L. STEINBERGER.

SPARK PLUG.

APPLICATION FILED SEPT. 21, 1912. RENEWED AUG. 15, 1916.

1,206,736. Patented Nov. 28, 1916.

Fig. 1.

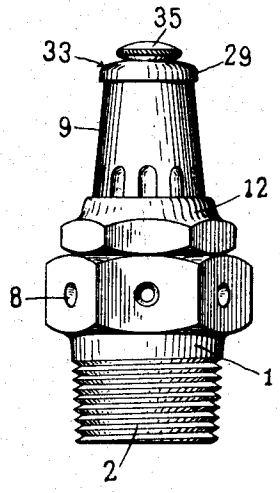
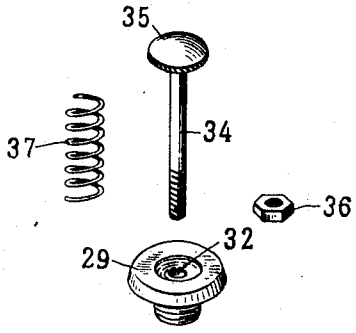


Fig. 4.



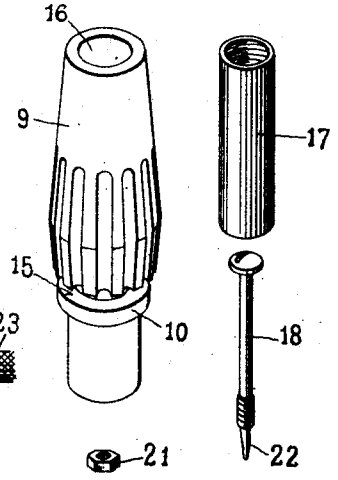


Fig. 2.

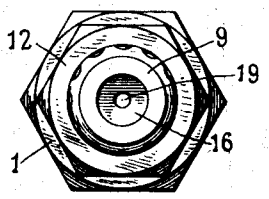


Fig. 3.

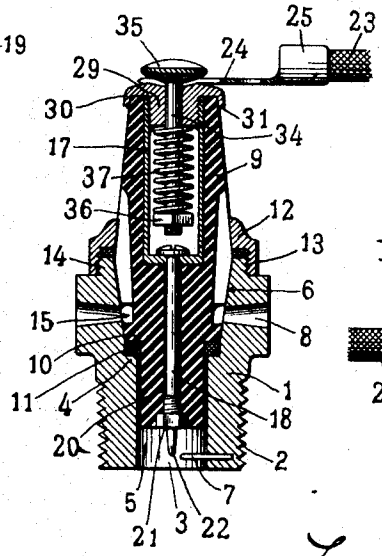


Fig. 5.

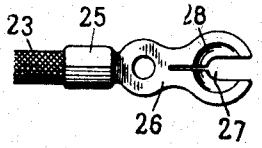
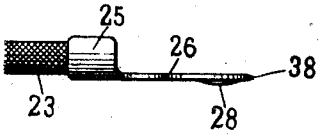


Fig. 6.



WITNESSES

J. Clyde Tipley.

L. Bruford Hardie

INVENTOR

Louis Steinberger

BY

Charles H. Wilson

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LOUIS STEINBERGER, OF BROOKLYN, NEW YORK.

SPARK-PLUG.

1,206,736. Specification of Letters Patent. Patented Nov. 28, 1916.

Application filed September 21, 1912, Serial No. 721,692. Renewed August 15, 1916. Serial No. 115,116.

To all whom it may concern:

Be it known that I, LOUIS STEINBERGER, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to improvements in spark plugs such as are commonly used in connection with explosive engines.

Among the more important objects of the invention may be stated the following:

I. To provide a spark plug of readily assemblable and disassemblable parts, so that the device may be easily and quickly taken apart when desired for the purpose of repair, cleaning, or substitution of parts.

II. To provide a spark plug comprising a base part of conducting material, carrying one electrode, and an insulating part, carrying the other electrode, and to adapt the insulating part to ready removal from the base part to effect cleaning, or renewal, of the electrodes, without necessity for removing the base part.

III. To provide a spark plug in which provision is made for the circulation of air about certain of the parts, so that heat imparted thereto, incident to the explosions within the engine, may be, to a considerable extent, radiated and carried off.

IV. To provide a spark plug comprising a base member adapted to be fitted into the engine cylinder and to carry one of the electrodes, and to provide an insulating part carrying the other electrode, the latter part being provided with formations adapted to coöperate with parts of the base to form continuous air passages for affording a circulation of air, as above referred to.

V. To provide the base part with a seat adapted to receive a portion of the insulating part, to provide the base part with a plurality of apertures extending radially therethrough opening into the seat, to provide the insulating part with an annular groove arranged to coincide with the inner ends of the apertures when the insulating part is inserted in the seat, and to provide the insulating part with a plurality of longitudinal grooves extending upward from the annular groove and constituting therewith, and with the apertures, continuous air passages for the circulation of air, as above described.

VI. To provide the base part with a seat adapted to receive a portion of the insulating part, to provide an opening continuing beyond the seat, through the base part, into which opening one electrode carried by the base part, projects, to provide a packing in the seat upon which a shoulder of the insulating part engages for sealing the electrode carrying opening of the base part, and to provide an extension of the insulating part projecting into the electrode carrying opening of the base part, said extension carrying the other electrode of the device into close proximity with the first electrode, and to provide an easily releasable clamping member for holding the parts in the relation described.

VII. To provide a spark plug including an insulating part having, at its upper end, a well or cavity, to provide a metallic lining for the cavity, to provide means for retaining the lining in the cavity adapted to form a conductor from the lining through the insulating part to the electrode carried thereby, and to provide means for electrically connecting a conductor terminal to the lining.

VIII. To provide a spark plug including an insulating part having a cavity at one end, to provide a lining for the cavity of conducting material, to provide a bolt extending through the bottom wall of the lining and through the remainder of the length of the insulating part, being threaded at its lower end for receiving a clamping nut, whereby to hold the lining in fixed relation in the cavity, to form an extension upon the bolt, projecting beyond the threaded portion thereof, adapted to comprise one electrode of the device, and to provide means for electrically connecting a conductor terminal to the lining.

IX. To provide efficient means for quick attachment and detachment of a conductor terminal to the spark plug.

X. To provide means for attaching a conductor terminal to the spark plug comprising a dished part formed upon the spark plug, and to provide means adapted to hold the conductor terminal in the dished portion for preventing accidental detachment of the conductor terminal and to increase the efficiency of the electrical connection.

XI. To provide means for attaching a conductor terminal to the spark plug, said

terminal comprising a dish shaped part, the attaching means embodying a portion dish shaped to correspond to the shape of the conductor terminal, and to provide means for yieldingly maintaining the dish shaped portion of the conductor terminal within the correspondingly shaped portion of the spark plug.

XII. To provide means for attaching a conductor terminal to the spark plug, said terminal comprising a dish shaped portion, the spark plug embodying a part dish shaped to correspond to the shape of the conductor terminal, and to provide a spring pressed rod extending through the dish shaped portion of the spark plug having a head adapted to engage the conductor terminal for yieldingly maintaining the dish shaped portion thereof in the dish shaped portion of the spark plug.

XIII. To provide a spark plug having a part of insulating material formed with a cavity therein, to provide a lining for the cavity, to provide a closure for the lining having an aperture therethrough and having a dish shaped surface portion surrounding the outer end of the aperture, to provide means extending through the aperture adapted to yieldingly maintain the conductor terminal electrically connected to the lining, said conductor terminal comprising a dish shaped portion for engaging the dish shaped portion of the lining closure, and to provide electrical connection between the lining and one electrode of the device.

XIV. To provide a spark plug including an insulating member having a cavity at one end, to provide a lining for the cavity electrically connected to one electrode of the device, to provide a closure for the lining extending across the upper surface of the insulating part, to provide the upper surface of the closure with a dish shaped central portion, to provide means extending through the closure for attaching a conductor terminal to the closure, said conductor terminal comprising a portion shaped to register with the dish shaped portion of the closure, and said means comprising a rod extending through said closure into the cavity, a coil spring mounted for drawing the rod into the cavity, and a head on the outer end of the rod convexed on its under surface to correspond with the dish shaped formation of the upper surface of the closure for engaging the upper surface of the conductor terminal to hold the dish shaped portion thereof in engagement with the dish shaped portion of the closure, and to form the portions of the upper surface of the closure, radially beyond the dish shaped central portion, inclined downwardly to facilitate introduction of the conductor terminal into the dish shaped central portion beneath the head of the rod.

Other objects and aims of the invention, more or less specific than those referred to above, will be in part obvious and in part pointed out in the course of the following description of the elements, combinations, arrangements of parts and applications of principles, constituting the invention; and the scope of protection contemplated will be indicated in the appended claims.

In the accompanying drawings which are to be taken as a part of this specification, and in which I have shown a merely preferred form of embodiment of the invention: Figure 1 is a side elevational view of a spark plug constructed in accordance with the provisions of this invention; Fig. 2 is a top plan view of the structure, the conductor attaching member being removed; Fig. 3 is a transverse vertical sectional view through the complete spark plug and illustrating a conductor terminal attached; Fig. 4 illustrates an aggregation of independent perspective views of the several separately formed elements comprising the structure; and Figs. 5 and 6 illustrate, respectively, plan and side elevational views of the conductor terminal constructed to coöperate with the structure of the binding post illustrated.

Referring to the drawings for describing the invention in detail, the reference numeral 1 indicates the base member of conducting material comprising a threaded plug having threads 2 exteriorly upon its lower annual portion adapted for relatively fixed attachment in suitable position in the cylinder of an explosive engine in a well known manner. The outer surface of the upper portion of the member 1 is formed hexagonal, so as to facilitate the application of a wrench to the member when required.

An aperture 3 extends axially through the member 1 and is given two dimensions, so as to form an annular shoulder 4 intermediate the length of the aperture, the portion of the aperture below the shoulder 4, as at 5, is relatively smaller than the portion 6 of the aperture above the shoulder, and one of the electrodes, as 7, is fixed within the material of the member and projects into the portion 5 of the aperture at, or near, the lower end thereof. Above the shoulder 4 the aperture is of conical shape, the smaller diameter being at the shoulder 4, and the aperture flaring outwardly toward the upper end of the member.

A plurality of apertures, as 8, are formed through the material of the member 1 from the outer surface of the hexagonal portion thereof and opening into the conically shaped portion 6.

The insulating member, as 9, is adapted to carry the other electrode of the device and comprises an elongated body of insulating material formed adjacent its lower end with

an annular shoulder 10 adapted to rest upon the shoulder 4 of the base 1 with an interposed packing ring 11. Immediately above the shoulder 10 the insulating member 9 is of conical shape to correspond with the shape of the portion 6 of the aperture in the base member, so as to fit snugly therein, said conical portion continuing to the plane of the upper end of the base member, said insulating member being thereafter tapered in a reverse direction, so that its upper end is considerably smaller in diameter than is its portion adjacent the plane of the upper end of the base member.

A locking nut 12 encircles the upper portion of the member 9 and is internally threaded, as at 13, to engage a correspondingly threaded portion 14 upon the upper end of the base 1. This locking nut grips the inclined walls of the upper portion of the insulating member and serves to force the insulating member downwardly so that the shoulder 10 is brought into firm engagement with the washer or packing 11 interposed between said shoulder, and the shoulder 4 of the base for sealing the aperture 3 to prevent escape of gases therethrough from the engine cylinder.

In a plane just above the shoulder 10, the insulating member 9 is formed with an annular groove 15 disposed to coincide with the inner ends of the several radial apertures 8 in the hexagonal portion of the base. Extending upwardly from the annular groove 15 is formed a plurality of longitudinally extending grooves which continue to a point somewhat above the upper edge of the locking nut 12. These grooves coöperate with the apertures 8 to afford a free circulation of air through said apertures and along said grooves to reduce the temperature of the parts, and especially of the binding post mechanism to be described, when the device is in use.

It will be noticed from the drawings that the apertures and grooves provide air-passages of generous dimensions, extending longitudinally of the structure and having both their ends open to the atmosphere, that is opening above the point of attachment of the spark plug to an engine or the like. The opening through the base member 1, below the shoulder 4, into the cylinder has no connection whatever with the cooling air-passages formed by the apertures and grooves. The opening from the base member 1 into the cylinder is not an opening into the atmosphere in the sense that the cooling air-passages are open to the atmosphere. In operation the heat of explosions will cause an ascension of air along the grooves of the insulating member and fresh cool air will be continuously drawn in through the apertures 8 of the base, into the annular groove 15, and upwardly along the insulating member, so as to maintain the insulating member relatively cooler and to protect the binding post mechanism referred to. It should also be noted that the longitudinally extending grooves on the insulating member provide a series of longitudinally extending ribs or ridges between them extending from what might properly be termed the body portion of the insulating member, and engaging the base member. The outer surface of the small portion of the insulating member between the shoulder 10 and the annular groove 15 comprises an annular rib or flange also projecting from the body of the insulating member and engaging the base. The outer surfaces of these ribs are the only portions of the insulating member which come into surface contact with the metallic base. The annular rib may be slightly reduced in diameter, if desired, so as not to engage the metallic base.

The transmission of heat from the base to the body of the insulating member is thus strongly retarded. The presence of the cooling air constantly moving through the passageways between the ribs will maintain the walls of the ribs cool so that transmission of heat through the ribs to the body will be improbable, at least to any material extent.

The locking nut 12 engages the outer surface of the longitudinal ribs and the air-passages extend between the locking nut and the body of the insulating member and prevent possible cohesion of the locking member with the insulating member due to heat. The relatively small surface contact between the locking member and the outer surface of the ribs is also effective for this purpose.

Obviously the thickness of the ribs, as well as the distance between them, may be proportioned so as to provide the desired resistance to the passage of heat commensurate with proper strength in the structure.

The insulating member 9 is formed with a cavity 16 in its upper portion, and a lining 17, of conducting material, is fitted into said cavity and is held therein by a bolt 18 which extends through an aperture 19 formed in the lower wall of the lining. The bolt 18 extends through an aperture 20 in the insulating member, to the lower end thereof and projects therefrom into the portion 5 of the aperture in the base member 1 somewhat below the shoulder 4. The lower end of the bolt is threaded and fitted with a locking nut 21, whereby to draw the lining into fixed relation in the cavity 16. Below the threaded portion the bolt 18 is formed with a portion 22 arranged to occupy a desirable position adjacent the electrode 7, and serving as the other electrode of the device.

The lining 17 is adapted to conduct the charge of current from a conductor 23, having a conductor terminal 24, to the electrode

22, through an easy attach and release mechanism for the conductor terminal now to be described: The conductor terminal 24 comprises a portion 25 electrically connected to the conductor 23, and a relatively thin flat portion 26 extending therefrom and having a slot 27 formed therein. Adjacent the inner end of the slot 27 the material of the flat portion 26 is dish shaped as at 28, said portion 28 being substantially concentric with the inner end portion of the slot 27. The upper end of the lining 17 in the cavity 16 is preferably internally threaded and fitted with a closure 29 having a head portion 30 extending radially beyond the lining, across the upper surface of the member 9, and having a down-turn portion 31 engaging the outer annular upper edge of the member 9. The central portion of the upper surface of the head 30 is dish shaped to a degree similar to the shape of the portion 28 of the conductor terminal 24, and beyond this central dish shaped portion the upper surface of the head 30 is inclined downwardly as at 33 for a purpose presently apparent. An aperture 32 extends axially through the closure 29, opening centrally of the dish shaped portion, and a rod 34 extends through said aperture having a head 35 at its upper end convexed on its under surface with a convexity corresponding to the shape of the upper surface of the dish shaped portion 28 of the conductor terminal. The lower portion of the rod 34 is fitted with a detachable head 36 for retaining a coil spring 37 interposed therebetween and the under surface of the closure 29, adapted for drawing the head 35 toward the surface of the dish shaped portion 32.

The tension of the spring may be readily adjusted by movement of the head 36 along the rod 34 as will be understood, and the clamp formed by the relation between the upper surface of the closure 29 and the under surface of the head 35 is adapted to effectually retain the conductor terminal 24 when said terminal is introduced into said clamp. The portion 28 of the terminal engages the correspondingly shaped portions of the head and closure. The outer end of the conductor terminal is preferably tapered as at 38 so as to coöperate with the inclined under surface of the head 35, and the inclined upper surface 33 of the closure to facilitate easy introduction of the terminal into position beneath the head.

It will be obvious that in use, the electrode 7 in the base 1 will be supplied with one side of the electric circuit from engagement of said base with the material of the engine, and that the other electrode 22 will be supplied with the other side of the circuit from the conductor 23 through the terminal 24, closure 29, lining 17, and bolt 18. The air passage along the insulating part serves to protect the parts from the deteriorating effects of heat, and thus prolong the life of the device.

In case of trouble, when the spark plug is in use, the insulating portion may be readily detached so that the electrodes may be inspected, repaired, or cleaned, as required, and since the air passages formed prevent excessive heating of the insulating part, this operation may be proceeded with without such delay as is ordinarily occasioned when the engine is overheated.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which as a matter of language, might be said to fall therebetween.

Having thus described my invention what I claim as new and desire to secure by Letters Patent, is:

1. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said insulating member being readily detachable from said base member, so as to give access to both of the electrodes, and a cooling air-passage extending along the joint between said members having its opposite ends open to the atmosphere.

2. In a spark plug, the combination of a metallic base member and an insulating member engaging said base member, said insulating member having means formed thereon adapted to coöperate with parts of the base member for forming a plurality of substantially uniformly spaced air passages about said insulating member for the purpose set forth.

3. In a spark plug, the combination of a metallic base member and an insulating member engaging said base member, said insulating member having an annular groove formed thereon, said base member having an aperture opening transversely therethrough and into the annular groove of said insulating member, and a passage leading from said annular groove to the atmosphere so as to afford a circulation of air through said aperture and passage for the purpose set forth.

4. In a spark plug, the combination of a metallic base member and an insulating member engaging said base member, said

insulating member having a longitudinally extending groove on its outer surface, and said base member having an aperture extending transversely therethrough adapted to coöperate with said groove to provide an air passage transversely through said base and longitudinally along said insulating member, for the purpose set forth.

5. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said base member being formed with a seat and having cooling apertures formed therein, and said insulating member having a part snugly fitting within said seat and held thereby against movement in one direction, said insulating member being provided with means registering with said cooling apertures to provide against the over heating of said plug.

6. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said base member having an aperture extending therethrough and being provided with an annular shoulder in said aperture, and said insulating member being provided with an opposingly formed annular shoulder for coöperating with the shoulder in said base for supporting said insulating member against movement in one direction, means detachably engaging between the base member and the insulating member for retaining said insulating member in operative relation with said base member, and the spark plug being formed with cooling air-passages extending between the insulating member and the retaining means, and being open to the atmosphere above and below said retaining means.

7. In a spark plug, the combination with a metallic base member, of an insulating member engaging said base member, said base member having an aperture extending therethrough, an electrode fixed to said base member projecting into said aperture, a seat formed in said base member, said insulating member being adapted to rest upon said seat, an electrode carried by said insulating member being held by the engagement of said insulating member with said seat in coöperative relation with said first mentionel electrode, a shoulder formed on said insulating member, said base member having an aperture therethrough communicating with a groove formed in said insulating member above said shoulder to supply cooling air to said groove.

8. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said base member being formed with a seat and said insulating member being formed with a part adapted to be fitted snugly within said seat, an annular groove formed upon said insulating member, a longitudinally extending groove formed upon said insulating member continuing from said annular groove, and said base member being formed with an aperture extending transfersely therethrough opening into said annular groove to coöperate therewith to provide an air passage transversely through said base member and along the longitudinally extending groove on the insulating member.

9. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member, said insulating member being formed with a cavity therein, a lining of conducting material for said cavity, a closure for said cavity fixed to said lining, a rod extending through said closure, means for resiliently drawing said rod into said cavity, a head formed upon said rod adapted to coöperate with said closure to provide a quick attach and release means for a conductor terminal, and means for retaining said lining in said cavity comprising the other electrode of the device.

10. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said insulating member having a cavity formed at one end, a closure for said cavity having an aperture therethrough, a rod extending through said aperture, means engaging said rod within said cavity for resiliently drawing said rod into said cavity, a head on the outer end of said rod adapted to be drawn into engagement with the outer surface of said closure, said closure being dish shaped on its outer surface, and said head being convexed on its under surface to correspond with the shape of the outer surface of the closure and adapted to form therewith a dish shaped clamp for engaging and retaining a conductor terminal, and electrical connections between said closure and the electrode carried by said insulating member.

11. In a spark plug, the combination of a metallic base member and an insulating member engaging said base member, of cooperative formations between said members for providing a plurality of distinct air-passages at spaced intervals about one of said members, said air passages being opened to the atmosphere at their opposite ends only.

12. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said base member being

formed with a seat therein, said insulating member having a part snugly fitting within said seat, the base member being formed with an aperture opening through the wall of said seat, and the insulating member being formed with means registering with said aperture for providing a cooling air-passage from said seat and along the insulating member.

13. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said base member being formed with a seat therein, said insulating member having a part snugly fitting within said seat, the base member being formed with an aperture opening through the wall of said seat, and the insulating member being formed with means registering with said aperture for providing a cooling air-passage from said seat and along the insulating member to the atmosphere at a point removed from said seat.

14. In a spark plug, the combination with a metallic base member carrying one of the electrodes, of an insulating member engaging said base member carrying the other of the electrodes, said base member being formed with a seat, and said insulating member being formed with a part adapted to be fitted snugly within said seat, the insulating member being further formed with a groove extending longitudinally thereof from a point spaced above said seat, and said base member being formed with an aperture transversely therethrough communicating with the lower end of said longitudinally extending groove and coöperating therewith to provide a cool air-passage transversely through the base and upward along the side of the insulating member.

15. A spark plug comprising an attaching part, and an insulating member connected thereto having a plurality of ribs projecting therefrom into engagement with said attaching part whereby to provide cool air circulating passages between said attaching part and said separately formed part, said cool air circulating passages being open to the atmosphere at both their ends.

16. A spark plug comprising a base member having an opening therein adapted to communicate with the engine cylinder, a seat formed within said opening, an electrode carrying member within said seat to close said opening, and said electrode carrying member having a plurality of ribs formed thereon engaging the walls of said seat whereby to provide air spaces between said electrode carrying member and the wall of said seat.

17. A spark plug comprising a base member having an opening therein adapted to communicate with the engine cylinder, a seat formed within said opening, an electrode carrying member within said seat to close said opening, said electrode carrying member having a plurality of ribs formed thereon extending into engagement with the walls of said seat whereby to provide air passages between said base member and said electrode carrying member, and said base member having an aperture therethrough communicating with at least one of the spaces between said ribs.

18. A spark plug comprising a base member having an opening therein adapted to communicate with the engine cylinder, a seat formed within said opening, an electrode carrying member within said seat to close said opening, said electrode carrying member having a plurality of ribs formed thereon extending into engagement with the walls of said seat whereby to provide air passages between said base and said electrode carrying member, said base member having a plurality of apertures extending therethrough in different radial directions communicating with all of the spaces between said ribs.

19. A spark plug comprising a base member having an opening therein adapted to communicate with the engine cylinder, a seat formed within said opening, an electrode carrying member within said seat to close said opening, and said electrode carrying member having a plurality of ribs extending longitudinally thereof engaging the walls of said seat and providing longitudinally extending air-passages between said base member and said electrode carrying member.

20. A spark plug comprising a base member having a seat formed therein, an electrode carrying member within said seat having a plurality of ribs extending longitudinally thereof engaging the walls of said seat and providing longitudinally extending air-passages between said base member, and said electrode carrying member, and said base member having an aperture extending transversely therefrom communicating with the lower ends of the spaces between said ribs.

21. A spark plug comprising a base member having a shoulder formed interiorly thereof, an electrode carrying member within said base member having an annular rib formed thereon for engaging said shoulder, spaced members formed upon the electrode carrying member above said annular rib, means carried by the base member engaging said spaced members for holding said electrode carrying member against said shoulder, and the base member being formed with an aperture through the wall thereof communicating with the spaces between said spaced members whereby to pro-

vide a circulation of air about said annular rib and between said electrode carrying member and said retaining means.

22. A spark plug comprising a base member having a seat formed therein, an electrode carrying member engaging said seat, retaining means engaging between the base member and the electrode carrying member to hold the electrode carrying member within said seat, and the spark plug being formed with a cool air circulating passage extending between said retaining means and said electrode carrying member, said cooling air circulating passage being open to the atmosphere above and below said retaining means, for the purpose set forth.

23. A spark plug comprising a base member having a seat formed therein, an electrode carrying member engaging said seat, retaining means engaging between the base member and the electrode carrying member to hold the electrode carrying member within said seat, the spark plug being formed with an opening between said retaining means and said electrode carrying member, and the base member having an aperture therethrough communicating with said opening to provide a cool air-passage, for the purpose set forth.

24. A spark plug comprising a base member having a seat formed therein, an electrode carrying member engaging said seat, an annular nut threaded upon the base member having an opening through which the electrode carrying member projects, said nut engaging the surface of the electrode carrying member to force said electrode carrying member against said seat, the electrode carrying member being formed with a groove extending longitudinally thereof along the surface engaged by said nut to provide an opening between the electrode carrying member and said nut, and said groove being open to the atmosphere above and below said nut so as to provide a cooling air-passage.

25. A spark plug comprising a base member, an insulating member, and opposite electrodes, said spark plug having a substantially L-shaped aperture extending therethrough forming an air circulating passage for cooling the spark plug, one leg of said aperture extending longitudinally of the spark plug between the base member and the insulating member, and the other leg of the aperture extending transversally through the material of the base member outwardly from the first leg to the atmosphere.

In testimony whereof, I affix my signature in the presence of two witnesses.

LOUIS STEINBERGER.

Witnesses:
L. GESSFORD HANDY,
NATHALIE THOMPSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."