

May 16, 1933.

G. F. BENKELMAN

1,909,247

ELECTRICAL RESISTANCE DEVICE

Filed Dec. 11, 1930

Fig. 1

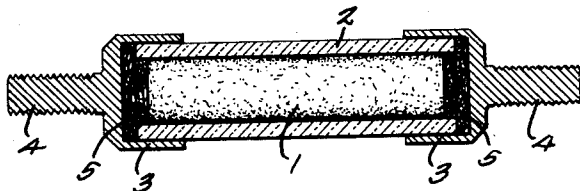


Fig. 2

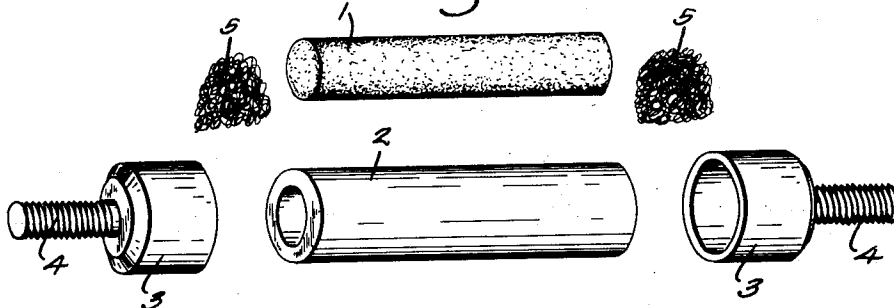


Fig. 3

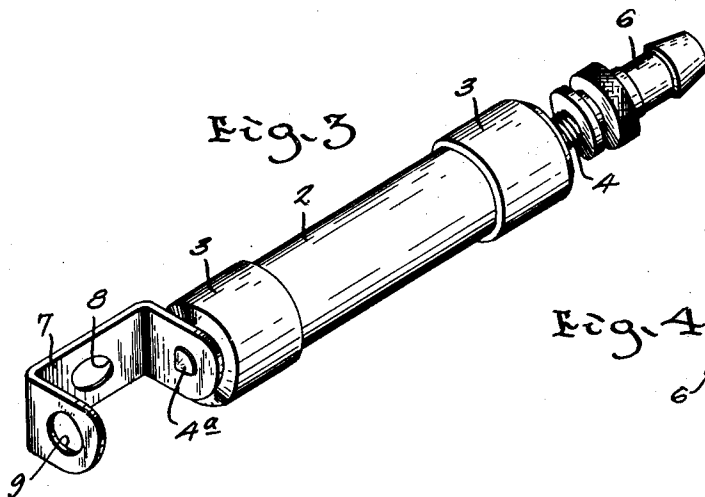
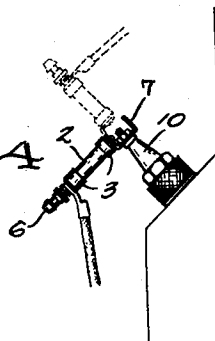


Fig. 4



Glen E. Benkelman
INVENTOR
By *Smith and Freeman*
ATTORNEYS

UNITED STATES PATENT OFFICE

GLEN F. BENKELMAN, OF CLEVELAND, OHIO, ASSIGNOR TO CONTINENTAL CARBON, INC., OF CLEVELAND, OHIO, A CORPORATION OF OHIO

ELECTRICAL RESISTANCE DEVICE

Application filed December 11, 1930. Serial No. 501,579.

This invention relates to resistance devices and has for its object the provision of a new, improved, simplified, reliable, and weather-proof resistance element of great cheapness and simplicity, combined with mechanical strength and sturdiness; the provision of new means for assembling such a resistance device; while further objects and advantages of the invention will become apparent as the description proceeds.

In the drawing accompanying and forming a part of this application, I have shown certain typical forms of my improved resistance device. Fig. 1 is a longitudinal sectional view through one of the devices assembled; Fig. 2 is a separated perspective view showing the same elements disassembled; Fig. 3 is a perspective view of a spark-plug resistance containing my improvements; and Fig. 4 illustrates the mode of using the last-named device.

Delicately - adjusted signal - and - control - systems, such as radio, train-control, light-control devices, and the like often require the employment of resistance-elements in exposed situations; yet under conditions demanding a high degree of accuracy. As an example of such a use, which in addition contains a sharply-limited cost-element I have here selected the ignition-system of an automobile or aeroplane which is equipped with radio-receiving apparatus, whether for ulterior use or for mere pleasure. Experience has demonstrated that it is necessary to introduce resistance into the ignition-system sufficient to reduce the current-flow to a point which will not interfere with the reception, without at the same time rendering the motor inoperative; and a great many other uses exist.

According to my invention I employ a resistance element 1 of carbon, finely-ground, mixed with clay (with or without other substances) and baked to a hard, stable condition. The fineness proportions and compositions of the ingredients and the length and cross-section of the resulting rod determine the resistance which can be controlled with a high degree of exactness; but the rods, particularly when small, are somewhat fragile in addition to which they need to be

shielded from moisture and climatic influences. This I accomplish by introducing the rod into a tube 2 of suitable material such as porcelain or the like, and upon the ends of this tube I press hollow metallic caps 3 provided with suitable stems 4. These caps are made a proper press-fit as will be well understood by mechanics; and in order to effect a tight seating of the cap and a reliable electric contact between the cap and the rod I introduce into each cap a quantity of metal wool 5. The metal employed for this purpose is generally steel, although brass is equally usable, but whatever the material it should be of very great fineness. Substantially no care is required as to the amount of such material to be used, since its elasticity enables the cap to be entirely filled with it, without preventing the application of the cap to the tube and likewise enables a small quantity to serve the purpose. In addition to effecting contact between the cap and rod, regardless of substantial variations in the relative length of rod and tube, this material has the further effect of increasing the security of contact between the cap and the tube.

The ends of the caps may be provided with any suitable attaching means. In Fig. 1 the stems are screw-threaded for the reception of binding-posts. In Fig. 3 one cap has threaded thereto a spark-plug adaptor terminal 6, while to the other cap is riveted at 4^a a U-shaped metallic clip 7 having apertures 8 and 9 with adjacent sides to enable the device to be affixed to a spark-plug 10 in different positions as indicated in the full lines and dotted lines of Fig. 4.

Many modifications of the specific forms herein shown may be made, and I do not limit myself except as specifically recited in my several claims which I desire may be construed broadly, each independently of limitations contained in other claims.

Having thus described my invention what I claim is:

1. An electric resistance device including an impervious rigid tube of non-conducting material, a resistance rod in said tube, end elements applied to the ends of the tube, and

a compressible wad of metal wool interposed between an end of said rod and the adjacent face of at least one of said end elements.

2. An electric resistance device comprising a mixture containing clay and carbon baked in the form of a rod, a hollow tube of nonconducting material surrounding said rod, metallic end members pressed on said tube and closing the ends thereof, and a wad of compressible electric conducting material in the form of metallic wool interposed between each end of the rod and the respective end members to effect a positive contact with the rod material when the end members are pressed into position on the tube.

3. A spark-plug resistance for the purpose described comprising a hollow tube of non-conducting material, a metallic end-member secured to each end of said tube, means for attaching one of said members to a spark-plug and the other member to a wire, a resistance-rod inside said tube and a wad of hair-like metallic members comprising a compressible electric conducting cushion interposed between said rod and one of said members.

4. A resistance device comprising, in combination, a mixture containing clay and carbon baked in the form of a rod, a hollow tube of non-conducting material surrounding said rod, means closing the ends of the tube, and having metallic contact faces pressed towards the bore of said tube, and a wad of compressible material comprising hair-like tangled metal members interposed between the end of said rod and the adjacent contact face.

In testimony whereof I hereunto affix my signature.

GLEN F. BENKELMAN.