HARRY LE VAN HORNING.

SPARK PLUG FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JUNE 8, 1917.

1,432,811. Patented Oct. 24, 1922

Fig. 1

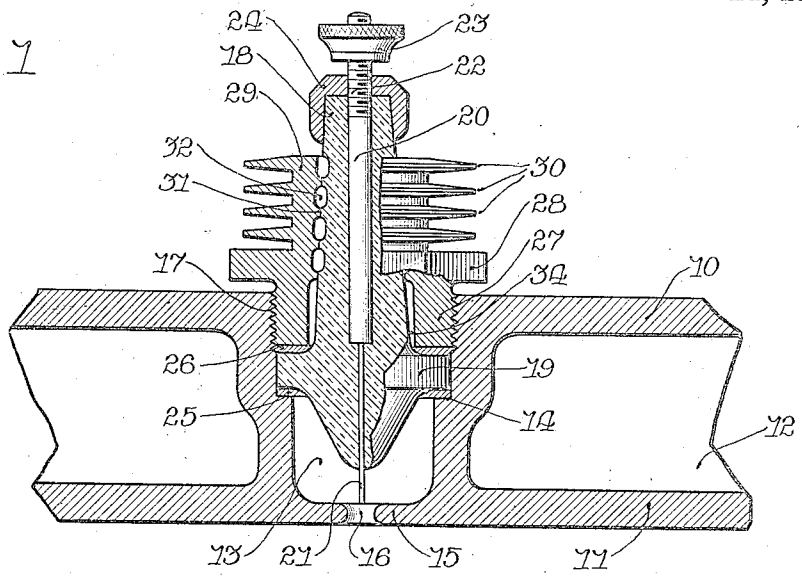


Fig. 2

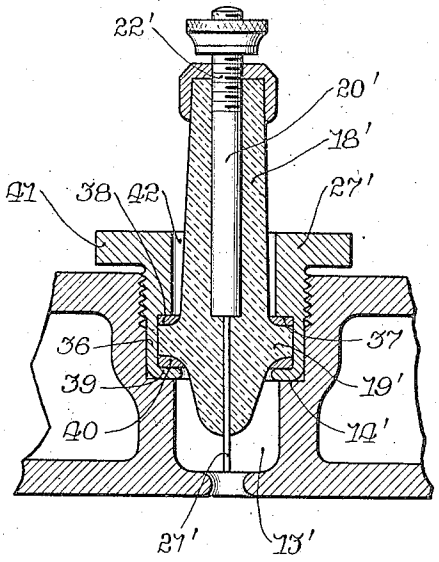
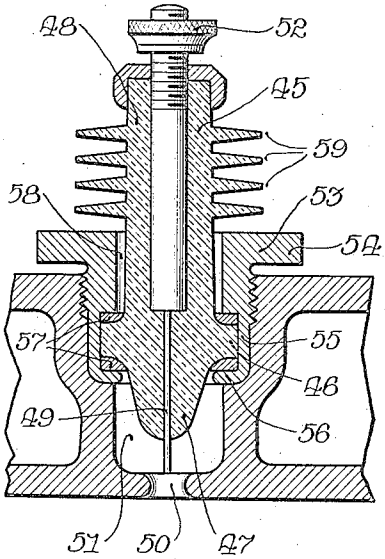


Fig. 3



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UNITED STATES PATENT OFFICE.

HARRY LE VAN HORNING, OF WAUKESHA, WISCONSIN.

SPARK PLUG FOR INTERNAL-COMBUSTION ENGINES.

Application filed June 8, 1917. Serial No. 173,441.

To all whom it may concern:

Be it known that I, HARRY LE VAN HORNING, a citizen of the United States, residing at Waukesha, in the county of Waukesha and State of Wisconsin, have invented a certain new and useful Improvement in Spark Plugs for Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates broadly to internal combustion engines and has particular reference to the spark plug construction and the adjacent portions of the cylinder structure, one of its objects being to accomplish the elimination of "hot spots" in the cylinder, which frequently cause pre-ignition, rendering inefficient the operation of the engine and causing deterioration of the structure, not only of the spark plug, but of the engine structure as well.

In the ordinary spark plugs of the prior art the plug is constructed as a unit inserted in the head of cylinder, which is convenient, but, while facilitating the installation and replacement of the plug, the device is subject to rapid deterioration, owing to the creation of "hot spots" in the cylinders and the slow dissipation of heat both during use and for considerable time thereafter.

Therefore, I contemplate, together with the foregoing object, the provision of a spark plug which is not only a unit insertable in the cylinder structure but eliminates "hot spots" by conducting the heat efficiently to the air and to the water in the water jacket, which results in a quick dissipation of the heat and as a further consequence the prolongation of the life of the plug.

In accordance with my invention I mount the porcelain or other insulating portion of the plug in a suitably formed opening in the cylinder head, which is preferably provided with the usual water cooling jacket, the said porcelain portion being retained by a gland or the like surrounding the same, which gland is screwed into or otherwise engaged with the opening in the cylinder head. The plug embodies features of construction which hasten the dissipation of the heat with a consequent increase of the life of the plug by preventing cracking or other deterioration of the plug, owing to subjection of the same to harmful temperatures.

Other objects will appear from the following detailed description of the claims, taken with an inspection of the accompanying drawing, in which—

Figure 1 is a cross-sectional view of a spark plug embodying the features of the preferred form of my invention;

Figure 2 is a similar view of a modification; and

Figure 3 illustrates another modification.

Referring more particularly to the drawings, and specifically to Figure 1, wherein one form of my invention is shown, 10 and 11 designate the outer and the inner walls, respectively, of the cylinder head of an internal combustion engine. The head may be of the detachable or of the integral type. The walls 10 and 11 form a water jacket 12 which surrounds the end and sides of the cylinder structure for cooling purposes.

The cylinder head is provided with a spark plug opening 13 formed with an annular shoulder 14, the lower end of the opening having a wall 15 provided with an aperture 16 for a purpose which will hereinafter appear. The portion of the opening 13 above the shoulder 14 is threaded as at 17.

The spark plug of the form of the invention shown in Figure 1 preferably comprises a tapering body 18 of porcelain or similar insulating material, said body having a relatively heavy annular flange 19 formed thereon adjacent the larger end thereof. One electrode is disposed axially through the body 18 and projects from both ends thereof, the inner end being reduced to form a spark terminal 21 and the outer end threaded as at 22 to receive a binding nut 23. A metallic cap 24 surrounds the upper end of the body 18 to form an electrical conductor. The spark terminal 21 projects within the aperture 16, the walls of the aperture forming the other terminal at the spark gap, the cylinder structure proper forming the grounded end of the ignition circuit. Of course, I do not limit myself to the use of the particular type of electrode and spark gap employed, since two electrodes might be disposed in the plug if desired. An annular cushion 25 is disposed on the shoulder 14 beneath the flange 19 and a similar cushion 26 is disposed above said gland, a threaded gland nut 27 being receivable in the spark plug opening and engageable with the threaded portion 17 thereof. The gland nut 27 is adapted to bear upon the cushion 26 and

thereby force the gland 19 into engagement with the cushion 25 to retain the plug firmly within the opening. The gland nut is provided with a portion 28 to receive a wrench or the like for turning the nut, said nut being formed with an extended collar 29 having a plurality of heat disseminating flanges 30 formed thereon. The gland nut is retained on the body 18 by the cap 24, when the parts are removed from the cylinder. The contiguous surfaces of the body 18 and the collar 19 are formed for contact at a plurality of points 31, annular spaces 32 being formed by virtue of said contact. The gland nut is in spaced relation to the body 18 at the lower end of the latter as indicated at 34. Thus in providing contact between the collar 29 and the body 18 at a plurality of points a sufficient circulation of air is provided to cool the body 18 and a sufficient contact is afforded to conduct heat from the body through the gland nut to the air and from the body directly to the water jacket, hastening the cooling of the body 18. The cooling of the body by way of the flange 19 will be well accomplished owing to the fact that the same is in intimate contact with the wall of the opening 13 so that any heat will be quickly conducted to the water in the water jacket. This intimate contact also forms a guide to keep the electrode 21 and opening 18 in proper relation. The conduction of heat in the manner stated is brought about by the passage of heat from a hotter to a colder object. The dissipation of the heat is further assisted by the provision of the cooling flanges 30.

In Figure 2 I have illustrated a modification of the invention, wherein the porcelain body designated 18′ and the gland nut designated 27′ are permanently associated as a unit but are only in actual contact at a point from which it is desirable to dissipate the heat by conduction. The body 18′ is provided wth an electrode 20′ provided with a spark terminal 21′ and a threaded portion 22′ similar to the electrode 20 illustrated in Figure 1. Of course, it will be understood that two electrodes may be employed in this modified form of my invention as well as in the form shown in Figure 1. The shape of the body 18′ is similar to that shown in Figure 1, with the exception that there are no annular recesses formed in the upper surfaces thereof and the flange 19′ formed thereon is of slightly smaller diameter. Of course, the flange might be made of the same diameter and the gland nut formed correspondingly so as to construct a spark plug which is adapted for universal service in a standard size of opening. In the modified form of the invention the lower end of the wall of the gland nut 27′ is reduced as at 36 to form a thin cross section and a shoulder 37, the flange 19′ formed on the body 18′ being receivable in the nut as shown. A washer 38 is disposed between the shoulder 37 and the flange 19′ so as to prevent jarring and fracture of the body 18′. After the body 18′ has been placed in the gland nut the free margin of the wall 36 is rolled inwardly as at 39 to form an annular retaining portion, a washer 40 being inserted between the retaining portion 39 and the under surface of the gland 19′. The retaining portion 39′ is adapted to abut the shoulder 14′ formed in the opening 13′ in the cylinder head. The space and size of the opening 13′ may be identical with the opening 13 hereinbefore referred to. The upper end of the gland nut 27′ is provided with an enlarged portion 41 to receive a wrench or the like for screwing the gland nut into the opening. The inner surface of the gland nut is slightly spaced from the outer surface of the body 18′ as at 42 in order to further permit the free access of air and to secure cooling of the insulating body 18′. In this form of the invention it will be apparent that the insulating body is well exposed to permit expansion and to be cooled by the air.

Referring to the modification shown in Figure 3, I have provided an insulating body 45 slightly tapering in shape and having a flange 46 adjacent the larger end thereof. The body extends beyond the flange as at 47 similar to the insulating bodies 18 and 18′ hereinbefore described. An electrode 48 is mounted axially in the body 45, one end of the electrode being reduced and extended to form a spark terminal 49 receivable in the aperture 50 formed at the base of the spark plug opening 51. The spark plug opening 51 is constructed practically identical with the spark plug openings 13 and 13′ and therefore further description of the same is not thought to be necessary. The upper end of the electrode 48 is threaded to form a binding post and to receive a retaining nut 52. A gland nut is provided designated 53 and is provided with a portion 54 for engagement with a wrench or the like. The gland nut is threaded for engagement with the spark plug opening, the wall of said nut adjacent its inner end being reduced as at 55 to receive the flange 46, the free margin of the wall 55 being rolled over as at 56 to retain said flange and the body 45, thereby making the body and gland nut a unit. Cushion washers 57 are placed above and below the flange 46. The upper portion of the gland nut is preferably spaced as at 58 from the surface of the body 45 so as to permit of a free circulation of air therebetween. The structure of the body thus far and the gland nut is practically identical with that form of the invention shown in Figure 2. However, in the form of the invention shown in Figure 3, the body 45 is

provided with a plurality of peripheral spaced flanges 59 for dissipating the heat contained in the body 45. Thus instead of placing the flanges 59 on the upper portion of the gland nut I find it possible and sometimes desirable to place the flanges as shown in Figure 3, that is, upon the upper end of the insulating body.

In the three forms of the invention as shown it will be apparent that the same general principle is involved, namely, that of dissipating heat from a hotter to a colder body, namely, from the insulating bodies, 18, 18′ and 45 to the air and to the water in the water jacket through the medium of either immediate contact with the cylinder wall or through the thin extension of the gland nut. Thus, in Figure 1 the heat of the body is conducted from the flange 19 to the water jacket directly through the cylinder wall and also through the points of contact 31 between the body 18 and the collar 29 to the air through the flanges 30, through said collar to the nut and thence to the cooling jacket. The forms of the invention shown in Figures 2 and 3 are practically identical with the exception of the additional flanges 59 on the insulating body in the form of Figure 3. Thus the heat is conducted from the insulating body by conduction through an area which is in as close contact with the cooling water as is possible. Beyond that area the body is subjected to the atmospheric temperature as much as is possible. It will be apparent that efficient dissipation of the heat to which the spark plug insulating body is subjected is obtained by bringing atmospheric temperatures into cooperation with the cooling temperatures of the water in the water jacket, so that under the most severe operating conditions the insulating body will be maintained at a moderate temperature and thereby prevent damage or complete destruction of the insulating body of the plug. This principle may be applied in various structures and I therefore do not desire to limit myself to the details shown. It will of course be apparent that the manner of uniting the gland nut and the body as a unit as shown in Figures 2 and 3 may readily be applied to the structure shown in Figure 1. It will also be apparent that two electrodes may be employed in place of one, as hereinbefore pointed out, regardless of the form of the invention as described which may be used.

I claim:

1. In combination, a cylinder head having a cooling jacket, said head having an opening therethrough, a shoulder in said opening, an insulating body having an axial electrode projecting from both ends thereof, said body being receivable in the opening and having an annular flange formed thereon to a seat on said shoulder, a gland nut surrounding the body and receivable in the opening to retain the body, a collar on said nut provided with heat dissipating flanges, and said collar having contact with said insulating body at a plurality of points having air spaces therebetween.

2. In combination, a cylinder head having a cooling jacket surrounding the same, said head having an opening therethrough, a shoulder in said opening, a body of insulating material having a flange resting upon said shoulder with its sides in intimate contact with the side walls of said opening and having an electrode therein, means entirely above said flange to retain said body in said opening having air circulating passages between the body and said means, and heat dissipating flanges on said retaining means.

3. In combination, a cylinder head having a cooling jacket surrounding the same, said head having an opening therethrough, a shoulder in the opening, a spark plug including a body of insulation having a flange to rest upon said shoulder within the opening, a portion of the plug projecting from the opening, that portion of the plug within the opening being in intimate contact with the wall of the opening to conduct the heat to the cooling medium in the jacket, a gland nut for retaining said body of insulation within the opening, and said gland nut having intimate contact with the insulating body at a plurality of points outside the opening so as to further dissipate the heat from said body, there being air spaces between said points.

In witness whereof, I hereunto subscribe my name this 31st day of May A. D. 1917.

HARRY LE VAN HORNING.