March 23, 1965 W. RAPPOLT 3,174,469

CARBURETOR ARRANGEMENT

Filed March 31, 1961 4 Sheets-Sheet 1

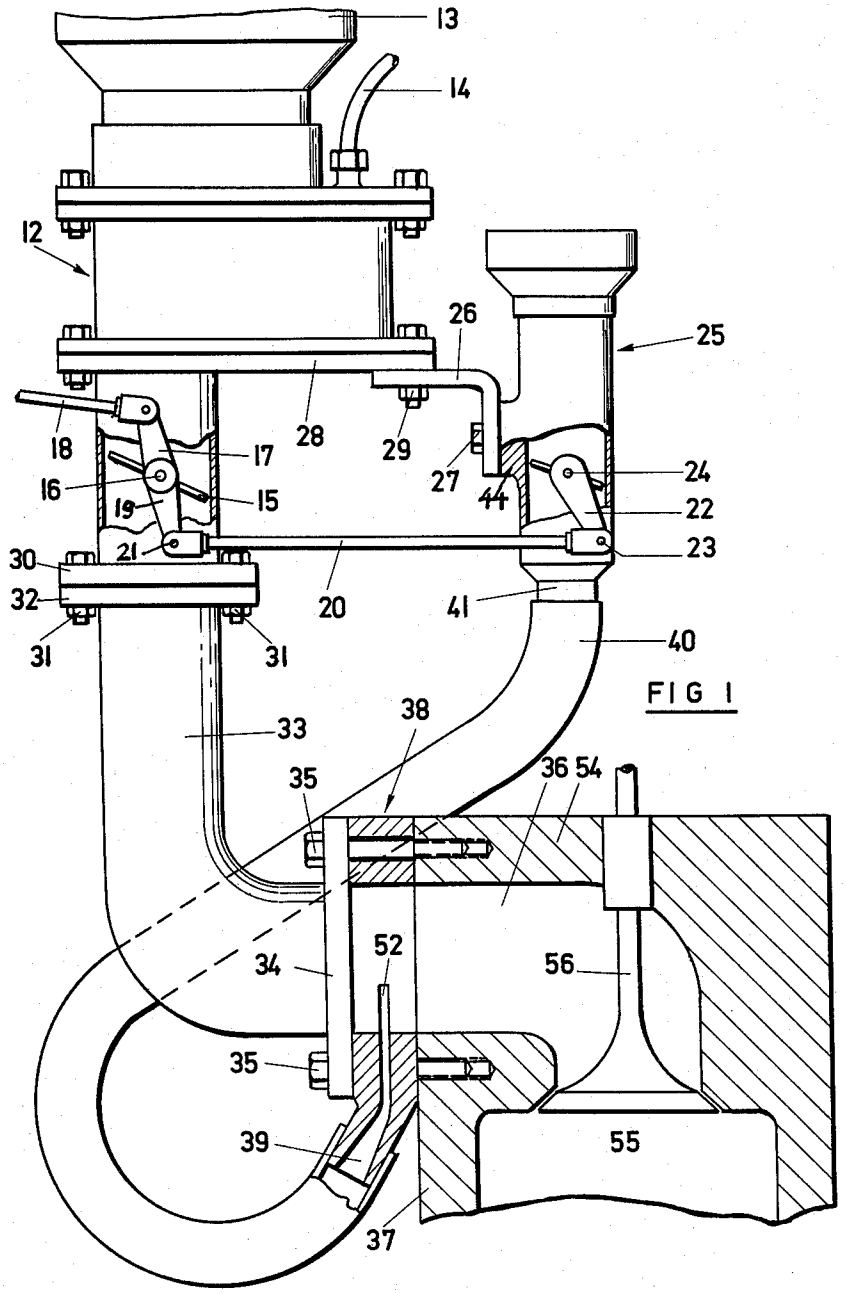


FIG 1

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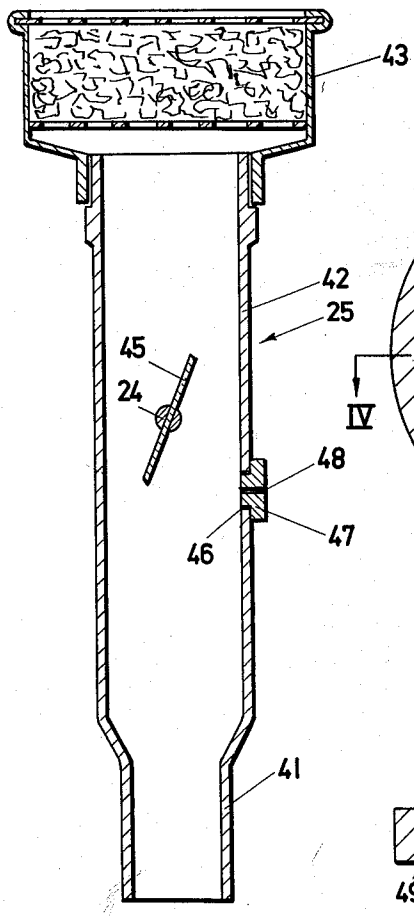
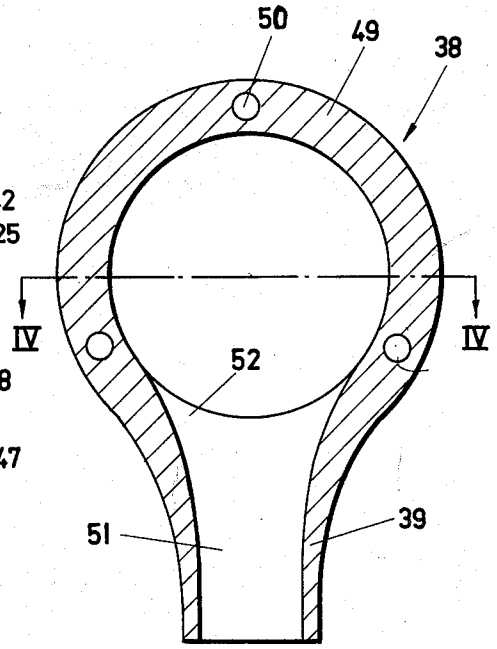


FIG. 2

FIG. 3



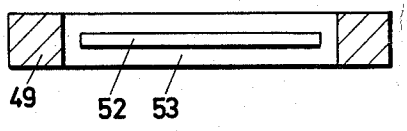


FIG. 4

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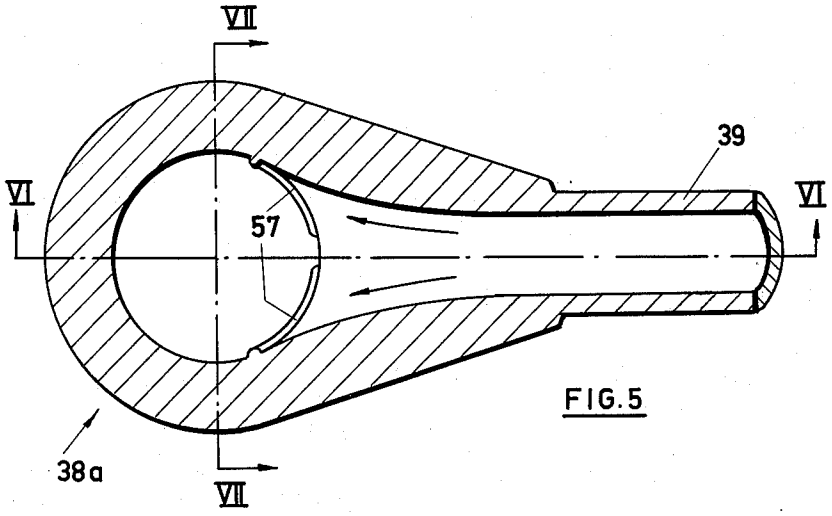


FIG.5

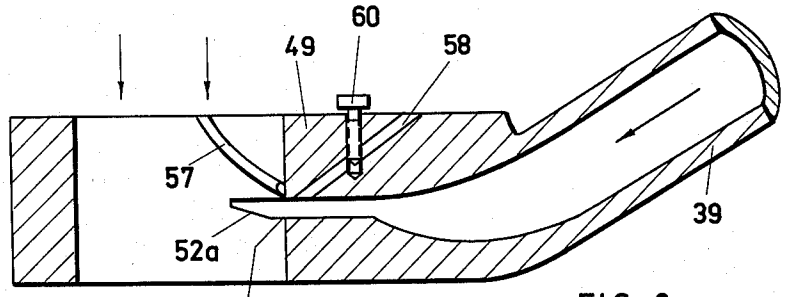


FIG. 6

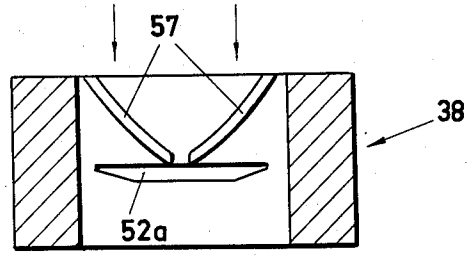


FIG. 7

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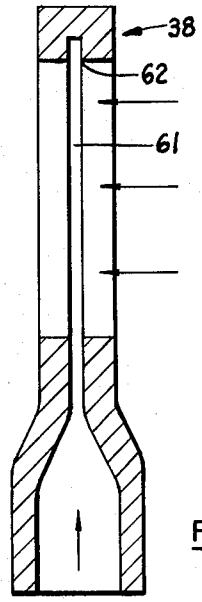


FIG. 9

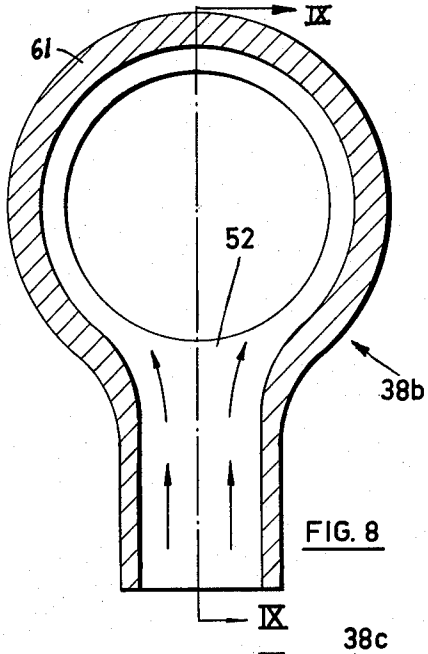


FIG. 8

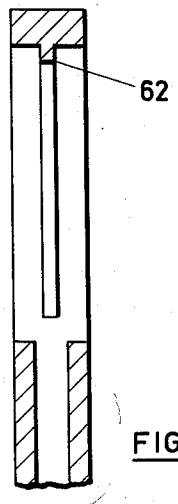


FIG. 11

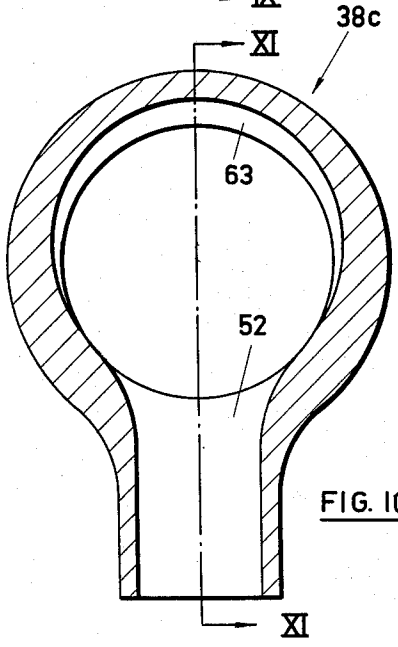


FIG. 10

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3,174,469

CARBURETOR ARRANGEMENT

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Filed Mar. 31, 1961, Ser. No. 99,760
Claims priority, application Germany, Apr. 9, 1960, G 29,424; Sept. 1, 1960, G 30,408
9 Claims. (Cl. 123—119)

The present invention relates to a carburetor arrangement in an internal combustion engine, more particularly, to an improved mixing device positioned in the suction line between the carburetor and the cylinder intake ports for vaporizing fuel condensate accumulating in the suction line.

The art has long recognized the problem of fuel condensation which occurs when the mixture of fuel and air from a downdraft carburetor passes through the suction line to the intake ports of the engine. The fuel condenses on the walls of the suction line and is introduced as a liquid into the engine cylinders. This liquid fuel is not useful in producing energy but is deposited on the cylinder walls and causes dilution of the lubricating oil and formation of carbon and carbon monoxide by incomplete combustion.

It has been known to devices in the suction line between the carburetor and the cylinder intake ports for vaporizing the fuel condensate accumulating on the walls of the suction line by means of an additional quantity of air, which is projected against the condensate to vaporize the same. The known devices were not satisfactory since the condensate was not completely vaporized.

It is therefore the principal object of this invention to provide a novel and improved apparatus for vaporizing fuel condensate accumulating in the suction line of a gasoline engine.

It is another object of this invention to provide a simple and effective mixing device for vaporizing fuel condensate accumulating in the suction line between the carburetor and the cylinder intake ports.

It has been found, as the result of tests, that the greatest accumulation of fuel condensate occurs in the suction line adjacent its connection to the cylinder head of the engine. At that point the drops of fuel condensate may flow along the walls of the suction line in a constant stream.

The present invention, therefore, positions a mixing device in the suction line closely adjacent the cylinder head. This location of the mixing device prevents recondensation of the redispersed fuel because of the short distance between the mixing device and the combustion chamber of the engine. Thus the vaporized condensate is immediately exposed to the high temperatures of the intake valves and a second condensation is prevented.

The present invention in its more specific aspects provides a mixing chamber which forms an extension of the suction line at the end thereof adjacent the cylinder head and the cylinder intake port. The mixing chamber has a transversely elongated slot connected to an air-feed pipe. A valve in this pipe regulates the air discharged from the slot according to the position of the throttle valve of the carburetor. The edges of the slot in the wall of the mixing chamber disperse the streams of condensate flowing along the walls of the suction line and result in a more effective vaporization of this condensate.

The slot extends circumferentially of the mixing chamber and has a length of about one third of the inner circumference of the suction line. Secondary air is only supplied to those portions of the suction line upon which the fuel condensate accumulates. Supply of air to the portions of the mixing chamber substantially free from

fuel condensate is disadvantageous since it merely unnecessarily dilutes the fuel mixture.

According to an additional feature of this invention collecting ribs on the walls of the mixing chamber may direct the flow of condensate towards the slot.

The present invention is characterized by the following features:

(1) The secondary air is admitted to the suction line at a point thereof closer to the cylinder intake port than to the carburetor.

(2) The nozzle opening in the mixing chamber for the secondary air has the shape of a narrow slot whose circumferential length is several times longer than its axial distance or width.

(3) The length of the slot is about one third of the circumference of the suction line.

Other features and advantages of this invention will become apparent upon reference to the following description of preferred embodiments when taken in conjunction with the annexed drawings, wherein—

FIGURE 1 is a side-elevational view of a carburetor arrangement of this invention with portions thereof being shown in section to illustrate the details of the mixing device;

FIGURE 2 is a side-elevational sectional view of a detail of FIG. 1, showing the air-feed pipe for secondary air on an enlarged scale;

FIGURE 3 is a front-elevational sectional view of the mixing chamber of the arrangement illustrated in FIGURE 1;

FIGURE 4 is a sectional view, taken along the line IV—IV of FIGURE 3;

FIGURE 5 is a front-elevational sectional view of a modified form of the mixing chamber of FIG. 3;

FIGURE 6 is a sectional view, taken along the line VI—VI of the mixing chamber shown in FIGURE 5;

FIGURE 7 is a sectional view, taken along the line VII—VII of FIGURE 5;

FIGURE 8 is a front elevational sectional view of still another modification of the mixing chamber of this invention;

FIGURE 9 is a sectional view, taken along the line IX—IX of FIGURE 8;

FIGURE 10 is a front elevational sectional view of a further modification of the mixing device of this invention; and

FIGURE 11 is a sectional view, taken along the line XI—XI of FIGURE 10.

Referring now to the drawings wherein like reference symbols indicate the same parts throughout the various views, a specific embodiment and several modifications of this invention will be described.

There is illustrated in FIGURE 1 a conventional downdraft carburetor **12** to which air is introduced through a filter **13** mounted on top and fuel through a fuel line **14**. The outlet **15** for the fuel mixture from the carburetor has a throttle valve of which a shaft **16** is shown. The throttle valve is conventional and controls the supply of fuel mixture from the carburetor to the engine.

A lever fixedly mounted on the shaft **16** has an arm **17** which is connected to a throttle control rod **18**. The other arm **19** of the lever is connected to one end of a coupling rod **20** by a pivot **21**. The other end of the rod **20** is connected to an arm **22** by another pivot **23**. The arm **22** is fixedly mounted on a shaft **24** which is journalled in an air-feed pipe **25**.

The pipe **25** is attached by a bracket **26** and screws **27** and **29** to a flange **28** of the carburetor.

The outlet **15** of the carburetor has a flange **30** to which a flange **32** is secured by bolts **31**. The flange **32** is mounted on one end of the suction line **33** the other end

of which is fastened by a flange 34 and screws 35 to the cylinder head 36 of an internal combustion engine 37. An intake valve 56 is mounted in an intake port 54 of the cylinder head 36.

The mixing chamber of the present invention is indicated at 38 and is mounted between the cylinder head 36 and the suction line flange 34. The lower end of the mixing chamber 38 is provided with a nozzle 52 having a tapering bore 39. The bore 39 is connected by a flexible conduit 40 with the lower end 41 of the air-feed pipe 25.

As seen in FIGURE 2, the air-feed pipe 25 consists of a tubular casing 42 having an air filter 43 mounted on the upper end thereof.

A boss 44 integral with the casing 42 is attached to the angle bracket 26 as previously described.

A control valve 45 is mounted on the shaft 24 in the casing 42 for regulating the flow of air through the air-feed pipe to the mixing chamber 38. The valve 45 is coupled by the rod 20 to the carburetor throttle for joint opening and closing movement.

The casing 42 has a threaded lateral opening 46 below the control valve 45 in which is mounted a plug 47 having a fine bore 48 therethrough. The bore 48 provides air to the mixing chamber when the carburetor throttle valve is in the idling position and the control valve 45 is closed.

The mixing chamber 38 is further illustrated in FIGURES 3 and 4 and comprises an annular member 49 having a plurality of axially extending bores 50. Clamping screws 35 in the bores 50 simultaneously secure the mixing chamber and the suction line flange 34 to the cylinder head 36. The nozzle bore 39 has a circular cross-section at the inlet thereof outside the mixing chamber. The shape of the cross-section progressively changes in the zone 51, and the bore 39 terminates in an elongated slot 52 at its inner end. The slot 52 opens into the central aperture 53 of the annular member 49. The slot 52 is elongated transversely to the flow of gases through the suction line. The length of the slot 52 is approximately one third of the internal circumference of the mixing chamber at this point. It is to be noted that the mixing chamber forms a continuous passage of substantially uniform cross-section with adjacent portions of the suction line 33 and the intake port 54 in the cylinder head 36. The port 54 communicates with the combustion chamber 55 of the engine when the intake valve 56 is open.

When the carburetor throttle is in the idle position air for the mixing device is admitted through the bore 48 in the plug 47 since the control valve 45 which is coupled to the throttle valve of the carburetor is closed. When it is desired to accelerate the engine the rod 18 is operated to open the carburetor throttle valve. The control valve 45 in the air-feed pipe 25 is correspondingly opened because of the connection provided by the coupling rod 20. The amount of secondary air supplied through the air-feed pipes is therefore directly related to the quantity of fuel air mixture supplied from the carburetor to the suction line 33 and to the quantity of condensate accumulating therein. The secondary air supplied through the air filter 43 passes through the casing 42 and the flexible conduit 40 into the nozzle bore 39 and is discharged from the slot 52 into the mixing chamber 38. This secondary air and the fuel mixture are admitted by the valve 56 into the combustion chamber 55.

The mixing chamber is mounted so that the slot 52 is in the lowest wall portion. The condensate which flows along the lower wall of the suction line 33 is directly contacted by the incoming secondary air rushing into the mixing chamber through the slot 52. Since the mixing chamber is mounted immediately adjacent the intake port 54 condensation of the mixture discharged from the mixing chamber is not possible because of the short distance between the mixing chamber and the combustion chamber 55. The high temperature in the port 54 makes the mixture of fuel and air entering the combustion chamber 55 from the mixing chamber 38 free from condensate.

A modification 38*a* of the mixing chamber described is illustrated in FIGURES 5 through 7. The chamber 38*a* has two ribs 57 which are transversely positioned on the lower wall of the mixing chamber in such a manner that the condensate formed in the suction line 33 and flowing along the lower wall of the mixing chamber is directly guided to a slot 52*a*. The slot 52*a* corresponds to the previously described slot 52 except for having a trapezoid cross-section formed by tapering both ends of the slot as may be seen in FIGURE 7. A passage 58 is formed in the mixing chamber 38*a*. One end of the passage is open to the atmosphere, and the other end of the passage communicates with the slot 52*a* adjacent the central aperture of the mixing chamber. A needle valve 60 which is accessible from the outside contacts the flow of air through the passage 58. The passage 58 provides air when all valves are closed and is positioned to direct air upon the edge 59 of the slot 52*a*.

Since the major portion of the fuel condensate is guided by the ribs 57 to the center portion of the slot 52*a*, the width of the slot is reduced at both longitudinal ends thereof. Thus most of the secondary air supplied to the mixing chamber is admitted through the central or widest portion of the slot 52*a* with only small quantities of air entering through the tapered ends of the slot.

Proceeding next to FIGURES 8 and 9, there is illustrated a further modified mixing chamber 38*b*. In this modification a circumferential groove 61 is provided in the interior wall of the mixing chamber. The groove 61 is positioned so as to communicate directly with the slot 52. The groove in the inner surface of the mixing chamber forms an edge 62 which disperses the stream of condensate flowing along the walls of the mixing chamber. The air admitted through the slot 52 can more effectively vaporize the condensate after it has been divided into smaller particles by the edge 62.

In the modified mixing chamber 38*c* illustrated in FIGURES 10 and 11 an edge 62 is formed by a circumferentially extending rib 63 mounted on the inner surface of the mixing chamber.

A plurality of dispersing edges of any desired shape may be employed in the mixing chamber of this invention. These edges may be spaced from each other longitudinally within the mixing chamber or staggered along the circumference thereof. Thus it is not necessary that the edges be positioned directly in front of the slot 52 through which air is supplied to the mixing chamber.

The present invention provides an improved mixing device which effectively vaporizes the fuel condensate accumulating in the suction line leading from a downdraft carburetor to the engine. The mixing device is positioned at the point of greatest accumulation of the fuel condensate in the suction line. Dispersing edges in the mixing chamber break up the stream of condensate flowing from the suction line and assist in effective vaporization of this condensate.

It will be understood that this invention is susceptible to modification in order to adapt it to different applications and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. In a carburetor arrangement, in combination,
   (*a*) a carburetor;
   (*b*) a cylinder head having an intake port;
   (*c*) an elongated suction line having an upper longitudinal end portion connected to said carburetor and a lower longitudinal end portion communicating with said intake port; and
   (*d*) nozzle means in said lower portion adjacent said intake port and remote from said carburetor for admitting air to said suction line in a plane transverse of the direction of elongation thereof, said nozzle means having an orifice in said lower portion, said orifice being elongated in said plane and extend-

ing over not substantially more than one third of the circumference of said suction line in said plane.

2. In an arrangement as set forth in claim 1, throttle means in said carburetor for throttling flow of a fuel mixture from said carburetor to said engine, said nozzle means including an air conduit having two spaced terminal portions respectively communicating with the atmosphere and said orifice, and control valve means in said conduit intermediate said terminal portions, said arrangement further including motion transmitting means connecting said throttle valve means and said control valve means for joint movement between respective open and closed positions.

3. In an arrangement as set forth in claim 2, said lower portion of said suction line being elongated in a horizontally extending direction and having a lower internal wall portion, said orifice extending in said lower wall portion.

4. In an arrangement as set forth in claim 2, said conduit being formed with a bore to the atmosphere intermediate said control valve means and said terminal portion communicating with said orifice, said bore having a flow section substantially smaller than the flow section of said conduit.

5. In an arrangement as set forth in claim 2, said lower portion of said suction line having an internal wall portion, said orifice extending in said wall portion, said wall portion being formed with an edge elongated transversely of the direction of elongation of said suction line, said edge being adjacent said orifice and spaced therefrom toward said upper portion.

6. In an arrangement as set forth in claim 2, said lower portion of said suction line having an internal wall portion formed with a circumferentially elongated groove, said orifice directly communicating with said groove.

7. In a carburetor arrangement, in combination,

(*a*) a downdraft carburetor;

(*b*) a cylinder head having an intake port;

(*c*) an elongated suction line having an upper longitudinal end portion connected to said carburetor, and a lower longitudinal end portion;

(*d*) a mixing chamber formed with an aperture therethrough, said aperture having a horizontally extending axis and axially communicating with said suction line and with said intake port, said mixing chamber being formed with a slot-shaped orifice communicating with said aperture, said orifice having a circumferential length not substantially greater than one third of the circumference of said aperture and extending over a portion of said circumference downwardly spaced from said axis, said orifice having an axial width substantially smaller than said length thereof;

(*e*) a conduit having two spaced terminal portions respectively communicating with the atmosphere and with said orifice;

(*f*) control valve means in said conduit intermediate said terminal portions thereof;

(*g*) throttle valve means in said carburetor for throttling flow of a fuel mixture from said carburetor to said engine through said suction line; and

(*h*) motion transmitting means operatively connecting said control valve means and said throttle valve means for joint movement between respective open and closed positions.

8. In an arrangement as set forth in claim 7, said conduit being formed with a bore to the atmosphere intermediate said control valve means and said terminal portion communicating with said orifice, and adjustable valve means in said bore.

9. In a carburetor arrangement, in combination,

(*a*) a carburetor;

(*b*) a cylinder head having an intake port;

(*c*) an elongated suction line having an upper longitudinal end portion connected to said carburetor and a lower longitudinal end portion communicating with said intake port, said lower end portion having an internal wall portion;

(*d*) nozzle means in said lower portion remote from said carburetor for admitting air to said suction line in a plane transverse of the direction of elongation thereof, said nozzle means having an orifice in said wall portion, said orifice being elongated in said plane;

(*e*) an air conduit having two spaced terminal portions respectively communicating with the atmosphere and said orifice; and

(*f*) guide rib means on said internal wall portion, said guide rib means being obliquely inclined relative to the direction of elongation of said suction line for guiding liquid toward said orifice when said liquid flows downward on said wall portion.

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