

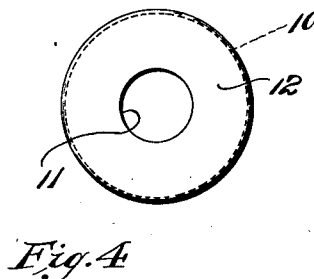
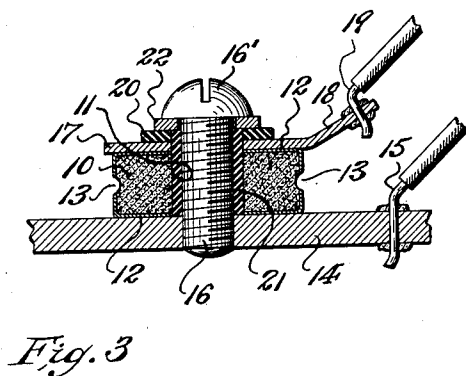
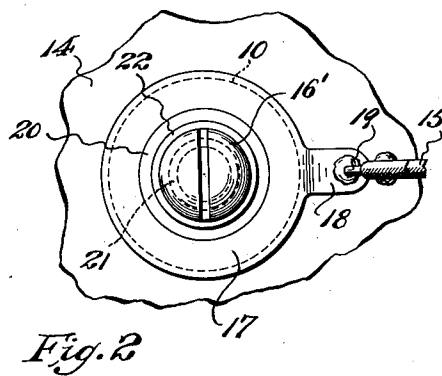
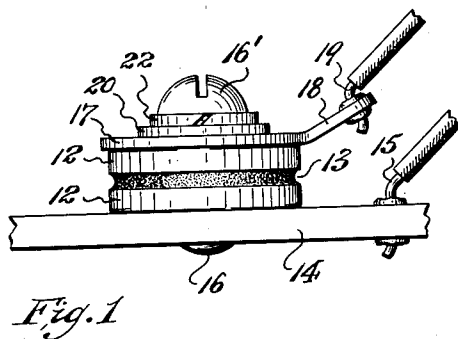
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2,289,791

ELECTRICAL RESISTOR

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ELECTRICAL RESISTOR

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4 Claims. (Cl. 201—63)

This invention relates to improvements in electrical resistors and in the art of producing and rating the same; and the invention has reference, more particularly, to carbon resistors of novel form and highly efficient heat dissipating characteristics, conveniently adopted for use in confined locations or restricted space, and whereby the same are adapted to carry comparatively much higher loads than heretofore possible with prior forms of resistors.

Carbon resistors of various values of resistance are usually produced by mixing an inert non-conductive material (e. g. finely ground mica) and a carbonaceous material (e. g. carbon black) in selected relative proportions together with a suitable bonding agent (e. g. phenolic resin), and thereupon molding the mix into desired shape and size. The order of magnitude of resistance for a given size of resistor is usually controlled by varying the relative proportions of the inert and carbonaceous ingredients of the molding compound or mix, the percentage of bonding agent being ordinarily held approximately the same.

It has heretofore been standard practice in the art to use carbon resistors on comparatively light loads or when the number of watts to be dissipated by a resistor unit is small. Examples of service involving such conditions are for use in radio equipment where the wattage is usually one watt or less per resistor, or in connection with automotive starting and lighting generator voltage regulators where the wattage per resistor is ordinarily approximately five watts. The reason for limiting the use of carbon resistors to conditions involving but low wattage is that the maximum temperature of the resistor must be kept down so as to prevent possibility of excessive carbonization of the bonding agent, which, if permitted to occur, would result in decreasing the resistance of the unit, thus rapidly altering the original or specific resistance desired to be maintained, and ultimately causing the resistor to fail or even burn up because of the high temperature attained.

The conventional carbon resistor has heretofore been made in elongated body form of relatively small cross-sectional area compared with its length. Such body forms are usually mounted between end supporting brackets or spacers, or carried by wire leads. By reason of such body forms and methods of support, the major part of the heat generated in the resistor could only be dissipated by radiation, since but a minor part of said heat could escape by conduction through

the small supports or wire leads, and since dissipation of the heat by radiation is slow and inefficient, the trapped heat causes the resistor temperature to rapidly mount to a high or excessive range, with resultant rapid diminution of specific resistance desired to be maintained, as well as with risk of destroying the resistor due to burning thereof, all of which is highly objectionable.

With a view of avoiding the objections above referred to, this invention has for an object to provide a novel form and construction of carbon resistor, the body of which is of disc-like shape, having a large diameter and cross-sectional area compared with its length or thickness; such disc-like body providing large face areas adapted to be mounted respectively in good contact with its supporting base and top contact plate or the like, whereby a greater percentage of heat generated in the resistor body will be rapidly carried away by conduction through the supporting base and top contact plate or the like, thus maintaining a safe working temperature for the material from which the resistor body is made, and thereby eliminating risk of alteration of the specific resistance desired to be maintained, as well as risk of destruction by burning.

Another object of the invention is to provide a disc-like resistor body having its face areas, and portions of its peripheral areas there-adjointing, coated with a low resistance and relatively high heat conductive material, such e. g. as metallic material, thus assuring both good electrical and heat transfer contact thereof with the supporting base and top contact plate or the like by which the same is operatively mounted and connected in the circuit to be served thereby.

Another object of this invention is to provide a disc-like resistor body which can be easily and accurately rated to a desired specific resistance by cutting away the low electrically conductive material thereof at the center of its periphery by an amount calculated to accurately attain the exact total resistance required within the range of the particular compound of which it is made; the depth and width of the annular cut being so selectively determined as to desirably adjust the resistance of the unit within limits, as well as to compensate for small variations which may arise during the making up and processing of the compound of which the resistor body is composed.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

An illustrative embodiment of the instant in-

vention is shown in the accompanying drawing, in which:

Fig. 1 is a side elevation of a disc-like carbon resistor according to the invention, the same being shown as operatively mounted between a support and top contact plate or the like; Fig. 2 is a top plan view of the same; Fig. 3 is a vertical sectional view of the same; and Fig. 4 is a plan view of the resistor body per se.

Similar characters of reference are employed to indicate corresponding parts.

In the drawing, the reference character 10 indicates the body of the resistor, the same being of substantially disc-like form of any suitable peripheral shape. By "disc-like" form is meant that the body is so dimensioned that it possesses a large diameter and cross-sectional area compared with its length or thickness. The ratio of area to length (A/L) should be greater than unity.

The body 10 is made of a suitable compound of inert non-conductive material, carbonaceous conductive material, and a bonding agent; said compound being molded into a solid mass, either directly into the required disc-like form, or to provide material from which said disc-like form may be cut and machined. For convenience in mounting the resistor body 10, the same is provided with a central vertical through opening or bore 11. The top, bottom and external peripheral surfaces of the body 10 are provided with a low resistance but high heat conductive coating 12 of metallic material. This coating 12 may be deposited upon the body 10 by electro-plating procedure, or by spraying the metallic material thereon. The coating 12 is cut away from the periphery of the body 10 intermediate the top and bottom faces of the latter, so as to be electrically interrupted by a gap which is bridged only by the intermediate high resistance material of which the body is made.

To rate or adjust the resistance of the body within limits, the material at the periphery thereof which is exposed by the gap between the coating sections, is cut or trimmed away to remove an amount thereof calculated to give the remainder the exact total resistance required within the range of the compound of which the body 10 is composed. Both the width and depth of the peripheral regulating groove or channel 13 thus formed will be factors in determining the adjustment of the resistance of the unit within limits. This will be apparent from the following formula:

R equals PL/A
wherein

R denotes resistance of the unit;

P denotes specific resistance of the compound of which the unit is composed;

L denotes effective length of the unit (this being determined by the width of the regulating groove or channel 13); and

A denotes cross sectional area of the unit (this being determined by the depth of the regulating groove or channel 13).

Illustrative of a convenient manner and means of mounting the resistor, the body 10 is shown with its coated bottom face seated upon and in electrical contact with the base 14 or other suitable conductive part of the device to be served by the resistance, and to which a lead wire 15 may be secured, if desired; said base 14 or the like being tapped to receive a fastening screw 16. Superposed upon and in electrical contact with

the coated top face of the body 10 is a perforate conductive contact plate 17, which, if desired, may be provided with an ear or lug 18 to receive connection thereto of a lead wire 19. Overlying said contact plate 17 is an insulating washer 20. Inserted through said insulating washer 20 and contact plate 17 to extend into and line the bore 11 of the body 10 is an insulating bushing 21. The fastening screw 16, equipped with a lock-washer 22 beneath its head 16', is passed downwardly through the bushing 21 and screwed into the base 14, thus securing the body in service position and operative relation to the device to be served thereby. The bushing 21 and insulating washer 20 serve to efficiently insulate said fastening screw and its lock-washer from the resistor unit.

It will be obvious that, by reason of the relatively considerable area of the coated bottom and top faces of the body 10 which are in contact with the base 14 and with the contact plate 17, and by reason of the efficient heat conductive character of the sections of coating material 12, the major percentage of heat generated within the resistor body in use will be quickly transferred from the body 10 to the base 14 and contact plate 17, and will be carried away therefrom by conduction through the latter parts, thus maintaining a safe working temperature for the material from which the resistor body is made. A carbon resistor, constructed and mounted in the manner above described, will provide a very stable resistor unit when working at loads heretofore considered impractical and generally impossible for the same volume or size of material in body forms heretofore used in the art.

Having described our invention, we claim:

1. A method of regulating the effective resistance of a disc-like resistor body having a coating of low electrical resistance material covering its top, bottom and peripheral surfaces comprising the steps of cutting away portions of said coating contiguous to the periphery of said body to interrupt said coating by an annular gap and then cutting away exposed peripheral portions of said body to form a diameter reducing circumferential channel therein, the width of said gap and the depth of said channel being selectively predetermined to adjust resistance of the body within limits.

2. A resistor comprising, a body of disc-like form having high electrical resistance characteristics, said body having a diameter and cross-sectional area substantially in excess of its length or thickness, a coating of low electrical resistance but high heat conductive characteristics adhered to and covering the top, bottom and peripheral surfaces of said body, an intermediate annular portion of said coating which covers the periphery of said body being cut away to provide a gap of selected width, whereby to adjust the resistance of the body within limits, while at the same time providing, by the remaining parts of said annular portion together with the respective coating areas on the respective top and bottom faces of said body extending therefrom, means to rapidly conduct away and dissipate heat from said body.

3. A resistor comprising, a body of disc-like form having high electrical resistance characteristics, said body having a diameter and cross-sectional area substantially in excess of its length or thickness, a coating of low electrical resistance but high heat conductive character-

istics adhered to and covering the top, bottom and peripheral surfaces of said body, an intermediate annular portion of said coating which covers the periphery of said body being cut away to provide a gap of selected width, as one factor adapted to adjust the resistance of the body within limits, and peripheral portions of said body exposed by said gap being cut away to provide a channel of selected depth as another factor adapted to adjust the resistance of the body within limits, the remaining parts of said coating providing means to rapidly conduct away and dissipate heat from said body.

4. A resistor comprising, a body of disc-like form having high electrical resistance characteristics, said body having a diameter and cross-sectional area substantially in excess of its length or thickness, a coating of low electrical resistance but high heat conductive characteristics adhered to and covering the top, bottom

5 and peripheral surfaces of said body, an intermediate annular portion of said coating which covers the periphery of said body being cut away to provide a gap of selected width, as one factor adapted to adjust the resistance of the body within limits, and peripheral portions of said body exposed by said gap being cut away to provide a channel of selected depth as another factor adapted to adjust the resistance of the body within limits, the remaining parts of said coating providing means to rapidly conduct away and dissipate heat from said body, a conductive base to contact the coated bottom face of said body, a contact plate to engage the coated top face of said body, fastening means to bind said contact plate, body and base together, and means to insulate said fastening means from said body and contact plate.

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