R. WHITE.

IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES.

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1,356,247. Patented Oct. 19, 1920.

Fig. 1.

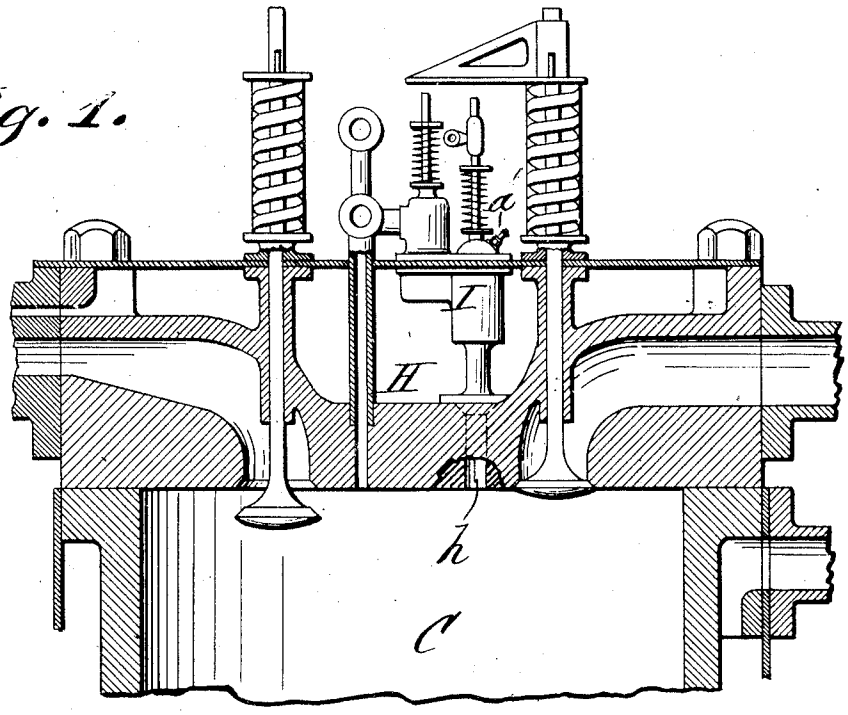
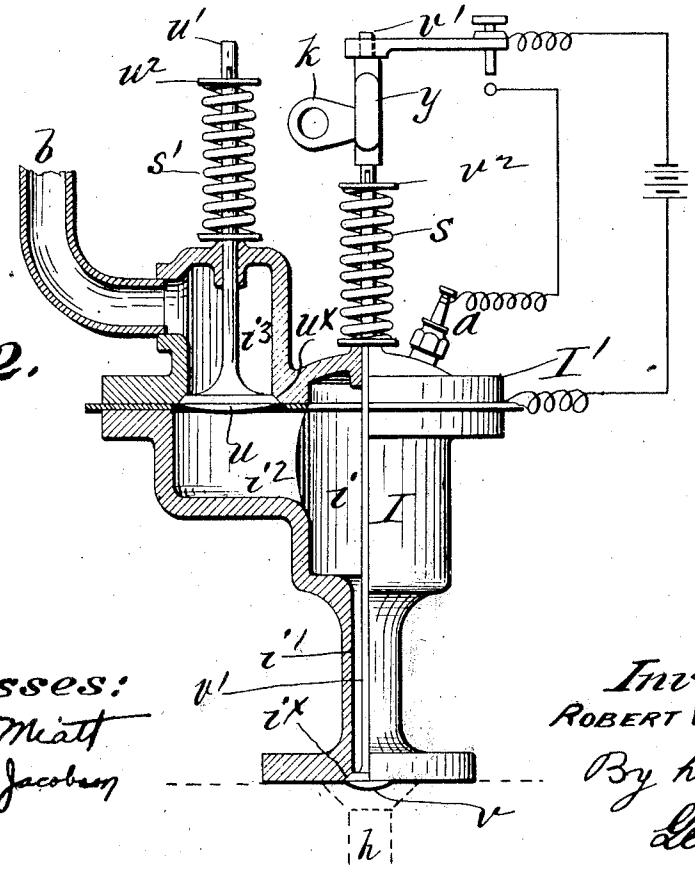


Fig. 2.



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UNITED STATES PATENT OFFICE.

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IGNITION DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,356,247. Specification of Letters Patent. Patented Oct. 19, 1920.

Application filed March 11, 1919. Serial No. 281,988.

To all whom it may concern:

Be it known that I, ROBERT WHITE, a citizen of the United States, and a resident of the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Ignition Devices for Internal-Combustion Engines, of which the following is a specification.

My improvements relate to means for positively effecting the ignition and explosion of charges of vaporized hydrocarbon in the power cylinders of internal combustion engines irrespective of the character or degree of compression imparted to said charges; and incidentally to the protection of the ignition means against danger of fouling or deterioration by carbonization in and by contact with the power charge of hydrocarbon, and the products of combustion resulting therefrom.

It is well known in the art that the main cause of limitation, trouble and failure in internal combustion engines is the fouling of sparking devices, or of incandescent means of firing, and that this difficulty increases with the crudeness of the fuel used and with the degere of compression imparted thereto, to such an extent that it is not possible to effect combustion at high pressures by means of sparking mechanism as heretofore employed.

It is the object of my invention to overcome these difficulties and to not only isolate and protect the sparking means from direct contact with the power charge of hydrocarbon and from the resultant gaseous products of combustion, but also to positively insure the effectual firing and combustion of said power charges irrespective of the grade of fued used, and of the degree of compression imparted thereto,—the invention consisting essentially in the provision and use of a preliminary ignition firing chamber and accessories, in conjunction with the combustion cylinder, in such manner that a jet of incandescent gas is injected into the power charge in the combustion chamber at the most opportune period in the cycle of operations, the preliminary ignition and firing chamber and its operative parts being controlled directly and automatically by the engine itself, all as hereinafter more fully set forth.

In the accompanying drawings,

Figure 1, is a central sectional elevation of a part of an internal combustion power cylinder and of the cylinder head thereunto attached, illustrating the application of my auxiliary ignition and firing chamber thereto;

Fig. 2, is a sectional elevation of the auxiliary ignition and firing chamber and accessory parts.

C, represents the power cylinder of an internal combustion engine in which the force of explosion of hydrocarbon effected therein is imparted to a reciprocatory piston in the usual way, the end of said cylinder being closed by a head H, provided with the usual inlet and discharge ports and valves, and other details and accessories as may be found most expedient, and unnecessary to particularize herein, as my invention relates solely to means for effecting the ignition of the charge of vaporized hydrocarbon after its introduction into said power cylinder C.

With this understanding I, represents my auxiliary or preliminary ignition and firing device, the explosion chamber i, of which communicates with the main combustion chamber or cylinder C, through the firing port h, (Fig. 1) in the head H, said firing port h, being controlled by a valve v, (Fig. 2) on the inner end of the valve stem v', which latter extends through the preliminary ignition chamber i, and through the cover I', thereof, being provided at its outer extremity with a yoke y, engaging with a cam arm k, which is connected with suitable valve gear mechanism actuated by the engine in a manner well known in the art. A spring s, is interposed between a stationary part, as the cover I', of the igniter and a disk v^2 keyed to the valve stem v', and tends constantly to hold the valve v, to its seat i^x, at the end of the discharge passage i', of the ignition chamber i, said passage i', being conincident with the aforesaid firing port h, in the cylinder head H.

A lateral extension i^2, of the explosion chamber i, is made in the casing I, for the accommodation of the inlet valve u, interposed between said explosion chamber i, and the inlet chamber i^3, with which the supply conduit b, communicates directly, said inlet chamber i^3, being formed in the cover I', of the igniter I. The valve stem u', of the inlet valve u, extends through the top of the inlet chamber i^3, and into proper proximity to the engine valve gear actuat-

ing mechanism by which its movements are timed and controlled in conjunction with those of the valve v, governing the firing port h, as hereinbefore stated. A spring s', is interposed between the cover I', and a disk or collar u^2, on the valve stem u', and tends constantly to hold the valve u, to its seat u^x.

a, represents symbolically any desired form of sparking device, either of the spark plug or the make and break ignition type, as may be found most expedient, said sparking device being arranged to ignite hydrocarbon vapor within the incipient explosion chamber i, at the proper time, in unison with the engine valve control.

The gas used in the incipient explosion chamber i, is preferably of a highly volatile nature, such as gasolene, and is also preferably thoroughly carbureted, and stored in a reservoir under suitable pressure, so that it will enter the inlet chamber i^3, from the supply pipe b, at an initial pressure sufficient to purge and scour the chambers and passages of my preliminary ignition and firing device when both the valves u, and v, are opened for the purpose. That is to say, during the operation of the engine, the valves u, and v, are simultaneously opened by mechanism operating the air intake etc., thus permitting the carbureted gasolene under pressure to pass through the inlet chamber i^3, the explosion chamber i, the discharge passage i', and the firing port h, thereby clearing my preliminary ignition and firing device of all residual gases of the last preceding explosion. Both the valves u, and v, then remain closed, confining a suitable incipient firing charge of gasolene within the inlet chamber i^3, explosion chamber i, and discharge passage i', until the firing instant, when the valve v, is opened simultaneously with the ignition of such incipient charge by the sparking device a, with the result that the incandescent gas thus engendered is injected through the firing port h, directly into the mass of the main or power charge of vaporized hydrocarbon in the cylinder, thereby causing the immediate explosion and complete combustion thereof.

There are many practical advantages attained by the use of my auxiliary and incipient ignition and firing device. In the first place, the use of the common spark plug is made feasible, or the use of a make and break ignition system is made possible, without either of them being liable to interference or deterioration from the combustion of the main or power charge of vaporized hydrocarbon, no matter what the grade of fuel oil from which it is derived,—it being understood that the sparking device a, as indicated in the drawings is used symbolically for any desired or suitable spark ignition device, as hereinbefore intimated. Furthermore the degree of compression in the cylinder C, does not affect the operation of the ignition means, as this is in a separate chamber and connected with the cylinder only by suitable passages under valvular control. Hence, also, the use of my preliminary ignition and firing device and system will give absolute time control, and will obviate interference from carbonization or other fouling; and will also inject a large predetermined volume of heat in the form of incandescent gas directly into the mass of hydrocarbon vapor within the combustion cylinder C, exploding the same instantaneously, and effecting its complete combustion in such manner as to utilize its full calorie value in the production of motive power. And the ignition and firing of the incipient charge of highly volatilized and carbureted gasolene is effected in unison with the engine valve control irrespective of the degree of pressure within the cylinder C, so that heavy fuel and relatively high degrees of compression may be effectually used with absolute certainty, increasing the scope and capacity of internal combustion engines as a class, and extending the field of utilization therefor.

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

1. In combination with the power cylinder of an internal combustion engine of the character designated, an auxiliary ignition and firing chamber communicating with said power cylinder through a valve-controlled discharge port, and a sparking device for igniting an incipient charge of gas in said auxiliary chamber, together with means opening said valve simultaneously with the ignition of the incipient charge by the sparking device, whereby a firing charge of incandescent gas is injected into the hydrocarbon charge in the said power cylinder, for the purpose set forth.

2. In combination with the power cylinder of an internal combustion engine of the character designated, an auxiliary ignition and firing chamber communicating with said power cylinder through a valve-controlled discharge port, said discharge port and valve, and an inlet valve for admitting gas to said auxiliary ignition and firing chamber, and means for opening and closing both of said valves simultaneously for the purpose of purging said auxiliary chamber and passages as set forth.

3. In combination with the power cylinder of an internal combustion engine of the character designated, an auxiliary ignition and firing chamber communicating with said power cylinder through a valve-controlled discharge port, said discharge port and valve, and an inlet valve for admitting gas to said auxiliary ignition and firing

chamber, means for opening and closing both of said valves simultaneously for the purpose of purging the said auxiliary chamber and passages, a sparking device for igniting an incipient charge of gas in said auxiliary chamber, and means for opening said valve in the discharge port simultaneously with the ignition of the incipient charge by the sparking device, whereby a firing charge of incandescent gas is injected into the hydrocarbon charge in the power cylinder, for the purpose set forth.

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