Dec. 14, 1965 B. R. WALSH 3,223,394

ASPIRATOR FOR A CARBURETOR

Filed Dec. 18, 1961 2 Sheets-Sheet 1

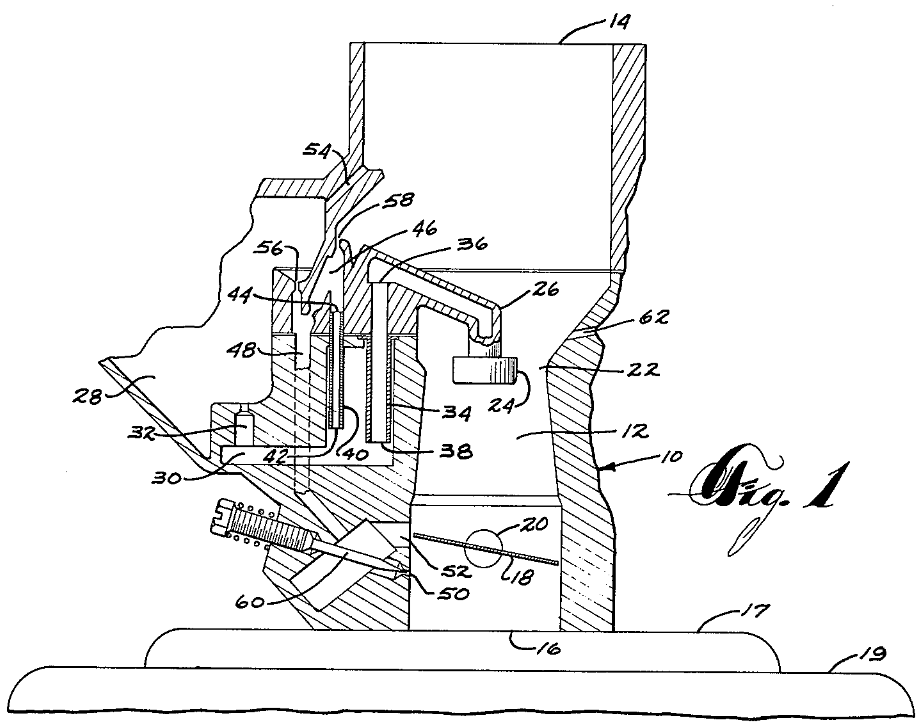


Fig. 1

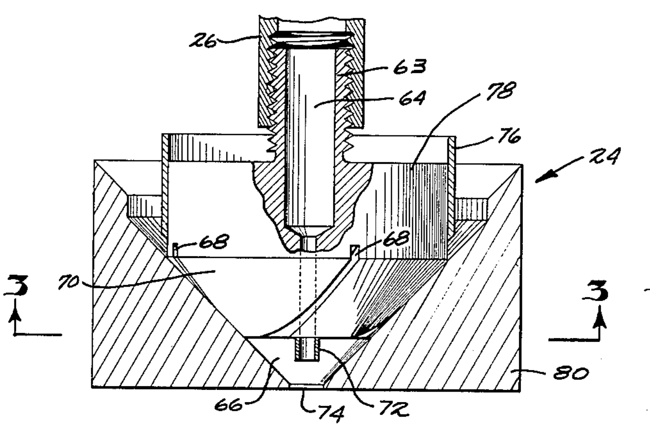


Fig. 2

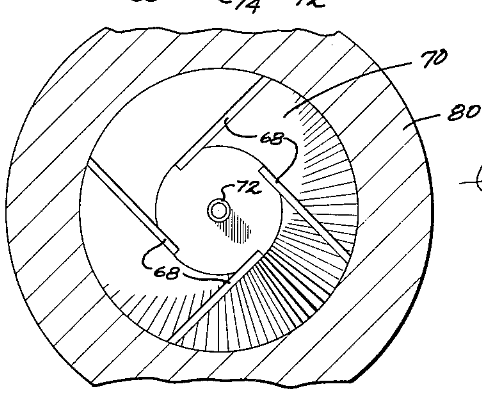


Fig. 3

INVENTOR.
BRUCE R. WALSH
BY

ATTORNEY

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ASPIRATOR FOR A CARBURETOR

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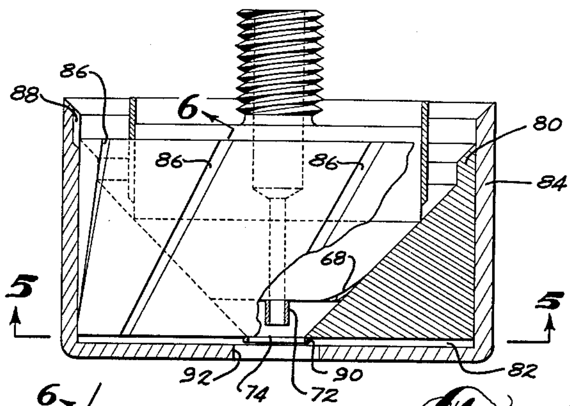


Fig. 4

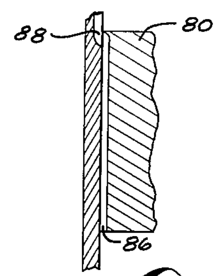


Fig. 6

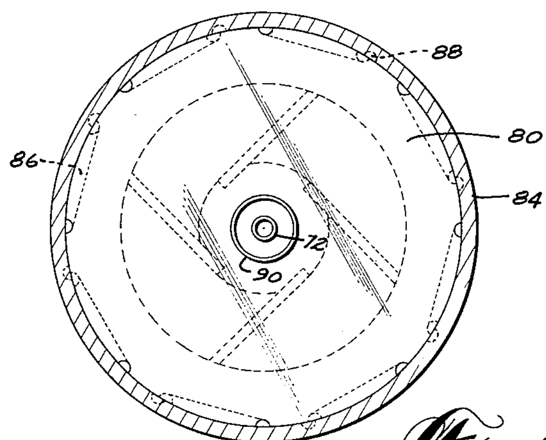


Fig. 5

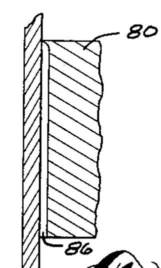


Fig. 7

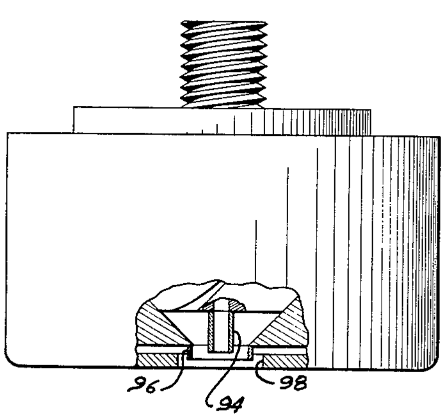


Fig. 8

INVENTOR.
BRUCE R. WALSH
BY
[signature]
ATTORNEY

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# ASPIRATOR FOR A CARBURETOR

Bruce R. Walsh, Wilkinsburg, Pa., assignor to Gulf Research & Development Company, Pittsburgh, Pa., a corporation of Delaware

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7 Claims. (Cl. 261—78)

This invention relates to improvements in carburetors for use with internal combustion engines.

Conventional carburetors utilized with internal combustion engines have an air passageway through which atmospheric air is drawn by means of a vacuum induced by the internal combustion engine with which the carburetor is associated. The air passageway is equipped with an adjustable throttle valve for adjusting the rate of flow of air through the passageway and has a venturi restriction to provide a local increase in air velocity. A liquid fuel reservoir is disposed outside of the air passageway in the region of the venturi restriction and a fuel conduit extends upwardly from the fuel reservoir into said air passageway, the fuel conduit having a terminus at the venturi restriction coaxial therewith and this terminus opens in a downstream direction in the air passageway. Air moving past the open terminus of the fuel conduit aspirates fuel from said fuel reservoir to form an air-fuel mixture for combustion in the engine. The liquid level in the fuel reservoir is below the open terminus of the fuel conduit and the fuel is drawn into the carburetor solely by the aspirational effect of the air passing therethrough.

The improvement of this invention comprises the utilization of an aspirator secured coaxially to the open terminus of the fuel conduit. The aspirator has a swirl chamber of substantially circular transverse cross section and a portion of the air passing through the air passageway of the carburetor in the region of the venturi restriction is channeled into the aspirator and enters substantially tangentially into the rear of the swirl chamber. A fuel duct extends axially into the rear of the swirl chamber and the tangentially supplied air swirls past the open terminus of the fuel duct drawing fuel from the duct to form a fuel-air mixture which is then discharged into the carburetor proper.

The use of an aspirator in combination with a carburetor in accordaance with this invention notably improves the performance of an internal combustion engine. For example, an engine utilizing the aspirator modified carburetor of this invention exhibited a higher brake torque and a higher brake horsepower as compared to the performance of the same engine when employing the same carburetor not modified with an aspirator at the same fuel-air ratio and crankshaft speed. Although not bound by a particular theory, the improved engine performance when employing the carburetor of this invention is probably due at least in part to superior admixing of air and fuel. The air-fuel mixture from a carburetor is charged to a manifold for distribution to the various cylinders of an internal combustion engine and poor mixing of air and oil can result in the engine cylinders most remote from the carburetor receiving an air-fuel mixture of a different quality as compared to the quality of the air-fuel mixture supplied to the cylinders closest to the carburetor. Therefore, improvement in mixing of fuel and air, as is achieved with the aspirator modified carburetor of the invention, probably tends to improve engine performance by standardizing the quality of the air-fuel mixture supplied to the various engine cylinders.



In a conventional carburetor a single aspirational effect which is induced by air movement longitudinally past the open terminus of the fuel conduit draws fuel into the carburetor. In the present invention, this effect remains in the longitudinal movement of air past the exterior of the aspirator. However, the aspirator of the present invention permits aspiration of fuel into a carburetor by two additional aspirational effects. The first additional aspirational effect is induced by the movement of air longitudinally past the open terminus of a fuel inlet conduit in the interior of the aspirator. The second additional aspirational effect is induced by the swirling of the air during its axial movement past the open terminus of this fuel conduit. Swirling of aspirational air in a helical pattern creates an evacuated central vortex in the air stream and the fuel is exposed to this central vortex and drawn therein. Therefore, the combination of the axial movement of air longitudinally past the open terminus of the fuel conduit and the swirling motion of the air manifests a double aspirational effect which is not possible in a conventional carburetor.

A further advantage of the aspirator-carburetor combination of this invention is that the quality of the air-fuel mixture can be advantageously adjusted by means of indirect adjustment of the quantity of fuel aspirated in the aspirator. By adjustment of the size of air inlet openings to the aspirator the proportion of the air flow through the carburetor which is utilized for aspirational purposes is easily increased or decreased without adjustment of total air flow through the carburetor and such adjustment regulates indirectly the quantity of fuel drawn into the aspirator. It is therefore seen that by utilizing an aspirator of this invention the quantity of fuel drawn into the carburetor can be adjusted without restriction of either the carburetor air passageway or the carburetor fuel passageway. Regulation of quantity of fuel drawn into a carburetor in this manner without restriction of the fuel conduit is advantageous since regulation of the fuel flow by the alternate method of restriction of the fuel conduit causes frequent plugging of the fuel conduit due to unavoidable particles of dirt lodging in restricted carburetor fuel passageways.

The invention will be more clearly understood by reference to the drawings in which:

FIGURE 1 is an elevation cross sectional view of a carburetor employing the improved fuel aspiration means of the invention,

FIGURE 2 is an elevational interior view of a single chamber fuel aspiration device for use with the carburetor in FIGURE 1,

FIGURE 3 is a view of the cross section taken through the plane 3—3 of FIGURE 2,

FIGURE 4 is an elevational interior view of a double chamber aspirating device for use with the carburetor of FIGURE 1,

FIGURE 5 is a view of the cross section taken through the plane 5—5 of FIGURE 4.

FIGURES 6 and 7 are views of fragments of the cross section taken through the plane 6—6 of FIGURE 4, and

FIGURE 8 is a partial interior view of a modification of the double chamber aspirating device of FIGURE 4.

Referring to FIGURE 1, **10** indicates generally a carburetor having an air passageway **12** in which upper opening **14** is relatively close to the atmosphere and lower opening **16** is relatively close to the intake manifold **17** of an internal combustion engine such as automobile engine **19**. The flow of air from the top to the bottom of air passageway **12** is regulated by a butterfly valve **18** fixedly attached to a rotatable shaft **20** which is actuated by a throttle. Air passageway **12** has a restricted venturi region **22** in which region is disposed an aspirating apparatus **24** secured to the terminus of a gasoline inlet duct **26**. As is shown in FIGURE 1, aspirating apparatus **24** is axially disposed in air passageway **12** and spaced apart from the wall of air passageway **12** to provide an annular space between the wall of said air passageway and the exterior of aspirating apparatus **24**.

Liquid fuel, such s gasoline, is stored in the bottom portion of a relatively large liquid fuel reservoir **28** to which it is supplied by means of a fuel pump, not shown. The fuel in reservoir **28** has access to a smaller reservoir **30** through passageway **32**. A well **34** having a top opening **36** and a bottom opening **38** extends down into fuel reservoir **30**. During operation of the engine above idling speeds, fuel is drawn from reservoir **30**, through opening **38** into well **34**, out of well **34** through opening **36**, through fuel pipe **26** and finally through aspirator **24** from which it is sprayed into air passageway **12** in admixture with air.

Also extending down into fuel reservoir **30** is an idle tube **40** having a bottom opening **42** and a top opening **44**. Idle tube **40** is provided with access to the air passageway **12** through upper opening **44**, chamber **46**, a bore **48** in the body of the carburetor, a primary idle port **50** and a secondary idle port **52**. A restricted passageway **54** is provided to vent the main fuel reservoir **28**, while restricted passageways **56** and **58** are provided to vent the idling fuel system. A needle valve **60** is provided to adjust the opening of primary idle port **50**.

A port **62** also extends into air passageway **12** for providing occasional heavy surges of fuel, if required, from an auxiliary fuel pump, not shown. A heavy surge of fuel might be required during startup of a cold engine.

In operating the engine at speeds above idling speeds, rotation of shaft **20** adjusts butterfly valve **18** into an open position allowing air to flow from the atmosphere downwardly through air passageway **12** to the engine manifold **17**. Flow of air through venturi restriction **22** of air passageway **12** causes a portion of the air stream to enter aspirator **24**. The passageway of air through aspirator **24** induces an aspirational effect drawing gasoline from fuel reservoir **30**, through opening **38**, well **34**, opening **36** and fuel inlet duct **26** to aspirating nozzle **24** wherein it is admixed with air and discharged as an air-fuel spray.

Closure of the throttle to the position shown in FIGURE 1 results in butterfly valve **18** obstructing air flow through air passageway **12**. The obstruction of air flow reduces the aspirational effect at the nozzle **24** and results in actuation of the carburetor idling system whereby fuel flows into the bottom of air passageway **12** at a position below the butterfly valve **18** to provide the engine with sufficient fuel to prevent stalling. Fuel is drawn from secondary fuel reservoir **30** into idling tube **40** through bottom opening **42** and passes upwardly through idle tube top opening **44**, through chamber **46**, bore **48** and outwardly through primary idle port **50** and secondary idle port **52**. Adjustment of the opening of primary idling port **50** can be accomplished by rotation of needle valve **60**.

FIGURES 2 and 3 show internal details of a single chamber construction for aspirator **24**. The aspirator **24**



can be attached to fuel tube **26** by means of a threaded stud **63**. Stud **63** is provided with an axial bore **64** through which fuel is passed to swirl chamber **66**. A portion of the air passing downwardly through air passageway **12** is entrapped in the zone between the upper rim of aspirator casing **80** and the exterior of sleeve **76** from which zone the air enters swirl chamber **66** through a plurality of slots **68** on a frusto-conical swirl stem **70**. Slots **68** enter the rear of swirl chamber **66** substantially tangentially as is clearly shown in FIGURE 3. The frusto-conical surface of swirl stem **70** containing the slots **68** abuts in sealing engagement against a complementary interior surface of casing **80**. Air entering swirl chamber **66**, after passing through tangential slots **68**, has a swirling motion imparted to it causing it to swirl in the swirl chamber and to establish an axial vortex which is under a vacuum. The fuel is exposed to this axial vortex causing it to be drawn through cylinrical tube **72** into the swirl chamber. A swirling mixture of air and fuel is discharged downwardly into air passageway **12** through swirl chamber discharge orifice **74**.

Swirl chamber **66** is shown as having a conical shape. However, the swirl chamber can be of any shape having a circular cross section transverse to its longitudinal axis whereby an aspirating fluid is permitted to swirl. For example, a cylindrical swirl chamber can be employed.

Axial tube **72** whose outer periphery is cylindrical in shape extends into swirl chamber **66** to an intermediate axial position therein which position is further from the rear of the swirl chamber than the distance of any air inlet openings from the rear of the swirl chamber. Cylindrical tube **72** is critical to the operation of the aspirating nozzle and the nozzle would be inoperative in its absence. The reason cylindrical tube **72** is critical to the operation of the aspirator is that the fluid being aspirated must be exposed to the swirl chamber in a region in which the swirling gas has assumed a definite helical movement. Air moving in a helical pattern has a central vortex which is under a vacuum into which aspiration of fuel can proceed. Utilization of an axial oil inlet tube **72** extending to an intermediate position along the length of the swirl chamber permits a helical pattern of air movement to develop prior to exposure of fuel to the air stream. A highly important aspect of this invention is that the fluid being aspirated must be axially exposed to the swirl chamber at an intermediate position therein. In this manner effective aspiration of fuel into the vortex of a swirling stream of air is accomplished and no external pressure need be applied to the fuel entering the carburetor.

The aspirating air enters the swirl chamber at the base of axial duct **72** and swirls around the duct, assuming a helical pattern of movement. The duct is sufficiently long to permit the air to assume a definite helical pattern of movement prior to reaching the open end of the duct. In this manner the swirling gas travels past the opening at the end of duct **72** in a parallel direction and never travels transversely across the opening. Parallel movement past the opening allows aspiration of fuel into the vortex of the swirling air to proceed, whereas transverse air movement across the opening would block the opening and prevent aspiration.

The axial duct through which a fluid is being aspirated should not terminate at the beginning of the discharge orifice of the swirl chamber. The reason is that air traveling along the wall in the forward portion of the swirl chamber will be directed transversely across the opening of the axial duct and thereby inhibit or prevent aspiration through the duct. Therefore, the axial duct should either terminate at an intermediate point along the length of the swirl chamber in advance of the beginning of the discharge orifice or extend into the orifice to an intermediate point along the longitudinal axis of said orifice.

It was further found by tests that the exterior surface of axial inlet port 72 must be cylindrical, i.e., it must extend longitudinally parallel to the nozzle axis. It was found that if the exterior of axial inlet port 72 constitutes a cone with its broad base coincident with the rear of the swirl chamber and its smaller base closest to the swirl chamber orifice, it is not possible to aspirate sufficient fuel to discharge a combustible mixture from the nozzle. It was also found that if the exterior of the axial inlet duct is hemispherical in shape with the base of the hemisphere coincident with the rear wall of the swirl chamber it is not possible to aspirate sufficient fuel to discharge a combustible mixture from the nozzle. In contrast, when an axial duct whose exterior surface had a cylindrical shape was employed highly satisfactory aspiration was achieved. The reason evidently is that in the cases of the conical and hemispherical axial ducts the swirling air was directed past the fuel opening in a direction at least partially transverse to the opening, thereby blocking the opening. On the other hand, with a cylindrical axial duct the air traveling past the opening moves completely parallel to the opening thereby preventing back pressure against the opening and allowing aspiration to proceed. With an axial duct whose outer periphery is cylindrical in shape the only axial component of movement of the swirling air stream in the region surrounding the opening of the axial duct is parallel to the opening, rather than transverse to it.

The quantity of fuel aspirated is advantageously adjustable in accordance with this invention. The quantity of fuel aspirated can be adjusted by regulating the amount of air permitted to enter into aspirating nozzle 24. This is accomplished by axial adjustment of sleeve 76 which fits snugly around the base 78 of swirl stem 70, thereby permitting at least partial obstruction of the entrance to air slots 68. By the provision of suitable means, not shown, axial adjustment of sleeve 76 can be accomplished from the instrument panel of a vehicle.

The regulation of fuel flow in a carburetor indirectly by means of regulation of air flow through the aspirator is a significant advantage of this invention. If fuel flow rate adjustment is performed by the direct method of restriction of fuel passages, the presence of dirt particles in the fuel would readily plug the carburetor and render it inoperative, thereby greatly increasing carburetor maintenance problems. However, by means of partial restriction of air flow through an aspirator in accordance with this invention the fuel flow rate can be adjusted without restriction of fuel passages, thereby allowing any dirt particles to freely pass through the carburetor without causing plugging.

FIGURE 4 illustrates a double swirl chamber aspirator. The first swirl chamber of the aspirator of FIGURE 4 is similar to that shown in FIGURES 2 and 3. The mixture of fuel and air exiting from the first swirl chamber through orifice 74 travels across a second swirl chamber 82. Second swirl chamber 82 is formed by enclosing the casing 80 which encloses the first swirl chamber with a second casing 84 which is in sliding engagement with respect to the first casing and in fluid-tight engagement therewith. The first casing 80 is provided with a plurality of parallel air slots 86 on its outer periphery which are inclined with respect to the longitudinal axis of the aspirator.

The grooves 86 extend from the bottom edge of the outer periphery of casing 80 towards the upper edge of the outer periphery of casing 80, terminating just short of the upper edge, as shown clearly in FIGURES 6 and 7 which are fragmentary views taken along the plane 6—6 of FIGURE 4. The inner periphery of outer casing 84 is provided with a plurality of grooves 88 extending from the upper rim thereof downwardly to a position overlapping the upper portion of slots 86. Each slot 86 has a corresponding groove 88. Grooves 88 are equal in number to grooves 86 and are spaced the same distance apart as are grooves 86. When outer casing 84 is rotated so that grooves 86 and 88 are in alignment with each other, as shown in FIGURE 6, a continuous passage is provided for air into the second swirl chamber 82. When grooves 86 and 88 are out of alignment, as shown in FIGURE 7, no air is permitted to enter the second swirl chamber and the aspirator operates as a single swirl chamber device. By the provision of suitable means, not shown, rotation of outer casing 84 can be accomplished from the instrument panel of a vehicle.



FIGURE 5 is a view of the aspirator of FIGURE 4 taken through the plane 5—5 of FIGURE 4. FIGURE 5 shows outer casing 84 rotated with respect to inner casing 80 so that the air slots 86 extending to the second swirl chamber 82 are in only partial register with respect to grooves 88. Partial obstruction of the air passage to the second chamber in this manner permits regulation of the volume of air supplied to the second swirl chamber to the amount desired. The second swirl chamber is provided with a duct 90 whose outer periphery is cylindrical in shape and which extends a portion of the length of swirl chamber 82. When the slots 86 extending into second swirl chamber 82 are in an open position, as shown in FIGURE 6, or are in partially open position, as shown in FIGURE 5, air enters second swirl chamber 82, swirls therein and is discharged through second discharge orifice 92. In passing through swirl chamber 82 and discharge orifice 92 the secondary air is admixed with the air-fuel mixture from the first swirl chamber to form a new mixture for discharge from the nozzle which is richer in air than the mixture from the first swirl chamber.

It is advantageous to employ a second swirl chamber. A second swirl chamber accomplishes both an additional aspirating function and an atomizing function. In the advantageous double swirl chamber embodiment, the discharge orifice of the first swirl chamber is equipped with a cylindrical duct extending from it at least a portion of the distance through the second swirl chamber. The air enters the second swirl chamber through tangential openings in the rear thereof and moves in a helical path past the terminus of this duct drawing the mixture within the axial duct into itself. The presence of the cylindrical duct extending through the forward portion of the swirl chamber prevents the air swirling in the second chamber from exerting a back pressure against the air-fuel mixture from the first chamber. In the absence of any duct in the second swirl chamber the secondary air would exert a back pressure against the air-fuel mixture from the first swirl chamber and render the aspirator inoperative. Also, if a duct is employed having an outer surface which does not extend longitudinally parallel to the nozzle axis the secondary air will travel transversely across the duct opening, obstruct it and thereby render the aspirator inoperative. Therefore, the outer surface of the duct extending through the final chamber cannot have the configuration of a cone, for example, having its base at the rear of the swirl chamber but is advantageously cylindrical in configuration.

The aspirator shown in FIGURE 8 represents the most preferred aspirator embodiment. FIGURE 8 shows an axial duct 94 of a first swirl chamber extending a portion of the distance into an axial duct 96 of a second swirl chamber. Axial duct 96 extends a portion of the distance into second swirl chamber orifice 98. The features of the aspirator of FIGURE 8 which are not shown are similar to the aspirator of FIGURE 4.

Tests were made on a gasoline burning automobile engine equipped with a standard carburetor of the general type illustrated in FIGURE 1 except that the standard carburetor was not modified by the addition of an aspirator. The results of these tests are shown in the following table. Thereupon further tests were made with the same engine by modifying the carburetor to include a double-chamber aspirator of the general type shown in FIGURE 8 in which the air passageways to each swirl chamber were set to a wide open position. The results of these tests are also shown in the following table:

*Comparison of performance of an 8.0:1 combustion ratic 6 cylinder automobile engine when employing a standard carburetor and when employing the same carburetor with an aspirator*

STANDARD CARBURETOR

| Engine crank shaft speed (r.p.m.) | Throttle position | Crank shaft brake torque (ft.-lb.) | Brake horse power | Fuel consumption (lb./hr.) | Brake specific fuel consumption (lb./B.H.P.-hr.) | Average Air: Fuel Ratio (lb.:lb.) | Corrected [1] brake torque (ft.-lb.) | Correctes brake horse power |
|---|---|---|---|---|---|---|---|---|
| 800 | Wide open | 79 | 12.0 | 8.475 | 0.704 | 12.2 | 82.4 | 12.6 |
| 1,200 | do | 86 | 19.7 | 13.636 | 0.694 | 12.3 | 89.7 | 20.5 |
| 1,600 | do | 94 | 28.6 | 18.237 | 0.637 | 12.2 | 98.0 | 29.9 |
| 2,000 | do | 97 | 36.9 | 22.489 | 0.609 | 12.3 | 101.2 | 38.5 |
| 2,400 | do | 98 | 44.8 | 27.125 | 0.606 | 12.3 | 102.2 | 46.7 |
| 2,800 | do | 96 | 51.2 | 31.414 | 0.614 | 12.4 | 100.1 | 53.4 |
| 3,200 | do | 90 | 54.8 | 35.672 | 0.650 | 12.0 | 93.9 | 57.2 |

CARBURETOR MODIFIED WITH ASPIRATOR

| Engine crank shaft speed (r.p.m.) | Throttle position | Crank shaft brake torque (ft.-lb.) | Brake horse power | Fuel consumption (lb./hr.) | Brake specific fuel consumption (lb./B.H.P.-hr.) | Average Air: Fuel Ratio (lb.:lb.) | Corrected [1] brake torque (ft.-lb.) | Correctes brake horse power |
|---|---|---|---|---|---|---|---|---|
| 800 | Wide open | 83 | 12.6 | 8.721 | 0.690 | 12.2 | 85.7 | 13.1 |
| 1,200 | do | 91 | 20.8 | 13.272 | 0.638 | 12.1 | 93.9 | 21.5 |
| 1,600 | do | 97 | 29.6 | 18.927 | 0.641 | 11.7 | 100.1 | 30.5 |
| 2,000 | do | 100 | 38.1 | 22.371 | 0.587 | 12.2 | 103.2 | 39.3 |
| 2,400 | do | 101 | 46.2 | 27.248 | 0.590 | 12.1 | 104.2 | 47.6 |
| 2,800 | do | 100 | 53.3 | 32.468 | 0.609 | 11.8 | 103.2 | 55.0 |
| 3,200 | do | 92 | 56.1 | 36.991 | 0.660 | 11.4 | 94.9 | 57.9 |

[1] Corrected to standard dry air pressure of 29.92 inches Hg and standard temperature of 60° F.

The results of the tests tabulated in the above table show that the aspirator modified carburetor produced superior performance as compared to the standard carburetor. For example, at any given engine crankshaft speed both the corrected and uncorrected brake torque and brake horsepower are higher in the case of the aspirator modified carburetor. Also, at most engine speeds the brake specific fuel consumption is advantageously generally lower when employing the aspirator modified carburetor as compared to the standard carburetor. It is also seen from the table that at a uniform air-fuel ratio such as substantially obtained, as shown by the data, during the 2000 r.p.m. engine speed test with both the standard and aspirator modified carburetor, the aspirator modified carburetor advantageously produced a lower brake specific fuel consumption and advantageously produced higher corrected and uncorrected brake torque and brake horsepower as compared to the standard carburetor.

In operating the gasoline burning automobile engine with the same aspirator modified carburetor utilized in the tests it was observed visually that the aspirator continued to spray an appreciable quantity of gasoline even at idling speeds. In conventional carburetors aspiration of fuel through the primary fuel inlet port falls to an inoperably low level at engine idling speeds and therefore an independent idling fuel inlet port must be provided. Since the use of an aspirator in accordance with this invention permits appreciable fuel aspiration through the primary fuel inlet port at idling speeds it is likely that no carburetor idling fuel inlet system is required in the improved carburetor of this invention. Simplification of standard carburetors by omission of the idling fuel system represents a substantial advantage of this invention.

Various changes and modifications can be made without departing from the spirit of this invention or the scope thereof as defined in the following claims.

I claim:

**1.** In a carburetor having an air passageway defined by an air passageway wall one end of which is an upstream end and the other a downstream end, a fuel conduit adapted to supply fuel to said air passageway extending into said air passageway, said fuel conduit having a terminus coaxially disposed with respect to said air passageway and facing in a downstream direction therein, the improvement comprising aspirator means disposed at said fuel conduit terminus, said aspirator means coaxially disposed with respect to said air passageway and spaced apart from the wall of said air passageway to provide an annular space between the wall of said air passageway and the exterior of said aspirator means so that air flowing in said air passageway flows past the exterior of said aspirator means, air inlet means in said aspirator means open to said air passageway adapted to channel a portion of the air flowing in said air passageway into said aspirator means, swirling means in said aspirator means adapted to swirl the air entering through said air inlet means, said aspirator means adapted so that the swirling air aspirates fuel through said fuel conduit to form a fuel-air mixture, discharge means in said aspirator means opening into said air passageway in a downstream direction adapted for the discharge of a swirling spray into said air passageway.

**2.** In claim **1**, adjustable closure means for adjusting the size of said air inlet means.

**3.** In a carburetor having an air passageway defined by an air passageway wall one end of which is an upstream end and the other a downstream end, a fuel conduit adapted to supply fuel to said air passageway extending into said air passageway, said fuel conduit having a terminus coaxially disposed with respect to said air passageway and facing in a downstream direction therein, the improvement comprising aspirator means disposed at said fuel conduit terminus, said aspirator means coaxially disposed with respect to said air passageway and spaced apart from the wall of said air passageway to provide an annular space between the wall of said air passageway and the exterior of said aspirator means so that air flowing in said air passageway flows past the exterior of said aspirator means, enclosed swirl chamber means in said aspirator means, discharge opening means at the downstream end of said swirl chamber means, air inlet means in said aspirator means open to said air passageway adapted to channel a portion of the air flowing in said air pasasgeway tangentially into said swirl chamber means, fuel supply means extending axially into said swirl chamber means, said aspirator means adapted so that swirling air aspirates fuel in said swirl chamber means and discharges a swirling spray downstream into said air passageway.

**4.** In claim **3**, adjustable closure means for adjusting the size of said air inlet means.

**5.** In a carburetor having an air passageway defined by an air passageway wall, the upstream end of said air passageway being the air entrance end and the downstream end being the discharge end, a fuel conduit adapted to supply fuel to said air passageway extending into said air passageway, said fuel conduit having a terminus coaxial with respect to said air pasageway, the terminus of said fuel conduit in said air passageway opening in the direction of said discharge end of the air passageway, the improvement comprising an aspirator secured coaxially to the terminus of said fuel conduit and spaced apart from the wall of said air passageway to provide an annular space between the wall of said air passageway and the exterior of said aspirator, said aspirator comprising an enclosed swirl chamber having a substantially circular transverse cross section, the rearward portion of said swirl chamber being relatively close to the upstream end of the air passageway and the forward portion of said swirl chamber being relatively close to the downstream end of the air passageway, an axial discharge orifice in the forward portion of said swirl chamber directed toward the downstream end of said air passageway, air inlet means in said aspirator opening to the air passageway, groove means extending from said air inlet means toward the rear of said swirl chamber, said groove means terminating with substantially tangential openings into the rear of said swirl chamber, fuel supply means extending into said swirl chamber from the rear, said aspirator adapted so that swirling air aspirates fuel in said swirl chamber and discharges a swirling spray downstream into said air passageway means.

6. In claim 5, adjustable closure means for adjusting the size of said air inlet means.

7. In a carburetor having an air passageway defined by an air passageway wall, the upstream end of said air passageway being the air entrance end and the downstream end being the discharge end, a fuel conduit adapted to supply fuel to said air passageway extending into said air passageway, said fuel conduit having a terminus coaxial with respect to said air passageway, the terminus of said fuel conduit in said air passageway opening in the direction of said discharge end of the air passageway, the improvement comprising an aspirator secured coaxially to the terminus of said fuel conduit and spaced apart from the wall of said air passageway to provide an annular space between the wall of said air passageway and the exterior of said aspirator, said aspirator comprising an enclosed swirl chamber having a substantially circular transverse cross section, the rearward portion of said swirl chamber being relatively close to the upstream end of the air passageway and the forward portion of said swirl chamber being relatively close to the downstream end of the air pasageway, an axial discharge orifice in the forward portion of said swirl chamber directed toward the downstream end of said air passageway, air inlet means in said aspirator opening to the air passageway, groove means extending from said air inlet means toward the rear of said swirl chamber, said groove means terminating with substantially tangential openings into the rear of said swirl chamber, an axial cylindrical duct extending from the rear of said swirl chamber, said duct providing extension means from said fuel conduit, and said duct extending into said chamber a greater distance from the rear of the swirl chamber than the distance of the tangential openings from the rear of the chamber.




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HARRY B. THORNTON, *Primary Examiner.*

HERBERT L. MARTIN, *Examiner.*