

Dec. 28, 1937.

S. H. STUPAKOFF

2,103,759

SPARK PLUG AND METHOD OF MAKING THE SAME

Filed Aug. 30, 1937

2 Sheets-Sheet 1

Fig. 1.

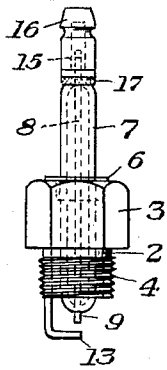


Fig. 2.

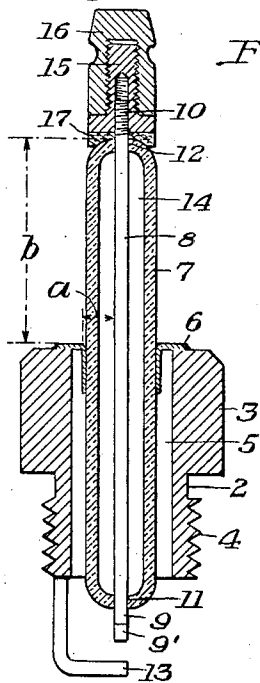


Fig. 3. Fig. 4. Fig. 5.

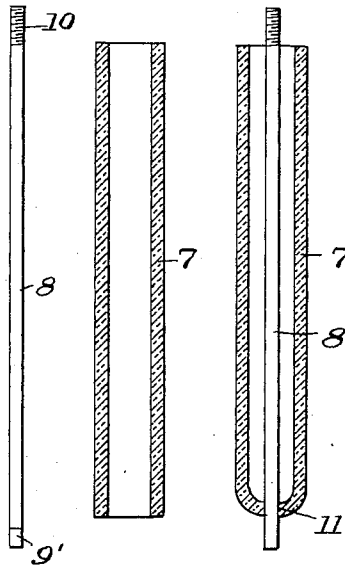


Fig. 6.

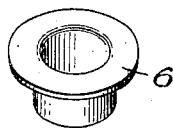


Fig. 7. Fig. 8. Fig. 9. Fig. 10.

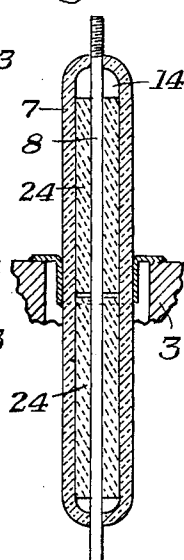
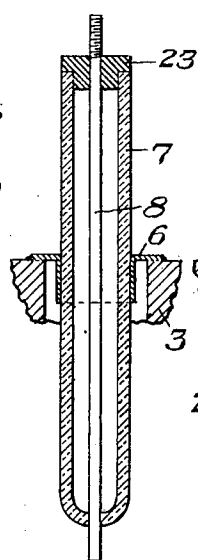
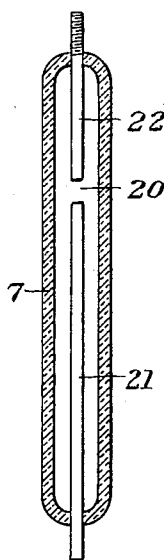
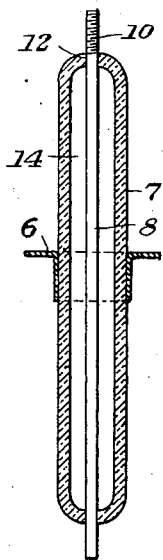
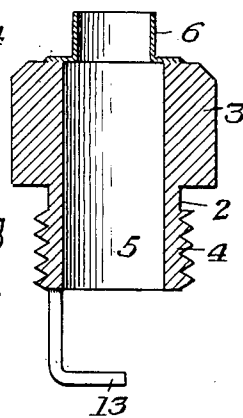


Fig. 11.



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Fig. 12.

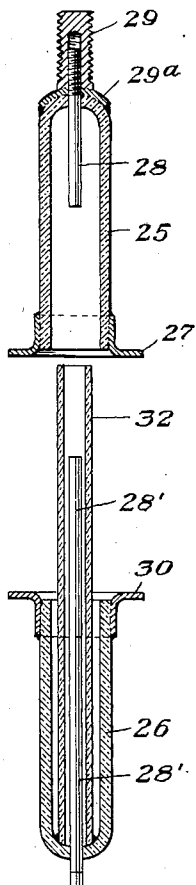


Fig. 13.

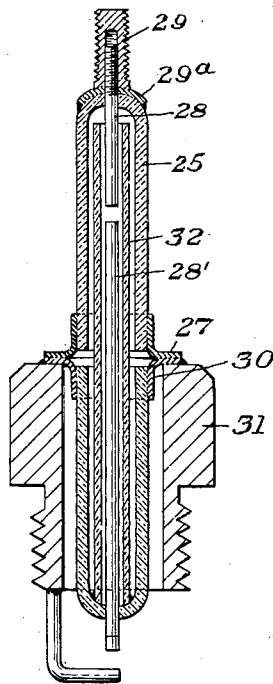
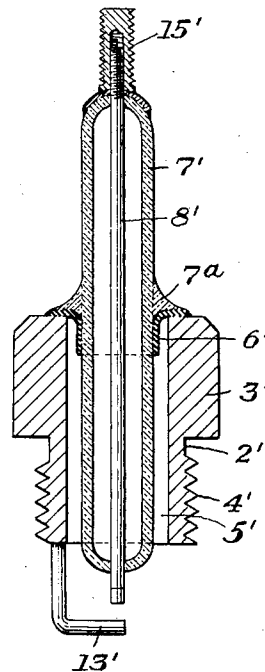


Fig. 14.



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SPARK PLUG AND METHOD OF MAKING
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Application August 30, 1937, Serial No. 161,618

26 Claims. (Cl. 123—169)

This invention relates to spark plugs and to the method of making the same, and is for a spark plug wherein the insulator is sealed to both the body and the central electrode to provide a gas-tight structure.

Spark plugs generally comprise a metal body having a nut-shaped head and a threaded extension, this body constituting one electrode of the spark plug. A central electrode passes through this body and is supported by a porcelain insulator which surrounds the central electrode and which is fitted into an opening in the metal body. Copper packing rings are provided between the porcelain insulator and the body in order to seal the opening through the body into which the insulator extends against escape of gases. This is a relatively expensive construction to manufacture and it is difficult to provide and retain a gas-tight seal between the metal and porcelain. Even though the seal be initially tight, the copper packing will, after a period of use under the pressures encountered in the engine and under the repeated action of heating and cooling and under vibration, become loose and permit the escape of gas.

Standard specifications for spark plugs require that the leakage for a new plug shall not exceed a fixed maximum. They provide that the resistance path from the central electrode to the metal body shall not be less than a predetermined minimum, the present specifications of the Bureau of Standards requiring that this resistance path be at least 500,000 ohms.

According to the present invention, there is provided a spark plug and a method of constructing the same wherein the use of any packing is eliminated and whereby a gas-tight seal is assured.

Attempts have been made heretofore to use glass in place of porcelain as an insulator for spark plugs, both for reasons of economy and because of the fact that if the insulator is made of glass one can determine by the light which diffuses upwardly through the insulator whether the cylinder is firing without removing the plug from the engine and without resorting to external testing devices. One difficulty encountered in the use of glass as an insulator is the fact that it has a considerably lower coefficient of electrical resistance than porcelain, particularly at temperatures to which the spark plug is subjected. Consequently, spark plugs with glass insulators as heretofore generally designed have been incapable of meeting the resistance specifications established for porcelain plugs. Another difficulty en-

countered has been the problem of sealing the glass and metal without imposing excessive strains on the glass. Another difficulty which arises in connection with the use of glass has been to render the same resistant to thermal shock. Spark plugs as heretofore constructed to employ glass insulators have followed very closely the design of spark plugs employing porcelain insulators. This results in the incorporation into the plug of a relatively large solid mass of glass incapable of adjustment to sudden thermal shock. Furthermore, this general design limits the depth of the chamber surrounding the insulator, whereas it is desirable to have this chamber as large as possible both in length and in free area between it and the insulator.

According to the present invention, a spark plug is provided enabling the use of glass or other transparent insulation and having the desired electrical and structural characteristics, resistant to mechanical strains resulting from the heating and cooling of the plug, devoid of packing, and characterized by the absence of a large mass of glass incapable of rapid adjustment to sudden heating or cooling. My invention also contemplates that the spark plug may be much smaller than spark plugs currently in use and require a smaller amount of metal in the supporting body. My invention further contemplates a unique manner of assembling spark plugs.

The invention may be readily understood by referring to the accompanying drawings which illustrate certain preferred embodiments of my invention and the method of practicing the same, but it will be understood that this is by way of illustration and that the invention is not restricted to the specific construction and embodiments shown. In the drawings:

Fig. 1 represents a full sized spark plug embodying my invention of the size that is required for general automobile use;

Fig. 2 shows a longitudinal vertical section through the spark plug of Fig. 1, the drawing being on an enlarged scale;

Fig. 3 is a side elevation of the central electrode apart from the rest of the plug;

Fig. 4 is a longitudinal section through the glass insulator in its initial form;

Fig. 5 is a longitudinal section illustrating the first step in the method of assembling the electrode and the insulator;

Fig. 6 is a perspective view of a metal eyelet used in the assembly;

Fig. 7 is a view similar to Fig. 5 showing a further development in the assembly with the in-

insulator closed at both ends and the metal eyelet applied thereto;

Fig. 8 is a view similar to Fig. 7 of a slightly modified form of assembly in which a discontinuous central electrode is employed;

Fig. 9 is a view generally similar to Fig. 7 showing another modified form of assembly;

Fig. 10 is a view similar to Fig. 9 showing a further modification;

Fig. 11 is a longitudinal section through the metal body of the plug illustrating an alternative method of assembly;

Fig. 12 is a view showing a further modification with the parts incompletely assembled, the view being a longitudinal section;

Fig. 13 shows the parts of Fig. 12 assembled into a complete plug; and

Fig. 14 is a longitudinal section through a plug generally similar to that illustrated in Fig. 12 showing one way of producing a mechanically stronger seal.

In Figs. 2 to 11, the parts have all been illustrated on a scale larger than the actual size required for ordinary use.

Referring to the construction illustrated in Figs. 1 and 2, 2 designates the metal supporting body having a head portion 3 shaped for engagement by a wrench and a threaded extension 4 to be entered in the cylinder of an engine.

This body is formed with a central hole 5 therethrough preferably of uniform diameter throughout. Welded to the body 2, preferably to the top of the head 3, is a flanged metal eyelet 6. The weld between the member 6 and the head 3 of the body is continuous. Passing through the eyelet or collar 6 is a transparent insulating tube 7 preferably made of a hard glass and the glass of this tube is fused to the eyelet. Passing through the center of the tube is the central

electrode 8, the lower end 9 of which projects through the lowermost end of the glass tube and the upper terminal 10 of which projects beyond the upper end of the glass tube 7. The glass tube 7 is fused to the central electrode at the point marked 11. It is likewise preferably, but not necessarily, fused to the electrode 8 near its upper end at the point marked 12. The inner end of the portion 4 of the body of the spark

plug may be provided with any of the usual or preferred types of projections 13 forming a cooperating electrode to provide a spark gap between the central electrode 8 and the extension 13. The hole 5 through the body 2 is of larger diameter than the tube 7 so that tube 7 throughout its

length has no direct contact with the body 2 and so that there is a deep chamber in the spark plug formed below the eyelet 6 and between the lower part of the tube 7 and the metal body 2 of the spark plug.

This structure provides a gas-tight structure by reason of the fact that the eyelet is fused to the tube 7 so that gas cannot escape between the eyelet 6 and the glass tube 7. Neither can gas escape between the body 2 and the flange of the eyelet 6 by reason of there being a continuous weld between these two parts. Neither can gas escape between the insulator electrode 9 and the tube 7 at point 11 nor through any other point where the electrode 9 and the insulator 7

may be fused together. Although the feature of seeing the spark through a transparent insulator is of value, nevertheless, non-transparent non-conducting materials such as porcelains can be used for the tube. These porcelains are attached to the metal parts by means of fusing

glass between each of the metal members and insulating members thereby affecting a gas tight seal. The construction, therefore, provides a gas-tight plug without requiring the use of any packing between the insulator and the metal body in which it is carried. If desired, the metal body 2 and the eyelet 6 could be formed integral with one another. The tube 7 may be evacuated, or filled with an inert gas or a gas such as neon, at any desired pressure.

The insulating tube 7 contacts the central electrode 8 only at the two ends, i. e., at points 11 and 12, there being a chamber 14 inside the insulator 7 around the electrode 8. The tube 7 has sufficient length above and below the eyelet so that the conductance path from the points 11 and 12 where the glass and metal contact to the eyelet 6 has a sufficiently high resistance to meet existing specifications. If the insulator 7 were solid, the conductance path through the glass from one electrode to the other would be very short, i. e., it would be the distance *a* indicated in Fig. 2. As it is, the conductance path has the distance *b*. Thus, even though the glass is more conductive than porcelain, the present invention provides a greater length for the conductance path. Two factors enter into the electrical resistance of the plug; one is the length of the conductance path, the other is the cross sectional area of the conductance path. To increase the resistance of a spark plug having the design described, it is merely necessary to either increase the length of the tube 7 or decrease the thickness of the glass in the tube, or do both. With a plug as described, the electrical resistance characteristics can therefore be readily changed to meet any specification without varying the diameter of the plug, whereas with spark plugs as heretofore generally constructed, an increase in the resistance specification requires either an improvement in the porcelain or an increase in the diameter of the porcelain which is not desirable. If I employed a solid glass insulator instead of a tubular one, thereby eliminating the chamber 14, the diameter of the glass mass, in order to have the necessary resistance would have to be many times that of a similar body of porcelain.

The plug as described in Figs. 1 and 2 requires the selection of materials to enable it to be assembled and to stand up under use. The metal supporting body 3 may be an ordinary low-carbon steel similar to that used at the present time in spark plugs. The metal eyelet 6 and the glass 7, however, should have matched coefficients of thermal expansion, and the electrode 8 should also have a thermal coefficient matched or nearly matched to that of the glass. For example, the electrode 8 may be an alloy of the type disclosed in United States Patent No. 1,942,260, which alloy is commercially available under the trade-mark "Kovar", in which case the insulator 7 is a borosilicated glass having a thermal coefficient of approximately 4×10^{-6} . Kovar metal has a thermal coefficient comparable or matched to a glass of this character and it also has the property that the glass will "wet" or fuse to it. While these represent typical materials, it will be understood that the invention is not limited to the particular materials mentioned. The tube 7 is preferably formed of glass for the reason of its cheapness, but other insulation, as for example, fused quartz, might be substituted.

Plugs shown in Figures 1 and 2 may be provided with a threaded terminal 15 to which a

nut 16 is attached. A compressible washer 17, preferably formed of asbestos, is interposed between the end of the glass tube and the threaded sleeve 15. If the "Kovar" metal is unsuited for use as the terminal of the spark gap of the plug, a suitable metal terminal 9' may be provided on the end of the "Kovar" rod.

In assembling the structure the rod 8 shown in Fig. 1 is placed inside of the preformed glass tube 7 of Fig. 4. The glass is then heated causing it to contract and seal to the electrode as shown in Fig. 5. After this, the upper end of the glass tube 7 may be heated and fused to the upper end of the rod at 12 as shown in Fig. 7 to facilitate manufacturing. If desired, a vent may be provided in the tube or in the terminal 15. After the tube assembly is completed, the vent is sealed off. The eyelet 6 shown in Fig. 6 is then slipped over the tube and heated to cause the glass to fuse to the sleeve of the eyelet, the structure then having the assembled appearance shown in Fig. 7. This structure is then inserted in the metal supporting body 2 from the top, concentrically positioned and welded, contact welding being employed. The assembly can thus be very simply and cheaply carried out.

In some cases it may be desirable to make the rod 8 discontinuous as illustrated in Fig. 8 primarily to relieve mechanical strain, but incidentally also to provide an intensifying gap 20 through which sparking of the plug may be observed. Where this is desired, the rod is made in two sections, the lower one 21 being fused into the lower end of the tube and the upper one 22 being fused into the upper end of the tube, the structure otherwise following that previously described. This facilitates certain problems of manufacture and relieves strain which may be imposed on the insulator where the electrode is continuous.

For the purpose of relieving mechanical strain, it may be desirable in some cases not to fuse the upper end of the glass insulator 7 to the electrode. Such an arrangement is shown in Fig. 9 wherein the glass tube 7 is fused only to the lower end of the electrode 8, there being merely a bushing or other closure 23 at the opposite end of the tube.

Also, in some cases it may be desirable, particularly to facilitate assembly, to use either a complete or partial porcelain body inside the glass tube. For example, in Fig. 10 the arrangement is similar to that shown in Figs. 2 and 7, but I have shown porcelain sleeves 24 within the chamber 14. These porcelain sleeves give mechanical support to the glass, particularly when the eyelet is being fused to the glass. At the same time, they have a very high electrical resistance as compared to the glass so that they do not give too low a conductance path from the electrode to the eyelet. The insulator 24 may completely fill the chamber 14 or may be separated or otherwise arranged.

In the method of assembling the spark plug, it may be desirable to make the last operation the fusing of the eyelet to the tube. In this case the modification shown in Fig. 11 is employed in which case the eyelet 6 is inverted from the position shown in Figs. 2 and 7, and is first welded to the top of the portion 3 of the body. The insulator and electrode assembly is then slipped through the eyelet to the proper position and the eyelet is then fused to the insulator. The advantage in inverting the eyelet is that it exposes the sleeve portion of the eyelet so as to

make it accessible for heating by a gas flame in carrying out the final step of fusing.

The invention provides a spark plug which can be economically manufactured. Glass can be satisfactorily employed, and the over-all dimensions of the structure, particularly the diameter, kept very low, but there will nevertheless be a high resistance to the direct conductance path between the central electrode and the metal shell or eyelet. The use of all packing is eliminated. By using a glass tube evacuated if desired, instead of a solid glass insulator, the resistance to sudden thermal shock is increased as the thin-walled tubing will adjust itself to a sudden change of temperature more readily than would a solid body of glass of the same diameter. By using properly matched metals and glass, strain set up by expansion and contraction can be largely avoided.

Since "Kovar" and other metals or alloys whose coefficient of thermal expansion may be matched to that of glass are relatively expensive as compared to low-carbon steel, there is a considerable advantage in attaching the insulator to the body through a "Kovar" eyelet instead of having the body 2 formed directly of "Kovar". A further desirable advantage of this construction resides in the provision of the long deep chamber formed by the hole 5 below the eyelet 6 on the inside of the body 2 around the insulator. It is in this portion of the spark plug that fouling from carbon usually occurs. By establishing a chamber of considerable capacity and of relatively great length from the exposed electrode to the nearest contacting metal it requires longer for a conducting bath to build up and there is less chance for it to be built up. By reason of the low mass of the insulation, heat is readily dissipated, which is a further desirable feature of this spark plug embodying my invention.

The modification shown in Figs. 12 and 13 incorporates the general design heretofore described, but the glass insulator, instead of being continuous, is discontinuous, being comprised of two sections but for electrical purposes being the equivalent of a single insulator. In this modification, the insulator comprises two tube-like insulator members 25 and 26, the outer one 25 having a flanged eyelet 27 on its inner end and a section of electrode 28, there being a connecting terminal 29 on the outer end of this electrode. A washer 29a of "Kovar" or similar material is fused to the terminal 29 and to the upper end of insulator member 25. The inner insulator section 26 has a flanged eyelet 30 on its inner end and has a central electrode rod 28' sealed through its outer end. An internal tubular insulator 32 preferably of glass is provided around the electrodes 28 and 28'. In assembling the spark plug, the two flanged eyelets are welded together and the flanges of the assembly welded or fused to the body member 31. The assembled glass insulator may be evacuated, if desired, to increase the electrical resistance. This construction provides a spark plug particularly adapted for use with glass insulation, as do the other modifications by reason of the fact that there is a long conductance path from the point of contact between the insulator and central electrode and the insulator and supporting metal body. It is more resistant to mechanical or thermal strain than a continuous insulator, but from the electrical standpoint is the equivalent of a continuous insulator. The central electrode is preferably made in two sections, as

shown, to relieve strain, and incidentally to provide an intensifying gap and a visual indication of the operation of the plug. In this assembly the insulator sections 25 and 26 and eyelets preferably have matched coefficients of thermal expansion.

The arrangement shown in Fig. 14 provides a means for strengthening the structure mechanically while maintaining its resistance to thermal shock. Structurally, the assembly resembles that described in Fig. 2, except that the outer terminal is conformed to the end of the insulator and may be fused thereto, eliminating the asbestos washer. Reference characters similar to those used in Fig. 2 but with a prime affixed have accordingly been used in Fig. 14.

It has previously been pointed out that where glass is used as the insulator, the glass and the eyelet 6' preferably have matched coefficients of thermal expansion and the glass "wets" or fuses to the metal. The point where the glass insulator is fused to the eyelet may be a mechanically weak point. Added strength may be obtained by using a fillet 7a around the insulator where it is fused to the eyelet. Usually a glass which has a coefficient of expansion similar to that of the metal is less resistant to sudden thermal shock than a glass having a low or negligible coefficient. The fillet or seal at 7a is preferably a graded glass seal, having at the point of contact with the eyelet a glass with a relatively high thermal coefficient, and outside of this a different glass having a lower thermal coefficient of expansion and greater resistance to sudden therm shock is used. This construction provides a gas-tight seal having a large mass of glass to give mechanical strength and still be resistant to sudden thermal changes. This type of seal may be used in the various other modifications herein specifically described. It is to be understood, however, that the glass or fillet 7a may be uniform throughout.

As previously stated, a transparent insulator has certain advantages to the user, but my invention in its broader aspects is applicable also to use with other insulating materials. In the accompanying claims, the terms "fusion" or "fused" are intended to cover a joint produced by heating and fluxing contacting surfaces, as by welding, soldering, or fluxing to produce a permanent gas-tight connection.

While I have shown and described certain preferred specific embodiments of the invention it will be understood that various changes and modifications may be made therein within the scope of the following claims.

I claim:

1. A spark plug comprising a metal supporting body, a transparent insulator, an electrode passing through the insulator and sealed thereto, and a metal member permanently fused to the metal body and fused to the insulator for securing the insulator to the body and forming a gas-tight seal.

2. A spark plug comprising a metal supporting body, a transparent insulator, an electrode passing through the insulator and sealed thereto, and a metal member of a composition different from that of the body permanently fused to the metal body and fused to the insulator for securing the insulator to the body and forming a gas-tight seal, the electrode, the insulator and the metal member having matched coefficients of thermal expansion.

3. A spark plug comprising a metal body con-

stituting one electrode, an insulator passing through the metal body, an electrode passing through the insulator and fused thereto, and means fused to the insulator and welded to the body permanently connecting the two.

4. A spark plug comprising an electrode, a metal supporting body through which the electrode passes, and a hollow insulator supporting the electrode and fused thereto, the hollow insulator contacting the metal body and the electrode only at points which are separated by a distance greater than the radius of the insulator, the metal body having a thin flange member thereon which is fused to the insulator.

5. A spark plug comprising an electrode, a metal supporting body through which the electrode passes, a supporting body having a sleeve portion thereon having a permanent gas-tight connection therewith, a hollow insulator supporting the electrode and fused to the sleeve portion of the body, the insulator being fused to the electrode and contacting it at a point remote from the point where it contacts the sleeve, the point of contact between the electrode and the insulator and the point of contact between the sleeve portion of the body and the insulator being separated longitudinally of the spark plug a distance greater than the diameter of the insulator.

6. A spark plug comprising an electrode, a metal supporting body through which the electrode passes, a hollow transparent insulator supporting the electrode and contacting the metal body and the electrode only at points which are separated by a distance greater than the radius of the insulator, the hollow insulator having other insulation therein about the electrode the coefficient of electrical resistance of which is greater than that of the transparent insulator.

7. A spark plug comprising an electrode, a tube-like insulator fused to the electrode, a supporting body through which the insulator and electrode passes and which has a relatively thin sheet metal extension thereon welded thereto, said insulator having a fused connection with the thin extension on the supporting body and providing the only contact of the insulator with the body, the point of contact between the insulator and electrode being longitudinally separated from the point of contact between the insulator and the body a distance greater than the radius of the insulator.

8. A spark plug comprising an electrode, a tube-like insulator with a diameter greater than the electrode having its inner end fused to the electrode near the inner end thereof, a supporting body having an opening therethrough greater than the diameter of the insulator, the body having a portion of smaller diameter which contacts with and is fused to the insulator intermediate the ends of the insulator.

9. A spark plug comprising an electrode, a tube-like insulator with a diameter greater than the electrode having its inner end fused to the electrode near the inner end thereof, a supporting body having an opening therethrough greater than the diameter of the insulator, the body having a portion of smaller diameter which contacts with and is fused to the insulator intermediate the ends of the insulator, said insulator being formed of transparent material.

10. A spark plug comprising an electrode, a tube-like insulator of transparent material of a diameter greater than the diameter of the electrode, fused at its opposite ends to the electrode and being out of contact with the electrode in-

intermediate its ends, and a metal supporting structure through which the insulator passes and which contacts the insulator intermediate the ends of the insulator only.

11. A spark plug comprising an electrode, a tubular insulator of a diameter greater than the diameter of the electrode, fused at its opposite ends to the electrode and being out of contact with the electrode intermediate its ends, and a gas tight metal supporting structure through which the insulator passes and which contacts the insulator intermediate the ends of the insulator only, the portion of the supporting structure which contacts the insulator being fused to the insulator.

12. A spark plug comprising an electrode, a tubular transparent insulator through which the electrode passes and which has an interior diameter greater than the outside diameter of the electrode, one end of the insulator being sealed to the electrode adjacent one end thereof, a metal supporting body having a hole therethrough through which said insulator with its electrode passes, the diameter of the hole being greater than the external diameter of the insulator, and a flanged element welded to the supporting body and fused to the insulator and connecting the two, said flanged member being fused to the insulator intermediate the ends of the insulator.

13. The method of assembling spark plugs which comprises inserting a rod-like conductor of small diameter in a surrounding insulator of relatively larger diameter and sealing one end of the insulator to the rod, mounting the insulator in a supporting body in such manner that the point of contact between the insulator and the body is remote from the point of contact between the insulator and the conductor and forming a permanent fusion seal between the insulator and the body.

14. The method of assembling spark plugs which comprises fusing one end of a glass tube to an electrode member having a coefficient of thermal expansion matched to that of the glass with the electrode extending lengthwise of the tube, forming a body member having a hole therein of larger diameter than the tube, and securing the tube in the body member by fusing an annular metal member to the tube and welding the same to the body, said annular metal member and the glass tube having matched coefficients of thermal expansion.

15. The method of assembling spark plugs which comprises the steps of forming a metal body having a hole therethrough welding an annular ring of a metal to which glass, or like insulator will fuse to the body around the hole, fusing a glass or like insulator to said ring, and fusing an electrode to the insulator in a position to extend coaxially through the hole in the body.

16. The method of assembling spark plugs having a metal body, an electrode and an insulator which comprises fusing a body of insulating material about the electrode fusing the insulating body to a thin metallic connector to which the glass will adhere, and welding the metallic connector to the metal body of the plug.

17. The method of assembling spark plugs which comprises fusing a body of insulating material about a central electrode and fusing the insulating body to the metal body of the spark plug by means of a metal ring welded to the body of the spark plug and fused to the insulating body.

18. A spark plug comprising a metal body hav-

ing a hole therethrough, a metal eyelet welded to the body around the hole in such manner as to provide a passage through the eyelet of less diameter than that of the hole through the body, a tube-like insulator passing through the eyelet and fused thereto, a coaxial electrode within the insulator spaced from the insulator intermediate its ends and sealed to the insulator adjacent at least one end of the insulator and remote from the eyelet, there being a chamber around the insulator and the interior of the metal body, the lower end of which opens at the base of the plug and the top of which is closed by the eyelet.

19. A spark plug having a metal body and an electrode carrying insulator characterized by the provision of a chamber around the insulator and within the body which is open at the inner end of the spark plug and closed at its opposite end by a fused joint between the insulator and body, the insulator being out of contact with the body below the fused joint.

20. A spark plug comprising an electrode, a tube-like insulator structure fused to the electrode at its ends and out of contact with the electrode intermediate its ends, a supporting body through which the insulator and electrode assembly passes, and which carries a metal member for contact with the insulator, there being a graded glass body fusing the insulator to the metal member, the glass adjacent the member being a glass which fuses to it and has a thermal coefficient of expansion compatible with that of the metal member, the glass remote from the metal member having a different coefficient of expansion lower than the first mentioned glass.

21. A spark plug comprising an electrode, a tube-like insulator structure fused to the electrode at its ends and out of contact with the electrode intermediate its ends, a supporting body through which the insulator and electrode assembly passes and which carries a metal member for contact with the insulator, there being a glass body fused to the insulator and to the metal member.

22. A spark plug comprising an electrode, a tube-like insulator structure fused to the electrode at its ends and out of contact with the electrode intermediate its ends, a supporting body through which the insulator and electrode assembly passes, the insulator contacting the body at a point between its ends and being fused to the body at such point of contact, said insulator being thickened where it is fused to the supporting body.

23. A spark plug comprising an electrode, a tube-like insulator fused to the electrode adjacent one end of the electrode, the electrode being out of contact with the insulator except at points adjacent the ends of the insulator, a supporting body through which the insulator and electrode passes, said insulator comprising separate inner and outer sections each having a fused connection with the supporting body.

24. A spark plug comprising an electrode, a tube-like insulator fused to the electrode adjacent one end of the electrode, a supporting body through which the insulator and electrode passes said insulator having separate inner and outer sections, said sections having abutting flanged members fused thereto, the flange members being welded together and to the supporting body to provide a fused connection.

25. A spark plug comprising an externally threaded supporting shell formed of metal, the shell having a central passage therethrough, an

eyelet member welded to the top of the shell and having an opening therethrough, a tube-like insulator fused to the eyelet, the eyelet and the insulator being of a character such that a fused
5 gas-tight connection may exist between them, and an electrode fused to the insulator and projecting through the shell, the tube-like insulator contacting the electrode at a point which is offset longitudinally of the assembly from the point
10 where the insulator is fused to the eyelet, there being a chamber in the shell around the electrode closed by the fusing of the insulator and the electrode and the fusing of the insulator and the eyelet.

15 26. The method of assembling spark plugs hav-

ing a metal supporting body, an electrode and an insulator which comprises mounting the electrode in a substantially tubular insulator in a coaxial position therein and forming a fused joint between the insulator and the electrode, fusing a
5 metal eyelet to the insulator in a point longitudinally offset to the joint between the insulator and the electrode and welding the eyelet to the supporting body, the supporting body having a longitudinal opening therethrough through which
10 the electrode passes, the electrode being maintained in spaced relation to the body by the insulator.

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