J. A. JEFFERY.

SPARK PLUG.

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1,259,240. Patented Mar. 12, 1918.

Fig. 1.

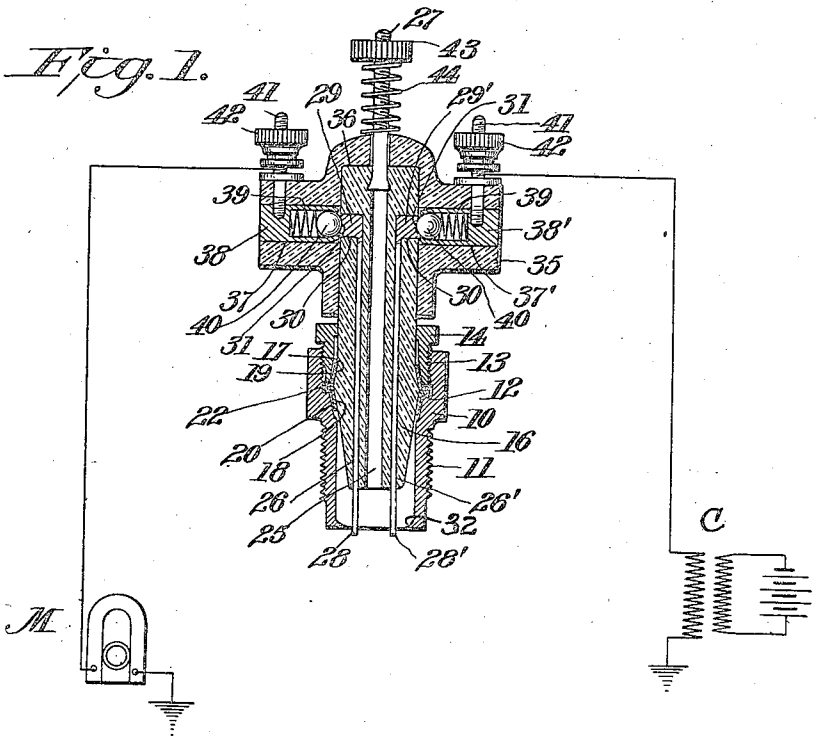
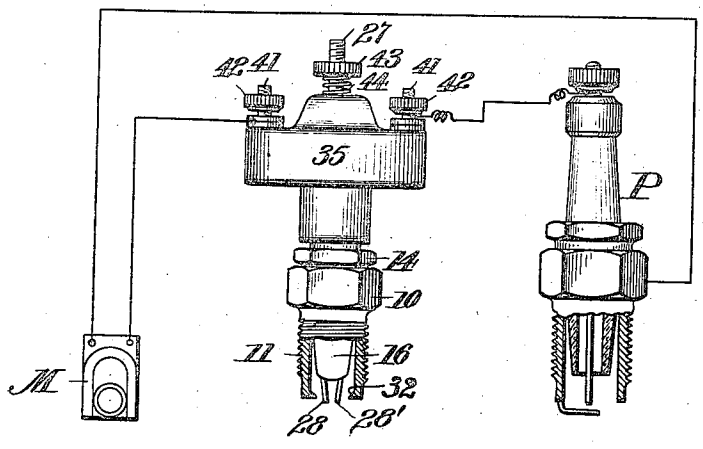


Fig. 2.



WITNESSES

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SPARK-PLUG.

1,259,240. Specification of Letters Patent. Patented Mar. 12, 1918.

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To all whom it may concern:

Be it known that I, JOSEPH A. JEFFERY, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented new and useful Improvements in Spark-Plugs, of which the following is a specification.

This invention relates to certain new and useful improvements in spark plugs.

In the operation of the internal combustion engine, and particularly in its application to the motor vehicle, it is desirable to have two separate and independent sources of energy that supply the spark for igniting the gases in the cylinder. It is obvious that this involves the use of two spark plugs in each cylinder, or else the use of a single spark plug which has incorporated therein two independent conductors or electrodes that are well insulated from each other, and means for supporting and insulating from each other the cables or conductors that connect the two independent sources of energy to the plug. Recent investigations have demonstrated that greater power and economy may be obtained by causing two sparks to occur simultaneously at two points in the combustion space in the cylinder, and particularly in that type of cylinder known at the T-head, or similar types of construction. To overcome many serious mechanical and electrical difficulties it is desirable to furnish the two sparks from a single electric circuit with the two spark gaps in series with each other. To accomplish this result it is necessary to provide two electrodes properly insulated from each other and also insulated from the motor. A third electrode must then be provided, preferably in the form of an ordinary spark plug. One of the objects of the present invention is to provide a spark plug that may be readily converted from a double system to a series spark plug, or vice versa, whereby it may be used for either of the purposes above outlined. A further object is to provide a spark plug provided with an insulating block which may be readily removed from its base or support for the purpose of cleaning. A further object is to provide a terminal block which may be removed from the insulating block without detaching the cables from said block. A further object is to provide means whereby the cables are firmly attached to the terminal block and separated from each other. A further object is to provide means whereby the insulating block and base may be readily removed from the cylinder with the ordinary socket wrench without disconnecting the cables from the terminal block. A further object is to provide means whereby the terminal block and insulating block may properly register with each other to provide for the passage of the electric circuit from the terminals through the terminal block and into the electrodes of the insulating block.

The invention will be hereinafter fully set forth and particularly pointed out in the claims.

In the accompanying drawings:—

Figure 1 is a longitudinal sectional view illustrating our improved spark plug. Fig. 2 is a similar view of the same illustrating its use in a "series system."

Referring to the drawing, 10 designates a supporting shell provided with the usual screw threads 11 for engagement with the engine cylinder. Said shell is provided with a longitudinal bore which is offset to form an annular shoulder 12, the bore, above said shoulder, being internally threaded at 13. A bushing 14 engages the internal threads 13 for the purpose of securing the insulating block in position within the shell.

The insulating block 16 is made of any suitable material, preferably porcelain, and is provided with an annular enlargement in the form of a double cone obtained by tapering the surface of the insulating block in opposite directions, as indicated at 17, 18, respectively. Surrounding the enlarged portion of the insulating block 16 are packing collars 19, 20, each collar being provided with a bore having the same degree of taper as the tapered portions 17, 18, each collar being also provided with an annular flange 21. The adjacent flanges of the collars 19, 20, abut, and are united by a ferrule 22, the edges of which are bent over the flanges to prevent separation of the latter. It will be noted that a slight radial clearance is provided for the collars 19, 20, and the ferrule 22.

The insulating block 16 is provided with three bores 25, 26, and 26′, the central bore 25 being larger than the others. The upper end of the bore 25 has cemented, or otherwise secured thereto, a threaded member 27. The electrodes 28, 28′ are placed within the bores 26, 26′, and said electrodes contact with the inner ends of plugs 29, 29′,

secured in lateral recesses 30 intersecting the bores 26, 26′, the outer faces or ends of said plugs being provided with recesses or pockets 31. The lower end of the shell 10 is provided with an inturned flange 32 which serves as the grounded electrode.

The terminal block 35 is provided with a central bore 36 of a size to receive the upper end of the insulating block 16, said bore being reduced at its upper end to conform to the size of the threaded member 27. Intersecting the bore 36 are lateral bores or chambers 37, 37′, in which are mounted metal plugs 38, 38′, each of which is bored or chambered to receive a spring 39 and a ball 40, the latter being retained in position by leading over the inner end of its supporting plug. Each plug 38, 38′ is also tapped to receive the lower threaded end of a binding post 41 provided with the usual thumb nut 42. A nut 43 engages the threaded member 27 to unite the insulating block and the terminal block, and if desired a spring 44 may be interposed between said nut and the wall of said terminal block.

To assemble the insulating block 16 and the terminal block 35, the nut 43 and spring 44, if the latter is employed, are removed from the member 27, and the latter pushed through the reduced portion of the bore 36 until the end of the block 16 abuts against the shoulder formed by the reduced portion of the bore. The insulating block 16 is then rotated until the balls 40 engage the recesses or pockets of the plugs 29, 29′. The tension of the springs 39 is sufficient to secure the blocks 16 and 35 quite firmly together and to maintain a close electrical contact between the electrodes 28, 28′, and the plugs 38, 38′, but to make the parts more secure, the spring 44 may be employed and the nut 43 screwed up to provide sufficient tension to unite the parts securely and to prevent wear of the conductors in the side of the insulating block. To separate the parts the foregoing operation is reversed.

In order to operate my improved spark plug as a double system plug the same is used in the form illustrated in Fig. 1. The electric current then passes from the magneto M to the plug 38, and from thence through the plug 29 to the electrode 28, and from thence across the gap to the lip 32 to ground. The circuit for the coil is the same except that it is through the electrode 28′. In order to operate the plug in a "series system" the electrodes 28, 28′ are bent toward the center of the insulating block, as indicated in Fig. 2, and in this manner the gaps between the electrodes and the lip 32 are greatly increased. In this form the circuit is from the magneto M to the plug 38, and from thence through plug 29 to the electrode 28, across the gap to electrode 28′, plug 29′, plug 38′ to the binding post 41 of the latter, and from thence through a suitable conductor to the insulated electrode of an ordinary spark plug P, and from thence across the spark gap of the latter to ground.

In practice, the plugs 29, 29′ are made of an alloy that melts at a little below red heat, and are cast in by a suitable mold. The metal is retained in place by suitable undercuts that are made in the porcelain before firing. The alloy used is so proportioned that it has but slight, if any contraction, and yet is hard enough to resist the abrading effect of the balls 40. By means of this method I avoid dependence upon cement and also avoid setting up any strains in the insulating block that would result if said plugs were screwed or otherwise forced into place.

A most important advantage is obtained by arranging the bores of the insulating block as herein shown and described. During the operation of the plug the tendency, owing to the employment of the two electrodes 28, 28′, is to more rapidly heat the outer structure of the insulator. This is due to the fact that the metal of the electrodes conducts the heat rapidly, and being situated near the surface of the insulator tends to raise the temperature at this point more rapidly than if no metal was employed. Consequently the porcelain would be subjected to severe strains if some means were not employed to equalize the temperature. The large central bore not only increases the surface distance between the two electrodes on the end of the insulator, but permits the hot gases of combustion to circulate therein and thus raise the temperature of the insulating block more uniformly than would be possible were the center solid. The importance of raising the temperature in this manner will be more readily understood when it is remembered that porcelain is a relatively poor conductor of heat, and therefore the action of the gases on the surface of the insulator (if constructed without the central bore), would tend to raise the temperature of the surface rapidly, whereas the center of the core, deriving its heat from the conductivity of the porcelain only, would heat more slowly. Consequently great strains would be set up in the porcelain. This becomes more evident if the porcelain is cooled off rapidly as often occurs in the operation of the engine. If the bore were omitted the surface of the porcelain would cool rapidly and the center of the core might still be almost red hot, which would most likely result in a fracture and destruction of the insulator. With the large central bore and consequent thin walls of the insulating block, the heat has but a relatively short distance to travel to heat the whole mass to a uniform temperature.

From the foregoing it will be seen that I have produced a spark plug of simple con-

struction that may be readily used either as a double system plug or a series plug. It will be further noted that the parts are so arranged that the insulating block may be readily removed from its base or support for any purpose, and that the terminal block may be separated from the insulating block without detaching the electric cables. It will also be noted that the insulating block and base may be readily removed from the cylinder with the ordinary socket wrench without disconnecting the cables from the terminal block. A further and great advantage is obtained by the structure provided with means whereby the terminal block and the insulating block are brought into proper register with each other and automatically locked together so as to provide for the proper passage of the electric current.

Having thus explained the nature of my invention, and described an operative manner of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, or all of the modes of its use, what I claim is:—

1. An improvement in spark plugs comprising an insulating block, a terminal block, said blocks being provided with complemental interlocking means to normally prevent separation thereof, electrodes carried by the insulating block, and means carried by the terminal block for connecting all of said electrodes with means for supplying electrical energy.

2. An improvement in spark plugs comprising an insulatiag block provided with electrodes, a terminal block removably connected with said insulating block and means movable with said terminal block for connecting all of said electrodes with means for supplying electrical energy.

3. An improvement in spark plugs comprising an insulating block provided with electrodes, a supporting shell for said block serving as a grounded electrode, and a terminal block removably connected with said insulating block and means movable with said terminal block for connecting all of said electrodes with means for supplying electrical energy.

4. An improvement in spark plugs comprising an insulating block provided with electrodes, a terminal block provided with electrical terminals independent of said electrodes, there being a terminal for each electrode, and complemental interlocking means for connecting said insulating block and said terminal block, said interlocking means completing the circuit between said terminals and their respective electrodes.

5. An improvement in spark plugs comprising an insulating block provided with electrodes, a terminal block provided with a bore to receive one end of said insulating block, and electrical terminals independent of said electrodes, there being a terminal for each electrode, carried by said terminal block, said insulating block and said terminal block being provided with complemental interlocking means connecting said terminals and their respective electrodes.

6. An improvement in spark plugs comprising an insulating block provided with electrodes and laterally arranged plugs connected with said electrodes, a terminal block provided with electrical terminals, and locking devices carried by said terminal block and connecting the said terminals with said plugs.

7. An improvement in spark plugs comprising an insulating block provided with electrodes and laterally arranged plugs connected with said electrodes, a terminal block provided with electrical terminals, and spring pressed locking devices in circuit with said terminals and arranged to engage said plugs.

8. An improvement in spark plugs comprising an insulating block provided with electrodes, a terminal block provided with a bore to receive one end of said insulating block, electrical terminals carried by said terminal block, and laterally arranged plugs carried by said terminal block and arranged to connect said terminals with said electrodes.

9. An improvement in spark plugs comprising an insulating block provided with electrodes, a terminal block provided with a bore to receive one end of said insulating block, laterally arranged plugs intersecting said bore, spring contact members carried by said plugs and arranged to engage said electrodes, and electrical terminals connected with said plugs.

10. An improvement in spark plugs comprising an insulating block provided with electrodes having lateral extensions, a terminal block provided with a bore to receive one end of said insulating block, laterally arranged plugs intersecting said bore, spring contact members carried by said plugs and arranged to engage the lateral extensions of said electrodes, and electrical terminals connected with said plugs.

11. An improvement in spark plugs comprising an insulating block provided with electrodes, a threaded stem extending from said insulating block, a terminal block provided with a bore to receive said block and stem, electrical terminals carried by said terminal block and connected with said electrodes, and a binding screw working on said threaded stem.

12. An improvement in spark plugs comprising an insulating block provided with electrodes, lateral plugs connected with said electrodes and having the same coefficient

of expansion as the material forming said insulating block, a terminal block provided with electrical terminals, and means for connecting said terminals and said plugs.

13. An improvement in spark plugs comprising an insulating block provided with electrodes, a terminal block provided with electrical terminals, one for each electrode, and means carried by one of said blocks for connecting said electrodes and their respective terminals.

14. An improvement in spark plugs comprising an insulating block provided with a plurality of electrodes, a terminal block, said insulating block and said terminal block having engaging portions, electrical terminals carried by said terminal block, and means carried by one of said blocks for connecting all of said terminals with their respective electrodes when the blocks are engaged.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOSEPH A. JEFFERY.

Witnesses:
LOUISE M. HOWE,
FRED. L. PARKER.