W. H. GRAINGER.

SPARK PLUG FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED OCT. 22, 1914.

1,264,870. Patented Apr. 30, 1918.

Fig. 1.

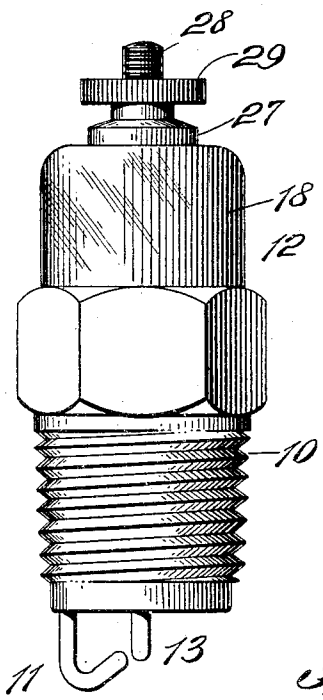


Fig. 2.

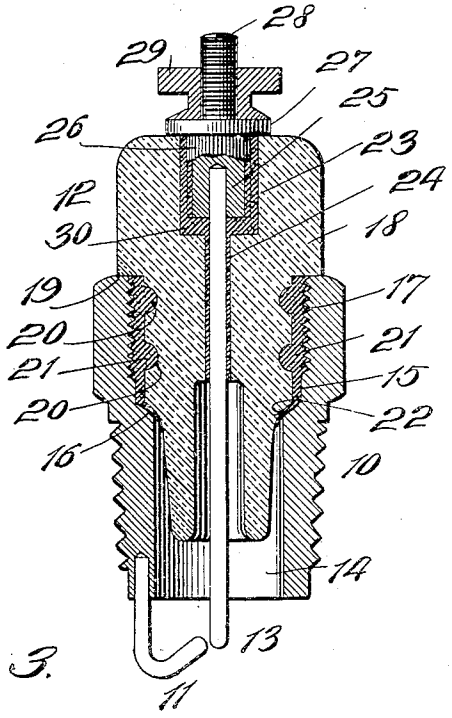
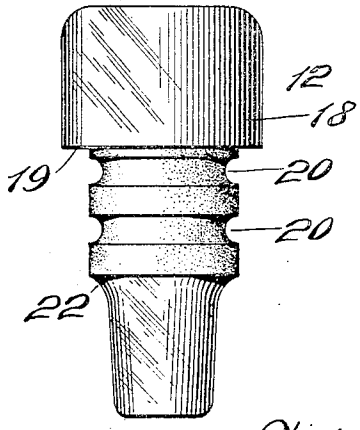


Fig. 3.



Witnesses:
Julius W. Smith.
Arthur Marion.

Inventor:
William H. Grainger,
By his Attorney,
Charles C. Gill.

UNITED STATES PATENT OFFICE.

WILLIAM H. GRAINGER, OF TRENTON, NEW JERSEY.

SPARK-PLUG FOR INTERNAL-COMBUSTION ENGINES.

1,264,870. Specification of Letters Patent. Patented Apr. 30, 1918.

Application filed October 22, 1914. Serial No. 867,980.

To all whom it may concern:

Be it known that I, WILLIAM H. GRAINGER, a citizen of the United States, and a resident of Trenton, in the county of Mercer and State of New Jersey, have invented certain new and useful Improvements in Spark-Plugs for Internal-Combustion Engines, of which the following is a specification.

The invention relates to improvements in electric ignition devices, commonly called spark plugs, for internal combustion engines, and it consists in the novel features, structure and combinations of parts hereinafter described, and particularly pointed out in the claims.

The object of the invention is, generally speaking, to provide a spark plug which may be conveniently manufactured and composed of a limited number of parts and in operation be highly efficient and reliable, and more specifically the object of the invention is to provide a spark plug comprising a main exterior casing carrying one electrode and an insulating core or body carrying the other electrode, said exterior casing being adapted to be screwed into a wall of the engine cylinder and said insulating core or body being secured within said exterior casing by suitable cement thoroughly hardened, as by baking, and engaging undercut surfaces or grooves or threads formed on the exterior of said core or body and the adjacent interior surfaces of said exterior casing.

A further object of my invention is to dispense with the usual bushing which is employed to hold the porcelain of a spark plug in position and to dispense with the customary packing employed for forming tight joints between said bushing and the insulating or porcelain body as well as the packing which is commonly employed between said body and the exterior casing, the entire construction of the spark plug being thus simplified and at the same time rendered more efficient and less liable to become injured or have its correct operation impaired.

The spark plug of my invention comprises two main parts, one being the exterior casing carrying one electrode and the other the insulating core or body carrying the other electrode and permanently secured within the exterior casing by means which, while securing the two parts together, form a gas-tight joint between said parts.

The invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which:

Figure 1 is a side elevation of a spark plug embodying my invention;

Fig. 2 is a central vertical section through the same, and

Fig. 3 is a side elevation of the insulating core or body detached from the plug.

In the drawings 10 designates the exterior casing or shell carrying one electrode 11 and receiving an insulating core or body 12 carrying the other electrode which I number 13. The casing or shell 10 is substantially of known form and construction, being screw-threaded to enter a threaded opening in the wall of a cylinder and having a polygonal portion to receive a wrench. The casing or shell 10 is of metal, as usual. Within the casing or shell 10 is formed, at the lower portion thereof, a cylindrical chamber 14 and at the upper portion thereof a larger cylindrical chamber 15, said chambers merging into each other and at their point of juncture creating a seat for the insulating core or body 12. The wall of the upper chamber 15 is roughened, and in the present instance this roughness is created by the formation of a screw-thread 17 in said wall.

The insulating body or core 12 is of elongated form and at its upper portion is formed with a part or head 18 of larger diameter than the lower part of said core or body, the presence of said head 18 creating at the lower end thereof an annular shoulder 19 adapted to bear upon the upper edges of the exterior casing 10, as shown in Fig. 2. Below the shoulder 19 the core or body 12 is preferably formed with annular grooves 20, and this portion of the core or body 12 is less in diameter than the diameter of the chamber 15, whereby a substantial space is left between the wall of said chamber and the adjacent surface of said core or body, and into this space is filled the cement or holding substance 21, which entirely fills said space and also the grooves 20 and the threads 17 and in addition extends downwardly upon the upper surface of the annular shoulder 16 which forms a lower seat for the core or body 12, as shown in Fig. 2.

The core or body 12 is formed adjacent to the shoulder 16 on the shell 10 with an annular shoulder 22 to coöperate with said

shoulder 16 in properly sustaining the core or body in position, and below said shoulder 22 the core or body 12 is of reduced diameter and extends downwardly into the chamber 14 of the casing 10 without projecting entirely through said casing. The lower portion of the core or body 12 is formed with a chamber, as usual, through which the electrode 13 extends and which chamber coöperates with a chamber surrounding the lower portion of the core or body 12 to avoid the deposit of carbon within the plug. At its upper end the core or body 12 is formed with a central recess 23 which is in communication with a central longitudinal opening 24 within the core or body to receive the electrode 13. Within the recess 23 is a plug 24 whose outer surface is serrated, as at 26, and which plug is formed integrally with an annular shoulder or disk 27 and outwardly projecting threaded stem or screw 28, said screw or stem 28 being provided to receive the binding nut 29 by which a conductor terminal may be held against the annular shoulder or disk 27. The upper end of the electrode 13 is secured within the plug 25 and said plug and electrode are secured within the core or body 12 by a cementing or holding substance 30 which surrounds the plug 25 within the recess 23 and that portion of the electrode 13 which is within the hole or opening 24. The plug 25 is serrated vertically on its surface so as to aid in resisting any tendency for said plug to turn during the tightening of the nut 29, the cementing or holding material 30 entering into firm relation with the serrations in said plug and the inner walls of the recess 23 and central opening or hole 24 for the electrode 13 and also closely binding against the said electrode. The core or body 12 will have a glazed exterior surface except on that portion thereof which is between the shoulder 19 and shoulder 22 and at this part of the core or body the exterior surface thereof will be left unglazed, as shown in Fig. 3, whereby a somewhat roughened surface is produced with which the cementing or holding substance 21 may enter into interlocking relation.

One of the main features of my invention resides in the provision of the insulating body or core 12 and exterior casing 10 and securing said parts together by the holding or cementing material 21, the usual bushings and packings being entirely dispensed with, and in carrying out this feature of my invention I prefer to construct the adjacent surfaces of the core or body 12 and exterior casing 20 in the manner hereinbefore described, the core or body 12 being of porcelain and the shell 10 of metal, and secure these two parts together by holding or cementing material 21 applied upon the core or body 12 in such quantity as to completely fill the chamber 15 when said core or body is pushed firmly into position in the outer portion of the casing 10 and then baked under a high degree of heat in order to make the same very hard and of sufficient strength and of proper character to key the body or core 12 within the casing 10 and effect the permanent connection of said parts as well as to create a hermetically sealed joint between them. I preferably use a cementing substance containing porcelain, and in the baking of this substance it becomes very hard and finally enters into such close binding relation to the core or body 12 and shell 10 as to be in effect, if not in reality, substantially an integral part thereof. It will be seen on reference to Fig. 2 that the holding or cementing substance 21 when hardened will key the core or body 12 within the shell 10 and prevent the withdrawal of said core or body from said shell. I do not limit this invention to the presence of the two annular grooves 20 in the core or body 12, since a highly efficient spark plug would be produced if the core or body 12 had only one of the annular grooves 20 or other undercut surface enabling the cementing or holding substance 21 to key the body or core 12 firmly in position within the casing 10.

I do not limit this invention to the securing of the electrode 13 by means of the plug 25, since this plug entering a recess in the outer end of a porcelain or insulating core or body and holding an electrode is not my invention and is to be made the subject of a separate application for Letters Patent so that the same may be protected. My invention resides more largely in the construction of the spark plug of two main parts, to-wit, the shell 10 and insulating core or body 12 keyed or firmly secured together by cementitious material, bushings, gaskets and the like being dispensed with.

What I claim as my invention and desire to secure by Letters Patent, is:

1. In a spark plug, in combination, a main casing carrying one electrode, an insulating core therein carrying the other electrode, and cementitious material keying said casing and core permanently together, said casing in its surface opposite to said core at which the cementitious material is applied being threaded and said core at said location being undercut whereby the cementitious material engages undercut surfaces of both said core and casing for aiding in the locking of the two parts together by means of said material, and said casing forming therein a commodious chamber for the inner end portion of said core and separated at its walls therefrom and said core terminating at its inner end within said chamber and at its outer portion extending beyond said casing.

2. In a spark plug, in combination, a main casing having an enlarged chamber in its

outer portion and a shoulder at the base thereof and carrying one electrode, an insulating core carrying the other electrode and inserted within said casing and having a head to engage the outer end thereof and a shoulder to seat on the said shoulder of said casing, and cementitious material applied within said chamber and keying the casing and core permanently together, said plug at the location of said cementitious material having undercut surfaces to receive said material and thereby aid in locking the said main parts together, and said casing forming therein a commodious chamber for the inner end portion of said core and separated at its walls therefrom and said core terminating at its inner end within said chamber and at its outer portion extending beyond said casing.

Signed at Trenton, in the county of Mercer and State of New Jersey, this 20th day of October A. D. 1914.

WILLIAM H. GRAINGER.

Witnesses:

ALFRED C. GRAINGER,

E. R. CARROLL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."