United States Patent [19]

Huff

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[54] **CARBURETOR ACCELERATING PUMP SYSTEM FUEL ATOMIZER**

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[52] **U.S. Cl.** ..... **261/34 A;** 239/494; 261/78 R; 261/DIG. 39

[51] **Int. Cl.²** **F02M 7/08**

[58] **Field of Search** ..... 261/34 A, 78 R, DIG. 39; 239/494

[56] **References Cited**

UNITED STATES PATENTS

1,998,784	4/1935	Mock	261/DIG. 51
2,313,258	3/1943	Olson	261/34 A
3,019,990	2/1962	Campbell	239/494
3,120,348	2/1964	O'Donnell	239/494

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[57] **ABSTRACT**

A carburetor has an accelerating pump circuit that includes a fuel atomizing vortex generator located just prior to the fuel discharge nozzle so that the fuel has a spinning motion imparted to it to discharge in a conical spray pattern of fine mist providing rapid vaporization and thereby lowering emission output and reducing fuel requirements.

1 Claim, 4 Drawing Figures

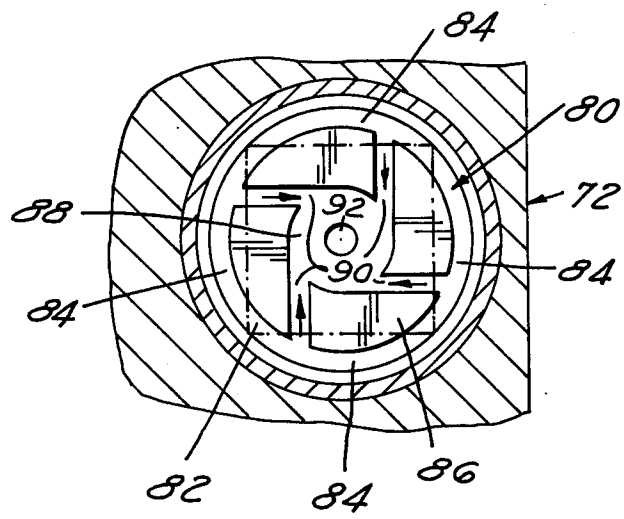


FIG. 1

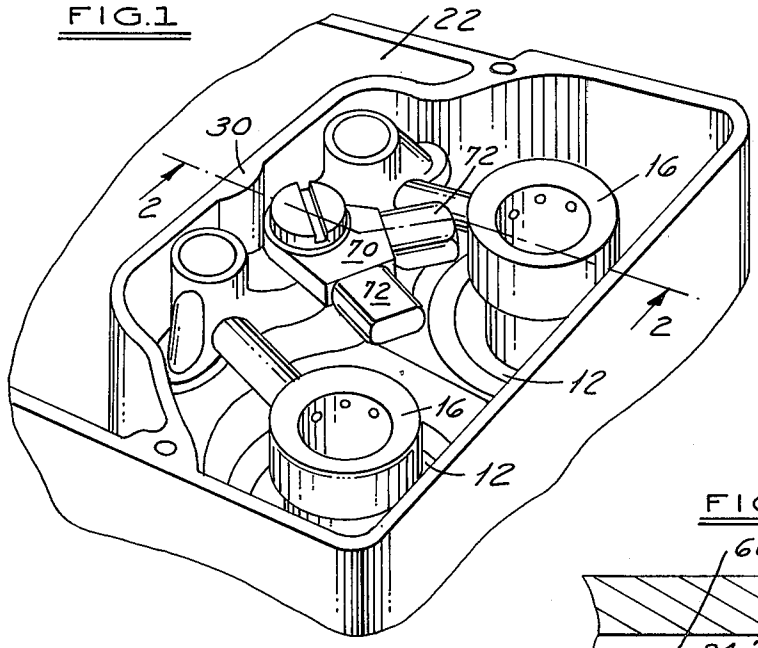


FIG. 3

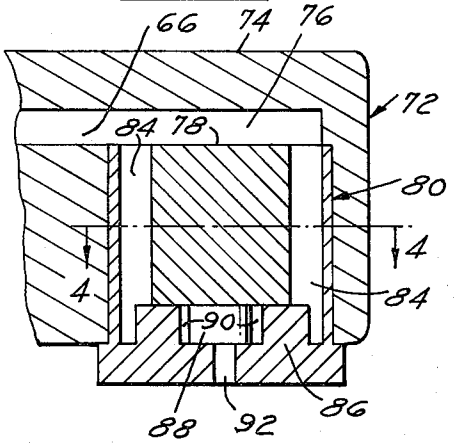


FIG. 2

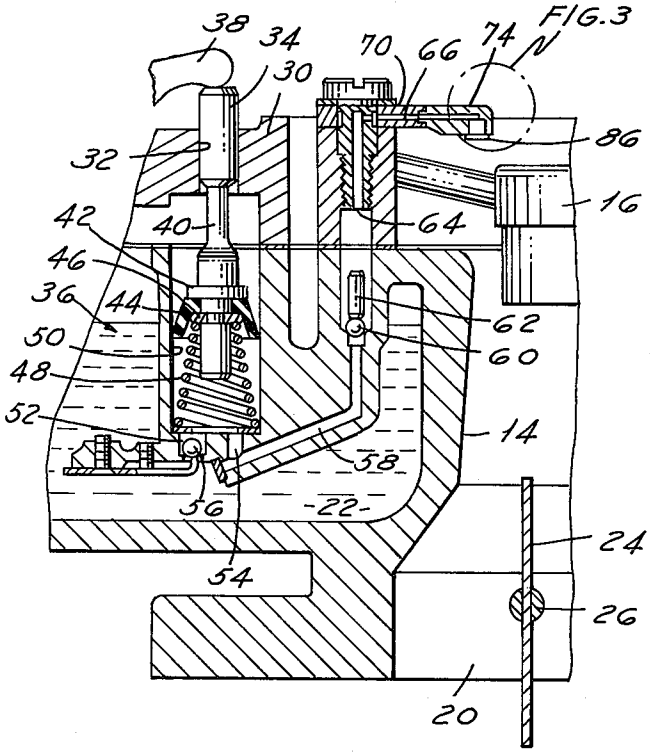
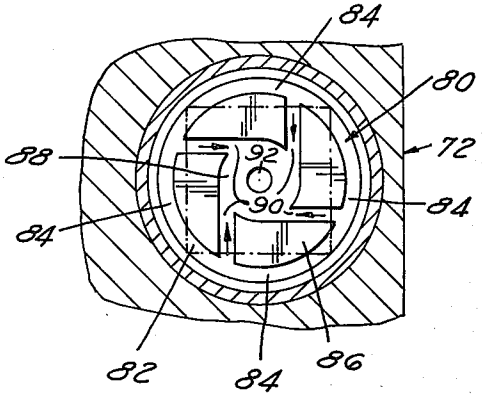


FIG. 4



CARBURETOR ACCELERATING PUMP SYSTEM FUEL ATOMIZER

This invention relates, in general, to a motor vehicle type carburetor. More particularly, it relates to the accelerating pump system of the carburetor that incorporates a fuel atomizer to reduce the output of undesirable emissions into the atmosphere.

Most motor vehicle type carburetors have an accelerating pump system in which the pumped fuel is discharged through a nozzle located in one side of the carburetor induction passage and at the same level or slightly above the booster venturi rings. Studies have shown, however, that the streams of fuel shot into the vicinity of the booster rings are unbroken, impinge against the rings, and do not appear sufficiently conditioned to vaporize quickly. This leads to the passage of considerably more quantities of liquid fuel into the engine combustion chambers than is desirable, which may result in the emission of unburned hydrocarbons and carbon monoxide into the atmosphere.

With the presently designed systems, the fuel stream at best will break up into rather large droplets of varying size. The exposed surfaces of these droplets, for all intents and purposes, produces an adequate air-fuel mixture to achieve desired engine response when accelerating. However, there appear to be amounts of fuel that do not oxidize completely or do not oxidize at all. When combustion occurs, the unvaporized mixture is oxidizer starved and by the time vaporization does occur incomplete oxidization results. This invention alleviates this condition by reducing the droplet size and increasing the total surface area of the injected fuel mass. This allows more rapid vaporization during periods of acceleration. This also requires less fuel as a result of only introducing that amount of fuel that will completely vaporize, before combustion, and maintain a near constant air-fuel ratio.

It is an object of this invention, therefore, to provide an accelerating pump system that will introduce a reduced amount of fuel into the induction passage as compared with known systems, in the form of a fine spray or an atomized mixture of fuel and air which reduces the droplet size and increases the total surface area of the injected fuel mass.

It is another object of the invention, therefore, to provide an accelerating pump system with a vortex generator located just upstream of the accelerating pump discharge nozzle or orifice so that a vortex flow is imparted to the fuel prior to its being forced through the nozzle. A spinning motion is imparted to the fuel that is continued through the nozzle from which it expands in a conical spray pattern due to centrifugal forces acting on the fuel particles, which break up the flow into fine droplets forming a mist. The conical pattern mist is then caught in the engine intake air stream in the carburetor induction passage producing a feathering effect which further breaks up the mist and results in a more rapid vaporization for a given mass of fuel due to increased total surface area. Since it is fuel vapor that immediately enters the engine combustion chambers instead of liquid fuel, less fuel need be used by the accelerating pump for the same engine response.

It is a still further object of the invention to provide a carburetor with an accelerating pump system including a fuel pump actuated in response to movement of the throttle valve to pump fuel under low pressure into the outer annulus of a vortex generator from which fuel flows inwardly through circumferentially spaced radially offset passages tangentially arranged with respect to the outer periphery of a vortex chamber to impart vortex flow to the fuel increasing its velocity and centrifugal force as it moves toward an axial discharge that is essentially at right angles to the direction of vortex flow. The spinning motion continued through the nozzle effects a conical spray discharge into the carburetor induction passage in esssentially the same direction as the incoming air stream, the air particles further bombarding the fuel particles and breaking them into smaller droplets of mist from so that essentially all of the fuel injected is vaporized.

Other objects, features and advantages of the invention will become more apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating the preferred embodiment thereof, wherein;

FIG. 1 is a perspective view of the portion of a two-barrel down-draft type carburetor embodying the invention;

FIG. 2 is a cross-sectional view of a portion of the carburetor shown in FIG. 1 taken on a plane indicated by and viewed in the direction of the arrows 2—2 of FIG. 1;

FIG. 3 is an enlarged cross-sectional view of a detail encircled in FIG. 2; and,

FIG. 4 is a cross-sectional view taken on a plane indicated by and viewed in the direction of the arrows 4—4 of FIG. 3.

FIGS. 1 and 2 show a portion of a downdraft type carburetor **10** having a pair of conventional air/fuel mixture induction passages **12.** Each induction passage contains a conventional fixed area venturi section **14,** a boost venturi ring **16,** and is open at its upper end to receive fresh air from the conventional air cleaner, not shown. Its lower end **20** is adapted to be connected to the intake manifold of an internal combustion engine so as to be subject to the vacuum changes, for control purposes to be described.

Fuel is supplied to the boost venturi **16** from a float bowl or fuel reservoir **22** through a passage, not shown, upon the flow of air through passages **12,** in a conventional manner. Each passage **12** also contains a throttle plate **24** fixed to a shaft **26** that is mounted in the side walls of the carburetor for rotation between closed and fully open positions to control the flow of air and fuel through the passage. Further details of construction and operation of the carburetor per se other than those portions relating to the invention are not given since they are known and believed to be unnecessary for an understanding of the engine.

FIG. 2 illustrates more clearly the accelerating pump circuit of the carburetor. The carburetor air horn or upper body portion **30** located over fuel bowl **22** contains a hole **32** through which projects the plunger **34** of an accelerator pump **36.** The plunger is adapted to be actuated by a lever **38** that is connected by suitable linkage not shown to the vehicle throttle valve shaft **26.** The plunger **34** has a reduced diameter neck portion **40** fixed to a pump piston **42** against which rides a vented pump cup **44** of rubber or similar elastic properties. The cup is held in place by an O-ring **46** serving also as a seat for a return spring **48.** The opposite end of the spring seats at the bottom of a fuel well **50** secured to the underside of the upper body portion.

The well at its bottom is open to a pair of passages **52** and **54, 52** being a fuel inlet passage connected to fuel bowl **22** past a ball check valve **56.** Passage **54** is a discharge port connected by a passage **58** past a ball valve **60** and a weight **62** to a passage **64.** The latter passage is intersected by a pair (only one shown) of angled passages **66** formed in a plate **70** (See FIG. **1**). Each passage **66** extends in a direction towards a boost venturi ring **16** and supplies fuel to a combination vortex generator and discharge orifice assembly **72** secured at the end of the passages.

As best seen in FIGS. **3** and **4,** the assembly **72** includes a nylon or similar housing **74** having a passage **76** that extends over the end **78** of a vortex generator **80.** The latter has a main body portion **82** that is squarish in cross-section to define four fuel flow channels **84.** Attached to the main body portion is an annular portion **86** having a central vortex cavity **88,** four equally circumferentially spaced fuel inlet passages **90,** and an axially located and extending discharge orifice **92.**

The inlet passages **90** extend in a direction essentially at right angles to the axis of the vortex cavity **88,** radially and tangentially offset from the center of the discharge orifice **92.** That is, each inlet passage **90** connects tangentially to the outer periphery of the vortex cavity **88** to induce vortex flow or eddies around the cavity. The fuel remains spinning as it is forced through the orifice **92** by the differential pressure between the low fuel pump pressure and the pressure or vacuum in passages **12.** This causes the fuel then to be thrown outward of the orifice exit due to centrifugal forces. This produces a conical spray of fine droplets which enter the engine intake air stream in induction passages **12** in the same general direction. The small droplets quickly vaporize and produce improved mixing as the mixture passes through the intake manifold and into each cylinder.

From the foregoing, therefore, it will be seen that the invention provides an accelerating pump circuit in which the fuel is forced to pass through a vortex generator before reaching the discharge orifice, which results in a conical mist of fuel in the engine induction passages that provides more rapid vaporization of the fuel for a given mass of fuel due to the increased total surface area, thereby requiring less fuel than is necessitated by conventionally designed carburetor accelerating pump systems, to accomplish the same results.

While the invention has been shown and described in its preferred embodiment, it will be clear that many changes and modifications can be made thereto without departing from the scope of the invention.

I claim:

1. A fuel enrichment control device for the accelerating pump system of a carburetor having an air/fuel induction passage open at one end to air at ambient pressure and connected at its other end to an engine intake manifold to be subject to the changes in vacuum therein, the induction passage including a fuel discharge port means supplying fuel under pressure at times to the discharge port, the pump system including a fuel pump connected by passage means to the port and actuated in response to opening movement of the carburetor throttle valve to deliver fuel to the port, the control device comprising fuel atomizing means connected to the discharge port for receiving the pumped fuel and discharging the fuel into the induction passage in a finely atomized state promoting mixing of the fuel with the air in the induction passage to effect maximum fuel vaporization and thereby a reduction in fuel enrichment requirements during vehicle accelerations, the fuel atomizing means comprising a vortex generator including a vortex cavity having an axial fuel outlet and a radially outward tangential off-center fuel inlet inducing spinning and increased velocity to the fuel, the vortex generator including an annular member having an axial discharge nozzle of a first predetermined diameter at one end constituting the fuel outlet, a radially outer torodial fuel flow inlet chamber connected to the fuel passage means at the opposite end, the vortex generator connecting the inlet chamber and nozzle, the vortex generator having a tubular shape with a number of circumferentially spaced peripheral flow passages extending essentially parallel to the axis of the generator and constituting the tangential off-center fuel inlet connecting to the vortex cavity in a tangential manner to induce vortex flow around the axis of the vortex chamber for central discharge through the nozzle with increased velocity.

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