June 4, 1935. T. G. McDOUGAL 2,003,453

IGNITING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed June 30, 1933

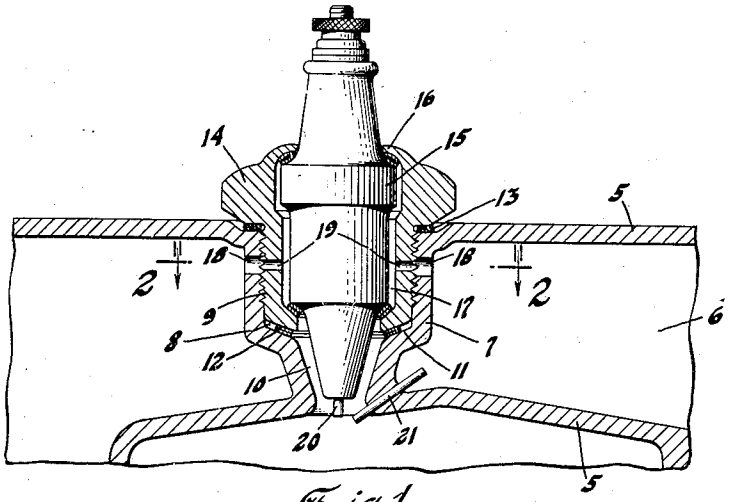

Fig. 1

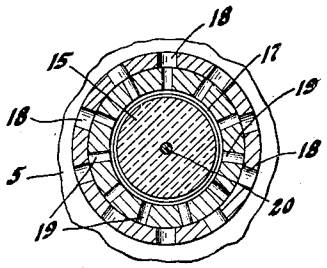

Fig. 2

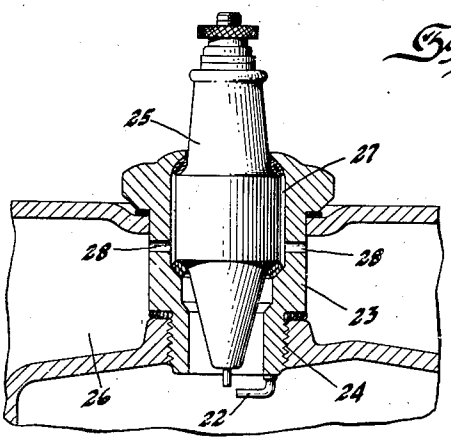

Fig. 3

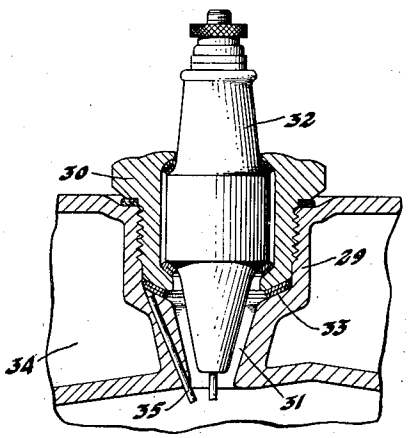

Fig. 4

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Patented June 4, 1935 2,003,453

UNITED STATES PATENT OFFICE

2,003,453

IGNITING DEVICE FOR INTERNAL COMBUSTION ENGINES

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Application June 30, 1933, Serial No. 678,339

6 Claims. (Cl. 123—169)

My invention relates to igniting devices for igniting the combustible mixture in internal combustion engines, the same being similar in a general way to spark plugs although certain features of the engine enter into the structure and operation of the device wherein my invention consists.

The object of my invention is to provide an igniting device wherein the insulating member for the central electrode (which is equivalent to insulating members and central electrodes of ordinary spark plugs) is kept cooler than has heretofore been the case, thus lessening the tendency of the combustible mixture to preignite and reducing the liability of the insulating member being injured by the burning gases within the engine cylinder. This keeping of the insulating member (which is ordinarily made of ceramic material) as cool as possible is becoming of progressively more importance as compression pressures before ignition are increased, with resulting higher temperatures of the mixture after the ignition thereof; and that end is attained by the invention herein by providing for a more direct and unrestrained flow of heat from the insulating member and especially from the lower end thereof, into the mass of cooling medium within the cylinder head, all as will hereinafter appear in describing my invention and explaining the operation thereof.

The drawing submitted herewith illustrates three ways differing slightly each from the others whereby my invention may be carried out, and the object thereof attained, and the concluding claims particularly point out the features wherein my invention consists.

In the drawing accompanying and forming a part of this application:

Figure 1 is a view showing a longitudinal section upon a central plane of my improved spark plug and its relation to the head of the engine with which it is used, the insulating member of the plug, however, being shown in side elevation.

Figure 2 is a view showing the same upon a transverse plane indicated by the line 2—2, Figure 1.

Figure 3 is a sectional view similar to Figure 1 showing a modified form of my improved spark plug.

Figure 4 is a similar sectional view showing still another form of my invention.

Referring now to the drawing, the numerals 5—5 designate the head of an internal combustion engine having the usual cooling medium space 6 for limiting the rise of temperature in the head, the upper and lower walls of the head being connected by an annular partition or wall 7 which provides a chamber 8 having an enlarged upper part open at its upper end, and within which the external shell 9 of my improved spark plug is housed; said shell being threaded as shown to engage internal threads in the enlarged upper part of the chamber so that the shell may be conveniently put in place and removed therefrom. The lower part 10 of the chamber 8 communicates with the interior of the engine cylinder and is smaller than the upper internally threaded part, and the same is shown as conical in form. The partition 7 is shown as shaped to provide an intermediate ledge 11 between the lower conical part and the upper internally threaded part of the chamber and which lies just below the lower end of the shell 9 when the same is in place; and gaskets 12, 13 are commonly provided as shown for securing liquid tight joints between the lower end of the shell and the ledge, and between the usual hexagonal upper part 14 of the shell and the upper wall of the cylinder head. The shell 9 being in intimate contact with the interior of the chamber within which it is housed, a substantially continuous metallic path is provided through which such heat as may reach the shell is conducted to the cooling liquid within the space 6, whereby the shell is kept cool when the engine is in operation.

The insulating member 15 may be secured within the shell 9 in any way as by an inturned holding flange 16, and the same is spaced from the interior of the shell 9 so as to provide an annular cooling jacket 17 surrounding the insulator. When the shell is in place within the chamber 8 this cooling jacket is in direct communication with the interior of the head through registering holes 18, 19 in the wall 7 and shell 9, so that the cooling medium within head space 6 enters the cooling jacket 17 to thereby cool the insulating member.

The lower end of the insulating member 15 enters the smaller lower part 10 of the chamber 8; and the same is preferably made conical, as shown. This conical lower end being located in close proximity to the conical inner surface of the comparatively small conical chamber, and the surfaces of said lower end and the interior of the chamber being approximately parallel, it follows that a considerable part of the heat imparted by the combustion gases to the insulating member will be radiated from said lower end to the relatively cooler wall of said chamber, and will flow rapidly therethrough and to the

cooling medium within the space 6 within the head. Quite obviously the part of the heat thus radiated will not flow upward and into the larger body of the insulating member; but such heat as is not so radiated will be conducted upward through the mass of insulating member and communicated to the cooling medium within the jacket 17, which is in direct communication with the cooling medium space 6 of the head. These two schemes for dissipating heat from the insulating member are to a considerable degree independent of one another, and a plug in which both are present will be kept cooler than has been the case in spark plugs such as have heretofore been in use.

The insulating member 15 has the usual insulated electrode 20 extending through it; and the grounded electrode 21 preferably extends into the cooling liquid space 6 in the head, as shown, to thereby the more effectively cool the same.

In the form of my invention illustrated in Figure 3 the grounded electrode 22 is carried by the shell 23 so that the plug is a single self-contained device in which particular it more closely resembles spark plugs as ordinarily made. The shell 23 has threaded engagement at 24 with the inner of the spaced walls of the cylinder head, and the wall 7 of the Figure 1 form is omitted; so that there are no chambers separate and distinct from the plug shell itself housing the shell and the lower end of the insulating member 25. This permits the cooling liquid in the space 26 to come into direct contact with the shell 23 (which does not occur in the form shown in Figure 1) so that in this form the shell itself is more effectively cooled than in the Figure 1 form. However and in this second form the cooling liquid within the space 26 enters a jacket 27 through holes 28 and comes into direct contact with the insulating member 25 so that it is cooled to the same degree, and in the same way as in the form of my invention first described. Heat from the lower end of the insulating member is, however, radiated and flows to the cooling liquid within the space 26 through the lower end of the shell 23 in substantially the same way as in the form shown in Figure 1; and in both forms there is a transfer of heat from the insulating member to the cooling liquid within the head through separate paths one directly to the cooling liquid in the head space 6, and the other through the liquid within the jacket 27 and to the same mass of cooling liquid within the head.

In the form of my invention illustrated in Figure 4 a wall 29 like the wall 7 in Figure 1 provides an upper internally threaded chamber into which the spark plug shell 30 screws, and a lower and smaller conical chamber 31 into which the lower end of the insulating member 32 extends; there being a ledge 33 between the chambers as in the form illustrated in Figure 1. In this form the cooling liquid within the space 34 of the head does not come into direct contact with the insulating member as in the forms of my invention illustrated in Figures 1 and 3, but the shell 30 is cooled in substantially the same way and to the same extent as in the Figure 1 form; and the arrangement of the lower end of the insulating member within, and with its peripheral surface adjacent the interior of the lower chamber 31, secures a plug wherein a large part of the heat communicated to the insulating member is radiated and flows with a minimum of restraint directly into the cooling liquid within the head space 34; while such heat as flows upward along the insulating member and heats the shell 30 flows without substantial restraint through the upper threaded surfaces of the shell 30 and the wall 29 and into the cooling liquid in the space 34. The grounded electrode 35 in this form of my invention is shown as within a passage in the inclined wall of the lower chamber 31 instead of extending into the cooling liquid space 34, but it will nevertheless be effectively cooled because of its long and intimate contact with said wall which is a good conductor of heat and its location close to the cooling liquid within the head space 34.

The series of holes 18 in the wall 7 and 19 in the shell 9 are made quite numerous as shown, and one series preferably has an odd and the other an even number of holes; the purpose of this being to insure registry of a plurality of pairs of holes, and free access of cooling medium to the cooling jacket 17, whatever angular position the shell may come to rest in as it is screwed into the chamber 8.

Having thus described and explained my invention I claim and desire to secure by Letters Patent:

1. In an igniting device of the class described and in combination with a cylinder head having spaced walls whereby a cooling medium space is formed; a hollow shell arranged to be cooled by a cooling medium within said cooling liquid space; an insulating member secured within and spaced apart from the interior of said hollow shell to thereby provide a cooling liquid jacket between the two, said hollow shell having a hole whereby said jacket is placed in communication with the cooling liquid space within said head; an insulated electrode carried by said insulating member; and a grounded electrode arranged in sparking relation with the inner end of said insulated electrode.

2. In an igniting device of the class described and in combination with a cylinder head having spaced walls whereby a cooling liquid space is formed; an annular partition connecting said walls and so shaped as to provide a large upper chamber open at its upper end, and a lower chamber smaller than the upper chamber and communicating at its lower end with the interior of the cylinder; a hollow shell secured within said upper chamber; an insulating member secured within and spaced apart from the interior of said hollow shell to thereby provide a cooling liquid jacket between the two, and the lower end of which insulating member extends into the smaller lower chamber aforesaid; registering holes in said annular partition and in said shell whereby said jacket is placed in communication with the cooling liquid space within said head; an insulated electrode carried by said insulating member; and a grounded electrode arranged in sparking relation with the inner end of said insulated electrode.

3. In an igniting device of the class described and in combination with a cylinder head having spaced walls whereby a cooling liquid space is formed; an annular partition connecting said walls and so shaped as to provide a large upper chamber open at its upper end, an intermediate ledge, and a lower chamber below said ledge and smaller than said upper chamber, and which lower chamber communicates at its lower end with the interior of said cylinder; a hollow shell secured within said upper chamber and the lower end of which overlies said ledge; an insulating member secured within and spaced apart from the interior of said hollow shell to thereby provide a cooling liquid jacket between the two, and

the lower end of which insulating member extends into the smaller lower chamber aforesaid; registering holes in said annular partition and in said shell whereby said jacket is placed in communication with the cooling liquid space within said head; an insulated electrode carried by said insulating member; and a grounded electrode arranged in sparking relation with the inner end of said insulated electrode.

4. In an igniting device of the class described and in combination with a cylinder head having spaced walls whereby a cooling liquid space is formed; a hollow shell arranged to be cooled by cooling liquid within said cooling liquid space; an insulating member secured within said hollow shell; an insulated electrode carried by said insulating member; and a grounded electrode arranged in sparking relation with the inner end of said insulated electrode and extending through the lower of said head walls and into the cooling liquid space within said head.

5. In an igniting device of the class described and in combination with a cylinder head having spaced walls whereby a cooling liquid space is formed; an annular partition connecting said walls and so shaped as to provide a large upper chamber open at its upper end, and a lower chamber smaller than the upper chamber and communicating at its lower end with the interior of the cylinder; a hollow shell secured within said upper chamber; an insulating member secured within said hollow shell, and the lower end of which insulating member extends into the smaller lower chamber aforesaid; an insulated electrode carried by said insulating member; and a grounded electrode arranged in sparking relation with the inner end of said insulated electrode and extending through the lower of said head walls and into the cooling liquid space within said head.

6. In an igniting device of the class described and in combination with a cylinder head having spaced walls whereby a cooling medium space is formed; a hollow shell arranged to be cooled by a cooling medium within said cooling liquid space; an insulating member secured within and spaced apart from the interior of said hollow shell to thereby provide a cooling liquid jacket between the two; means for supplying a cooling liquid to said jacket, to thereby cool said insulating member by direct contact of a cooling liquid therewith; an insulated electrode carried by said insulating member; and a grounded electrode arranged in sparking relation with the inner end of said insulated electrode.

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