June 20, 1933. J. PUURMANN 1,914,787

INTERNAL COMBUSTION ENGINE

Filed Sept. 11, 1930

Fig. 1.

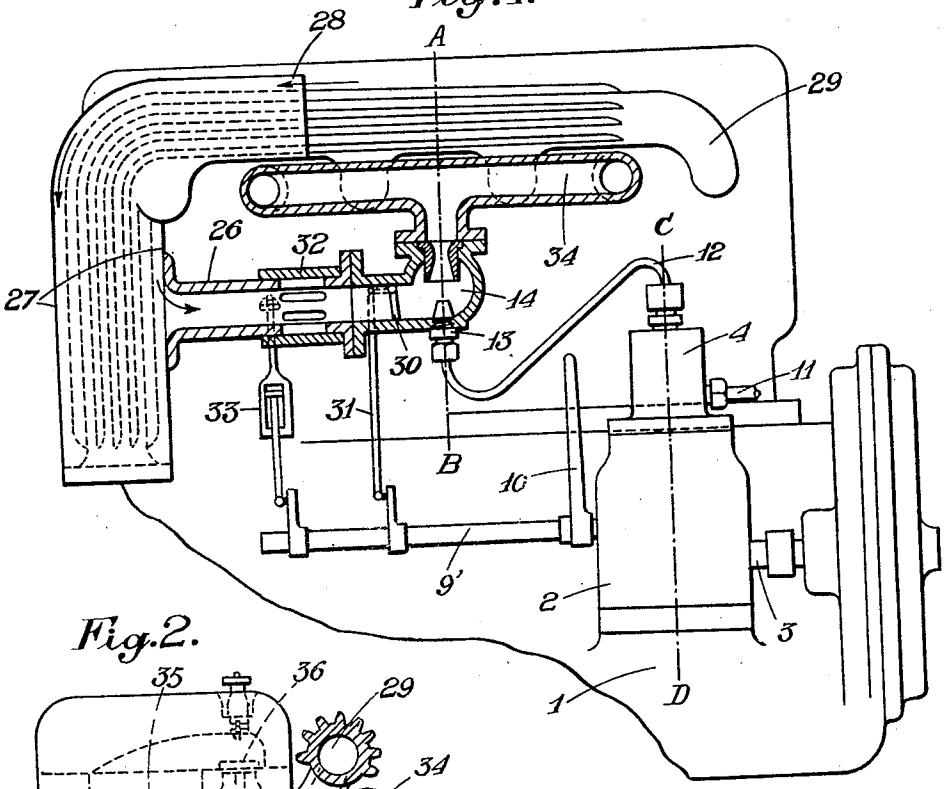

Fig. 2.

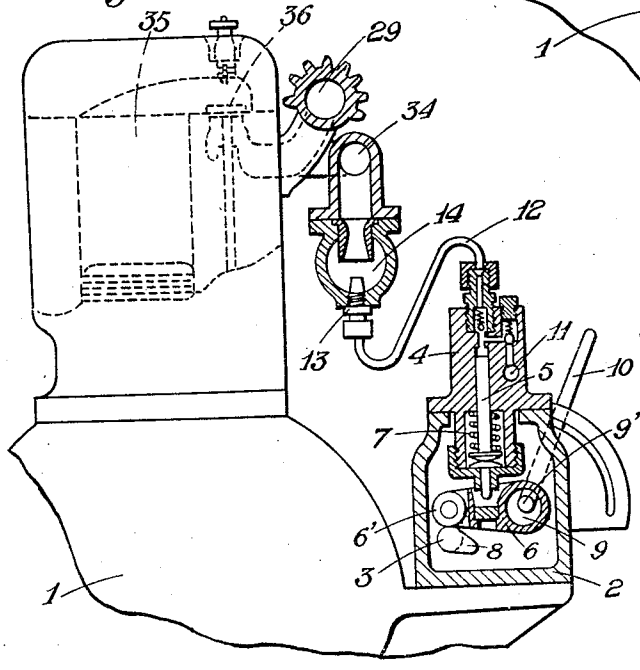

Fig. 3.

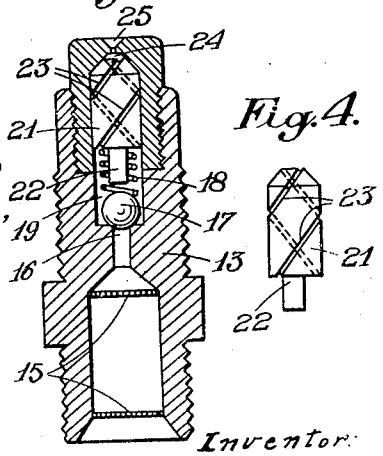

Fig. 4.

Inventor:
Juri Puurmann,
By E. F. Neuderoth
Atty

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JURI PUURMANN, OF BRUSSELS, BELGIUM

INTERNAL COMBUSTION ENGINE

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This invention refers to a carburation device for use within internal combustion engines, which allows ordinary petrol motors to be driven by means of fuels heavier than petrol such, for instance, as paraffin, gas and crude oils &c.

According to this invention, the supply of fuel atomized under very high pressure into a carburation chamber opening directly into the inlet manifold, on the one hand, and the delivery of air to the carburetion chamber, on the other hand, are simultaneously regulated by means of a common control acting upon the fuel pump and the air inlet valve. In this way, although the fuel is atomized under pressure, its supply may constantly be kept in inverse ratio to the vacuum created by the motor in the carburetion chamber and be controlled by the air throttle, carburetion thus being effected at all times under the most favourable conditions.

The best results are obtained by the use of an atomizer comprising a check valve and narrow helical ducts through which the fuel is forced at high pressure (25 to 150 atmospheres, for instance) into a very small frusto-conical chamber (of a capacity of 1 or 2 cubic millimeters for example) opening into the carburetion chamber by a capillary hole, flared towards said chamber. After whirling in the frusto-conical chamber, the fuel gushes from this hole in the form of a fan-like jet of extremely fine mist.

The check valve prevents pulsations from arising in the atomizer, whose result might be to disturb its delivery and to cause the fuel to flow out in the form of non atomized drops.

The carburation chamber is preferably of a flaring shape corresponding with that of the jet of mist, in order that the latter may be completely incorporated into the air before touching any wall.

The unusual height of pressure used for driving the fuel through the capillary ducts of the atomizer permits of the heaviest fuels being converted into a mist capable of complete combustion in the motor cylinders. In certain cases, the air used may be preheated by any known means, in order to assist carburation.

In order that the invention may be clearly understood, one form of construction will now be described as an example, with reference to the accompanying drawing in which:

Fig. 1 is a general diagrammatic side view of the carburation device fitted to an ordinary four cylinder engine, the carburation chamber and air supply pipe being shown in axial section.

Fig. 2 is a cross section of the same device, taken through the carburation chamber on line A—B and through the fuel pump on line C—D of Fig. 1.

Fig. 3 shows a greatly enlarged vertical section of the atomizer of which

Fig. 4 shows a separate part.

On one side of the engine crank-case 1 is fitted a high pressure pump 2 which may be driven by the engine crankshaft through an appropriate transmission and a shaft 3. This pump comprises one or more cylinders 4 in each of which works a plunger 5, substantially of the size of a pencil, reciprocated by a bell crank 6 and a check spring 7. A cam 8 on driving shaft 3 strikes a roller 6′ on the free end of bell crank 6, whose middle portion actuates the plunger and whose other end oscillates round an eccentric 9.

By means of a lever 10 which controls eccentric shaft 9′, the fulcrum of the bell crank may be raised or lowered and the stroke of the plunger 5 and, consequently, the output of the pump may be regulated as desired. The plunger sucks fuel through a duct 11 fitted with a check valve (not shown) and drives it, at a pressure which may reach or exceed 150 atmospheres, through a valve and into a pipe 12 leading to the atomizer 13, which feeds the atomized fuel to a carburetion chamber 14 connected with the inlet manifold without the interposition of any valve.

Within the atomizer 13, the fuel passes through a filter 15 and a constricted duct 16, it raises a ball-valve 17 fitted with a spring 18 and enters a cylindro-conical chamber 19 contained partly in the body of the atomizer and partly in a plug 20 screwed into the body of the atomizer. Chamber 19 contains a needle 21, likewise cylindro-coni-

cal, fitted with a tailpiece 22 which acts as stop for ball 17 and as guide for spring 18. The needle 21 closes the bottom of chamber 19 and only allows fuel to pass through two narrow helical grooves 23 cut in its outside surface and ending in a very small frusto-conical chamber 24 in which the fuel is whirled before escaping as a spray of mist through a capillary hole 25, provided at the apex of chamber 24. Said hole 25 is flared outwards and the spray of mist therefore spreads in the carburetion chamber 14, whose shape lends itself to such expansion.

In the form of construction shown, the carburetion chamber 14 receives, through duct 26, air preheated in a housing 27, to which it is admitted through a sieve 28 and in which it is warmed by contact with the engine exhaust manifold 29 before entering duct 26. The inflow of air to the carburetion chamber is controlled by a throttle valve 30, positively connected by link 31 with lever 10, which governs the flow from the pump (Fig. 1).

An additional cold air inlet may be branched on duct 26 and controlled by a rotary sleeve valve 32, connected with lever 10 by means of a delayed action link 33, whose effect is to delay the opening of sleeve valve 32 in relation to that of butterfly valve 30.

Air admitted to chamber 14 mixes intimately with the mist of fuel and the carbureted mixture is sucked direct into the engine inlet manifold 34, whence it enters the various cylinders 35 through the usual inlet valves 36.

The air preheater 27 may also surround the inlet manifold 34, so that the carbureted mixture is further warmed before entering the motor cylinders. When the design of the motor is suitable, the inlet manifold may be enclosed centrally inside the exhaust manifold and the air heating housing may surround the latter, space being gained thereby. In order to increase the suction power of the engine, a choke tube may, in certain cases, be fitted between the carburetion chamber 14 and inlet manifold 34. It may also be desirable to make use of two atomizers 13 of different outputs, one being for normal running and the other for slow running.

The actuation of the carburetion device is wholly controlled by pump lever 10, which may be connected in any suitable manner, with an accelerator pedal, for instance. Depression of lever 10 accelerates the engine by increasing the output of pump 9 and consequently the quantity of fuel-mist emitted from atomizer 13.

Simultaneously, link 31 opens in equal ratio the throttle valve 30 which, in the absence of any valve between the carburetion chamber and the inlet manifold, is the only member giving control of the vacuum created by the motor in that chamber. This degree of vacuum is therefore always in inverse ratio to the feed of fuel, whatever may be the speed of revolution of the motor.

Valve 32, controlling the admission of cold air, only begins to open when link 33 is at the end of its stroke i. e. when the acceleration has reached the point when the temperature of the air to be carbureted may be reduced in order to increase power.

When gears are changed, check-valve 17 of the atomizer prevents pulsations or oscillations of the liquid column from reaching the atomizer and causing the fuel to emerge from hole 25 in the shape of drops.

The great advantage of the device according to this invention resides in the fact that it may be adapted to any existing gasolene engine in order to drive the same by means of paraffin or other heavier fuel cheaper than petrol, without requiring any substantial alteration of the engine. The device could, of course, also be embodied in an engine specially built to receive it, in which case it might still be further simplified. Furthermore, the form of construction herein described and illustrated does not limit the scope of the invention and it can be modified without departure from its principle.

I claim:

1. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber opening direct into said manifold, an atomizer for liquid fuel opening into said chamber, means for controlling the delivery of fuel into said atomizer, an air conduit opening into said chamber, a hot air supply and a cold air supply for said conduit, means for controlling the ratio of hot and cold air supplied to said conduit, and an operative connection between both said controlling means.

2. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber permanently connected with said manifold through a wide opening, means for spraying liquid fuel into said chamber, means for supplying air to said chamber, means for controlling the temperature of said air, means for controlling the delivery of fuel, and an operative connection between both said controlling means.

3. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber, a permanently wide open passage between said manifold and said chamber, a conduit for supplying air to said chamber, an atomizer for liquid fuel, narrow helical ducts in said atomizer, a high pressure pump for delivering liquid fuel into said ducts, means for controlling the delivery of fuel to said ducts, means for controlling the temperature of the air in said chamber and an operative connection between both said controlling means.

4. In an internal combustion engine, the

combination with an inlet manifold, of a carburetion chamber freely opening into said manifold, a fuel atomizer opening into said chamber, a high pressure pump for supplying liquid fuel to said atomizer, means for supplying cold air to said chamber and means for supplying hot air to said chamber, means for varying the delivery of said pump, means for controlling the ratio of hot and cold air supplied to said chamber, and an operative connection between said fuel delivery varying means and said air controlling means.

5. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber freely opening into said manifold, a fuel atomizer opening into said chamber, a reciprocatory high pressure pump for feeding said atomizer, means for varying the delivery of said pump, means for supplying air at a regulable temperature to said chamber comprising an air conduit and a valve for varying the temperature of the air in said conduit, and an operative connection between said valve and the means for varying delivery of said pump.

6. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber opening into said manifold, means for spraying liquid fuel into said chamber, means for controlling the supply of fuel to said spraying means, an air conduit opening into said chamber, a hot air supply connected to said conduit, a cold air inlet in said conduit, a valve controlling said cold air inlet, a valve inserted between said inlet and said chamber, and operative connections between said fuel controlling means and both said valves respectively.

7. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber freely opening into said manifold, a fuel atomizer opening into said chamber, a high pressure pump for feeding said atomizer, means for controlling the delivery of said pump, a conduit for feeding air to said chamber, a hot air supply and a cold air supply both opening into said air conduit, means for controlling said cold air supply, means for controlling the delivery of air through said conduit, an operative connection between said pump controlling means and said air delivery controlling means, and an operative connection between said pump controlling means and said cold air supply controlling means adapted to open said cold air supply after said conduit has been opened.

8. In an internal combustion engine, the combination with an inlet manifold, of a carburetion chamber opening into said manifold, a fuel atomizer opening into said chamber, a high pressure pump for feeding said atomizer, an air conduit leading to said chamber, a hot air supply and a cold air supply both opening into said air conduit, and means for simultaneously controlling the operation of said pump and the temperature of the air in said conduit.

In testimony whereof I affix my signature.

JURI PUURMANN.