J. B. GARNER AND J. B. ANDERSON.

PRIMER FOR GAS ENGINES.

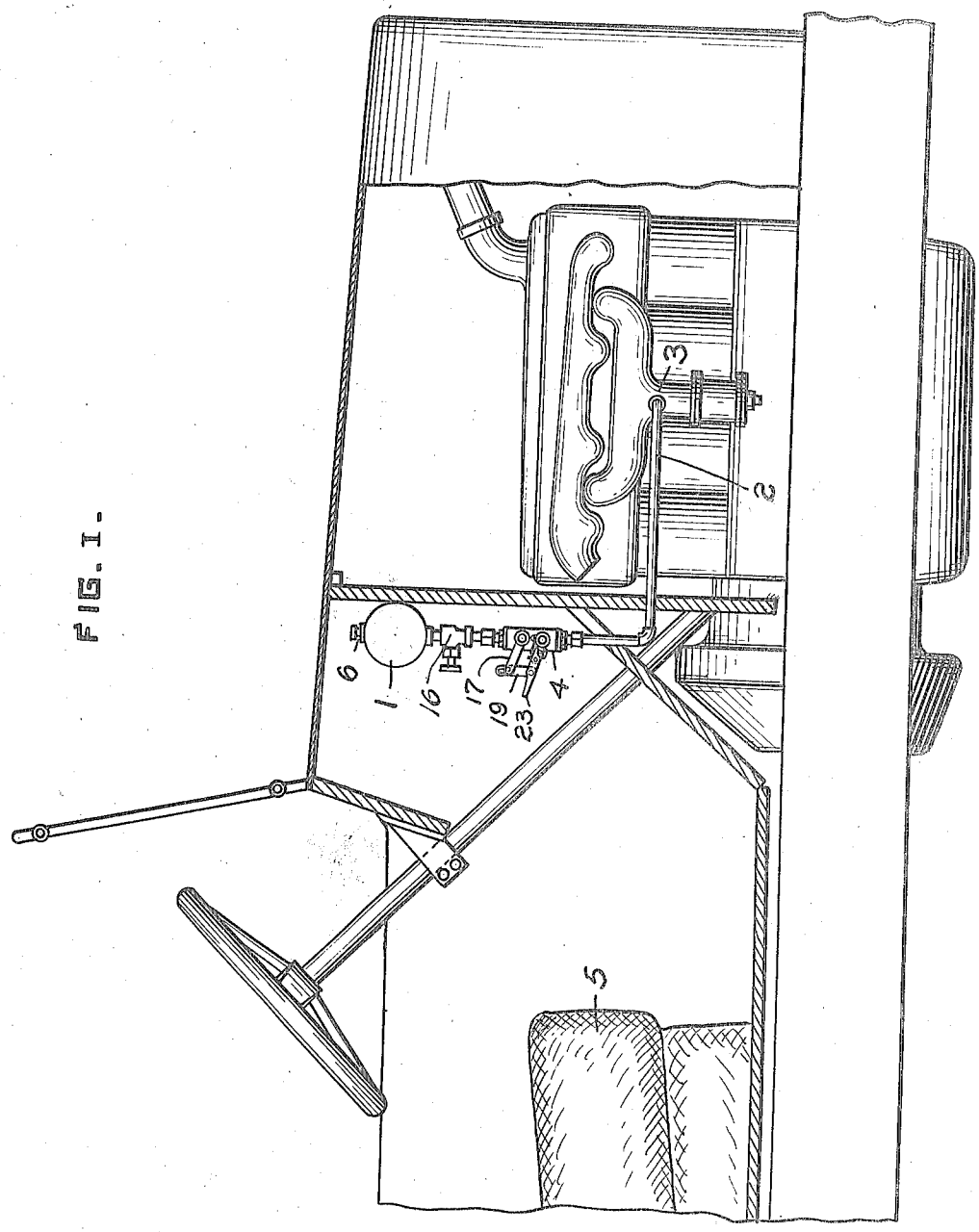
APPLICATION FILED JUNE 20, 1921.

1,431,518.

Patented Oct. 10, 1922.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES

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2 SHEETS—SHEET 2.

FIG. II.

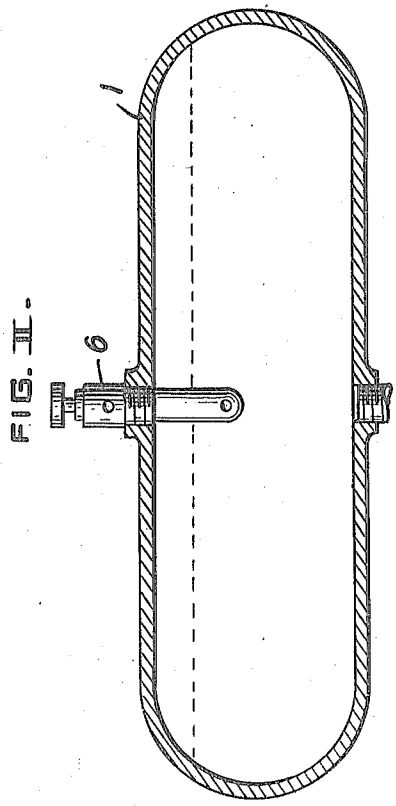


FIG. V.

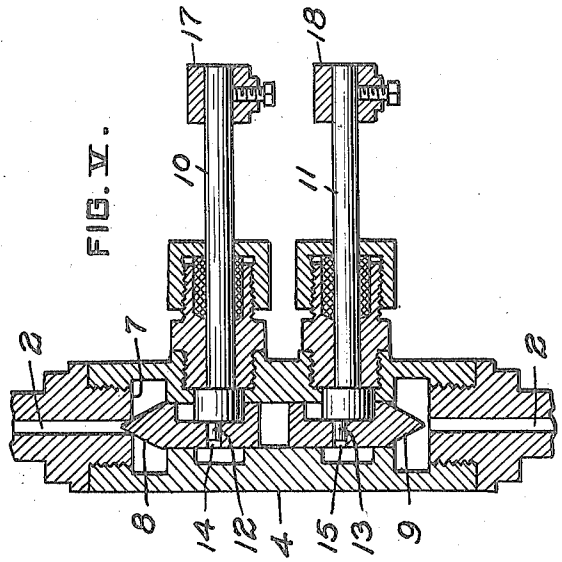


FIG. IV.

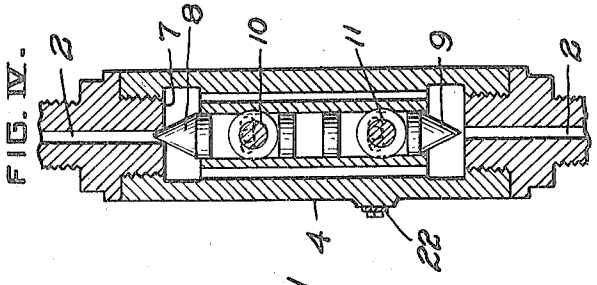
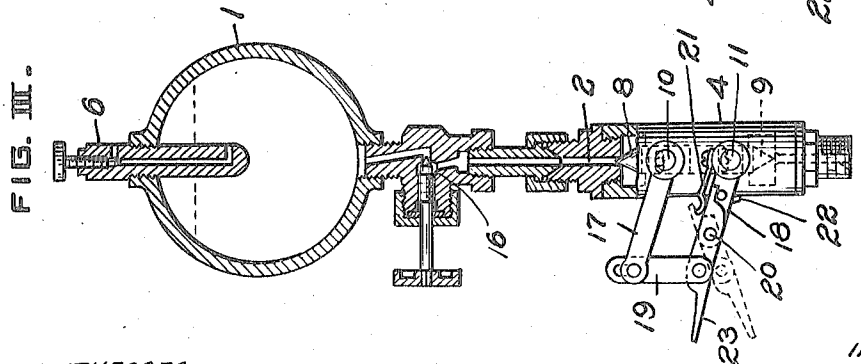


FIG. III.



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UNITED STATES PATENT OFFICE.

JAMES B. GARNER, OF PITTSBURGH, AND JAMES B. ANDERSON, OF SHALER TOWNSHIP, ALLEGHENY COUNTY, PENNSYLVANIA.

PRIMER FOR GAS ENGINES.

Application filed June 20, 1921. Serial No. 478,785.

To all whom it may concern:

Be it known that we, JAMES B. GARNER, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, and JAMES B. ANDERSON, residing at Shaler Township, in the county of Allegheny and State of Pennsylvania, both citizens of the United States, have invented or discovered certain new and useful Improvements in Primers for Gas Engines, of which improvements the following is a specification.

Our invention relates to primers for gas engines, and consists in a novel structure designed for and suited to the use of butane as a priming agent, but it will be understood that the use of another substance as priming agent is not precluded,—for example, any liquefied petroleum gas, low boiling-point gasoline, petroleum ether, or its separate constituents, sulphuric ether, and propane.

In the accompanying drawings Fig. I is a view in longitudinal section through an automobile of conventional build, showing that portion, where the engine is situated, and showing the engine in elevation, and the primer of our invention associated therewith; Fig. II is a view in vertical and longitudinal section, and to larger scale, of the tank for the priming material; Fig. III is a view in vertical and transverse section through the same tank and through the feed duct therefrom, and shows, partly in section partly in side elevation, the controlling valve. Figs. IV and V are views in vertical section and at right angles one to another, and to larger scale, of the controlling valve in its casing.

A tank 1 for the priming material is suitably placed adjacent the gas engine. The gas engine here chosen for illustration is the familiar engine of an automobile, and in this instance the tank is shown to be placed behind the dashboard of the vehicle. Its particular location is it will be understood a matter of convenience. From the tank 1 a feed duct 2 leads to the manifold 3 of the engine. In this duct a manually operable control valve is arranged, and, the invention being applied to an automobile, this control valve will advantageously be so placed as to be accessible for operation from the driver's seat, by hand or by foot, as may be preferred. Accordingly, in this instance the control valve, indicated in Fig. I by the reference numeral 4, is shown to be arranged behind the dashboard, in proper relation to the driver's seat 5.

The tank shown in Figs. II and III is in form and in connections suitable for containing butane for example as a priming material. Butane is a petroleum derivative, a paraffin of the normal formula (with variations) C_4H_{10}. Under normal atmospheric conditions it is a gas; it may be brought to liquid form by compression at a temperature of −40° F. and, such being the case, the fluid is one capable of being stored and carried in liquid form, and evaporated for use as a gas as need requires. Invention in the recovery of substantially pure butane from petroleum is the subject-matter of United States Letters Patent No. 1,307,353 granted June 24, 1919, to James B. Garner, one of the present applicants, jointly with Howell C. Cooper.

The tank 1 of the apparatus shown is cylindrical with rounded ends, and is indicated to be made of metal with walls of substantial thickness. Such is the familiar construction of a container for compressed gases. The filling plug 6 is of usual form, and requires no particular description. Butane is introduced in liquid form and in practical service may be introduced in sufficient quantity to fill the tank say 80% full of liquid. Above the liquid, butane will fill the remaining space in gaseous condition and under relatively high pressure.

In the length of duct 2 which leads from tank 1 to engine manifold 3 are arranged an expansion chamber and valves controlling ingress to and egress from the expansion chamber, and it is in this expansion chamber and the associated valves where our invention centers.

With particular attention to Figs. III, IV, and V, the expansion chamber 7 will be seen to be an enlargement by a considerable number of diameters and for an appreciable

length of the diameter of duct 2. The shoulders formed where duct 2 widens to chamber 7 and contracts again form seats for the two valves, 8 and 9. These valves are conical, are movable in ways in the direction of and in axial alignment with duct 2. Stems 10 and 11 extend through suitably packed orifices in the walls of chamber 7 and these stems are provided at their inner ends with longitudinally extending but eccentrically placed pins 12 and 13. These pins enter transverse slots 14 and 15 in the bodies of valves 8 and 9, and the effect of stem rotation is valve movement longitudinally, in direction to and from the valve seat.

Valves of this type will be found to be minutely described, and their advantages dwelt upon in an application for Letters Patent, Serial No. 456,798, filed March 30th, 1921, by James B. Anderson, one of the present applicants. Suffice it here to say of them that they are well adapted to control the flow of expanding fluids through small orifices, to retain accuracy under exacting service conditions, and to be easily operated.

Normally valve 8, the valve at the intake end of chamber 7, stands closed, and valve 9 at the outlet end open, in the positions shown in Figs. IV and V. When in operation of the apparatus valve 8 is opened and valve 9 closed a small quantity of butane in liquid form gains access to chamber 7. It there expands to gaseous form, and when immediately thereafter the valve position is reversed, this segregated charge of butane gas is released, to expand and flow to the engine manifold, and to perform there its priming surface.

The delivery from tank 1 to duct 2 and chamber 7 is, it will be observed, from the bottom of the tank, and, accordingly, the butane as it enters duct 2 is in liquid form. This has already been intimated. In duct 2, between tank 1 and chamber 7 is advantageously placed an adjustable valve 16 controlling the passage and determining its effective area. This valve is so adjusted in its opening that a charge of butane filling duct 2 in liquid form between valves 16 and 8 may, on the opening of valve 8 expand at once into chamber 7, while the orifice is insufficient to allow the feeding down, during the short interval of time during which valve 8 is open, of any such additional quantity of butane as to disturb operation or unduly build up pressure in chamber 7.

Means are provided, whereby the valves 8 and 9 are normally held, valve 8 to its seat, and valve 9 open; and whereby in operation valve 9 closes before valve 8 opens, and opens again after valve 8 has closed. These means in preferred form are shown in Figs. III and V.

From stems 10 and 11 extend crank arms 17 and 18. A link 19 engages both crank arms. Crank arm 18 is made of two pieces hinged medially, as by a pivot 20, by virtue of which the outer end of the crank arm may swing on this pivot downward (cf. Fig. III) after the inner end has reached the limit of its downward swing. A spring 21 normally holds the two ends in the relative position indicated by full lines, Fig. III. The connection between link 19 and crank arm 17 is by means of pin and slot, to the end that there is a limited range of independent movement of link 19, before crank arm 17 will be moved. A spring 22, engaging crank arm 18 at its inner end normally holds both crank arms in their uppermost positions, in which they are shown by full lires in Fig. III. The outer end of crank arm 18 conveniently terminates in a handle or treadle, 23.

Of duct 2, including its enlargement into chamber 7, adaptation to the use of priming substance such as we have indicated, is to be recognized, in that there is no venting of the duct in order to facilitate flow, but the duct is continuous-walled from end to end, the flow of priming material being due to volatilization of liquid to gas.

Operation will readily be understood. Normally the device is inactive, and the parts occupy the positions shown in Fig. III. When, under winter conditions, for example, the cylinder walls of the gas engine are so cold that an introduced charge of gasoline and air will not expand and mingle to form a proper explosive mixture the priming apparatus becomes valuable to afford a substance which being introduced through manifold and carburetter into the cylinder, will do what gasoline fails to do, until at length the cylinder becomes heated to a point at which gasoline will serve as intended.

When such a condition obtains the driver of the car depresses the handle 23 of his priming apparatus. The following movements occur: (1) crank arm 18 swings as a unit, against the tension of spring 22, stem 11 turns, and valve 9 closes, cutting off expansion chamber 7 from the continuation of duct 2 to the manifold. It is in virtue of the slotted connection between link 19 and crank arm 17 that this closure of valve 9 is effected before valve 8 is unseated. When valve 9 has so come to its seat further turning of stem 11 is blocked. (2) Further depression of handle 23 then causes the outer end of crank arm 18 to swing upon its pivot downward, against the tension of spring 21, to the position indicated in dotted lines in Fig. III. This further downward swing of the outer end of crank arm 18 more than takes up the

lost motion afforded by the slotted connection between link 19 and crank arm 17; accordingly, as this further traverse of the outer end of crank arm 18 occurs, crank arm 17 is swung, stem 10 is turned, and valve 8 is opened. With the opening of valve 8 the small quantity of liquid butane theretofore contained in duct 2 above valve 8 and incompletely segregated by valve 16 from the large quantity in tank 1 passes into chamber 7, vaporizing and expanding as it goes.

After momentary pressure upon the handle 23 is relieved, and springs 21 and 22 become effective; the depressed parts rise, the stems 10 and 11 turn in opposite direction to the initial turning described above, and first valve 8 closes. Then, after an interval, valve 9 opens, and thereupon the charge of butane, which has just been segregated in chamber 7 and which is contained in chamber 7 in the condition of hightly compressed gas, expands through the further reaches of duct 2, (driving forward butane gas already filling the tube) and injecting into manifold 3 a charge of butane to serve there the purpose intended.

During the time when valve 8 is open valve 16 so far chokes the duct from tank 1 that the segregation of a charge in gaseous form (though under great pressure) is achieved; but (valve 8 having after a short interval closed again) the flow beneath valve 16 will still be sufficient to allow the gradual filling again of the portion of the duct 2 between valves 16 and 8 with liquid butane.

It is to be remarked of valves 8 and 9 that both of them open inwardly and close outwardly with respect to chamber 7. This arrangement insures tight and leakage-preventing closure of the valves.

Spring 22 will be strong enough to hold valve 8 normally to its seat and prevent leakage and loss of butane. Further insurance against loss is found in valve 16 which when the services of the feed mechanism are not required may be completely closed.

Butane is the priming material which we by preference employ, but manifestly other suitable material may be used instead; and in the use of another material, the change from liquid to gaseous state may not be involved. In case the material employed be under the conditions of service liquid, the suction of the engine may suffice to draw in the fumes or vapor of the liquid, and so to achieve the end desired; if however the liquid be so stable as not to respond to suction to the end indicated, it is an obvious matter to add an injection pump.

The application of our invention to an automobile specifically is merely by way of example; manifestly, it is applicable to gas engines generally. Details of structure are not of the essence of the invention; an engineer will recognize the possibility of structural variation; we have indicated what is essential, and define it in the following claims:

1. Priming apparatus for a gas engine adapted to a volatile priming fluid and including in combination a liquid container, a continuous-walled duct leading from such container to the gas engine, a segregation chamber in the length of such duct demarcated by valves, means for maintaining the inlet valve to such chamber normally closed and the outlet open, such means being movable and in movement effecting closure of the outlet valve and in sequence thereafter opening of the inlet valve.

2. Priming apparatus for a gas engine adapted to a volatile priming fluid and including in combination with a gas engine, a liquid container, an expansion chamber, a duct leading from said source of supply to said expansion chamber and from said expansion chamber to said engine, said chamber and duct being formed with continuous and unvented walls, inwardly opening valves controlling inlet to and exit from said expansion chamber, means for shifting said valves in sequence and effecting the opening of one only after the other has closed, and a throttle valve arranged in the duct between source of supply and expansion chamber.

3. Priming apparatus for a gas engine including, in combination with the engine, a source of supply of priming material, a segregation chamber, ducts leading from said source of supply to the segregation chamber and from the segregation chamber to said engine, two inwardly opening valves arranged in said segregation chamber and controlling communication from duct to chamber and from chamber to duct again, two rotary stems extending through the wall of the segregation chamber and connected one to each of said valves, a crank arm connected to each of said stems, one of said crank arms being formed of two parts pivoted one to the other and held by spring tension against relative movement, and crank-swinging means engaging said crank arms with allowance for lost motion in one case while in the other case the engagement lacks such allowance, such crank-swinging means, driven in either of two opposite directions, effect on initial traverse the closure of one of said valves and on further traverse the opening of the other.

4. Priming apparatus for a gas engine including, in combination with the engine, a receptacle adapted to maintain a quantity of priming material under pressure and in liquid form, a duct leading from said receptacle to the engine, an expansion chamber

arranged in the course of said duct and marked off therefrom by valves, each valve opening only when the other is closed and closing before the other can be opened, and a throttle valve arranged in the duct at an intermediate point between the receptacle aforesaid and the expansion chamber.

In testimony whereof we have hereunto set our hands.

JAMES B. GARNER.
JAMES B. ANDERSON.

Witnesses:
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FRANCIS J. TOMASSON.