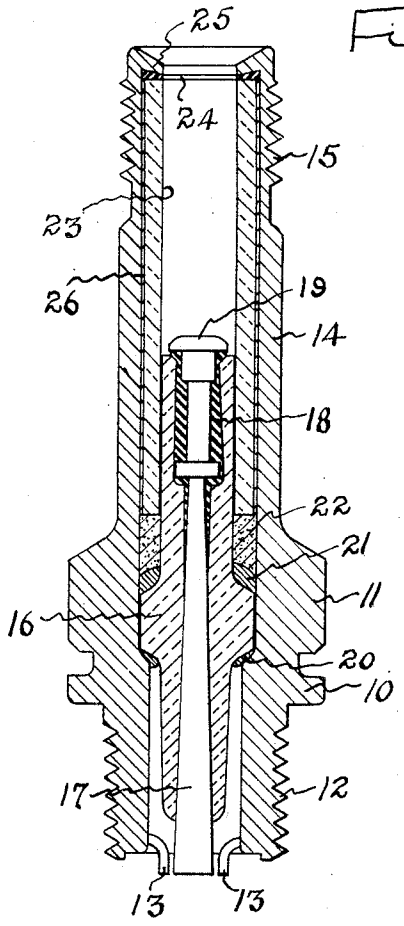
May 29, 1945. H. I. DANZIGER 2,377,213

ELECTRICAL DEVICE

Filed July 9, 1943

Fig. 1.



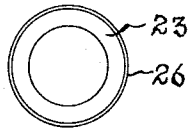


Fig. 2.

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ELECTRICAL DEVICE

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Application July 9, 1943, Serial No. 493,967

2 Claims. (Cl. 123—169)

This invention relates to improvements in electrical devices of various forms in which high voltage stresses normally occur as, for example, aviation engine spark plugs particularly as constructed for high altitude flying.

The main object of this invention is to provide means in devices of this type by which the concentration of electrical stresses is prevented with the result that the tendency to break down the insulation thereof is minimized.

The more detailed objects of the invention and the full nature thereof will be apparent from the following description of one embodiment of the invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts as will be described in detail below.

In the accompanying drawing,

Figure 1 is a vertical, central, cross-sectional view of an aviation engine spark plug embodying the subject matter of this invention; and

Figure 2 is an end view of the insulating sleeve prepared in accordance with this invention.

The invention is described in connection with an aviation engine spark plug especially of the type devised for high altitude flying but as will be apparent to those skilled in the art as the description proceeds, it has a wide variety of applications. The structure of the figures will first be described since the function will then be easier to explain. The spark plug illustrated in the drawing is of a conventional type and includes a metallic body and shield 10 having a nut or wrench portion 11, the threaded end 12 which fits into the engine, and the sleeve 14 terminating in the threaded end 15 by means of which the usual ignition shielding is mechanically and electrically connected thereto. At the threaded end 12 of the housing are a plurality of sparking points 13 commonly found in such devices. This tubular housing or body portion 10 is, of course, of metal and the interior bore thereof is formed to provide a seat against which the central electrode assembly is mounted and sealed. This assembly includes a ceramic member 16 within which the tapered central sparking terminal 17 is mounted and sealed by means of the insulating composition 18. The insulator 16 is usually of a ceramic material. The terminal end 19 of the sparking pin 17 receives one terminal of the ignition circuit.

This firing pin unit is mounted in the bore of the housing as shown and sealed therein in gastight relation by means of the metal seals 20 and 21 which are sometimes copper. Packed in above the seal 21 is a cement or insulating paste or powder 22 against which one end of the insulating tube 23 lies. The other end is engaged by a gasket 24 of rubber or the like and both are locked in place by forming over the end of the housing as shown at 25 to lock the parts in assembled relation. The insulator 23 may be of many insulating materials but is commonly of a ceramic nature and is usually formed basically of steatite.

To this point the description is of a conventional structure to which alone no claim of novelty is asserted herein. The other ignition circuit wire, of course, is grounded on the housing through the engine so that high potential electrical stresses are set up between the conductor extending into the ceramic sleeve 23 and the metallic sleeve portion 14 of the housing. Except and unless very expensive and prohibitive machining and finishing operations are performed there are found to be irregularities in the outer surface of the sleeve 23 and the adjacent inner surface of the sleeve portion of the housing 14 in which small pockets of air are trapped when the device is assembled. Under the high potential stresses to which the device is subjected, these pockets of air break down and ionize forming a brush discharge which results in the concentration of the potential stresses at these points. As a result of such concentration rather than uniform distribution of these stresses the insulation frequently breaks down under continued stress which, of course, is highly undesirable.

In accordance with this invention, in the form illustrated, the outer surface of the insulating sleeve 23 is coated in any suitable manner with a conducting shield 26. By way of example, this shield may consist of a thin coating of any suitable metal applied to the bushing 23 so as to be firmly bonded thereto throughout all its areas. It is possible by various methods to apply this coating so that no air pockets are formed. The coating may be applied by electro-plating, metal spraying as by a Shoop gun, dipping and the like. The only precaution necessary is to be sure that the coating which may be exceedingly thin is in contact with and firmly bonded to the outer surface of the sleeve throughout its area. As illustrated in Figure 1, such a coated sleeve can be more easily finished than the insulator so as to minimize the number of pockets between it and the sleeve 14 but it does no harm if small air pockets are present with this arrangement in

view of the fact that the voltage gradient due to the electrical stresses produced by the high potential difference if uniformly distributed throughout the areas under stress so that there is not a sufficient concentration of stress to cause ionization of the air and any pockets that may be present. Thus concentrated stresses on the insulator are eliminated and the danger from breakdown is removed.

In some ignition systems, the ignition circuit wire which extends to the contact 19 is uninsulated at the portion within the bushing 23 and in this case it will be helpful to provide a coating on the interior of the bushing 23 similar to the coating 26 but, of course, terminating short of the upper end of the bushing a sufficient distance so that serious current leakage does not result. It is, of course, within the contemplation of the invention to use such coatings on both the inside and outside of the bushing when this appears to be advantageous.

From the above description it will be apparent to those skilled in the art that the subject matter of this invention is adaptable to various forms of electrical devices and may itself take variations while securing the advantages of the invention. I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration but rather by the scope of the claims granted me.

What is claimed is:

1. An aviation spark plug comprising a metallic housing having a sleeve portion, a sparking terminal mounted in said housing, a separate ceramic insulating bushing lying in said sleeve into which the circuit conductor for the sparking terminal extends and a conducting coating bonded to the surface of said bushing on the side adjacent said sleeve.

2. In the combination of claim 1, said conducting coating being of metal firmly bonded to the bushing and contacting said sleeve substantially throughout its area.

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