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L. L. STOFFEL ET AL
RESISTOR FOR SPARK PLUGS

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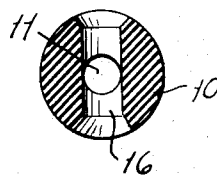
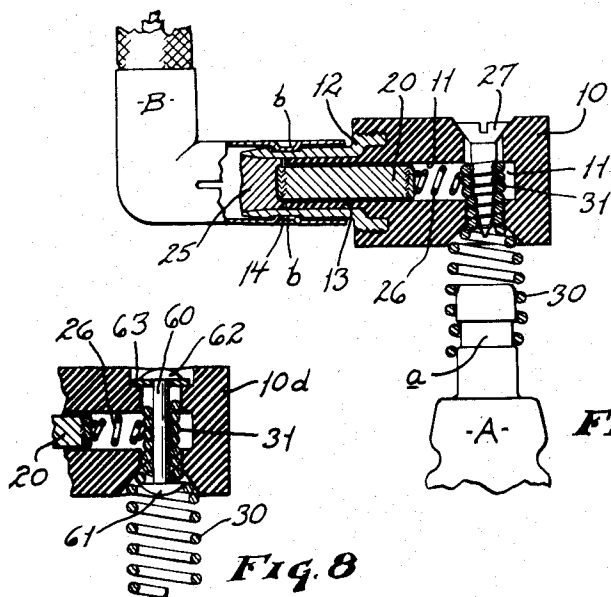


Fig. 3

Fig. 1

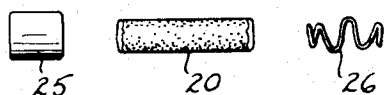


Fig. 2

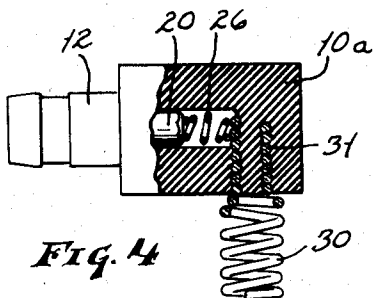
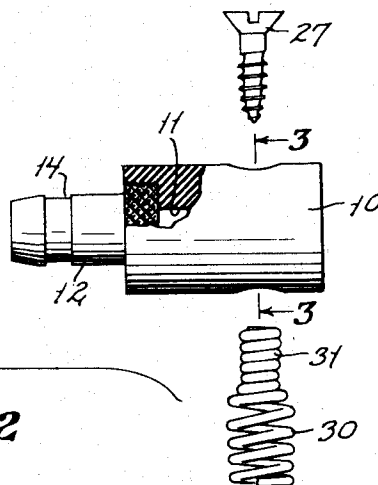


Fig. 4

Fig. 5

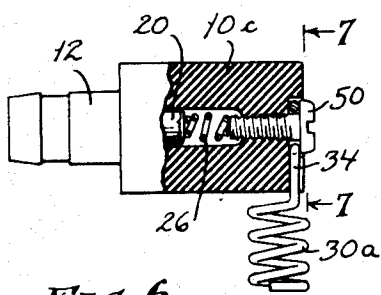


Fig. 6

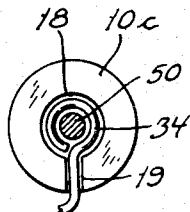


Fig. 7

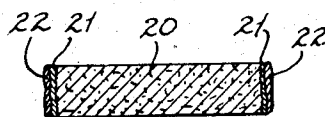


Fig. 9

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RESISTOR FOR SPARK PLUGS

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Application December 12, 1941, Serial No. 422,752

11 Claims. (Cl. 201—63)

This invention relates to a resisting device adapted to be inserted between an electric conductor and a spark plug to continue the connection and introduce a resistance adapted to suppress a spark at the connection to the plug. Such devices are in use for the purpose of preventing interference with radio reception on an automobile, due to the leakage or other irregular action of the ignition circuit. Our invention is concerned with the means for carrying the resisting element and effectively connecting it to the spark plug. Several embodiments of the invention are shown in the drawing hereof and are hereinafter more fully described and the essential novel characteristics are summarized in the claims.

In the drawing, Fig. 1 is a sectional side elevation of one form of our resistor in place between a spark plug and the conductor therefor; Fig. 2 is an exploded view of the parts of the resistor shown in Fig. 1; Fig. 3 is a cross section through the body of this resistor, as indicated by the line 3—3 in Fig. 2; Figs. 4, 5 and 6 are side elevations partly broken away and partly in section of modified forms of our resistor; Fig. 7 is a vertical cross section on a line 7—7 of Fig. 6; Fig. 8 is a fragmentary vertical cross section of still another modification of the resistor; Fig. 9 is a longitudinal axial section of the resisting element.

In Fig. 1, A indicates a spark plug having a conducting stem with an annular groove *a* therein. B indicates the head of a conductor which terminates in a split sleeve having inward projections *b* adapted to engage in the groove *a* of the plug when no resisting device is present. Our resisting device in any of the forms illustrated is adapted to be mounted on the spark plug and electrically and mechanically connect with the conducting groove *a* thereof and also with the two spring projections *b* of the supply line.

Referring first to the resisting device shown in Figs. 1, 2 and 3, 10 indicates a cylindrical body of insulating material having a central bore 11 leading from one end. This body carries a metallic sleeve 12 which is embedded in the end portion of the body and extends beyond it and around a reduced portion 13 of the body, and is provided with an annular groove 14 to receive the projections *b* of the conducting cable B.

Inserted in the bore 11 is a resisting element 20 which may be a round stick of carbon. 25 indicates a metallic plug, which may be of lead, seated in the end portion of the metallic sleeve 12, which preferably flares in this region. This

plug is thus in electric contact with the metallic sleeve 12 and also with the resisting element 20.

In the bore 11 of the body, at the other end of the resisting element and in electric connection therewith, is a compression spring 26 bearing against the other end of the element 20. This spring is compressed between the resisting element and an abutment (to be described) carried by the body. The spring 26 engages one end of the resisting element 20 and forces the other end against the plug 25.

The resisting element preferably carries suitable conducting metal at each end. To make a good connection between the metallic end and the carbon body of the resistor, we first spray the end of the resistor with molten copper to produce a layer 21 adhering to the resisting element, and then we apply a layer of solder 22 to the outside of this copper layer, as indicated in Fig. 9.

The means to connect our device to the spark plug comprises an external coiled spring 30 adapted to overlap the stem of the plug and seat in the groove *a* as shown in Fig. 1. In that view, and in Fig. 2, the end portion 31 of the spring 30 is coiled more tightly than the main body thereof, and this portion 31 enters a transverse opening 16 in the insulating body 10. A wood screw 27 enters the spring extension 31 within the lateral passageway of the insulating body 10 and holds its position, when it forms the abutment for the internal spring 26. That is to say, this wood screw is turned in from a position diametrically opposite the spring extension 31 and screws into such extension, thus expanding it and locking it to the body 10 as shown in Fig. 1, and at the same time establishing a good electric connection to the spring 26 which leads to the metallic end of the resisting element 20.

It will be seen that when the parts shown in Fig. 2 are assembled they produce the construction of Fig. 1 and provide a simple device readily attachable to the spark plug and to the conductor normally connecting directly to the plug, and thus introduce in the circuit a resisting element. The resistance of this resisting element exceeds the resistance between any other meeting parts of the connection from the conductor to the spark plug and thus operates to suppress any spark which might otherwise form at such junction and thereby reduces the interference with any radio equipment.

In the embodiment of Figs. 4, 5 and 6, the metallic sleeve 12 connected to the conductor and the open coiled portion of the spring adapted

to be mounted on the spark plug stem are the same as heretofore. The insulating body, while of the same general character, differs in the different embodiments, as does also its connection to the spring, as will now be explained.

In Fig. 4, the coiled spring 30 has an extension 31 substantially the same as in Fig. 1, but in this case the extension instead of being clamped by a screw is embedded in the body 10a at the time of formation of the body. A portion of the spring 31 bears against the inner end of the spring 26, the outer end of which bears against the end of the resisting element 20, as in Fig. 1. The parts of this embodiment not specifically shown are the same as in Fig. 1.

In Fig. 5, the body 10b is slightly differently formed. Its bore carries the resisting element 20 as already explained, backed up by the compression spring 26, but the inner end of this spring is held by a rivet 40, the shank of which is mounted in a transverse end portion of the body and the inner head 41 of which overlaps and engages the final coil of the spring 26. At the outer end the shank 40 extends through an eye 32 formed by the end of the spring 30a and the head 42 on that end of the shank overlaps the exterior of this loop or eye, with the result that the spring 30a is firmly attached to the body in good electric connection to the resisting element 20.

In the embodiment of Fig. 6, the body 10c is similar to those heretofore described, though specifically different, and is axially threaded to receive a clamping screw 50. This screw passes through a loop 34 on the spring 30a so that the head of the screw not only clamps the spring to the body 10c but is in good electric connection therewith. The inner end of the screw 50 bears against the internal spring 26 which at its other end bears against the resisting element 20.

In each of the embodiments of Figs. 5 and 6, the extreme end of the body 10b or 10c is circularly recessed at 18 to receive the loop of the spring 30a, the body having also a radial recess 19 to receive the extension of that loop leading to the open coil 30a, as illustrated in Fig. 7.

In Fig. 8, we have shown a modification of the embodiment of Fig. 1 in which the external coil spring is held in place by a rivet instead of a screw. In this view the body, designated 10d, is very similar to that of Fig. 1 and the receiving metallic sleeve (not shown) is the same as in Fig. 1, as is also the resistor 20 and the internal spring 26. The external spring 30 with its reduced extension 31 is the same as in Fig. 1, in place, however, of the wood screw 27. We secure the spring to the body in Fig. 8 by a rivet 60, which at the lower end has a head 61 underlying one of the smaller coils of the spring, where the size is reduced from the part 30 to the part 31, and at the upper end has a head 62 overlying a washer 63 seated in a recess in the body 10d.

The shank of the rivet 60 extends diametrically across the body and by means of its heads, permanently and effectively holds the external coiled spring in position to project at right angles to the body and engage the spark plug stem. The internal spring 26, which at one end abuts the resistor 20, and abuts at the other end some of the reduced coils 31 of the spring 30, as in the case of the embodiment of Fig. 1.

It will be seen that in each of the five embodiments shown, the resisting element of our device is housed within an insulating body and is in good electric connection to the open spring 75

coil 30 which engages the spark plug. This open spring provides a yielding mechanical support for the conductor and resistor, so that they are not likely to jar loose in the travel of the car.

In each embodiment the external spring is in good electric connection to the internal spring which bears against the metallic end of the resisting element and operates to press said element so that its other end is maintained in good metallic connection with the plug connected to the terminal which the spring sleeve of the conductor engages.

It is to be understood that in each of the views, the parts are shown on a considerably larger scale than is normally employed in practice. The simple little device illustrated is readily mounted whenever desired by simply pulling the normal conductor free from its plug and attaching the resistor to the plug and the conductor to the resistor. The conductor is thus maintained approximately in its normal position and serves to conduct the sparking current to the plugs without danger of extraneous sparks to interfere with radio operation.

Reference is made to our divisional application Serial No. 450,672, filed July 13, 1942, for claims relating to a resistor for spark plugs have the screw anchorage of the external spring, illustrated, for instance, in Figs. 1 to 6, and to our divisional application 501,964, filed September 11, 1943, for claims on the electric connector herein illustrated independent of the resistor.

We claim:

1. A resistor for spark plugs comprising a body, means carried thereby for attachment of a conductor, a resisting element in the body, a coiled spring secured at one end to the body and projecting therefrom in the form of a helix adapted to embrace the stem of the spark plug and a conductor in the body electrically connected at one end with the coiled spring and at the other end with the resisting element.

2. In a resistor for spark plugs, the combination of an insulating body, a conductor carried thereby and projecting therefrom, a resisting element within the body, in electric connection at one end with the projecting conductor, an external spring having a portion adapted to engage the stem of the spark plug and having an extension projecting into a lateral opening in the body, a transverse member inserted into the body and occupying the extension and binding the external spring to the body, and a conductor within the body connecting one end against the resisting element with the inward extension of the external spring.

3. A resistor for spark plugs comprising an insulating body, a conducting sleeve carried thereby, a resisting element within the body and sleeve, means for establishing an electric connection between the outer end of the resisting element and the sleeve, an external coil spring adapted to embrace a spark plug stem having a coiled extension of reduced diameter embedded within the material of the body, and an internal compression spring bearing at one end against the resistor at the other end against the extension of the external spring.

4. In a resistor for spark plugs, the combination of a body, a conductive extension carried thereby, a resisting element within the body, means for establishing electric connection between the outer end of the resisting element and said conductive extension, a coiled external

spring adapted to embrace a spark plug stem having an extension overlapping the body, a metallic member extending from the outside into the body and having an external head engaging and holding the extension to the body, an internal compression spring bearing at one end against the inner end of the resisting element and at the other end against the member which secures the external spring to the body.

5. In a resistor for spark plugs, the combination of an insulating body having a longitudinal bore, a conductive extension projecting from one end of the body, a resisting element within the body and extension, means for establishing electric connection between the outer end of the resisting element and the extension, a coiled external spring adapted to embrace a spark plug stem having an extension terminating in an eye at the opposite end of the body, a longitudinal metallic member passing through the eye and having a head on the exterior thereof to hold the extension to the body, an internal compression spring bearing at one end against the inner end of the resisting element and at the other end against the member which secures the external spring to the body.

6. A resistor for spark plugs comprising an insulating body having a bore, a conducting extension carried by the body, a resisting element within the bore, means for connecting one end of the resisting element electrically to the conducting extension, an external spring adapted to embrace the stem of a spark plug, said spring having an extension terminating in an eye at one end of the body, a rivet having a shank passing through the eye and occupying the body and having an external head on the outer side of the eye and an internal head within the bore of the body, and an internal compression coiled spring within the bore having its end coil entered by the shank and overlapped by the inner head of the rivet, the other end of the internal spring bearing against the resisting element.

7. A resistor for spark plugs comprising an insulating body having a bore, a metallic conducting sleeve carried by the body projecting beyond one end thereof and suitable for engagement by the electric conductor which normally engages the spark plug stem, an external metallic coiled spring secured to the body and having a portion projecting at right angles thereto adapted to embrace a spark plug stem having an external form similar to the conductor carried by the body, a resisting element within the body having metallic ends attached thereto, a plug for connecting the outer end of the resisting element electrically to the external sleeve carried by the body, a compression spring within the body bearing against the other metallic end of the resisting element, an extension of the external spring ef-

fectively secured to the body, and means for establishing an electric connection between such extension and the internal spring.

8. In a resistor for spark plugs, the combination of an insulating body, a conductor carried thereby and projecting therefrom, a resisting element within the body, in electric connection at one end with the projecting conductor, an external spring having a portion adapted to engage the stem of the spark plug and having an extension projecting into a lateral opening in the body, a rivet extending transversely of the body and occupying the extensions, said rivet having a lower head engaging a coil of the external spring when its diameter is reduced and an upper head coacting with the opposite side of the body, and a compression spring within the body bearing at one end against the resisting element and at the other end against the inward extension of the external spring.

9. A resistor for spark plugs comprising an insulating body having a longitudinal bore, a resisting element and a spring element aligned therewith, both within said bore, a spring having an external helical coil adapted to embrace a spark plug and having its end portion firmly anchored to the insulating body, the anchoring means also maintaining the attached end of the external spring in electric contact with the adjacent element within the bore.

10. A resistor for spark plugs comprising an insulating body having a bore, an external metallic member carried by the body and extending across the end of the bore, an external coiled spring anchored to the body in a manner to present a conductor within said bore adjacent its opposite end, and a resisting element and a compression spring in series within the bore forming the connection from the external metallic member first mentioned to the coiled spring anchorage, said resisting element comprising a carbon body having metallic layers firmly adhering to its opposite ends.

11. A resistor device for eliminating radio interference caused by the high frequency discharge of a spark plug, said device comprising a hollow body, a resistor element in said body, connector means carried by said body for attachment to a conductor cable, an electrical connection between said means and said resistor, a resilient and flexible connector means carried by said body and electrically connected with said resistor, said last named means projecting from said body and being provided at its outer end with a spark plug engaging portion whereby a region of said means intermediate said portion and said body permits limited relative movement between said body and the spark plug to which it is attached.

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