Oct. 20, 1931. H. PENDER 1,828,577

ELECTRICAL RESISTANCE DEVICE

Filed May 4, 1929

Fig. 1.

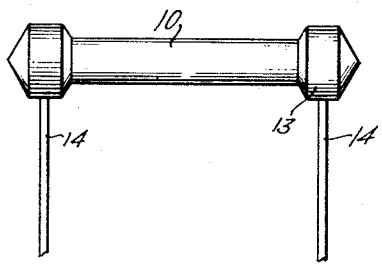


Fig. 2.

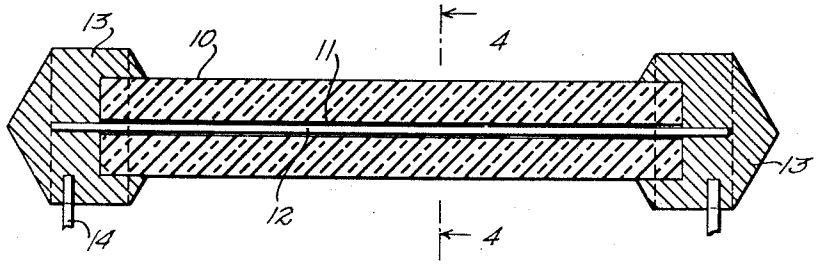


Fig. 3.

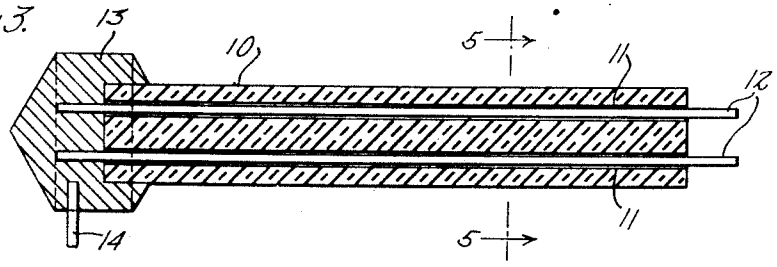


Fig. 4.

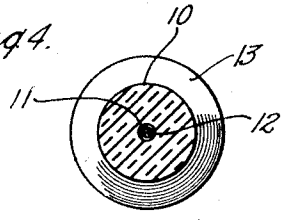
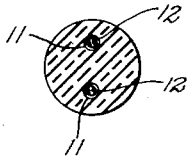


Fig. 5



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UNITED STATES PATENT OFFICE

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ELECTRICAL RESISTANCE DEVICE

Application filed May 4, 1929. Serial No. 360,343.

This invention relates to the construction of electric resistance devices.

One of the objects thereof is to provide a device of the above nature which is practical and efficient in operation. Another object is to provide a device of the above nature capable of affording a high electrical resistance and particularly well adapted for use with power supply apparatus employed in connection with radio receiving apparatus. Another object is to provide a device of the above nature capable of carrying substantial loads and dependably withstanding service usage. Another object is to provide a device of the above nature, simple in construction and inexpensive to manufacture. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are shown two of the various possible embodiments of my invention,

Figure 1 is a side view of a complete resistance device;

Fig. 2 is a longitudinal section through the axis of the device;

Fig. 3 is a similar section taken through a modification in which two resistance elements are employed;

Fig. 4 is a cross section taken on the line 4—4 of Fig. 2; and

Fig. 5 is a cross section taken on the line 5—5 of Fig. 3.

Similar reference characters refer to similar parts throughout the specification and the drawings.

Referring now to the drawings for a description of my invention, there is shown at 10 an insulating rod or tube serving as a support and protector for the resistance element 12. This rod, or tube, is composed of a material of good electrical insulating properties and having high heat conductivity. It is also, to a high degree, impervious to the infiltration of air. Porcelain is preferably used for this purpose, as it has these desired qualities to a notable extent. The member 10 has formed therein one or more capillary passages 11, extending therethrough from end to end.

Referring to Fig. 2, a resistance element 12 is shown positioned within the capillary passage 11, which furnishes a conducting path of high electrical resistance and extends through the member 10, and preferably slightly beyond the same at both ends. I prefer to use for this resistance element a construction in which a film of conducting material is deposited upon a suitable non-conductive surface, and in practice I use a glass rod, fiber, or filament coated with a film of conducting material, such as is described in my co-pending application, Serial Number 33,327, filed May 28, 1925 and which has now become Patent 1,771,055. The conducting material referred to is preferably a thin film of carbon or its allotropic form graphite, deposited upon the glass fiber and having a film of resin or other binder deposited on the outside thereof to serve as a protection for said film. The relative cross sectional dimensions of the capillary passage 11, and the resistance element 12, are such that the passage is just capable of receiving the said element when the latter is introduced into one end of said passage and pushed through to the desired position, so that while the element 12 is movable longitudinally of the member 10, it is, notwithstanding, in substantial and intimate surface contact with the walls of said passage. As shown in the drawings, the space about the fiber is exaggerated, better to disclose the structure. In practice, the diameter of the filament preferably is on the order of .022″, while that of the passage is on the order of .024″. It should here be stated that other forms of resistance material may be employed in this connection.

The ends of the tube 10 are sealed by molding thereover metal caps 13, consisting of an alloy of comparatively high melting point, such as a high melting solder. These caps form an air-tight covering for the ends of the tube and support the ends of the resistance

element 12, making electrical contact with the conducting film. The caps 13 are formed at their tips adaptably to be received and held between spring clips and are provided with terminal conductors 14, each of which has an end thereof passing through the side of its respective cap and is secured therein, when the said caps are molded to the insulating tube 10. These terminals furnish a convenient means for attaching a fixed condenser or other device.

It will be understood that the tubes 10, and alloy caps 13, provide protection for the resistance element 12, from mechanical injury, and prevent access of air thereto. Efficient electrical contact is maintained between the said caps and the conducting film or surface of the resistance element 12; and the porcelain, by reason of its heat conducting capacity and substantial contact relation with said surface, is able to conduct away heat generated by currents flowing through the said element, and thereby materially prolong the life of the device.

Figs. 3 and 5 illustrate the employment of two film-coated fibers or resistance elements positioned in parallel relation in two spaced capillary passages through the tube 10. Without affecting the nature of my invention, constructions may be used employing three or more such elements. By thus adding to the conducting paths maintained in the resistance device, its effective resistance may be dependably reduced in a manner proportional to the said number of paths, without materially increasing the size of the finished device, and without going to the trouble and expense of providing resistance elements or film covered fibers of different conductive capacity. This not only facilitates the manufacture of the devices, but renders them capable of close standardization, and uniformity in service.

Thus these resistance devices are capable of affording a wide range of electrical resistance and are capable of carrying a substantial load without being harmfully affected thereby; for example, a single film, which will normally stand only about a quarter watt in the open air, can be made to pass as high as three or four watts when incased in a tube such as has been described. This device is particularly adapted for use in power units such as the current rectifiers or B-eliminators used with radio receiving apparatus.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In an electrical resistance, in combination, a rod of insulating substance of good heat conducting quality having a capillary passage longitudinally therethrough, a resistance element in said passage comprising a filament of insulating substance coated with carbon, and molded metal end pieces on the ends of the rod sealing the ends of the capillary passage and having the filament embedded therein said molded metal embracing the outside of the said rod, said resistance element being in substantial contact with the wall of and substantially fitting the capillary passage.

2. In an electrical resistance, in combination, a rod of insulating substance of good heat conducting quality having a capillary passage longitudinally therethrough, a carbonaceous resistance element in said passage, and molded metal end pieces embracing the ends of the rod sealing the ends of the capillary passage and having the ends of the element embedded therein, said resistance element being in substantial contact with the wall of and substantially fitting the capillary passage.

3. In an electrical resistance, in combination, a rod of insulating substance of good heat conducting quality having a capillary passage longitudinally therethrough, a carbonaceous resistance element in said passage, molded metal end pieces embracing the ends of the rod sealing the ends of the capillary passage and having the ends of the element embedded therein, said resistance element being in substantial contact with the wall of and substantially fitting the capillary passage, and terminal conductors embedded in the molded metal end pieces in intimate contact therewith.

In testimony whereof, I have signed my name to this specification this twenty-ninth day of April, 1929.

HAROLD PENDER.