

April 26, 1960

G. J. DALL

2,934,668

SPARK PLUG

Filed Jan. 16, 1959

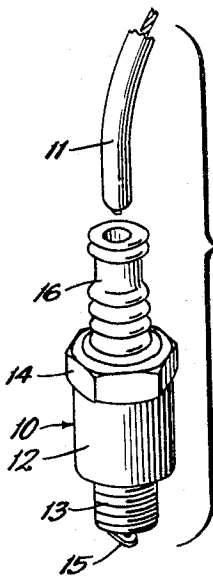


Fig. 1

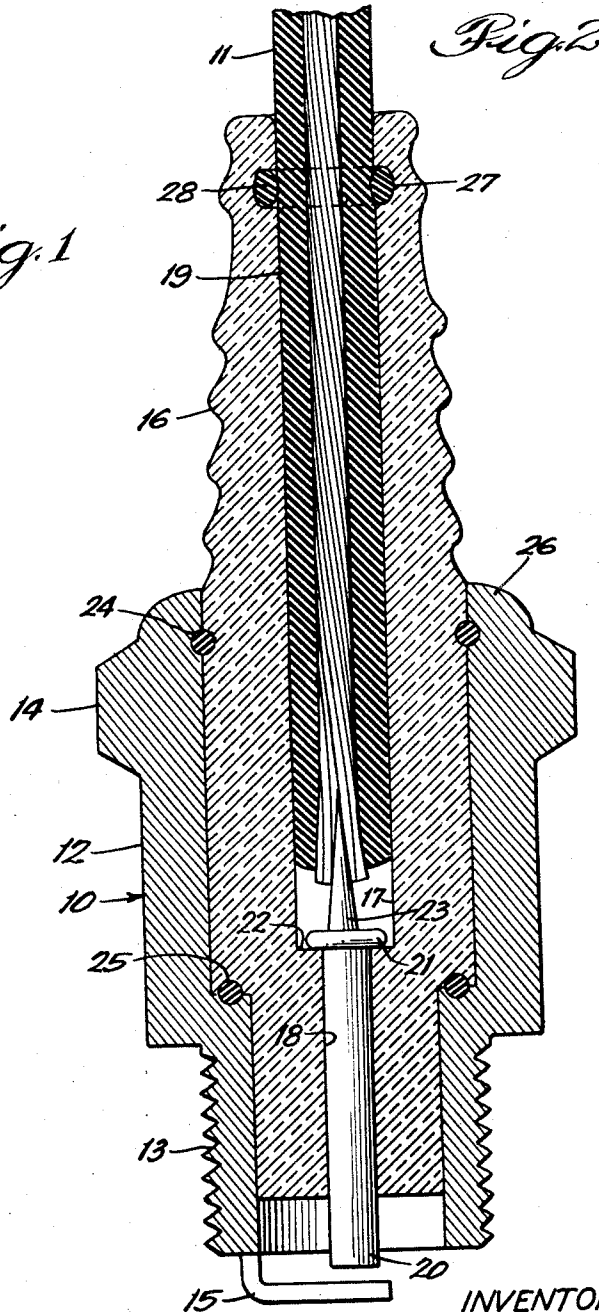


Fig. 2

INVENTOR:
Gerald J. Dall.

BY *Dawson, Tilton, Fallon & Longmire,*
ATTORNEYS.

1

2,934,668

SPARK PLUG

Gerald J. Dall, Chicago, Ill.

Application January 16, 1959, Serial No. 787,203

4 Claims. (Cl. 313—135)

This invention relates to a spark plug, and more specifically, to a waterproof spark plug particularly adapted for use in connection with modern automobile engines.

In an effort to achieve reliable performance from modern high compression engines of relatively large displacement, most automobile manufacturers now equip their vehicles with heavy duty ignition systems and with twelve volt batteries rather than the six volt batteries commonly used in the past. As a result, the voltage of the current passing through the spark plugs to ignite the air-gasoline mixture in the cylinders of modern engines ordinarily ranges between fifteen to seventeen thousand volts, in contrast to voltages of about seven thousand in earlier models. While such heavy duty electrical systems help insure proper ignition under favorable weather conditions, they also increase the tendency for an engine to misfire should the plugs become covered with moisture and dirt on damp or rainy days.

The problem is particularly troublesome with automobiles equipped with V-8 or V-type engines where the plugs are arranged along the sides rather than the top of the engine blocks and are therefore more likely exposed to water, slush and dirt splashed or thrown upwardly from the road surface while the vehicles are in motion. Furthermore, aside from the problem of spark plug "fouling" because of moisture accumulation, the plugs of modern V-type engines are often exceedingly difficult to remove, adjust or connect because of their inconvenient side location.

Accordingly, it is a principal object of the present invention to provide a spark plug construction which overcomes or greatly reduces the aforementioned problems and disadvantages in the operation of modern high compression automotive engines. Another object is to provide a waterproof spark plug which will not tend to foul out because of external moisture accumulation and which, at the same time, may be simply and easily connected to the lead wires of the ignition system.

Other objects will appear from the specification and drawings in which:

Figure 1 is a perspective view of a spark plug embodying the present invention, the plug being shown in conjunction with a lead wire of the ignition system.

Figure 2 is an enlarged vertical sectional view of the plug shown in Figure 1 and with the lead wire fully inserted therein.

In the embodiment of the invention illustrated in the drawings, the numeral 10 generally designates a spark plug adapted for connection with an ignition wire or cable 11. Plug 10 comprises an outer metal casing 12 of generally cylindrical shape which is threaded along its lower end portion 13 and which is provided at its upper end with hexagonal sides 14 for rotation of the plug by means of a suitable wrench. As shown most clearly in Figure 2, the casing is hollow and is open at both its upper and lower ends. At the lower end of the casing is an L-shaped electrode 15 welded or otherwise secured to the casing

2

wall. Since the structure so far described is entirely conventional, a more complete description of the casing is believed unnecessary herein for the purpose of disclosing the present invention.

Within the casing and projecting upwardly therefrom is an elongated body 16 formed from a hard insulating material. Porcelain or other ceramic insulating materials may be advantageously used, in forming the inner body. Extending through the body is an axial bore or opening 17 having a lower portion 18 of reduced diameter. The upper portion 19 of the bore is of uniform diameter and is substantially longer than the lower portion 18. As indicated in the drawings, the upper portion 19 of the bore has a diameter sufficiently large to slidably receive a length of the rubber or plastic coated ignition cable 11 therein.

Within the lower portion 18 of the bore is a metal electrode 20. The lower end of the electrode projects downwardly below the lower end of the spark plug body 16 and is spaced from electrode 15 to define a gap therebetween. The upper portion of the electrode 20 is provided with an annular enlargement 21 which bears against shoulder 22 of the body and prevents downward axial movement of that electrode. Above enlargement 21, the electrode tapers to provide a pointed upper end portion 23 adapted to penetrate into the end of a cable inserted into the plug body and thereby make electrical contact between the cable and the axially disposed electrode.

The porcelain body 16 is securely connected to the casing 12 by means of compression rings 24 and 25 which are held in annular grooves provided in both the body and the casing. In forming the complete plug during a manufacturing process, ring 24 is slipped about the periphery of the body and, after the parts have been assembled, the upper portion 26 of the metal casing is pressed inwardly to lock the ring and body in place.

Near the top of the body 16 is an internal annular groove or recess 27 adapted to receive an annular sealing ring 28. The ring is formed from a resilient material such as natural rubber or a synthetic rubber product. A chloroprene polymer such as neoprene of the E. I. du Pont de Nemours and Company, Inc., has been found particularly effective although other rubber-like products such as butadiene polymers, vinyl chloride polymers, organic polysulphides, etc. may also be used. The resilient sealing ring is generally circular in cross-section and, since the recess 27 is substantially semicircular in section, the ring normally projects into the bore 17. Since the inner diameter of the ring is smaller than either the diameter of the bore's upper portion 19 or the external diameter of the coated cable 11, it snugly fits the outer surface of the cable when the same has been inserted into the bore of the plug body.

Unlike conventional spark plugs, the plug of the present invention therefore grips a portion of an ignition cable within the plug body and with a substantial portion of that cable extending downwardly from the gripping means to the point of contact with the axial electrode. Since ring 28 is formed from a resilient, elastic material, it not only holds the ignition wire in place but also forms a liquid-tight seal with the resilient casing or covering of the cable. Water accumulating upon the outside of body 16 and upon the exposed portion of the cable above the plug is effectively prevented from entering the interior of the body below recess 27 because of this liquid-tight barrier. It has been found that a plug, constructed in accordance with the present disclosure, will not foul even after immersion for twenty-four hours in twenty-five feet of water because of the protective seal between the resilient ring 28 and the casing of ignition cable 11.

An important aspect of the present invention lies in the

fact that the sealing ring 28 is disposed adjacent the upper end of body 16 and at a substantial distance above the pointed portion 23 of electrode 20. Therefore, even if moisture should invade the plug body behind sealing ring 28, the electric current must travel substantially the entire length of the bore's upper portion 19 and then in a reverse direction down the ribbed outer surface of the body before misfiring or "fouling" can occur. It will be noted that such a path not only reverses itself but that it is also considerably longer than the direct path from the end of the cable to the lower end of the plug along electrode 20. Thus, the plug of the present invention is not only substantially waterproof but is virtually "non-fouling" even if water invasion occurs under extreme conditions.

In Figure 2 it will be seen that the pointed end portion 23 of electrode 20 projects into the stranded wire portion of the cable 11 when the ignition cable is properly attached to the plug. The penetration of the tapered electrode into the cable not only insures proper electrical connection between the parts but also tends to wedge the resilient covering at the lower end of the cable into tight sealing contact with the inner wall of porcelain body 16, thereby providing additional protection against moisture reaching the exposed ends of the wires.

It is believed apparent from the foregoing that attachment of the ignition cable to a mounted plug may be accomplished quickly and easily by simply forcing the free end portion of the cable into the bore portion 19 of the body 16 through the open upper end thereof. Consequently, the plug of the present invention is adapted to form a water-tight internal seal with an ignition cable while at the same time permitting detachment and insertion of the cable without the use of tools.

While in the foregoing specification I have disclosed an embodiment of the present invention in considerable detail, for purposes of illustration, it will be understood by those skilled in the art that many of these details may be varied considerably without departing from the spirit and scope of the invention.

I claim:

1. A spark plug comprising a hollow metal casing open at its upper and lower ends and being adapted at its lower end for connection to the cylinder head of an internal combustion engine, a body formed of hard insulating material mounted within said casing and having an axial bore extending therethrough, an electrode mounted within the lower portion of said bore, said electrode having its upper end terminating intermediate the upper and lower ends of said body within said bore, and a resilient sealing ring mounted within the upper end of said bore below the top of said body and having a central opening smaller in diameter than said bore for frictionally and sealingly engaging an ignition cable inserted into the bore through the top of said body.

2. A spark plug comprising a hollow and generally cylindrical metal casing open at its upper and lower ends

and being threaded for connection to the cylinder head of an internal combustion engine, an elongated body formed of hard insulating material mounted within said casing and projecting upwardly therefrom, said body having an axial bore extending therethrough, an electrode mounted within said bore and projecting downwardly beyond the lower end of said body, said electrode having a top portion terminating intermediate the upper and lower ends of said body, and a resilient sealing ring mounted within the upper end of said bore below the top of said body, said ring having a central opening smaller in diameter than said bore for frictionally and sealingly engaging the peripheral surface of a covered ignition cable having the free end portion thereof disposed within said bore above said electrode.

3. A spark plug comprising a hollow metal casing open at its upper and lower ends and being adapted at its lower end for connection to the cylinder head of an internal combustion engine, a body formed of hard insulating material mounted within said casing and having an axial bore extending therethrough, an electrode mounted within the lower portion of said bore, said electrode having its upper end terminating intermediate the upper and lower ends of said body within said bore, said body being provided with an internal annular groove within said bore adjacent the top of said body, and a resilient sealing ring mounted within the annular groove of said body and having its inner peripheral surface portion disposed within the radial limits of said bore for frictionally and sealingly engaging an ignition cable inserted into the bore through the top of said body.

4. A spark plug comprising a hollow and generally cylindrical metal casing open at its upper and lower ends and being threaded for connection to the cylinder head of an internal combustion engine, an elongated body formed of hard insulated material mounted within said casing and projecting upwardly therefrom, said body having an axial bore extending therethrough and having an internal annular groove within said bore adjacent the upper end of the body, an electrode mounted within said bore and projecting downwardly beyond the lower end of said body, said electrode having a top portion terminating intermediate the upper and lower ends of said body, and a resilient sealing ring disposed within said groove in said bore and having an inner diameter smaller than the diameter of the upper portion of said bore for frictionally and sealingly engaging the peripheral surface of a covered ignition cable having the free end portion thereof disposed within said bore above said electrode.

References Cited in the file of this patent

UNITED STATES PATENTS

1,814,997	Wittner	July 14, 1931
2,281,511	Parkin	Apr. 28, 1942
2,589,338	Candelise	Mar. 18, 1952
2,651,025	Elliott	Sept. 1, 1953