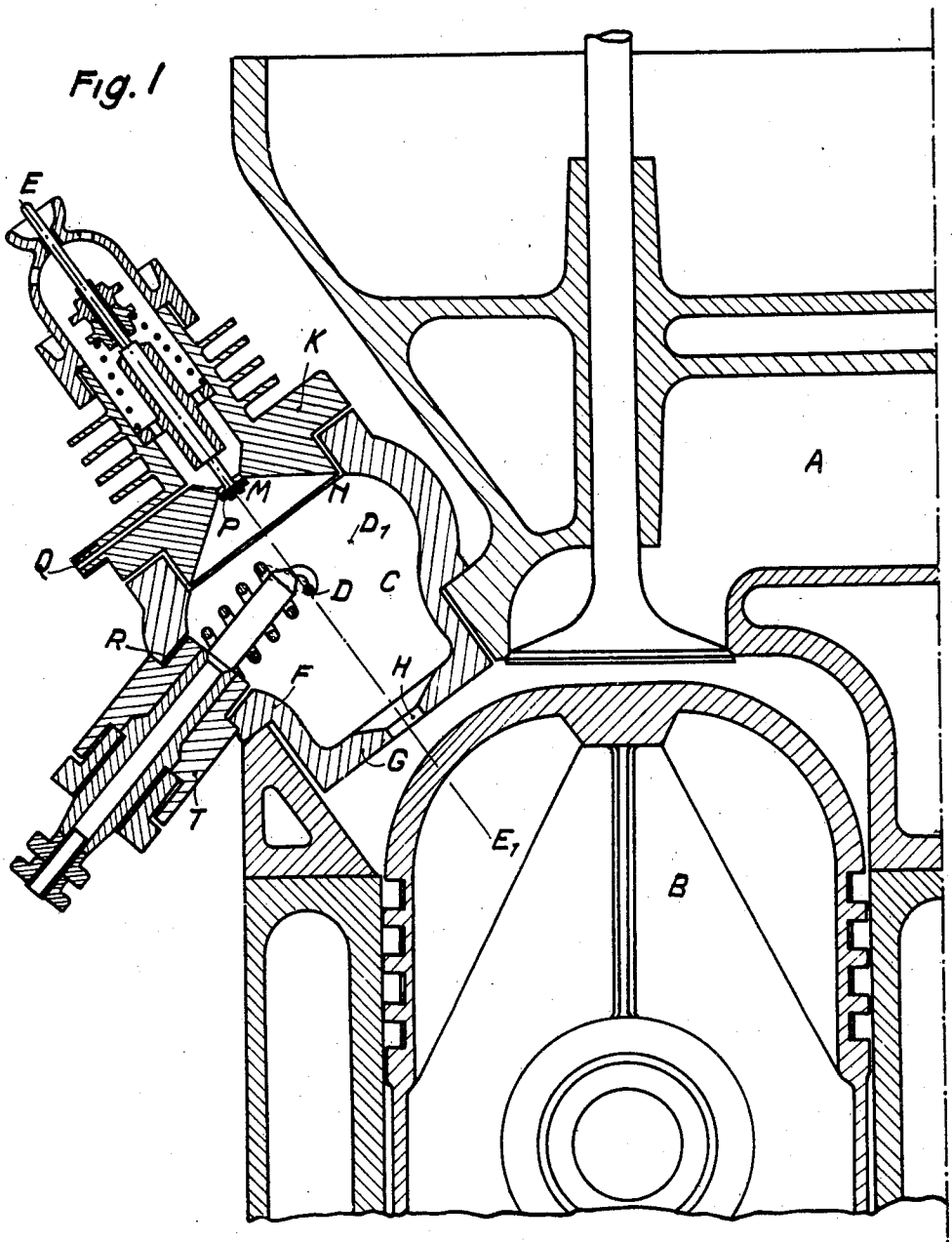
May 30, 1933. A. BAGNULO 1,912,057

LIQUID FUEL ENGINE

Filed Nov. 17, 1928 3 Sheets-Sheet 1

Fig. 1



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Filed Nov. 17, 1928 3 Sheets-Sheet 2

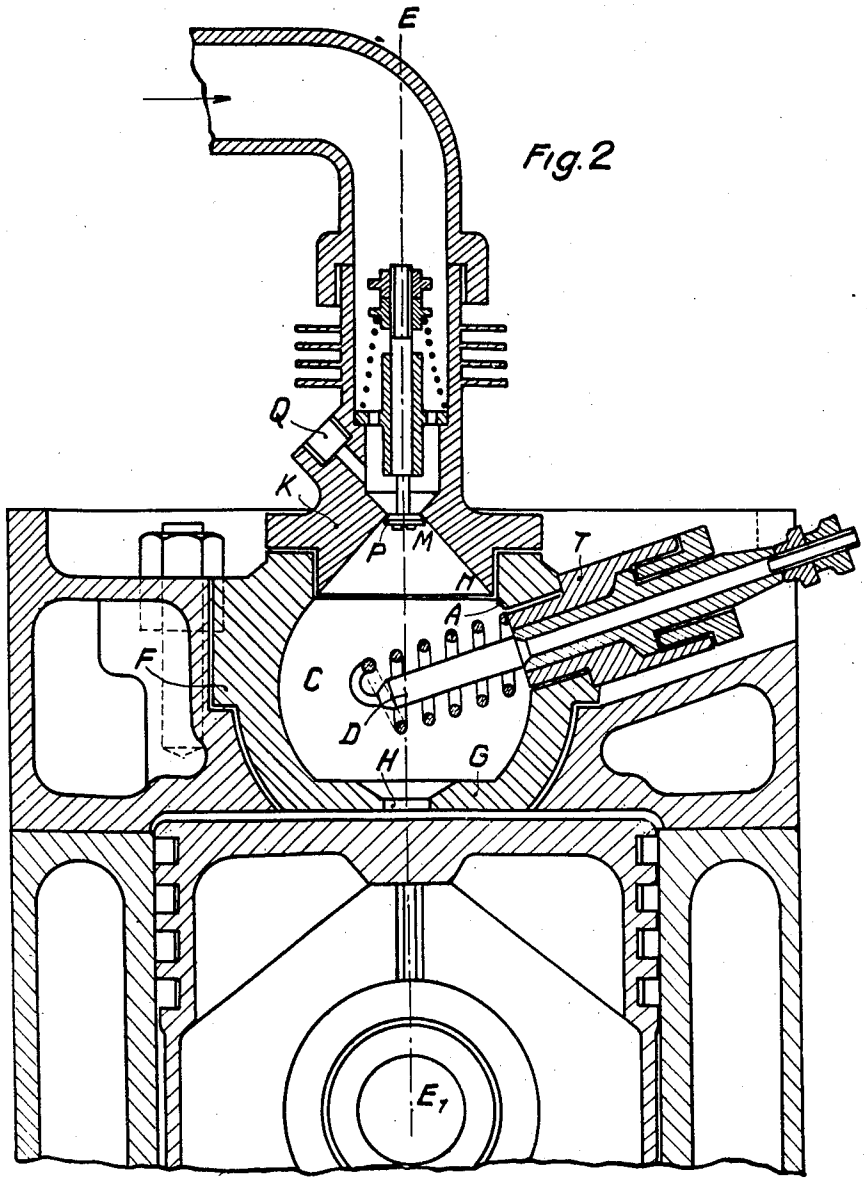


Fig. 2

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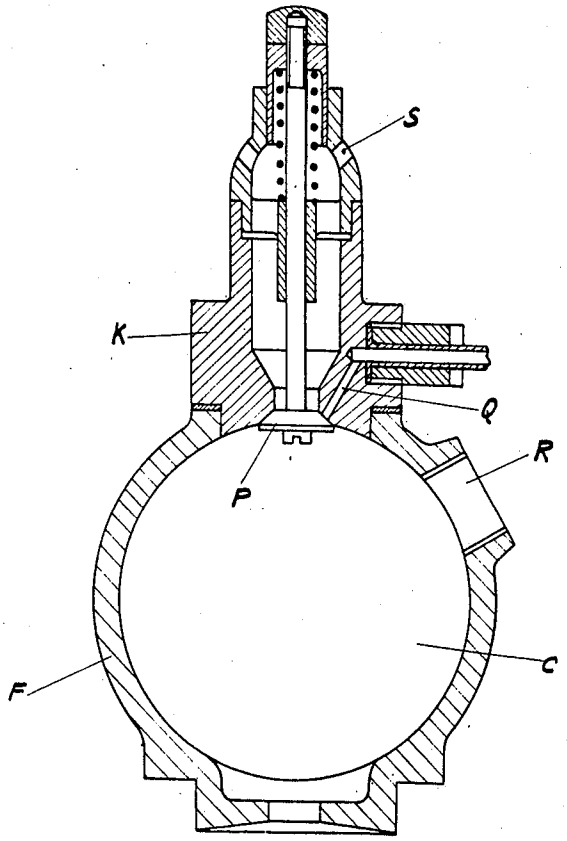


Fig. 3.

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LIQUID FUEL ENGINE

Application filed November 17, 1928, Serial No. 320,176, and in France November 17, 1927.

The present invention has for its principal objects:

1. To improve and simplify pulverization, vaporization and ignition in liquid fuel engines.

2. To apply electric heating.

3. To concentrate the entire carbureting, preheating and combustion at a maximum in the combustion chamber, to increase the specific power of the engine and to permit an increase in angular speed of rotation.

In the accompanying drawings given by way of example, Figure 1 shows the application to a four cycle engine; Fig. 2 shows the application to a two cycle engine; and Fig. 3 shows a manner of realization of fuel injector.

A designates the head of a cylinder of an engine in which is located the normal pure air suction valve and the exhaust valve if the engine is of the four cycle type.

B designates the piston which almost touches the bottom of the head of the cylinder.

C is the vaporization chamber, which is approximately bell shaped. This chamber C is placed upon the head of the engine between the normal distribution valves if the engine is of the four-cycle type, as shown in Fig. 1, and at the center of the head of the motor if it is of the two-cycle type as shown in Fig. 2.

The chamber C comprises a part of its surface in the form of a surface of revolution obtained by rotating around the axis of the chamber C an arc of a circle disposed in a plane containing this axis. In the case of Fig. 1 the surface of revolution is a toroid, the arc of the circle having its center at D^1, in the case of Fig. 2 it represents a sphere with the center at D. The chamber, as mentioned previously, is placed upon the head of the cylinder according to a vertical axis $E—E^1$ (Fig. 2) or inclined to the axis of the engine cylinder (Fig. 1). The two polar spherical segments perpendicular to this axis $E—E^1$ are omitted. At its lower portion and by its base F the chamber is screwed down to the head of the engine. On this end is located a diaphragm G with a central hole H. In the upper segment is fixed an injector K which serves for the introduction of fuel. This injector is of a conical shape in its lower portion and the generatrix M—N of the cone is tangent to the curved surface of the chamber as formed by revolving an arc of a circle. At the center of this cone is located a valve P retracted by a spring and set into communication with the atmospheric air in the case of a four-cycle engine (Fig. 1) and with scavenging air in the case of a two-cycle engine (Fig. 2). This small valve may be opened by the suction of the engine or be controlled by known means. The fuel arrives by way of the spray nozzle Q above the valve P as in Figs. 1 and 2, or in the seat of the valve, as in Fig. 3. This fuel may arrive by gravity or be injected by any suitable mechanical means.

In the wall of the sphere is formed a hole R wherein is screwed a heating plug T of electrical resistance. The hot point of this plug coincides with the center or fire-zone of the sphere.

The operation is as follows:

The fuel is delivered by suitable means to the spray nozzle M of the injector K (Figs. 1 and 2).

The fuel, during the phase in which the valve P of the injector K is closed, is deposited above the valve P in a determined quantity.

In the phase of suction of the four cycle engine (Fig. 1) the valve P opens automatically under the effect of the depression produced in the cylinder, or by a suitable member, in the case of a mechanical control. At this moment the fuel is drawn violently into the interior of the sphere C under the effect of the introduction of atmospheric air, assuming that the upper portion of the valve is in communication with the atmosphere.

The valve P has a small lift and consequently, the fuel is subjected to intense pulverization for the length of the wall M—N of the cone tangent to the surface of the chamber. Then occurs the compression phase during which the air of the cylinder is forced through the hole H of the diaphragm in the interior of the chamber, thus completing the

pulverization of the fuel which is at the same time vaporized.

There is formed, consequently, a very intimate mixture which burns and produces the expansion phase.

In the case of the two cycle engine (Fig. 2), the introduction of the fuel is brought about in the same manner as previously across the spray nozzle Q by the valve P. At the moment when the exchange of gases takes place in the cylinder chamber, that is to say towards the end of the expansion period, a portion of the scavenging air under pressure passes above the valve P and forces the fuel in the chamber.

Obviously, before running the engine, the chamber C should be heated.

The heating plug T is subjected to the passage of electric current, which by reason of the resistance heats the metal and transmits the heat by radiation very rapidly into the sphere, this plug is in practice placed in the firing region of the chamber. Once the motor is started the current of the plug may be cut off.

It has been explained that the fuel is led into a space embodied above the injector valve, where it accumulates at atmospheric pressure until opening of the valves. For engines other than stationary, for example marine engines, this device may present the disadvantage of unequal feed to the cylinder block, according to the inclination of the engine at the moment of injection.

According to the present invention the inlet of the fuel supply projects into the seat of the admission valve, and under its bearing.

The invention will be better understood by means of Fig. 3 which represents by way of nonlimitative example one manner of realization. Retaining the notations adopted above, F represents the body of the vaporization chamber C. Upon this body is fixed the injector K, of which the interior cavity communicates freely with the atmosphere by way of air holes S and may communicate with the interior of the vaporization chamber by way of the opening which the valve P controls. This valve may be automatic or controlled. In the seat of this valve projects the conduit Q for the fuel lead. Several conduits may moreover be distributed at various points of the seat of the valve or a circular neck may be provided at the surface of the seat. The conical shape for the bearing of the valve is generally advantageous since it ensures an oblique direction for the streams of injected fuel. The flat shape of the valve may moreover be equally advantageous. R represents the orifice reserved for the introduction and the mounting of the heating plug.

The invention is of course susceptible of numerous variations apart from those expressly indicated by way of example of achievement, as to the shape, the method of control and the association of the different members which form the object thereof, and it is not intended to impose any limitation upon the scope of my invention except as specified in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In an internal combustion engine, a vaporization chamber of which one portion is a surface of revolution generated by rotating about an axis an arc of a circle co-planar with said axis, means for injecting a conical jet of the fuel simultaneously with a small quantity of air substantially along the walls of said chamber, means for supplying the said injection means with fuel, and electrical means for heating the interior of said chamber.

2. In an internal combustion engine, a vaporization chamber, an injector introducing the fuel, said injector being mounted at the extremity of said chamber, the interior surface of said injector being conical and tangential to that of the chamber, the assembly of these surfaces forming a surface of revolution circumscribed about an axis, a fuel admission portal, a valve of small lift controlling the admission of fuel together with a small quantity of air and directing the jets of fuel substantially along said conical surface, said axis passing through said admission valve, and electrical heating means in the interior of said chamber.

3. In an internal combustion engine, a vaporization chamber of which one portion is a surface of revolution generated by rotating about an axis an arc of a circle co-planar with said axis, an injector for introducing the fuel together with a small quantity of air, the interior surface of said injector being conical and tangential to the surface of the chamber, said injector being mounted upon said chamber and including a fuel supply opening and a valve of small lift communicating with said fuel supply opening disposed at the apex of said conical surface and directing the jets of fuel substantially along said conical surface, and electrical heating means in the interior of said chamber.

4. In an internal combustion engine, in combination, a vaporization chamber, an injector of which the surface is tangential to that of the chamber, means comprising a small lift valve for injecting the fuel, together with a small quantity of air substantially in the form of a conical jet along the walls of said injector, said valve having a space immediately thereover communicating with said injecting means, and electrical means for heating the interior of said chamber.

5. An internal combustion engine compris-

ing in combination a vaporization chamber of which one portion consists of a geometric surface having a center of symmetry and generated by rotating about an axis an arc of a circle co-planar with said axis, a fuel injection device in the said chamber, said fuel injection device comprising means for directing sprays consisting of conical jets of fuel together with a small quantity of air substantially along the walls of said chamber, means for supplying fuel to the said injection device, and electrically energized means for heating the fuel comprising a resistance heating plug, the hot point of said plug coinciding with the center of symmetry of said geometric surface of the vaporization chamber.

6. In an internal combustion motor, a vaporizing chamber of which one part consists of a geometric surface having a center of symmetry and generated by rotating about an axis an arc of a circle co-planar with said axis, an injector having its surface tangent to that of the said chamber, a valve of small lift which opens inwardly with reference to said chamber against the action of a restraining spring, said chamber communicating with the interior of the motor cylinder, said valve communicating on its rear side with the atmosphere, and electric heating means mounted substantially at the center of symmetry of said geometric surface.

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