R. W. HARROUN.

CARBURETER.

APPLICATION FILED DEC. 18, 1913.

1,158,494.

Patented Nov. 2, 1915.

2 SHEETS—SHEET 1.

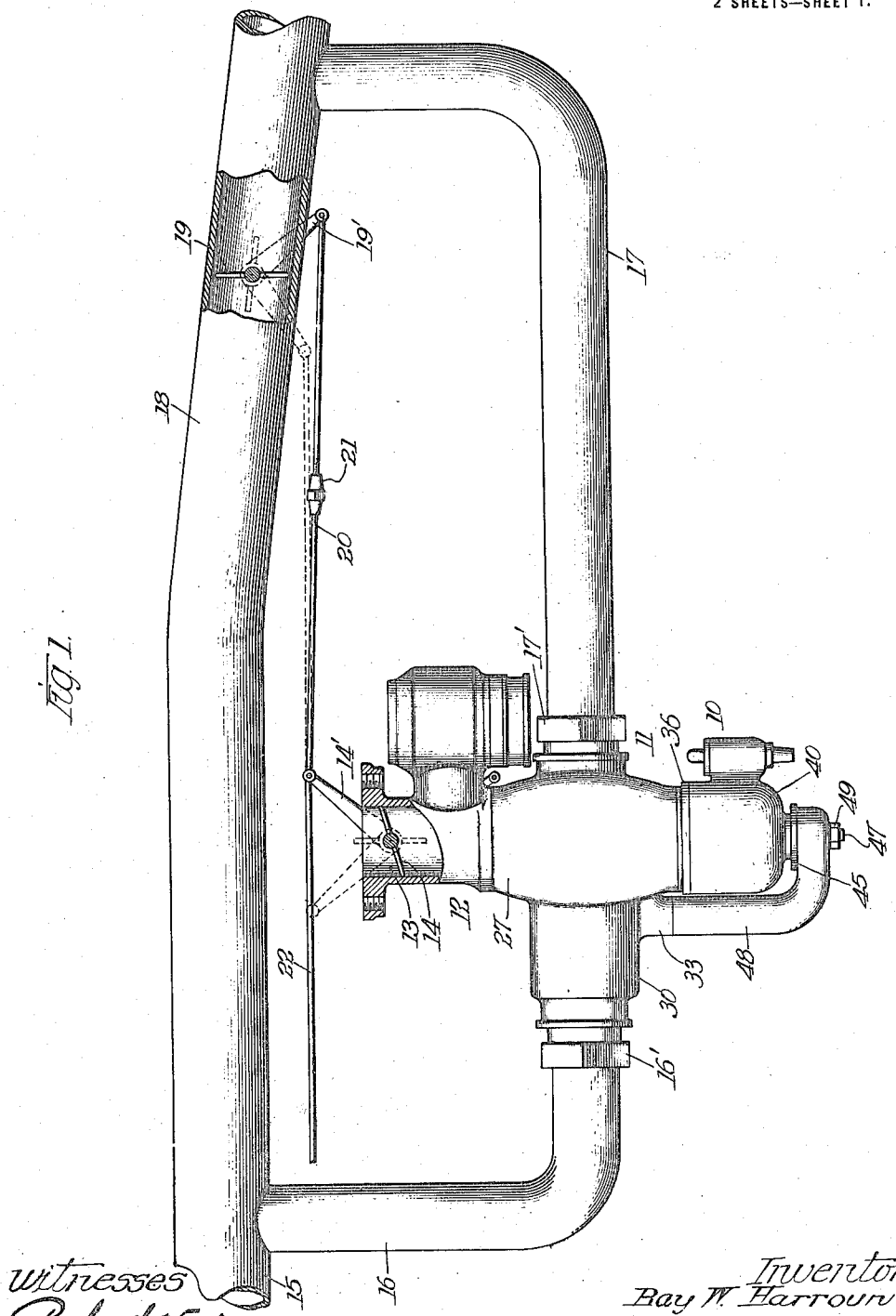


Fig. 1.

Witnesses
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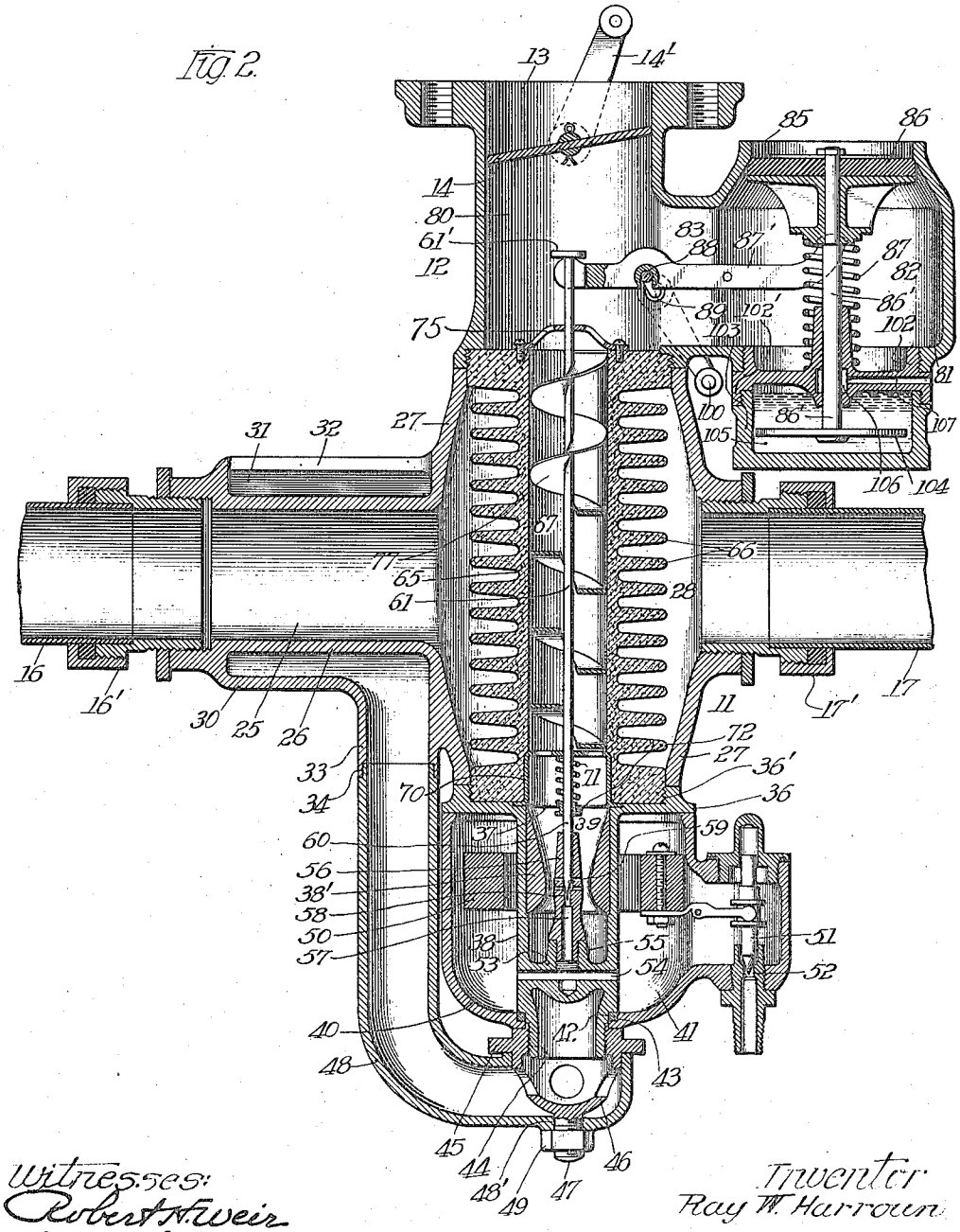
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2 SHEETS—SHEET 2.

Fig. 2.



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RAY W. HARROUN, OF INDIANAPOLIS, INDIANA.

CARBURETER.

1,158,494. Specification of Letters Patent. Patented Nov. 2, 1915.

Application filed December 18, 1913. Serial No. 807,416.

To all whom it may concern:

Be it known that I, RAY W. HARROUN, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Carbureters, of which the following is a specification.

My invention relates to improvements in carbureters.

The general object of my invention is to provide a carbureter capable of handling relatively low grade fuels, such as commercial "kerosene," for supplying fuel vapor to automobile engines and the like. To this end I provide for the utilization of the exhaust gases from the engine to heat the fuel content of the charge and combine the various parts of the structure in a coöperating relation which I have found most advantageous to secure adequate vaporization of the fuel when the engine is in operation.

Another object of my invention is to provide an advantageous regulation of the supply of the heating medium to the carbureter for automatically proportioning the heat supply to the demand upon the carbureter.

Further objects of my invention are to provide an advantageous heating structure of novel construction, to improve the valve arrangements for controlling the fuel and air flow, and to provide a construction which is simple, efficient, made of few parts, easily manufactured and assembled, and not liable to get out of order.

In the drawings, I have illustrated a single embodiment of my invention for purposes of disclosure thereof in a form which I have found practically effective.

Figure 1 is a front elevation of my improved carbureter showing the heater connections with the exhaust pipe of an engine, and Fig. 2 is a vertical sectional view through the center of the carbureter.

My carbureter is preferably divided into three correlated sections, being the carbureting section 10, the heating section 11, and the secondary mixing section 12.

Air, preferably heated preliminarily in a portion of the heating section, is passed through the carbureting section to receive therein a fuel charge, and the primary mixture passes thence through the heating section, for complete vaporization of the fuel content of the charge, and into the mixing section, where it is mixed with a secondary supply of air and directed through an outlet 13 leading to the intake of the engine cylinder, said outlet being throttled as by the oval butterfly valve 14.

The exhaust gas from the exhaust manifold of the engine is led through an exhaust pipe 15 which divides it into two branches, the heater branch 16 extending into communication with the heater section of the carbureter and thence as through pipe 17 to a suitable muffler, or to the atmosphere, and a by-pass branch 18 leading past the carbureter to the muffler or to the atmosphere, for eduction of the exhaust gas without its passage through the heater. This by-pass pipe 18 has therein a throttle valve 19, preferably in the form of a round butterfly or damper valve, and the valves 14 and 19 are interconnected for predetermined coöperation.

Of course in the operation of a gas engine a small throttle opening results in a relatively low engine speed and consequent reduction of the volume of exhaust gas so that under such conditions it is important that all of the exhaust gas, or substantially all of it, shall pass through the carbureter heater in order to insure proper heating effect in the carbureter; whereas if the throttle is open wider the engine speed is consequently greater and an increasing proportion of the exhaust gases may be by-passed around the carbureter without reducing the temperature of the carbureter below an efficient point. I therefore arrange the valves 14 and 19 for common control in a fashion which insures maintenance of the exhaust throttle 19 in the by-pass in substantially closed position until the carbureter throttle has opened to a material degree, and I also provide for a greater proportional movement of the exhaust throttle 19, when it starts to move to open position than takes place in the case of the simultaneously moving carbureter throttle, so that both valves 19 and 14 may attain their positions of substantially maximum openings at the same time. To this end, I preferably provide upon the exhaust throttle 19 and the carbureter throttle 14, operating arms 19′ and 14′ of different lengths, that on the exhaust throttle being the shorter, and these two arms I connect as by a rod provided with a turn buckle 21 for adjustment of its length, the two intercon-

nected valves being operable in common by a suitable operating rod 22. The exhaust throttle valve 19, I preferably make round so that it may turn completely in its pipe, while the carbureter throttle 14 is preferably made oval so that in closed position it stands at an angle in its pipe. The construction and connection of the two valves is such that the range of movement of carbureter throttle 14 is less than 90 degrees, from its inclined closed position to a position substantially parallel with the axis of the outlet which it controls, while valve 19 preferably has a movement from a position slightly inclined in one direction beyond its center,—or beyond right angles to the axis of its pipe,—past said dead center position, to a position substantially parallel with the axis of its pipe, such range of movement being more than 90 degrees. In this way I insure that the carbureter throttle will be moved through a substantial opening range before any substantial opening of the exhaust throttle 19 occurs, the exhaust pipe remaining substantially closed while the valve 19 is traveling from its initial position on one side of dead center to an equivalent position on the other side of dead center.

The heater element 11 of the carbureter with which the exhaust pipe sections 16 and 17 connect, as through appropriately packed couplings 16′ and 17′, consists of a horizontal gas passage 25 having its walls 26 merging into the walls 27 of a generally cylindrical enlargement 28, the axis of which vertically intersects the axis of the pipe, the enlargement preferably tapering somewhat toward both ends and at both extremities terminating in flat annular surfaces. Around the horizontal pipe wall 26 is provided a peripheral wall 30 to include between the two walls an air heating drum 31 having an air inlet opening 32 at its top and an open stub 33 constituting an outlet opening at its bottom, said stub preferably having a rabbeted or shouldered end 34, to communicate with a pipe which leads the air from the heating chamber to the inlet end of the carbureting structure. This carbureting structure 10 preferably has its frame made in two major parts, the specific construction shown providing a horizontal head 36 which coacts with the lower end of the enlargement 27 and forms a bottom wall therefor, said head having a central orifice, 37 surrounded by an integral tube 38, the interior of which constitutes the carbureting passage 39.

Against the under side of the head 36 fits a shell 40 of the fuel float chamber 41, said shell having at its lower end an opening so that it fits snugly around the lower extremity of the tube 38, which is reduced to provide a shoulder 42 between which and the contiguous portions of the float chamber shell a packing 43 is applied. The reduced portion of the tube 38, projecting through the aperture in the float chamber shell is screw threaded as at 44 and receives a coupling nut 45 which serves to clamp the float chamber shell against the packed shoulder 42, forcing the upper end of the shell into tight contact with the head 36. The coupling nut 45 is preferably provided with an apertured dome or spider 46 extending below the open end of tube 38 and bearing at its center, in alinement with the axis of the tube a bolt projection 47, by which there may be secured to the structure an air pipe 48 leading back to the stub projection 34 from the air receiving part of the heater structure. This pipe 48 has its end reduced to interfit in the rabbeted portion 34, of the air heater stub, and at its lower end is formed to interfit neatly against the flat surface of the nut and is provided with a suitable aperture 48′ through which the bolt portion 47 extends to receive the nut 49 which locks the air pipe in place.

The annular float chamber surrounding the carbureting tube 38 may contain any suitable form of float 50 governing a valve 51 controlling an inlet port 52 for admission of kerosene or other relatively low grade fuel into the chamber and to maintain it at a predetermined level therein in a manner well understood in the art. The liquid fuel issues from the float chamber into the passage 39 under the control of a needle valve, and to this end I preferably form integral with the wall 38 of the tube a transverse bridge 53, having a passage 54 extending transversely therethrough and communicating with a vertical passage in a stud 55 provided on the bridge in alinement with the axis of the tube. Into this stud is screwed a nozzle post 56 extending axially of the tube and providing an axial opening 57, reduced as at 58 to form a shoulder seat for a needle valve, and above said seat provided with radial nozzle openings 59. Above said seat and nozzle openings said nozzle post forms a vertical guide for a needle valve 60, which has a long stem 61 extending axially through the heater passage of the mixing chamber where it is provided with a flat head 61′ for coöperation with the valve mechanism to be described.

I prefer that the nozzle opening shall be slightly above the level of the liquid maintained in the float chamber, and in order that the air passing by the nozzle, may entrain fuel with certainty, I prefer that the passage area shall be materially reduced adjacent the nozzle openings. For this reason I mount within the tube 38 a filler 38′ in the form of a sleeve having its central opening or bore tapering from both its ends toward the plane of the nozzle openings the lower taper being preferably abrupt and the

upper taper more gradual, and extending preferably to the end of the tube.

The open end of the tube 38 communicates with the mixture heating passage in a heating tube structure 65 which extends vertically through the enlargement 28 of the heater element of the construction. This heater tube structure I prefer shall be made of lava in the form of a single tube, having its peripheral wall deeply corrugated exteriorly so as to provide a series of horizontal ribs 66, its central passage 67 being of substantially the same diameter as the tube 38. The lava thus employed, as a relatively thick wall, acts as a heat regulator, its conductivity being sufficiently high to insure proper heating of the passing mixture, but insuring that the mixture is not burned or overheated at any localized spot in its passage, as where the exhaust gases impinge on the near side of the tube. The mechanical strength of the lava tube is adequate for the purposes intended and it is not subject to deterioration under the varying conditions of heat to which it is subjected, nor under the action of the exhaust gases.

I prefer that the heater pipe structure 65 shall be used as a connecting means for securing together the three major elements 10, 11 and 12. To this end I preferably make the ends of the tube of maximum diameter equal to the greatest diameter of the flanges, so that they fit neatly in the smaller ends of enlargement 28 and I proportion said tube to extend beyond the ends of the enlargement so that its projecting portions may make screw threaded engagement with the proximate portions of the carbureting and secondary mixer elements. As will be observed the screw threaded lower end of the heater tube engages in the threaded peripheral wall 36′ of a recess made in the head 36 and that its threaded upper end is screw threaded into the shell of the secondary chamber 12.

I prefer that between the coacting surfaces of the tube 65 and head 36 there be clamped the feet of a metal bridge piece 70. The bridge piece constitutes a guide for the valve stem 61 and affords a bearing for a spring 71 which encircles said stem and at its lower end bears against the collar 72 thereon, said spring 71 insuring normal maintenance of the needle valve in lowered position. This bridge structure 70 preferably takes the form of a spider suitably apertured so as not to reduce to any undesirable extent the area of the fuel passage. A second spider 75 may be secured to the open upper end of the tube to afford guidance for the stem 61 near its upper end.

I prefer that within the open bore of the tube there be provided a helical deflector 77, in the form of a continuous strip, twisted to helical arrangement and resting on its lower end on the bridge 70, said deflector causing the mixture to whirl within the heating tube and its passage therethrough so as to be thrown by centrifugal action into contact with the heated wall 65.

The mixer 12 comprises a shell secured to the heater shell as heretofore described and having a generally cylindrical part 80 vertically alining with the heater tube and having an outlet orifice controlled by the throttle 14 as heretofore described, said shell having an extension 81 to provide an air chamber 82 communicating with the mixing chamber 80 through a passage 83. In the top of said chamber 82 is a secondary air port 85 controlled by a valve 86 vertically reciprocable to open against the tension of the spring 87 and by its opening and closing movements controlling the movement of needle valve 60. Specifically the valve 86 bears upon a lever 87′ which is pivoted on the crank portion 88 of a transverse shaft 89 to which is connected exteriorly an operating arm 100 by the movement of which the crank may be moved to raise and lower the fulcrum for the lever. The remote extremity of the lever, beyond said fulcrum engages beneath the head 61′ on the stem of the valve 60 so that as the valve 86 opens the valve 60 is proportionately open, but by adjustment of the arm 100 the initial position of the valve 60 before movement of the valve 86 commences may be predetermined, or adjusted.

Obviously the valve 86 effects its opening movement in response to engine suction, and I prefer that its movements both in opening and closing be mechanically retarded. To this end the valve stem 86′, which extends down through the spring 87, passes down into a dash pot and is connected with a disk or resistance element thereof. In the construction shown a head 102 is screwed into an orifice in the bottom of the shell extension 81 to form the base of the chamber 82; through this head the stem 86′ guidedly projects. The head has a lower rim 102′ in which is threaded a dash pot cup 103 into which the stem 86′ projects, said stem bearing on its lower end a disk 104 of the dash pot, the movements of which are resisted by a suitable fluid element within the dash pot such as the oil body 105. Since the chamber 82 is often under less than atmospheric pressure, there would be, without the compensating arrangement hereafter referred to, a tendency for the oil to leak out around the stem 86′ into the chamber 82. To prevent this I provide in the boss of the cap 102 through which the stem 86′ extends a chamber 106, surrounding said stem and forming an en-

largement of the bore through which the stem projects, said chamber 106 having open communication through a passage 107 extending through the cap 102, with the air. Thus any leakage that may occur around the stem 86′ is satisfied by the air entering through the relief passage 107 and the oil in the dash pot is not subject to the displacement by reason of unbalanced pressure.

The operation of the device will be apparent. The coöperating operation of the carbureter throttle 14 and the throttle 19 in the exhaust by-path insures delivery to the carbureter of an adequate portion of the exhaust gases which act upon the exterior walls of the heating pipe structure 66. The air, preliminarily heated in the drum 31 passes down through the connecting pipe 48 and the coupling structure to the vertical stack or conduit leading to the throttle controlled outlet. This vertical passage is divided substantially into three sections. In the lower section the air receives its charge, entrained into the air passage as the air at relatively high velocity passes the restricted zone contiguous to the radial outlets which deliver the fuel from the float chamber through the central nozzle post. The preliminarily heated air is in proper condition to receive the charge and the oil sprayed through the nozzle openings is effectively atomized, not only by the nature of the nozzle structure but by impingement of the radially delivered sprays upon the contiguous walls of the reducing sleeve 38′. The mixture thus produced passes into the second zone where it is caused to whirl within the heater tube and by the application of the heat complete vaporization of the fuel contents of the mixture is assured. The relatively rich mixture passing from the heater into the relatively large mixing chamber 80 is therein mixed with an appropriate quantity of fresh air drawn into the carbureter past the automatic valve 86 which opens under the influence of the same rarefaction in the air tube beyond the carbureter that causes the air flow through the primary conduit. Of course the extent of opening of the automatic air valve is in accordance with the speed of the engine, but its action both in opening and closing is properly dampened by the effect of the dash pot associated with the valve stem. The wider the valve opens, the greater is the proportion of air for the engine charge introduced through the auxiliary valve, but since the opening of the auxiliary valve results in greater opening of the needle valve which controls the fuel, the richer will be the primary mixture and consequently the automatic proportioning insures that there be supplied to the engine at all times an adequately rich fuel. The adjustability of the lever connections between the secondary air valve and the needle valve controlling the fuel supply enables an appropriate adjustment of the needle valve to be made for low speed conditions, by a very simple structure readily accessible from the exterior of the carbureter.

While I have herein described in some detail a particular embodiment of my invention, it will be apparent to those skilled in the art that many changes might be made in the details of construction without departure from the spirit of my invention and within the scope of the appended claims.

What I claim is:—

1. In a carbureter, the combination of a heating chamber having openings in its upper and lower walls, a heating tube extending through the said openings, a carbureting tube in vertical alinement with and screw threaded upon the lower end of the heating tube, a float chamber surrounding the said carbureting tube, a flange extending radially from the upper end of the said carbureting tube, the upper edge of the float chamber abutting against the said flange, said carbureting tube extending through an opening in the lower end of the float chamber and a retaining nut screw threaded upon the lower end of the carbureting tube and abutting against the lower end of the float chamber, thereby holding the above mentioned parts in rigid relation.

2. In a carbureter, the combination of a heating chamber having openings in its upper and lower walls, a heating tube extending through the said openings, and making tight contacts therewith, a tubular shaped carbureting tube in vertical alinement with the said heating tube, and screw threaded in engagement therewith, a flange extending outward from the upper end of the carbureting tube, a float chamber concentric with the carbureting tube chamber and with its upper end abutting against the said flange, the lower end of the carbureting tube extending down through an opening in the lower end of the float chamber, and a nut screw threaded upon the lower end of the carbureting tube abutting against the float chamber.

3. In a carbureter for an internal combustion engine, the combination of a heating chamber having openings in its upper and lower walls, lateral extensions from the heating chamber for connection with the exhaust pipe of the engine, a heating tube extending through said openings and making close contact with the walls thereof, a carbureting tube in vertical alinement with said heating tube, and screw threaded in engagement therewith, a flange extending radially from the upper end of the carbureting

tube, a float chamber concentric with the carbureting tube and with its upper end abutting against the said flange, the lower end of the carbureting tube extending down through an opening in the lower end of the float chamber, an open chamber surrounding the outer walls of one of the said extensions from the heating chamber, a duct extending into the said chamber and communicating with the lower end of the carbureting tube, and means for engagement with the said duct and the lower end of the carbureting tube for securing the duct, float chamber and carbureting tube in fixed relation one to the other.

4. In a carbureter, the combination of a heating chamber having openings in its upper and lower walls, a heating tube extending through the said openings, and making close contact with the walls thereof, a carbureting tube positioned beneath the heating tube and in alinement therewith, a nozzle within the carbureting tube, a float chamber concentric with the carbureting tube, ducts connecting the float chamber with the nozzle, an elongated needle valve stem extending upward from the nozzle through the heating tube, a valve stem guide positioned within the said heating tube and provided with a flange extending between the adjacent ends of the heating tube and carbureting tube and secured in position thereby, and means positioned above the carbureting tube for operating the said needle valve.

5. In a carbureter for an internal combustion engine, the combination of a heating chamber communicating with the exhaust pipe of the said engine, a heating tube extending through the said heating chamber and open at its ends, a duct leading to the cylinder of the gas engine positioned in vertical alinement with the heating tube and of a greater area, helically arranged flanges extending inward from the walls of the heating tube, a carbureting tube positioned in alinement with and directly below, the heating tube, a nozzle within the said carbureting tube, a float chamber concentric with the carbureting tube, and ducts connecting the said nozzle with the float chamber, the openings in the said nozzle being radial and adapted to spray the fuel radially against the walls of the said carbureting tube, the cross sectional area of the said carbureting tube opposite the nozzle openings being restricted substantially as and for the purpose set forth.

6. A heating device for gas engine carbureters, comprising a heating chamber, a gas duct extending through the said heating chamber and communicating with the cylinder of the engine, a throttle valve within the said duct, an exhaust pipe leading from the said engine, a valve in the exhaust pipe, a duct leading from the heating chamber into the said exhaust pipe at a point intermediate the said exhaust controlling valve and the cylinder, and means interconnecting the two valves and opening the exhaust controlling valve after the throttle valve is partially open.

7. A heating device for gas engine carbureters, comprising a heating chamber, a gas duct extending through the said heating chamber and communicating with the engine cylinder, a throttle valve positioned within the said duct, an exhaust pipe for carrying the burned gases away from the said cylinder, a valve within the said pipe, a duct connecting the heating chamber with the exhaust pipe at a point intermediate the exhaust controlling valve and the engine cylinder, and means interconnecting the two valves for opening the exhaust controlling valve after the throttle valve and subsequently opening of the exhaust controlling valve at a more rapid rate than the throttle valve.

8. A heating device for gas engine carbureters comprising a heating chamber, a gas duct extending through the said chamber and communicating with the engine cylinder, a throttle valve within the said duct, a pipe for carrying away the exhaust gases from the engine cylinder, a damper valve in the said pipe, a duct connecting the heating chamber with the exhaust pipe at a point intermediate the valve and the engine, a lever carried by the throttle valve, a shorter lever attached to the exhaust controlling valve, and an adjustable rod connecting the two levers, the exhaust controlling valve being positioned with regard to its operating lever so that it remains closed until after the throttle valve has commenced to open.

9. A heating device for gas engine carbureters comprising a heating chamber, a gas duct extending through the said chamber and communicating with the engine cylinder, a throttle valve within the said duct, a pipe for carrying away the exhaust gases from the engine cylinder, a damper valve in said pipe, said damper being round to permit complete revolution within the pipe, a duct connecting the heating chamber with the exhaust pipe at a point intermediate the valve and engine, and means connecting the throttle and damper valves, said damper valve being positioned back of its point of closure when the throttle valve is closed.

10. A heating device for gas engine carbureters, comprising a heating chamber, a gas duct extending through the said chamber and communicating with the engine cylinder, a throttle valve within the said duct, a pipe for carrying away the exhaust gases from the engine cylinder, a damper valve

in said pipe, said damper being round to permit complete revolution within the pipe, a duct connecting the heating chamber with the exhaust pipe at a point intermediate the valve and engine, a lever carried by the throttle valve, a shorter lever carried by the damper valve, and a rod connecting the ends of the two levers, said damper valve being positioned back of its control or closing position when the throttle valve is closed.

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

RAY W. HARROUN.

In the presence of—
L. R. TOWNSLEY,
A. A. FRANKLIN.