Oct. 28, 1930. W. E. KEMP 1,780,019

CHARGE FORMING DEVICE

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Fig. 1.

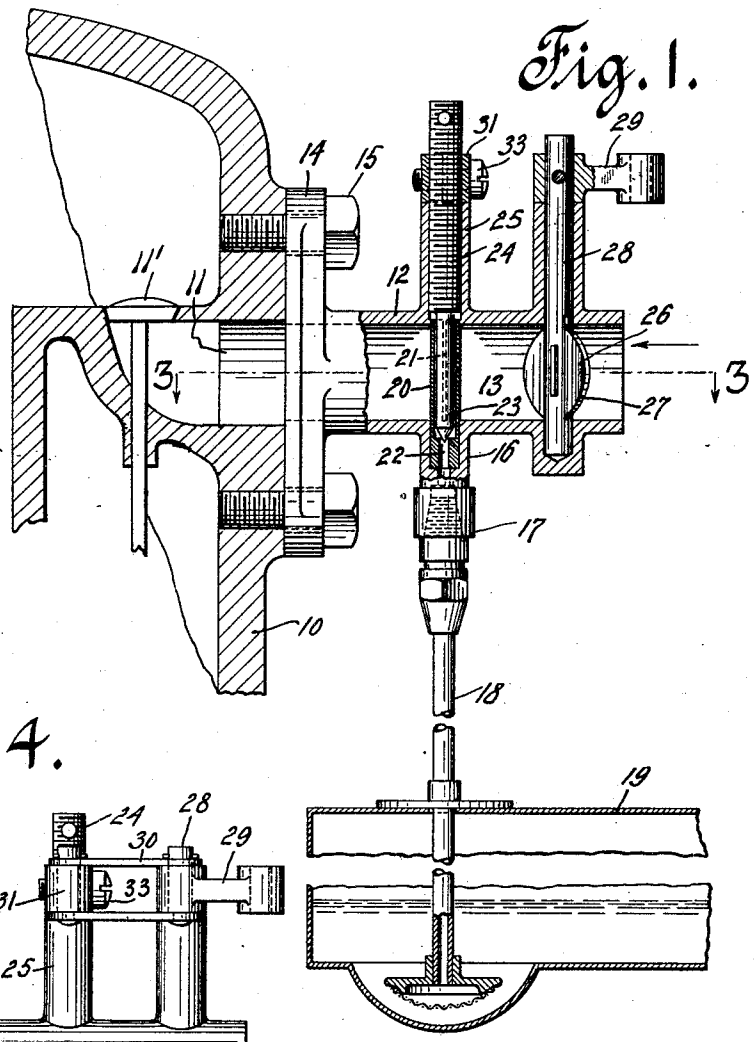


Fig. 4.

Fig. 2.

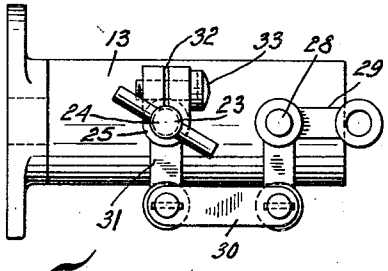
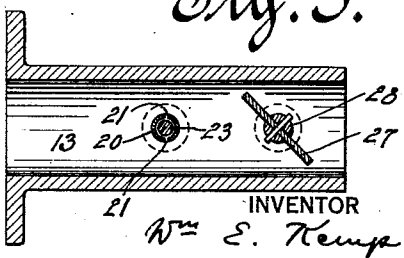


Fig. 3.



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Fig. 5.

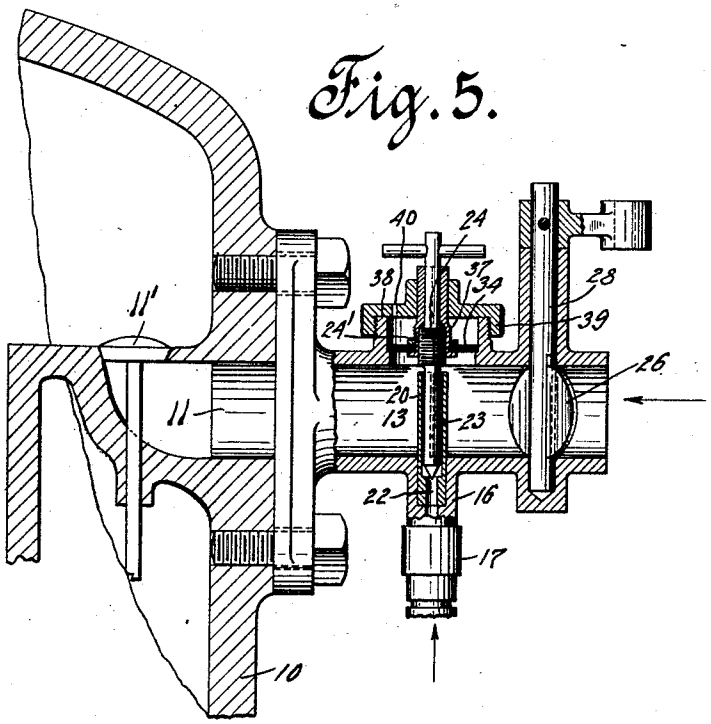


Fig. 6.

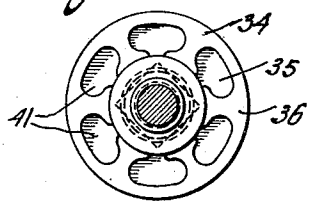
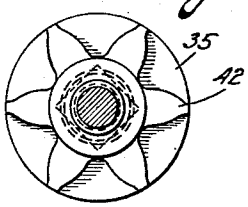


Fig. 7.



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Patented Oct. 28, 1930 1,780,019

UNITED STATES PATENT OFFICE

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CHARGE-FORMING DEVICE

Application filed June 26, 1920. Serial No. 391,948.

The present invention relates to improvements in devices designed and especially adapted for use with an internal combustion engine, for the purpose of producing a combustible mixture from liquid hydrocarbon and air, to be supplied to and burned within the engine.

In the most common type of these devices, the supply of liquid hydrocarbon is controlled by a float, resting upon the liquid in a chamber connected to the carbureting chamber. Carbureters containing float chambers can obviously be used only on engines which are maintained in horizontal or nearly horizontal positions, and are otherwise objectionable because of possible leakage of the liquid hydrocarbon, due to the wear of the float mechanism. This leakage increases the fire hazard to such an extent that the use of internal combustion engines, having float controlled feeding mechanisms, is expressly prohibited in certain localities by the rules and regulations of the Board of Fire Underwriters.

The main object of the present invention is to provide a charge forming device which does away entirely with the float mechanism, the liquid hydrocarbon being fed to the charge forming device by the suction produced by the working piston of the engine from a tank, disposed below the level of the charge forming device, thereby obviating the defects of the carbureters heretofore in use.

Another object of the invention is to produce a charge forming device, wherein the liquid hydrocarbon, not already vaporized, returns to a tank located below the same as soon as the engine comes to rest.

A further object of the invention is to provide a charge forming device, wherein the proper proportion of air and liquid hydrocarbon is obtained by the interdependent operation of a fuel supply controlling valve and an air throttle.

A still further object of the invention is to produce a charge forming device, which is simple in construction and highly efficient in operation, and one which is capable of manufacture on a commercial scale, or in other words one which is not so difficult to make as to be beyond the reasonable cost of such a contrivance.

With these and other objects in view, which will more fully appear as the nature of the invention is better understood, the same consists in the combination, arrangement and construction of parts hereinafter described, pointed out in the appended claims and illustrated in the accompanying drawings, it being understood that many changes may be made in the size and proportion of the several parts and details of construction within the scope of the appended claims, without departing from the spirit or sacrificing any of the advantages of the invention.

Two of the many possible embodiments of the invention are illustrated in the accompanying drawings, in which:—

Figure 1 is a central longitudinal section taken through a charge forming device constructed in accordance with the present invention; Fig. 2 is a top plan view of the said device; Fig. 3 is a section taken on line 3—3 of Fig. 1; Fig. 4 is a front elevation of a portion of the said device; Fig. 5 is a section similar to the one shown in Fig. 1 of a modification of the invention; Fig. 6 is a top plan view of a detail of construction of the device shown in Fig. 5; and Fig. 7 is a modification of the said detail.

Referring now first to Figs. 1 to 4, inclusive, of the drawings, the numeral 10 indicates a portion of the cylinder of an internal combustion engine, having an intake port 11, through which the combustible mixture enters the said cylinder. This port is controlled by a valve 11′, as usual in constructions of this type. The port 11 communicates with a charge forming device 12, comprising a carbureting chamber 13, in the form of a tubular body, that is provided with a flange 14. This flange abuts against the cylinder 10, screws 15 serving to attach the same to said cylinder. The chamber 13 is provided, intermediate its ends, with a nipple 16, to which is joined, by a suitable coupling 17, a pipe 18, the latter leading to a tank 19, that is disposed a suitable distance below the charge forming device and contains liquid hydrocarbon. Into the nipple fits a nozzle 20, ex-

tending diametrically across the carbureting chamber. This nozzle is provided with longitudinal slots 21, disposed in a plane at right angles to the longitudinal axis of the carbureting chamber, for a purpose hereinafter to be described. The nozzle is provided below its slots with a restricted opening 22, with which co-operates a mechanism for controlling the flow of liquid hydrocarbon into the carbureting chamber, said mechanism being, preferably, in the form of a needle valve 23, which is disposed within the nozzle 20, its diameter being slightly smaller than the inner diameter of said nozzle. The needle valve is carried by, or made integral with, a screw threaded stem 24, the threads of which mesh with internal threads of a tubular extension 25 on the carbureting chamber, thereby permitting of an adjustment of the discharge end of the liquid hydrocarbon conduit, for the well known purpose.

In front of the needle valve, there is located, within the carbureting chamber, a throttle 26, for instance a butterfly valve, comprising a disk 27, which is attached to a spindle 28. This spindle extends in parallel relation to the needle valve and is rotatably mounted in the carbureter casing. To the spindle 28 is fixed, outside of the carbureter casing, a bell-crank 29, one arm of which is adapted to be connected with an actuating rod, not shown, while its other arm is connected by a link 30 with a lever 31, the latter being fixed to the screw-threaded stem of the needle valve. The inner end of the lever 31 is split, as shown at 32, and through the split portions extends a clamping screw 33. This construction permits of a fixing of the lever to the needle valve in any adjusted position of the latter.

From an inspection of the drawings it appears that the carbureting chamber is cylindrical throughout its length, and that the only restriction or obstruction to the flow of air through the said chamber is constituted by the throttle. It also appears from the drawings, that there is no restriction in the carbureting chamber between the nozzle and the engine, or in other words there is no obstruction placed in the path of the combustible mixture. Due to this construction, the highest vacuum or lowest pressure point in the carbureting chamber is immediately in rear of the throttle. The nozzle is within the range of the highest vacuum or lowest pressure point, for a purpose which will presently appear.

In operation, the suction produced by the working piston of the engine lifts liquid hydrocarbon from the tank 19 against the force of gravity into the nozzle, and the air, which is caused to flow in a confined stream through the carbureting chamber past the discharge end of the said nozzle, entrains and vaporizes the liquid hydrocarbon, the resulting combustible mixture being drawn into the cylinder. A lifting of the fuel is made possible by the fact that the nozzle is subjected to the highest vacuum created by the suction of the piston, irrespective of the speed of and load to the engine. The slots 21 in the nozzle are placed in a plane at right-angles to the longitudinal axis of the carbureting chamber to produce a homogeneous mixture of air and combustile gas, the hydrocarbon being discharged at right-angles to the flow of the air through the carbureting chamber. By reason of this construction the sensibility of the needle valve is eliminated to a great extent.

The purpose of the throttle in this construction is only to measure the volume of air admitted to the carbureting chamber, due to the suction of the piston in the cylinder. Inasmuch as this throttle is disposed in front of the nozzle and constitutes the only obstruction in the carbureting chamber, the combustible mixture is carried to the engine at any speed of the latter and has, therefore, no chance to condense and stagnate in the said chamber. Each charge is thus of the same quality with a given throttle opening, resulting in an even running of the engine.

The throttle and needle valve of the carbureter being connected in the maner above described, the discharge end of the fuel supply conduit is varied in proportion to the throttle movement. A proper proportion of air and liquid hydrocarbon is thus always obtained. This is true at any speed of the engine, so that its flexibility is greatly increased. A complete combustion is obtained in the cylinder at any speed, decreasing the carbon deposit therein materially, when compared with the constructions heretofore in use.

Another advantage of the charge forming device herein described over the conventional carbureter construction is that the operation of the engine is more sensitive to adjustment and will not load on account of a heavy mixture, because the liquid hydrocarbon is vaporized in high vacuum and carried into the motor completely at any speed, it having no chance to condense and stagnate in the carbureting chamber, for the reasons above referred to. By reason of the fact that there is no restriction in the carbureting chamber between the nozzle and the motor, the liquid hydrocarbon is adapted to be vaporized at a lower vacuum than in the constructions heretofore in use, the result being that more power is obtained for a given quantity of liquid hydrocarbon, there being less motor energy utilized for the vaporization.

The modification shown in Fig. 5 of the drawings differs from the one above described in that its throttle 26 and needle valve 23 are not connected. Another difference consists in that the needle valve of the construc-

tion shown in Fig. 5 of the drawings is actuated by and in unison with the engine. For this purpose the needle valve is provided with a flexible diaphragm 34, composed of a disk 35, for instance, of cork, that is held between flexible metallic disks 36. These disks are mounted upon an interiorly screw threaded sleeve 37. With the threads of this sleeve mesh the threads 24′ on the stem 24 of the needle valve. The diaphragm is slidably disposed in a cylindrical extension 38 of the carbureting chamber, said extension being closed by a cover 39, having a vent 40. The disks 36 may be provided with openings 41, to increase their flexibility, as clearly shown in Fig. 6 of the drawings, or they may be made in the form of stars 42, as indicated in Fig. 7.

In operation, the needle valve is adjusted in relation to the restricted opening 22 in the nozzle, according to the requirements. During the suction stroke of the piston in the cylinder the needle valve is lowered, because of the vacuum in the carbureting chamber. The opening 22 in the nozzle is thus restricted, as required. Immediately after the suction stroke, the needle valve returns to its normal position, the vent 40 permitting of an escape of air from the cylindrical extension 38. The lowering of the needle valve is due to the difference of pressure on the underface and upperface of the diaphragm 34. The purpose of this arrangement is as follows: It provides automatic means for regulating the needle valve, the latter restricting during the suction strokes of the piston the discharge end of the fuel conduit in proportion to the speed of the engine.

From the foregoing it will be seen that in both devices herein described the liquid hydrocarbon is drawn into the carbureting chamber, instead of being forced in, all possibility of flooding the apparatus is thus removed, as no liquid hydrocarbon can be introduced into the same except by the suction of the engine piston, which at once vaporizes the hydrocarbon. In case of accident or stopping of the engine, the liquid hydrocarbon in the supply pipe 18 immediately returns by gravity into the tank 19.

Attention is called to the fact that the charge forming devices herein described operate in any position of the engine, as long as the tank is not brought above the carbureting chamber. The use of the engines is thus available for many purposes, to which engines with ordinary carbureters cannot be put.

What I claim is:—

1. A charge-forming device comprising a carbureting chamber, a throttle therein, a supply nozzle in said chamber between said throttle and the outlet thereof, a valve controlling said nozzle, and a connection between said valve and throttle for causing said valve to open said nozzle in inverse proportion to the vacuum created in said carbureting chamber by the suction of the piston in the cylinder of the engine.

2. A charge-forming device, comprising a carbureting chamber, a supply nozzle in said chamber, a valve controlling said nozzle freely movable in relation thereto, and means connected with said valve controlled by the suction of the engine for automatically adjusting the outlet of said nozzle in proportion to the vacuum produced in said carbureting chamber.

3. A charge-forming device, comprising a carbureting chamber, a supply nozzle in said chamber, a valve controlling said nozzle freely movable in relation thereto, and means controlled by the suction of the engine for causing said valve to automatically obstruct the outlet of said nozzle in proportion to the vacuum produced in said carbureting chamber.

4. The combination with the cylinder of an internal combustion engine having an intake port, of a charge-forming device communicating therewith and comprising a cylindrical horizontally extending carbureting chamber continuously open to the atmosphere, a valve-controlled nozzle projecting transversely from below into said carbureting chamber, and a reservoir disposed wholly below said carbureting chamber containing a supply of liquid hydrocarbon and communicating directly and continuously with said nozzle, whereby liquid hydrocarbon is supplied to said nozzle by vacuum feed, the level of the liquid in said reservoir being always below the lowest point of said nozzle and the liquid hydrocarbon being supplied to said nozzle irrespective of the change of level of the liquid in said reservoir.

Signed at New York, in the county of New York and State of New York this 27th day of May, A. D. 1920.

WILLIAM E. KEMP.