M. KLEIN & H. N. PORTER.

COMBINED SPARK PLUG AND VAPORIZER.

APPLICATION FILED JAN. 26, 1915

1,191,193. Patented July 18, 1916.

Fig. II

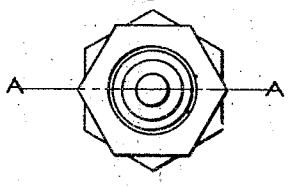


Fig. IV

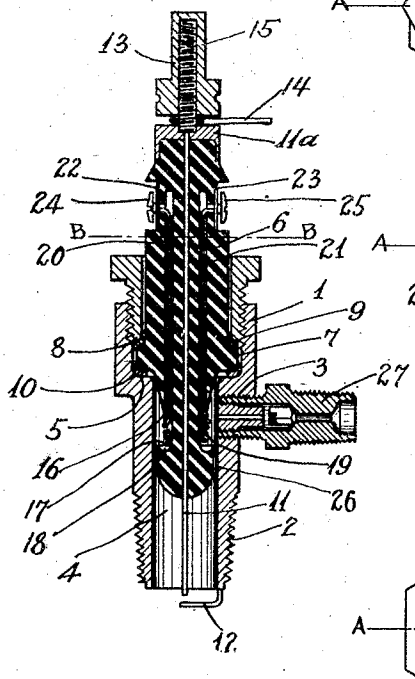


Fig. V

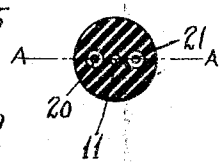


Fig. I

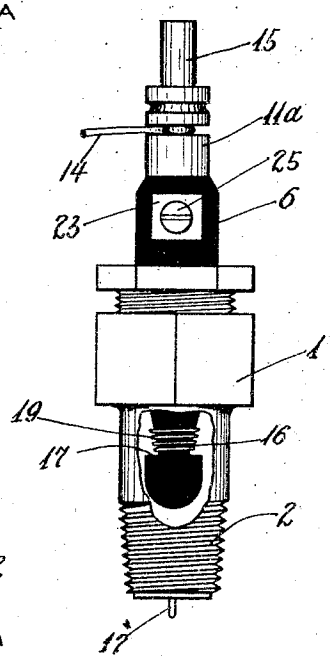


Fig. III

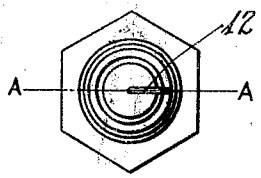


Fig. VI

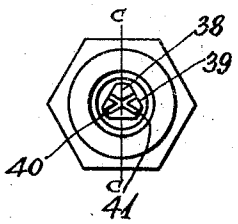


Fig. VII

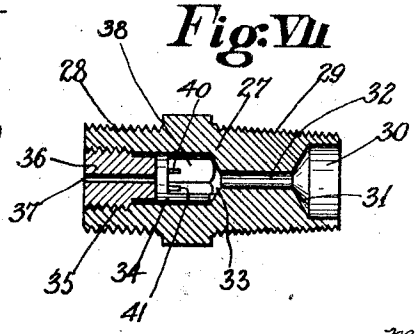
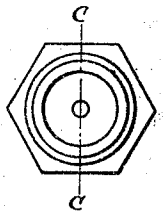


Fig. VIII



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UNITED STATES PATENT OFFICE.

MAX KLEIN AND HUGH N. PORTER, OF DENVER, COLORADO.

COMBINED SPARK-PLUG AND VAPORIZER.

1,191,193. Specification of Letters Patent. Patented July 18, 1916.

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To all whom it may concern:

Be it known that we, MAX KLEIN and HUGH N. PORTER, citizens of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Combined Spark-Plugs and Vaporizers; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to combined spark plugs and vaporizers for internal combustion engines, and has for an object to provide, in a device of the class described, new and improved fuel receiving and containing means.

Another object is to provide an improved and more efficient heating means for vaporizing the fuel.

Another object is to provide an improved means for clearing the spark chamber of soot.

With these and other objects in view the invention comprises certain novel constructions, combinations and arrangements of parts as will be hereinafter more fully described and claimed and as illustrated in the accompanying drawings in which similar characters of reference indicate corresponding parts throughout the several views and in which—

Figure I is an elevation of the spark plug with a portion cut away showing the vaporizing portion of the core. Fig. II is a top view of the plug. Fig. III is a bottom view of the plug. Fig. IV is a vertical section of a spark plug on line A—A Fig. II and also of the valve in place of the plug. Fig. V is a cross section of the core on line B—B Fig. IV. Fig. VI is an enlarged view of one end of the improved valve with plug removed. Fig. VII is an enlarged longitudinal section of the improved valve on line C—C Fig. VI. Fig. VIII is an enlarged view of the other end of the casing of the improved valve.

Our improved spark plug has a casing very similar to those upon spark plugs now in common use. In fact, such commonly used casings may be used in the construction of our invention though it may be found advisable in practice to employ a core of size larger than those in common use thus also requiring a larger casing to accommodate the same.

We provide a casing 1 which may be threaded as at 2 for being screwed into the cylinder of the engine in the usual and well known manner, and provided in its side with a threaded opening 3 for accommodation of the improved valve for admitting fuel as hereinafter described. Within the casing a spark chamber 4 is provided for accommodation of the core and terminals, an annular shoulder 5 being provided at the upper end thereof.

Within the casing 1 we provide our improved core 6 of porcelain or other insulating material, having a shoulder or annular ridge 7 for seating against shoulder 5 and receiving the end of lock nut 8 threaded into casing 1 for retaining the core 6 therein. Washers 9 and 10 may be provided for preventing leakage of pressure from the cylinder. Core 6 carries a sparking electrode 11, one end of which projects and extends to form a spark gap with another suitable electrode as 12 which may be mounted upon and grounded through casing 1. The opposite end of the core 6 is provided with suitable connections as cap 11^a carrying screw 13 with which may be connected a wire 14 leading from a battery or other source of ignition current (not shown and forming no part hereof) held in connection by nut 15 threaded upon screw 13.

The description of the core 6 thus far is simply a description of cores now in use in a variety of spark plugs and any of the parts thus described may be changed without affecting our invention which consists of those features of said core and plug which we shall now describe.

The lower portion of the core 6 is cut away or provided with an annular channel as at 16 forming a shelf 17 which is cupped or grooved out as at 18 to produce a gutter for receiving and retaining fuel. Around the channel above said gutter we provide a heating coil 19 connecting with a battery or other source of heating current through wires 20 and 21 embedded in and carried by the core 6, said wires being provided with suitable plates 22 and 23 and retaining screws 24 and 25, where they leave the core near its upper end. At and below shelf 17

the core is of a diameter smaller than that of chamber 4 so that a space or passageway 26 is left around the core 6 at this point.

It will be noted that by the above construction we provide a heating coil adapted to be directly connected with both poles of the battery or source of current instead of grounding one wire through the engine. Thereby our heating device is rendered more efficient as it is entirely independent of the spark circuit in its action and control.

For supplying fuel to the receiver and heating coil above described it is necessary to provide a valve adjacent the spark plug. The heat from the cylinder is so great that a spring would be detemperized thereby. Accordingly a springless valve is required which will allow fuel to pass into the spark plug but prevent the escape therethrough of back pressure from the cylinder after explosion. For this purpose and in order to make practical the operation of our vaporizer, we provide an improved valve having a casing 27 threaded at one end as at 28 for insertion in opening 3 in casing 1 and threaded at the other end as at 29 for connection with any suitable fuel conduit. The valve casing 27 stands horizontal and is provided with an enlarged bore 30 tapering as at 31 into passage 32 which flares as at 33 to form a seat facing inward toward the valve chamber 34. Valve chamber is formed by counter-boring the passage 32 in the casing 27 and the bore thus formed is threaded as at 35 for receiving threaded plug 36 having passage 37 therein leading from the valve chamber 34 through and out of said plug 36. Within the valve chamber 34 is slidingly mounted the valve piston 38 having one end formed to correspond to the seat 33 so as to close the inlet passage 32 when positioned as shown at Fig VII. Portions of the piston 38 ar cut away, preferably as at 39, so as to leave passageway alongside the valve. The opposite end of the piston is grooved or slotted as at 40 and 41 so as to leave a connecting passageway at all times between outlet passage 37 and the spaces or passageways left the sides of piston 38 by the cutaways 39.

It will be noted that the outlet passage 37 is smaller than the inlet passage 32 so that when passage 32 and valve chamber 34 are filled with fluid under pressure, the fluid will pass out of passage 37 in a jet or stream which will strike core 6 and flow down over coil 19 into cupped shelf 17—18.

Without departing from the spirit of the invention, means other than difference in the relative sizes of the passages 32 and 37 may be used for causing the fuel to flow in a jet or stream or to strike core 6.

In operation, the heating circuit may be closed at any time for letting current through coil 19 for heating it, and fuel admitted from any suitable source through the valve and directed in a jet against core 6 where it floods coil 19 and is heated and vaporized. Any fuel that is not vaporized in passing over coil 19 flows into the gutter 18 where it is retained adjacent the coil and thus heated and vaporized. The vapor thus formed passes out through space 26 around core 6 and envelops the ends of electrodes 11 and 12 at the spark gap at the mouth of the spark chamber 4, and will be ignited by the next spark formed thereat, in the usual manner, thus causing an explosion within the cylinder. The pressure resulting from the explosion will press back through passage 37 with such force as to throw the piston 38 against seat 33 and close passage 32, thus preventing loss of pressure through the valve. It will be seen that each intake stroke of the piston in each cylinder will thus draw in a small charge of gasolene, either raw if it is taken from the feed line or vaporized if it is taken from the carbureter manifold, this charge strikes the coil and is heated and thoroughly vaporized, it flows along the space 26 and through the chamber 4 to the spark gap and drives all particles of soot into the cylinder, and it is exploded by the next succeeding spark and therefore explodes the main charge. In its inrush it scavenges and washes the bore of the casing, and we have found that a spark plug thus equipped will remain clean or at least serviceable for a much longer time than those now in common use. Moreover, a plug of this character is highly efficacious when the engine is cold, as when running in cold weather, when improper carburization is taking place, or when starting. The obvious reason is because the small charge drawn in is both vaporized and heated, even if the plug and cylinder at that time are cold.

It will, of course, be understood that many details of this device may be changed without departing from the spirit of the invention.

We claim—

1. In a combined spark plug and vaporizer, a pair of electrodes spaced to form a spark gap, means independent of the electrodes for producing heat near the spark gap, and means for causing a jet of fuel to come into contact with said heating means for vaporizing the same.

2. In a combined spark plug and vaporizer, a core, a pair of electrodes, a heating coil in proximity to said electrodes, means for causing a jet of fuel to come into contact with said coil for vaporizing the same, and wires from a source of electric current passing through said core independent of the electrodes and connected with said coil.

3. In a combined spark plug and vaporizer, the core and electrodes, heating means

on the core independent of the electrodes, means for causing a jet of fuel to flow over said heating means for vaporizing the same, and other means for receiving such of said fuel as is not vaporized in flowing over said heating means and retaining the same in proximity to said heating means.

4. In a combined spark plug and vaporizer, a casing, a core, fuel-receiving means formed upon said core, and means carried by said core and adjacent said receiving means for vaporizing the fuel therein.

5. In a combined spark plug and vaporizer, a core, a heating coil carried thereon, and means on said core and adjacent said coil for receiving and retaining fuel.

6. In a spark plug, the combination with the casing, and the electrodes spaced to form a spark gap; of a core through which one electrode passes, the core having near its lower end an encircling gutter, a heating coil around said core above the gutter, energizing wires independent of the electrodes leading from said coil upward through the core to a source of electricity, and means for directing fluid fuel against the coil.

7. In a spark plug, the combination with the casing, and the electrodes spaced to form a spark gap; of a core through which one electrode passes, the core having near its lower end an encircling channel with a gutter at its bottom, a heating coil around said channel, energizing wires leading from said coil to a source of electricity, and means for directing fluid fuel against the coil above said gutter.

8. In combination with a spark plug having a hole through one side of its casing, and a core and electrodes; a fluid fuel inlet pipe communicating with said hole, a horizontally movable and outwardly closing check valve within said pipe, and means carried by said core for vaporizing the fluid admitted through said valve.

9. In a spark plug, a casing and a core carrying an electrode and having a portion thereof cut away, combined with wires carried in said core and formed into a coil around said cut-away portion, means for heating said coil, means for injecting fluid fuel against said core for causing it to flow over said coil, and means for receiving such of said fuel as flows below said coil.

10. The combination with a spark plug having a hole through the side of its casing, a core within the casing extending past said hole and provided with an annular channel opposite such hole, and a heating coil lying within the channel; of a pipe leading from a source of fluid fuel supply, a valve casing having one end connected with said pipe and the other end seated in said hole and provided with a jet opening directed toward said coil, and an outwardly closing check valve within said valve casing.

11. The combination with a spark plug having a hole through the side of its casing, and an internal core extending past said hole; of a pipe leading from a source of fluid fuel supply, a valve casing having one end connected with said pipe and the other end seated in said hole and provided with a jet opening, an outwardly closing check valve within said casing, an electric heater carried by the core opposite the jet for vaporizing the latter, and means for energizing said heater.

12. The combination with a spark plug having a hole through the side of its casing, and an internal core extending past said hole; of a pipe leading from a source of fluid fuel supply, a valve casing having one end connected with said pipe and the other end seated in said hole and provided with a jet opening, an outwardly closing check valve within said casing, an electric heating coil encircling the core opposite said jet, and a circuit separate from the sparking circuit connected with said coil.

13. In a spark plug, the combination with the casing, and the electrodes; of a core through which one electrode passes, the core having near its lower end an encircling channel with a gutter at its bottom, a heating coil around said channel, energizing wires independent of the electrodes leading from said coil upward through the core to a source of electricity, and means for directing a jet of fluid fuel against the coil above said gutter.

In testimony whereof we affix our signatures in presence of two witnesses.

MAX KLEIN.
HUGH N. PORTER.

Witnesses:
FRANK D. TAGGART,
CARLE WHITEHEAD.