March 8, 1938. E. B. NOWOSIELSKI 2,110,652

SPARK PLUG

Filed April 21, 1936

Fig. 2

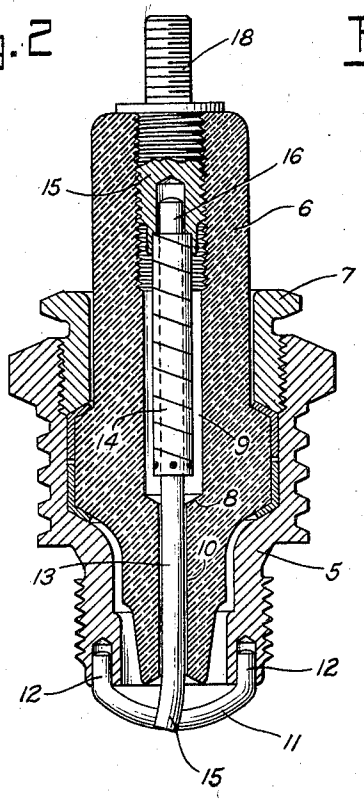



Fig. 1

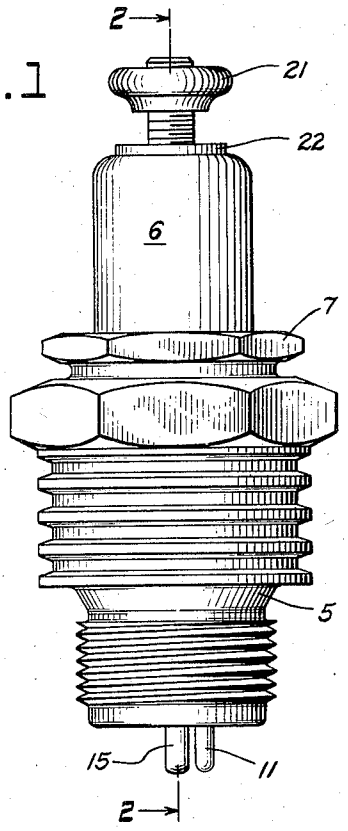
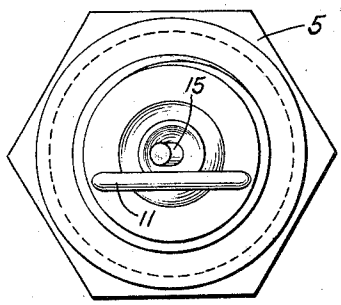



Fig. 3




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## SPARK PLUG

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6 Claims. (Cl. 123—169)

This invention relates to spark plugs and particularly to those of the variable spark gap type.

An object of the invention is to provide a novel method of varying the spark gap in accordance with temperature changes, the novel method involving the turning of the central electrode about its longitudinal axis to vary the distance between the offset end portion of the electrode and the grounded electrode cooperating therewith.

Such a rotatable central electrode has been employed heretofore but in the prior devices of this character there has been no means for producing such rotation by automatically acting heat responsive means, and it is accordingly an object of the present invention to provide such an automatically rotatable central electrode for the specified purpose of varying the spark gap in accordance with temperature changes.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawing:

Fig. 1 is a view in elevation of a spark plug embodying the invention;

Fig. 2 is a longitudinal sectional view along the line 2—2 of Fig. 1; and

Fig. 3 is a bottom plan view of the plug shown in Figs. 1 and 2.

Referring to the drawing and particularly to Figures 1 and 2, I have shown a spark plug which comprises a conductor shell 5, an insulator 6 mounted therein and retained in position by a gland nut 7, the inner end of the insulator being disposed within the shell and the outer end of the insulator projecting for a considerable distance beyond the gland nut. The bore or recess 9 of the insulator is provided with an annular ledge 8 at the point where recess 9 narrows to form the restricted bore portion 10.

Attached to the inner end of the shell is a ground electrode 11 having two longitudinally extending attaching shanks 12 staked, brazed, or fused to the shell, and an inwardly radially extending center portion.

Axially disposed within the recess 9 of the insulator 6 is a spirally wound ribbon 14 of suitable bi-metal which will expand and contract under temperature changes, whereby upon expansion the movable lower end of the spiral ribbon will turn in an unwrapping direction with respect to the upper fixed end of the said ribbon, the said upper end being suitably secured (preferably by spot-welding) to the retaining element 15 which is threaded into insulator 6. The central electrode 13 has the lower end of the helical ribbon 14 welded thereto, so as to turn about its axis as the ribbon alternately expands and contracts; and as the exposed end of the electrode is bent, as indicated best in Fig. 2, the air gap between said lower end and the surface of the grounded electrode will vary in accordance with the amount of turning of the ribbon. The usual terminal nut and washer are indicated at 21 and 22 respectively, surrounding the exposed reduced end 18 of the retaining member 15.

The diameter of the recess 9 in the insulator is considerably greater than the diameter of the spirally wound ribbon portion 14 and consequently an air space is formed around that portion of the electrode which is located within the recess. Thus the ribbon 14 of the electrode will become completely surrounded by compressed gases and these compressed gases will serve as an additional insulation between the rod and gland nut; but due to the lack of any substantial clearance between the central electrode 13 and the lower end of the insulator 6, any exploded gases from the combustion chamber which may pass up into the recess 9 will have difficulty in escaping therefrom during the succeeding exhaust stroke of the piston and therefore when the cycle of operations is repeated the pressure of exploded gases remaining in the recess 8 will tend to block the entry of any further combustible mixture. Consequently the continued depositing of carbon on the inner surface of the insulator 6 can not proceed to as great a degree as in spark plugs having no such restricted space between the electrode and the insulator. The efficiency of the insulator is thereby assured for a longer period than would be the case if a constant infiltration of carbon into the pores thereof were to occur.

In order to provide a bearing or guide for the electrode 13 at its upper end as well as its lower portion, the said upper end extends into the socketed part of the retaining member 15, as indicated at 16, thereby assuring a smoother rotation, and a uniform gap-varying action in service.

What I claim is:

1. In a spark plug, the combination with an outer shell of an insulator mounted therein, said insulator having an annular ledge intermediate the ends of the electrode receiving central por-

tion thereof, a grounded electrode extending from said shell into the space below said insulator, a central electrode spaced from said grounded electrode to provide a spark gap below said insulator, and heat responsive means within the portion of said insulator above the said annular ledge to vary said spark gap in accordance with the amount of heat applied thereto.

2. In a spark plug, the combination with a grounded electrode, of a central electrode having an end surface movable toward and away from said grounded electrode to vary the size of the spark gap therebetween, and means integrated with said electrode to turn the latter about its longitudinal axis to produce such variation in spark gap in response to a variation in the amount of heat applied to said electrode said means comprising a metallic helix constituting both a thermal and an electrical connection between the spark plug terminal and the central electrode.

3. In a spark plug, the combination with an outer shell of an insulator mounted therein, said insulator having an annular ledge intermediate the ends of the electrode receiving central portion thereof, a grounded electrode extending from said shell into the space below said insulator, a central electrode spaced from said grounded electrode to provide a spark gap below said insulator, and heat responsive means within the portion of said insulator above the said annular ledge to vary said spark gap in accordance with the amount of heat applied thereto said heat responsive means comprising a metallic ribbon constituting an integrated part of the central electrode.

4. In a spark plug, the combination with an upper terminal post to receive the spark plug cable connection, a central electrode coaxial with said terminal post, an insulator surrounding said central electrode, an outer shell supporting said insulator, and means movable within said insulator to turn said central electrode about its longitudinal axis in accordance with the amount of heat applied thereto.

5. In a spark plug, the combination with an upper terminal post to receive the spark plug cable connection, a central electrode coaxial with said terminal post, an insulator surrounding said central electrode, an outer shell supporting said insulator, and means movable within said insulator to vary the spark gap in accordance with the amount of heat applied thereto said heat responsive means comprising a metallic helix constituting both a thermal and an electrical connection between said terminal post and said central electrode.

6. In a spark plug, the combination with an upper terminal post to receive the spark plug cable connection, a central electrode coaxial with said terminal post, an insulator surrounding said central electrode, an outer shell supporting said insulator, and means movable within said insulator to vary the spark gap in accordance with the amount of heat applied thereto said heat responsive means comprising a metallic helix constituting both a thermal and an electrical connection between said terminal post and said central electrode said central electrode being rotatable in response to expansion or contraction of said metallic helix, and said terminal post having a counterbored portion acting as a guide for the rotating upper end of said central electrode during such expansion or contraction of said metallic helix.

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