

Sept. 30, 1947.

N. VASILEFF

2,428,053

RESISTOR

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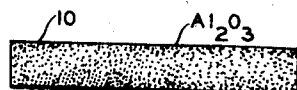


FIG. 1.



FIG. 2.



FIG. 3.

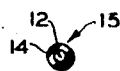


FIG. 4.

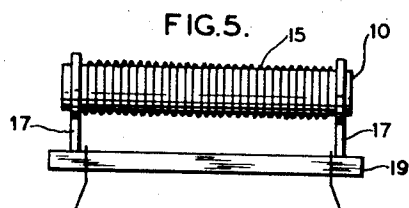


FIG. 5.

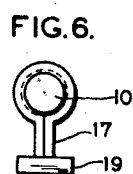


FIG. 6.

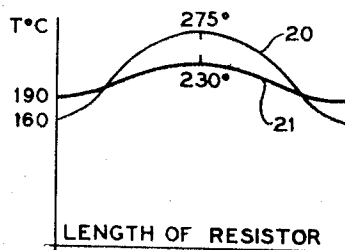


FIG. 7.

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RESISTOR

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4 Claims. (Cl. 201-63)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to resistors, and is particularly valuable as incorporated in power, wire wound resistors.

An object of the invention is to provide a power resistor which will be, and remain, moisture proof.

Another object is to provide a power resistor which will operate at a lower maximum temperature for a given rating.

A further object is to provide a resistor having a more uniform temperature distribution.

A still further object is to provide a power resistor having an insulator which will remain intact, and not crack and break off, and which will also meet the requirements for class 1, grade 1 resistors.

Other objects and advantages will be appreciated by those skilled in the art from a reading of the specification.

Power resistance elements, as resistance wires of class 1 resistors, are insulated with vitreous enamels. These enamels crack and pieces break off, due to the different coefficients of expansion of the core, the resistance wire and the insulation, leaving the insulation defective. Furthermore, these enamels have alkaline constituents which, in the presence of moisture, directly and indirectly corrode, the resistance wire, the indirect corrosion resulting from electrolysis of the dissolved alkaline substance. The latter has access to the wire through the mentioned cracks, and at the bare spots resulting from pieces of the cracked enamel falling off the wire. The corrosion of the wire obviously alters its resistance and eventually destroys the wire, so hot spots develop at points of corrosion, where the effective diameter is diminished.

The usual power resistor has a core of some insulating material, such as porcelain or steatite for example. These materials have poor heat conductivity, so that resistance elements wound thereon operate at a relatively high temperature. The high operating temperature requires that an inorganic substance, as an enamel, be employed as an insulator covering the resistance element. The inorganic insulators are brittle and, as stated above, crack, and break off in parts, due to thermal changes.

The usual organic insulators, such as varnishes, do not crack, but are capable of withstanding a temperature of only about 125° C., and are therefore unsuitable for power resistors, which operate at a higher temperature.

Power resistors of the prior art have therefore been unsatisfactory, the proper combination of components not having been discovered.

The new combination employed in the resistor

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of this invention comprises a resistance element insulated with a silicone resin, and an aluminum oxide core on which the resistance element is wound. The silicone resin withstands a temperature about 100° C. higher than the usual insulating varnishes do. However, these resins do not withstand the rated temperature of 275° C. specified for class 1 resistors. The core of aluminum oxide is therefore used to reduce the operating temperature to a point allowing the use of a silicone resin, this oxide having a sufficiently high specific heat conductivity to accomplish the purpose, as distinguished from the usual porcelain, steatite, etc. Aluminum oxide in fact has a specific heat conductivity comparable to that of certain metallic alloys, such as German silver, for example.

The invention is illustrated in the accompanying drawings, in which

Figure 1 is a plan view of an aluminum oxide core used in the resistor;

Figure 2 is an end view of Figure 1;

Figure 3 is a plan view of a length of wire, enlarged in diameter, and coated with a silicone resin;

Figure 4 is an end view of Figure 3;

Figure 5 is an elevational view of a class 1, grade 1, power resistor embodying the invention;

Figure 6 is an end view of Figure 5; and

Figure 7 shows comparative graphs of the temperature distribution of the usual power resistor and of the present resistor.

Referring to the drawings for a more detailed description thereof, Figure 1 shows a hollow cylindrical core 10 of aluminum oxide, on which a resistance element is to be wound. Such a core is used for its insulating quality and also for its high heat conductivity, as explained above. The later property rapidly dissipates the heat generated in the resistance element, resulting in a more nearly uniform temperature along the length of the core and a lower maximum and average temperature, the maximum being low enough to allow the use of the desirable silicone resin.

Figure 3 shows a length 12 of Nichrome or other resistance wire which is covered with a silicone resin 14, the wire with its coating being designated by the numeral 15. The insulated resistance wire 15 is wound helically on the core 10 as shown in Figure 5, and the wire-wound core is mounted on the usual type of uprights 17 which are secured to, and rise from, a base 19. The whole assembly may desirably be immersed in a silicone resin to receive a protective coating thereof.

Figure 7 shows curves 20 and 21 in which temperatures, in degrees centigrade, are plotted against positions along the length of the resistor. Curve 20 shows the temperature distribution in

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the usual length of the resistor of the type having a porcelain or steatite core, with enamel insulation on the resistance element. Curve 20 shows this type of resistor as having a maximum temperature of 275° C., which is at the mid point of the resistor, from which point the temperature falls to 160° C. at the ends, with a spread or difference of 115° C.

Curve 21 shows the temperature distribution along the resistor of my invention. The curve indicates a maximum of 230° C. at the middle of the resistor, which temperature is 45° C. lower than the midpoint of curve 20, due to the aluminum oxide core having better heat conductivity than other types of core. The operating temperature is thereby brought down to the point where a silicone resin may be used, the temperature of 275° C. of prior resistors being too high for these resins to withstand. Curve 21 also indicates a temperature of 190° at the ends of the resistance element, with a spread or difference, therefore, of 40° C. between the mid point and ends, as against a difference of 115° between the mid point and ends of prior power resistors.

It will be readily appreciated from the foregoing matter that the new resistor has accomplished the objects of the invention and is a substantial advance in the art.

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What is claimed is:

1. A resistor comprising a core of aluminum oxide, a resistance element wound on the core, and an insulating coating, consisting of a silicone resin, applied directly to the resistance element.

2. A resistor comprising a core of aluminum oxide, a resistance element helically wound on the core, and an insulating coating, consisting of a silicone resin, applied directly to the surface of the resistance element.

3. A resistance element and an insulating coating, consisting of a silicone resin, applied directly to the resistance element.

4. A metallic resistance wire and an insulating coating, consisting of a silicone resin, applied directly to the resistance element.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,035,707	Oldbury	Mar. 31, 1936
2,372,212	Lewin	Mar. 27, 1945
2,377,600	Barker et al.	June 5, 1945
2,397,568	Seaman	Apr. 2, 1946