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VAPORIZER

Filed March 16, 1928

Fig. 1.

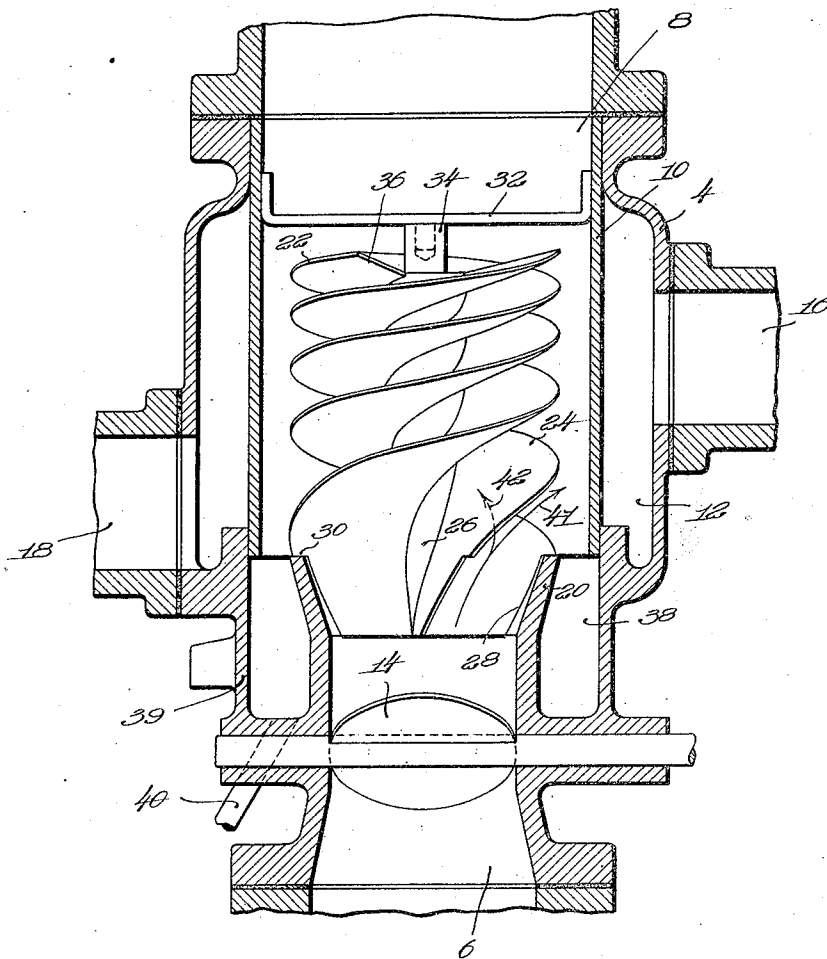


Fig. 2.

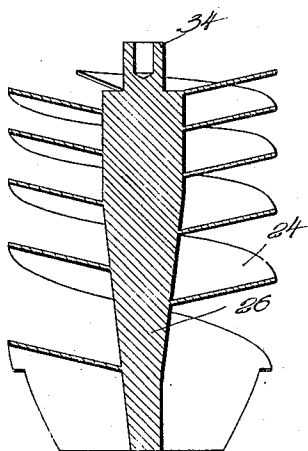
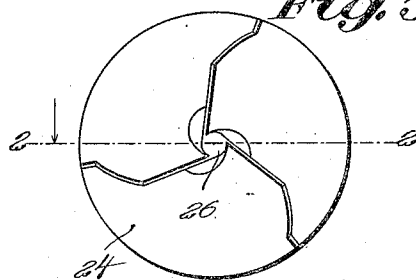


Fig. 3.



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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.

5 The principal object of the present invention is to provide a vaporizer which will effect an intimate vaporized mixture of combustible fuel and air and a substantially complete removal of heavy unvaporizable fractions of the fuel, and which will result in increased economy and performance at all engine speeds.

10 With this and other objects in view, as will hereinafter appear, the present invention consists in the vaporizer hereinafter described and particularly defined in the claims.

15 In the accompanying drawings illustrating what is now considered the preferred form of invention, Fig. 1 is a sectional elevation of the vaporizer; Fig. 2 is a sectional elevation of the swirling member on line 2—2 of Fig. 3; and Fig. 3 is a bottom plan view of the swirling member.

20 The illustrated embodiment of the invention comprises a casing 4 of cast iron formed with an axial fuel-air inlet 6 at the bottom and an axial outlet 8 at the top. A circular steel tube 10 driven into the casing forms the wall of a vaporizing chamber, which is heated by exhaust gases in a surrounding jacket 12. The inlet 6 is adapted for connection with the carburetor, and the outlet 8 with the intake manifold of the motor. A butterfly valve 14 is journaled in the inlet. Exhaust gases for heating the chamber are conducted into and out of the jacket 12 by pipes 16 and 18, and the volume of gases passing through the jacket may be controlled by a by-pass of any usual or preferred form. The upper end of the inlet is flared, as indicated at 20, and a swirling member indicated generally at 22 is seated in the inlet.

25 The swirling member comprises a plurality of stationary helical vanes 24 mounted on a central core 26. In the illustrated apparatus, three of the vanes 24 are employed, and the core to which they are secured is of conical form. The core and vanes may be integral and made up of die-cast parts. The

three vanes are regularly spaced about the core, and each makes approximately one and one-half turns. The outer edges of the vanes are in proximity to the chamber wall, and for the greater portion of the length of the member 22, the vanes are in an open chamber, the space between the edges of the vanes and the wall being unobstructed. The swirling member is of a length to terminate slightly below the top of the jacket 12.

30 The outer contour of the swirling member is preferably cylindrical. The vanes 24 are formed at the inlet end to fit snugly against the flared part of the casing inlet, as shown at 28, and to provide shoulders 30 which position the swirling member on the casing. The swirling member is held in place by a narrow cross bar 32 which is secured at opposite ends to the tube 10 and at the center to a projection 34 on the core.

35 The formation of the vanes is clearly shown in the drawings. Each is steeply pitched from the inlet for a part of a revolution, preferably about one-quarter of a revolution, and thereafter the pitch is progressively reduced. The vanes, therefore, have a maximum separation at the inlet to define helical conduits of relatively large cross-section, and these conduits are progressively reduced toward the outlet. It will be seen that the first revolution of the vanes takes up the greater part of the length of the swirling device. Each vane terminates at the top in a radial edge 36. In addition to the pitch of the vanes, the surface of each vane, as shown by the section of Fig. 2, has an upward inclination with respect to the radius of the chamber, which inclination is substantially uniform throughout its length.

40 The space between the inlet of the casing and the outer wall forms an annular well 38 which serves to collect unvaporized particles of fuel. This well is subjected to the heat of the exhaust gases, but it will be seen that it is not in a zone of maximum temperature, being placed below the bottom of the jacket 12. Any particles contained in the well are heated by conduction through the relatively long outer wall 39 of the casing, and are therefore not subjected to excessive temperature, but

only to sufficient heat to vaporize any valuable fuel particles that may not have become previously vaporized in their passage through the swirling member. A drain pipe 40, leading from the well, permits removal of any residue of heavy unvaporizable particles which are unsuitable for combustion.

In operation the mixture from the carburetor enters the inlet 6 and passes through the vaporizing chamber and the outlet 8 to the intake manifold. The fluid entering the inlet 6 is not in most cases a true mixture inasmuch as it contains not only a mixture of vaporized fuel with air, but also particles of unvaporized fuel. It will be recognized that the liquid fuel contains not only the light gasoline fractions suitable for combustion, but also some medium fractions which are vaporized only with difficulty, as well as some heavy fractions which are totally unsuitable for combustion. The medium fractions which probably comprise some kerosene constituents, are valuable in that they have a high heat content, but in the ordinary carburetor they are not thoroughly vaporized and mixed with the air so that they tend to pass in liquid form and collect on the cylinder walls. The heavy fractions comprise heavy oils which are contained in a slight degree in some fuels and which, if passed to the cylinder, tend to form a carbon deposit.

This mixture of fluids upon engagement with the helical vanes has imparted thereto a swirling or rotating motion by virtue of the helical twist of the vanes. This rotative motion tends to throw the particles of fluid outwardly by centrifugal force. Upon the first engagement with the vanes which are steeply pitched at the inlet, the heaviest particles are immediately thrown outward by centrifugal force taking the path indicated by the arrow 41. The lighter particles because of the action of a smaller centrifugal force, wind about the vanes substantially as indicated by the arrow 42. The initial steep pitch of the vanes is for the purpose of selectively discharging the heavy particles without imparting a sufficient rotative velocity to throw off the lighter fluid. As the fluid progresses upwardly through the swirling member, its velocity increases because of the decreased separation between the vanes. This increasing velocity tends progressively to discharge lighter unvaporized particles by centrifugal force while the vaporized mixture continues upwardly through the vanes. The particles thrown off from the edges of the vanes are directed toward the chamber wall and inasmuch as they have a rotative velocity are caused to sweep across the heated wall. The particles which are capable of vaporization such as the medium fractions are vaporized by the action of heat and pass upwardly through the outlet. The heavy particles which cannot be vaporized, as well as some

medium particles which are entrained therewith, are believed to coalesce on the chamber wall and pass by gravity into the well 38. It will be seen that any fluid which is thrown out into the space between the swirling member and the wall is acted upon by two forces, namely, the engine suction which tends to draw it upwardly into the intake manifold, and the centrifugal force which tends to throw it outwardly toward the wall. A particle, therefore, which is thrown out in unvaporized condition, has opportunity for being vaporized by the heated wall and its density having been decreased, it rises under the influence of the engine suction and joins the mixture which passes into the manifold. Heavy and unvaporized fractions which pass into the well 38 are subjected to the action of heat which is conducted through the outer wall of the chamber. Since the heat must pass through the relatively narrow chamber wall before it acts upon the residue in the well, its temperature is considerably reduced, and in fact, the heat to which the residue is subjected is of mild temperature only sufficient to vaporize valuable constituents without chemical decomposition. A slow heating effect is obtained which vaporizes any light or medium fractions and these fractions rise under the influence of the suction to pass in vaporized condition to the motor.

The present invention provides for effective vaporization at any motor speed. At high speed, when the velocity of the entering gases is high, the centrifugal force is high and particles are probably thrown out into the heating space without traversing the full length of the swirling member. The true vaporized mixture under the influence of the high engine suction and the high centrifugal force, is also probably thrown off from the vanes before it reaches the top of the swirling member. The effect, therefore, is to remove the heavier particles at a point near the inlet. Moreover, since the mixture after being thrown off from the swirling member is in an unobstructed zone subjected to the engine suction, it passes upwardly through the heating space without being obliged to follow the contour of the vanes. The resistance to flow by the use of the vanes is therefore not appreciably increased at high speed. Moreover, at high speeds the action is enhanced by the upward inclination of the vanes, as shown by the section of Fig. 2.

At low speeds, when the velocity of the fluid is relatively low, the centrifugal force is less and the fluid is retained by the helical conduits for a longer period. The closer spacing of the vanes near the top of the swirling member tends to increase the velocity of the fluid and therefore to increase the centrifugal force which throws off the unvaporized particles of fluid. Inasmuch as the velocity is relatively low compared to

the velocity at high speed operation, the resistance introduced by the close spacing of the conduits is inappreciable and the vaporized mixture may traverse substantially the complete length of the swirling member without being thrown into the heating space by centrifugal force.

It will be seen that the present invention acts to increase the economy and performance of the motor in two particulars: first, by enhancing the vaporization of the fractions which have a high heat content, and second, by segregating the heavy fractions which are unsuitable for combustion in any event. The swirling member which extends throughout its length in a heated zone subject to the engine suction is effective to discharge particles from the edges of the vanes at all points. The particular point at which a discharge of fluid may occur will depend on the density of the particles and on the rotative speed of the fluid in the swirling member, and this rotative velocity in turn depends on the motor speed. At low speeds, when the centrifugal force is relatively small, the retention of the fluid by the vanes takes place over a sufficiently long period to assure effective action, and at high speeds, when the centrifugal forces are greater, the fluid is discharged from the influence of the vanes at a lower point. The device therefore automatically accommodates itself to most satisfactory operation under all conditions. At any speed, opportunity is afforded for proper vaporization and segregation without interposing an excessive resistance to the flow of fluid.

It has been found that the fuel economy of an internal combustion motor provided with the vaporizer of the present invention is materially increased. Moreover, the disadvantages of crank case dilution and carbonization are greatly reduced because of the fact that the fluid entering the motor is a substantially homogeneous mixture of air and vaporized fuel. Because of the improved vaporization, the motor operates with increased power at all speeds and has especially good performance at low speeds where the ordinary carburetor is ineffective to produce sufficient vaporization of the fuel.

Having thus described the invention, what is claimed is:

1. A vaporizer for internal combustion motors comprising a chamber having an inlet and an outlet, means for heating the wall of the chamber, helical vanes for swirling the mixture extending from the inlet into the chamber adjacent to the wall and spaced therefrom, the space between the outer edges of the vanes and the wall being unobstructed to permit centrifugal discharge of fluid toward the wall at any point, the vanes being steeply pitched at the inlet and then less steeply pitched for a portion of the length.

2. A vaporizer for internal combustion motors comprising a chamber having an inlet and an outlet, means for heating the chamber, a swirling member upon which the fluid impinges at the inlet and extending into the chamber, the swirling member comprising helical vanes adjacent to and spaced from the chamber wall, the vanes being steeply pitched and widely separated at the inlet and closely spaced at the opposite end to define helical conduits of decreasing area from the inlet toward the outlet.

3. A vaporizer for internal combustion motors comprising a chamber adapted to be placed between the carburetor and intake manifold of the motor and having an opposed inlet and outlet, a stationary swirling device in the chamber coaxial with the inlet and outlet and comprising upwardly inclined helically shaped vanes having a plurality of convolutions, the outer edges of the vanes being spaced from the inner wall of the chamber to provide an unobstructed zone subjected to the engine suction through which the vapor mixture is free to pass upwardly and across which unvaporized particles are directed laterally by centrifugal force, and means for heating the wall of the chamber.

4. A vaporizer for internal combustion motors comprising a cylindrical chamber having at the bottom an inlet adapted to be connected with the carburetor and at the top an outlet adapted to be connected with the intake manifold of the motor, a stationary swirling member in the chamber comprising helical vanes having a plurality of convolutions, the diameter of the vanes being less than that of the chamber to provide an annular unobstructed zone subjected to the engine suction through which the vapor mixture is free to pass upwardly and across which unvaporized particles are directed laterally by centrifugal force, and means for heating the wall of the chamber.

5. A vaporizer for internal combustion motors comprising a chamber adapted to be placed between the carburetor and the intake manifold and having an opposed inlet and outlet, a stationary swirling device in the chamber comprising upwardly inclined helically-shaped vanes of a plurality of convolutions, the top of the swirling device terminating below the outlet, and the peripheral edges thereof being spaced from the inner wall of the chamber to provide an unobstructed annular zone through which the vapor mixture may pass unimpeded to the outlet and across which unvaporized particles are laterally directed by centrifugal force, whereby the mixture and the unvaporized particles enter said unobstructed zone at different points, depending on the velocity of the fuel, and means for heating the wall of the chamber.

6. A vaporizer for internal combustion motors comprising a chamber adapted to be

placed between the carburetor and intake manifold and having an opposed inlet and outlet, a stationary swirling device in the chamber comprising helically shaped vanes inclined from the inlet toward the outlet and
5 of a plurality of convolutions, the end of the swirling device terminating at a distance from the outlet, and the peripheral edges thereof being spaced from the inner wall of the chamber to provide an unobstructed an-
10 nular zone through which the vapor mixture may pass unimpeded to the outlet and across which unvaporized particles are laterally di-
rected by centrifugal force, whereby the mix-
15 ture and the unvaporized particles enter said unobstructed zone at different points, depend-
ing on the velocity of the fuel, and means for heating the wall of the chamber.

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

FRANCIS F. CHASE.

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