No. 897,122. PATENTED AUG. 25, 1908.

H. C. TER MEER.

SPARK PLUG FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAR. 27, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

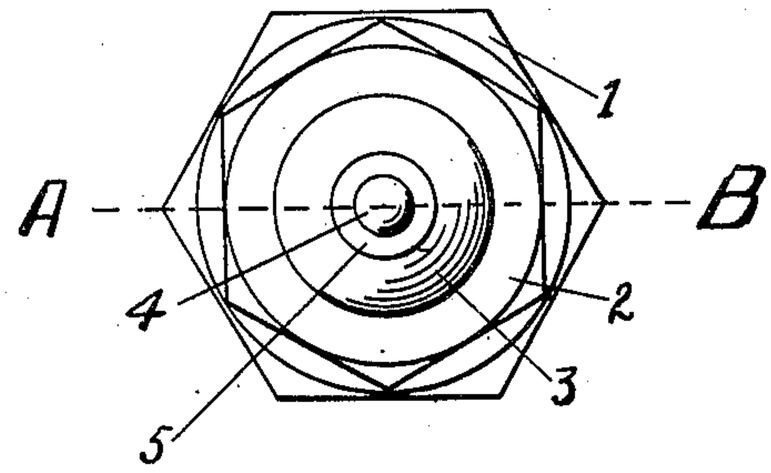


Fig. 2.

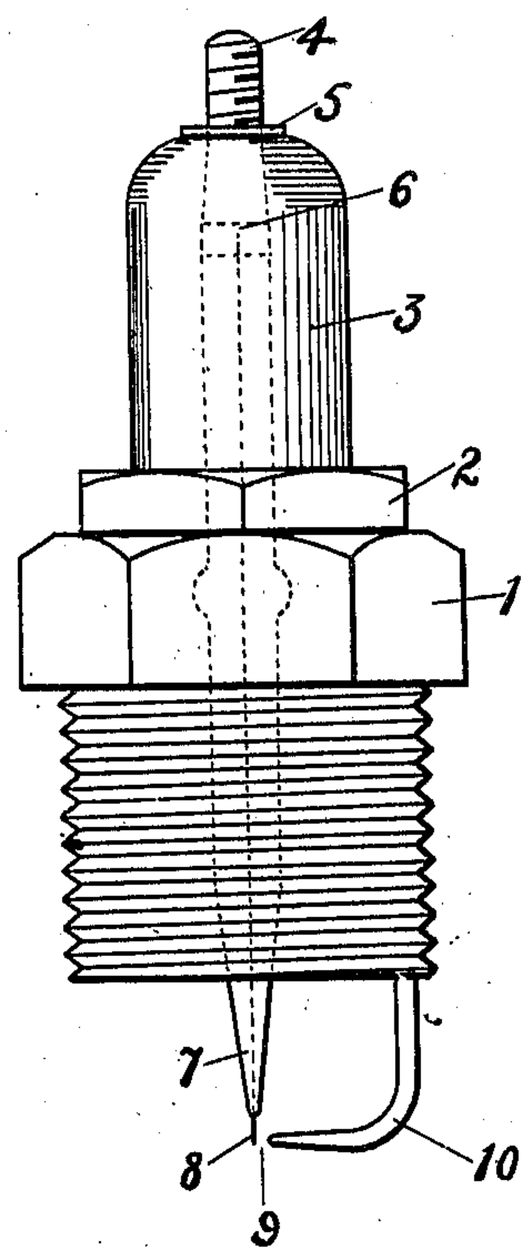
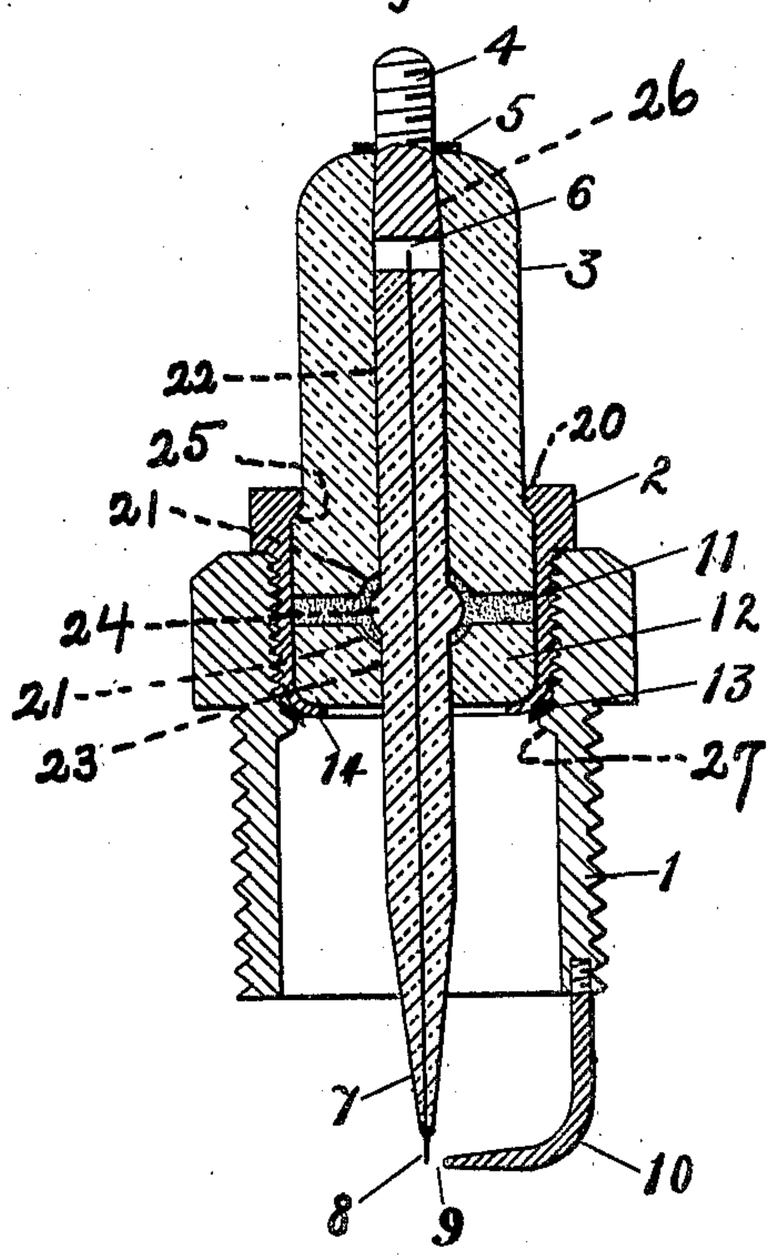


Fig. 3.



WITNESSES:

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2 SHEETS—SHEET 2.

Fig. 4.

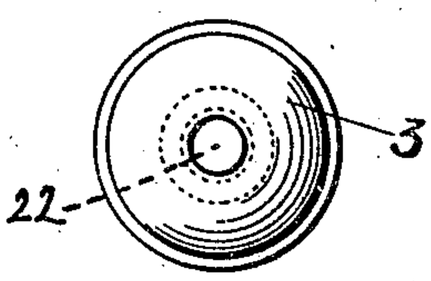


Fig. 5.

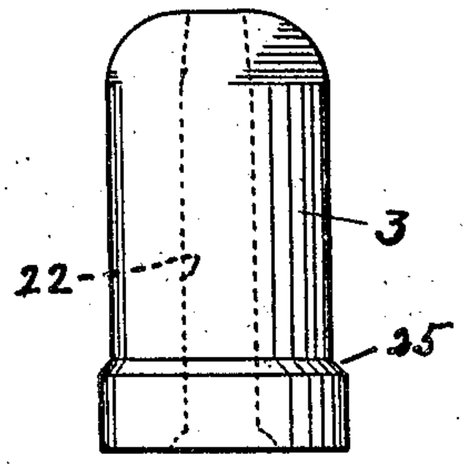


Fig. 6.

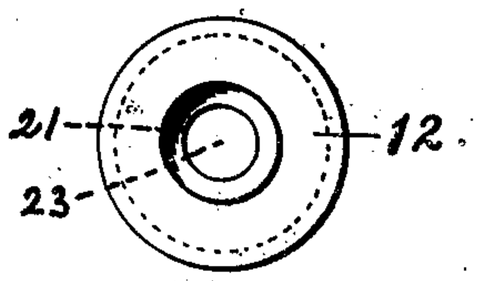


Fig. 7.

Fig. 10.

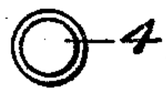


Fig. 11.

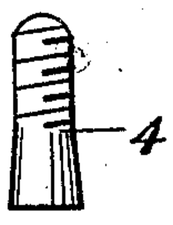


Fig. 12.

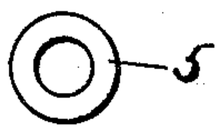


Fig. 13.

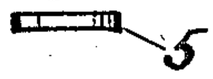


Fig. 8.

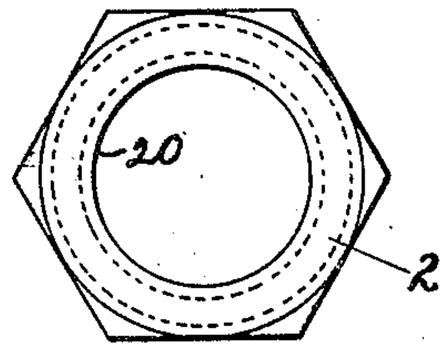


Fig. 9.

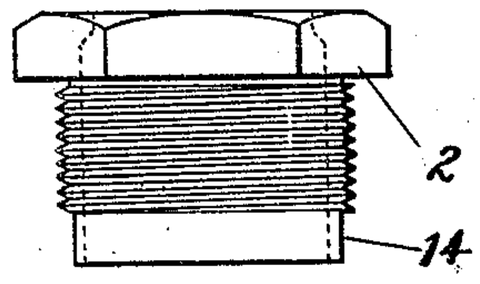


Fig. 14.

Fig. 15.

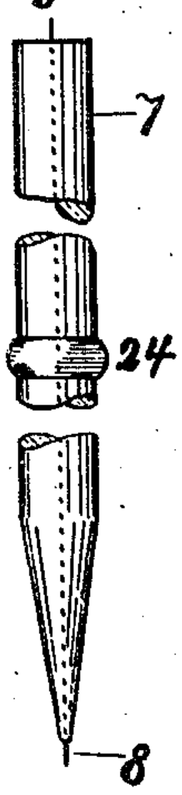
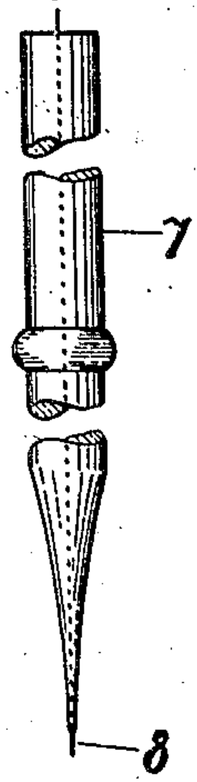


Fig. 16.



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UNITED STATES PATENT OFFICE.

HENRY C. TER MEER, OF SUMMIT, NEW JERSEY.

SPARK-PLUG FOR INTERNAL-COMBUSTION ENGINES.

No. 897,122. Specification of Letters Patent. Patented Aug. 25, 1908.

Application filed March 27, 1908. Serial No. 423,722.

To all whom it may concern:

Be it known that I, HENRY C. TER MEER, a citizen of the United States, and a resident of Summit, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Spark-Plugs for Internal-Combustion Engines, of which the following is a specification.

The invention relates to improvements in spark-plugs for internal combustion engines, and it consists in the novel features and combinations of parts hereinafter described, and particularly pointed out in the claims.

The objects of the invention are, generally speaking, to present a spark-plug of simplified construction and which will be highly efficent and reliable in use.

A further object of the invention is to present a spark-plug which may be readily taken apart for inspection, cleaning or repair without necessitating or even rendering liable the breaking of packed joints between the insulators and their surrounding parts.

The invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which:

Figure 1 is a top view of a spark-plug constructed in accordance with and embodying my invention; Fig. 2 a side elevation of the same; Fig. 3 a vertical transverse section of the same on the dotted line A—B of Fig. 1; Fig. 4 a detached top view of the upper outer insulator; Fig. 5 a side elevation of the same; Fig. 6 a detached top view of the lower outer insulator; Fig. 7 a side view of the same; Fig. 8 a detached top view of the bushing used to connect the upper and lower outer insulators; Fig. 9 a side elevation of the same; Fig. 10 a detached top view of the binding post at the upper end of the plug; Fig. 11 a side elevation of the same; Fig. 12 a detached top view of the binding post nut; Fig. 13 a side elevation of the same; Fig. 14 a detached top view of the inner insulator and central electrode; Fig. 15 a side elevation, partly broken away, of the same, and Fig. 16 a side elevation, partly broken away, of a modified form of inner insulator carrying the central electrode.

In the drawings, 1 designates the shell of the plug to be screwed into a cylinder-wall, not shown, said shell having an exteriorly threaded cylindrical lower portion and an interiorly threaded upper portion, and being formed on the exterior of its upper end with a polygonal head to receive a wrench or other convenient tool to be used for screwing the shell into said wall.

The shell 1 has secured to its lower edge the electrode 10 of usual construction, and receives within its upper end the exteriorly threaded bushing 2 having a polygonal head for a wrench or other suitable applying tool and an inwardly extended annular flange 20 for purposes to be hereinafter explained.

The outer insulators are numbered 3, 12 respectively and are centrally apertured through their length to receive the inner insulator 7 containing the central electrode 8 which will preferably be a platinum wire 0.01 inch in diameter. The insulators 3, 12 will preferably be made of porcelain, lava or soapstone and at their facing sides are recessed, as at 21, about their central apertures 22, 23 respectively to coöperate with the asbestos packing 11 between said insulators and an annular projection or beading 24 on the inner insulator 7 to secure the latter in firm position. The insulator 3 is an integral cylindrical body having the central vertical aperture 22 and an exterior annular shoulder 25 to be engaged by the flange 20 on the bushing 2, as shown in Fig. 3. The upper end of the aperture 22 has converging walls, as at 26, to engage the lower conical end of the binding post or terminal 4, which is inserted through said aperture 22 from the inner end of the insulator 3 and has a threaded end which projects above said insulator and receives a binding nut 5, the latter when screwed down on the upper end of said insulator firmly securing the post 4 in rigid position. The lower outer insulator 12 is in the form of a thick disk matching but separated by the packing 11 from the lower end of the insulator 3, and this insulator 12 is firmly secured against said packing by an inwardly spun flange 14 on the lower edge of the bushing 2, the flanges 20, 14 on the bushing serving to firmly connect the upper and lower outer insulators and bind their facing ends against said packing.

The inner insulator 7 may be formed of any suitable material but will preferably consist of quartz or Jena glass fused around the central electrode 8, which extends entirely through said insulator and projects slightly above and below the same, a spark gap 9 being formed between the electrodes 8, 10 and an auxiliary spark gap 6 being formed between the upper end of said electrode 8 and

the lower end of the binding post 4. The insulator 7 is rigidly held within the insulators 3, 12 by the action of the bushing 2 and the provision on the insulator 7 of the shoulder 24. When the bushing 2 carrying the insulators 3, 12 and 7 is screwed into the shell 1 its lower edge firmly seats against a packing 13, preferably of copper, applied on an annular shoulder 27 formed on the inner wall of said shell.

The insulator 7 is of special character in that it is comparatively long and small in diameter and has a tapered lower end, my purpose being to improve the efficiency of the plug by reducing the surface of the insulator on which foreign matter, which causes leakage, can deposit to a minimum. The lower tapered end of the insulator 7 projects below the shell 1, which affords a considerable chamber about said insulator above its lower end and below the lower end of the insulator 12.

The inner insulator of Fig. 16 differs from that shown in Fig. 15 only in the formation of the tapered lower end thereof, the lower end of the insulator shown in Fig. 16 being tapered on concave lines, while that illustrated in Fig. 15 is tapered on straight lines.

One of the main advantages accomplished by my invention, especially by the design of the inner insulator 7, is to prevent the fouling of the surface of the insulator at its lower end. A deposit of soot on the insulator creates a comparatively low resistance path for the leakage of the current from one electrode to the other, diminishing the size of the ignition spark, which causes faulty ignition. As the carbon deposit on the insulator increases in thickness its resistance diminishes, causing more and more current to leak, until finally the spark ceases to pass between the sparking points.

In accordance with my invention I make the insulator 7 as small in diameter as possible, consistent with the requisite degree of strength, and thereby present the minimum surface on which carbon could be deposited. By making the insulator 7 of small diameter the cross-section (perpendicular to the path of the current) is reduced and hence the resistance of the deposit is increased. The leakage current is thereby decreased, causing more current to jump the gap, with the result that a hotter spark is secured. On account of the small cross-section of the foreign substances deposited on the insulator 7, the resistance to the current will be high and consequently heat will be produced, the greatest amount of heat being generated at the point of smallest cross-section near the end of the insulator. The design of the insulator is such that enough heat shall be produced at its end to burn off or volatilize any film of soot, oil or other foreign matter, a zone free from the foreign matter being thus maintained around the central electrode and assuring the reliable and efficient operation of the plug.

The spark plug of my invention consists of few readily assembled parts of durable form and construction, and it is to be noted that the metal bushing 2 directly engages the shell 1 thereby forming a metal to metal joint by which the complete core is secured to said shell. The construction illustrated enables the removal of the core from the shell for the inspection, cleaning or repair without necessitating or rendering liable the breaking of packed joints between the insulators and their surrounding parts.

What I claim as my invention and desire to secure by Letters Patent, is:

1. An electric ignition device comprising an outer insulator having a central opening throughout, an inner insulator of elongated form having within it an electrode and held within the opening of said outer insulator, the walls at the outer end of said opening converging, a binding post within the outer end of said opening and tapered to conform to the walls thereof, and a binding nut on the exposed threaded end of the post for securing the same in position; substantially as set forth.

2. An electric ignition device comprising an outer insulator having a central opening throughout, an inner insulator of elongated form having within it an electrode held within the opening of said outer insulator, the walls at the outer end of said opening converging, a binding post within the outer end of said opening and tapered to conform to the walls thereof, and a binding nut on the exposed threaded end of the post for securing the same in position, a spark gap being left between the outer end of said inner insulator and its electrode and the inner end of said binding post; substantially as set forth.

3. An electric ignition device comprising outer matching insulators containing a central opening and separated at their facing ends by a packing, an inner insulator of elongated form held within said opening and having within it an electrode and formed on its exterior at a point between the facing ends of said outer insulators with a shoulder, and means for securing the outer insulators together; substantially as set forth.

4. An electric ignition device comprising outer matching insulators containing a central opening and separated at their facing ends by a packing, an inner insulator of elongated form held within said opening and having within it an electrode and formed on its exterior at a point between the facing ends of said outer insulators with a shoulder, and a metal bushing for securing said outer insulators, said bushing having inwardly extending flanges at its opposite ends and the upper insulator having a shoulder to enga-

the upper flange of said bushing; substantially as set forth.

5. An electric ignition device comprising outer matching insulators containing a central opening and separated at their facing ends by a packing, an inner insulator of elongated form held within said opening and having within it an electrode and formed on its exterior at a point between the facing ends of said outer insulators with a shoulder, a metal bushing for securing said upper and lower outer insulators and having an exterior screw thread, and a shell having an interior thread to receive said bushing and an exterior thread to be screwed into the wall of a cylinder; substantially as set forth.

6. An electric ignition device comprising outer matching insulators containing a central opening and separated at their facing ends by a packing, an inner insulator of elongated form held within said opening and having within it an electrode and formed on its exterior at a point between the facing ends of said outer insulators with a shoulder, a metal bushing for securing said upper and lower outer insulators and having an exterior screw thread, and a shell having an interior thread to receive said bushing, an exterior thread to be screwed into the wall of a cylinder and an inner flange with a packing thereon to receive the lower edge of said bushing; substantially as set forth.

Signed at Summit, in the county of Union, and State of New Jersey, this twenty-sixth day of March A. D. 1908.

HENRY C. TER MEER

Witnesses:
EUGENE C. PIERSON,
EVERETT T. SPINNING.