No. 764,626. PATENTED JULY 12, 1904.

A. F. PIEPER.

SPARKING PLUG.

APPLICATION FILED APR. 22, 1901.

NO MODEL.

Fig. 1.

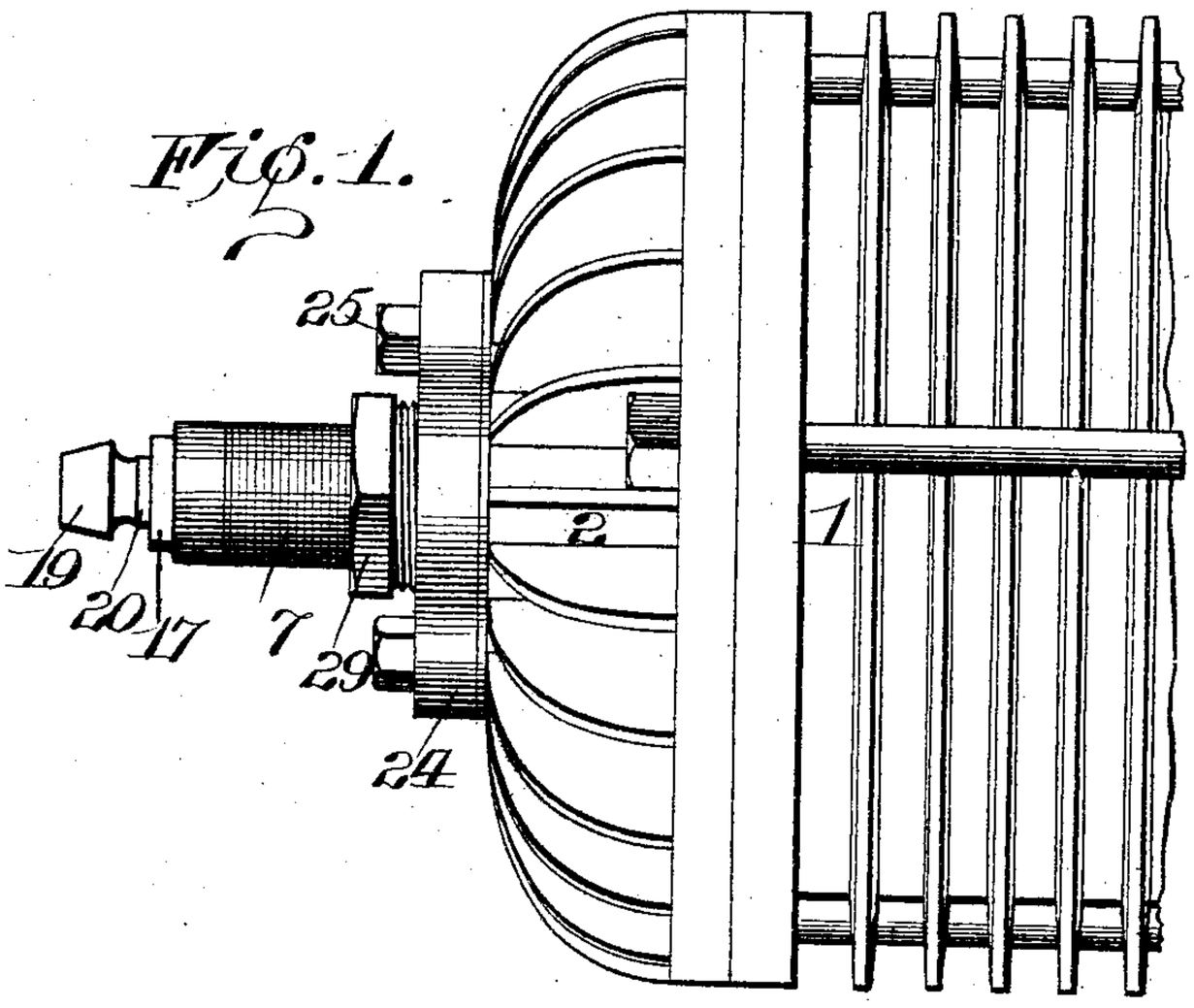
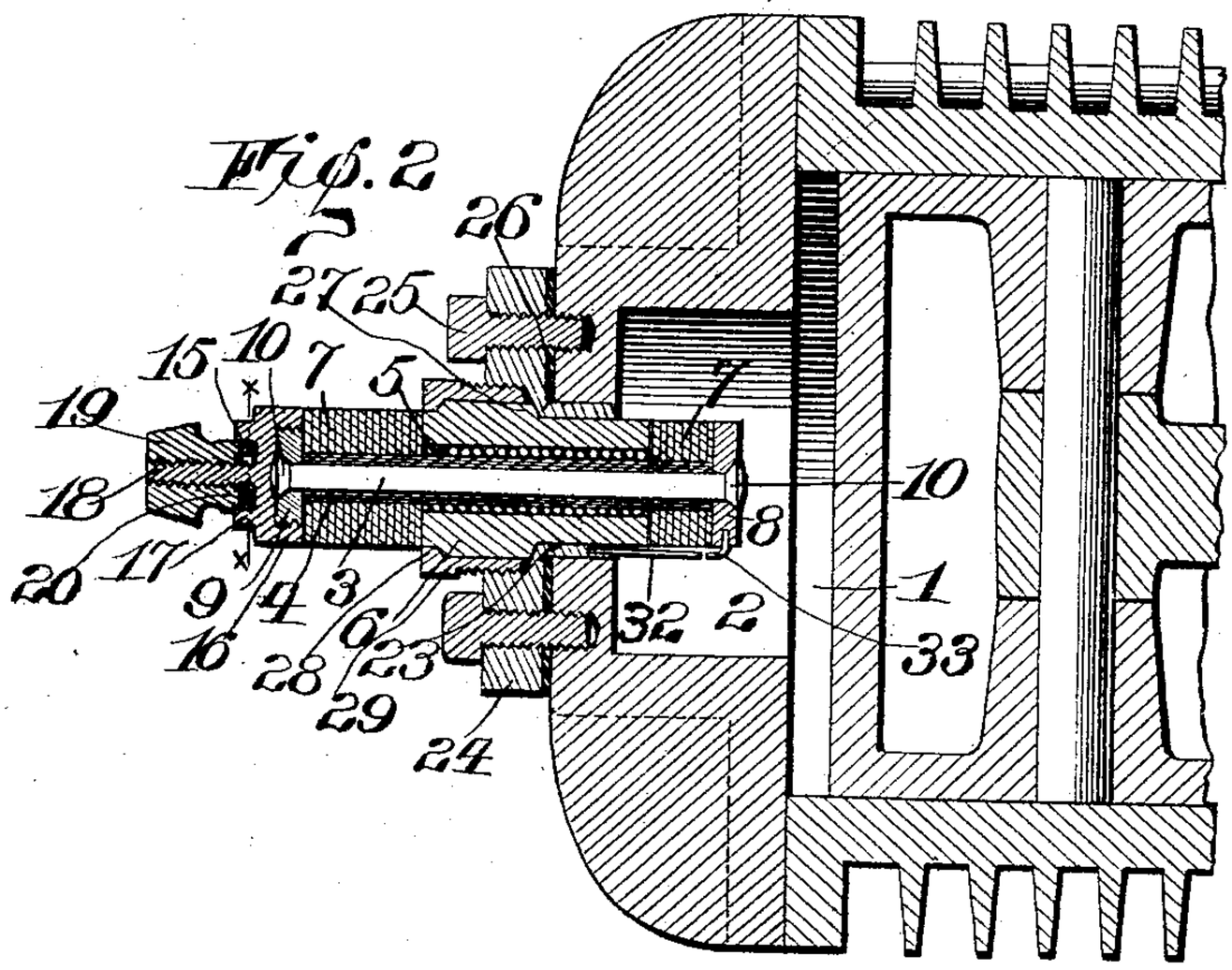


Fig. 2.



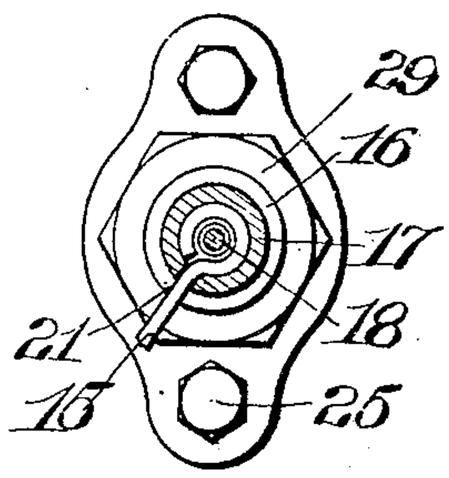


Fig. 3.

Witnesses.

Walter B. Payne.

Willard Rich.

Inventor.

Alphonse F. Pieper

by Frederick P. Church

his Attorney.

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UNITED STATES PATENT OFFICE.

ALPHONSE F. PIEPER, OF ROCHESTER, NEW YORK.

SPARKING PLUG.

SPECIFICATION forming part of Letters Patent No. 764,626, dated July 12, 1904.

Application filed April 22, 1901. Serial No. 56,806. (No model.)

To all whom it may concern:

Be it known that I, ALPHONSE F. PIEPER, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Sparking Plugs; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference-numerals marked thereon.

My present invention relates to igniting or sparking devices adapted to be subjected to high temperatures, and particularly to be employed upon explosive-gas engines; and it has for its object to provide an improved device preferably in the form of a plug containing electrodes or contacts between which a spark is formed; and it has for its further object to provide a device that will be unaffected by changes of temperature or other causes tending to permit a leakage of the current from one line to the other which would reduce the potential and prevent the sparking between the terminals when the circuit is broken or will permit leakage of gas or products from the cylinder.

With these ends in view my invention consists in the features of construction and combination of parts hereinafter described, and more specifically designated in the claims at the end of this specification.

In the drawings, Figure 1 is a side elevation of one end of an engine-cylinder, showing the application of a sparking plug constructed in accordance with my invention. Fig. 2 is a longitudinal sectional view thereof. Fig. 3 is a cross-sectional view on the line *x x* of Fig. 2.

Similar reference-numerals in the several figures indicate similar parts.

Devices of this class when used in gas-engines are arranged either partly or wholly within the cylinder 1 or in a firing-chamber 2, communicating therewith, so they are subjected to a very high temperature during the operation of the engine, which will cause the parts to expand, ordinarily loosening the insulation and permitting an otherwise perfect plug to leak, thereby reducing the potential between the poles to such an extent that it is impossible to obtain a proper spark between the terminals. To obviate this difficulty, I employ in the construction of my plug two metals possessing different coefficients of expansion and so arranging them that the expansion of one when heated will be greater than the expansion of the other, thereby causing the inclosed insulating material to be the more firmly compressed instead of being loosened during the operation of the engine, as would be the case were the interior and exterior portions formed of the same metal or of metals which expand equally.

A plug constructed in accordance with my invention embodies a central stem 3, composed in the present instance of steel, inclosed by a covering 4, of insulating material, which may be easily applied by winding the stem with sheet material, such as mica, to form an insulation of the desired thickness, and at its central portion it is secured by a wrapping of fine wire 5, which holds the insulation in place and permits the ready application of the supporting-shell 6. The shell is formed of brass or similar metal or alloy tending to expand greatly when heated, and I determine its length proportional to the length of the steel stem, so that their expansion may be equal or that of the former even slightly in excess of the latter. This shell is arranged centrally on the stem 3, and surrounding the extending ends thereof is the insulation 7, which may be formed by a series of washers composed of non-conducting material, and these are held in position by plates or disks 8 and 9, secured to the stem 3. In order to obtain an insulating material that will withstand a high temperature and also one that will be unaffected by the moisture which is present in the cylinder when the engine is first started, I employ mica, as the latter is capable of being compressed tightly, and as it is not brittle the plug may be subjected to severe use without danger of injury from careless handling.

In constructing my plug I first wind the covering 4, preferably of sheet-mica, upon the stem 3 and secure its central portion by the wrapping of wire 5, and the parts being then inserted in the shell 6 the insulating-

washers 7, also of mica, are placed over the extending ends of the stem, after which follow the plates 8 and 9, the whole being compressed compactly together and secured by upsetting the ends of the stem forming the rivet-heads 10, engaging the plates, to compress them tightly against the washers 7, it being well understood that the upsetting operation causes the plates or burs 8 and 9 to move toward each other.

The outer end of the plug is provided with a binding-screw for receiving one of the wires 15 of the circuit, and I attach the latter by forming a thread on the exterior of the plate or cap 9, which engages a head 16, having in its outer side a cup or recess formed by the rim 17, from the center of which extends a threaded stem 18, provided with a nut 19, the lower end 20 of which is adapted to pass within the rim 17. An aperture or slot 21 is formed in the rim 17 and permits the passage of the conducting-wire, as shown in Fig. 3. This arrangement of the cup and the binding-screw having the coöperating end is applicable wherever binding-screws are employed, as the end of the wire is prevented by the rim from being twisted from beneath the end of the screw by the rotary movement of the latter as it is brought into position, and it is also prevented from accidental removal whether or not the screw is held firmly in engagement therewith.

The plug may be secured in the cylinder in the usual or any preferred manner, and in the present instance I have shown it mounted in a sleeve 23 on the plate 24, which is secured to the cylinder by means of bolts 25. In order to make a tight fit between the plug and the surrounding sleeve, I provide the latter with the seat 26 and arrange the annular flange 27 on the sleeve 6 of the plug, the forward edge of which engages the seat, and its opposite edge forms a shoulder which also forms a seat for and is engaged by the inwardly-extending rim 28 of the nut 29, surrounding the sleeve and screwing into the plate 24.

The terminals between which the spark is produced are composed of platinum wires 32 and 33, extending from the supporting-sleeve 23 and from the plate 8, respectively, and having their ends arranged in proximity but out of contact.

The plug I have shown and described is capable of application to any engine, and its construction is such that it is impossible for it to get out of order under the conditions to which devices of the kind are ordinarily subjected.

While I have shown and described a single and effective form of binding-post for securing the conducting-wire to one of the terminals of the plug, I have not claimed the construction herein, as this subject-matter is reserved for a subsequent application.

I claim as my invention—

1. In an electric sparking device, the combination with a metallic stem, of a shell composed of a more expansible metal arranged between the ends of the stem whereby the unequal expansion of the parts will cause the proximate ends of the stem and shell to approach each other and a refractory insulating material arranged between the stem and shell.

2. In an electric sparking device, the combination with a stem having the laterally-extended ends, the tubular insulation thereon, and a supporting-shell shorter than the stem composed of a more expansible material and surrounding the insulation and arranged intermediate the ends thereof, of the separate pieces of insulating material at the ends of the shell and surrounding the tubular insulation, and sparking terminals suitably connected in relation thereto.

3. In an electric sparking device, the combination with a stem, tubular insulation thereon, and a supporting-shell shorter than the stem, and composed of a more expansible metal, surrounding the insulation and arranged intermediate the ends thereof, of the separate pieces of insulating material surrounding the tube and located at the ends of the shell, plates on the stem and means for securing said plates to compress the parts between them.

4. In an electric sparking device, the combination with a stem, tubular insulation surrounding the latter and a supporting-shell surrounding the insulation and arranged centrally upon the stem, and composed of a more expansible material than the latter, of separate pieces of insulating material surrounding said tubular insulation at the ends of the shell, plates and heads on the stem engaging the exterior of the plates.

5. In an electric sparking device, the combination with a metallic stem, tubular insulation upon the latter, and a shell surrounding the insulation, and composed of a more expansible metal than said stem, of separate portions of insulating material at the ends of the shell, plates on the stem, means on the stem for engaging said plates to compress the parts lying between them, a supporting-sleeve and sparking terminals mounted respectively on one of said plates and the other upon said sleeve.

6. In an electric sparking plug, the combination with a stem, tubular insulation composed of sheet material wound thereon and a wrapping securing the latter, of a shell surrounding said insulation and arranged centrally upon the stem, washers of insulating material on the stem at the ends of the shell and plates on the stem engaging the washers, heads on the stem compressing the plates and rigidly securing them against removal and sparking terminals suitably mounted in relation to these parts.

7. In an electric sparking plug adapted to be subjected to high temperatures, the combination with the two conductors composed of metals having different coefficients of expansion, of insulating material arranged between them and between their proximate ends upon which one conductor is entirely supported.

8. In an electric sparking plug adapted to be subjected to high temperatures, the combination with the two conductors composed of metals having different coefficients of expansion and insulating material arranged between the conductors and between their proximate ends subjected to compression when the conductors expand under the influence of heat.

9. In an electric sparking plug adapted to be subjected to a high temperature, the combination with the two conductors formed of metals having different coefficients of expansion and of relative lengths approximately inversely proportional to their coefficients of expansion arranged with their ends in opposition, of insulating material arranged between said conductors.

10. In an electric sparking plug adapted to be subjected to high temperatures, the combination with a brass shell, of a steel or iron stem therein having lateral extensions at the ends and insulating material surrounding the stem and arranged between it and interior of the shell and separate insulating material surrounding the insulating material on the stem and arranged between the ends of the shell and the lateral extensions on the stem.

ALPHONSE F. PIEPER.

Witnesses:
G. WILLARD RICH,
ELIZABETH J. PERRY.