

March 15, 1927.

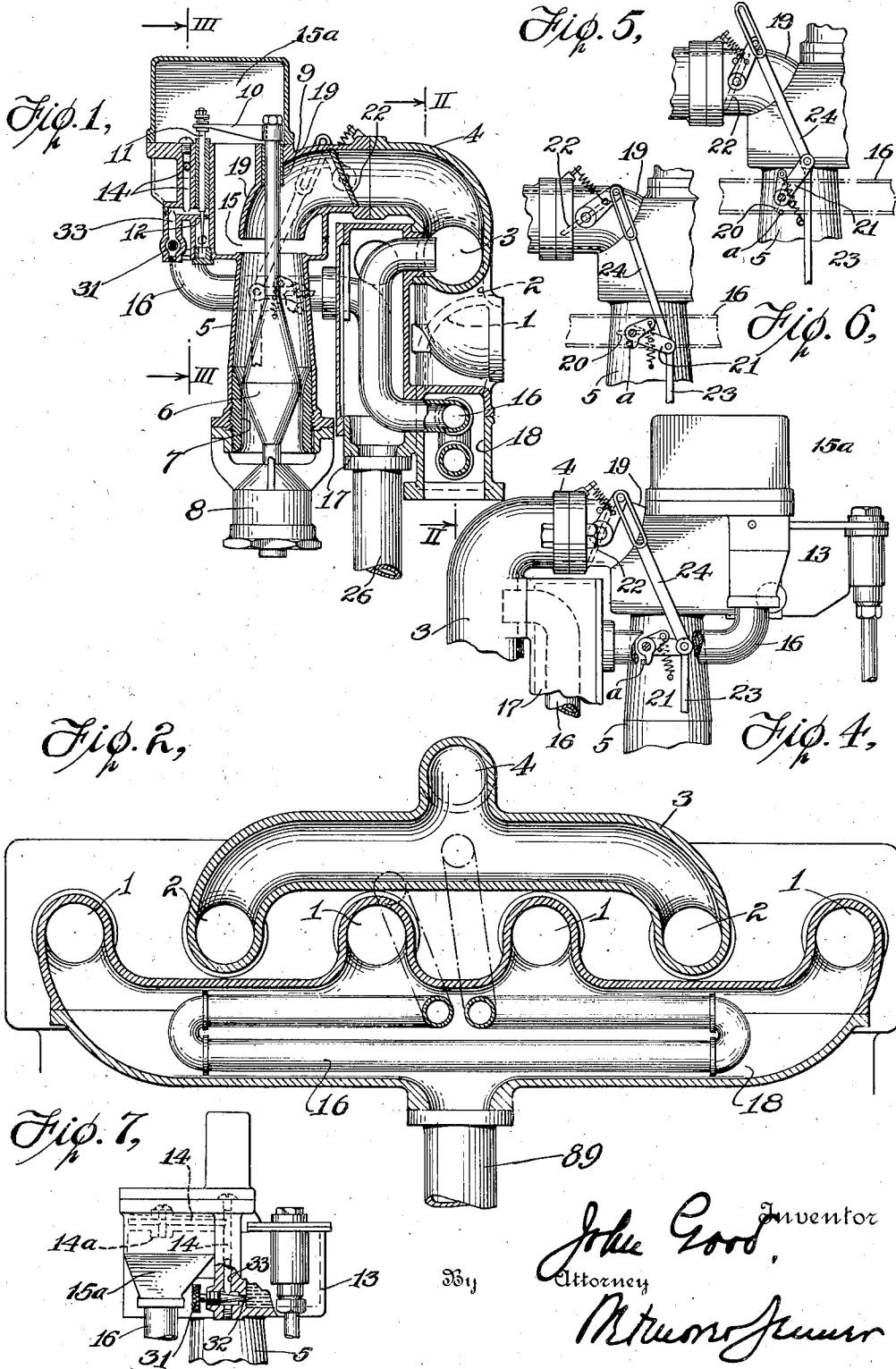
J. GOOD

1,620,645

FUEL SUPPLY MEANS FOR COMBUSTION ENGINES

Filed Nov. 16, 1916

2 Sheets-Sheet 1



John Good, Inventor
Attorney
M. J. J. J.

March 15, 1927.

J. GOOD

1,620,645

FUEL SUPPLY MEANS FOR COMBUSTION ENGINES

Filed Nov. 16, 1916

2 Sheets-Sheet 2

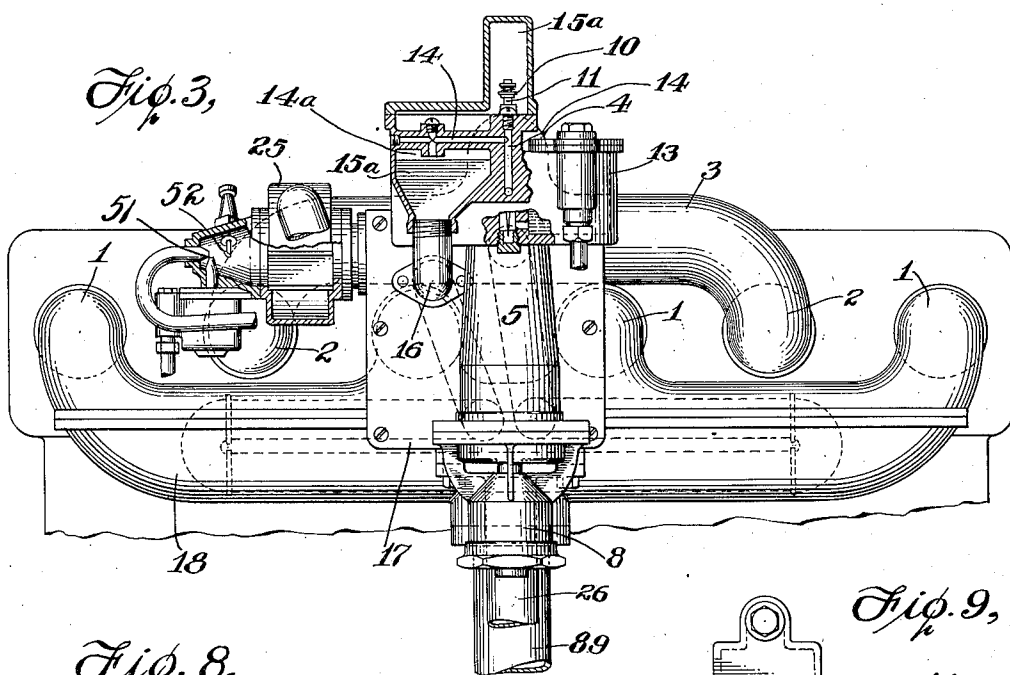


Fig. 8,

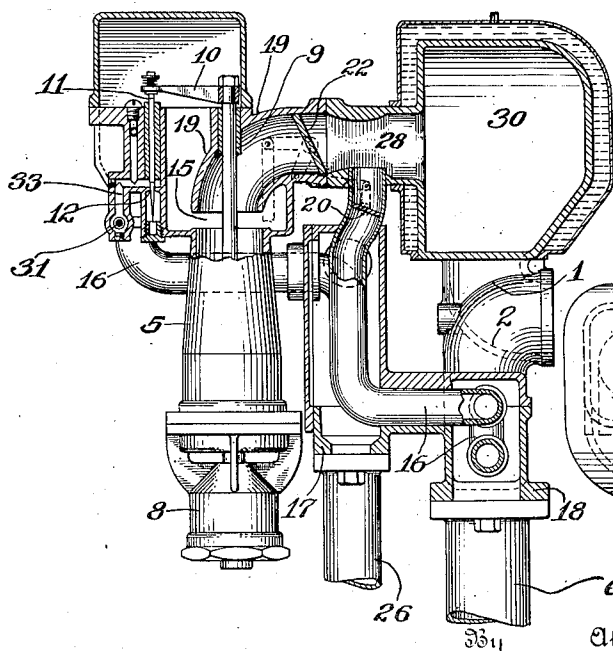
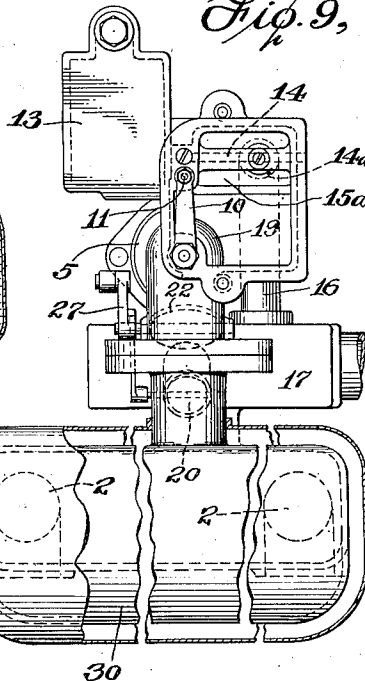


Fig. 9,



Inventor
John Good
Attorney
Netmore & Jensen

UNITED STATES PATENT OFFICE.

JOHN GOOD, OF BROOKLYN, NEW YORK, ASSIGNOR TO GOOD INVENTIONS CO., OF
BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

FUEL-SUPPLY MEANS FOR COMBUSTION ENGINES.

Application filed November 16, 1916. Serial No. 131,613.

The invention's object is to supply the charge mixture to combustion engines using kerosene or other relatively non-volatile fuels in such manner as to maintain automatically, the appropriate temperatures and physical condition of the entering mixture and a sufficient degree of vaporization of the liquid fuel to avoid fouling the interior of the engine or the charge forming apparatus under all conditions incident to the use of such engines for propelling automobiles.

In the accompanying drawings forming part hereof:—

Fig. 1 represents a general vertical section, with parts in elevation, of a form of this invention at present preferred;

Fig. 2 a section of the intake and exhaust manifolds of the engine on which it is used and such as would appear in section on line II—II of Fig. 1;

Fig. 3 is a view partly on line III—III of Fig. 1, with the heating burner and measuring apparatus broken away and omitting the throttle levers.

Fig. 4 is a partial side elevation illustrating the double-throttle control.

Fig. 5 and Fig. 6 are similar views showing the throttles in different positions.

Fig. 7 is a detail illustrating the by-pass from the float-chamber to the engine.

Fig. 8 is a section similar to Fig. 1 but illustrating a modified form of the invention.

Fig. 9 is a top plan view.

Referring first to Fig. 2, the parts marked 1 represent the exhaust ports of an ordinary multi-cylinder engine such as common in automobiles and the parts marked 2 are the intake ports, being connected to and supplied with fuel mixture by an intake manifold 3 connected by the elbow 4 with the apparatus in which the proportions of liquid fuel and air are automatically governed. This proportioning device includes a casing 5 and together with the connection 4 and the manifold 3 constitutes the suction intake of the engine. The exhaust ports discharge into an exhaust manifold 18 designed to accommodate the vaporizer tube as presently described and such discharge is led off through an off-take 89. Air enters the suction intake, under the inspiration of the working pistons, at the lower end of the

casing 5 and against the weight of a vertically movable control body 6 which normally tends to seat upon and close the entrance opening 7. The control body is guided by its spindle at the lower end, in a dash-pot 8 and at its upper end in a bearing 9, and rises and falls according to the volume of air passing through the entrance 7, thus assuming different positions of elevation in proportion to varying volumes or rates of inflow. Through the cross-arm 10 at the upper end of the spindle, the body 6 moves a device 11 to different elevations corresponding to its own position. In the present case this device has the form of a tapered pin protruding more or less into a restricted orifice 12 between the float chamber 13 and a liquid delivery passage or duct 14, and the extent of its protrusion thus corresponds to the volume of air entering the intake, and thereby serves to measure the flow of liquid in a predetermined, and desirably constant ratio to the inflow of air. The pin may be assumed to have a straight taper and the seating surface 7 to be specially curved so that for all values of air flow rate of liquid delivery as controlled by the pin will maintain an exactly constant proportion of fuel and air in the ultimate charge mixture. The seat member 7 is formed as an annulus screw-threaded into the lower end of the casing 5 so as to be adjustable therein to vary the richness of the fuel mixture without disturbing the uniformity thus obtained. It will be understood that although the control body is shown as closed by gravity, there is no essential limitation to gravity action; obviously, the operating characteristic of the force moving the control body is one of the factors determining the curvature of the seat 7 to maintain correct proportions of liquid and air for all rates of flow.

Some of the air passing the control body 6 flows through the internal opening 15 into the space 15^a in rear of and surrounding the cross arm 10, where it meets the liquid delivered from the nozzle orifice 14^a of the duct 14 (Fig. 3). The liquid fuel is drawn from the said nozzle by virtue of the depression or partial vacuum obtaining in the suction intake between the air entrance and the engine,—a constant vacuum in the present case because the control

body 6 is gravity seated. The pressure in the float chamber 13 is assumed to be atmospheric although it might be otherwise. The liquid fuel from the nozzle 14^a is discharged into the funnel-shaped entrance of a pipe 16 which conducts it with air from the space 15^a through a heating jacket 17 and thence through the interior of the exhaust manifold 18, making one or more turns therein (Fig. 2) and thence again through the heating jacket 17, and directly into the suction manifold 3, entering the latter preferably at a central point midway between inlet ports as indicated in Fig. 2. That part of the air entering at 7, which does not take the course just described, flows into the horn 19 in the proportioning device and through the connection 4 of the intake. Between the air entrance and the engine, there are thus two passages in parallel or branched relation, the one represented by the fuel and air pipe 16 and the other by the parts 19 and 4 which latter branch conducts air only and no fuel. Each passage forms part of the suction intake of the engine and each is supplied with a throttle, and both throttles are correlated for operation conjointly or in a predetermined sequence whereby the flow through the fuel and air pipe 16 is maintained at the requisite velocity for effective and clean vaporization under all conditions, especially the idling condition.

The throttle 20 in the fuel branch 16, is normally urged to the open position by a spring connected to its operating crank as indicated, and is closed by the engagement of a small pin on the swinging arm 21 with the lower edge of said crank. The control rod 23 is connected to the arm 21, and by a link 24, to the air-branch throttle 22 with which it has a slot connection giving a certain lost motion. The air throttle 22 is closed by a spring and the adjustments are such that when the control rod 23 is pulled downwards, the first effect is to turn the fuel throttle away from its closed (Fig. 5) position without thereby opening the air throttle because of the lost motion of the link. (Fig. 4.) The continued descent of the control rod will thereafter continue the opening of the air throttle but without further actuation of the fuel throttle beyond its wide open position, in which it is held by its spring and limit pin marked *a* in Fig. 5. In size the fuel-and-air passage 16 is so large in diameter or cross area (as compared to the size of the air passage 19—4 and the freedom of the air flow there-through), that a sufficient flow of air is produced in the fuel and air passage to convey the fuel when the air-throttle 22 is wide open. In all adjustments of the throttles 20 and 22, therefore, a vigorous fuel-delivery air flow is maintained throughout

pipe 16. That is to say, a vigorous flow is maintained or arranged for through this passage 16, regardless of the freedom of flow in the air passage 19—4, by a suitable relative proportioning of the air-flow passage 19—4 and the fuel-and-air passage 16. In this respect, the present invention differs from my Patent 1,405,777, Feby. 7, 1922, wherein special means are provided to restrict the air-flow passage to insure a flow through the fuel-and-air passage. The larger capacity of the fuel branch admits a larger proportion of the air charged, and thereby facilitates the vaporization of the liquid fuel and its delivery to the intake heater in vaporous form. To the same end, the throttles may be interconnected in other manners and without involving the lost motion feature; such another interconnection is described hereinafter with reference to Figs. 8 and 9. In the apparatus shown in Figs. 1 to 3, it is intended that all of the air component of the fuel charge, up to a certain point, shall pass through the fuel branch passage 16 which is subjected to heat either in the heating jacket 17 or the exhaust manifold 18 or both, and after such point, that the excess shall pass without heating through the passage 19. The pipe 16 is a vaporizer tube and the limitation as to the amount of air allowed to pass through it with the fuel is for the purpose of maintaining proper and clean vaporization for all conditions, from idling for long periods to full speed and load. It will be understood that in the idling condition the air throttle 22 in this form, will be closed and the fuel throttle 20 also closed or nearly closed so that only sufficient liquid fuel and air will pass therethrough as will be sufficient to keep the engine turning over. Under such conditions the whole engine charge will of course be transmitted to the engine through the pipe 16.

The jacket 17 in the case illustrated is merely a casing or enclosure between the proportioner 5 and the exhaust header and will be understood to be for use primarily in starting the engine cold on the non-volatile fuel although it might also be used at other times. For this purpose it is connected at one end to a burner 25 and at the other end to an exhaust pipe 26. The burner includes a fuel spray nozzle 51 using the engine fuel, and a spark igniter 52, and is supplied with air under a pressure difference and so arranged that the flame may be carried through the casing 17 and exhaust pipe 26 to preheat and vaporize the initial charge mixture. My Patent No. 1,231,152, June 26, 1917, shows and describes such a burner in detail. Any other heating agent may be employed, for instance, electricity. When not used for heating, the casing serves as heat insulation to the pipe 16.

While the said pipe 16 is illustrated herein as a tube with a fairly thin wall and uniform diameter it is nevertheless to be understood that it may assume any desired shape thought best for vaporization. In the form of the apparatus above described the charge mixture issuing into the inlet header 3 from pipe 16 is a dry and completely vaporized gaseous mixture for so long as the air throttle remains closed. Such a mixture will burn clean in the engine with none of the objections commonly found in kerosene engines. Upon the admission of cold air into the manifold from the branch passage 19 this dry mixture becoming slightly chilled thereby, is converted in whole or in part into a fine fog-like mist which is also capable of burning cleanly and satisfactorily in the engine. In both cases the liquid kerosene is kept out of the engine in the form of large particles or liquid films, which condition it is most essential to avoid.

In Figs. 8 and 9 the general construction will be recognized without further description. It will be noted however, that the throttles 20 and 22 are tied together by a link, so that they move together and open and close together, without the lost motion feature of the preceding figures. In the same manner as before, however, assisted or not, as may be, by the relation of the two throttle openings to each other, vigorous flow is always present in the pipe 16 and the two streams of vaporized fuel and air meeting at the point marked 28, and in the manifold 30, immediately form the fog above referred to and which serves the engine for all loads and speeds excepting possibly for idling or slow idling. For such condition the air throttle may be completely closed and a small opening of the fuel throttle may serve to pass the idling charge to the manifold as a dry mixture.

This fog mixture, as I have ascertained, requires large and commodious passages in which to move to the engine without precipitation and the manifold 30 is shown large on that account and also water jacketed to avoid becoming excessively hot on long runs. The water jacket will be understood to form part of the cylinder cooling system through connections not shown. The heated vaporized mixture from pipe 16 is desirably led directly into the air flow to insure mixture and at the point of entrance the passage is slightly constricted as indicated. The outlets from the large manifold 30 into the inlet port 2 are arranged at its bottom, so that the fog mixture may find a direct and easy entrance into the combustion cylinders. The manifolds or header pipes for combustion engines are generally designed of no greater diameter than that of the inlet ports they serve and in no case do they constitute a space in which the velocity of the charge mix-

ture is appreciably reduced. The manifold requisite for the purposes of the chilled fog, or fog produced by chilling a dry-hot gaseous mixture, however, requires to be much larger, as above stated, and such large manifold in conjunction with fog forming agencies I regard as an important part of my invention.

The detail shown in Fig. 7 illustrates an adjustable by-pass from the liquid float chamber 13 to the liquid discharge orifice 14^a which has been above described. This by-pass is controlled by a needle valve 31 in the restricted outlet 32 from the float chamber. The liquid passing the needle valve may flow upwardly through the duct 33 into the liquid delivery duct 14 and thence to the nozzle 14^a. A sufficient normal flow may be permitted through this pass to compensate for such air as may find its way into the engine cylinder without passing under and by the control body 6 as for instance such air as leaks into the engine by the valve stems, etc.

Claims:

1. The combination with an internal combustion engine and an exhaust passage therefrom, of a plurality of branch or parallel intake passages having a common outlet to the engine and a common air entrance, a source of liquid fuel having an outlet into one of said passages, an air actuated control body located in said common entrance whereby it is actuated by the total air flow to the engine, means controlled by the actuation of said body for controlling the delivery of fuel from said fuel outlet and a manually operated throttle in each passage through the joint actuation of which the engine is controlled, said branch passage into which the fuel is delivered being of such size or capacity that the engine suction may maintain an air flow therethrough sufficient to maintain the delivery of fuel to the engine regardless of the freedom of flow in the remainder of the branch passages and being contained in said exhaust passage whereby fuel therein is vaporized by the engine exhaust heat.

2. The combination with an internal combustion engine and an exhaust passage therefrom, of two branch or parallel intake passages having a common outlet to the engine and a common air entrance, a source of liquid fuel having an outlet into one of said passages, an air actuated control body located in said common entrance whereby it is actuated by the air flow of both intake passages, means controlled by the actuation of said body for controlling the delivery of fuel from said outlet, a throttle in each branch intake passage, and manually operable means for actuating said throttles to control the engine, said means including a lost motion connection whereby the throttle in

said fuel passage opens ahead of the throttle in the other branch passage and moves to its closed position after the throttle in said other passage, said branch fuel passage being contained in said exhaust passage and being of such size or capacity that the engine suction maintains an air flow there-through sufficient to maintain the delivery of fuel to the engine regardless of the freedom of flow in the other branch passage.

3. A carburetor for combustion engines comprising means providing an air entrance space, exhaust gas heated and unheated passages leading the air therefrom and together conducting the total air supply to the engine, said passages being so proportioned relatively to each other that a fuel delivery flow of air can be maintained in a heated passage regardless of the freedom of flow in the unheated of the passages, throttle means intercepting and controlling said total air supply, and a constant level fuel receptacle having a discharge orifice operated by the engine suction thereon and delivering the fuel in substantially direct proportion to the air taken in through said entrance space, said heated passage being arranged for receiving and vaporizing liquid fuel in the presence of such air flow.

4. A carburetor comprising a passage for air only and a second passage for both fuel and air, the two passages joining in advance of the engine intake port and said second passage being large enough to cause a fuel-delivering flow to be maintained therein irrespective of the freedom of flow in the first mentioned passage, a fuel orifice delivering fuel into said second passage under the engine suction, and under the control of the total air flow through both said passages, means for heating said second passage, and

throttle means intercepting and controlling said total air supply.

5. A carburetor comprising an air passage and a second passage for both fuel and air, the two passages joining in advance of the engine ports, a fuel orifice opening into said second passage and delivering fuel thereto under the engine suction and proportional to the total air flow in both said passages, means for heating the fuel and air passage, and an engine controlling throttle in each of said passages connected for conjoint operation, the fuel and air passage being large enough to cause a fuel-delivering air flow to be maintained therethrough irrespective of the freedom of flow in the other air conducting passages.

6. A carburetor for combustion engines comprising a suction intake having air admission means adapted to control liquid fuel delivery and two confluent passages receiving air passing said admission means and joining in advance of the engine intake port to form a single passage, a fuel orifice delivering fuel into one of said passages under the engine suction and in amounts controlled by said air admission means, means for heating said passage receiving the liquid fuel, and a throttle in each of said passages conjointly acting to control the air and fuel flow, the fuel-receiving passage supplying all the air as well as the fuel when the engine is idling and said confluent passages being so proportioned relative to each other that a fuel-delivering air flow can be maintained in the passage receiving the fuel regardless of the position of the throttle in the other of said passages.

In testimony whereof, I have signed this specification.

JOHN GOOD.