning of the alar portions 18 precludes the overlapping and consequent tying together of terminal end members of adjacent cores by convolutions of resistance wire during a winding process, such as the one to be hereinafter described. Further, it is to be understood that after bending and shaping of the end member 12, the normally parallel sides or edges 16 of the ovate body portions 13 at the inner ends thereof are substantially coincident with the circumference of the annular faces of the cores 10 respectively. Also, each of the edges 40 of the shank 15 at its point of juncture with the respective shoulders 14 securely seats and is positioned in one of the corners 41, which is formed by the leg 19 to frictionally retain said end members, as illustrated in Fig. 5.

While the winding and mounting of the resistance wire 27 upon and about the core may be done either manually or with the aid of a rotatable gripping element which grips the core body, or in a variety of other manners, the assemblies of the core 10 and the end members 12 may be placed in a metal cylinder or sleeve 20, as illustrated in Fig. 1. A wheel 21 is journaled on the end portion of this sleeve 20 by means of a suitable bearing 22, said bearing being secured in the passaged hub portion of the wheel 21 by means of a lock nut 23. A yieldable bushing 24 is mounted on the end of sleeve 20, the same having a passage of a size to permit pressing therethrough of core bodies to be wound with resistance wire, though also frictionally engaging such core bodies to prevent their rotation during the winding of the resistance wire thereon.

Numeral 25 designates a metal tube or cylinder which is disposed co-axially with respect to the sleeve 20 and positioned a short distance therefrom, said distance being less than the length of the core 10 and end member 12 assembly. A spool 26 containing resistance wire 27 is journaled on the sleeve 25 by means of retaining bushings or nuts 28. The end of the tube 25 nearest the cylinder 20 has mounted thereon a yieldable and removable inwardly flanged bushing 29, whose annular flange is adapted to frictionally engage the resistor cores as the same are moved and pressed therethrough.

The cylinder 20 is of sufficient length so that a number of core assemblies may be fitted and moved therein in an end-to-end relation. The wheel 21 carries a projecting passage arm 30 which has an eyelet in the end thereof and through which the resistance wire is threaded so that the wire may be extended to the area between the bushings 24 and 28, as indicated in Fig. 1.

The train of cores which are placed in end-to-end relation in the cylinder 20 is moved at a substantially uniform rate of speed to cause the resistor wire to be wound in a desired spaced apart relation on the core. During the winding the frictional engagement of the annular flanges of the bushings 24 and 28 will prevent rotation of the core assemblies being moved therethrough. As the "rear" terminal end member 12 of each core passes through the path and position in which the wire is wound, the wire will continue to be wound around the end member so that several spaced apart convolutions of the wire will be wound thereupon.

When the resistance wire is wound around the terminal end member 12, as stated, the frictional engagement of the bushing 28 will prevent rotation of the core, and as the wire continues to be wound without interruption of the rotation and of the progression of the train of cores, the wire will continue to be first wound about the termi-

nal end member 12 on the "forward" end of the next succeeding core, and continue being wound around the main core body; this while said succeeding core is held against rotation by the frictional engagement of the bushing 24. This cycle of winding continues as the train of cores is pushed through the cylinder 20 and through said bushings and through the tube 25. The train of cores emerging from the outlet tube 25 will be connected together by a segment of spirally wound wire which extends from the alar portions 18 of the end members 12 to the adjacent alar portions of the end member 12 of the adjacent core. This segment is cut, after emergence from the tube 25, to separate the individual core assemblies with the wire wound thereon.

Previously designed terminal members or their equivalents have not been adapted to this or similar methods of winding because there has been no means for keeping the successive convolutions of resistance wire being wound upon the portions corresponding to my end member 12 of adequate diameter. Consequently as the arm 30 would rotate and apply the resistance 27 to the terminal members, the diameter of the convolutions applied to the end members, or parts which correspond to my end member 12, was smaller than the diameter of the core. As the core 10 would come into position for application of the wire to the surface thereon, the wire being wound upon the terminal member was not able to immediately adapt to the change in size between the diameter of the end member and that of the core. Consequently, a number of convolutions of wire which were intended to be placed upon the surface of the core did not get there. Also some of those convolutions which by chance happen to be applied to the end of the core would slip therefrom because the diameter of the core was greater than the diameter of the convolutions. Employing a terminal end member, such as the one which I have invented, precludes the occurrence of the above described objectionable phenomenon. By using my end member, we are able to wind resistance wire 27 uniformly from the "rear" end member 12 of one core to the "front" end member 12 of the adjacent core to the adjacent core body 10, and so on, so that the wire disposes itself in uniformly spaced apart convolutions upon the core body 10 over the entire length thereof, the resistance wire 27 upon the said core 10 always being of substantially the same length on all the cores which are wound in any given method to which my core 10 and end member 12 is adaptable.

Referring to Figs. 2, 6 and 7, numeral 31 represents an end cap which preferably has an integral upwardly and inwardly extending annular flange 32. A terminal circuit wire 33 projects through the space formed by the flange 32 and an end portion 34 of said wire 33 is bent over the flange 31 and outwardly.

Preferably a non-conductive covering 35, of any suitable material, is applied to each of the cores 10 and the resistance wire wound thereon, after the cores are separated one from the other by severing the segments of resistance wire connecting the end members 12 thereof. An electrically conductive end cap 31 is securely mounted on each of the ends of the core and end member assemblies after the application of the non-conductive coat 35. Because of the hole 17 each terminal member 12 is adapted to seat down beneath the inner end of the flange 32 of the end cap 31, said end flange extending up through

the hole 17. The alar members 18 and the end portion 34 of the connecting circuit wire 33 are preferably secured within the end cap 31 by a fusible metal 39, such as solder. Because a pellet of fusible metal is used in securing the above said parts, which is of predetermined size, in the assembly of the completed resistor unit none of the fusible metal will spill out through the passage defined by the flange 31.

The core 10 does not come in contact with the metal of the cap 31. The diameter between the annular wall 36 of the end cap 31 is substantially the same as the diameter of the core 10 with the non-conductive coat 35 thereon, so that each cap will abut against or slightly overlap its respective end of said core. One of said end caps 31 and circuit wire arrangements 33 is secured with respect to each end of the core 10 and the end members 12 mounted thereon.

In one modified form of my invention the end cap 31 is formed with an integral outwardly extending flange 37. This form will permit the optional use of a solid sleeve or cylinder 38 of glass or some other non-conductive solid to be placed over and around the core 10 with the resistance wire wound thereon. Optionally this modified form may be covered with a suitable non-conductive covering or coating 35. In the event the covering 35 is not used the height of the cap 31 must be such as to preclude the cap 31 from coming in contact with the resistance wire wound upon the core 10.

In the event, a sleeve 38 is not used, it is preferable to coat the entire herein described resistor unit, including the end caps 31, with a second non-conductive material. An example of the material used for said non-conductive coating is one such as porcelain enamel which, when dried and baked, effectively protects the resistor over its entire length. Such enamel coating has high heat conductivity and quickly dissipates the heat developed in the resistor element.

The present invention has been described herein in more or less as to details, yet is to be understood that the invention is not limited thereby, as changes may be made in the arrangement and proportion of parts, and equivalents may be substituted without departing from the spirit and scope of the invention.

I claim:

1. In a resistor for electrical circuits and the like, a non-conductive core having an opening in each end thereof; an insertable metal terminal end member mounted on each end of said core, each of said terminal end members comprising a shank and a body portion integral therewith, the outer ends of said body portions extending radially substantially to the projection of the curved plane of said core, and said body portion having an integral portion of said body portion bent substantially perpendicularly thereto, said body portion and said shank being bent along the longitudinal axis thereof so that a tapered angle is formed along said axis of said shank, the innermost portion of said shank normally being in non-abutment with said core, the remainder of said shank normally frictionally abutting in each of said core openings; each of said body portions having a hole therein at the center thereof; a resistance wire spirally wound around said core and each of said end members; a metal end cap electrically connected to and substantially enveloping each of said terminal end members, said end cap having an integrally formed inwardly extending flange, said flange

passing through said hole in said terminal end member, and a connecting circuit wire secured to each of said end caps.

2. In combination with a resistor for electrical circuits and the like, a core having an opening in each end thereof; an electrically conductive and slidably insertable terminal end member mounted on each end of said core, each of said terminal end members comprising a spring-like tapered shank and an integral body portion, said shank being retained in said core openings by the engagement of portions thereof with said core, the inner portions of the side edges of said shank being in non-engagement with said core; and a resistance wire spirally wound around said core and said end members.

3. In a resistor for electrical circuits and the like, an open ended non-conductive core, said openings being multiangular; a metal terminal end member mounted on each end of said core, said terminal end members having a shank integral with the body thereof, the outer ends of each of said bodies extending outwardly substantially to the general curved plane of said core, and said body having an integral portion thereof bent substantially perpendicularly thereto, said body and said shank being bent along the longitudinal axis thereof and being gradually tapered inwardly; said outer portions of the lateral edges of said shank normally abutting two of the corners of said core opening, said end members normally being retained in said openings by engagement of said lateral edge portions; a resistance wire wound spirally around said core and each of said end members; a metal end cap conductively connected to and enveloping each of said terminal end members; and a connecting circuit wire secured to each of said end caps.

4. In a resistor for electrical circuits and the like, a non-conductive core having end openings, said openings in said core being multilateral; a metal terminal end member mounted on each end of said core, each of said terminal end members having an integral reduced shank, the opposite end edges of said members being substantially coincident with the peripheral projection of the end faces of said core, and said end members having an integral portion of each thereof bent substantially perpendicularly thereto, said end members being bent along substantially a longitudinal axis thereof, the inner portion of the angle of said shank being smaller than the angle of the remainder of said end member thereof, the edges of said shank normally abutting in and frictionally engaging in one of said core openings, each of said end members having a central hole therein; a wire wound in spiral convolutions around said core, said convolutions being of predetermined resistance and uniformly distributed over the length of said core; a non-conductive coating covering said core and said resistance wire wound thereon; a metal end cap electrically connected to and enveloping each of said terminal end members, said end cap having an integrally formed inwardly extending flange defining an opening, said flange passing through the hole in the adjacent terminal end member, and a connecting terminal circuit wire securely mounted on each of said end caps, each of said circuit wires having a bent end portion, said circuit wire passing through the opening in said end cap, said bent portion extending around said inwardly projecting flange of said cap.

5. In combination with a resistor for electrical circuits and the like, a non-conductive core providing an opening at each end thereof; a metal terminal end member mounted on each end of said core, each of said terminal end members including a shank integral with a body, the lateral edges of said bodies being substantially coincident with the periphery of the end faces of said core, said body having an integral portion of said body bent substantially perpendicularly thereto, said body and said shank being bent along the longitudinal axis thereof to form a tapered angle, the inner portion of said angle of said shank being smaller than the angle formed at the top thereof to facilitate insertion of said end member into said core; each of said shanks at the outer portion thereof normally frictionally abutting in one of said openings respectively, each of said end members having a central hole therein; a resistance wire of predetermined resistance wound in spiral convolutions around said core, said convolutions being uniformly distributed over the length of said core; a metal end cap electrically connected to and enveloping each of said terminal end members, said end cap having an inwardly projecting extension, said extension passing through the hole in the adjacent terminal end member, said end caps each having an annular peripheral flange; a connecting terminal circuit wire securely mounted in each of said end caps, each of said circuit wires having a bent end portion; each of said bent portions extending around said inwardly projecting flange; a fusible metal connecting each of said end caps with the adjacent terminal end member and with the bent end portion respectively, said fusible metal being of a predetermined amount so that in the fusing thereof none will spill from the cap; and a non-conductive sleeve around said core and said resistance wire, said sleeve at the ends thereof abutting against said annular peripheral flanges of said end caps respectively.

6. In combination with a resistor for electrical circuits and the like having a non-conductive core having end openings; a slidably insertable metal terminal end member mounted on each end of said core, said terminal end members each having a reduced portion thereof bent angularly and tapered and being retained in said openings by the engagement of portions of the edges of said reduced portion with the core faces defining said openings, the side edges and innermost part of said reduced portion being in non-engagement with said core; a resistance wire wound spirally around said core and each of said end members.

7. In a resistor for electrical circuits and the like, a non-conductive core having end openings, said openings in said core being multilateral; a metal terminal end member mounted on each end of said core, each of said terminal end members having an integral reduced shank, the edges of the ends of said members extending substantially to the largest dimension of the peripheral projection of the adjacent end faces of said core and said end members each having an integral portion thereof bent substantially perpendicularly thereto, said end members being bent along the longitudinal axis thereof, the inner portion of the angle of said shank being smaller than portions of the angle of the remainder of said end member thereof to facilitate easy insertion of said end members in said core opening respectively, the edges of said shank normally abutting in and frictionally engaging in one of said core openings, each of said end members having a

central hole therein; a wire wound in spiral convolutions around said core, said convolutions being of predetermined resistance and uniformly distributed over the length of said core; a metal end cap electrically connected to and enveloping each of said terminal end members, said end cap having an integrally formed inwardly extending flange defining an opening, said flange passing through the hole in the adjacent terminal end member, and a connecting terminal circuit wire securely mounted in each of said end caps, each of said circuit wires having a bent end portion, said circuit wire passing through the opening in said end cap, said bent portion extending around said inwardly projecting flange of said cap.

8. In combination with a resistor for electrical circuits and the like, an open ended non-conductive core; a slidably insertable electrically conductive terminal end member mounted on each end of said core, each of said terminal end members having a spring-like shank integral with a body, the end edges of said bodies being substantially coincident with portions of the peripheral projections of the adjacent end faces of said core, and said body having an integral portion thereof bent substantially perpendicularly thereto, said shank at outer portions thereof normally engaging the faces defining said opening in said core and at inner portions being in non-abutment with said core; and a resistance wire spirally wound around said core and said end members.

9. In a resistor for electrical circuits and the like, an open ended non-conductive core, said

openings being multiangular; a metal terminal end member mounted on each end of said core, said terminal end members having a shank integral with the body thereof, the outer ends of each of said bodies extending outwardly substantially to the general curved plane of said core, and said body having an integral portion thereof bent substantially perpendicularly thereto, said body and said shank being bent along the longitudinal axis thereof and being gradually tapered inwardly; said outer portions of the lateral edges of said shank normally abutting two of the corners of said core opening, said end members normally being retained in said openings by engagement of said lateral edge portions; and a resistance wire wound spirally around said core and each of said end members.

JOSEPH J. CERNY.

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