Feb. 5, 1924. 1,482,422

A. E. WORKMAN

SPARK PLUG

Filed Nov. 7, 1922

Fig. 1.

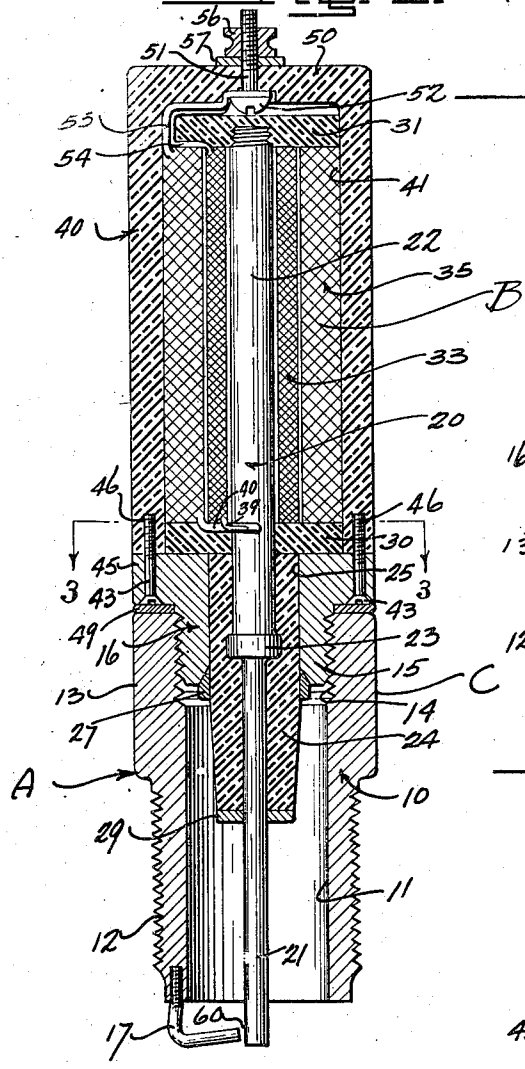


Fig. 2.

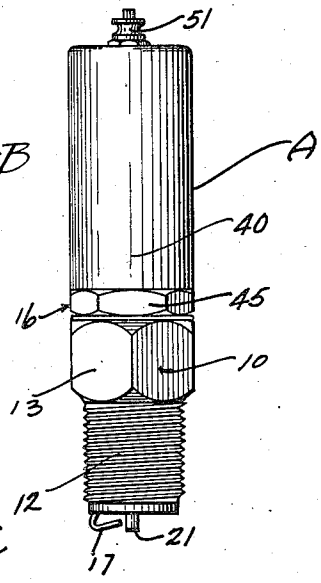


Fig. 3.

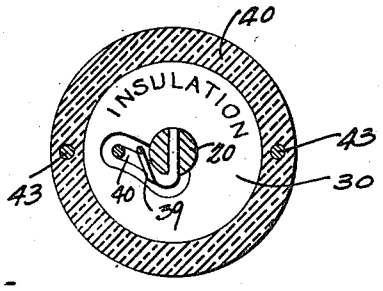
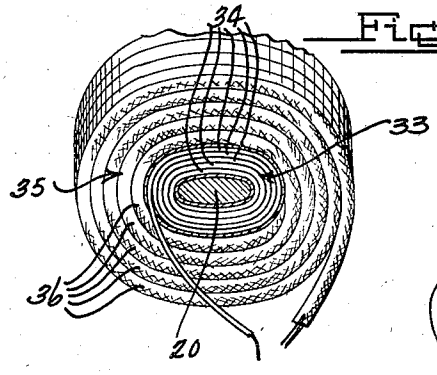


Fig. 4.



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UNITED STATES PATENT OFFICE.

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SPARK PLUG.

Application filed November 7, 1922. Serial No. 599,550.

To all whom it may concern:

Be it known that I, ANSEL E. WORKMAN, a citizen of the United States, residing at Gales Ferry, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Spark Plugs, of which the following is a specification.

This invention relates to improvements in spark plugs.

The primary object of this invention is the provision of a compact and effective spark plug, embodying a novel arrangement by means of which an ordinary current may produce a spark that is hotter and more intensive, than is capable of being produced by the ordinary spark plugs.

A further object of this invention is the provision of a spark plug embodying a novel coil arrangement cooperating about the central electrode therof, so that current passing through the plug may produce a magnetic spark, so to speak, which more effectively cooperates with explosive charges than the sparks produced by the conventional spark plug arrangement.

Other advantages are inherent in the improved spark plug and will be partially apparent during the course of the following detailed description.

In the drawing, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views.

Figure 1 is an enlarged longitudinal cross sectional view, taken through the improved spark plug.

Figure 2 is a side elevation of the improved spark plug.

Figure 3 is a transverse cross sectional view, taken substantially on the line 3—3 of Figure 1.

Figure 4 is an enlarged perspective view of a coil arrangement embodied in this invention.

In the drawing, wherein for the purpose of illustration is shown but the preferred embodiment of this invention, the letter A generally indicates the improved spark plug, which may include the novel current cooperating coil arrangement B, and the housing arrangement C.

Referring to a portion of the housing arrangement C, the same preferably includes the metal body 10, having the chamber or passageway 11 therethrough, and including the lower externally screw threaded cylinder inserting end 12, and the external polygonal shaped wrench engaging portion 13, which is internally screw threaded, as at 14, for the detachable connection of the externally threaded shank end 15 of the coupling nut 16. The lower end of the body portion 10 preferably carries the L-shaped ground electrode 17.

Referring to the arrangement B, the same includes the relatively long central electrode 20, which includes the relatively small diameter lower portion 21, and the upper relatively larger diameter cylinder portion 22; the latter being longer than the portion 21. At the juncture of the portions 21 and 22, an annular flange 23 is preferably provided, which may receive a sleeve of mica or analagous insulating material 24, against liability of longitudinal movement thereon. This insulation body 24 preferably is disposed through the passageway 25 of the coupling nut 16, as by being rigidly affixed thereto in any approved manner. At the lower juncture of the coupling 16 and the insulation sleeve 24, a wedge ring 27 may be permanently affixed, to provide a leak proof connection; and at the lower end of the insulation sleeve 24, a washer 29 integral with the electrode portion 21 may provide a leak proof connection. In this arrangement, the top surfaces of the coupling member 16, and the insulation sleeve 24 are flush, substantially as is illustrated in Figure 1 of the drawing. On these surfaces, a fiber end or ring member 30 is provided, which cooperates with the upper similarly shaped fiber or other insulating disc member 31, which is screw threaded upon the extreme upper end of the central electrode 20.

The larger diameter portion 22 of the central electrode 20, intermediate the disc members 30 and 31, is adapted to support an inner coil 33 of relatively fine copper wire, which for ordinary spark plugs provides five series of convolutions 34, circumferentially the entire length intermediate the insulating ends 30 and 31. An outer coil 35 is also provided, annularly arranged about the inner coil 33, intermediate the ends 30 and 31. This coil 35 is of relatively coarse copper wire and preferably provides five series of convolutions 36 thereof ex-

tending longitudinally along the inner coil. Thus it can be seen that the cores 33 and 35 possess the same number of series of spiral convolutions about the core portions 22 of central electrode 20. The winding of the coils 33 and 35 are in opposite directions about the electrode portion 22 and the lower ends 39 and 40 respectively of the inner and outer coils 33 and 35 are grounded, upon the central electrode 20, substantially as is illustrated in Figure 1 of the drawing. Of course, the coils are insulated with respect to each other and with respect to the various convolutions thereof.

Referring again to the housing arrangement C, it is preferred to provide a relatively long cap shaped member 40 of insulating material, which provides a compartment 41 open at the lower end thereof for receiving the coils 33 and 35 in said compartment 41. In order to securely and effectively mount the coils, in secret and protected position, against liability of loosening of the spark plug parts, counter sunk set screw 43 are preferably provided, which may be disposed upwardly through the wrench engaging flange portion 45 of the coupling nut 16, so that the screw threaded ends thereof may detachably engage in certain screw threaded openings 46 provided upwardly from the lower edge of the cap 40. By this arrangement, when the coupling 16 is screw threaded in the body portion 10, the counter sunk heads of the screws 43 will rest directly upon the washer 49, intermediate the flange 45 and the top edge of the body portion 10, as to maintain said screws against liability of loosening incident to vibration.

The top or upper end 50 of the detachable insulating cap 40 is preferably provided with an opening therethrough having a terminal post 51 mounted axially thereon, providing a head 52 within the chamber 41 of the cap 40 adapted to detachably connect the upper ends 54 and 55 of the wire on the coils 33 and 35 respectively, as a common terminal. A binding nut and washer 56 and 57 respectively, may be provided outwardly on the post 51 for clamping a connecting wire thereto.

In operation, a wire leads from the distributor or other ignition controlling device to the binding post 51 and current is supplied to both the inner and outer coils 33 and 35; said current being conveyed in opposite directions about said coils downwardly through the same to the contacts thereof with the central electrode 20. Of course, the lower end of the central electrode portion 21 is disposed in proximate relation adjacent the ground electrode 17, to provide a spark gap 60. The spark produced by the improved plug A has been found, by experiments, and prolonged tests, to be greatly superior to the spark produced by conventional plugs, in that the thermal efficiency of the same is increased. Such a spark, in the explosion of a fuel charge leaves practically no carbon. It is therefore possible to utilize lower grades of fuel, or by utilizing normal grades of fuel obtain greater power and have no difficulty in starting the engine upon which the improved plug is provided. The theory of operation of the plug and the effect which the coils have upon the current conveyed therethrough is not altogether understood. However, experiments prove that the spark produced by the improved spark plug is greatly superior to the spark produced by conventional plugs.

Various changes in the shape, size and arrangement of parts, may be made to the form of invention herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. A spark plug comprising a supporting casing, an electrode ground in said supporting casing, a central electrode insulated from the casing and first mentioned electrode, and a pair of coils supported on said central electrode wound in opposite directions thereabout and grounded at adjacent ends to said electrode, the opposite adjacent ends of said coils being connected to a common terminal.

2. A spark plug comprising a supporting casing, an electrode ground on said supporting casing, a central electrode insulated from the casing and first mentioned electrode, and coils of relatively fine and relatively coarse insulated wire wound on said central electrode in opposite directions and grounded at adjacent ends to said electrode, the opposite adjacent ends of said coils being connected to a common terminal.

3. As an article of manufacture, a spark plug comprising a supporting casing, an electrode ground on said supporting casing, a central electrode insulated from said casing and first mentioned electrode and adapted for cooperation with the latter in providing a spark gap, a coil of relatively fine mesh insulated wire wound about said central electrode having the lower end thereof grounded on said central electrode, and a second coil of relatively coarse insulated wire wound concentrically about the coil of finer wire and having the lower end thereof grounded on said central electrode, the upper ends of said coils being connected to a common terminal.

4. As an article of manufacture, a spark plug comprising a supporting casing, an electrode ground on said supporting casing, a central electrode insulated from said casing and first mentioned electrode and adapted for cooperation with the first mentioned

electrode in providing a spark gap therewith, inner and outer coils of relatively fine and coarse copper insulated wire respectively, wound about said central electrode having the lower adjacent ends thereof spliced on said central electrode, and a terminal member at the upper ends of said spark plug for receiving the adjacent upper ends of said inner and outer coils as a common terminal, said coils being wound in opposite directions and having the same number of spiral convolutions thereon.

5. As an article of manufacture, a central electrode, upper and lower spaced flanges of insulation material extending annularly about said central electrode about the upper portion thereof, and coils of wires wound in opposite directions on said central electrode intermediate said upper and lower flanges, said coils adjacent the lower flange being spliced to said electrode.

6. As an article of manufacture, a spark plug comprising a central electrode, a ring shaped flange of insulating material disposed on said central electrode substantially midway of the ends thereof, a second flange of insulating material disposed upon the upper end of said electrode, an inner coil of relatively fine insulated wire wound about said central electrode intermediate the lower and upper insulated flanges thereof providing substantially five series of convolutions circumferentially thereabout, a second coil of relatively coarse insulated wire wound outwardly about the inner coil intermediate the lower and upper insulation flanges on said electrodes, said outer coil being of coarser wire than the inner coil and providing five series of convolutions arranged thereon, the lower ends of said coils being spliced on said central electrode, and a common terminal member for the upper ends of said coils.

7. As an article of manufacture, a spark plug comprising a metal casing, an electrode grounded to said casing, a central electrode, a coupling nut for detachable engagement in the upper end of said casing including the laterally extending flanged portion adapted to overlie the upper edge of said casing, means mounting said central electrode axially through said coupling in insulated relation therewith so that the lower end of said electrode may extend in proximate engagement with the grounded electrode of said casing to provide a spark gap therewith, the upper end of said central electrode extending outwardly of said coupling, a pair of spaced insulated flanges mounted on said upper portion of said central electrode, a pair of coils of wire wound in opposite directions upon said central electrode intermediate said insulated flanges and having their lower ends spliced upon said central electrode, a cap of insulated material, attaching means carried by the flanges of said coupling for connection of the insulation cap thereto, said insulation cap adapted to retain the coils therein in closed relation, and a terminal carried by said insulating cap adapted to receive the upper ends of said coils in conducting relation therewith.

ANSEL E. WORKMAN.