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SPARK PLUG

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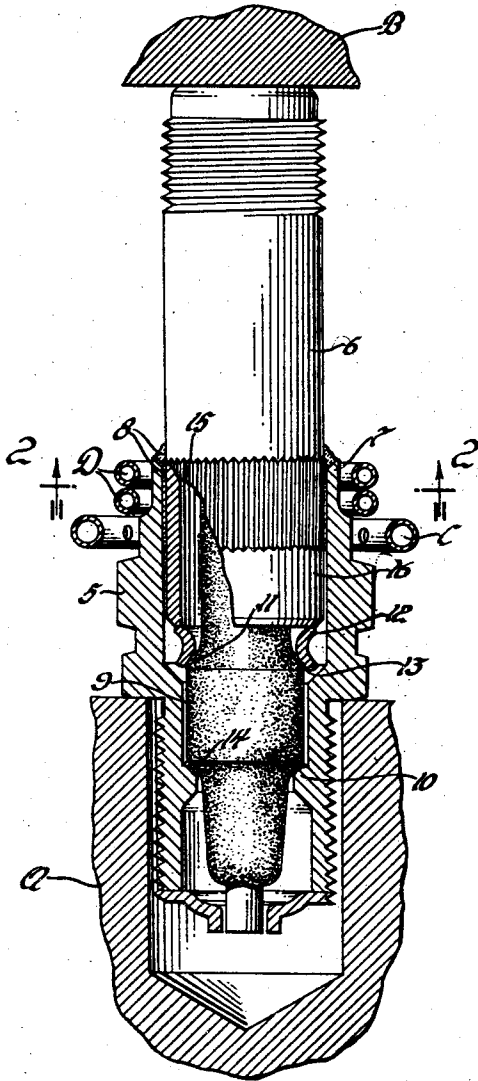


Fig. 1

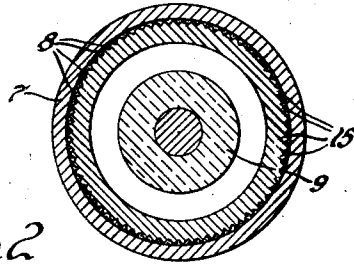


Fig. 2

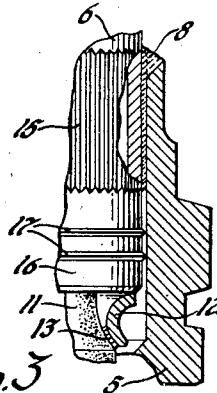


Fig. 3

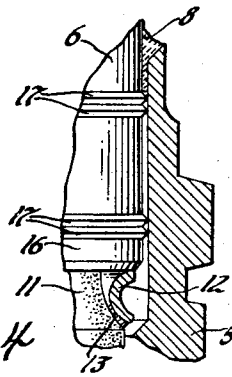


Fig. 4

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SPARK PLUG

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9 Claims. (Cl. 123—169)

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This invention has to do with internal combustion engine spark plugs which include a metal shell within which the lower portion of the insulator is housed and a tubular metal shield which houses the upper portion of the insulator and whose lower end extends into the shell and is metal-
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lically bonded thereto. The invention resides in improvements which insure more perfect positioning of the shield with respect to the shell during the operation of metal-
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lically bonding the shield to the shell to the end of securing a more perfect bond between the shield and the shell and a more perfect position-
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ing of the shield with respect to the shell in the finished plug.

For a better understanding of the nature and objects of this invention reference is made to the following specification and the accompanying drawing in which are described and illustrated preferred embodiments of the invention.

In the accompanying drawing:
Figure 1 shows elements of a spark plug in accordance with my invention in the apparatus in which the shield is metal-
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lically bonded to the shell.
Figure 2 is a section taken as indicated by the line 2—2 in Figure 1.

Figures 3 and 4 show portions of other spark plugs in accordance with my invention.

Referring now to the drawing accompanying and forming a part of this specification, the reference numeral 5 designates the hollow tubular metallic shell portion of a spark plug whose lower end is threaded to screw into an internally threaded opening in the head of an internal combustion engine cylinder; and 6 designates the tubular metallic shield portion of the plug whose lower end fits closely within the tubular upper portion 7 of the shell. In the finished plug the lower end of the shield is held in place within the portion 7 by the metal bond indicated by the numeral 8 and as will hereinafter appear.

The usual insulating member of the plug, which is indicated by the numeral 9, is supported by a lower annular ledge 10 in the shell and has an inclined upper shoulder 11. Above this shoulder and surrounding the portion of the insulator member immediately thereabove is an annular holding member 12, preferably C-shaped in cross-section as shown, on which the lower end of the shield 6 is seated and which in the finished plug acts as a stiff spring to hold the insulating member against a gasket 14 supported by the ledge 10 to thereby secure gas-tightness in the finished plug. A metallic gasket 13 of copper, nickel or
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equivalent material is shown as interposed between the lower end of the holding member 12 and the shoulder 11.

The reference character A indicates the fixed and the reference character B the movable element of a press in which the heretofore mentioned elements of the plug are held during the operation of metal-
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lically bonding the shield 6 to the shell 5 to force the insulator 9 into gas tight engagement with the gasket 14 supported upon the ledge 10; this being accompanied by downward movement of the shield 6 and by distortion of the resilient holding member 12 as the pressure applied between the press elements is ordinarily around 3000 pounds. The downward movement of the shield, however, and despite the great pressure commonly employed, is slight because the C-shaped holding member 12 is extremely stiff and is but little distorted notwithstanding the great pressure to which it is subjected.
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While the parts of the plug are held under compression between the press elements A and B the lower end of the shield 6 is metal-
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lically bonded in place within the tubular extension 7 of the shell as by melting a ring of brazing material seated in the channel between the upper end of the extension 7 of the shell and the shield, and the joint between the parts is then rapidly cooled by jets projected from an annular air or water supply conduit C. Heating of the upper end of shell to accomplish the metallic bonding of the parts together may be accomplished by a coil D through which an alternating current flows as in the usual method of induction heating.
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Especially with respect to the press elements A and B, the illustration in the drawing of the apparatus in which the shield 6 is metal-
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lically bonded to the shell 5 must be considered highly diagrammatic. In actual practice, in order to avoid applying to the shield pressure which may collapse it, it is preferably to employ, to hold the parts of the plug under compression during the operation of metal-
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lically bonding the shield to the shell, apparatus of the type disclosed in my application Serial No. 454,418, filed August 11, 1942. But, since this application is not concerned with this feature of the manufacture of the plug, it is thought that the diagrammatic illustration thereof which is found in the drawing will suffice.
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To insure a strong and secure bond between the shield and the shell, a layer of bonding material of considerable extent lengthwise of the shield and the shell and of uniform thickness throughout its length and circumference is desirable. To insure this and proper positioning of the shield

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with respect to the shell in the finished plug any of the several expedients hereafter referred to may be employed.

For example, as shown in Figure 1, the upper portion of that part of the shield 6 which is disposed within the shell may be provided with lengthwise extending knurls or ridges 15 and made of such diameter that it will fit snugly into the shell and of such length as to obviate cocking of the shield with respect to the shell during the operation of metallically bonding the shield to the shell and, a fortiori, thereafter. Preferably the portion 16 of the shield below the knurls or ridges is left or made of slightly smaller diameter than the internal diameter of the upper end of the shell so that it may serve to pilot the shield into the shell.

The knurls or ridges 15 insure that when the shield is in place in the shell it will be neither displaced laterally more to one side than the other or cocked with respect to the shell and there will, nevertheless, be between the shield and the shell space for an adequate layer of bonding metal which is uniformly distributed circumferentially and of adequate dimensions both lengthwise and radially of the shield and the shell. Consequently, when the ring of brazing metal is fused it will flow down into the grooves between the ridges or knurls 15 and form between the shield and the shell a bond of adequate dimensions both lengthwise and radially and of substantially uniform thickness throughout the circumference of the shield and the shell. Thus my invention insures not only proper positioning of the shield with respect to the shell in the finished plug but also a strong and secure bond between the shield and the shell.

To obviate any tendency of the brazing metal to run out of the zone of the knurls or ridges 15 during the operation of bonding the shield to the shell there may, as Figure 3 shows, be provided on the shield below the knurls or ridges 15 circumferentially extending knurls or ridges 17 which will fit snugly within the shell.

Projections of other forms than the lengthwise extending knurls or ridges 15 may be employed to much the same effect. For example, instead of the lengthwise extending knurls or ridges 15 there may be provided spur-like projections distributed over the same area.

In the embodiment of the invention which is shown in Figure 4, there are provided no projections which correspond to the lengthwise extending knurls or ridges 15. Instead the external diameter of the shield is made sufficiently smaller than the internal diameter of the shell to accommodate a layer of bonding metal of the desired thickness between the shield and the shell and eccentricity and cocking of the shield with respect to the shell and any tendency of the bonding metal to run out of the zone in which the bond between the shield and the shell is desired is prevented by providing on the shield below this zone circumferentially extending knurls or ridges 17 which will fit snugly within the shell.

Any or all of the knurls, ridges, spurs or other projections referred to may be formed on the interior of the shell instead of on the exterior of the shield but this does not appear as practicable as forming them on the exterior of the shield.

I claim:

1. A spark plug which includes a metal shell, a metal shield telescoped within the shell, spaced circumferentially extending projections on one of the mentioned members at a distance from an

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end of the shell which space substantially uniformly from the shell both circumferentially and lengthwise a portion of the shield near the mentioned end of the shell, and bonding metal in the space between the shell and the mentioned portion of the shield.

2. A spark plug which includes a metal shell, a metal shield telescoped within the shell, spaced projections on one which engage the other of the specified members and with the shield and the shell define channels between the shield and the shell near an end of the shell, bonding metal in the channels, and a circumferentially extending projection on one of the shield and the shell between the specified projections and the entering end of the shield to prevent loss of bonding metal from the mentioned channels during the operation of bonding the shield to the shell.

3. A spark plug which includes a metal shell, a metal shield telescoped within the shell, spaced projections on the exterior of the shield which engage the interior of the shell and with the shield and the shell define channels between the shield and the shell near an end of the shell, the shield being of smaller external diameter at its entering end than in the zone of the spaced projections to facilitate its insertion into the shell, and bonding metal in the channels.

4. A spark plug which includes a metal shell, a metal shield telescoped within the shell with relatively raised and depressed portions on the exterior of the shield which engage the interior of the shell and define channels between the shield and a portion of the shield near an end of the shield, and bonding metal in the channels.

5. A spark plug which includes a metal shell, a metal shield telescoped within the shell, relatively raised portions on one which engage the other of the specified members and space substantially uniformly from the shell both circumferentially and lengthwise a portion of the shield near an end of the shell, the shield being of smaller external diameter at its entering end than at a distance therefrom to facilitate its insertion into the shell, and bonding metal in the space between the shell and the first mentioned portion of the shield.

6. A spark plug which includes a metal shell, a metal shield telescoped within the shell, relatively raised portions on the exterior of the shield which engage the interior of the shell and space substantially uniformly from it both circumferentially and lengthwise a portion of the shield near an end of the shell, the shield being of smaller external diameter at its entering end than at a distance therefrom to facilitate its insertion into the shell, and bonding metal in the space between the shell and the first mentioned portion of the shield.

7. A spark plug which includes a metal shell, a metal shield telescoped within the shell, relatively raised portions on the exterior of the shield which engage the interior of the shell and space substantially uniformly from it both circumferentially and lengthwise a portion of the shield near an end of the shell, and bonding metal in the space between the shell and the mentioned portion of the shield.

8. A spark plug which includes a metal shell, a metal shield telescoped with respect to the shell, relatively raised portions on one which engage the other of the specified members and space substantially uniformly from the shell both circumferentially and lengthwise a portion of the shield near an end of the shell, and bonding

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metal in the space between the shell and the mentioned portion of the shield.

9. In the art of manufacturing spark plugs which include a metal shell and a metal shield telescoped within and metallicity bonded to the shell, the expedient for properly positioning the shield with respect to the shell during the bonding operation and thereafter and thus insuring a satisfactory bond between the shield and the shell and proper positioning of the shield with respect to the shell in the finished plug which

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consists of providing on one of the shield and the shell relatively raised portions for engagement with the other of the shield and the shell and for spacing substantially uniformly from the shell both radially and circumferentially a portion of the shield near an end of the shell so that bonding metal may be introduced into the space between the shell and the mentioned portion of the shield.

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