May 23, 1933. A. N. VAN NOSTRAND 1,910,866

RESISTOR

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Fig. 1.

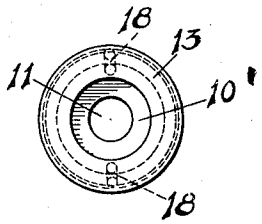


Fig. 2.

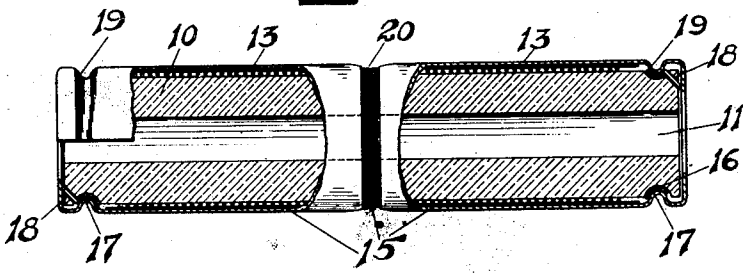


Fig. 9.

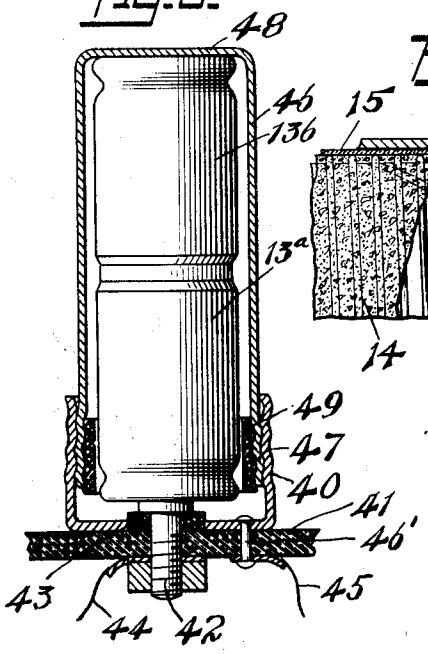
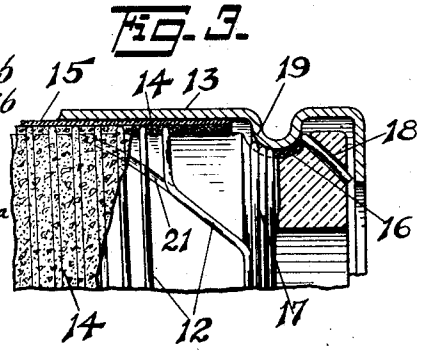


Fig. 3.



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RESISTOR

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Fig. 5.

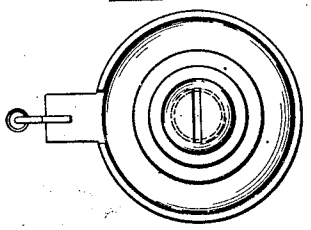


Fig. 4.

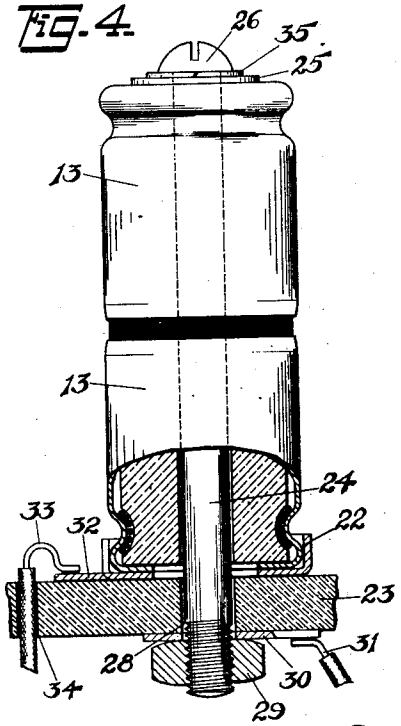


Fig. 7.

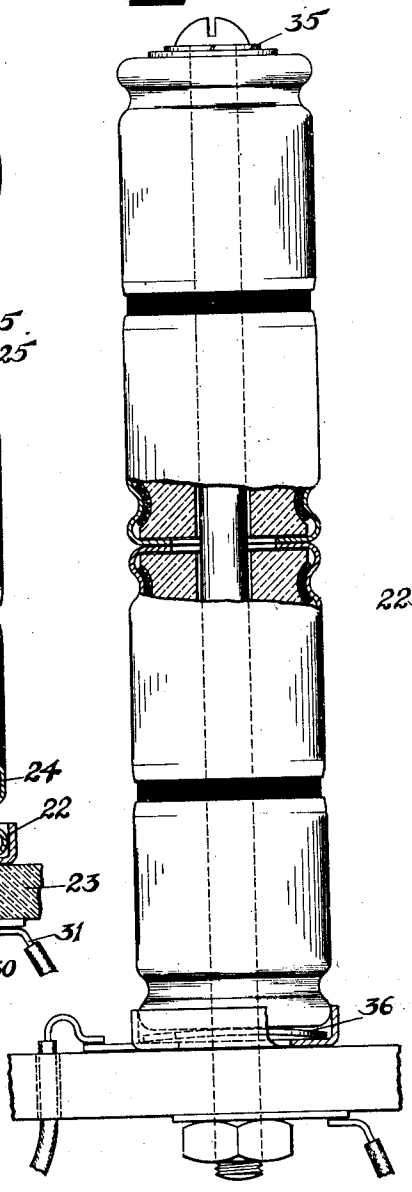


Fig. 8.

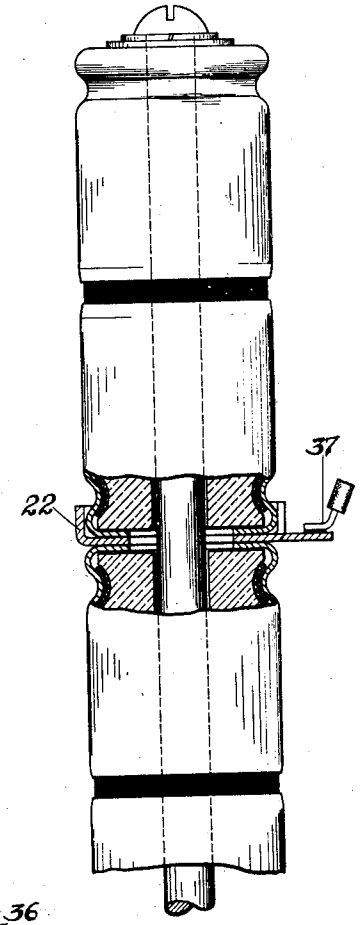
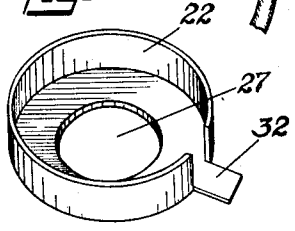


Fig. 6.



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Patented May 23, 1933 1,910,866

UNITED STATES PATENT OFFICE

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RESISTOR

Application filed March 25, 1930. Serial No. 438,664.

This invention relates to a resistor.

The invention is intended generally to provide a resistor in the form of a unit, of simple, compact and durable construction, and of reliable and dependable operation.

The resistor to which the invention relates is of a type which comprises a core of insulating material, a resistance wire wound on said core from end to end, and a metallic terminal cap surrounding each end of the core and wire and connected electrically to the wire end.

It is one object of the invention to develop a construction which provides good firm electrical connections and contacts between the wire ends and caps.

Another object is to introduce a resistor which has a large, rapid heat radiating surface for dissipating the heat generated in service.

A further object of the invention is to restrict contact of the resistance wire with air, to reduce and minimize oxidation and deteriorating effects due thereto.

Another object is to produce a construction to facilitate obtaining an exact resistance for the resistor in manufacture.

Other objects are to make provision for permitting vertical panel mounting of the resistor and series mounting of resistor units and to produce practical structure for obtaining the mountings of resistors and connections to the resistors.

With these general objects in view, the invention consists in the features, combinations, arrangements and details of construction which will first be described in connection with the accompanying drawings and then more particularly pointed out in the appended claims.

In the drawings:

Figure 1 is an end view of a resistor constructed in accordance with the present invention;

Figure 2 is a longitudinal elevational view, partly in section, of the resistor;

Figure 3 is an interior, partly sectional view, showing different strata of the resistor;

Figure 4 is an elevational view, partly in section, illustrating vertical mounting of the resistor on a panel;

Figure 5 is a plan view of the construction of Figure 4;

Figure 6 is an isolated perspective view of an element utilized in vertical mounting of the resistor;

Figure 7 is an elevational view, partly sectional, showing vertical mounting of a plurality of resistors in series;

Figure 8 is a similar view, illustrating a tap connection; and

Figure 9 is a sectional elevational view of a screw threaded form of mounting for the resistor.

The resistor selected to illustrate the invention comprises a core 10 which is of electrically insulating, heat-resisting material, such as porcelain. As here shown, the insulating core is turned to a cylinder in shape and is provided with an axial hole 11 for mounting in certain cases. Around the core a resistance wire 12 of any approved composition is spun and wound helically from one end of the core to the other. The wire is advantageously of relatively small diameter and the convolutions are spaced close together over the length of the core. In this embodiment, the surface of the core is smooth but it might be provided with helical or other grooves to accommodate the wire. Surrounding each end of the core and wire is a terminal cap 13 of metal, such as aluminum, which engages the wire end and is connected electrically thereto.

Provision is made for restricting contact with air, minimizing oxidation and deteriorating effects due thereto. This is advantageously accomplished by surrounding the wire with a sheet of flexible insulating material, such as clear mica. In this example, the wire is first cemented to the core after being wound thereon. To this end, a cementitious substance 14, such as a mixture of lacquer and pipe clay, may be distributed over the wire convolutions and against the core surfaces. The cement also serves to insulate adjacent convolutions of resistance wire. The sheet of mica 15 is now wrapped around the wire in a few layers and directly above the wire.

The mica extends longitudinally and axially of the resistor and terminates just short of the wire ends to leave said ends uncovered to be engaged directly by the caps, said mica preventing contact of resistance wire with terminal caps throughout the mica length.

Provision is made for obtaining good firm contacts between the wire ends and caps. To this end, circumferential grooves 16 are provided in the core surfaces, one near each end. A plurality of turns of wire 17 are laid in each groove and partly fill the groove. These turns are connected electrically to the respective ends of the resistance wire. It is possible to make the turns of a cheaper wire and splice same to the resistance wire. It has been found cheaper and more advantageous, however, to make the turns of resistance wire, that is, to bring the ends of the resistance wire out in a suitable manner and wrap and lay them in the grooves, thus eliminating need for splicing. Some 25 or 30 turns of resistance wire may be wound in each groove. It will be noted that these turns are in parallel contact with each other and do not function as resistance but simply form a relatively massive end electric terminal for contact with the inspun cap. During assembly, the extreme wire ends are inserted in holes 18 in the core. As here shown, these holes extend obliquely from the grooves to the core ends and the wire ends can be conveniently inserted and temporarily fastened therein in process of assembly. The metal of the caps is crimped or spun circumferentially and inwardly in the form of annular indentations 19 which project into the grooves and firmly engage the turns within throughout the circumferential area thereof. Good contacts are thus made between the caps and the wire ends, the caps securely held in place and a tight unit formed.

In the illustrated embodiment, provision is made for varying the resistance so as to obtain an exact resistance value. In the practice of the invention according to what is now deemed to be the best advantage, such variation in resistance is achieved by varying the effective length of resistance wire without changing the core size or the wire size or spacing. To this end, as here shown, a groove 21 is placed in the core surface at each end of the core and extends diagonally and into the respective circumferential groove. The respective wire end is laid in the diagonal groove (Fig. 3) and the length of the helical resistance windings is determined by said grooves and the wire ends terminated therein at points giving the required exact resistance, the wire ends being brought out in the diagonal grooves somewhat sharply to the circumferential grooves.

The invention provides for dissipating rapidly the heat generated by the resistance wire in service. To this end, the resistor is equipped with a large, rapid heat-radiating surface. As here shown, the metallic terminal caps 13 are elongated axially and incase the resistor like sleeves. The caps are tightly spun against the mica, thus sealing the wire in an air tight container. Each cap extends axially nearly one-half the length of the core but a small space 20 is left between the adjacent cap ends. This space is just sufficient to insure against short-circuit therethrough. Radiation of heat is through the mica to the metallic incasing caps. In addition to providing a large, rapid heat-radiating surface over practically the entire peripheral area of the resistor, the sleeve-like caps present large contact areas, if such are desired.

The resistor may be mounted horizontally in the usual manner between two spring terminal clips which engage respectively the end caps of the resistor. This form of resistor also lends itself very readily to vertical mounting and to vertical mounting of two or more resistors in series whereby very little panel space is occupied. In such vertical mounting, the central bore of the resistor is utilized for reception of a supporting bolt and the resistor is mounted on the bolt.

In one practical exemplification of such vertical mounting, one end of the resistor is seated in a cup-shaped metallic washer 22 or socket-device abutting against the panel 23 (Figs. 4 and 5) and the resistor and washer are clamped tightly against the panel by bolt 24. As here shown, a washer 25 is placed beneath head 26 of the bolt and engages one end of the resistor, the bolt passing through the central bore of the resistor and through a hole 27 in the cup washer and a hole 28 in the panel and having a nut 29 threaded on the end projecting from the opposite side of the panel. The nut is tightened on the bolt to draw the resistor and cup washer tightly against the panel and to hold them rigidly in position. The bolt through washer 25 makes electrical connection with one terminal cap of the resistor and the cup washer engages the other terminal cap. As here shown, a washer 30 is positioned beneath the nut 29 and a wire 31 soldered or otherwise connected to the said washer. The cup washer has an extending lug 32 (Fig. 6) to which a wire 33 is soldered or joined. This latter wire passes through an aperture 34 in the panel so that the wires are behind the panel relative to the resistor. The electric circuit is from wire 31, washer 30, bolt 24, washer 25 to one terminal cap of the resistor, then through the resistance wire to the other terminal cap, cup washer 22 to wire 33. Considerable clearances are left between the bolt and the cup washer and abutting terminal cap end to prevent short-circuit between these parts. To augment the rigidity of the mounting and the firmness of the electrical connec-

tions, a spring washer 35 may be placed beneath the bolt head.

To mount two or more of the resistors in series, it is only necessary to use a longer bolt. In such case, the resistors are stacked one upon the other (Fig. 7) around the same bolt and are clamped together with abutting terminal caps of adjacent resistors firmly engaging. A relatively strong spring washer 36 may advantageously be placed beneath the resistor stack and in the cup washer to keep tension on the whole assembly.

To obtain a tap connection, a washer like cup washer 22 may be interposed between adjacent resistors (Fig. 8) and tap wire 37 soldered to the lug of said cup washer.

Figure 9 illustrates a screw threaded form of mounting for the resistor. In this embodiment, the resistor is adapted to be applied to a conventional screw socket comprising an internally threaded shell contact 40 mounted against an insulating base 41 and having a central contact 42 insulated from said shell, as by an insulating washer 43. An electrical conductor 44 is connected to said central contact and another conductor 45 to said socket shell through rivet 46'.

The means for applying the resistor to the socket, as here shown, include a tubular metallic shell 46 having an open end with rolled outside and inside threads 47 and a flanged or closed end 48. The resistor is inserted in the shell and the threads 47 of the latter then screwed tightly into the socket. One cap terminal 13*a* of the resistor is thus clamped firmly against the center contact and the other cap terminal 13*b* is firmly engaged by the shell.

To prevent the shell from engaging the lower terminal 13*a* and thus short-circuiting the resistor, an insulating spacer 49 is inserted between the shell and terminal cap. As here shown, the spacer is an externally threaded fibre ferrule which screws inside the shell. The threads may be cut or rolled and the inside surface may or may not show corrugations.

It may be desirable to provide the shell with openings for allowing air circulation and preventing overheating. Such openings may be designed in various ways.

What is claimed is:

1. A resistor comprising an insulating core having a peripheral resistance-wire supporting-surface arranged to receive a plurality of convolutions of the resistance wire and having a groove near each end, each groove extending spirally along said supporting surface from the respective end of the said supporting-surface toward the longitudinal center of the said surface, whereby various lengths of resistance-wire may be used on any core and each terminal end of such wire may be brought out through the corresponding groove, and a resistance-wire wound on the said supporting-surface of the core and having terminal portions laid in said grooves.

2. A resistor comprising an insulating core having a circumferential groove near each end, a resistance wire wound on said core, each end of the wire being laid in the respective end groove in a plurality of turns of bare wire, a metallic cap for each end of the core, each cap surrounding its respective end of the core and wire and being crimped circumferentially and inwardly into conductive contact with the turns in the respective end groove, and means for insulating each cap from the resistance wire except at its crimped portion.

3. A resistor comprising an insulating core having a circumferential groove near each end, a resistance wire wound on said core, each end of the wire being laid in the respective end groove in a plurality of contacting turns of bare wire and its extreme end caught in a hole in the core extending obliquely from the groove, and a pair of metallic caps, each surrounding its respective end of the core and wire and crimped circumferentially and inwardly into conductive contact with the turns in the respective end groove.

4. A resistor comprising an insulating core, a resistance wire wound on said core from end to end and having its end portions bare, a sheet of flexible insulating material wrapped around the wire and extending longitudinally and terminating just short of the ends of the wire to leave said ends uncovered, and a metallic cap for each end of the core, each cap surrounding its respective end of the core and wire and indented inwardly against the respective uncovered wire end, each cap extending axially nearly one-half the length of the core to provide a large radiating surface, the space between caps being just sufficient to insure against short-circuit therethrough.

5. A resistor comprising an insulating core having a circumferential groove near each end, a resistance wire wound on the core between each groove, a plurality of contacting turns of bare wire laid in each groove, said turns being connected electrically to the resistance wire, and a metallic end cap for each end of the core, each cap surrounding its respective groove and being crimped circumferentially and inwardly into conductive contact with the turns therein.

6. A resistor comprising an insulating core, a resistance wire wound on said core from end to end and having its ends bare, and a metallic cap for each end of the core, each cap surrounding its respective end of the core and wire and being indented inwardly near its outer end into engagement with the respective bare wire end and out of contact with the resistance wire except at its

indented portion, each cap extending axially nearly one-half the length of the core to provide a large radiating surface, the space between caps being just sufficient to insure against short-circuit therethrough.

7. A resistor comprising an insulating core having an axial hole and a circumferential groove near each end, a resistance wire wound on said core its turns being spaced apart, each end of the wire being bare and laid in the respective end groove in a plurality of turns, a cementitious substance distributed over the wire and between the turns thereof, a sheet of flexible insulating material wrapped around the wire between the grooves and terminating just short of the grooves, and a metallic cap for each end of the core, each cap surrounding its respective end of the core, wire and insulating material and being crimped circumferentially and inwardly into contact with the bare turns of wire in the respective end groove, each cap extending axially nearly one-half the length of the core to provide a large radiating surface, the space between caps being just sufficient to insure against short-circuit therethrough.

In testimony whereof, I have hereunto set my hand.

ARLEIGH N. VAN NOSTRAND.