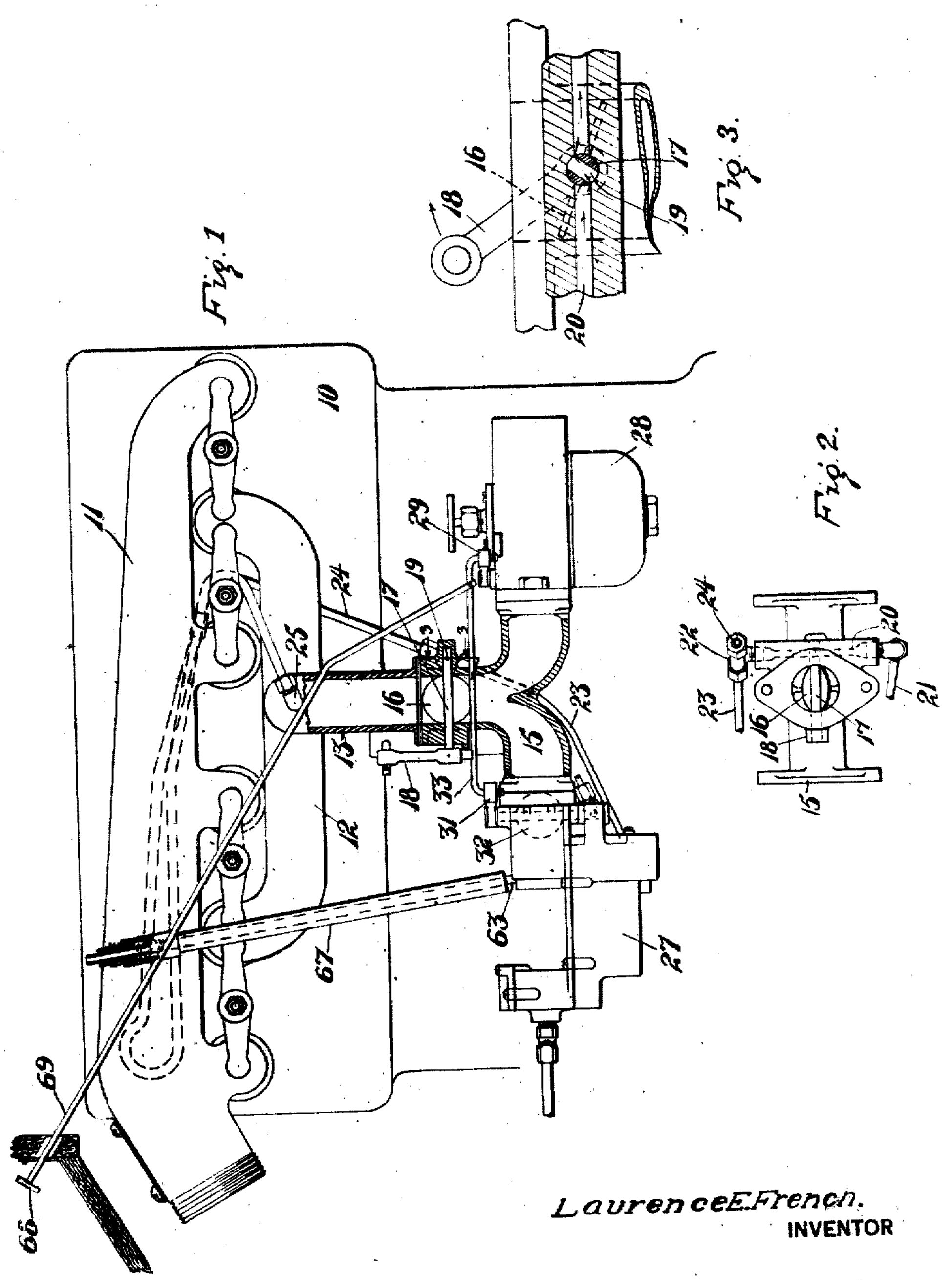
Oct. 16, 1923. 1,470,967

L. E. FRENCH

FUEL VAPORIZING SYSTEM

Filed April 22, 1919 2 Sheets-Sheet 1



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2 Sheets-Sheet 2

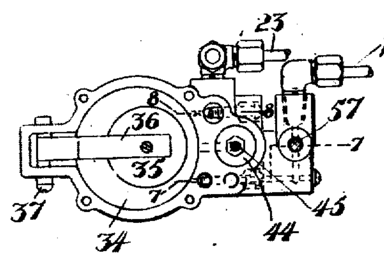


Fig. 4.

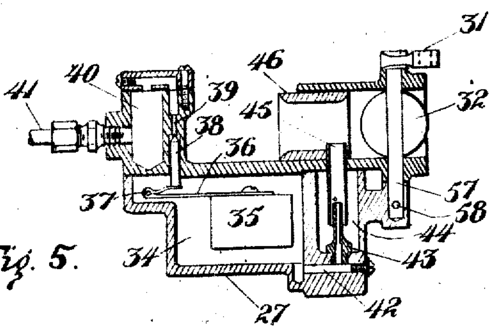


Fig. 5.

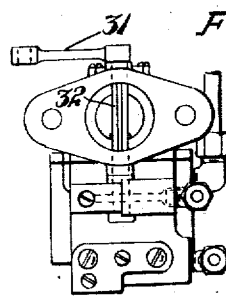


Fig. 6.

Fig. 7.

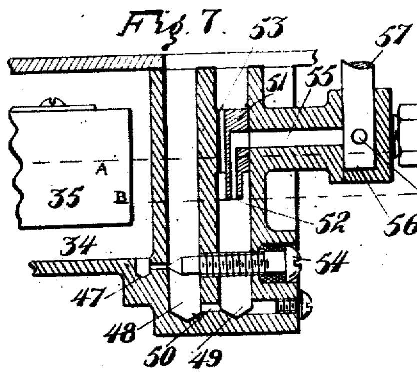
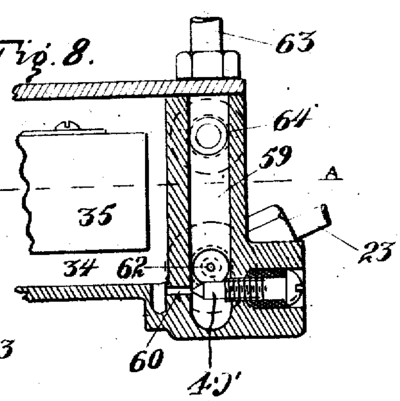


Fig. 8.



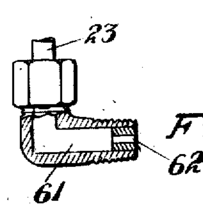


Fig. 10.

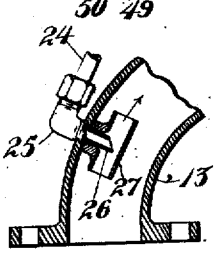


Fig. 9.

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UNITED STATES PATENT OFFICE.

LAURENCE E. FRENCH, OF SEBASTOPOL, CALIFORNIA.

FUEL-VAPORIZING SYSTEM.

Application filed April 22, 1919. Serial No. 291,844.

To all whom it may concern:

Be it known that I, LAURENCE E. FRENCH, a citizen of the United States, residing at Sebastopol, in the county of Sonoma and State of California, have invented new and useful Improvements in Fuel-Vaporizing Systems, of which the following is a specification.

This invention relates to an internal combustion engine and particularly pertains to a fuel vaporizing system therefor.

In the use of heavy fuel, it is often found necessary to start the engine on some light and volatile fuel and to operate on this fuel for some little time to give the entire engine and radiator time to attain normal working temperatures, as the condensation of heavy fuel in a cold engine often causes damage to the cylinders, due to the removal of the lubricating oil, and other troubles through the dilution of lubricating oil in the crank case.

It is the principal object of the present invention to provide a fuel vaporizing system with which heavy fuel may be used while the engine is normally running and which system provides simple means whereby a light and more volatile fuel may be used in starting and warming the engine, said system embodying means for unitarily controlling both of said carburization mechanisms.

Other objects of the present invention are to provide means of carburization, whereby heavy fuel may be finally gasified by being finely pulverized and then efficiently heated at reduced pressure during vaporization. This is due to the fact that the wide range of temperature of the exhaust gas of the engine under different throttle openings makes it normally impossible to exhaust-heat a non-volatile fuel sufficiently on a nearly closed throttle without overheating the mixture on open throttle to a point where loss of volumetric efficiency and pre-ignition occurs. Such a condition, it is known, will seriously lessen the maximum power of the engine, and it is an object of this invention to provide a system which will heat to vaporization the heavy fuel mixtures carried to the engine cylinders on closed throttle, with decreasing proportion of heat as the cylinder compression and intake gas velocity increases with opening of the throttle, thereby automatically insuring that an efficient mixture of gaseous fuel will at all times be delivered to the engine without reference to the load upon the engine or its speed of rotation.

The present invention contemplates the use of a volatile fuel carbureter and a heavy fuel carbureter, both united to an intake manifold, said heavy fuel being provided with means whereby it may be readily vaporized by heat derived from the exhaust manifold of the engine, and its flow and temperature automatically controlled by the control of the two carbureters. These carbureters collectively furnish a starting fuel jet for light fuel and three fuel jets have heavy fuel which comprises an idling jet always functioning at a constant rate of flow when the engine operates, an intermediate jet which begins to function at a constant rate of flow when a predetermined rate of engine speed has been reached and a third fuel jet which begins to function when another higher rate of speed has been reached and through which the flow increases in direct ratio, to an increase in engine speed.

The invention is illustrated by way of example in the accompanying drawings, in which—

Fig. 1 is a view in side elevation, disclosing an internal combustion engine fitted with an intake and exhaust manifold, and further illustrating the application of the present system thereto, the manifolds of which are broken away, clearly disclosing the invention.

Fig. 2 is a view in plan, illustrating the manifold connections between the main intake pipe and the two separate carbureters, further disclosing the main butterfly valve and the fuel valve.

Fig. 3 is an enlarged view in vertical section, as seen on line 3—3 of Fig. 1, disclosing the relation between the fuel valve and the main throttle valve.

Fig. 4 is the view in plan, illustrating the arrangement of the heavy fuel carbureter.

Fig. 5 is a view in longitudinal central section, through the carbureter, shown on Fig. 4, and clearly discloses the float arrangement as well as the vaporization system therefor.

Fig. 6 is a view on end elevation, showing the carbureter disclosed in Fig. 4 and Fig. 5.

Fig. 7 is an enlarged fragmentary view of the heavy fuel carbureter, as seen on line 7—7 of Fig. 4.

Fig. 8 is an enlarged fragmentary view

of the heavy fuel carbureter, as seen on line 8—8 of Fig. 4.

Fig. 9 is an enlarged view in detail, showing the fuel inlet nozzle to the heavy fuel carbureter and to the intake manifold of the engine.

Fig. 10 is a fragmentary view of a nozzle used in the heavy carbureter.

The invention is illustrated in the accompanying drawings, in which 10 indicates an internal combustion engine. This engine is here shown as fitted with an exhaust manifold 11 and intake manifold 12, the manifolds in the present instance both being shown as upon the same side of the engine.

The intake manifold is formed with central downwardly extending portion 13, having a bolting flange at the bottom thereof for receiving a T manifold connection 15. The manifold connection 15 carries a main butterfly valve 16, shown in Figs. 1, 2 and 3. This valve is mounted upon a rotative stem 17 to one end of which is secured an operating lever 18. The opposite end of the stem is formed with a fuel valve duct 19 which register with a fuel passageway 20, formed in the wall of the T 15.

By reference to Fig. 3, the exact relation of the butterfly valve 16 and the duct 19 for the fuel valve control is clearly shown as one end of the passageway 20 is fitted with a fuel supply-pipe 21, while the opposite end is provided with a connection 22. At one end of which connection a pipe 23 is secured and at the opposite end, a vaporizing pipe 24 or as shown in Fig. 2. The vaporizing pipe 24 is shown as being led up and into the exhaust manifold 11, after which it is brought c t through the wall of the manifold, and is led to an elbow 25. This elbow is particularly shown in Fig. 9 as extending through the side wall of the intake manifold. It is there fitted with a tube 26 which has a beveled end, and which is enclosed within a shield member 27. Through this tube and the shield member, the gaseous fuel which has been vaporized within the exhaust pipe is drawn into the intake manifold for the purposes of carburization.

The opposite end of the connection 22, which is fitted with the pipe 23, communicates with a heavy fuel carbureter 27, as indicated in Fig. 1. This carbureter is fastened on one end of the T manifold member 15, while the other leg of the T is in connection with a light fuel carbureter 28. The light fuel carbureter 28 may be of any desired construction and may be the carbureter originally designed for use upon the engine. In any case it is fitted with a cut-off valve 29 by which the flow of gaseous fuel from this carbureter to the engine manifold may be established or discontinued. This cut-off valve has a lever in direct connection with the lever 31 of the cut-off valve 32 carried by the heavy fuel carbureter 27. This connection is made by a rigid connecting rod 33 shown in Fig. 1. It is intended that the cut-off valves 29 and 32 will be alternately thrown to extreme positions, the gaseous fuel being controlled at all times by the main throttle valve 16.

Reference being particularly had to Fig. 5, it will be noted that the heavy fuel carbureter 27 is formed with a bowl 34 within which a float member 35 is mounted. This member is here shown as hanging from a lever arm 36, pivoted upon a pin 37 at one end of the bowl, and which actuates the vertically movable needle valve 38. The needle valve 38 is disposed to seat at the lower end of a fuel inlet duct 39, which is in communication with a fuel inflow well 40. The well 40 is fitted with a fuel pipe 41, by which the fuel is led from any suitable source of supply. An outflow passageway 42 is formed from the bottom of the carbureter bowl 34, and communicates with a spray nozzle 43. This nozzle extends upwardly into an air chamber 44, and its upper end is surrounded by an air tube 45. The tube 45 does not fit closely around the nozzle 43, but provides a space between the two members through which air may be drawn, and its circulation established. The upper end of the tube enters an air intaking throat 46, through which air is directly admitted to the butterfly cut-off valve 32 and from thence will flow to the engine. The suction of the air passing through this tube 46 will draw the fuel upward through the members 43 and 45 and will cause this fuel to unite with the gas and the air in a manner to form a suitable fuel mixture for the engine, the mixture then flowing to the manifold member 15 and upwardly to the intake manifold 13.

The float chamber 34 does not alone control the supply of fuel for the engine. Means are provided whereby a certain amount of the heavy fuel may be deviated from its course to the vaporizing members 43 and 45, and allowed to pass through the vaporizing tube 24, as more clearly shown in Fig. 1 of the drawing. By reference to Figs. 7 and 8, the details of the construction of the carbureter, are shown. It is to be seen that the float bowl 34 is connected with an outlet duct 47 leading from the bottom of the bowl to a cavity 48. This cavity extends vertically and is separated from the main body of the bowl by a vertical intermediate wall. Parallel to the cavity 48 is another compartment 49, which communicates therewith through a bottom duct 50. The cavity 48 is open to the atmosphere while cavity 49 is enclosed and is fitted with a nozzle member 51, having a downwardly descending duct 52, through which gaseous fuel may pass in a manner hereinafter described, and an opening 53, through which air may flow to the cavity 49. The inflow of fuel to the cavity 48 from chamber 34 is controlled by an adjustable valve 54, which extends through the cavities 48 and 49 and is adjusted from the exterior thereof. The nozzle member 51 extends within the lower end of its passageway 52 considerably below the fuel level A—A in the float chamber 34, thus establishing a fuel head above the lower end of passageway 52 and below the fuel level A—A. The duct 52 communicates with the port 55, which port leads directly to seat 56 of a valve stem 57. Valve stem 57 is clearly shown in Fig. 5 as carrying the butterfly cut-off valve 32, its lower end being formed with a transverse passageway 58, by which the control of fuel flowing from the opening 55 to the fuel supply tube 21 is brought about as the cut-off valve and its stem are rotated.

After the fuel which has been deviated from the vaporizing nozzle 45 and has passed through pipe 21, it will flow through the tube 24 enclosed within the exhaust manifold, and will thereafter be delivered to the intake manifold of the engine. If desired, the fuel may ascend from another chamber of the heavy fuel carbureter 27, where the heavy fuel will be more thoroughly vaporized and a more perfect carburization produced. This flow takes place through the pipe 23, clearly shown in Fig. 8 as leading from a metering chamber 59. The chamber 59 is formed alongside of the carbureter bowl 34 and communicates therewith by means of the duct 60. The sectional area of the tube 23 is considerably greater than the area of the passageway occurring between the tube and the compartment 59, as indicated in Fig. 10. Here it will be seen that the end of tube 23 is fitted into an elbow nozzle member 61, having a restricted end opening 62. This opening admits the fuel from the compartment 59 to the tube, sucking out all the fuel passing in from the float chamber 34 through the opening 60 and maintains the liquid at reduced pressure when the engine operates at low temperature. This position of the nozzle 62 is considerably lower than the level of the fuel, as indicated on line A—A of Figs. 7 and 8. In order to more thoroughly complete the vaporization of the fuel, an air inlet pipe 63 is provided and communicates with the upper end of the cavity 59 through an opening 64. The air inlet tube 63 extends vertically and terminates at a point above the exhaust manifold, as particularly shown in Fig. 1. This inlet tube is opened at its upper end, and is surrounded throughout its length by a jacket 67. This jacket is in communication with the side of the exhaust manifold and is filled with a heated gas, which will warm the air passing through the tube and deliver a warmed air to the compartment 59, this air uniting with the fuel which passes from this compartment through the opening 62.

The control of the present system is effected by the usual hand throttle lever mounted upon the steering column or the steering wheel of an automobile and which is connected with the arm 18. While the cut-off valves 29 and 32 are controlled by foot lever 68, which is fastened at the upper end of a push rod 69. This push rod is secured to the connecting rod 33, with which levers 29 and 31 are united, and will alternately open and close the butterfly cut-off valves 29 and 32 of the gasoline and heavy fuel carbureters, throwing them to extreme positions. The cut-off valves 29 and 32 are cross-connected so that when one is opened, the other is simultaneously closed and vice versa. Upon closing valve 32, the fuel valve 58 closes off, the suction from pipe 21 simultaneously so that no heavy fuel may pass through this pipe during the operation of carbureter 28 although the valve 19 may be open.

In operating the present invention, the engine is started by any desired means and the push button 68 is drawn back to close the cut-off valve 32 and to open the cut-off valve 29. The engine will thus be started on a gasoline fuel from the carbureter 28, the speed of the engine being controlled by means of the master throttle valve 16. This valve, as shown in Fig. 1, is mounted in the vertically extending leg of the T manifold member 15. When the engine has attained its normal working temperature, the push button 68 is manipulated to completely close the cut-off valve 29 and to open the valve 32. The heavy fuel carbureter 27 will then be set in action, and carbureter 28 rendered inoperative.

When considering the carbureter 27, the operation is found to be in three distinct phases, depending on the opening of the main throttle valve 16. The first phase is established when the throttle is closed or nearly closed, and represents a car speed on a smooth, level road at five to ten miles per hour. This speeed we will designate as the "idling" speed. The second phase is established when the throttle 16 is partially opened and represents a car speed of ten to twenty miles an hour, this speed being designated as the "intermediate" speed. The third speed is established when the throttle 16 is wide open or nearly so and represents a car speed on the level of from twenty to forty miles per hour, which speed is designated the "high" speed position.

During idling speed the operation of the carbureter is as follows: The fuel valve 19 is simultaneously closed with the closing of the throttle 16, as particularly shown in the sectional view of Fig. 3. The intake pipe 13 will thus be closed and a suction will be established in this portion of the pipe, reaching approximately nine pounds per square inch under these conditions. The vaporizing tube 23 is subjected to the intake suction through its connection with the intake pipe at the T 22; hence, valve 19 is closed and the intake vacuum is communicated to the tube 23 and thence to the member 61, and creates a suction through the opening 62 in this spray member. The restriction of this opening is shown in detail in Fig. 10, and has an important bearing on the operation in two distinct matters, which will be explained shortly. Fuel is then admitted to the cavity 59 through the port 60 and from the float chamber 34. The level of the fuel is maintained by the float 35 along the line A—A, as indicated in Figs. 7 and 8. The amount of fuel entering the chamber 59 is determined by the position of the needle valve 49', 59 at the bottom of the float chamber, and also the head of fuel represented by the difference in level from the line A—A to the lower port opening of passageway 62. Air is admitted to the cavity 59 through the port 64 by the tube 63, the air entering this tube at a point above the exhaust manifold and being heated as it passes downwardly therethrough. As has been previously explained, the heating of this vertically descending tube is brought about by the delivery of the exhaust gases to the outer surface thereof, and passing along a jacket surrounding the same.

The restricted opening 62 at the end of the nozzle 61 insures that the full vacuum in the intake pipe 13 will be effectively transferred throughout the length of vaporizing tube and tube 23 to a point directly behind the restriction and that a reduced pressure will be produced in tube 23. This reduction of pressure below atmospheric pressure in the heated portion of the tube 24 is quite necessary to the proper vaporization of heavy fuel under ordinary conditions, due to the lowering of the boiling point of the fuel passing through this tube. It is understood that the temperature of the exhaust gas in the average combustion engine, as used on automobiles is about 250° Fahrenheit in the idling position. As the boiling point of kerosene ranges from about 390° to 500° Fahrenheit at atmospheric pressure, it is only by reducing the pressure and breaking up the fuel that desirable results can be obtained under "idling" conditions. It will be noted that air enters the opening 62 simultaneously with the fuel and that the high velocity obtained by using the restricted opening causes the fuel to be effectively broken up into a fine spray which is carried along by the air. Relating to this operation, it has been demonstrated that a given heating surface will evaporate nearly four times the quantity of liquid fuel when that surface is subjected to a finely divided liquid spray instead of an unbroken column of liquid. In the present instance, it will be recognized that a finely divided spray will be produced, due to the inrush of heated air from the tube 63 and the liquid which will be drawn to the tube 23. The fine division of the fuel and the reduction of pressure during the heating are accomplished in the present system largely by means of the restricted opening at the entrance of the nozzle 61. It will be noted that the amount of fuel which is fed into the cavity 59, as shown in Fig. 8, is constant as determined by the fuel head in the float chamber 34, and the metering hole 60, and that the fuel passing through 60 is in no way dependent upon the amount of air passing through the cavity or the suction existing in the vaporizing tube. The fuel to be vaporized will thus be drawn from the carbureter 27, and will be delivered gasified, to the intake manifold of the engine, to there unite with the air passing directly from the carbureter. This condition takes place when the engine is in what has been termed its "idling" position and it will be noted that the fuel flow will be constant.

When the engine is to be operated at an intermediate speed, the throttle valve is operated by the lever 18 and will swing in the manifold, as particularly shown in Fig. 3. Simultaneous with this swinging motion, the opening in the duct 19 is produced and it then registers with the passageway 17 and 20 at the opposite sides thereof. Now, when this operation takes place, communication will be established between the pipe 24 and the pipe 21 and thus suction, as shown, will be established through the tube 24 to the tube 21 as well as through tube 23. This tube 21 leads into other parts of the carbureter, as more clearly indicated in Fig. 7. When the butterfly valve 16 is initially opened, there will be but a very slight drop in the suction pressure, as permitted through the pipes 21 and 23. This suction will be transmitted to the restricted opening 52 in the downwardly descending nozzle, shown in Fig. 7, as communicating with the passage 49. As the nozzle inlet is only slightly below the depth of the fuel level A—A, there will be a slight drop in pressure to cause the fuel level in the cavity 49 to drop to the point of exit of the opening 52, accompanied by the air entering the opening 53 in this nozzle. The result will be that a considerable spray of this fuel will be produced in the larger portion 55 of the outlet passageway. As the main throttle 16 is further opened, more air will be admitted and simultaneously the fuel valve 19 will be further opened, increasing the suction on the nozzle opening 52. The fuel level will thus be lowered from the point shown by the lines A—A in the cavity 48 to the point of the drilled passageway 50, which connects the cavities 48 and 49. This increases the fuel head and consequently increases the flow of fuel at the needle and through the duct 47 into the cavity 48, and thence to the nozzle 52. It will be noted that as the cavity 48 is opened at the top, no increase in fuel will be obtained in this cavity, due to an increased suction in the adjoining cavity 49 after air begins to enter the passage 50 simultaneously with the fuel, but owing to air entering the hole 53, considerable reduction of pressure must occur in passageway 55 before a reduction of pressure occurs in the cavity 49. The ratio of the diameters of holes 52 and 53 thus bear an important relation to each other in governing this action. The holes are normally about the same diameter.

It is very important that some flow of fuel be maintained at all times through the nozzle 52, even with a very light suction in 55. With the slight fuel head represented by the difference in level A—A to B—B, this condition is met and the fuel flow increased in exact proportion to the increase of suction in the port 55 until the fuel level in 48 reaches the hole 50, after which no increase of fuel feed is possible, but a constant flow maintained with any further increase of suction.

When the engine is to be driven at "high speed," the throttle valve 16 is widely opened, and the velocity of the air passing through the passageway 46 will be materially increased to a point at which suction on the tube 45 will draw the fuel up from the chamber 34 through the stem 43 and into the passageway 46, thereafter to be delivered to the engine manifold. This fuel will, of course, be atomized and will be in a finely divided state, thoroughly mixed with the air entering the intake of the engine. While the fuel entering the air from nozzle 43 is not heated directly in any way by the exhaust gases, the velocity of the air on open throttle is nevertheless sufficient to cause a fine division of pure spray which forms a very readily combustible mixture while at the same time heated fuel from tubes 21 and 23 is being delivered to the manifold through pipe 24. The heat of cylinder compression and the temperature of combustion are also greatly increased on wide open throttle which assists combustion. Particular attention is called to this feature of the present invention, and to the advantages to be gained thereby. The exhaust temperature on open throttle averages about 1300° Fahrenheit at high speed. In other systems heretofore used, the entire mixture or nearly a constant proportion of the entire mixture is heated by the exhaust. Owing to the wide range of the temperature of the exhaust at different throttle openings and varying speeds, it is rarely possible in these other systems to get sufficient heat on a nearly closed throttle without incurring an overheated mixture on open throttle to a point where loss of efficiency and pre-ignition conditions occur to seriously lessen the maximum power of the engine. In the present system, the mixture is run into the engine, at high engine speed, at a very low temperature, and this entails practically no power loss on open throttle and on closed throttle practically the entire mixture is heated to a point insuring thorough vaporization. This is accomplished in the operation by an automatic action, and also insures a proper graduation of heat for the fuel under varying conditions, and regulates automatically the proportion of cold air used at intermediate speeds.

It will thus be seen that the present system embodies the use of duplex carburization, whereby light and heavy fuel may be alternately delivered to the intake manifold, and which also incorporates means for automatically raising the temperature of a certain percentage of the heavy fuel in direct ratio to the rising temperature of the exhaust gases delivered from the engine, and thus insuring that a maximum efficiency of the carburization system will be attained at all times, and that ease in starting the engine may be produced.

While I have shown the first form of my invention as now known to me, it will be understood that various changes in the combination, construction and arrangement of parts may be made by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In combination with an internal combustion engine having intake and exhaust manifolds, heavy and light fuel carbureters, connecting with said exhaust manifold and adapted to be alternately placed in communication therewith, an auxiliary fuel passageway leading from one of the carbureters to the intake manifold and a master throttle adapted to control the flow of fuel from either of the carbureters to the engine and regulate the flow of fuel through the auxiliary passageway.

2. In combination with explosive engine having an intake manifold, an exhaust manifold connected with said engine, a carbureter in communication with said engine, a fuel vaporization pipe leading from the carbureter to a point in the intake manifold, a master valve for controlling the flow of fuel and air from the carbureter to the engine, and the stem of said master valve controlling the flow of liquid fuel through this vapori-

zation pipe in ratio to the volumetric flow of gaseous fuel admitted by the master valve.

3. In combination with an internal combustion engine having an intake and an exhaust manifold, a light fuel carbureter in communication with said intake manifold, a heavy fuel carbureter in connection with said intake manifold, a vaporization tube leading from the heavy fuel carbureter through the exhaust manifold and connecting with the intake manifold at a point between the engine and the throttle valve, whereby suction influence may be exerted thereto, a valve controlled simultaneously with the main valve in the manifold, whereby the flow of fuel to the vaporization tube may be regulated in proportion to the opening of the main fuel valve.

4. In a fuel vaporization system, the combination with an internal combustion engine, having intake and exhaust manifolds, of a T manifold in communication with the intake manifold, a light fuel carbureter connected to one leg of the T, a heavy fuel carbureter connected to the opposite leg of the T, control valves regulating the flow of gaseous fuel from each carbureter to the respective legs of the T manifold and connected for simultaneous operation in alternate directions, a throttle valve controlling the flow of fuel from either of said carbureters to the manifold, a fuel suction pipe connecting with the heavy fuel carbureter, and after passing through the exhaust manifold, leading to the intake manifold, and valve means controlled by movement of the throttle valve, whereby the degree of suction in the suction tube will be regulated simultaneously with the regulation of the flow of gaseous fuel to the manifold.

5. A carbureter comprising a float bowl, a fuel inlet well disposed above one end of said bowl and in communication therewith, a valve member for regulating the flow of fuel from the well to the bowl, a float within the bowl for controlling the valve, a fuel nozzle in communication with the opposite side of the bowl and extending vertically, a nozzle tube telescoping over the mouth of the nozzle and extending upwardly through the cover of the float bowl, an air passageway standing at right angles to the nozzle tube and with which it communicates, a butterfly valve adapted to be interposed between the point of communication of the tube with the passageway and the engine with which it communicates, fuel cavities formed within the bowl portion of the carbureter, suction pipes in communication therewith and after passing through an exhaust manifold leading to an intake manifold, and means for simultaneously controlling the degree of suction existing in said pipes and the volume of flow of gaseous fuel from the carbureter to the engine.

6. In combination with an internal combustion engine having exhaust and intake manifolds, a carbureter provided with a float bowl, a master valve interposed between the carbureter and the engine, means for preheating the liquid fuel at a reduced pressure when the master valve is in a slightly opened condition and delivering the same to the intake manifold at a point between the master valve and the engine, means for creating a delivery of fuel through the preheating means under a definite head of liquid when the master valve is in an intermediate position, and means for directly carbureting gaseous fuel and drawing it into the engine when the throttle is approximately open.

7. A nozzle by which gaseous fuel is admitted to an intake manifold, comprising a tube projecting into the manifold at substantially right angles to the flow of air therethrough, the end of said tube being cut off at an angle to present an oblique opening facing in the direction of flow through the manifold and a cylindrical sleeve into which said nozzle projects and which sleeve is open at its opposite ends to permit a free flow of air therethrough.

8. A gaseous fuel carbureter having a low speed fuel jet, an intermediate speed fuel jet and a high speed fuel jet, all of which speeds relate to the speed of the engine upon which the carbureter is mounted, a throttle valve for directly controlling the flow of air from the carbureter to the engine and the performance of the high speed fuel jet, means operated thereby for successively and collectively causing the low and intermediate speed nozzles to function when different engine speeds have been reached and at a speed lower than the speed at which the high speed nozzle operates and means for heating the fuel passing from the low speed nozzle to the engine.

9. A gaseous fuel carbureter having a low speed fuel jet, an intermediate speed fuel jet and a high speed fuel jet, all of which speeds relate to the speed of the engine upon which the carbureter is mounted, a throttle valve for directly controlling the flow of air from the carbureter to the engine and the performance of the high speed fuel jet, means operated thereby for successively and collectively causing the low and intermediate speed nozzle to function when different engine speeds have been reached and at a speed lower than the speed at which the high speed nozzle operates and means for heating the fuel passing from the low speed nozzle to the engine, and means for creating a low pressure on the fuel passing from said low speed nozzle whereby it will be more readily vaporized while passing to the engine.

10. A gaseous fuel carbureter having a high speed fuel nozzle adapted to begin functioning after a predetermined engine

speed has been reached and to increase the flow in direct ratio to the increase in engine speed, an intermediate speed nozzle having a constant rate of flow and beginning to function at a lower rate of engine speed than that of the high speed nozzle, a low speed nozzle having a constant rate of flow and beginning to function with the initial rotation of the engine and continuously operated throughout the performance thereof, a throttle valve for controlling the flow of air to the engine and thereby directly controlling the operation of the high speed nozzle, and indirectly operated means controlled by the movement of the throttle valve whereby the low and intermediate speed nozzles may be successively placed in operation.

11. A gaseous fuel carbureter having a high speed fuel nozzle adapted to begin functioning after a predetermined engine speed has been reached and to increase the flow in direct ratio to the increase in engine speed, an intermediate speed nozzle having a constant rate of flow and beginning to function at a lower rate of engine speed than that of the high speed nozzle, a low speed nozzle having a constant rate of flow and beginning to function with the initial rotation of the engine and continuously operated throughout the performance thereof, a throttle valve for controlling the flow of air to the engine and thereby directly controlling the operation of the high speed nozzle, an indirectly operated means controlled by the movement of the throttle valve whereby the low and intermediate speed nozzles may be successively placed in operation, and means for heating the fuel passing from the intermediate and low speed nozzles and to the engine.

12. A gaseous fuel carbureter for internal combustion engines comprising a main nozzle, a throttle valve and controlling the performance thereof, a low speed nozzle, means connecting this nozzle with the manifold of the engine at a point above the throttle valve and means actuated by the throttle valve for establishing operation of said low speed nozzle, and means for creating low pressure upon the fuel passing from the low pressure nozzle to the engine whereby it may be vaporized at low temperature.

13. A gaseous fuel carbureter for internal combustion engines comprising a main nozzle, a throttle valve and controlling the performance thereof, a low speed nozzle, means connecting this nozzle with the manifold of the engine at a point above the nozzle with the manifold of the engine at a point above the throttle valve and means actuated by the throttle valve for establishing operation of said low speed nozzle, and means for heating the fuel passing from said nozzle to the engine.

14. A gaseous fuel carbureter for internal combustion engines, comprising a main nozzle, a throttle valve and controlling the performance thereof, a low speed nozzle, means connecting this nozzle with the manifold of the engine at a point above the throttle valve and means actuated by the throttle valve for establishing operation of said low speed nozzle, and means for heating the fuel passing from said nozzle to the engine, and means for creating a low pressure upon the fuel passing from the low pressure nozzle to the engine whereby it may be vaporized at low temperature, and means for delivering heated air to pass through the low fuel nozzle with the liquid fuel.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LAURENCE E. FRENCH.

Witnesses:
A. C. KRAMER,
C. PAULSON.