W. S. WITTER.

SPARK PLUG.

APPLICATION FILED FEB. 21, 1911.

1,038,701.

Patented Sept. 17, 1912.

2 SHEETS—SHEET 1.

FIG. 1.

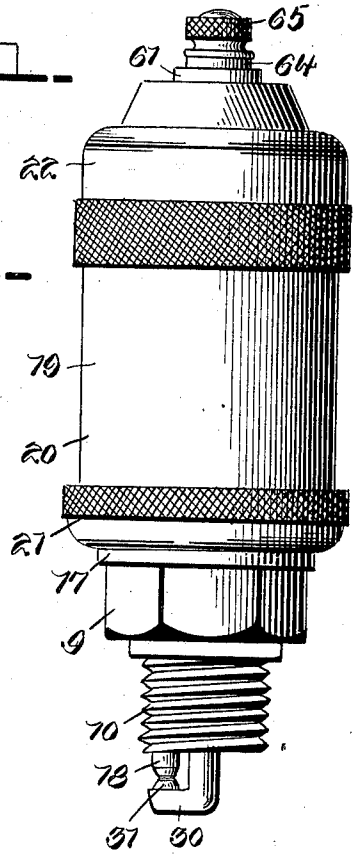


FIG. 3.

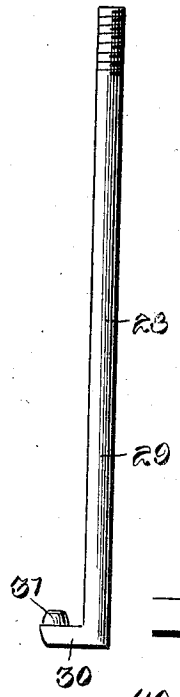


FIG. 4.

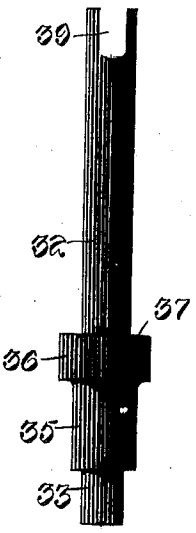


FIG. 5.

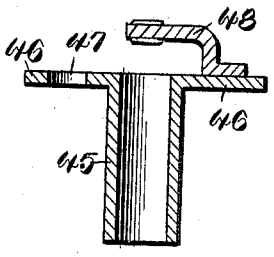
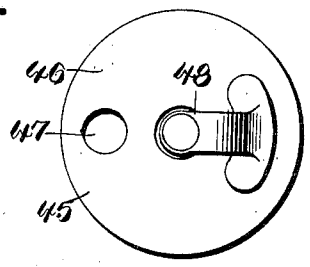


FIG. 6.



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2 SHEETS—SHEET 2.

Fig. 2.

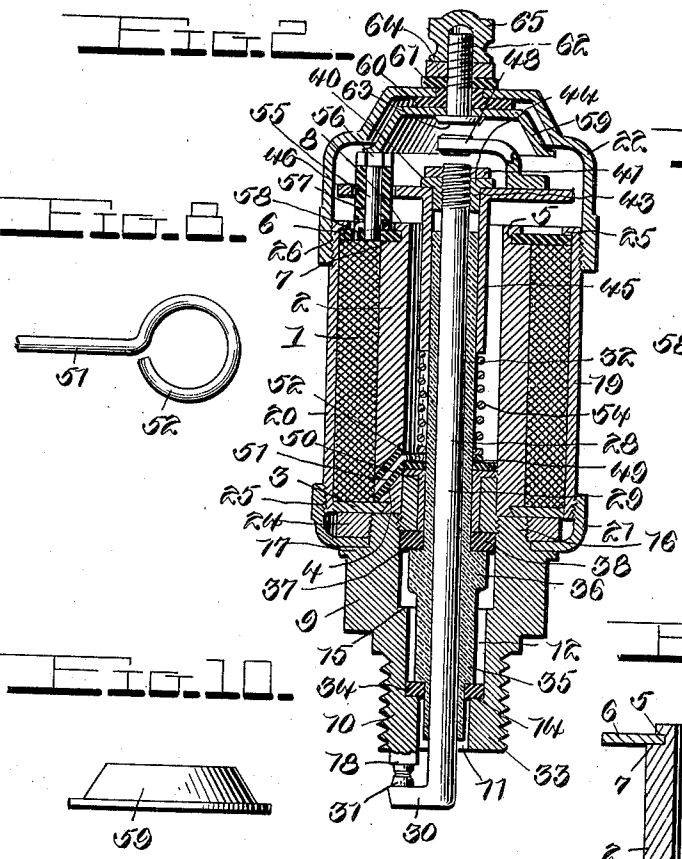


Fig. 8.

Fig. 9.

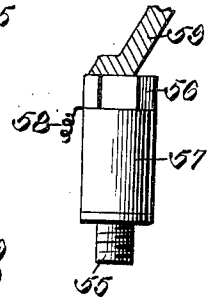


Fig. 10.

Fig. 7.

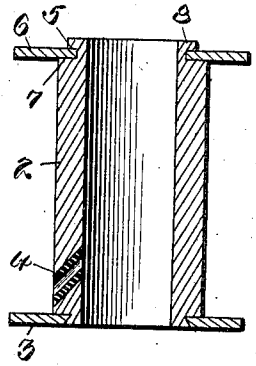


Fig. 11.

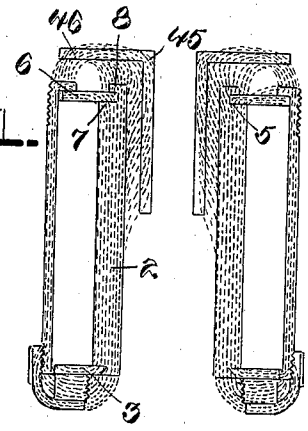
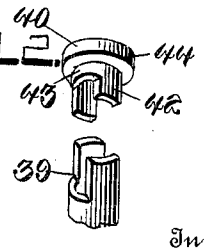


Fig. 12.



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UNITED STATES PATENT OFFICE.

WILLIAM SIBERT WITTER, OF JULESBURG, COLORADO.

SPARK-PLUG.

1,038,701. Specification of Letters Patent. Patented Sept. 17, 1912.

Application filed February 21, 1911. Serial No. 609,961.

To all whom it may concern:

Be it known that I, WILLIAM SIBERT WITTER, a citizen of the United States, residing at Julesburg, in the county of Sedgwick and State of Colorado, have invented certain new and useful Improvements in Spark-Plugs, of which the following is a specification, reference being had to the accompanying drawings.

This invention is an improved spark plug for use in internal combustion engines, the object of this invention being to provide an improved plug of this character which is adapted to work on low tension current, batteries or low tension magneto, and one which will produce large hot sparks for igniting the explosive charges in internal combustion engines, the invention consisting in the construction, combination and arrangement of devices hereinafter described and claimed.

In the accompanying drawings—Figure 1 is a side elevation of a spark plug constructed in accordance with my invention. Fig. 2 is a vertical central sectional view of the same. Fig. 3 is a detail elevation of the firing pin. Fig. 4 is a similar view of the insulating sleeve for the firing pin. Fig. 5 is a detail sectional view of the armature. Fig. 6 is a detail plan of the same. Fig. 7 is a detail sectional view of the core of the electromagnet. Fig. 8 is a detail plan of the connector between the winding of the electromagnet and the conducting washer of the insulating sleeve. Fig. 9 is a detail elevation of the inside contact bolt and a section of the insulating sleeve therefor. Fig. 10 is a detail elevation of the contact disk. Fig. 11 is a diagrammatic sectional view of the core of the electromagnet and of the armature, showing the magnetic lines of force. Fig. 12 is a perspective view of the firing pin and guide and also shows the upper end of the insulating sleeve.

In accordance with my invention, I provide an electromagnet 1, the core 2 of which is tubular and is provided at its lower end with an iron head 3. In one side of the tubular core near its lower end is an inclined opening through which extends an insulating tubular shell 4. The upper end of the tubular core is reduced and is provided in its reduced portion with an annular groove 5 which is engaged by the inner edge of an annular head 6, which head is made of fiber or other suitable insulating material. This insulating head 6 bears between the shoulder 7 formed at the lower side of the groove 5, and the overhanging shoulder 8 which is formed at the upper side of the said groove, and which serves to secure the insulating head in place. The lower end of the magnet core 2 bears on the upper end of the base piece 9 of the plug, which base piece is preferably made of brass or other non-magnetic material, and is provided with a screw threaded reduced lower portion 10, adapting the same to be screwed in the usual threaded opening in the head of the engine cylinder. This base piece is provided with a bore 11, and with counter-bores 12, 13 which form shoulders 14, 15. At the upper end of the base piece is a concentric annular flange or extension 16 on which the lower end of the magnet core bears, and which is provided with exterior and inner screw threads as shown, an outer annular shoulder 17 being formed at the base of the said extension. The base piece of the plug is provided at its lower end with a contact point 18.

The electromagnet is inclosed in a casing 19 which comprises a tubular body 20, a lower cap 21 and an upper cap 22. The tubular body 20 and the lower cap 21 are made of iron or other magnetizable material, and are screwed together as at 23. The lower cap 21 has a central opening through which the extension 16 of the base piece 9, extends, the lower cap bearing on the shoulder 17 of the base piece, and being firmly secured in place by an iron nut 24 which is screwed to the outer side of the said extension, and bears between the lower cap and the lower end of the core 2. Hence the pole pieces of the electromagnet are formed by the upper ends of the core 2, and of the body 20. The body is provided at its upper end with an inturned flange 25 which bears on the upper side of the insulating head 6. The upper cap 22 is made of brass or other suitable nonmagnetic material, and the lower end thereof is screwed to the upper end of the body 20 as at 26. Said cap has a central opening.

The firing pin or sparking pin 28 comprises a straight stem 29, a right angled arm 30 at the lower end of the stem, and an upwardly extending contact point 31 on the outer end of the arm. The upper end of the

stem 29 is provided with screw threads. The stem extends through and is movable longitudinally in an insulating sleeve 32. This sleeve has a reduced lower portion 33 which extends through the opening in an insulating washer 34 which bears on the shoulder 14 of the plug base 9, and also has an enlarged portion 35 disposed in the counter-bore 12 and an annular enlargement 36 in the counter-bore 13, and providing a shoulder 37. An insulating washer 38, which together with the washer 34 is preferably made of mica, fits in the counter-bore 13 and bears on the shoulder 37, the insulating sleeve extending through the central opening of the insulating washer 38. The insulating sleeve is provided at its upper end with a transverse slot 39. The upper end of the stem of the firing pin extends through a guide 40 and is secured thereto by a nut 41, which is screwed to the upper end of the firing pin. This guide has a transverse fin or bar 42 which operates in the vertical slot 39 of the insulating sleeve 32, and hence serves to prevent the firing pin from turning. The guide also has a cylindrical portion 43 the diameter of which corresponds with the exterior diameter of the insulating sleeve, there being an annular shoulder or flange 44 above the cylindrical portion 43.

A tubular armature 45 is disposed with its tubular portion which is nonmagnetic telescopically engaged with the insulating sleeve 32. The armature also has at its upper end, a disk 46 provided near one side with an opening 47, and also provided opposite the said opening with a hammer or tappet arm 48, which extends over the center of the armature and the free end of which is spaced from the upper end of the armature. The cylindrical portion 43 of the guide 40 is fitted in the upper end of the armature, its shoulder 44 bearing thereon.

An insulating washer 49 bears on the upper end of a bushing 50, the bushing being disposed in the lower portion of the bore of the core 2, being engaged with the interior threads of the part 16 of the plug piece 9, and also bearing on the insulating washer 38, and clamping the latter in place. A contact piece 51 is connected to the inner end of the coil or winding of the electromagnet, passes through the insulating sleeve 4 of the core 2, and terminates in a ring 52 which bears on the upper side of the washer 49, and also extends around the insulating sleeve 32. A washer 53 which is a conductor bears on the ring 52 of the contact piece. The coiled extensile spring 54 which is around the insulating sleeve 32, bears at its lower end on the conducting washer 53, and at its upper end under the tubular portion of the armature 45, the action of the spring being to raise the armature and cause the latter by reason of its being connected to the firing pin, by the guide 40 and the nut 41, to also raise the firing pin so as to cause its sparking point 31 to closely approach the sparking point 18 of the plug base 9.

A contact stud 55 has its lower end screwed in a threaded opening in the insulating head 6 of the core of the electromagnet. The nut 56 of the contact bolt bears on the upper end of an insulating sleeve 57, the said sleeve passing through the opening 47 in the disk of the armature, and its lower end bearing on the insulating head of the electromagnet. This contact stud is connected as at 58 to the coils or windings of the electromagnet. A contact disk 59 which is of frusto-conical form bears on the head of the contact bolt. An insulating washer 60 bears between the upper side of the contact disk and the lower side of the top of the upper cap 22, and is provided with a boss which extends through the opening 27 of said cap. An outer insulating disk 61 bears on the center of the upper cap 22 and has an opening through which a bolt 62 extends, the said bolt also passing through central openings in the contact disk and in the insulating washer 60, and having at its lower end a head or flange 63 which engages the under side of the contact disk at the center thereof. A binding nut 64 is screwed on the bolt 62 and coacts with a lock nut 65 on the said bolt to enable a conducting wire to be connected to the bolt 62. The base piece 9 of the plug is, as is usual, grounded to the engine.

When an electric circuit including the windings of the electromagnet 1 is closed, current flows through the contact bolt 62, contact disk 59, contact bolt 55, the coils of the electromagnet, the contact piece 51 to the washer 53, thence through the spring 54, to the armature and from the latter through the guide 40 to the firing pin 28 and from thence across the gap between the sparking points 31 and 18, to the base piece 9 of the plug. The electromagnet 1, is in effect a solenoid, the pole pieces being the end 8 of its tubular core, and the end 25 of the part 20 of the casing of the plug, as hereinbefore stated, so that the armature disk is in the field of magnetic force and is attracted, thus causing the armature to move toward the electromagnet against the tension of the spring 54, and cause its tappet arm or hammer 48 to strike the upper end of the firing pin and hence drive the firing pin so as to cause its sparking point 31 to suddenly move from the sparking point 18, thereby forming a gap between the sparking points and hence producing a hot fat or large spark to ignite the explosive charge in the engine. The instant the circut is broken, the spring acts to restore the armature and the firing pin to their initial positions with the contact point 31 closed against the contact

point 18. Inertia causes the contact points to remain in contact until the firing pin is overtaken by the hammer.

I claim:—

1. A spark plug having a fixed sparking point, a longitudinally movable firing pin having a sparking point, an insulating sleeve in which the firing pin is movable, an electromagnet having a tubular core through which the insulating sleeve extends, an armature having a tubular portion mounted for movement on the insulating sleeve, a guide carried by and mounted for independent longitudinal movement in the armature and connected to the firing pin, said armature, guide and firing pin being included in circuit with the windings of the electromagnet, a spring to move the armature, guide and firing pin in one direction, and a hammer carried by the armature and normally, by the action of the spring, spaced from the upper end of the firing pin, said hammer, when the electromagnet is energized, striking the firing pin and moving the same downwardly to suddenly separate the sparking points.

2. A spark plug having a fixed sparking point, a longitudinally movable firing pin having a sparking point, an insulating sleeve in which the firing pin is movable, an electromagnet having a tubular core and also having a tubular outer member forming a casing, magnetically connected to the tubular core piece and forming a pole of the electromagnet, both poles being presented at the upper end of the electromagnet, an armature presented to the poles of the electromagnet and having a tubular portion mounted for movement on the insulating sleeve, a guide carried by and mounted for independent longitudinal movement in the armature and connected to the firing pin, said armature, guide and firing pin being included in circuit with the windings of the electromagnet, a spring to move the armature, guide and firing pin in one direction, and a hammer carried by the armature and normally, by the action of the spring, spaced from the upper end of the firing pin, substantially as described.

3. A spark plug having a fixed sparking point, a longitudinally movable firing pin having a sparking point, an insulating sleeve in which the firing pin is movable, an electromagnet having a tubular core and also having a tubular outer member forming a casing, magnetically connected to the tubular core piece and forming a pole of the electromagnet, both poles being presented at the upper end of the electromagnet, an armature presented to the poles of the electromagnet and having a tubular portion mounted for movement on the insulating sleeve, a guide carried by and mounted for independent longitudinal movement in the armature and connected to the firing pin, said armature, guide and firing pin being included in circuit with the windings of the electromagnet, a spring to move the armature, guide and firing pin in one direction, and a hammer carried by the armature and normally, by the action of the spring, spaced from the upper end of the firing pin, a non-magnetic cap forming the upper end of the casing, attached to the tubular outer core piece of the electromagnet and inclosing the armature, the hammer, the upper end of the electromagnet and the firing pin.

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

WILLIAM SIBERT WITTER.

Witnesses:
J. R. HAMILTON,
F. H. KLUCKMAN.