No. 679,041. Patented July 23, 1901.

R. VARLEY, JR.

ELECTRICAL SPARKING DEVICE FOR EXPLOSIVE ENGINES.

(Application filed Oct. 5, 1900.)

(No Model.)

Fig. 1.

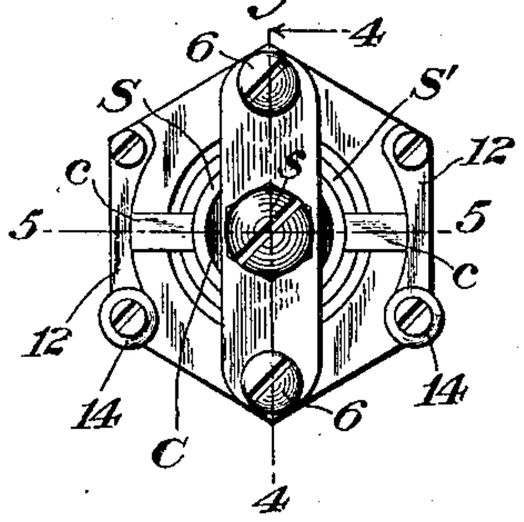


Fig. 2.

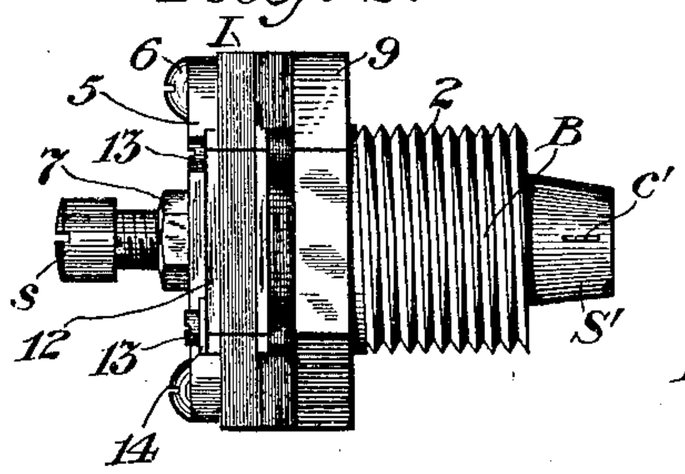


Fig. 3.

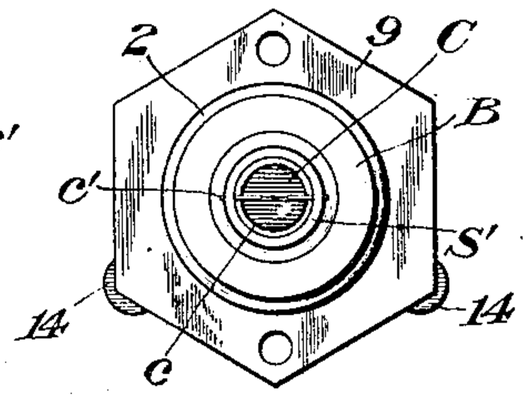


Fig. 4.

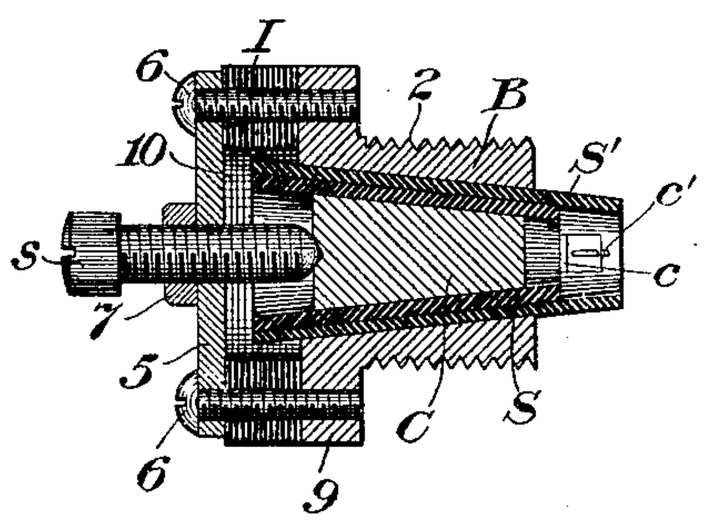


Fig. 5.

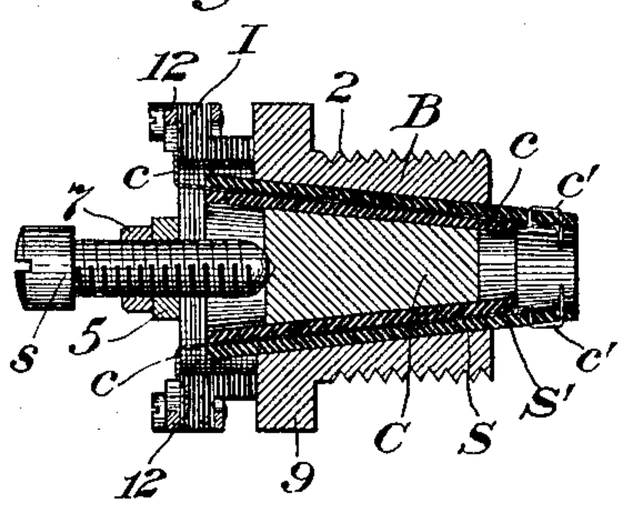


Fig. 6.

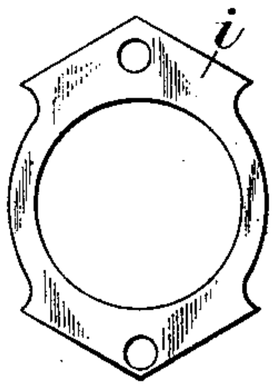


Fig. 7.

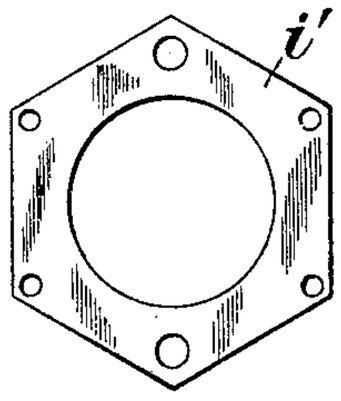
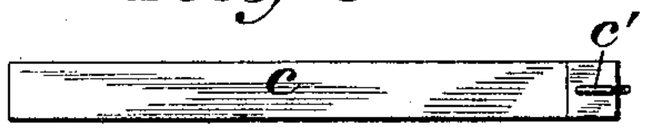


Fig. 8.



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UNITED STATES PATENT OFFICE.

RICHARD VARLEY, JR., OF JERSEY CITY, NEW JERSEY.

ELECTRICAL SPARKING DEVICE FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 679,041, dated July 23, 1901.

Application filed October 5, 1900. Serial No. 32,127. (No model.)

To all whom it may concern:

Be it known that I, RICHARD VARLEY, Jr., a citizen of the United States, residing in Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Electrical Sparking Devices, of which the following is a specification.

This invention relates to an electrical sparking device, and especially to an ignition device for use in gas-engines for igniting explosive charges; and it has for its main object an improved sparking device in which the electrical conductors through which the current passes to the terminals between which the spark is formed are separated from each other and insulated by insulating elements the meeting faces of which are in engagement with such conductors. Ordinarily the conductors themselves will be flat conducting-strips, preferably of conducting-foil, such as platinum foil, of such thinness that when held in place between two similar opposing surfaces there will be practically no space between the latter. Such conductors as these are especially adapted for use in a sparking device constructed according to my present invention, for the reason that I make use of insulating means in which complementary elements having corresponding surfaces engage the conductors or strips of foil between them. In sparking devices of this class as heretofore constructed it has been customary to embed the conducting-wires in the insulating material—as, for example, by molding a solid insulating-plug of any suitable material, such as lava, around wires. These solid insulating-plugs have not given good service, however, for the reason that the expansion of the wires due to the heating of the same on the passage of current therethrough has frequently been sufficient to crack the plug. One of the principal objects of the present invention is to insulate the conducting-wires in such a manner as to avoid splitting or cracking of the insulation when the conductors are so heated, and in order to accomplish this result most perfectly I have found that insulating means such as has hereinbefore been described is most suitable for the purpose. Preferably the conductors will be held between complementary insulating-surfaces substantially circular in cross-section, and here said surfaces converge and are conical. When constructed in this manner, the coacting elements of the insulating means serve to wedge the conductors in place between these surfaces, and this wedging action is accomplished most perfectly and the closest joint between such surfaces is obtained when the conductors are strips of very thin foil, said foil being usually considerably less than one-thousandth of an inch in thickness. These insulating-surfaces may of course be shaped and constructed in any suitable manner; but I prefer to make use of complementary insulating layers or elements (such as tapered or conical shells of lava) between which the conducting-strips will be wedged firmly in place. These complementary layers or elements may surround a central core, preferably tapered, each of said layers or elements being substantially of uniform thickness throughout in order that it may lie close to the adjacent element of the insulating means. The insulation should always have its layers or elements so disposed that an outer element or layer will project beyond the end of and surround an inner element or layer, and the conductors will be trained down between said layers and project beyond such end of the inner layer, they being secured, preferably, to the outer layer or element—as, for example, by means of separate terminal wires, which may be passed through the platinum strips and through the outer layer of the insulation and clenched in place on the latter in such positions that there will be a spark-gap between the terminals.

In the drawings accompanying this specification and forming part of the present application, Figure 1 is a rear elevation of a sparking device or ignition-plug embodying my present invention. Fig. 2 is a side elevation of the same. Fig. 3 is a front elevation of the same. Fig. 4 is a longitudinal section of the same, the section being taken in line 4 4, Fig. 1. Fig. 5 is a longitudinal section of the same, the section being taken in line 5 5, Fig. 1. Figs. 6 and 7 are details of mica insulating-sheets for forming an insulating-block for the binding-posts of the sparking device, and Fig. 8 is a detail of one of the strips of platinum foil.

Similar characters designate like parts in the different figures of the drawings.

The body portion of my improved sparking device may be of any suitable type; but I prefer to make use of a plug, preferably a metallic screw-plug, such as B, externally threaded at 2 for insertion into a wall of the combustion-chamber of a gas-engine, this plug being preferably centrally bored for the purpose of receiving the conducting and insulating parts of the sparking device proper. The bore in this plug is preferably tapered in order that the insulating material may be wedged firmly in place therein without requiring any additional parts for holding it in position.

The insulating material used may be any suitable solid insulation having complementary surfaces between which the conductors may be disposed, but preferably it will consist of at least two elements or layers so shaped as to be capable of being inserted in the bore in the plug B and wedged therein. Usually said insulating means will embody two tapered elements or members, such as S and S′, the taper thereof being preferably the same as that of the bore in the plug or body B. The particular construction of these tapered insulating elements is immaterial, provided that they are so constructed as to permit the conductors or strips of plantinum foil to be wedged firmly in place between the juxtaposed insulating-surfaces thereof; but in the construction shown the insulation is disposed in layers about a central core having preferably the same taper as the bore of the plug B, each layer of the insulation being in this case of substantially uniform thickness throughout. Only two layers of such insulation are shown herein, and these layers are in this instance in the form of complementary tapered shells, preferably conical and nested the one within the other, they being disposed about and held in place by a correspondingly-tapered or conical plug, such as C, which serves as a core about which the insulation may be placed and which will in turn be operative for wedging the insulation in place between the core and the plug B and also for wedging the conductors in place between the juxtaposed surface of the insulating-shells S and S′.

The insulating material hereinbefore described is intended to separate and insulate the conductors through which current will pass to form at the conducting-terminals the necessary spark for igniting the charge in the combustion-chamber of the engine to which the sparking device is applied. These conductors will ordinarily be two in number and will preferably be disposed at opposite sides of the insulating layers or shells in order that said conductors may be separated and insulated as perfectly as possible. When so located, it will be evident that they have between the respective side edges thereof a wide space, across which the current will be unable to jump and which will assure the perfect insulation of said conductors. Moreover, when these conductors are exceedingly thin, though wide, strips of metallic foil it will be evident that the coacting surfaces of the insulating layers or elements will be in substantially as close contact as if there were no foil between them. There will therefore be practically no space between such surfaces, and the complementary layers or shells will constitute substantially a unitary insulating device, which will, however, have the faces thereof which are in engagement with the conductors separated to such an extent that there will be no possibility of cracking or similarly injuring the insulation as a result of the expansion of the conductors.

The conductors or strips of platinum foil are designated herein by *c* and are preferably somewhat longer than the corresponding dimensions of the insulating elements or layers, said strips extending in this case somewhat beyond the rear ends of the shells S and S′ for the purpose of connection to suitable binding-posts, (hereinafter to be described,) while at their forward ends they extend beyond the corresponding end of the inner layer of insulation—that is, beyond the forward end of the shell S. As such thin metallic foil has not sufficient stiffness to keep its position well and form a proper terminal, I prefer to employ in connection with the strips *c* terminal wires, such as *c*′, which may be passed through holes punched or drilled in the outer layer or shell S′ and through the strips *c* and clenched in position at the forward end of said shell S′, it being obvious that the ends of these terminal wires, which will usually be of platinum, should be oppositely disposed and in alinement with each other in order to form a proper spark-gap between them.

The core C, by means of which the shells are wedged in the bore of the body B and are wedged together to hold the conducting-strips *c* in place, may be forced into the inner shell in any suitable manner, preferably by means of a clamp-screw, such as *s*, suitably supported on the body of the sparking device. Here this clamp-screw is passed through a threaded bore in a tie-piece or clamp-bar 5, secured to the head of the plug B, parallel therewith and held at a suitable distance therefrom, said tie-piece being secured to the head of the plug in this case by means of screws 6, a check-nut 7 being employed for holding the clamp-screw in its adjusted position. The tie-piece or clamp-bar 5 may be located at the proper distance from the head of the plug B by means of a block of insulating material inserted between the adjacent faces of said parts, and in turn said tie-piece may also serve to hold said block of insulation in its proper position and clamp it on the head of said plug. This block of insulating material is designated herein in a general way by I and may be any suitable solid insulation, preferably having the same external contour

as that of the head of the plug B, which, it will be noticed, is of such shape (hexagonal in this case, as shown at 9) as to permit the head of the plug to be manipulated and turned into and out of place by a wrench. This block of insulation may also have a central opening or circular bore, such as 10, therein into which the rear ends of the shells S and S′ may project, and the clamp-screw *s* will be passed through such opening in order that the point of the screw may impinge against the rear end of the core C. The block of insulation I, however, need not necessarily be in one piece, but may be composed of a plurality of thin sheets, such as the sheets of mica shown at *i* and *i′* in Figs. 6 and 7, these pieces of insulating material being preferably punched out of mica sheets, a plurality of each kind being assembled to form a block of sufficient thickness. The pieces *i′*, it will be noticed, are of the same size and contour as the head of the plug B, while the pieces shown at *i* are of slightly-different shape and are cut away at two sides thereof for the purpose of forming spaces into which small metal plates may be inserted to prevent projection of any of the parts beyond the edges of the head 9 of the plug B. These metal plates are preferably small strips, such as 12, of copper or brass disposed in sets at opposite edges of the insulating-block made up of the sheets *i* and also disposed at opposite sides of such block, as will be clear by referring to Figs. 1 and 2. These plates are held together in this case by screws, such as 13, these screws passing through the sheets *i′*, of course, and serving to clamp the same together, one of the screws 13 at each side of the plug B serving as a binding-post, to which conductors (not shown) from a suitable source of current may be connected. Here the binding-post screws have washers 14 beneath the heads thereof, and the ends of the conductors *c* are bent under the upper metallic plates 12, so as to be in metallic connection with said binding-posts.

It will be obvious from the foregoing description of the construction of the various parts that my improved sparking device or ignition-plug is very simple and may be cheaply manufactured, the body portion B being substantially the ordinary plug-body, the screws being standard sizes, the plates 12 being simple stampings, and the sheets *i* and *i′* being also stamped, while the core *c* is a plain metallic plug, and the shells S and S′ plain conical pieces made of some cheap insulation, preferably lava. Any of the parts may be readily replaced, and the plug does not have to be thrown away when one part gets out of order, as is the case with the ordinary solid lava plug, which becomes useless when cracked.

Having thus described my invention, I claim—

1. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means embodying juxtaposed insulating elements the meeting faces of which engage said conductors, and form therewith a tight joint.

2. An electrical sparking device embodying a pair of separated flat conducting-strips having terminals separated by a spark-gap, and insulating means embodying complementary insulating elements between which said conducting-strips are positioned, and forming with said strips a tight joint.

3. An electrical sparking device embodying a pair of separated strips of conducting-foil having terminals separated by a spark-gap, and insulating means embodying juxtaposed insulating elements the meeting faces of which engage said strips of foil, and form therewith a tight joint.

4. An electrical sparking device embodying a pair of separated strips of platinum foil having terminals separated by a spark-gap, and insulating means embodying juxtaposed insulating elements the meeting faces of which engage said strips of foil, and form therewith a tight joint.

5. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means having complementary curved surfaces between which said conductors are positioned, and with which they form a tight joint.

6. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means having complementary surfaces substantially circular in cross-section between which said conductors are positioned, and with which they form a tight joint.

7. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means having complementary conical surfaces between which said conductors are positioned, and with which they form a tight joint.

8. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means having complementary wedging surfaces between which said conductors are wedged in position, and with which they form a tight joint.

9. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means having complementary tapered insulating members between which said conductors are wedged in position, and with which they form a tight joint.

10. An electrical sparking device embodying a pair of separated conductors having terminals separated by a spark-gap, and insulating means having complementary tapered insulating-shells between which said conductors are wedged in position, and with which they form a tight joint.

11. An electrical sparking device embodying a pair of separated strips of conducting-foil having terminals separated by a spark-gap, and insulating means having complementary wedging-surfaces between which said strips of conducting-foil are wedged in position, and with which they form a tight joint.

12. An electrical sparking device embodying a pair of separated strips of platinum foil having terminals separated by a spark-gap, and insulating means embodying complementary conical insulating-shells between which said strips of foil are wedged in position, and with which they form a tight joint.

13. An electrical sparking device embodying a pair of oppositely-disposed strips of platinum foil having terminals separated by a spark-gap, and insulating means embodying juxtaposed insulating elements the meeting faces of which engage said strips of foil and form therewith a tight joint.

14. In an electrical sparking device, the combination, with a body having a tapered bore, of a pair of correspondingly-tapered complementary insulating members mounted in said bore, and a pair of separated electrical conductors disposed between said insulating members and having terminals separated by a spark-gap.

15. In an electrical sparking device, the combination, with a body having a tapered bore, of a pair of correspondingly-tapered complementary insulating members mounted in said bore; means for wedging said insulating members together; and a pair of separated electrical conductors disposed between said insulating members and having terminals separated by a spark-gap.

16. In an electrical sparking device, the combination, with a body having a tapered bore, of a pair of correspondingly-tapered nested insulating-shells mounted in said bore; a tapered core in the inner shell for wedging said shells together; and a pair of separated electrical conductors disposed between said insulating-shells and having terminals separated by a spark-gap.

17. In an electrical sparking device, the combination, with a core, of insulating means surrounding said core and embodying juxtaposed solid insulating layers, and a pair of separated electrical conductors disposed between said insulating layers and forming therewith a tight joint and having terminals separated by a spark-gap.

18. In an electrical sparking device, the combination, with a core, of insulating means surrounding said core and embodying juxtaposed solid insulating layers each of substantially uniform thickness, and a pair of separated electrical conductors disposed between said insulating layers and forming therewith a tight joint and having terminals separated by a spark-gap.

19. In an electrical sparking device, the combination, with a tapered core coacting with the insulating layers to wedge the latter together, of tapered insulating means surrounding said core and embodying juxtaposed solid insulating layers each of substantially uniform thickness, and a pair of separated electrical conductors disposed between said insulating layers and having terminals separated by a spark-gap.

20. In an electrical sparking device, the combination, with a tapered core, of a pair of complementary tapered insulating-shells surrounding said core and wedged together, and a pair of separated electrical conductors disposed between said shells and having terminals separated by a spark-gap.

21. In an electrical sparking device, the combination, with solid insulating means embodying an inner element and a juxtaposed outer element extending beyond the end of the inner element, of a pair of separated electrical conductors disposed between said insulating elements and forming therewith a tight joint and having terminals extending beyond the end of the inner element and separated by a spark-gap.

22. In an electrical sparking device, the combination, with solid insulating means embodying an inner element and a juxtaposed outer element extending beyond the end of the inner element, of a pair of separated electrical conductors disposed between said insulating elements and having terminals extending beyond the end of the inner element and secured to said outer element and separated by a spark-gap.

23. In an electrical sparking device, the combination, with insulating means embodying a pair of nested insulating members the outer of which extends beyond the end of the inner, of a pair of separated electrical conductors disposed between said insulating members and forming therewith a tight joint and having terminals extending beyond the end of the inner member and separated by a spark-gap.

24. In an electrical sparking device, the combination, with insulating means embodying a pair of nested insulating-shells the outer of which extends beyond the end of the inner, of a pair of separated strips of platinum foil disposed between said insulating-shells and forming therewith a tight joint and having terminals extending beyond the end of the inner shell and separated by a spark-gap.

25. In an electrical sparking device, the combination, with solid insulating means embodying an inner element and a juxtaposed outer element extending beyond the end of the inner element, of a pair of separated strips of conducting-foil disposed between said insulating elements and forming therewith a tight joint and having separate terminals connected with said strips beyond the end of the inner element and secured to said outer element and separated by a spark-gap.

26. In an electrical sparking device, the combination, with a plug having a tapered

bore, of a tapered core; insulating means between said plug and core and embodying juxtaposed insulating elements having respectively converging meeting faces; a pair of electrical conductors disposed between said meeting faces and having terminals separated by a spark-gap; and insulated binding-posts on said plug and connected with the opposite ends of said conductors.

27. In an electrical sparking device, the combination, with a screw-plug having a tapered bore, of a tapered core; insulating means between said plug and core and embodying juxtaposed insulating elements having respectively converging meeting faces; a pair of electrical conductors disposed between said meeting faces and having terminals separated by a spark-gap; and insulated binding-posts on said plug and connected with the opposite ends of said conductors.

28. In an electrical sparking device, the combination, with a plug having a tapered bore, of a tapered core; insulating means between said plug and core and embodying juxtaposed insulating elements having respectively converging meeting faces; a pair of electrical conductors disposed between said meeting faces and having terminals separated by a spark-gap; and a clamp-screw secured to the head of said plug for wedging said core in place.

29. In an electrical sparking device, the combination, with a plug having a tapered bore, of a tapered core; insulating means between said plug and core and embodying juxtaposed insulating elements having respectively converging meeting faces; a pair of electrical conductors disposed between said meeting faces and having terminals separated by a spark-gap; an insulating-block secured to the head of said plug; binding-posts on said insulating-block and connected with the opposite ends of said conductors; and a clamp-screw secured to the head of said plug and passed through said insulating-block for wedging said core in place.

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