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Patented Apr. 1, 1902.

H. C. FOLGER, H. MORIARTY & E. B. JACOBSON.

SPARKING PLUG.

(Application filed Dec. 18, 1900.)

(No Model.)

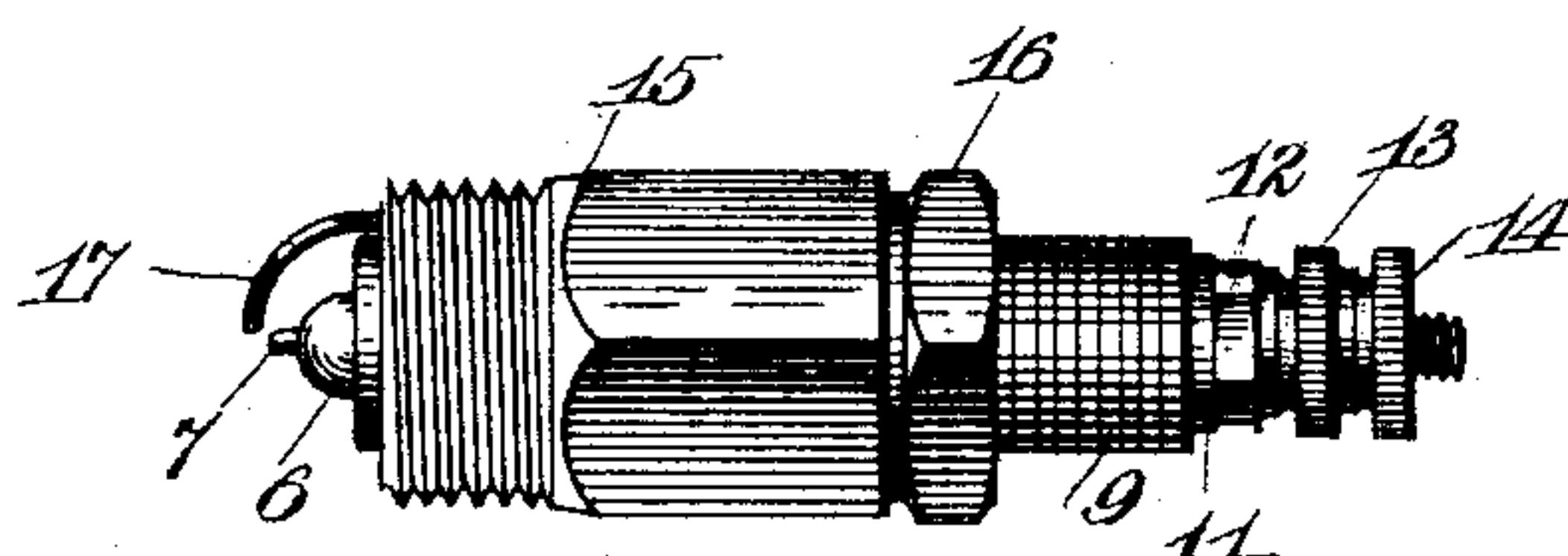


Fig. 1.

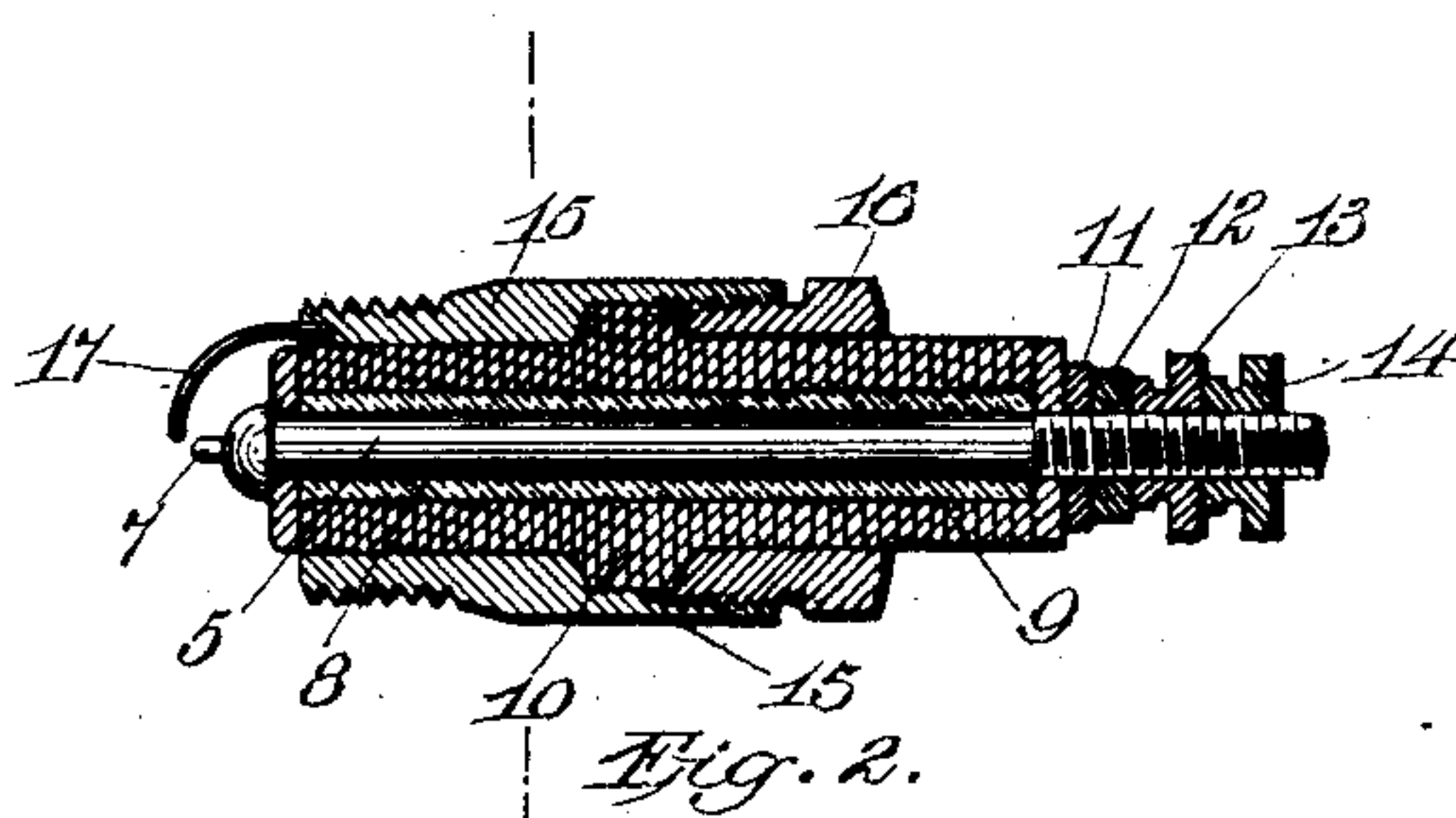


Fig. 2.

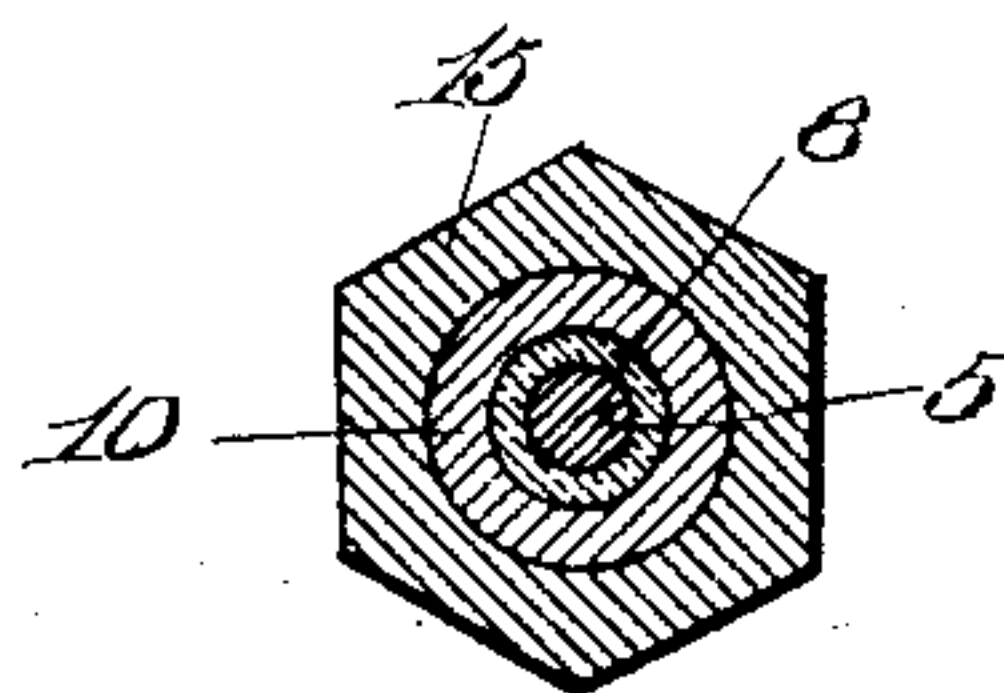


Fig. 3.

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UNITED STATES PATENT OFFICE.

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SPARKING PLUG.

SPECIFICATION forming part of Letters Patent No. 696,670, dated April 1, 1902.

Application filed December 18, 1900. Serial No. 40,298. (No model.)

To all whom it may concern:

Be it known that we, HENRY COLEMAN FOLGER, HARRY MORIARTY, and EDWARD B. JACOBSON, citizens of the United States, residing at West Somerville, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Sparking Plugs, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to improvements in "sparking plugs," so called, being supports or mountings for the terminals of an electric circuit, between which terminals electric discharges are effected at intervals.

The object of the invention is to provide a support for the separated terminals of an electric circuit, in which circuit a current of intense energy and volume is at times developed, that short-circuiting between the separated supporting parts for the terminals shall be prevented.

Another object is to so construct a sparking plug of this nature that under repeated disruptive discharges of the current between the terminals the insulation between the separated supports of the terminals will not become disintegrated or porous or be otherwise affected to open a path or paths therethrough for the electric current.

The invention consists in the construction of the improved spark-plug.

The invention also consists in such other peculiar combination of material and features of construction as shall hereinafter be more fully described, and pointed out in the claims.

Figure 1 represents the improved spark-plug in elevation. Fig. 2 represents a longitudinal sectional view thereof. Fig. 3 represents a cross-sectional view of the same.

Similar numerals of reference designate corresponding parts throughout.

While our invention is capable of varied use, it is primarily intended for use in connection with gas-engines, and particularly those which have come before the public recently for the more advanced kinds of automobile gas-engines. In this class of machines, as is well known, the electric spark-plug is required to withstand currents of extremely

high tension, such as are produced by the most approved induction-coils, the voltage thereof being momentarily exceedingly great, so that the liability of puncturing the insulation is so great that we have found all ordinary means of insulation too short-lived to be practicable, and, moreover, as the destructive effects of short-circuiting cause extended destruction, not only to the spark-plug, but to the rest of the apparatus, it becomes of vital importance to provide a spark-plug which will not under any conditions of use be in danger of breaking down because of having its insulation punctured.

Accordingly our invention resides in providing insulation between the adjacent portions of the spark-plug circuit which will not break down or puncture, no matter how high the voltage and frequency of the current and rapid the discharge thereof, and which will also stand the severe heat to which the plug is necessarily subjected in use. Stated broadly, our invention comprises, in connection with suitable circuit-terminals and conductors leading thereto, an insulation between the two parallel or adjacent portions of the circuit made up of a tubular portion of refractory insulating material—i. e., by "tubular" we mean that the longitudinal layer is integral and imperforate from end to end or is not made up of disks or radial sections—closely surrounding and extending longitudinally of the central conductor or core of the plug and another layer of refractory insulating material compressed around said horizontal tubular portion and being made up of successive layers extending vertically to said horizontal insulation; or, in other words, the gist of our invention lies in the provision of two insulations compressed together as nearly solidly as possible, one insulation extending in a horizontal plane and the other insulation extending in a vertical plane—that is to say, the two insulations extend in opposite directions and each is made up of suitable refractory insulating material capable of withstanding without fusion or reduction to another state the great heat to which the plug is subject—and one of said layers is integral in the direction of the length of the plug and the other is in-

tegral in the transverse direction or radially of the plug.

We have demonstrated by experiment and long practical tests in actual use that even with heavy currents of the highest frequency capable of being generated by modern apparatus there is no danger of this insulation, when constructed as will be explained more fully presently, being punctured or permitting a short circuit or even permitting apparently any mutual influence between the two approximately parallel conductors of the spark-making circuit; but short-circuiting is prevented effectually and completely by one or the other of the two insulations whose layers of refractory material extend in opposite planes.

In the embodiment herein shown and in which we have chosen to illustrate our invention we have shown the latter applied to a spark-plug of usual general shape, in which the sparking takes place between two usual electrodes 7 17, generally of platinum, the former extending from the headed end 6 of a core 5 and the latter from a surrounding sleeve or casing 15, which is usually externally threaded, as shown, for the purpose of proper insertion in the explosive-engine.

The insulation portion of the plug which constitutes our invention is shown at 8 and 9, the former indicating the horizontally-extending tubular portion thereof, which fits tightly around the core 5, and the latter showing the vertically-extending portion, which is compressed around the horizontally-extending part.

As the method of making the plug does not form a part of this application, it is unnecessary to enter into a full description, further than to explain that having prepared the two portions of the insulation of proper refractory material for the purpose they are coated or immersed in some adhesive material, such as shellac, and then at once put together on a suitable mandrel in the relation shown in Fig. 2 and heavily compressed, being then turned down to the proper shape required by the plug, and the parts of the plug are then put in place to make the complete plug, as shown in Fig. 2, so that subsequently when the plug is subjected to great heat there is no possibility that any portion of the oppositely-extending layers of insulation can, even in the minutest degree, move or change position, but will remain compacted in proper stratified relation, as shown.

For the purpose of holding the parts in place and protecting the insulation of the plug we have shown the right-hand end of the core 5 as threaded and containing washers next to the insulation and a nut 12 holding the outside washer 11, a set nut 13 and a binding-nut 14 for holding one of the wires of the electric circuit, and the casing or sleeve 15 is held in proper relation by a threaded collar 16, which coöperates therewith against a shouldered projection 10 of the radially-

extending disks of mica of which the perpendicularly-extending portion of the insulation is herein shown to consist, said portion constituting the external layer of the insulation according to the illustration of our invention herein presented.

In carrying out our invention we prefer to use common insulating materials and common forms and arrangements of plugs, as the chief feature which we intend to cover by this patent is the provision of the compacted contiguous layers of refractory insulating material extending in horizontal and radial planes, respectively, and integral or imperforate throughout their areas, so that one affords a complete barrier against puncturing in one direction and the other the same barrier against puncturing in the opposite direction, and with this in mind, it being also understood that our invention is capable of other embodiments than the particular one shown, our invention will be more particularly defined in the appended claims.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a device of the kind described, containing two spark-electrodes and conductors leading thereto approximately parallel, an insulation between said conductors consisting of two contiguous parts composed of refractory insulating material, one part being mounted in close contact around one of said conductors, and the other surrounding the former, one of said parts extending integrally lengthwise of the device, and the other of said parts being made up of a series of layers extending radially of said lengthwise part, and means holding said insulation under longitudinal compression.

2. In a device of the kind described, comprising a central conductor or core, a tubular insulation closely embracing said core and without transverse aperture or joint throughout its length, and a surrounding insulation mounted on said tubular insulation and composed of a series of disks extending transversely of said tubular insulation and compressed tightly together thereon, both of said insulations being composed of refractory material, and a second conductor mounted outside of said insulation, said two conductors being provided at one end with spark-electrodes.

3. A device of the kind described, comprising two electrodes, a casing carrying one, and a core carrying the other, combined with insulation filling the space between said core and casing, and comprising longitudinal and transverse layers of refractory insulating material compressed together, each layer being transversely integral and imperforate throughout its area.

4. A device of the kind described, comprising two spark-electrodes, a central conductor for one, a concentric casing for the other, insulation filling the space between said casing

and conductor composed of a tubular part
closely surrounding said central conductor
and transversely imperforate throughout its
area, and a series of disks compacted about
5 said tubular insulation, and each extending
radially thereto, said disks and tubular part
being composed of refractory material, the
peripheral surface of said compacted disks
containing a central rib against which said
10 casing abuts on one side, a collar adjustably
secured to said casing and abutting against

said rib on the opposite side, and means for
holding said insulation under longitudinal
pressure.

In testimony whereof we affix our signa- 15
tures in presence of two witnesses.

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