Dec. 15, 1925. 1,565,274

J. B. HAWLEY, JR

SPARK PLUG AND THE LIKE

Filed Feb. 12, 1923

Fig. 1.

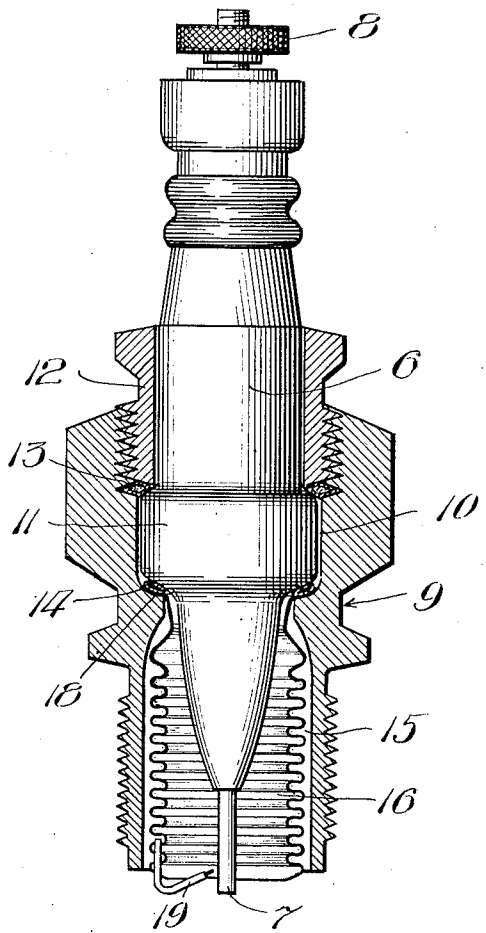



Fig. 2.

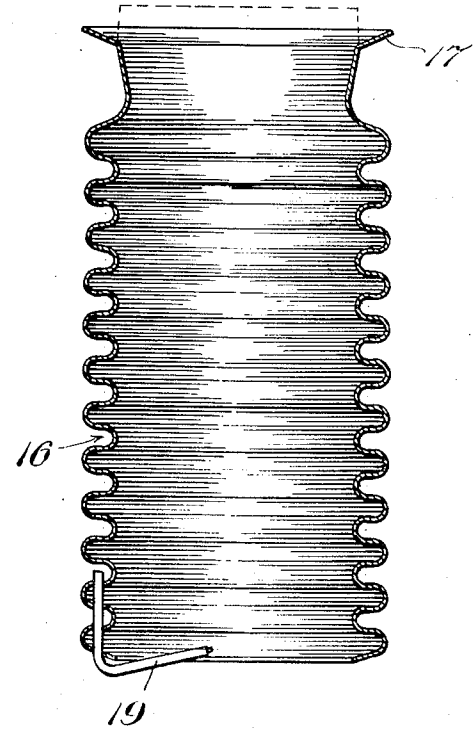



Fig. 3.

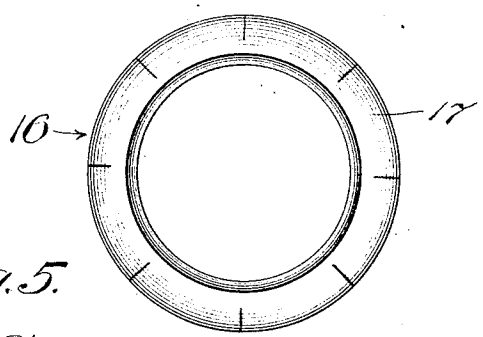



Fig. 4

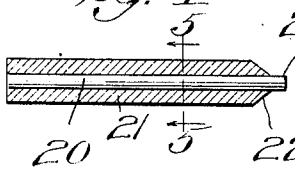



Fig. 5.




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# UNITED STATES PATENT OFFICE.

JOHN B. HAWLEY, JR., OF COLORADO SPRINGS, COLORADO.

## SPARK PLUG AND THE LIKE.

Application filed February 12, 1923. Serial No. 618,446.

*To all whom it may concern:*

Be it known that I, JOHN B. HAWLEY, Jr., a citizen of the United States, residing at Colorado Springs, in the county of El Paso and State of Colorado, have invented certain new and useful Improvements in Spark Plugs and the like, of which the following is a specification.

This invention has to do with certain improvements in spark plugs for internal combustion engines. The invention has for its objects to improve the construction and operation of the spark plugs in a number of features.

One object of the invention is to provide a spark plug construction such that the size of the gap will adjust itself automatically according to the temperature existing within the cylinder, so as to lengthen the spark gap as the temperature of the engine rises. This will materially improve the operation of the engine, since the length of a spark gap should be different when the engine is running hot from that when the engine is cold.

Another object of the invention, in connection with the foregoing, is to bring about the adjustment of the spark gap by a very simple construction, and one which can be cheaply manufactured and will not easily get out of order.

Another feature of the invention relates to the provision of a construction such that the relative position of the two electrodes will change longitudinally as the temperature of the engine rises, so that the spark will be caused to jump to different points on one of the electrodes at the different temperatures, thereby substantially equalizing the operation of the different portions of the electrodes.

Another feature of the invention relates to the provision of a construction such that the tendency for carbonization will be very materially reduced. This result is accomplished both by the form of the spark plug elements, and also by the kind of material which is used in building up the different parts of the plug.

A further feature of the invention relates to the provision of a sparking element made of wire of double composition of metal which will tend to burn and remain in pointed condition due to the constant passage of the sparks. This will materially reduce the tendency for the accumulation of oil, and will also substantially increase the sparking effect where the current is not of maximum strength.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawing:

Fig. 1 shows a longitudinal section through a spark plug embodying the features of the present invention, the porcelain being shown in elevation;

Fig. 2 shows a longitudinal section through the expansion insert;

Fig. 3 shows a plan view corresponding to Fig. 2;

Fig. 4 shows a fragmentary longitudinal section through the wire electrode, on enlarged scale as compared to Figs. 1 and 2; and

Fig. 5 shows a cross section taken on the line 5—5 of Fig. 4, looking in the direction of the arrows.

The spark plug illustrated in the drawing includes a porcelain element 6 through which extends the central electrode 7, whose upper end is connected to a terminal 8 for the high tension wire in accordance with usual practice.

The body or plug member 9 is provided with a socket 10 in its upper portion, which receives the enlarged neck 11 of the porcelain. A set nut 12 threads into the upper end of the body portion 9 so as to clamp the porcelain in place. A gasket 13 is illustrated as resting against the upper face of the neck 11, and another gasket 14 may be placed against the lower face of the neck 11 so as to provide the usual gas tight seal against the porcelain.

The lower portion of the body 9 is provided with a relatively large chamber 15 which reaches substantially from the position of the porcelain neck 11 down to the lower end of the plug. Within this chamber is located, what I have termed, an insert 16. This insert is preferably supported by a flange 17 at its upper end, which flange may be conveniently clamped stationary by resting it against the shoulder 18 of the body portion 9. When this is done, the act of tightening up the nut 12 will also clamp the insert rigidly in place.

This insert carries the wire electrode 19 at its lower end, the end of which electrode provides the spark gap in conjunction with the central electrode 7. The insert 16 is made of electrically conducting material, so that the electrode 19 is in electrical connection with the body member 9.

Furthermore, the insert 16 is so constructed and of such material that the position of the electrode 19 will change as the insert becomes hotter or colder so as to correspondingly change the spark gap to the central electrode 7. The arrangement is preferably such that as the insert rises in temperature the electrode 19 will move away from the central electrode 7 so as to increase the gap, a contrary action taking place when the temperature falls.

The particular arrangement illustrated is also such that the electrode 19 is moved longitudinally with respect to the central electrode 7 with changes of temperatures, so that the spark will jump to different points on the central electrode 7 at the different temperatures of operation.

All of the foregoing results are accomplished by corrugating the insert 16 as is clearly illustrated in Fig. 2 in particular. The corrugations are relatively small in size and relatively numerous, so that a maximum amount of change in position will be produced with a given change in temperature.

It is also observed that the size of the pocket 15 is such as to freely accommodate the insert 16 in its various positions and in the different temperature position, so that the lower end of the insert is free to assume whatever position is correct according to the temperature.

The electrode 19 is preferably made of two different metals. For example, this electrode may be formed of a steel wire 20 copper coated by a substantial thickness of copper 21, as illustrated in Figs. 4 and 5. When this combination of metals is used, it will be found that after a short period of service the copper coating 21 will burn back, as shown at 22 in Fig. 4, in order to leave an exposed point of steel 23. This will cause a sharp point to be presented for the jump of the spark, with the result that the tendency for the accumulation of oil will be reduced, and also a better spark will be created by a given current.

In order to reduce or prevent the adhesion of carbon to the insert, I prefer to silver plate the same, since it has been found that the carbon will not readily adhere to a silver surface. I also prefer to form the insert of thin brass or similar metal, and when this is done, the same may be silver plated in order to prevent the deposition of carbon. In some cases it will be found desirable to use an insert made of two different metals having materially different coefficients of temperature expansions so as to increase the movement of the electrode 19 caused by change of temperature.

I wish also to call attention to the fact that by silver plating the cylinder head and piston head of the engine, the tendency towards the deposition of carbon will be greatly reduced and the operation materially improved.

While I have herein shown and described only a single embodiment of the features of my present invention, still I do not limit myself to the same except as I may do so in the claims.

I claim:

1. In a spark plug, the combination of a base member having in its lower portion a downwardly facing chamber, a porcelain seated within said chamber and against the upper end thereof, a central electrode extending downwardly through said porcelain and having its lower end exposed below the porcelain, said porcelain being of smaller size than the chamber to leave an annular opening between the porcelain and the wall of the chamber, a cylindrical insert located within said annular opening, said insert comprising a relatively thin sheet of brass annularly corrugated and silver plated, an electrode point carried by the lower end of said insert and in close proximity to the exposed lower end of the first mentioned electrode, said point comprising a length of copper coated steel wire, substantially as described.

2. In a spark plug, the combination of a base member having in its lower portion a downwardly facing chamber, a porcelain seated within said chamber and against the upper end thereof, a central electrode extending downwardly through said porcelain and having its lower end exposed below the porcelain, said porcelain being of smaller size than the chamber to leave an annular opening between the porcelain and the wall of the chamber, a cylindrical insert located within said annular opening, said insert comprising a relatively thin sheet of metal annularly corrugated, and an electrode point carried by the lower end of said insert and in close proximity to the exposed lower end of the first mentioned electrode, substantially as described.

3. In a spark plug the combination of a base member having in its lower portion a downwardly facing chamber, a porcelain seated within said chamber, a central electrode extending downwardly through said porcelain and having its lower end exposed below the porcelain, said porcelain being of smaller size than the chamber to leave an annular opening between the porcelain and the wall of the chamber, a cylindrical insert located within said annular opening, said insert comprising a sheet of corrugated

metal, and an electrode point carried by the lower end of said insert, and in close proximity to the exposed lower end of the first mentioned electrode, substantially as described.

4. In a spark plug the combination of a base member having in its lower portion a downwardly facing chamber, a central electrode extending downwardly and terminating in the lower portion of said chamber, there being an annular opening between said electrode and the wall of the chamber, a cylindrical insert located within said annular opening, said insert consisting of corrugated sheet metal, and an electrode point carried by the lower end of said insert and in close proximity to the exposed lower end of the first mentioned electrode, substantially as described.

5. In a spark plug the combination of a base member, a central electrode within said base member and insulated therefrom, a cylindrical insert surrounding the electrode and in electrical connection with the base member and electrically insulated from the electrode, said insert comprising corrugated sheet metal, and an electrode point carried by the lower end of the insert and in close proximity to the lower end of the first mentioned electrode, substantially as described.

6. In a spark plug the combination of a base member, an electrode carried thereby and insulated therefrom, an insert surrounding said electrode and electrically connected to the base member and insulated from the electrode, said insert consisting of corrugated sheet metal, and an electrode point carried by the lower end of the insert and in close proximity to the lower end of the first mentioned electrode, substantially as described.

7. In a spark plug the combination of a central base member, a fixed electrode carried thereby and insulated therefrom, an electrode point in close proximity to the first mentioned electrode but separated therefrom by a spark gap, and a thermally operable adjustable support for the second mentioned electrode surrounding the central base member and operable to change the spark gap with change of temperature, substantially as described.

8. In a spark plug the combination of a central base member, an electrode carried thereby and insulated therefrom, another electrode in close proximity to the first mentioned electrode but separated therefrom by a spark gap, and a corrugated temperature operable means surrounding the central base member for changing the positions of the electrodes with respect to each other with change of temperature, substantially as described.

JOHN B. HAWLEY, JR.