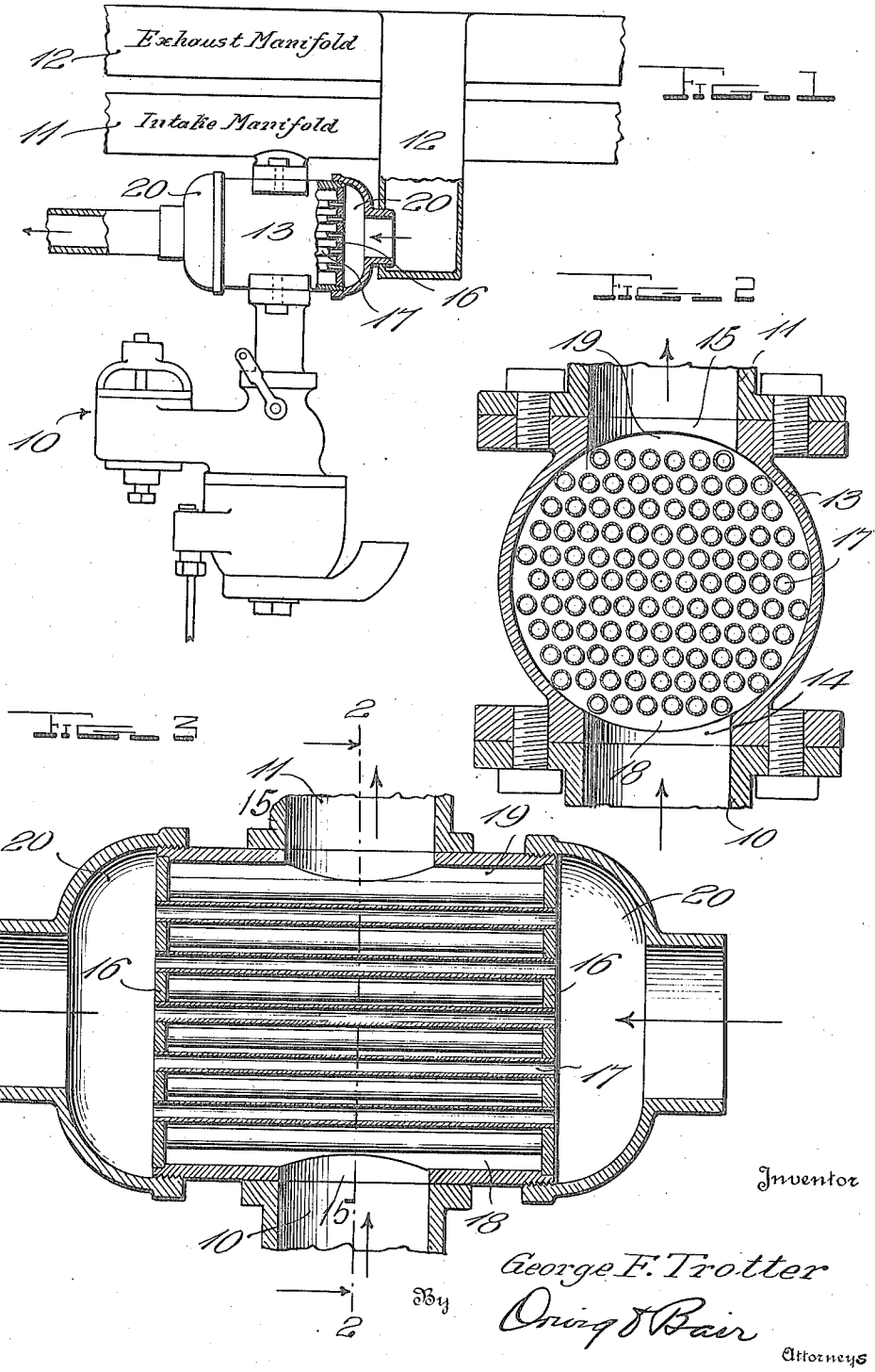
G. F. TROTTER.

CARBURETER FOR INTERNAL COMBUSTION ENGINES.

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1,248,954. Patented Dec. 4, 1917.



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CARBURETER FOR INTERNAL-COMBUSTION ENGINES.

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To all whom it may concern:

Be it known that I, GEORGE F. TROTTER, a citizen of the United States, and resident of Des Moines, in the county of Polk and State of Iowa, have invented a certain new and useful Carbureter for Internal-Combustion Engines, of which the following is a specification.

My invention relates to and consists of a vaporizing device that may be used in the nature of an attachment to be applied to the pipes or passageways leading from an ordinary carbureter to the intake manifold of an internal combustion engine of the kind commonly used in automobiles and which draws the charge into its cylinders by suction.

My object is to provide an attachment of this kind of simple, durable and inexpensive construction, and in which a liquid fuel such as kerosene may first be mixed with air within the carbureter and then the combined air and sprayed fuel introduced into the vaporizer and when thus introduced into the vaporizer by the suction of the engine it will be thoroughly vaporized both by mechanical action and by the application of heat to thereby produce a vapor of such quality and so free from particles of liquid fuel as to positively prevent any appreciable quantities of liquid fuel such as kerosene from accumulating in the engine crank case.

My invention consists in the construction, arrangement and combination of a carbureter of the class mentioned, an engine of the class mentioned and a vaporizer introduced into the passageway between the carbureter and the engine, designed to so act upon the sprayed fuel and air passing through it as to positively vaporize it by combined mechanical action and the application of heat, whereby the objects contemplated are obtained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, in which:

Figure 1 shows a side elevation partly in section, of my improved vaporizer combined with a carbureter and communicating with the intake manifold of an engine and also communicating with the engine exhaust pipe.

Fig. 2 shows a transverse sectional view of my improved vaporizer on the line 2—2 of Fig. 3, and

Fig. 3 shows a central, vertical, longitudinal sectional view of same.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate generally a carbureter of the type now in common use for automobile engines and which is provided with means for introducing air and spraying the liquid fuel.

Reference numeral 11 indicates an engine intake manifold designed to receive the vapor from my improved vaporizer and conduct it to an internal combustion engine of the type commonly employed in automobiles and which draws in the fuel charge by suction.

Reference numeral 12 indicates the exhaust pipe from an internal combustion engine which communicates with my improved vaporizer for the purpose of supplying it with heat.

Reference numeral 13 indicates a hollow cylindrical vaporizer body portion having openings 14 and 15 at opposite sides, the opening 14 being in communication with the carbureter and the opening 15 being in communication with the intake manifold.

The cylinder 13 is provided at its ends with cylinder heads 16 and the spaces between these cylinder heads are approximately filled with open ended tubes 17 extending through the cylinder heads 16. These tubes are of small size and I provide a large number of them and they are arranged close together and close to the interior of the cylinder, as clearly indicated in Fig. 2. In practice, I have successfully employed a cylinder of this class in the same combination in which there were as few as fifty-one tubes, each one-fourth of an inch in diameter, outside measurement, and spaced apart from each other three-sixty-fourths of an inch.

At the intake side of the cylinder 13 the tubes are spaced apart from the cylinder forming an expanding chamber 18 and at the discharge side of the cylinder 13 the tubes are spaced apart from the cylinder forming the collecting passageway 19.

At the end of the cylinder 13, I have provided caps 20, the cap at one end communicating with the exhaust manifold and at the other end leading to a point of discharge.

In order to thoroughly understand the construction and function of the element which constitutes the means for thoroughly

vaporizing the liquid kerosene during its passageway from the carbureter to the engine, it should be borne in mind that the engine with which my invention is used is of the type now in common use in automobiles. These engines, as is well-known, have a vacuum creating means by which the charge is drawn or sucked into the engine cylinders. My improved kerosene vaporizing element is especially constructed, designed and proportioned to coöperate with the engine intake manifold and the engine exhaust pipe of that type of engines which draw the charge into the engine cylinders by suction created by the partial vacuum created by the operation of pistons in the cylinders. In the process of thoroughly vaporizing the kerosene fuel, my invention necessarily acts on the fuel in two ways, first, mechanically and second, by the application of heat. The treatment of the liquid fuel in its passage from a carbureter to an intake manifold of an engine by the application of heat is old and well-known, but in my experiments I have demonstrated that the application of heat alone will not under all conditions thoroughly vaporize all the liquid fuel such as kerosene. It is therefore a very essential part of my fuel vaporizing element to have it mechanically act on the fuel and to have it associated with a carbureter in which the liquid fuel is sprayed and mixed with air and also in combination with a vacuum creating means to draw the charge into the engine cylinder or through the vaporizing element in order to perform its vaporizing function satisfactorily.

I have found it desirable to provide the cylinder 13 with a large number of small tubes, which tubes almost fill up the entire interior of the cylinder 13 and which are placed so close together that the total area of all of the passageways through the cylinder and between the tubes, is materially less than the cross-sectional area of the passageway communicating between the carbureter and the engine intake, that is to say the passageway between the carbureter and the engine intake is restricted within the cylinder 13. By thus restricting this passageway in the manner shown and described and by drawing the fuel charge through it by the partial vacuum pull at the engine end of the passageway, I have found that when the combined air and sprayed kerosene from the carbureter strikes the first set of tubes, the smallest drops of the liquid fuel will be mechanically flattened out into thin sheets or layers. These drops will be flattened out not only in a direction parallel with their line of travel through the vaporizing element but will also be flattened out or lengthened transversely of their line of travel because of the action of the partial vacuum within the vaporizing chamber tending to draw the flattened out drop of liquid fuel toward the ends of the cylinder 13. In addition to this mechanical flattening out and spreading the drops of liquid fuel the tubes perform another mechanical function due to the narrowness of the slots or passageways between them when combined with the accelerated speed of travel through the vaporizing element due to the partial vacuum pull at the engine end of the passageway as follows:

On account of the great velocity of the travel of the liquid fuel through the spaces between the tubes, it will be drawn successively into violent contact with the tubes due to the staggered relation of the tubes relative to each other or at least to the fact that there are no direct passageways through or between all of the tubes so that when the liquid fuel continues its travel through these narrow and tortuous passageways the accelerated speed of their travel due to the vacuum pull will cause the liquid particles of fuel to impinge by centrifugal action against one or more of the tubes whereupon the action of capillary attraction will cause it to be spread out over the surfaces of the tubes and in such condition that even a moderate degree of heat in the tubes will complete its vaporization.

In use, I have successfully employed these vaporizing elements with as few as fifty-one tubes, each having an outside diameter of one-fourth of an inch and being spaced apart from each other and from the cylinder 13 approximately three-sixty-fourths of an inch. In this connection it should be explained that I have found it desirable to use cylinders 13 of the same diameter with the same number of tubes and with the same spacing apart of the tubes for engines of the various kinds and sizes now commonly used in automobiles but the lengths of the cylinders and tubes must bear a proper proportion to the capacity of the engine with which my vaporizer is employed, that is to say for engines of large cylinder capacity, I make the cylinders 13 and the tubes relatively long and for engines of less cylinder capacity, I make these parts relatively short.

Another advantage that is gained in the use of my improved vaporizing element by reason of there being a large number of these tubes and the tubes being of small size and the spaces between them narrow and restricted, is that this construction, arrangement and combination tend to equalize the amount of heat applied to the liquid fuel under varying conditions of use during the operation of the engine to which the device is applied, and it also tends to insure that the surface of some, at least, of the rows of tubes near the outlet side of the vaporizing element shall be dry at all times, so that their

maximum heat is transmitted to the vapor in its passage to the discharge side of the vaporizing element. For instance, when the engine throttle is nearly closed, the liquid fuel is drawn into the vaporizing element in small quantities, and hence only a few of the rows of tubes adjacent to the intake side of the vaporizing element will be covered with liquid fuel and all of the remaining tubes will be dry and will readily impart their heat to the fuel, whereas when the engine throttle is relatively wide open large quantities of liquid fuel will be drawn through the vaporizing element and a considerably larger number of the tubes will have their surfaces covered with liquid fuel. However, when the throttle is nearly wide open, the amount of exhaust heat passing through the tubes will be relatively increased, so that the relatively few dry tubes at the outlet side of the vaporizing element will impart to the vapor substantially the same amount of heat as will be imparted to the fuel by the relatively larger number of dry tubes when the throttle is nearly closed. However, under all conditions of normal use when the engine is running, several rows, at least, of the tubes will have dry outer surfaces and there will be a sufficient amount of heat imparted to the fuel at all times to insure perfect vaporization.

I claim as my invention:

1. In an internal combustion engine system, a means for thoroughly vaporizing liquid fuel such as kerosene by treating it both mechanically and by the application of heat, said means comprising in combination an engine intake manifold through which a fuel charge may be sucked into an engine, a carbureter, a vaporizing chamber interposed between the carbureter and the manifold, there being suitable connections whereby the fuel from the carbureter is conducted through the vaporizing chamber and into the said manifold, said carbureter having means for admitting air into the fuel charge before it enters the vaporizing chamber, and a series of tubes extended through the vaporizing chamber across the path of travel of the fuel to the said manifold and designed to have heat introduced to and radiated from them, the arrangement, size and proportions of said parts being characterized by having a large number of said tubes of small diameter and arranged close together and approximately filling the interior of the vaporizing chamber whereby small drops of liquid fuel being drawn by the suction of an engine through the narrow slots between the tubes, will be mechanically flattened out both by the tubes and by the suction, and whereby the liquid fuel will be successively and violently thrown against the heated tubes, and whereby some of the tubes near the discharge side of the vaporizing chamber will have their outer surfaces dry during the operation of the engine under all conditions to thereby radiate a maximum of heat to the vapor passing around them.

2. In an internal combustion engine system, a means for thoroughly vaporizing liquid fuel such as kerosene by treating it both mechanically and by the application of heat, said means comprising in combination an engine intake manifold through which a fuel charge may be sucked into an engine, a carbureter, a vaporizing chamber interposed between the carbureter and the manifold, there being suitable connections whereby the fuel from the carbureter is conducted through the vaporizing chamber and into the said manifold, said carbureter having means for admitting air into the fuel charge before it enters the vaporizing chamber, and a series of tubes extended through the vaporizing chamber across the path of travel of the fuel to the said manifold and designed to have heat introduced to and radiated from them, the arrangement, size and proportions of said parts being characterized by having a large number of said tubes, of small diameter and arranged close together and approximately filling the interior of the vaporizing chamber whereby small drops of liquid fuel being drawn by the suction of an engine through the narrow slots between the tubes, will be mechanically flattened out both by the tubes and by the suction, and whereby the liquid fuel will be successively and violently thrown against the heated tubes, said parts being further characterized by having the area of the fuel passageways through the vaporizer materially less than the other parts of the passageway from the carbureter to the engine to form a restriction and to thereby accelerate the travel of the fuel charge at the point where it passes between the tubes.

3. In an internal combustion engine system, a means for thoroughly vaporizing liquid fuel such as kerosene by treating it both mechanically and by the application of heat, said means comprising in combination an engine intake manifold through which a fuel charge may be sucked into an engine, a carbureter, a vaporizing chamber interposed between the carbureter and the manifold, there being suitable connections whereby the fuel from the carbureter is conducted through the vaporizing chamber and into the said manifold, said carbureter having means for admitting air into the fuel charge before it enters the vaporizing chamber, and a series of tubes extended through the vaporizing chamber across the path of travel of the fuel to the said manifold and designed to have heat introduced to and radiated from them, the arrangement, size and proportions of said parts being characterized by having a large number of said

tubes, of small diameter and arranged close together and approximately filling the interior of the vaporizing chamber whereby small drops of liquid fuel being drawn by the suction of an engine through the narrow slots between the tubes, will be mechanically flattened out both by the tubes and by the suction, and whereby the liquid fuel will be successively and violently thrown against the heated tubes, said parts being further characterized by having the area of the fuel passageways through the vaporizer materially less than the other parts of the passageway from the carbureter to the engine to form a restriction and to thereby accelerate the travel of the fuel charge at the point where it passes between the tubes, there being at the inlet side of the vaporizing chamber an expanding chamber extending to the ends of the vaporizing chamber and at the outlet side a collecting chamber.

4. In an internal combustion engine system, a means for thoroughly vaporizing liquid fuel such as kerosene by treating it both mechanically and by the application of heat, said means comprising in combination an engine intake manifold through which a fuel charge may be sucked into an engine, a carbureter, a vaporizing chamber interposed between the carbureter and the manifold, there being suitable connections whereby the fuel from the carbureter is conducted through the vaporizing chamber and into the said manifold, said carbureter having means for admitting air into the fuel charge before it enters the vaporizing chamber, and a series of tubes extended through the vaporizing chamber across the path of travel of the fuel to the said manifold and designed to have heat introduced to and radiated from them, the arrangement, size and proportions of said parts being characterized by having a large number of said tubes, of small diameter and arranged close together and approximately filling the interior of the vaporizing chamber whereby small drops of liquid fuel being drawn by the suction of an engine through the narrow slots between the tubes, will be mechanically flattened out both by the tubes and by the suction, and whereby the liquid fuel will be repeatedly and violently thrown against the heated tubes, and whereby some of the tubes near the discharge side of the vaporizing chamber will have their outer surfaces dry during the operation of the engine under all conditions to thereby radiate a maximum of heat to the vapor passing around them, and pipes for conducting burned gases from an engine into and through said tubes.

Des Moines, Iowa, December 22, 1916.

GEORGE F. TROTTER.