E. H. TARTRAIS.

EXPLOSION ENGINE WORKING UNDER INJECTION OF LIQUID FUEL.

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1,414,384. Patented May 2, 1922.

Fig. 1

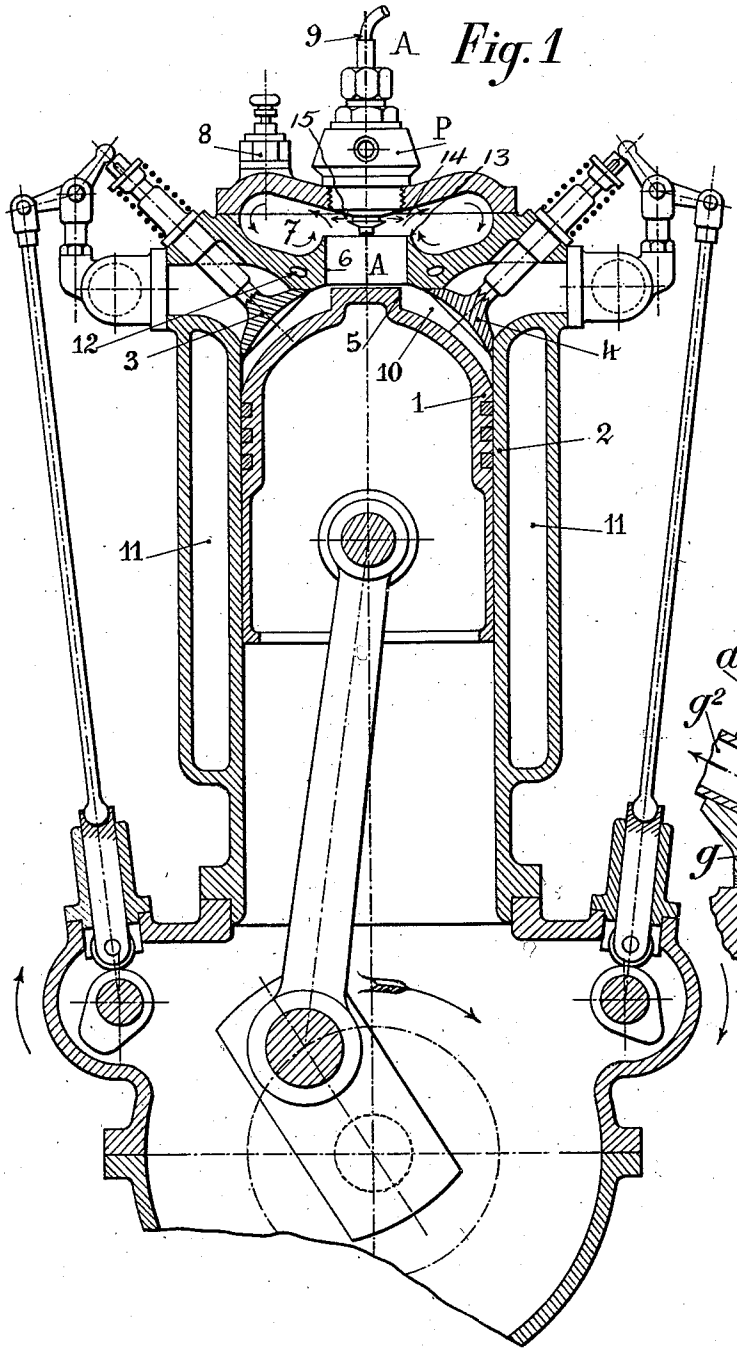
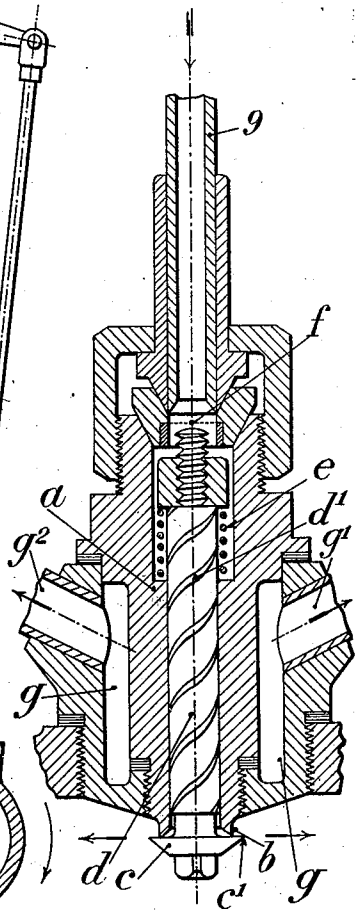


Fig. 2



Inventor

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by

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UNITED STATES PATENT OFFICE.

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EXPLOSION ENGINE WORKING UNDER INJECTION OF LIQUID FUEL.

1,414,384. Specification of Letters Patent. Patented May 2, 1922.

Application filed November 21, 1918. Serial No. 263,582.

To all whom it may concern:

Be it known that I, EUGÈNE HENRI TARTRAIS, citizen of the Republic of France, residing at 3 Rue de Mexico, Maisons-Laffitte, Seine-et-Oise, in the Republic of France, have invented new and useful Improvements in Explosion Engines Working Under Injection of Liquid Fuel, of which the following is a specification.

This invention has for its object the provision of an explosion engine working under high compression and in which liquid fuel is injected into the cylinder shortly before the fuel is to be ignited. It involves special means, which will be clearly hereinafter described to spread, atomize, and vaporize the fuel and mix same with air.

In my improved engine, ignition is effected when starting by means of any suitable firing device. Later on, when the engine is hot, ignition is due at the same time to the high temperature of the combustion chamber, the heat due to compression and eventually the aforesaid igniter which remains red hot owing to the repeated explosions.

In the accompanying drawing: Fig. 1 shows an example of construction of the motor assumed to be a four stroke one, in section at right angles to the shaft and passing through the axis of the cylinder, the parts being shown in a position slightly before the end of the second stroke, (compression) that is to say a little before ignition.

Fig. 2 is a section drawn on a larger scale on line A—A of Fig. 1.

Referring to Fig. 1, 1 it the piston, 2 the cylinder, 3 the outlet valve and 4 the inlet valve.

At the top of the piston, there is provided a cylindrical extension 5. Said extension is designed at the end of the stroke, to enter a passage 6 of the cylinder without exactly fitting into same. The passage 6 leads to a chamber 7 supporting an ignition plug 8 and an atomizer P for the injected liquid fuel entering at 9.

Between the piston 1 and the cylinder 2, is formed, in the position shown, a chamber 10 the purpose of which will be explained later; said chamber will have a volume practically equal to zero when the piston has reached the end of its stroke. At 11, is shown the water cooling jacket of the cylinder. The atomizer for injected liquid fuel will preferably be of the type shown in detail in Fig. 2, and fully described in my copending application for Letters Patent filed November 21, 1918, Serial Number 263,581. It comprises a valve body a to be secured onto the engine, a knife shaped valve seat b formed by the inner edge of the valve body, a valve c with a flat bearing surface having a thinned or sharpened edge c^1, a valve rod d fitting without play into the valve body and provided with grooves d^1 for allowing the liquid to pass, a return spring e, a joint connecting the valve body to the pipe 9 carrying the liquid injected at the proper time by a fuel pump of any known type, a filter f for the liquid and a chamber g surrounding the valve body together with an inlet pipe g^1 and an outlet pipe g^2 for providing a cooling circulation around the valve body.

The operation of the engine is as follows:

When the extension 5 engages the passage 6, (position of Fig. 1) there is a transfer of compressed air from 10 into 7 through the annular space between 5 and 6. At the same time, a certain quantity of liquid fuel is injected by the atomizer and equally, radially distributed in all directions. The air transferred from 10 into 7 produces in 7 an eddy in the direction of the arrows which enables an intimate mixture with the injected fuel to be obtained. On the other hand, said movement tends to project the liquid parts of the fuel against the wall of the chamber 7 and said wall is purposely kept hot as far as possible. It will be seen in the drawing that the upper part is without water. In the example shown, the lower part is cooled, as will be seen at 12, because of the presence of the valves at that part of the casing. It could be otherwise done and, particularly, it would be possible to coat said part with an athermanous lining. By these means, the vaporization of the whole fuel is hastened.

It will be seen that the inner rounded part of the torus shaped chamber 7 is provided with a sharp edge 13. By this means any fuel which may have crept along the wall of the chamber on account of the rotating movement above mentioned and is not yet vaporized is more easily caught by the air stream which still flows from the working chamber 10 to the combustion chamber 7 as shown by the arrows 14, as already explained. A thick edge might give rise to a dead quiet space in which the combustible liq-

uid might stay for a while at least when the engine is not yet quite hot.

It has been said that the ignition on starting is obtained by means of any suitable igniter. The construction shown has for its effect to render the working of said igniter easier since it will be seen that the fuel projected in the direction of the arrows 15 reaches directly the igniter as, at that time, the speed of the engine being low, the action of the whirling air is not very efficient. This is however only of advantage when starting is effected with a non volatile fuel.

It is to be noted that, in order to provide for speed regulation, it will be possible to vary the advance in the injection of the fuel, said variable advance performing the same function as the variation in ignition in the ordinary explosion engines.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An explosion engine working under injection of liquid fuel and comprising in combination: a cylinder, means for cooling said cylinder, means in the wall of said cylinder for effecting the suction of air and the exhaust of burned gases, an uncooled combustion or explosion chamber provided outside the cylinder and coaxially with the latter and having a substantially toroidal form, its central part constituting a capacity in which a liquid fuel distributer atomizer extends axially and uniformly distributes the atomized fuel in radial directions about its axis, a passage in the center of the cylinder head, said passage opening axially into the explosion chamber, a piston working in the cylinder and an extension provided on the face of said piston in line with the opening in the head of the cylinder and having a section somewhat less than that of said opening, said extension entering said opening at the end of the stroke and causing the rapid flowing, into the explosion chamber, of the air compressed between the piston and the head of the cylinder, and an igniter substantially as described and for the purpose specified.

2. An explosion engine working under injection of liquid fuel and comprising in combination: a cylinder, means for cooling said cylinder, means in the wall of said cylinder for effecting the suction of air and the exhaust of burned gases, an uncooled combustion or explosion chamber provided outside the cylinder and coaxially with the latter and having a substantially toroidal form, its central part constituting a capacity in which a liquid fuel distributer atomizer extends axially and uniformly distributes the atomized fuel in radial directions about its axis from a point substantially on a level with the middle of the height of the explosion chamber, a passage in the centre of the cylinder head, said passage opening axially into the explosion chamber, opposite the fuel atomizer and at a point substantially on the level with the middle of the height of the explosion chamber, an ignition plug, a piston working in the cylinder and an extension provided on the face of said piston opposite the opening, in the cylinder head and having a section somewhat less than that of said opening, said extension entering said opening at the end of the stroke and causing the rapid flowing into the explosion chamber of the air compressed between the piston and the head of the cylinder, substantially as described and for the purpose specified.

3. An explosion engine working under injection of liquid fuel comprising, in combination: a cylinder with a cooling jacket, means for effecting the suction of air and the exhaust of burned gases, an uncooled combustion or explosion chamber having substantially the form of a tore, placed outside the cylinder symmetrically with respect to the axis of said cylinder, there being an opening or passage in the center of the head of the cylinder in line with the axis of the explosion chamber;—a liquid fuel distributor atomizer extending axially into the explosion chamber opposite the opening in the head of the cylinder,—said atomizer embodying a valve the head of which presents a flat bearing surface with a sharp edge resting against a knife shaped seat, placed at the atomizer exit, at right angles to the liquid jet, in order that said liquid may be radially distributed all round the explosion chamber,—an ignition plug,—a piston working in the cylinder and an extension provided on the head of said piston opposite the opening in the head of the cylinder and having a section somewhat less than that of said opening, said extension entering said opening at the end of the stroke and causing the rapid flow into the explosion chamber of the air compressed between the piston and the head of the cylinder, substantially as described and for the purpose described.

4. An explosion engine working under injection of liquid fuel and comprising a combination: a cylinder with cooling jacket, means in the wall of said cylinder for effecting the suction of air and the exhaust of the burned gases, an uncooled combustion or explosion chamber having substantially the form of a tore, placed outside the cylinder, symmetrically with respect to the axis of said cylinder, said tore shaped chamber having a sharp inner edge, there being an opening or passage provided in the center of the head of the cylinder and in line with the axis of the explosion chamber, a liquid fuel distributor extending axially into the explosion chamber opposite the opening in the head of the cylinder and adapted to uniformly distribute the atomized fuel in radial directions about

its axis, in a substantially plane film passing above the inner edge of the tore shaped chamber, an ignition plug placed in the peripheral part of the explosion chamber so that the incandescent part of said ignition plug may be reached directly by the atomized fuel projected by the distributer, a piston working in the cylinder and an extension provided on the face of said piston opposite the opening in the cylinder head and having a section somewhat less than that of said opening, said extension entering said opening at the end of the stroke and causing the rapid flowing into the explosion chamber of the air compressed between the piston and the head of the cylinder, substantially as described and for the purpose set forth.

In testimony whereof I have signed my name to this specification.

EUGÈNE HENRI TARTRAIS.