L. B. CHERRY.

JUMP SPARK IGNITER PLUG.

APPLICATION FILED JAN. 17, 1910.

962,314. **Patented June 21, 1910.**

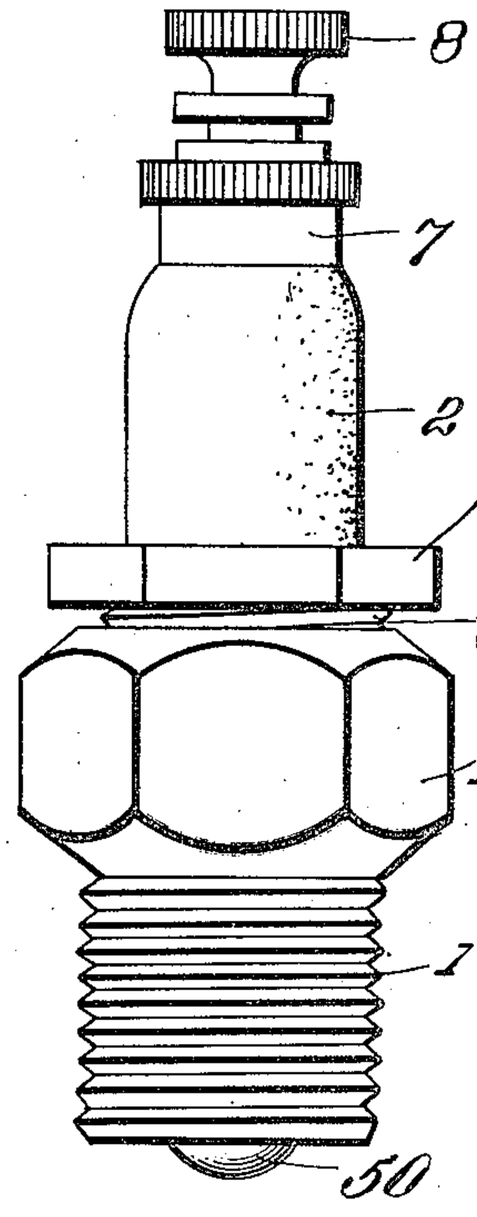

Fig. 1.

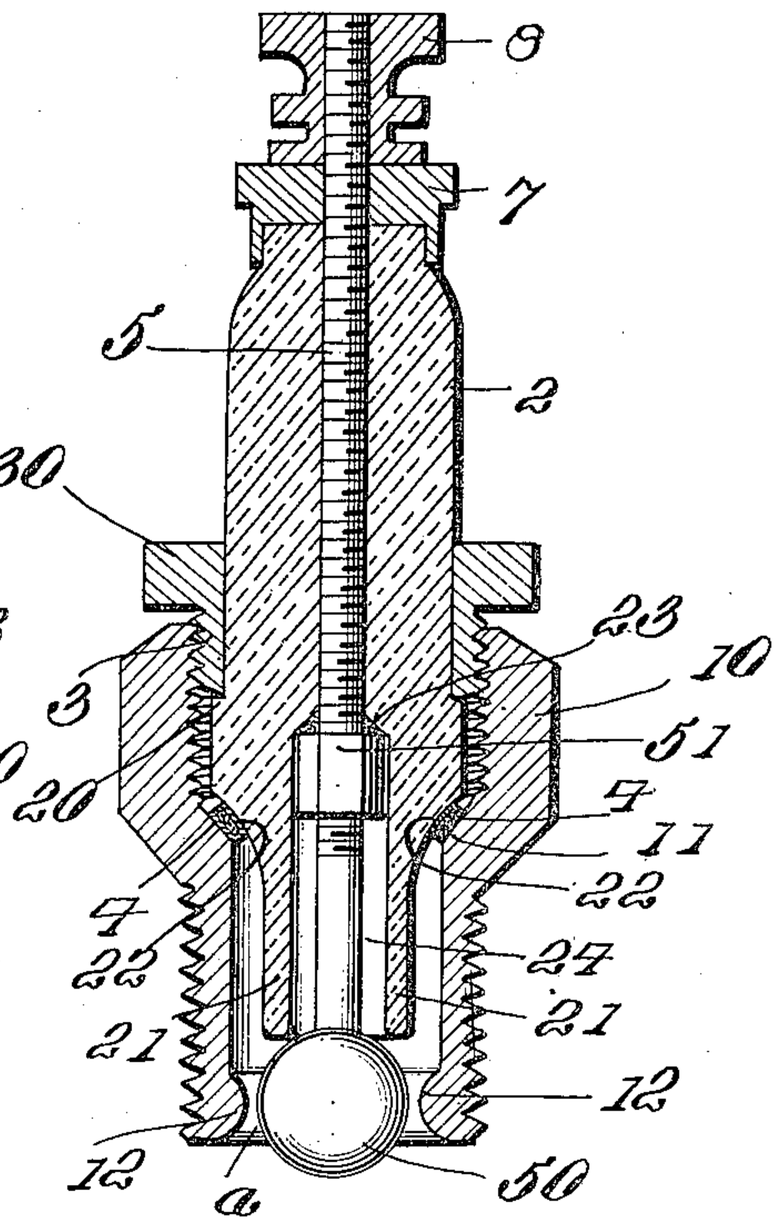

Fig. 2.

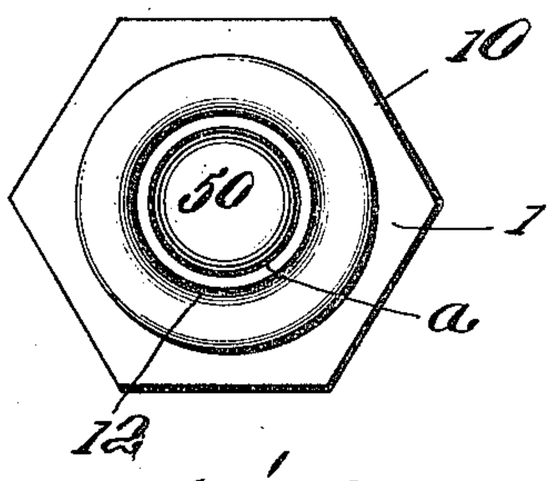

Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

LOUIS BOND CHERRY, OF ABERDEEN, SOUTH DAKOTA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE BALL MULTI-SPARK PLUG CO., OF ABERDEEN, SOUTH DAKOTA, A CORPORATION OF SOUTH DAKOTA.

JUMP-SPARK IGNITER-PLUG.

962,314. Specification of Letters Patent. Patented June 21, 1910.

Application filed January 17, 1910. Serial No. 538,525.

To all whom it may concern:

Be it known that I, LOUIS BOND CHERRY, a citizen of the United States, residing at Aberdeen, South Dakota, have invented certain new and useful Improvements in Jump-Spark Igniter-Plugs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain improvements in spark plugs for internal combustion engines, and more particularly to improvements in what might be termed jump spark igniter plugs; and the objects and nature of the invention will be readily understood by those skilled in the art in the light of the following explanation of the accompanying drawings illustrating what I now consider my preferred embodiment from among other formations, arrangements and combinations within the spirit and scope of my invention.

An object of the invention is to provide certain improvements in spark plugs whereby liability of fouling and short circuiting will be reduced to the minimum, and an exceedingly efficient, simple and durable device will be produced for the purposes intended.

A further object of the invention is to provide certain, simple, durable and efficient improvements in spark plugs for the purpose of intensifying and increasing the caloric value of the spark produced.

The invention consists in certain novel features in construction, in formations of parts, or in combinations and arrangements as more fully and particularly set forth hereinafter.

Referring to the accompanying drawings: Figure 1, is a side elevation of a plug, on an enlarged scale, constructed in accordance with my invention. Fig. 2 is a central longitudinal section, on the same scale. Fig. 3, is an inner end view, enlarged, of the plug.

In the drawings, 1, is the externally screw threaded metal shell of the plug which removably screws into the tapped hole or opening therefor in the cylinder of an explosive engine as will be readily understood by those skilled in the art. This shell at its outer end is exteriorly formed at 10, to receive a wrench or other implement whereby the plug can be rotated in screwing the same into or from the cylinder. The outer portion of the internal longitudinal bore of the shell is enlarged and threaded thereby forming the intermediate annular outwardly facing internal shoulder 11, from which the reduced portion of the bore extends to the inner end of the shell. At its inner end, the shell is preferably formed with an internal annular flange or bead 12, around the inner end opening of the shell. This flange or bead is preferably rounded or semi-cylindrical in cross section and preferably is formed with a continuous smooth surface unbroken by points or projections throughout the circle thereof, to form and constitute a rounded continuous or annular electrode projecting inwardly beyond the internal surface of the shell bore.

2, is the longitudinal elongated insulating plug or body composed of any suitable insulating or non-conducting material, such as porcelain or the like, and formed to longitudinally and removably enter the bore of the shell and to be held therein by the nut 3, through which the insulating plug or body loosely extends, and which screws into the threaded outer end of the shell bore and forces the insulating plug inwardly of the shell by the engagement of the inner end of the nut with the annular shoulder 20, of the insulating plug. The said nut holds the insulating plug to its limit of inward movement in the shell and preferably against a packing or cushioning ring or washer 4, seated against the shell seat or shoulder 11, and surrounding the reduced inner end portion or skirt 21 of the insulating plug and seated against the usually flared or inclined annular exterior shoulder 22, of said plug. If so desired, this packing ring can be formed by one or more asbestos washers covered by or inclosed within a ring of copper or other suitable sheet material. The outer end of the plug adjusting and clamping nut 3, beyond the outer end of the shell, is formed with an exposed enlarged head 30, formed to receive a wrench or other instrument whereby the nut can be rotated to screw the nut inwardly or outwardly within the shell. The reduced inner end portion of the insulating plug forms an annular skirt 21, arranged longitudinally and concentrically within the reduced por-

tion of the bore of the shell and terminating short of the annular end electrode 12, of the shell, and forming an annular fluid compression chamber within the shell around said skirt and extending from the open inner end of the shell longitudinally thereof to the packing washer 4. The insulating plug is formed with a longitudinal bore extending through the length thereof, and the inner end portion of this bore is enlarged to form a compressed fluid cavity or chamber 24, open at the inner end of the plug and forming the hollow interior of the skirt 21, and terminating in the intermediate internal annular seat or shoulder 23, within the plug.

5, is a longitudinally threaded conducting stem or rod removably extending through the bore of the insulating plug and projecting beyond the ends thereof, and at its inner projecting end carrying the electrode 50, fixed thereto. Intermediate its length, the stem is provided with longitudinally adjustable stop nut 51, coöperating with the internal shoulder 23 of the plug to limit the outward movement of the stem in the plug, and usually packing washer 6, of asbestos, or other suitable material, is interposed between shoulder 23, and said stop nut. The stem (and consequently the electrode 50) is held in place by the cap 7, removably fitting the outer end of the insulating plug and screwing on the projecting end of the stem. The end of the stem projecting beyond said cap is provided with a binding nut 8, by which the electric conductor from the magneto, vibrating coil box or other suitable source of high frequency electric current, while the return can be made through the shell and engine cylinder as usual or in some other suitable manner. The position of the electrode 50, with respect to the opposite electrode 12, and with respect to the end of the insulating skirt can be varied by separating the parts and changing the longitudinal position of the stop nut 51. The electrode 50, is preferably in the form of a smooth-surface spherical metal body or ball of less diameter than the internal diameter of the annular opposing electrode 12, and arranged concentrically within the same to form the annular spark gap *a*, within the annular electrode and around the spherical electrode. The spherical electrode is so arranged with respect to the annular electrode that the plane of the annular electrode will be co-incident with a diameter of the spherical electrode. The spherical electrode is spaced a distance from the inner end of the skirt of the insulating plug so that the inner open end of the compressed fluid chamber within said skirt is arranged opposite and adjacent to said spherical electrode and opens into the chamber within the inner end of the shell.

By employing curved surface electrodes of such formation as to produce an annular spark gap of uniform width throughout, the potential between the two electrodes will be approximately equal completely around the spark gap for the production of an electrical discharge across said gap consisting of a plurality of sparks distributed around the gap. A condenser effect is produced by forming the opposing surfaces of the electrodes curved or rounded and smooth, that is, without angular or sharp edges, points, projections or roughness. When the opposing electrode surfaces are thus smooth and curved the sparks can jump in either direction across the spark gap, and the electrical energy is stored or held back to attain the high potential necessary to produce an exceedingly "rich" electrical discharge of high caloric value and efficiency for ignition purposes. I find that peculiarly advantageous results and increased efficiency are attained in the operation of internal combustion engines by the employment of spark plugs or ignition devices embodying electrical condensers composed of the opposing electrodes and the intervening igniting spark gaps. With such a condenser, a spark gap of the desired width can be attained and even with an excess of oil and carbon on the condenser electrodes the exceedingly "rich" sparks are given off and the intensity thereof seems to be increased by the presence and combustion of the oil and carbon. To form the electrical condenser, the opposing surfaces of the electrodes are rounded or curved, and to remove all fine points or roughness which might permit current leakage and thus prevent the condenser action, said surfaces are burnished or polished as by the application of suitable finely divided abrasive and polishing material.

In the example shown, the two chambers formed in the shell around and within the depending skirt 21, have annular outlets between the lower edge of the skirt and the opposing electrodes, and the outrush of fluid from these chambers, on the ignition of the charge, is thus caused to sweep the lower edge of said skirt with a scavenging action as well as the electrode surfaces in passing through the annular spark gap. This outrush of fluid will tend to break and remove bridges of carbon and oil that might form across the spark gap and aid in the combustion thereof by the exceedingly "rich" sparks produced by the condenser.

It is evident that various modifications, variations, and changes might be resorted to, that elements or features might be added or other elements or features omitted, without departing from the spirit and scope of my invention and hence I do not wish to limit myself to the exact constructions shown.

What I claim is;—

1. An igniting device having opposing curved smooth-electric-condenser-surface-electrodes arranged one within the other and separated by an annular spark gap.

2. An igniting device comprising an annular rounded surface electrode, and an opposing spherical electrode arranged therein and separated therefrom by an annular spark gap, said electrodes having smooth burnished surfaces.

3. An igniting device comprising an annular electrode rounded in cross section, and an opposing spherical electrode arranged therein and spaced therefrom to form an annular spark gap.

4. A spark plug having its shell formed at its open end with an internal smooth annular bead rounded in cross section and constituting an electrode, and an opposing smooth rounded surface electrode arranged therein and spaced therefrom to form an annular spark gap.

5. A spark plug having an annular electrode, and a spherical electrode arranged therein and spaced therefrom to form an annular spark gap, said annular electrode having a continuous rounded surface opposing said spherical electrode.

6. A spark plug comprising a shell having a rounded annular bead around its inner open end and forming an electrode, an insulating plug arranged longitudinally within said shell and having a skirt forming chambers within the shell for the compressed charge, and a stem within said insulating plug and provided with a spherical electrode arranged adjacent to the edge of said skirt and within said annular electrode and spaced therefrom by an annular spark gap forming the opening to said chambers, substantially as described.

7. A spark plug comprising a shell having an internal annular electrode, an insulating plug arranged longitudinally within said shell and having a longitudinal skirt forming compressed charge chambers within the shell and around the skirt and within the skirt, and a conducting stem arranged longitudinally of said insulating plug and provided with a central rounded electrode within said annular electrode and spaced therefrom to form an annular spark gap, said central electrode forming annular outlets from said chambers, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

LOUIS BOND CHERRY.

Witnesses:

CORA GERBERICH,

RAY WEBB.