July 5, 1927. W. G. HEMENWAY 1,634,782

CARBURETING APPARATUS

Original Filed March 24, 1920 3 Sheets-Sheet 1

Fig. 1

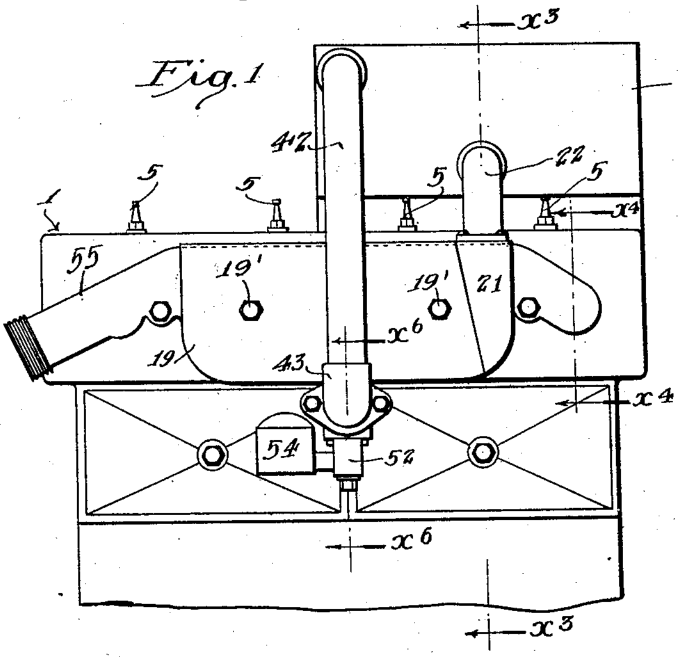
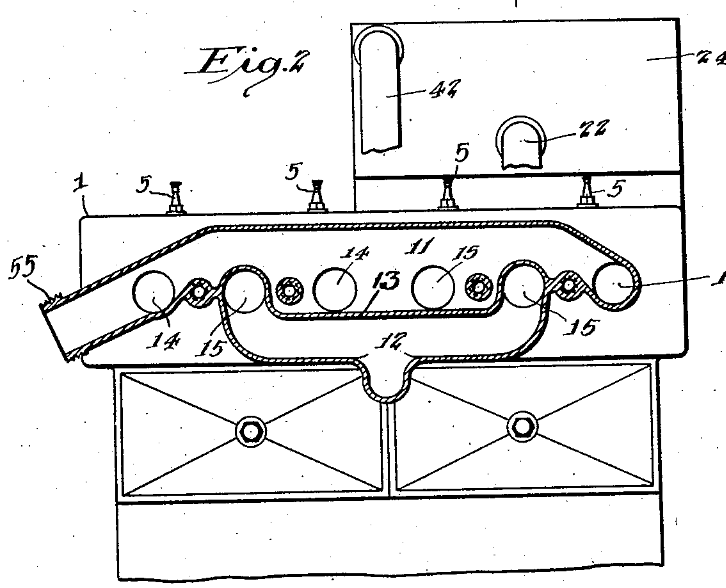


Fig. 2



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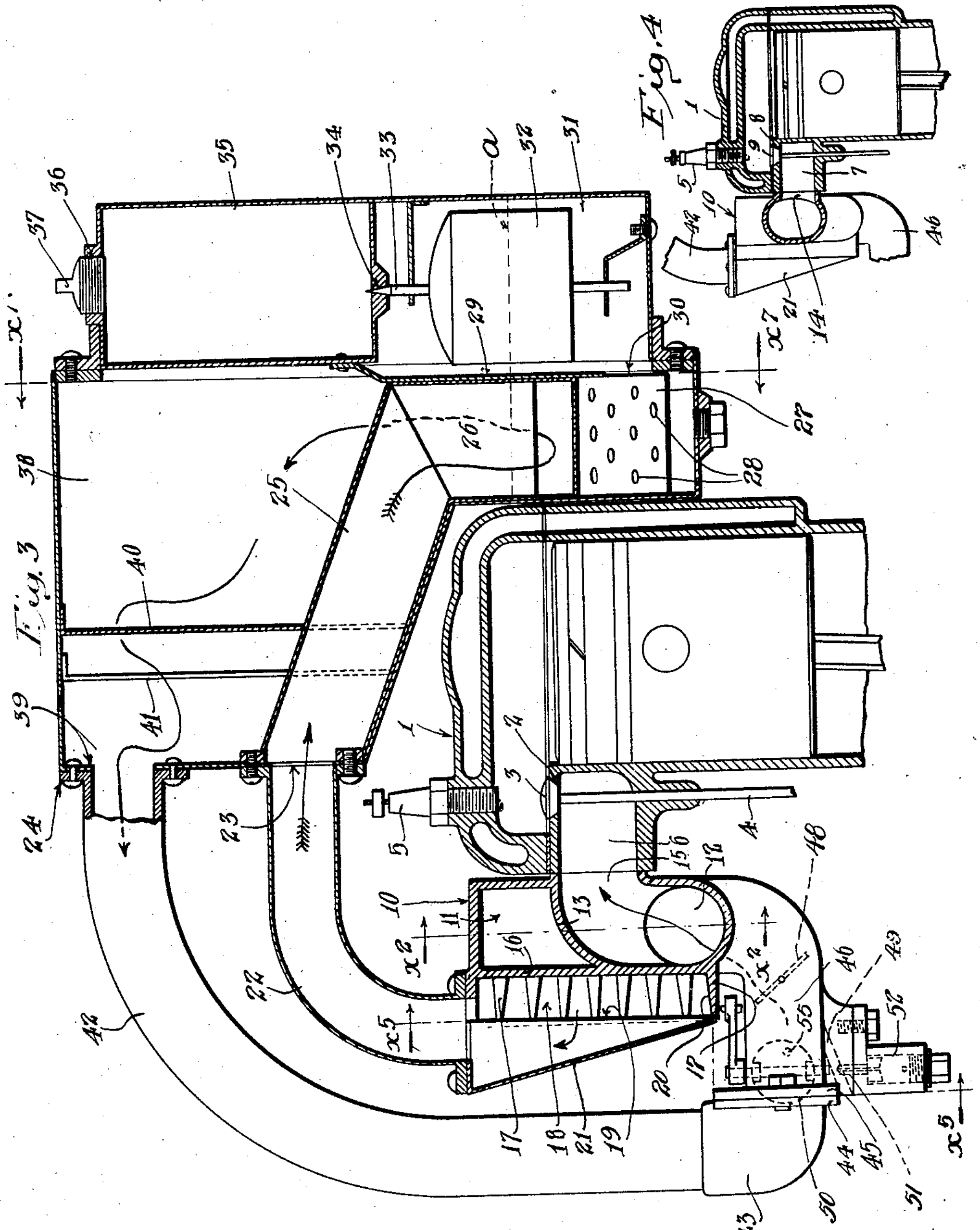
July 5, 1927. W. G. HEMENWAY 1,634,782

CARBURETING APPARATUS

Original Filed March 24, 1920 3 Sheets-Sheet 2



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1,634,782

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CARBURETING APPARATUS

Original Filed March 24, 1920 3 Sheets-Sheet 3

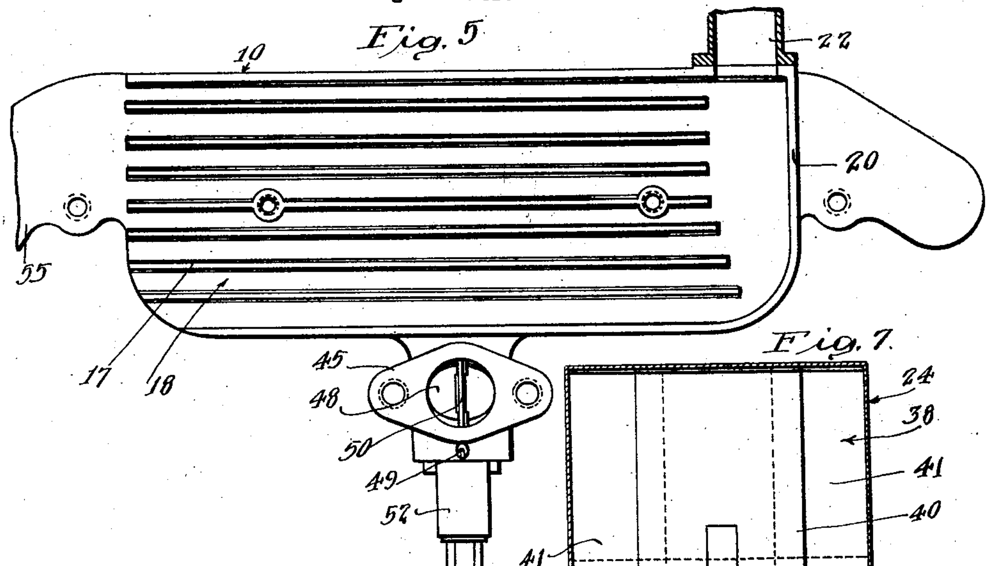

Fig. 5

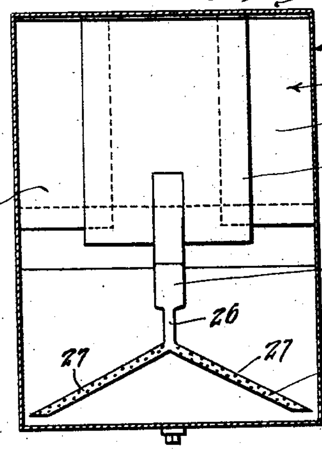

Fig. 7

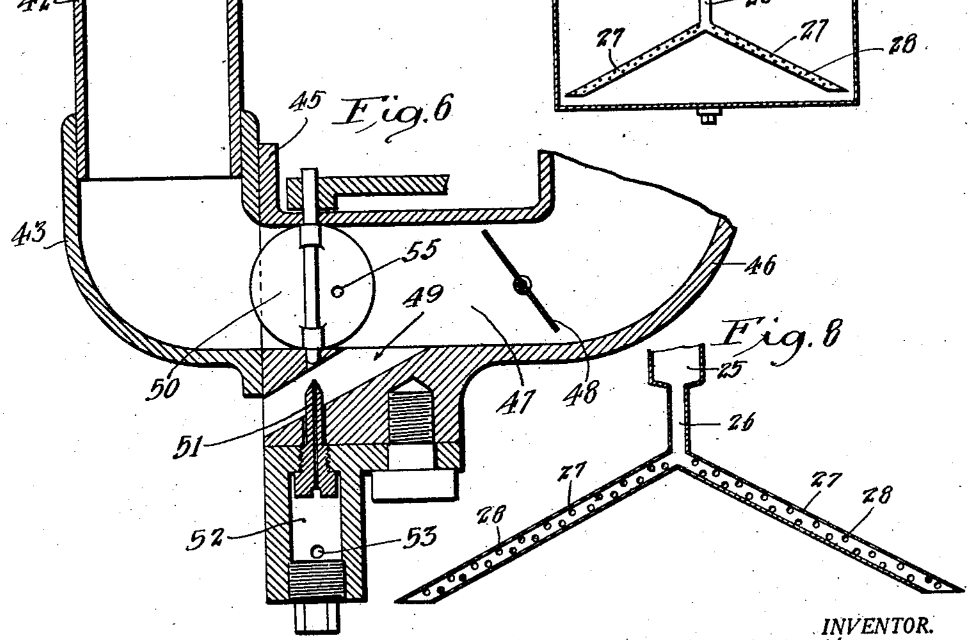

Fig. 6

Fig. 8

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Patented July 5, 1927. **1,634,782**

UNITED STATES PATENT OFFICE.

WALTER G. HEMENWAY, OF LOS ANGELES, CALIFORNIA.

CARBURETING APPARATUS.

Application filed March 24, 1920, Serial No. 368,355. Renewed December 15, 1926.

This invention relates to a type of carbureting apparatus similar in many respects to that shown in my patent for carburetor, No. 1,398,459, issued Nov. 29, 1921.

An object of this invention is to provide a novel form of apparatus for regulating the volume of air admitted to the mixing chamber by means of a liquid seal having air intake openings at different levels in the liquid.

One of the objects of this invention is to improve the construction shown in the foregoing noted patent application.

As distinguishing this invention from said prior invention, an object is to heat most of the air, passing into the apparatus, prior to the contact of said air with the liquid seal, thus enabling said air to absorb more moisture than if the air were not thus heated.

Another object is to make provision for thus heating the air by radiation of the hot exhaust gases of the engine with which the apparatus functions.

Another object is to effect cooling of the heated air before said air enters the cylinders of the engine so as to maximize the oxygen content of the combustible charges compressed in the engine.

Another object is to provide an improved form of manifold whereby the air which is to be carbureted can be readily heated by the heat of the exhaust gases of the engine with which the manifold functions.

A further object is to automatically effect, as nearly as may be possible, the maintenance of a uniform temperature of the combustible charges supplied to the engine at different engine speeds, loads on the engine and atmospheric temperatures.

The accompanying drawings illustrate the invention.

Figure 1 is a side elevation of a construction embodying the invention, the lower portion of the engine cylinders and the crank case being broken away to contract the view.

Fig. 2 is a side elevation similar to Fig. 1, excepting that the manifold is in vertical section on line indicated by x^2—x^2, Fig. 3.

Fig. 3 is an enlarged elevation, mainly in section on line indicated by x^3—x^3, Fig. 1.

Fig. 4 is a fragmental sectional elevation on line indicated by x^4—x^4, Fig. 1.

Fig. 5 is an elevation partly in section on the irregular line indicated by x^5—x^5, Fig. 3.

Fig. 6 is an enlarged sectional elevation on line indicated by x^6—x^6, Fig. 1.

Fig. 7 is a reduced elevation of the water tank from line x^7—x^7, Fig. 3, the wall of said tank being shown in section.

Fig. 8 is an enlarged sectional elevation of the lower portion of the air tube shown in Fig. 7.

In the drawings, engine cylinders are indicated at 1, one of the cylinders being shown in section in Fig. 3. The cylinders are provided with intake ports, one of which is shown at 2 in Fig. 3. Also one of the valves controlling the intake ports is indicated at 3 and said valve is provided with a valve stem 4 which is operated by any suitable means, in a manner well understood in the art pertaining to internal combustion engines. The cylinders may be provided with the usual igniters 5 to produce ignition of the combustible charges inducted to the cylinders through the intake ports.

Communicating with the intake ports 2 are passages 6, each passage serving a pair of intake ports, in this particular instance, though the arrangement of the passages and intake ports may be otherwise if desired. The cylinders are also provided with exhaust passages 7 communicating with exhaust ports 8 which are controlled by valves 9, this construction being clearly shown in Fig. 4.

Fitting against one side of the engine cylinders is a manifold, indicated in general by the character 10, and this manifold is constructed as follows: The manifold is provided with a longitudinally extending exhaust chamber 11 and also with a longitudinally extending air intake chamber 12, the two chambers being separated from each other by a wall 13. The exhaust chamber 11 is provided with ports 14 registering with the exhaust passages 7, and the intake chamber 12 is provided with ports 15 registering with the intake passages 6. The outer vertical wall of the manifold 10 is indicated at 16 and is provided with a series of longitudinally extending fins 17 which may be formed integral with or separate from said wall. The inter-fin spaces are indicated at 18 and form longitudinally extending passages open to the atmosphere at one end thereof as clearly shown in Fig. 5. The passages 18 are provided with an outer or front wall indicated at 19, said wall, in this instance, being formed by a detachable sheet metal plate held in place by cap screws 19′. An upward extension 20 of one end of the lowermost fin 17 forms an end wall which is engaged by one end edge of the plate 19. The wall 19 is provided with an outwardly projecting enlargement 21 at one end, said enlargement forming an outlet communicating with the inter-fin spaces 18, as clearly shown in Fig 3, and expanding upwardly. Thus the tube 22 connects with the inter-fin spaces 18. This completes the description of the manifold proper.

The outlet 21 of the manifold is connected by a tube 22 with an air intake opening 23 in a tank 24. The tank 24 is provided in its interior with an air tube 25 which extends downwardly from the opening 23. The tube 25 is provided with a vertically extending portion 26 which branches to form two separate legs 27 provided with perforations or air ports 28. The lower ends of the legs 27 are preferably close to the bottom of the tank 24, and the tank portion 29 in which the vertical portion 26 of the tube extends, in this instance, is considerably narrower than the upper portion of the tank.

The tank is provided with water, preferably to about the level indicated at *a*, in Fig. 3, and the water may be supplied in any suitable manner and by any suitable means. In the particular instance shown in the drawings the tank portion 29 is provided with an inlet opening 30 which communicates with a float chamber 31, provided with a float 32. The float 32 is provided with a needle-valve 33 adapted to close or open a port 34 in the top of the float chamber when the float is elevated or lowered. The port 34 communicates with the interior of a reservoir 35 which may be filled through an opening 36 closed by plug 37. The portion of the tank 24 above the water level *a* constitutes an air chamber 38, and extending transversely to the axis of an outlet opening 39 in the tank are baffles 40, 41, said baffles being in staggered relation so that air entering the chamber 38 will be forced to flow around the ends of the baffles before passing through the outlet opening 39. Connected with the outlet opening 39 is a tube 42 having an elbow 43 at its lower end. The elbow 43 is provided with a flange 44 adapted to fit against a flange 45 of a tubular member 46, the bore of said tubular member constituting a mixing chamber 47. The tubular member 46 is shown in the drawings as being integral with the manifold 10, but it is understood that it may be separate, if desired. In the mixing chamber 47 is a butterfly throttle valve 48. The mixing chamber 47 communicates with the manifold chamber 12 and the throttle valve 48 is positioned between the chamber 12 and a passage 49 communicating with the mixing chamber, said passage 49 preferably extending aslant downwardly and forwardly from the mixing chamber.

In the mixing chamber 47 forwardly of the passage 49 is a valve 50 to regulate the flow of air from the tube 42 into the mixing chamber. The passage 49 communicates with the mixing chamber between the valves 48, 50, and projecting into said passage 49 is a fuel nozzle 51 which receives fuel from a chamber 52 communicating by a port 53 with a float chamber 54. The float chamber is not shown and described in detail herein since the construction thereof is well understood in the art pertaining to carburetors.

Assuming that the tank 24 is provided with water to the level *a*, the invention operates as follows: Assuming that the valve 50 is closed and that the valve 48 is open to a slight degree, the engine is started into operation in a manner well understood in the art pertaining to internal combustion engines, thus producing a partial vacuum in the mixing chamber 47 which, of course, has the effect of causing fuel to discharge from the nozzle 51 into the passage 49. The fuel, together with a comparatively small volume of air drawn into the passage 49, discharges from said passage into the mixing chamber and the mixture of air and fuel then passes into the chamber 12 and thence through the ports 15, passages 6 and intake ports 2 to the engine cylinders when the valves 3 are opened in the operation of the engine. It is to be noted that because of the valve 50 having a small aperture 55 being closed at this time, very little air will be drawn through the tube 42 into the mixing chamber 47.

Ignition of the charges in the engine cylinders takes place in the usual manner and the exhaust products of combustion pass from the engine cylinders through the exhaust ports 8 when the valves 9 are opened in the operation of the engine in the usual manner. From the ports 8 the exhaust gases enter the passages 7 and thence discharge through the ports 14 into the exhaust chamber 11 of the manifold. Heat from the hot exhaust gases passing through the chamber 11 is transmitted by the wall 16 to the fins 17 and said fins radiate the heat into the passages 18. Heat is also abstracted from the wall 13 by heat radiating action of the fins 17, thus producing lower temperature in the intake chamber 12 than would otherwise be the case. The exhaust gases, after parting with a large portion of their heat, discharge from the exhaust chamber 11 into the exhaust pipe, not shown, which may be screw-threaded onto the manifold at the coupling 55.

Now assuming that higher speed or power of the engine is desired, the operator will open the throttle valve 48 to a greater degree and he will also open the valve 50. The pressure in the mixing chamber 47 being lower than the atmospheric pressure, on account of the partial vacuum produced by operation of the engine pistons, the greater pressure on the water in the tube 25 will lower the water level in said tube sufficiently to permit air in the tube escape therefrom through the ports 28.

The air thus discharging from the tube 25 bubbles upwardly through the water in the tank. The greater the partial vacuum produced by the engine the lower the level the water in the tube 26 will be caused to assume. It follows that the lower the water level in the tube, the greater the number of perforations 28 will become operative to discharge air from the tube through the water into the air chamber 38. The air that is drawn through the tube 25 first passes through the tube 22, and the air enters the tube 22 from the manifold where it flows through the passages 18, thus abstracting heat from the fins 17. The air being heated when it contacts with the water enables the air to take up more watery vapor than if the air were not first heated. Moreover, in passing through the water, the moisture laden air is cooled if it be hotter than the water, or is heated if it be cooler than said water; and the air then discharges from the chamber 38 through the tube 42 into the mixing chamber 47 and dilutes the explosive mixture discharging into said mixing chamber from the passage 49. As water is taken up by the air, in the form of watery vapor, it is replaced by water from the reservoir 35, the float 32 operating to maintain a substantially constant volume of water in the tank, it being understood that the water level will fluctuate considerably between minimum engine speed and maximum engine speed.

The moist air is in a relatively dense condition when it enters the engine, instead of in the expanded condition as it would be if it entered the mixing chamber directly from the passages 18 of the manifold or if heat were not abstracted from the intake chamber as has been explained above. Due to this, the explosive charges when compressed in the engine will contain a larger percentage of oxygen and the expansive range of the charge in the engine will be greater than if the air entered the engine in a more highly heated condition. The reason that the moist air is relatively dense is that it is materially cooled by passing through the water and is not subsequently heated to a great degree before entering the engine cylinders since the heat of the exhaust is carried away from the walls of the intake chamber 12 by the air flowing through the passages 18. The water in the tank 24 is not raised to any great degree in temperature, for the reason that the rapid evaporation of the water by the air passing therethrough has a cooling effect, in accordance with well-known natural laws.

The hotter the air which enters the water, the greater the evaporation effect and consequently the greater the cooling effect so that the water does not attain the boiling point, even though the atmospheric temperature be high, or the engine speed or load be comparatively great. In practice the apparatus which I have operated uses about one quarter as much water as it does fuel, and the temperature of the water does not rise materially.

The water vapor thus picked up by the air passes into the engine cylinders where it absorbs heat of combustion and thus tends to keep the engine from overheating. The hotter the engine tends to become the greater will be the amount of vapor produced, because of the air in the charges first traversing the fins 17 and then passing through the water in the tank 24, and consequently the greater will be the cooling effect on the engine.

From the foregoing it will be clear that perhaps the most important advantage of the above described construction is that the temperature of the combustible charges entering the engine is automatically regulated to a large extent; or in other words, when the engine operates at different speeds and under different loads and under widely differing degrees of temperatures, the temperature of the inducted charges at the different speeds, loads and temperatures will be more uniform than would be the case if the invention were not employed.

From the foregoing it is clear that in some respects the liquid-seal operates the same as the ordinary suction-operated auxiliary valve in carburetors of prior construction for admitting auxiliary air to the mixing chamber of the carburetor. In other respects, though, the liquid-seal functions as a valve differently than the ordinary suction-operated valve for it, in conjunction with the exhaust manifold, serves to regulate the temperature of the charges under varying engine speeds, loads and atmospheric temperatures.

It is understood that the invention is not limited in its broader phases to the exact details of construction shown in the drawings and described above, but that the invention also includes such changes and modifications as may lie within the spirit and scope of the appended claims.

I claim:

1. In a carbureting apparatus, operating at various degrees of engine suction, a mixing chamber, means to discharge fuel into the mixing chamber, a tank adapted to hold a liquid body, a tube in the tank having ports at different levels below the surface of the liquid to supply air to the tank in accordance with the degree of vacuum produced in the tank outside of the tube, a manifold having an exhaust chamber and having

air passages adjacent the exhaust chamber, means connecting said air passages with the tube, and a tube connecting the tank above the liquid level with the mixing chamber.

2. The combination with an internal combustion engine, of a tank adapted to contain a liquid body, a tube in the tank having ports at different levels below the surface of the liquid, a mixing chamber connected at one end with the engine intake and connected at its opposite end with the tank above the surface of the liquid, a manifold having an exhaust chamber communicating with the engine exhaust passage, said manifold having an air passage adjacent the exhaust chamber open at one end and connected at its opposite end with the tube whereby heated air is forced through the liquid body before its entrance into said mixing chamber.

3. In combination, a carbureting chamber having main and auxiliary air inlet ports and an outlet, a fuel nozzle terminating in the carbureting chamber, a second chamber adapted to hold a liquid body. means to admit air to the second chamber at different levels below the liquid level, means to heat said air by the exhaust gases of the engine, a throttle valve between the auxiliary air inlet port and the outlet, and means to conduct air from the second chamber above the liquid level thereof to the auxiliary air inlet port.

4. In combination, means forming a passage for air, said passage having main and auxiliary air admission ports and an outlet, a throttle valve between the auxiliary air port and the outlet, a fuel discharge nozzle terminating in the passage between the main air inlet port and auxiliary air admission port, a chamber independent of the nozzle adapted to hold a liquid body, means to admit air to the chamber at different levels below the liquid level, means to heat said air by the exhaust gases of an engine, and means to conduct air from the chamber to the auxiliary air admission port.

5. The combination with an internal explosion engine, of means for supplying the same with fuel and air comprising a primary air inlet pipe, a fuel nozzle extending into the same, a vessel containing a non-combustible liquid, a duct connecting the vessel to the engine and passing the primary air inlet pipe, so that the pressure in the vessel is reduced correspondingly with that of the intake manifold of the engine, an air inlet pipe extending into said vessel below the normal level of the liquid therein and means to heat the air admitted to said last mentioned air inlet pipe by the heat of the exhaust gases of the engine.

6. The combination with an internal explosion engine, of means for supplying the same with fuel and air comprising a primary air inlet pipe. a fuel nozzle extending into the same. a vessel containing a non-combustible liquid, which vessel is in communication with said primary air inlet pipe between the nozzle and the engine so that the pressure therein is reduced correspondingly with that of the engine, a secondary air inlet pipe extending into said vessel below the normal level of the liquid therein and means to heat the air admitted to the secondary inlet pipe.

Signed at Los Angeles, California, this 18th day of March, 1920.

WALTER G. HEMENWAY.