

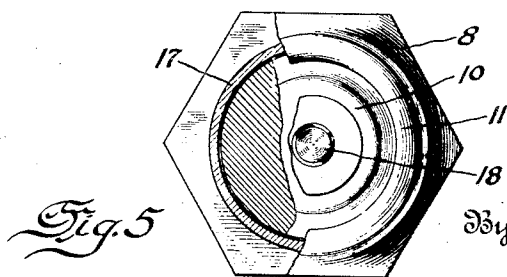
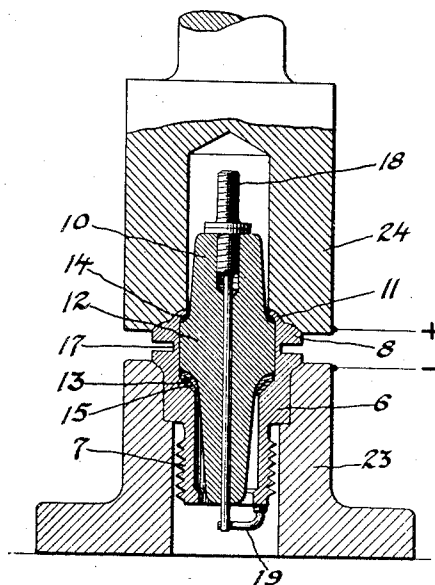
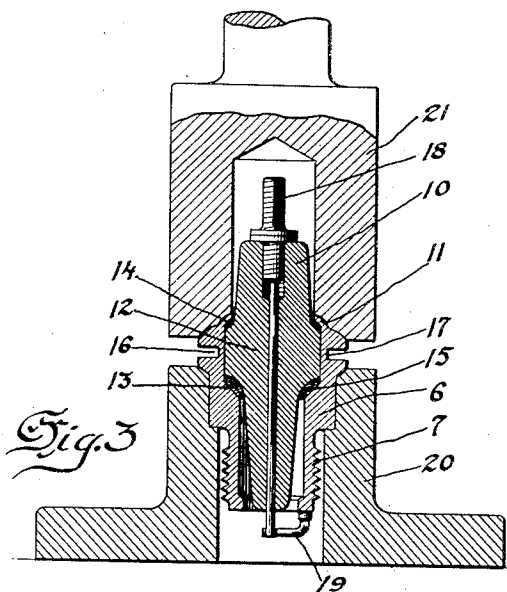
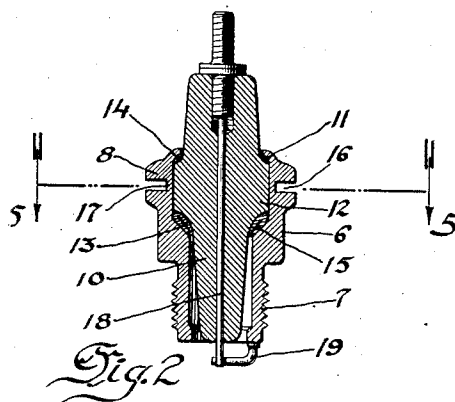
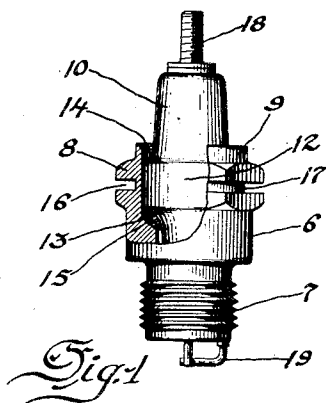
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H. RABEZZANA

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SPARK PLUG AND METHOD OF MAKING THE SAME

Filed August 9, 1922



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SPARK PLUG AND METHOD OF MAKING THE SAME.

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My invention relates to spark plugs of the single piece type or variety wherein the porcelain or equivalent material insulating member which carries the central electrode is permanently held in place within the hollow metallic shell or casing which carries the outer or grounded electrode of the plug by an inturned flange at the outer end of said shell, and which flange is forced into holding engagement with the insulating member during the manufacture of the plug; and the principal object of my invention is to provide a plug of the type referred to wherein the insulating member will be less likely to be injured, as by cracking or unduly straining the same, during the securing of the said member in place within the casing than has heretofore commonly been the case; with a resulting reduction in the number of imperfect plugs due to injury to the insulating members thereof during the assembling of the plugs.

A further object of my invention is to provide a spark plug of the type referred to and wherein the insulating member will be heated less during the assembling thereof within the supporting shell than has heretofore commonly been the case; this result being due for the most part to the fact that the holding flange which holds the insulator in place may be forced into holding engagement therewith without heating said flange at all, or by heating it much less than has heretofore commonly been the case, as well also as to the further fact that the portion of the shell or casing which is heated to insure gas tight joints between the shell and insulating member (due to contraction of said heated part as it cools) is a portion which is not in intimate contact with the insulating member, and is a portion which may in fact be spaced a substantial distance from said insulating member.

A further object of my invention is to provide a single piece or permanently assembled plug which may be manufactured at less cost than heretofore as the comparatively expensive dies employed in turning a flange of the shell inward and into holding engagement with the insulating member will last much longer than has heretofore been the case; this being due to the fact that the die which accomplishes such inturning of the holding flange acts upon a comparatively cold part of the shell or casing, and is not

heated by conduction from the shell upon which it operates.

With the above and other objects in view my invention consists in the improved single piece spark plug illustrated in the accompanying drawing and hereinafter described and claimed, and in such variations and modifications thereof, within the scope of the concluding claims, as will be obvious to those skilled in the art to which my invention relates; and in this connection I wish to state that my invention is regarded as including the method or process of making spark plugs, particularly as regards the securing of the insulating members within the external casings thereof as hereinafter explained, as well also as a plug having the features of construction hereinafter enumerated; and is so claimed and intended to be patented in this application.

In the drawing accompanying and forming a part of this specification and wherein the preferred embodiment of my invention is illustrated:

Figure 1 is a view partly in section and partly in elevation showing an insulating member in place within the shell or casing of a plug, the annular rib of the shell not having been turned into holding relation with the insulating member.

Figure 2 is a similar view showing the plug wholly in section upon a longitudinal central plane, the rib of the shell having been turned inward and into permanent holding engagement with the insulating member.

Figure 3 is a view showing the plug in section as in Figure 2, and showing also in a conventional manner one form or type of dies which may be used for performing one of the steps necessary in assembling the plug.

Figure 4 is a view similar to Figure 3 and showing, conventionally, how a portion of the shell of the plug may be heated electrically in performing the final step of securing the insulating member in place in the shell.

Figure 5 is a view upon a larger scale showing a section upon a transverse plane indicated by the line 5-5, Figure 2.

Referring now to the drawing, the hollow metallic shell or casing 6 of my improved spark plug is shown as provided with the usual threaded end portion 7 to be screwed

into a threaded opening in an internal combustion engine cylinder and with the usual hexagonal wrench receiving portion 8, and with an annular rib 9 at its outer end which is turned inward and into holding engagement with the insulating member 10 during the assembling of the parts in the manufacture of the plug, as shown at 11 in Figures 3 and 5, to thereby provide a holding flange which holds the insulating member permanently in place within the casing of the plug. The insulating member illustrated is one having an enlarged central portion 12 and shoulders 13, 14 at the lower and upper ends of said enlarged portion; the former overlying and being supported upon an annular ledge 15 within the shell while the intumed holding flange overlies the latter of said shoulders. Suitable gaskets are commonly placed between the shoulders 13, 14 and the ledge 15 and holding flange 11 as shown, and as is usual in spark plugs of the permanently assembled or single piece type to which my invention relates.

The shell or casing is provided with a circumferentially extending groove 16 whereby a comparatively thin wall section 17 is provided, said groove and wall being located between the shoulders 13 and 14 and between the two joints between the shell and the insulator; the joints as will be appreciated being formed one by the ledge 15, the lower shoulder 13 and by the gasket commonly interposed between said elements and the upper by the upper shoulder 14, the holding flange 11 and a similar gasket. The groove is illustrated as located in the hexagonal wrench receiving portion although it is obvious that this relationship of the elements in question may be varied, so long as the groove and wall section at the bottom thereof are between the joints which prevent leakage of gas from within the cylinder of the engine with which the plug is used through the plug between the insulating member and the shell or casing thereof.

The enlarged central portion 12 of the insulating member 10 ordinarily fits quite loosely in the internal cavity or space of the shell; so that the interior of the shell at or adjacent the wall section 17 and the periphery of the insulator are not in very intimate contact with one another, and indeed there is commonly quite an appreciable space about the enlarged central portion of the insulator; so that the flow of heat from the shell to the insulator when the wall section is heated as will hereinafter appear will be reduced to a minimum as there is a gap, or at least a portion of poor heat conductivity, in the path through which heat flows to the insulating member.

The central electrode 18 of the plug extends through a passage provided in the insulating member 10 while the outer or

grounded electrode 19 is welded or otherwise secured to the inner end of the shell 6, as is usual in spark plugs; although the form, arrangement or other features of the electrodes are in no way involved in this present invention and may be varied without departing therefrom.

In assembling my improved spark plug the insulating member 10 along with such gaskets as may be required is placed within the hollow shell 6 and the annular rib 9 at the upper end thereof is turned inward to provide the holding flange 11; which turning in operation may be performed by the use of any suitable machine, tool or device such, for example, as by the dies 20, 21, Figure 3, of a suitable press. This operation is commonly performed at ordinary or room temperature, that is, the rib 9 of the shell is not heated prior to or during the turning in operation, as has heretofore commonly been the case; from which it follows that the die 21 which performs such operation will have a long life, as it operates always upon cold metal and is not heated to any appreciable degree by the article upon which it operates.

This inturning of the holding flange 11 secures the insulator in place within the shell and, inasmuch as the gaskets at the joints between the shell and the insulator are necessarily compressed to some extent during this operation, results in tightness to a degree at the said joints; although the joints thus formed are not so perfect as are necessary or at least desirable in the finished plug to prevent leakage of gas therethrough.

After the insulating member has been secured in place as above explained the plug is placed between the conventionally shown terminals 23, 24 of a suitable electric welding machine, see Figure 4, and current sufficient in volume to soften the thin annular wall section 17 is passed through the casing 6 simultaneously with the application of pressure thereto through the terminals of the machine. During this step the said wall yields under the pressure transmitted thereto from the machine terminals through the more massive and unheated end portions of the casing upon either side of the groove 16. the gaskets are compressed to an extent such that gas tight joints are secured between the external shell and the insulating member contained therein, and all parts adapt themselves to one another and assume the fixed positions which they occupy in the finished plug. Then and upon the interruption of the flow of current the heated wall at the bottom of the groove contracts and further compresses the gaskets thus providing a plug in which the final pressure is due to the contraction of a heated portion of the metallic shell thereof, but in which little or no heat has been communicated to the insulating

member thereof; as the holding flange 11 has not been heated at all, and the heating of the wall section 17 has been for a short time only. Finally, the wall being commonly spaced slightly from the central portion of the insulator communicates little or no heat thereto; and such heating as may occur is of a massive part of the insulator remote from the joints where heating will be the least harmful. The heat of the wall section 17 is rapidly dissipated throughout the massive end portions of the shell upon each side of the groove aforesaid when the flow of current is interrupted, thus obviating local heating of the insulator and distributing the stresses incident to the assembling of the plug more uniformly throughout the entire structure thereof than has heretofore been the case in single piece spark plugs.

While in explaining my invention I have referred to the steps of turning the holding flange 11 inward, and of heating the thin wall 17 and subjecting the shell to the final compressing action of the terminals 23, 24, as performed by separate devices, these two operations may, if desired, be performed by one and the same machine. In that case dies the equivalent of the dies 20, 21 are insulated from one another and constitute the terminals of an electric machine of the riveting or welding type, and a current of electricity of sufficient volume to heat the wall 17 to the requisite degree will be caused to flow through the body and wall after the holding flange is turned inward to secure the insulating member in place within the shell. The turning in of the holding flange should as a matter of course be accomplished before the wall 17 becomes heated to such a temperature as to yield appreciably under the pressure due to the inturning of the holding flange; and the supply of heating current may, if found necessary or desirable, be delayed somewhat to secure the complete inturning of said flange before any current flows through the dies acting as terminals and the shell of the plug.

As a matter of course the pressure exerted by the terminals will be maintained during the heating of the wall 17 in order that said wall may be compressed while in a softened and yieldable condition, and the parts of the plug made to assume their final positions, after which and as the wall contracts the joints are subjected to a final gripping action as hereinbefore explained.

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

1. A spark plug comprising a hollow metallic shell or casing, and an insulating member permanently held in place therein between two joints spaced apart from one another; the wall of said casing between said joints being reduced in area throughout a

part of its length, and the thin wall portion thus produced having been compressed during the manufacture of the plug to a degree sufficient to produce yielding of said thin wall section, to thereby insure enhanced tightness at said joints.

2. A spark plug comprising a hollow metallic shell or casing, and an insulating member permanently held in place therein between two joints spaced apart from one another; the wall of said casing between said joints being reduced in area throughout a part of its length, and the thin wall portion thus produced having been heated under pressure applied thereto, and permitted to contract, during the manufacture of the plug, to thereby insure enhanced tightness at said joints.

3. A spark plug comprising a hollow metallic shell or casing and an insulating member permanently held in place therein between an internal supporting ledge of the casing and an inturned holding flange integral with the casing and engaging said insulating member, a portion of said casing between said ledge and holding flange having been compressed subsequent to the inturning of the flange aforesaid into holding relation with said insulating member to a degree sufficient to produce yielding of said intermediate portion.

4. A spark plug comprising a hollow metallic shell or casing and an insulating member permanently held in place therein between an internal supporting ledge of the casing and an inturned holding flange integral with the casing and engaging said insulating member, and which shell is grooved between said ledge and said holding flange to thereby provide a comparatively thin wall section at the bottom of said groove and between said elements; said thin wall section having been heated and compressed subsequent to the inturning of the flange aforesaid into holding relation with said insulating member.

5. The method of making a spark plug which consists in providing a hollow metallic shell or casing having an internal supporting ledge, a rib at its upper end, and an external circumferentially extending groove between said rib and said ledge; placing an insulating member within said casing and turning said rib inward and into permanent holding engagement therewith; and thereafter applying pressure to the portions of said casing separated by said groove to thereby compress the comparatively thin wall section at the bottom of said groove to a degree sufficient to produce yielding of said thin wall section.

6. The method of making a spark plug which consists in providing a hollow metallic shell or casing having an internal supporting ledge, a rib at its upper end, and an

external circumferentially extending groove between said rib and said ledge; placing an insulating member within said casing and turning said rib inward and into permanent holding engagement therewith; and thereafter heating the comparatively thin wall section at the bottom of said groove and

applying pressure to the portions of the casing separated by said groove, to thereby compress the thin wall section aforesaid. 10
In testimony whereof I affix my signature.

HECTOR RABEZZANA.