June 9, 1931. F. F. CHASE 1,809,438

VAPORIZER

Filed July 7, 1927

Fig. 1

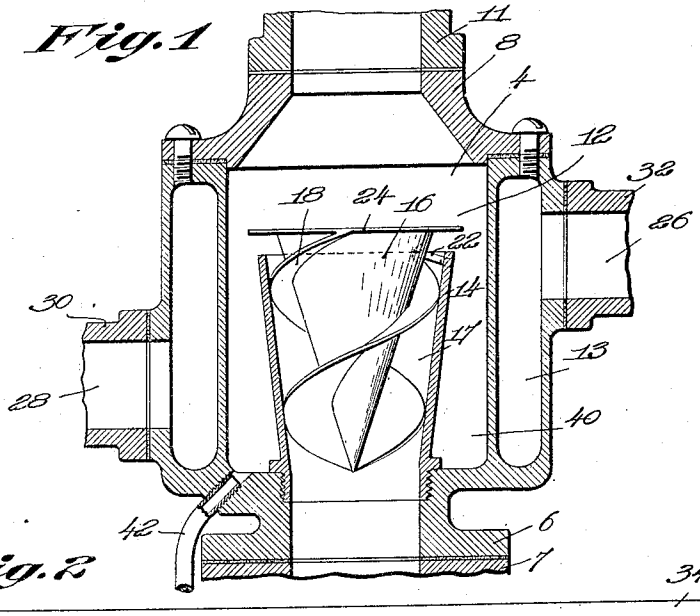


Fig. 2

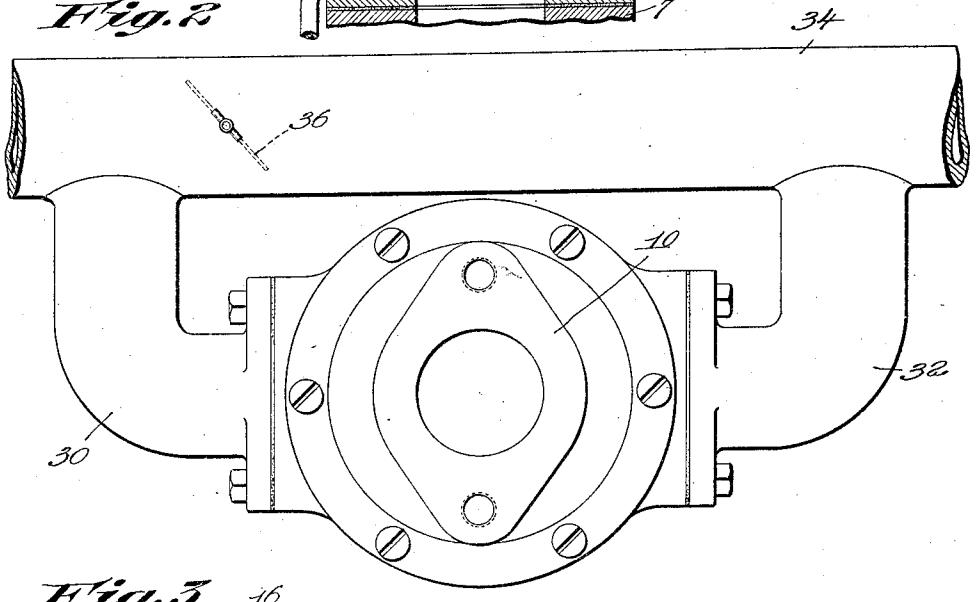
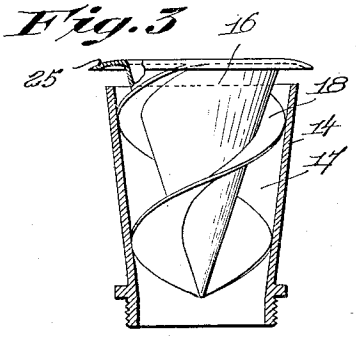


Fig. 3



Inventor
Francis F. Chase
by Van Everen Fish
Hildreth & Leary
his Attys.

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UNITED STATES PATENT OFFICE

FRANCIS F. CHASE, OF MELROSE, MASSACHUSETTS

VAPORIZER

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The present invention relates to vaporizers, and more particularly to vaporizers for causing an intimate mixture of fuel and air for supply to an internal combustion motor.

The mixture of fuel and air supplied by a carburetor to an internal combustion motor contains some particles of fuel which are not completely vaporized and which therefore do not form an intimate combustible mixture with the air. Thus considerable energy supposedly available in the liquid fuel is lost. This is particularly true of the medium weight constituents of the fuel, such as kerosene fractions, which have a high heat content, but which are not ordinarily passed into the motor in such a form as to promote satisfactory combustion. The loss of energy is not the only disadvantage attending the failure of portions of the fuel to vaporize, because the transmission of even a small quantity of fuel in liquid form to the cylinder walls prevents proper lubrication and leads to crank case dilution. Moreover, the fuel is likely to contain heavy fractions which are practically incapable of vaporization. These heavy fractions are passed into the motor where they form tenacious deposits on the cylinders and pistons, and thereby conduce to an even greater waste of power.

The principal object of the present invention is to provide a vaporizer which will effect an intimate homogeneous mixture of combustible vaporized fuel and air, which will form a mixture capable of substantially complete combustion in the motor, and which will remove substantially all heavy unvaporizable fractions of the fuel unsuitable for combustion.

With this and other objects in view, as will hereinafter appear, the principal feature of the invention comprises a vaporizing chamber through which the mixture of fuel and air is passed from the carburetor to the intake manifold and which has means for imparting a rotary motion to the entering mixture. Vaporization of the fuel particles and intimate mixture thereof with the air is effected not only by impact of the particles with each other, but also by heat preferably applied to the side walls of the chamber. The chamber has an inlet at the bottom and an outlet at the top and the means for imparting the rotary or swirling motion to the mixture consists of a set of helical vanes with which the fluid engages immediately upon passing through the inlet. The vanes are formed on an axis parallel with the side walls of the chamber in order that the mixture may be directed laterally by centrifugal force toward the heated side walls, the heavier relative unvaporizable portions of the fuel being thrown with greater force and hence into a region of greatest heat, while the vaporized fractions of the fuel which are in intimate mixture with the air may proceed with less centrifugal action and hence with less heating toward the outlet.

An additional feature of the invention consists in helical vanes which are of increasing radius from the inlet to the outlet and which are mounted on a tapered deflecting member which increases in diameter from the inlet toward the outlet of the chamber. By this means the outward deflection of the mixture and fuel particles toward the heated walls of the chamber is enhanced, the motion of the particles being determined not only by the engine suction and the action of the centrifugal force but also by the outward deflection effected by the increasing radius of the helical vanes.

Another feature of the invention consists in the provision of means arranged at the top of the tapered member and adapted to be engaged by the particles of the mixture thus deflected to direct them positively toward the walls of the chamber in a substantially horizontal direction. By this means, not only are the light and medium fractions suitable for combustion effectively vaporized, but also any unvaporizable heavy fractions which are unsuitable for combustion in the motor and which fail to be gasified after impact with the chamber wall, are segregated from the current passing to the intake and are permitted to pass by gravity into a well from which they may be drawn off at intervals.

Other features of the invention consist in certain novel features of construction, com-

binations and arrangements of parts hereinafter described and particularly defined in the claims.

In the accompanying drawings, Fig. 1 is a sectional elevation of a vaporizer embodying the features of the present invention; Fig. 2 is a plan view of the vaporizer shown diagrammatically as being connected with the exhaust of the motor for heating of the chamber; and Fig. 3 is a detail view showing a modified form of the lip.

In the illustrated embodiment of the invention, the vaporizer 4 has an inlet provided with a flange 6 for connection to the carburetor, the top of which is indicated at 7, and an outlet portion 8 provided with an upper flange 10 for attachment to a connection 11 leading to the intake manifold of the internal combustion motor. The vaporizer consists of a chamber 12 which has a jacket 13 to permit heating of the chamber by circulation of exhaust gases from the motor. Threaded into the chamber adjacent to the inlet is a cage 14 which flares outwardly from the inlet and terminates at a level intermediate to the inlet and the outlet of the chamber. Received in the cage is a tapered deflecting member 16 in the form of an inverted hollow cone which has its apex at the inlet and its base immediately above the upper surface of the cage. The space between the cone and the cage forms a swirling chamber through which the mixture passes from the carburetor to the intake. On the external surface of the vaporizing member are a plurality of helical vanes 18. These vanes are illustrated as being two in number, each making one complete revolution around the surface of the cone, but the number of vanes and their inclination with respect to the axis may vary. The vanes extend completely across the swirling chamber between the opposed surfaces of the cone and the cage, thus determining helical conduits of increasing radius, in which the mixture is constrained to travel in its passage from the inlet through the swirling chamber. The deflecting member and its associated vanes may be constructed as a unitary die casting. It is secured to the cage by screws 22.

The cone is provided at the top with an outwardly extended portion formed as an integral continuous annular lip 24. The lip is arranged above the top of the cage and extends outwardly beyond it toward the wall of the chamber. As shown in Fig. 1, the lip is flat and lies in a horizontal plane perpendicular to the axis of the cone. For some purposes, however, especially when fuels containing a high percentage of heavy fractions are employed, it is desirable to form the outer edge of the lip with a curved surface 25, concave downward, as shown in Fig. 3, in order to impart a partial downward deflection to the mixture emerging from contact with the vanes.

For heating the chamber, the jacket 13 has an inlet 26 and an outlet 28 adapted to be connected with pipes 30 and 32, respectively, which pipes are connected into the exhaust manifold 34 and serve to by-pass a part of the exhaust gases through the heating jacket of the vaporizer. A damper 36 in the manifold controls the amount of by-passed gases in order that the heating effect on the chamber may be controlled. The temperature within the chamber should be sufficient to cause vaporization without cracking.

In operation the fuel and air mixture leaving the carburetor enters the inlet of the vaporizing chamber. This mixture as it comes from the carburetor is not in the ideal completely vaporized condition, but contains some unvaporized particles of fuel held in suspension in the air current. This current is drawn into the swirling chamber 17 by the suction of the engine. It is not only deflected outwardly by the flare of the cone, but also has imparted to it a rotary motion by its constraint to travel in the helical paths determined by the vanes 18. As the fluid emerges above the top of the cage, the combined deflecting movement and the centrifugal force caused by the rotary motion cause the particles to be directed outward toward the heated wall. This rotary or swirling movement of the fluid causes it to sweep across the heated wall, so that an intimate homogeneous mixture of the air with all vaporizable portions of the fuel is promoted. The heat imparted to the mixture by the chamber wall not only enhances the vaporization of the fractions usually considered as useful for combustion, but also vaporizes any adjacent fractions of heavier weight such as kerosene and causes their intimate mixture with the air in suitable form for combustion of the motor. Thus any kerosene fractions which would ordinarily pass in unvaporized condition to the motor are rendered suitable for satisfactory combustion. Inasmuch as these fractions have a high heat content, the value of the fuel is considerably increased. If any extremely heavy fractions are present, such as tars and heavy oils, which are unsatisfactory for combustion in any event, they will be directed against the wall of the chamber even more forcibly than the combustible fractions because of their greater weight, and being unvaporized by the heat, will be permitted to pass by gravity into the annular well 40 which is enclosed between the outer wall of the cage and the inner surface of the vaporizing chamber. Although the apparatus functions satisfactorily without the lip 24 in some cases, it is believed that the lip contributes largely to the effectiveness of segregating the heavy incombustible fractions from the mixture. For this reason, this

action is enhanced by the downward extension 25 of the lip when heavy fuels are employed. The homogeneous mixture of air and vaporized fuel is drawn upwardly into the intake manifold by the suction of the engine. The unvaporized residue collected in the well may be removed at intervals through a drain pipe 42. It is to be noted that the heat of the jacket 13 is continuously applied to the contents of the well 40, so that opportunity is afforded for vaporization of any combustible fractions that may be entrained with the unvaporized heavy ends.

It will be seen from Fig. 1, that the surfaces of the cone and the cage are not parallel but that the separation between them diminishes from the inlet to the top of the cage. The relation between the diameters of the cage and the cone is preferably such that a uniform cross sectional area for the passage of the mixture is afforded at all points. It is desirable that the cross sectional area be not diminished from the inlet upwardly because of the increased resistance which would be opposed to the flow of fuel. The area at the top may be made slightly larger than that at the inlet but not to a sufficiently great extent to cause an appreciable reduction in the velocity of the mixture at the place where it emerges from contact with the helical vanes. In the illustrated embodiment of the invention, the cone and the cage are constructed to give a substantially uniform cross sectional area. The diminution of the distance between the cone and the cage near the top, although not reducing the cross sectional area of the conduit, nevertheless confines the mixture to a flatter and narrower stream which insures a more effective sweeping of all of the particles against the heated wall of the chamber.

By the use of the vaporizer, all of the fluid passed on to the motor is in its best effective condition for combustion, the particles unsuitable for combustion being collected in the well. The residue segregated in the well comprises not only heavy fractions of the fuel, but also foreign particles such as road dust, which would form a tenacious deposit if passed into the cylinders. In addition to the advantage of utilizing all of the available energy of the vaporized fractions, some of which have hitherto been passed in unvaporized or incombustible condition, the present invention possesses the desirable features of eliminating the condensation of fuel on the cylinder walls and thus avoiding dilution of the lubricant. The uniformity of the mixture assures maximum effectiveness over the entire range of conditions under which the motor is required to operate, responding on the one hand to demands for high power and rapid acceleration, and permitting on the other hand effective idling at low speeds. It has been observed that the quantity of carbon monoxide in the exhaust is greatly reduced, thus not only showing better combustion and consequent economy, but also affording in itself the important advantage of permitting operation of a motor under conditions where the ordinary types would be unsafe.

The invention having been thus described, what is claimed is:

1. A vaporizer comprising a casing having an inlet and an outlet, means forming a helical conduit through which the mixture passes from the inlet toward the outlet, said means including vanes having their axis extending longitudinally between the inlet and the outlet and laterally opposed to the wall of the casing to direct the mixture by centrifugal force laterally toward the wall of the casing, means for supporting and enclosing the vanes and means for applying heat externally of the casing.

2. A vaporizer comprising a chamber having a mixture inlet at the bottom and an outlet at the top adapted respectively to be connected with the carburetor and intake manifold of an internal combustion motor, means for heating the chamber, vanes in the chamber to confine the mixture passing therethrough to helical paths of increasing radii from the inlet toward the outlet, said means having at its greatest radius an outwardly extending annular lip to direct the mixture toward the wall of the chamber.

3. A vaporizer comprising a chamber having a mixture inlet at the bottom and an outlet at the top adapted respectively to be connected with the carburetor and intake manifold of the internal combustion motor, means forming a helical conduit through which the mixture passes from the inlet toward the outlet and terminating between the inlet and the outlet of the chamber, said means comprising vanes coaxial with the chamber, an annular lip extending outwardly from the end of the conduit at its greatest radius and constructed and arranged to direct the mixture toward the wall of the chamber, and means for heating the wall of the chamber.

4. A vaporizer comprising a vaporizing chamber, means for heating the vaporizing chamber, a swirling chamber including a tapered supporting cage and a tapered deflector received in the cage to direct fluid outwardly above the cage into the vaporizing chamber, and helical vanes extending between the tapered deflector and the cage to confine the fluid to helical paths of increasing radius.

5. A vaporizer for liquid fuel comprising a chamber having an inlet adapted to receive the mixture from a carburetor, and an outlet at the top of the chamber, a tapered member having its apex at the inlet, helical vanes on the tapered member for confining the mixture to helical paths of increasing radius around the tapered member, means for supporting and enclosing the vanes, the tapered

member being formed at the top with an annular outwardly extended portion to direct the mixture by centrifugal force toward the wall of the chamber, and means for heating the chamber.

6. A vaporizer for liquid fuel comprising a chamber having an inlet at the bottom and an outlet at the top, a cage extending upwardly into the chamber from the inlet, a tapered member received in the cage and having its apex at the inlet and helical vanes between the tapered member, the cage to confine the mixture to helical paths of increasing radii, means at the top of the tapered member for directing the mixture outwardly toward the wall of the casing and above the cage, and means for heating the chamber.

7. A vaporizer for internal combustion motors comprising a chamber having an inlet and an outlet, means for applying heat to the chamber, helical vanes coaxial with the chamber and extending from the inlet and terminating within the chamber for rotating the mixture, means for heating the casing, and a cage arranged externally of the vanes and terminating at a point below the top of the vanes and forming with the wall of the chamber an annular well for collecting any unvaporized heavy fractions and foreign matter.

8. A vaporizer for liquid fuel comprising a chamber having an inlet adapted to receive the mixture from a carburetor, and an outlet at the top of the chamber, means for heating the chamber, a tapered member having its apex at the inlet, helical vanes on the tapered member for confining the mixture to helical paths of increasing radius around the tapered member, the tapered member being formed at the top with an annular outwardly extended portion to direct the mixture by centrifugal force toward the wall of the chamber, and means forming a well adjacent to the tapered member for collecting unvaporized matter.

9. A vaporizer for liquid fuel comprising a chamber, means for heating the chamber, a tapered deflector in the chamber, means for supporting the deflector comprising a cage of less taper than the deflector, and helical vanes on the deflector for determining helical conduits for the fluid around the deflector.

10. A vaporizer for liquid fuel comprising a vaporizing chamber, means for heating the chamber, an inlet adapted to be connected with a carburetor, a cage in the vaporizing chamber, a tapered deflector in the cage having its apex at the inlet, and helical vanes between the cage and the deflector determining helical paths for the fluid, the space between the cage and the deflector diminishing from the inlet.

In testimony whereof I have signed my name to this specification.

FRANCIS F. CHASE.