June 8, 1948. H. W. ANDERSEN 2,442,945

SPARK PLUG

Filed June 11, 1946

Fig. 1.

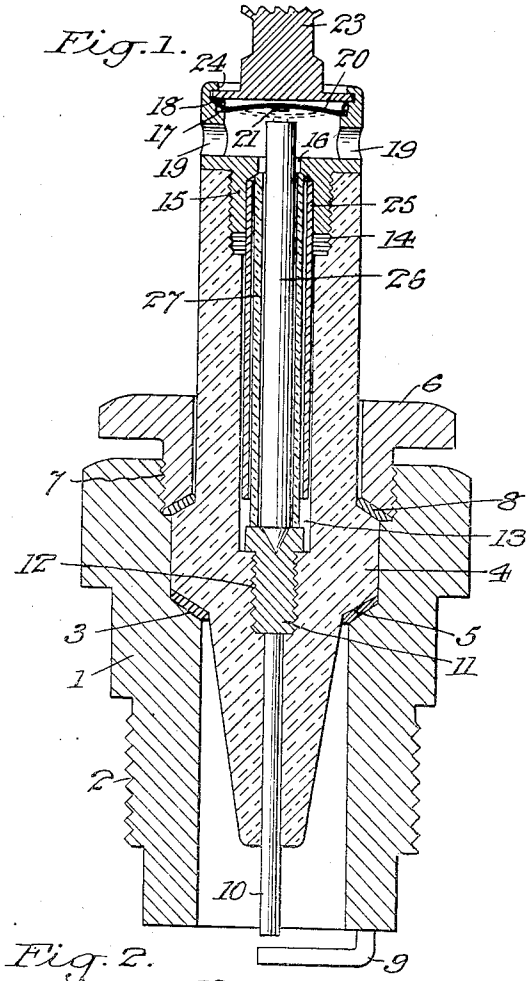
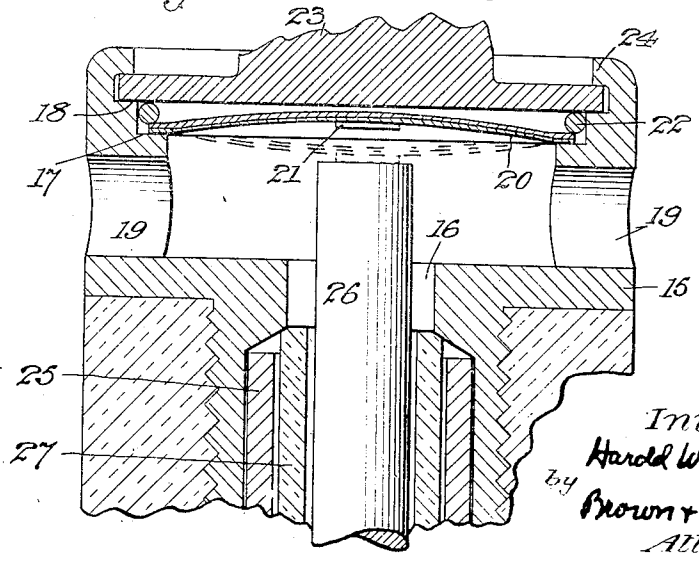


Fig. 2.



Inventor:
Harold W. Andersen
by Brown & Seward
Attorneys.

Patented June 8, 1948 2,442,945

UNITED STATES PATENT OFFICE

2,442,945

SPARK PLUG

Harold W. Andersen, Bayside, N. Y.

Application June 11, 1946, Serial No. 675,881

6 Claims. (Cl. 315—58)

1

This invention relates to a spark plug, of the type adapted for use in internal combustion engines.

An object of the invention is to provide such a plug in which an intensifier or booster gap is open during operation at low temperatures and is automatically short circuited just before the engine and plug reach their normal higher operating temperature.

Another object is to provide a condenser which acts when the intensifier gap is open to strengthen the discharge across said gap.

A further object is to provide certain improvements in the form, construction and arrangement of the parts whereby the above named and other objects may be effectively attained.

A practical embodiment of the invention is shown in the accompanying drawings, in which

Fig. 1 represents a vertical axial section through the spark plug, and

Fig. 2 represents a detail vertical axial section showing certain of the parts on a larger scale.

Referring to the drawings, the lower part of the plug is conventional and includes the base 1, externally threaded at 2 and provided with an internal shoulder 3 on which the matching shoulder of the porcelain 4 is supported through the intermediary of the annular gasket 5. The gland nut 6 screws into the top of the base at 7 and completes the seal by engagement with the gasket 8. An electrode 9 is welded on the bottom of the base 1, and the center electrode 10 passes axially through the lower part of the porcelain and is secured to the bushing 11 which is screwed and cemented tightly into the threaded recess 12.

The upper part of the porcelain contains a cylindrical bore 13, the upper end of which is enlarged and threaded as shown at 14 to receive the metallic crown 15. This crown is roughly cup-shaped, with a hole 16 in its middle, shoulders 17 and 18 near its top, and vent holes 19 in its sides. The shoulder 17 is designed to support the periphery of a bi-metallic snap disc 20, which may have a wear-resistant contact piece 21 mounted at its center, and a packing or retaining ring 22 overlies the periphery of the disc but without binding against it. The shoulder 18 supports the base of the terminal connector 23, and the top edge of the crown 15 is spun over as shown at 24 to grip firmly the base of the connector. The vertical distance between the shoulders 17 and 18 is approximately equal to the diameter of the ring 22 plus the thickness of the disc, so that the periphery of the latter is free to move laterally as required in connection with the snap action.

2

A cylindrical metallic tube 25 is supported from the lower part of the crown and extends through the bore 13 to a point slightly above the bottom thereof. An upper electrode 26 is mounted on the bushing 11 and extends axially of the plug, through the tube 25 in the bore 13 and through the hole 16, to a point slightly below the level of the shoulder 17. The electrode 26 is spaced from the tube 25 by an insulating tube 27 which terminates below the hole 16. For clearness of illustration the parts 25, 26 and 27 are shown in the drawings as being slightly spaced, but it will be understood that they may, in practice, be closely nested together.

The fuel ignition spark gap is between the electrodes 9 and 10, which may be of any specific form desired, and an intensifier gap is formed at the point where the electrode 26 passes through the hole 16. When the disc 20 is in its upper (cold) position the ignition current flows through the connector 23 and crown 15, across the intensifier gap to electrode 26, down through bushing 11 and electrode 10, across the ignition gap to electrode 9, and thence to ground through the base 1. Before jumping the intensifier gap each current impulse builds up a strong tension between the tube 25 and electrode 26 which, with the insulating tube 27, constitute a condenser with appreciable capacity, so that the spark which jumps the intensifier gap is materially reinforced and ensures a correspondingly strong or "hot" spark at the ignition gap.

The bi-metallic disc 20 is formed, in a known manner, of superimposed discs of metals having different coefficients of expansion and slightly dished, so that it is convex upwardly at low temperatures (as shown in full lines) but will snap to the position shown in broken lines (convex downwardly) as the temperature rises past a predetermined point. When the disc thus snaps to its lower (hot) position it immediately shorts out the intensifier gap and permits the current to flow from the connector 23, through the disc 20 and contact piece 21 to the electrode 26, the top of this electrode being so positioned as to assure the formation of a good contact. Naturally, when the temperature of the disc is again reduced it will snap back to its upper position, where it is spaced from the electrode 26 by a greater distance than that between said electrode and the walls of the hole 16. The action of the snap disc may be explained in more detail by noting that it tends to flatten out with an increase

of temperature, for instance in the range from 100° to 140° F., and at a certain point it brings the contact piece 21 closer to the end of electrode 26 than the distance across the intensifier gap. When this occurs the spark jumps between the piece 21 and the electrode (instead of across the gap), causing a sharp additional rise in temperature of the disc past the snapping point, so that the contact between the piece 21 and the electrode is immediately closed, as set forth above.

There is thus provided an intensifier gap of unvarying size and strong action, which is never closed but is instantaneously shorted out when the engine in which the plug is mounted reaches a temperature at which an intensified spark is no longer needed. The surfaces of the parts constituting the intensifier gap need not be cylindrical and concentric but may, if desired, be shaped to provide one or more definitely localized gaps. The insulating tube 27 may be of any suitable dielectric material and may, in some instances, be wholly or partially omitted.

It will be understood that various changes may be made in the form, construction, arrangement and materials of the apparatus and in the steps of the method without departing from the spirit and scope of the invention, hence I do not intend to be limited to the embodiments shown and described, but what I claim is:

1. A spark plug of the character described comprising, an electrode, a conductive element adjacent said electrode and spaced a fixed distance therefrom to provide an intensifier spark gap, and a separate heat-responsive element in continuous electrical connection with said conductive element and adapted at low temperatures to assume a position more distant from said electrode than the width of said gap and at normal engine operating temperatures to make contact with said electrode.

2. A spark plug according to claim 1 in which the heat-responsive element is a bi-metallic element adapted to snap substantially instantaneously between the positions named.

3. A spark plug according to claim 1 in which the heat-responsive element is a bi-metallic snap disc.

4. A spark plug according to claim 1 in which the conductive element surrounds the electrode at a fixed distance, and in which the heat-responsive element is movable into and out of contact with an end of the electrode axially with respect to said electrode.

5. A spark plug of the character described comprising, an electrode, a conductive element adjacent said electrode and spaced a fixed distance therefrom to provide an intensifier spark gap, a separate heat-responsive element in continuous electrical connection with said conductive element and adapted at low temperatures to assume a position more distant from said electrode than the width of said gap and at normal engine operating temperatures to make contact with said electrode, and a conductive body of extended area, said body being connected to the conductive element, surrounding said electrode and being dielectrically separated therefrom.

6. A spark plug according to claim 5 in which the conductive element surrounds the electrode and provides an annular spark gap, and in which the heat-responsive element is movable into and out of contact with an end of the electrode axially with respect to said electrode.

HAROLD W. ANDERSEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,548,031	Franzen	Aug. 4, 1925
1,704,781	Aspden	Mar. 12, 1929