June 4, 1935. H. RABEZZANA 2,003,464

METHOD OF MAKING SPARK PLUGS

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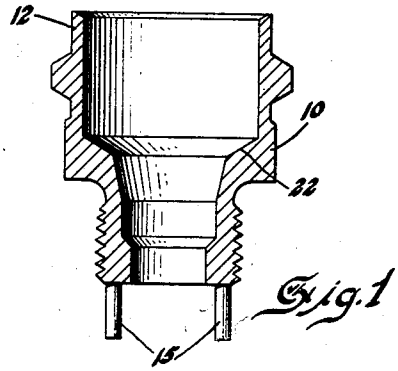


Fig. 1

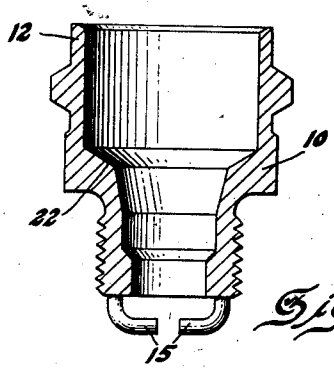


Fig. 2

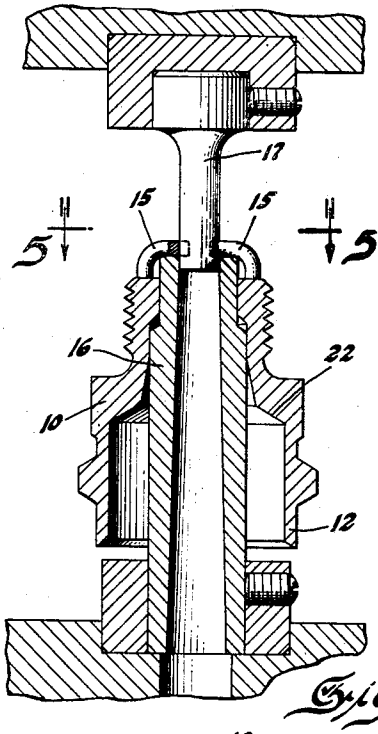


Fig. 3

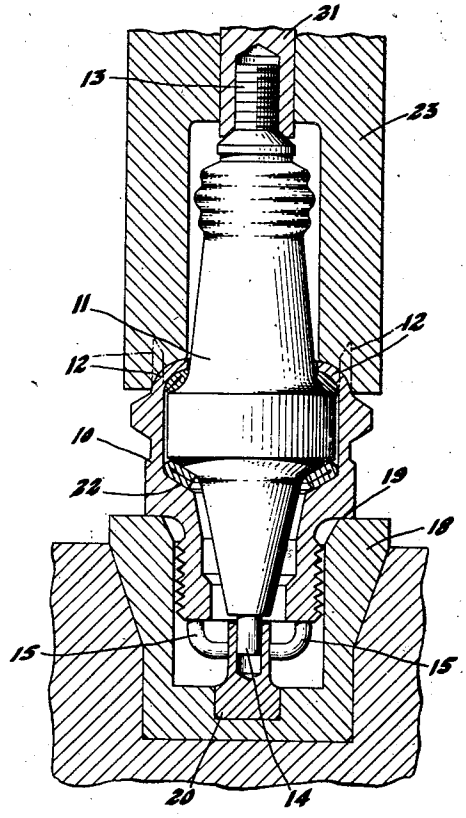


Fig. 4

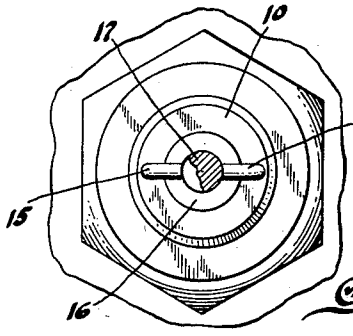


Fig. 5

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METHOD OF MAKING SPARK PLUGS

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8 Claims. (Cl. 29—155.51)

My invention relates to spark plugs for internal combustion engines, and the object thereof is to provide a method for making spark plugs whereby the outer shell electrode or electrodes may be better and more conveniently shaped into the form which they have in the finished plug, and more conveniently and certainly positioned in proper relation to the central insulated electrode in the completed plug, than has heretofore been the case.

Heretofore in the making of spark plugs the insulating member with the central electrode assembled therewith has usually been placed within the external metallic shell or casing of the plug and secured in place therein without particular regard for the position of the central electrode relative to the grounded shell electrode or electrodes; and the shell electrode or electrodes, the same having been welded or otherwise secured to the inner end of the shell, have been bent and adjusted into proper relation to the central electrode to form a spark gap of the proper length. This quite obviously required considerable care as the length of the spark gap is quite definitely fixed, and if the shell electrode was first positioned too close to the central electrode it had to be bent away therefrom, and if too far had to be bent toward the central electrode; the adjustment of the shell electrode relative to the central electrode to secure a proper length of spark gap prior to my invention having been an operation which required considerable skill and one in which repeated bending of the shell electrode was often necessary. In the method wherein my invention consists, however, the shell electrodes are bent into and given their finished form, and the length of the spark gap is definitely fixed and determined before the insulating member with the central electrode which it carries is assembled within the shell or casing of the plug; the insulating member and central electrode is placed within the shell and the inner end of the central electrode is located relative to the shell electrode in the definite position which it has to have in the completed plug to provide the proper length of spark gap; and then and while the extremity of the central electrode is kept in the particular definite relation to the shell electrode required in the completed plug the insulating member, which thus far has been loose within the shell, is fixedly secured in place within the shell, thus completing the plug.

The drawing accompanying and forming a part of this application is referred to in explaining the method wherein my invention consists, the various steps thereof being the better understood if explained in connection with figures of the drawing to be hereinafter more fully explained. Certain particular apparatus appears in connection with some of the figures; but it will be appreciated that my invention, being for a method or process, is independent of any particular mechanism and may be performed by the use of any apparatus, tools or devices suitable for use in the performing of the steps hereinafter explained and wherein my invention consists.

In the drawing:

Figure 1 is a view showing a section of a spark plug shell upon a central plane extending along its axis, the same being having two electrodes projecting from the inner end thereof.

Figure 2 is a similar view showing the shell electrodes bent inward and toward one another.

Figure 3 is a view used for explaining the step of my method which consists in removing surplus metal from the inner ends of the electrodes so that they will be properly spaced from the central insulated electrode in the finished plug.

Figure 4 is a view illustrating the steps of positioning the inner end of the insulated electrode properly relative to the ends of the shell electrodes, and securing the insulator in place within the shell while said inner end is kept in said position.

Figure 5 is a view looking down from a horizontal transverse plane indicated by the line 5—5, Figure 3.

Referring now to the drawing, the reference numeral 10 designates a hollow shell of a spark plug within which the porcelain or equivalent insulating material insulator 11 is secured in any way, as by bending an upstanding flange 12 of the shell into holding engagement with a shoulder upon the insulating member, as shown in Figure 4. The interior of the shell as will be understood is tubular in form, and circular in cross-section, and is commonly made from mild steel rod or bar stock. The insulating member has a tubular passage through which the insulated central electrode of the plug extends; the upper end of said central electrode to which a supply conductor is connected being indicated by the numeral 13, and the lower end thereof at which sparks occur by the numeral 14.

In the method wherein my invention consists the shell produced by a screw machine, turret lathe or equivalent device is provided with grounded or shell electrodes 15, these being preferably electrically welded to the inner end of the shell; although they may if desired be inserted

in holes in the shell and secured in place by staking, upsetting or otherwise so long as they are permanently and securely held in place. For convenience and to facilitate the equipping of the shell with the grounded electrodes they are commonly made straight initially, as shown in Figure 1.

The shell electrodes are next bent into substantially right angular form by any suitable mechanism or device, and the shell and electrodes after the latter are so bent is shown in Figure 2. The length of the electrodes is such that after having been bent, as shown in Figure 2, their inner ends are closer together than the distance between said ends in the finished plug.

The shell equipped with shell electrodes is next placed over a hollow die **16**, with the electrodes overlying the upper end thereof, as shown in Figure 3; and excess material is removed from the inner ends of the electrodes by a reciprocating punch **17** adapted to enter the hollow die. The inner extremities of the electrodes after the shearing step are the same distance apart that they are in the finished plug; and this distance may obviously be varied, as is necessary in producing plugs of different kinds and sizes, by using punches of different diameters and dies having corresponding central passages, to which end the die and punch are removable from the press parts whereby they are carried so that others of different size may be substituted for the ones shown in Figure 3.

The shearing or otherwise removing of surplus material from the inner ends of the electrodes leaves them in their final finished form and properly spaced to provide a spark gap of proper length in the finished plug, and the shell is next placed in a hollow supporting member **18**, as shown in Figure 4, whereby the shell is supported by engagement at **19** between the body of the shell and the upper end of the supporting member. Centrally located within the supporting member is an annular locating member **20** the external diameter of which corresponds with the distance between the inner extremities of the electrodes **15** after their ends have been sheared off or otherwise removed, as hereinbefore explained, and the internal diameter of which locating member corresponds with that of the inner end **14** of the central electrode of the plug. The insulating member **11** together with the usual gaskets is next placed within the shell **10**, with the inner end **14** of the central electrode extending into the annular locating member **20**. This is shown in Figure 4 although at this stage of the method the holding flange **12** has not yet been turned inward, as shown in full lines in said figure, to thereby hold the insulating member **11** permanently assembled with the shell.

It will be appreciated that when the shell is supported by the supporting member the annular locating member will be between the extremities of the shell electrodes, as shown in Figure 4; and that when the insulating member with its central electrode is assembled within the shell the inner end of the central electrode will be within the annular locating member and thus positioned centrally relative to the shell electrodes.

The wall thickness of the locating member as will be appreciated corresponds with the spark gap of the plug, and the same is made readily separable from the supporting member so that locating members corresponding with various distances between the extremities of the shell electrodes, and with various diameters of the inner end of the insulated electrode, may be used in place of the particular locating member shown in Figure 4 to thereby provide for varying diameters of said parts and for varying lengths of spark gap.

While the inner end **14** of the insulated electrode and the shell electrodes **15** are kept properly spaced by the locating member **20** the flange **12** of the shell is turned into engagement with the insulating member, as shown in Figure 4, to thereby hold the insulator permanently assembled within the shell; the length of the spark gap and the proper position of the shell electrodes relative to the central electrode having been determined before the bending inward of the holding flange as will be appreciated. If as is often the case a gland nut is used in lieu of a flange to hold the insulator in place the end of the central electrode will in the same way be held in proper position relative to the shell electrodes during the screwing home of the nut, the particular manner in which the insulating member is secured within the shell being variable although, as herein appears, I prefer to accomplish that end by forcing a flange which is integral with the shell into holding engagement with the insulating member.

The particular means for curling the flange **12** into holding engagement with the insulating member **11** may be of any suitable form. In Figure 4 this is accomplished by a holding plunger **21** which engages the upper end **13** of the central electrode and presses the insulator into firm engagement with the lower gasket shown and the shoulder **22** whereby the insulator is supported, and holds the insulator steady during the turning inward of the holding flange; after which a reciprocating die **23** having a properly shaped surface at its lower end engages the said flange **12** and bends it inward and into permanent holding engagement with the insulating member **11** as shown thereby finishing the plug.

Inasmuch as the later steps of my method are characterized by the keeping of the central and shell electrodes in the particular definite relation to one another which is necessary in the finished plug during, while and at the time when the insulating member is secured in place within the shell, so that a proper spark gap, that is one which does not have to be adjusted as a final step, is provided for initially and is present in the finished plug, I regard my method as starting either with a shell having electrodes longer than they are in the finished plug, as illustrated in Figure 2, or of the same length that they are in the finished plug. In the first case excess length has to be removed from the shell electrodes as illustrated in Figure 3; whereas in the second case the electrodes are assumed to be already of the proper length as, for example, by making use of shells after the shearing step illustrated in Figure 3, or of shells otherwise provided with electrodes of the form and length necessary in the finished plug.

Having thus described and explained my invention I claim and desire to secure by Letters Patent:

1. The method of making a spark plug which consists in providing a hollow spark plug shell with an electrode which is longer than is required in the finished plug; removing surplus material from the end of said electrode; assembling an insulating member having a central electrode within said hollow shell; definitely and exactly locating the inner end of said central

electrode relative to said shell electrode so that a proper spark gap will be present in the finished plug; and securing said insulating member in place within said shell while said central electrode is kept in the position aforesaid requisite to secure a proper spark gap in the finished plug.

2. The method of making a spark plug which consists in providing a hollow spark plug shell with electrodes the ends of which are closer together than the distance between their extremities in the finished plug; removing surplus material from the ends of said electrodes to thereby determine the distance between their extremities in the finished plug; assembling an insulating member having a central electrode within said hollow shell; definitely and exactly locating the inner end of said central electrode relative to the extremities of said shell electrodes so that a proper spark gap will be present in the finished plug; and securing said insulating member in place within said shell while said central electrode is kept in the position aforesaid requisite to secure a proper spark gap in the finished plug.

3. The method of making a spark plug which consists in providing a hollow spark plug shell with electrodes the extremities of which are spaced apart the distance necessary to provide a proper spark gap in the finished plug; assembling an insulating member having a central electrode within said hollow shell; definitely and exactly locating the inner end of said central electrode relative to the extremities of said shell electrodes so that a proper spark gap will be present in the finished plug; and securing said insulating member in place within said shell while said central electrode is kept in the position aforesaid requisite to secure a proper spark gap in the finished plug.

4. The method of making a spark plug which consists in providing a hollow spark plug shell with electrodes the ends of which are closer together than the distance between their extremities in the finished plug; removing surplus material from the ends of said electrodes to thereby determine the distance between their extremities in the finished plug; assembling an insulating member having a central electrode within said hollow shell and with an annular locating member between the extremities of said shell electrodes, and into which locating member said central electrode extends; and securing said insulating member in place within said shell while said locating member remains between the extremities of said shell electrodes, and said central electrode remains within said locating member.

5. The method of making a spark plug which consists in providing a hollow spark plug shell with electrodes the extremities of which are spaced apart the distance necessary to provide a proper spark gap in the finished plug; assembling an insulating member having a central electrode within said hollow shell and with an annular locating member between the extremities of said shell electrodes, and into which locating member said central electrode extends; and securing said insulating member in place within said shell while said locating member remains between the extremities of said shell electrodes, and said central electrode remains within said locating member.

6. The method of making a spark plug which consists in providing a hollow spark plug shell having a holding flange at its upper end, and having electrodes spaced apart the distance necessary to provide a proper spark gap in the finished plug; supporting said shell so as to resist pressure applied thereto assembling an insulating member having a central electrode within said hollow shell, definitely and exactly locating the inner end of said central electrode relative to said shell electrode so that a proper spark gap will be present in the finished plug; and bending the holding flange aforesaid into engagement with said insulating member while said central electrode is kept in the position aforesaid requisite to secure a proper spark gap in the finished plug, to thereby hold said member within said shell.

7. The method of making a spark plug which consists in providing a hollow spark plug shell with electrodes spaced apart the distance necessary to provide a proper spark gap in the finished plug; assembling an insulating member having a central electrode within said hollow shell; definitely and exactly locating the inner end of said central electrode relative to said shell electrodes so that a proper spark gap will be present in the finished plug; and securing said insulating member in place within said shell while said central electrode is kept in the position aforesaid requisite to secure a proper spark gap in the finished plug.

8. The method of making a spark plug which consists in providing a hollow spark plug shell with an electrode; assembling an insulating member having a central electrode within said hollow shell; definitely and exactly locating the inner end of said central electrode relative to said shell electrode so that a proper spark gap will be present in the finished plug; and securing said insulating member in place within said shell while said central electrode is kept in the position aforesaid requisite to secure a proper spark gap in the finished plug.

HECTOR RABEZZANA.