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W. E. KEMP

CHARGE FORMING DEVICE

Filed March 29 1921

Fig. 1.

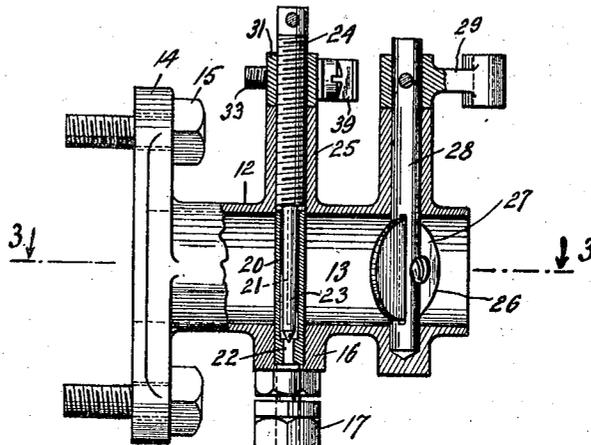


Fig. 4.

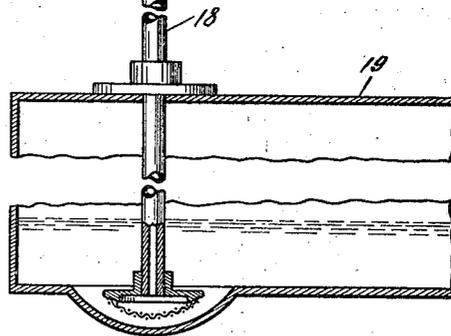
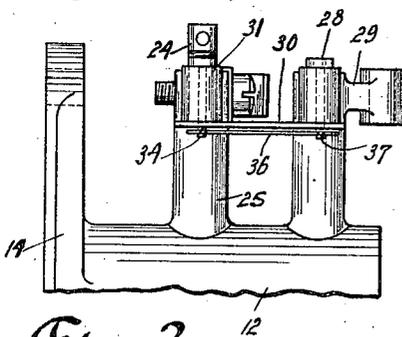


Fig. 2.

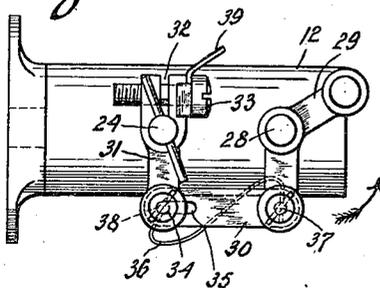
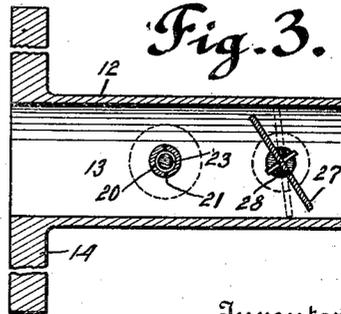


Fig. 3.



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## UNITED STATES PATENT OFFICE.

WILLIAM E. KEMP, OF NEW YORK, N. Y.

## CHARGE-FORMING DEVICE.

Application filed March 29, 1921. Serial No. 456,666.

*To all whom it may concern:*

Be it known that I, WILLIAM E. KEMP, a citizen of the United States, and resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Charge-Forming Devices, of which the following is a specification.

The present invention relates to improvements in devices designed and especially adapted for use in connection with internal combustion engines, 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 the 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 claim, without departing from the spirit or sacrificing any of the advantages of the invention.

One of the many possible embodiments of the invention is 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 said device; Fig. 3 is a section taken on line 3—3 of Fig. 1; and Fig. 4 is a front elevation of a portion of the said device.

In the drawings, the numeral 12 indicates a charge forming device, which is adapted to communicate with the intake port of an engine cylinder. The charge forming device comprises a carbureting chamber 13, in the form of a tubular body, that is provided with a flange 14. This flange abuts against the engine cylinder, screws 15 serving to attach the same to the 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, extending 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 interior 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 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 lever 29, one end of which is adapted to be connected with an actuating rod, not shown, while its other end 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 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. The connection between the link 30 and the lever 31 is such that a slight relative movement between the elements is permitted. For this purpose the pivot pin 34 on the lever 31 extends through a longitudinal slot 35 in the link 30. A spring 36, fixed to the pivot pin 34 and the pivot pin 37, connecting the said link with the bell-crank lever 29, has a tendency to keep the outer end 38 of the said slot in engagement with the pivot pin 34, for a purpose hereinafter to be described. To the lever 31 is attached, for instance by the clamping screw 33, a fixed stop 39, that is adapted to abut against the bell-crank lever 29, as will hereinafter appear.

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 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 appear hereinafter.

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 combustible 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 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. Another purpose of the throttle is to permit of a priming of the carbureter, as will presently appear.

The throttle and needle valve of the carbureter being connected in the manner 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. Complete combustion is obtained in the cylinder at any speed, decreasing the carbon deposit therein materially, when compared with the constructions heretofore in use. In Figs. 2 and 3 of the drawings the elements are shown in the position which they occupy when the engine is idling, that is to say when running without a load applied thereto. In order to shift the throttle toward opening position and correspondingly open the fuel conduit, the bell-crank lever 29 is shifted around its fulcrum counter-clockwise, or in other words in the direction of the arrow shown in Fig. 2 of the drawings. In order to prime the charge-forming device, the bell-crank lever must be shifted from the position shown in Fig. 2 of the drawings clockwise until the disk 27 of the throttle is brought into the position shown in dotted lines in Fig. 3 of the drawings, in which

the passage of air through the charge forming device is prevented. When shifting the bell-crank lever in the direction mentioned, the stop is brought, in the rotation of the 5 throttle and needle valve, to bear against the bell-crank lever 29. When this occurs, a further turning movement of the needle valve is prevented, but the throttle is permitted to continue its closing movement by 10 reason of the slot 35 in the link 30. In the further movement of the bell-crank lever, the throttle is brought into the position shown in dotted lines in Fig. 3 of the drawings, in which, while the carbureting chamber 15 is closed, the supply conduit is partly open. When now the engine is started, the suction of the piston will lift the fuel from the tank, that is to say the charge-forming device is primed. By opening then the 20 throttle, charges will be formed in the manner above mentioned and the engine may be run under its normal cycle of operation, the suction produced by the working piston maintaining the liquid hydrocarbon in the 25 supply conduit until the operation of the engine is stopped. It is to be observed that by permitting this slight relative movement between the valve and throttle, the proper proportion of air and liquid hydrocarbon is obtained at any speed of the engine. If 30 the slot 35 were not provided in the link 30 the mixtures would be too rich at slow speeds.

Another advantage of the charge-forming 35 device herein described over the conventional carbureter constructions 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 40 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 45 the fact that there is no restriction in the carbureting chamber between the nozzle and the motor, the liquid hydrocarbon is adapt-

ed to be vaporized at a lower vacuum than in the constructions heretofore in use, the result being that more power is obtained 50 for a given quantity of liquid hydrocarbon, there being less motor energy utilized for vaporization.

From the foregoing it will be seen that in the devices herein described liquid hydrocarbon is drawn into the carbureting chamber, 55 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 60 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. 65

Attention is called to the fact that the charge-forming device herein described operates in any position of the engine, as long as the tank is not brought above the carbureting chamber. The use of the engine 70 is thus available for many purposes, to which engines with ordinary carbureters cannot be put.

What I claim is:—

A charge-forming device, comprising a 75 carbureting chamber, a throttle therein, a supply nozzle in said chamber between said throttle and the outlet thereof, a valve controlling said nozzle, a lever fixed to said throttle, a lever secured to said valve, a 80 link connecting said two levers, said link being provided with a slot into which a pivot pin on said valve lever extends, and a stop carried by said valve lever adapted to abut against said throttle lever when 85 said throttle is substantially at the end of its closing stroke, thereby holding said valve stationary but permitting said throttle to move on its closing stroke a further distance determined by the length of said slot. 90

Signed at New York, in the county of New York and State of New York, this 18th day of December, A. D. 1920.

WILLIAM E. KEMP.