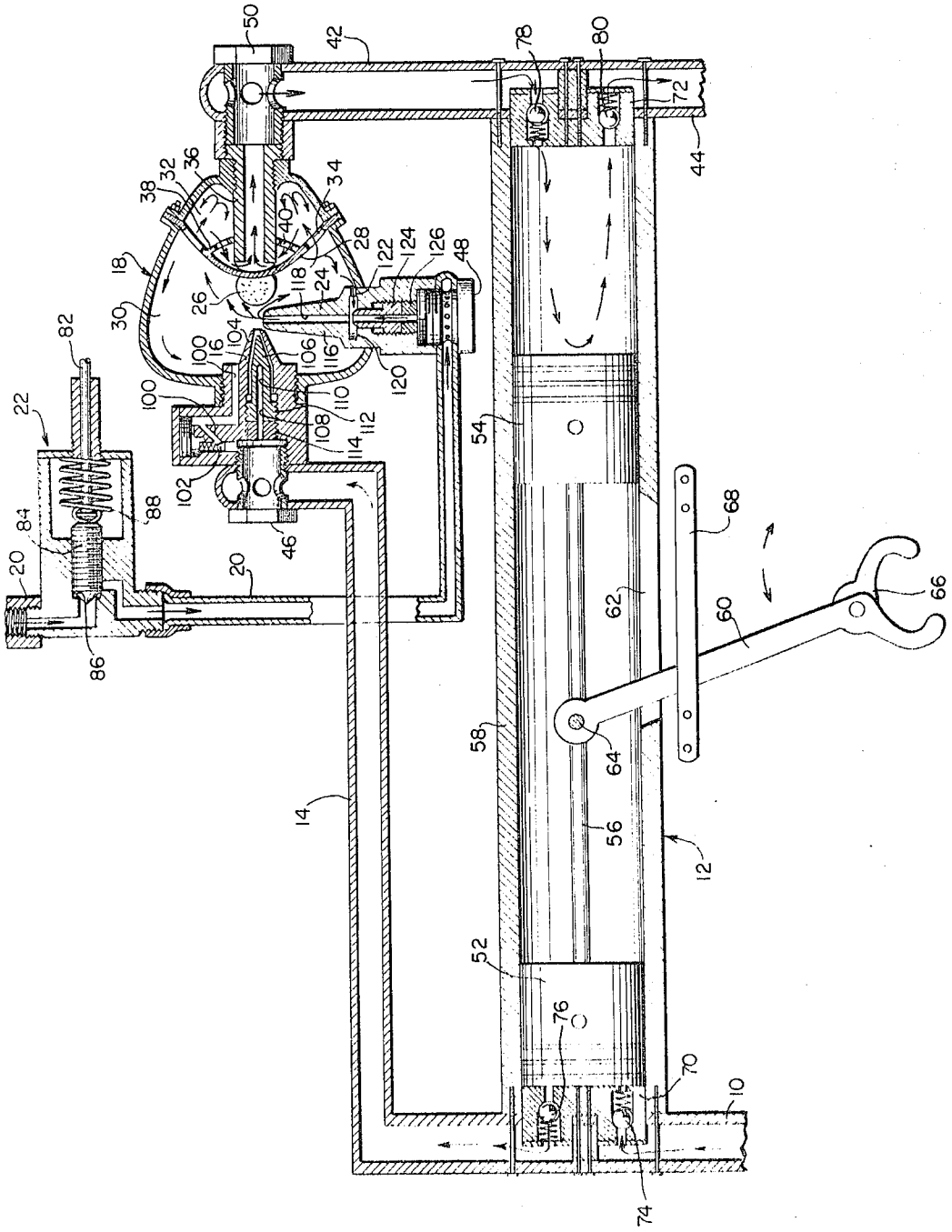
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CARBURETOR FOR ROTARY ENGINES

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CARBURETOR FOR ROTARY ENGINES

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ABSTRACT OF THE DISCLOSURE

A liquid fuel carburetion device for rotary internal combustion engines having an engine driven pump pressurizing an air injecting nozzle with a liquid fuel injecting nozzle disposed at right angles proximate thereto. A mixture dispersing sphere is disposed in axial alignment with the air injecting nozzle to receive the fuel-air mixture for dispersion thereof as a vapor, and the vapor is transmitted to the engine under positive pressure from an engine driven pump.

Background of the invention

This invention relates to fuel-air carburetion devices and more particularly to an engine driven pressurized fuel-air carburetion device for rotary engines.

There are, in the prior art, carburetion devices for internal combustion engines. These carburetion devices provide a vaporized mixture of liquid fuel and air to internal combustion engines. The more conventional type of carburetion apparatus for reciprocating piston internal combustion engines provides a vaporized mixture at substantially atmospheric pressure through a venturi effect wherein fuel is aspirated into the venturi throat by air drawn therethrough by the intake stroke of the reciprocating pistons. Other carburetion systems used in reciprocating piston internal combustion engines provide injection of fuel under positive pressure as a means of increasing the efficiency of the engine. These systems generally pressurize the fuel and inject it through nozzles into the individual cylinders of the engine.

This invention pertains to rotary internal combustion engines in which there is no substantial intake stroke imposed by the rotary mechanism of the engine and which, therefore, requires a positive pressure fuel injection system therefor.

Summary of the invention

This invention furnishes a positive pressure carburetion system, particularly adapted for use with rotary engines of the type disclosed in applicant's copending application Ser. No. 691,879, filed Dec. 19, 1967, by providing a positive displacement engine driven air pump communicative with an air injection nozzle disposed in proximate relationship to a fuel injection nozzle and a mixture dispersing member in a vaporization chamber for vaporization of the liquid fuel from the fuel injection nozzle. The invention also provides means to utilize the engine driven pump to transmit the air-fuel mixture from the vaporization chamber to the engine under positive pressure.

The objects and attendant advantages of the invention

will become better understood to those skilled in the art by reference to the following detailed description when viewed in light of the accompanying drawing.

Brief description of the drawing

The figure is an elevational view, in section, of an apparatus in accordance with the invention.

Description of the preferred embodiment

Referring now to the figure, the device comprises an air intake line **10** communicative with a pump, shown generally at **12**, which in turn is communicative, through an air feed line **14** and an air injection nozzle **16**, with a vaporization chamber **18**.

A fuel inlet line **20**, controlled by a fuel metering valve **22**, also communicates with the vaporization chamber **18** through a fuel injection nozzle **24** mounted proximate and at right angles to the center line of the air injection nozzle **16**. A mixture dispersing member in the form of a sphere **26**, having a roughened surface thereon, is disposed proximate the intersection of the axes of the air injection nozzle **16** and the fuel injection nozzle **24**. The sphere **26** is mounted on a dome-shaped baffle **28** which, in turn, is disposed to divide the interior of the chamber **18** into sub-chambers **30** and **32**. Communication is provided between the sub-chambers **30** and **32** through openings **34** disposed through the baffle **28**. A vaporized mixture conduit **36** is coaxially mounted in the sub-chamber **32** and terminates in spaced relationship to the baffle **28**. The conduit **36** is connected to the baffle **28** through an annular baffle support member **38**. Openings **40**, disposed in the baffle support member **38**, provide communication between the inlet to the conduit **36** and the sub-chamber **32**. An outlet transfer conduit **42** communicates the vaporized mixture outlet conduit **36** with the pump **12** which, in turn, communicates with a fuel supply manifold **44**. Connections to provide communication between the air line **14** and the air injection nozzle **16**, the fuel inlet line **20** and the fuel injection nozzle **24** and the vaporized mixture outlet conduit **36** and the transfer conduit **42** are accomplished through thimble type connectors **46**, **48** and **50**, respectively, of a type known to those skilled in the art.

Referring now more particularly to pump **12**, dual pistons **52** and **54** are connected to one another by a piston rod **56** and slidably disposed in a cylinder **58**. A drive arm **60** is disposed through a slot **62** in the cylinder wall **58** and is pivotally connected at **64** to the piston rod **56**. The free end of the drive arm **60** is provided with articulated jaws **66** which, through engagement with a rotary cam on an engine (not shown), provide means to oscillate the arm **60** in the direction shown by the double arrow in the figure. A bracket **68** slidably retains the arm **60** to provide for transmission of reciprocatory motion to the pistons **52** and **54** through the piston rod **56**.

Check valve housings **70** and **72** are disposed at either end of the cylinder **58** to control communication between the pump **12** and the lines **10** and **14** and the conduit **42** and manifold **44**, respectively. The housing **70** has, formed therein, a pair of check valves **74** and **76**, the check valve **74** providing one-way flow of air from the line **10** into the cylinder **58** while the check

valve 76 provides one-way flow of air from the cylinder 58 into the line 14. The housing 72 has a pair of check valves 78 and 80 disposed therein, the check valve 78 providing one-way flow of air into the cylinder 58 from the conduit 42 while the check valve 80 provides one-way flow of air from the cylinder 58 into the fuel supply manifold 44.

The fuel metering valve 22 is a needle type valve and provides for control of power by furnishing means to vary the amount of fuel metered therepast. Such variation is achieved by suitable rotary motion of a throttle linkage 82 which rotates a threaded needle valve member 84 to vary the space between the valve member 84 and a valve seat 86. A helical spring 88 biases the throttle linkage 82 in such a manner that the valve member 84 is normally positioned most proximate the valve seat 86 to thereby normally supply fuel at a rate sufficient to idle the engine.

Referring now more specifically to the air injection nozzle 16, a bypass, comprising a bypass conduit 100 communicating with the air line 14 upstream of the nozzle 16 and the sub-chamber 30, is controlled by a spring loaded check valve member 102 which is normally biased to preclude flow therethrough. The air injection nozzle 16 comprises an outer annular cone 104 having an inner cone 106 concentrically mounted in spaced relationship to the inner wall thereof. The inner cone 106 is provided with a central air transmitting bore 108 which communicates with the space between the inner cone 106 and the outer cone 104 through transverse openings 110. By providing a threaded connection 112 between the inner cone 106 and the outer cone 104, the space between the cones may be varied, thereby furnishing means to adjust the velocity of air injected through the nozzle. An adjustment locking screw 114 is threaded behind the inner cone 106 to provide locking of the position thereof once adjustment is made.

Referring now more particularly to the fuel injection nozzle 24, the nozzle cone 116 is provided with a central bore 118 which communicates with a cylindrical interior chamber 120 on the interior of the cone. The chamber 120 communicates with the interior of the sub-chamber 30 through a transverse opening 122. A threaded, longitudinally movable fuel transmitting member 124 extends into the chamber 120 in spaced relationship to the inlet of the bore 118. By movement of the member 124 with respect to the bore 118, the amount of gas recirculated through the opening 122 is varied thereby providing means to adjust the richness of the fuel injected through the nozzle 24. An adjustment locking screw 126 is threaded behind the member 124 to provide locking thereof when adjustment has been made.

It should be obvious that the adjustment structures for either of the above-described nozzles 16 or 24 may be of any type known in the art. It is contemplated that the adjustments of velocity and richness will be made periodically as is dictated by engine performance.

In operation, the arm 60 is oscillated as was described above, to reciprocate the pistons 52 and 54 in the cylinder 58. On the suction stroke to the right, piston 52 draws air in from the air inlet line 10 through the check valve 70. Return motion of the piston 52 to the left drives the air through the check valve 76 and the air line 14 to the air injection nozzle 16 where it is injected into the sub-chamber 30.

The velocity of air injection is determined by the relative position between the outer cone 104 and the inner cone 106 and the speed of the driving source is determined by the speed of the engine. When, due to increased engine speed, the volume of air being pumped through the line 14 becomes too great, as is determined by the spring loading on the valve 102, air is bypassed through the bypass conduit 100 directly into the sub-chamber 30 to thereby preclude overloading of the system at higher engine speeds.

Fuel, which may be supplied through a conventional fuel pump (not shown) or by gravity, enters the fuel inlet line 20 and, controlled by the metering valve 22, is transmitted to the fuel injection nozzle 24 from which it is aspirated by the air stream passing by the nozzle 24 from the air injection nozzle 16 in a manner known in the art. The air and fuel mixture then impinges against the dispersing member 26 so that the fuel droplets are evenly dispersed and vaporized and the mixture then, after further mixing in the sub-chamber 32, is exhausted through the vaporized mixture outlet conduit 36. Withdrawal of the fuel-air mixture from the vaporization chamber 18 is enhanced by operation of the piston 54 which, on the suction stroke when moving to the left, draws the fuel-air mixture through the fuel transfer conduit 42 and the check valve 78 into the cylinder 58 and, on the compression or pressure stroke thereof to the right, pumps the fuel-air mixture through the check valve 80 and into the fuel supply manifold 44 for transmission to the engine. The compression stroke of the piston 54 also serves to supply the fuel-air mixture to the engine at an elevated pressure as desired for the most efficient operation of the engine.

It should be obvious that, in lieu of the reciprocatory double acting piston pump illustrated, other positive displacement pumps, such, for example, as vane pumps, gear pumps or the like, may be substituted if desired.

As is evident from the above description, the apparatus provides a carburetion means to effectively break up and disperse liquid fuel in small droplets with a substantially constant dispersion of the fuel. By providing a positive pressure carburetion system, the invention provides greater efficiency by supplying and maintaining the fuel-air mixture to the engine under positive pressure. The invention also provides a relatively inexpensive, durable and simple apparatus having a minimum of delicate parts, thereby requiring less adjustment and maintenance.

What has been set forth above, is intended primarily as exemplary of a teaching in accordance with the invention to enable those skilled in the art in the practice thereof. It should, therefore, be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described.

What is new and therefore desired to be protected by Letters Patent of the United States is:

1. A liquid fuel carburetion device for rotary internal combustion engines comprising an engine driven air pump, a vaporization chamber, an air injecting nozzle disposed in said chamber in fluid communication with said pump, a dispersion member disposed in line with the center line of said air injecting nozzle, a fuel injecting nozzle disposed between said dispersion member and said air injecting nozzle proximate said air injecting nozzle at right angles to the center line thereof, means including conduiting and a metering valve to transmit fuel to said fuel injecting nozzle, said air pump comprising at least one reciprocating piston slideably disposed in a cylinder to form an expansible chamber at one end thereof, an air intake means including a check valve, an air line communicative with said expansible chamber to supply air thereto on the suction stroke of said piston, and an exhaust means including a check valve and an air feed line communicative with said expansible chamber and said air injecting nozzle to transmit air to said air injecting nozzle on the compression stroke of said piston, said piston being double acting and forming a second expansible chamber on the other end of said cylinder, a mixture intake means including a check valve controlled fuel transfer conduit communicative with said vaporization chamber and said second expansible chamber to provide transfer of fuel-air mixture to said second chamber on the suction stroke of said piston therein, mixture exhaust means including a check valve controlled manifold communicative with said second chamber to provide exhaust of fuel-air mixture from said second expansible chamber on the compression stroke of said piston therein.

2. A device in accordance with claim 1 wherein said dispersion member comprises a perforate baffle mounted substantially normal to the centerline of said air inject-

ing nozzle and disposed to divide said vaporization chamber into first and second sub-chambers.

3. A device in accordance with claim 2 wherein said dispersion member further comprises a sphere mounted on said baffle coaxial with the centerline of said air injecting nozzle.

4. A device in accordance with claim 3 wherein said mixture intake means further includes an exhaust tube extending into said second sub-chamber and terminating in spaced relation to said baffle, said tube being substantially coaxially disposed with respect to the centerline of said air injecting nozzle.

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