United States Patent [19]

Greenfield

[11] **3,920,775**

[45] **Nov. 18, 1975**

[54] **FUEL INJECTOR**

[75] Inventor: **Anthony F. Greenfield,** Baltimore, Md.

[73] Assignee: **Stanley Sollins,** Baltimore, Md. ; a part interest

[22] Filed: **Mar. 26, 1974**

[21] Appl. No.: **455,031**

[52] **U.S. Cl.**..... **261/23 A;** 251/DIG. 4; 261/51; 261/67; 261/105

[51] **Int. Cl.**[2] **F02M 19/04**

[58] **Field of Search** ..... 261/51, 23 A, 67, DIG. 39, 261/105, 106, 44 A; 251/120, 121, DIG. 4

[56] **References Cited**

UNITED STATES PATENTS

1,901,849	3/1933	Moore	261/DIG. 39 X
2,150,081	3/1939	Schorsch	261/51
2,247,189	6/1941	DeGuyon	261/DIG. 39 X
2,399,841	5/1946	Ware	261/42 X
2,443,120	6/1948	Saucier	261/51 X
2,996,290	8/1961	Munden	261/78 R

FOREIGN PATENTS OR APPLICATIONS

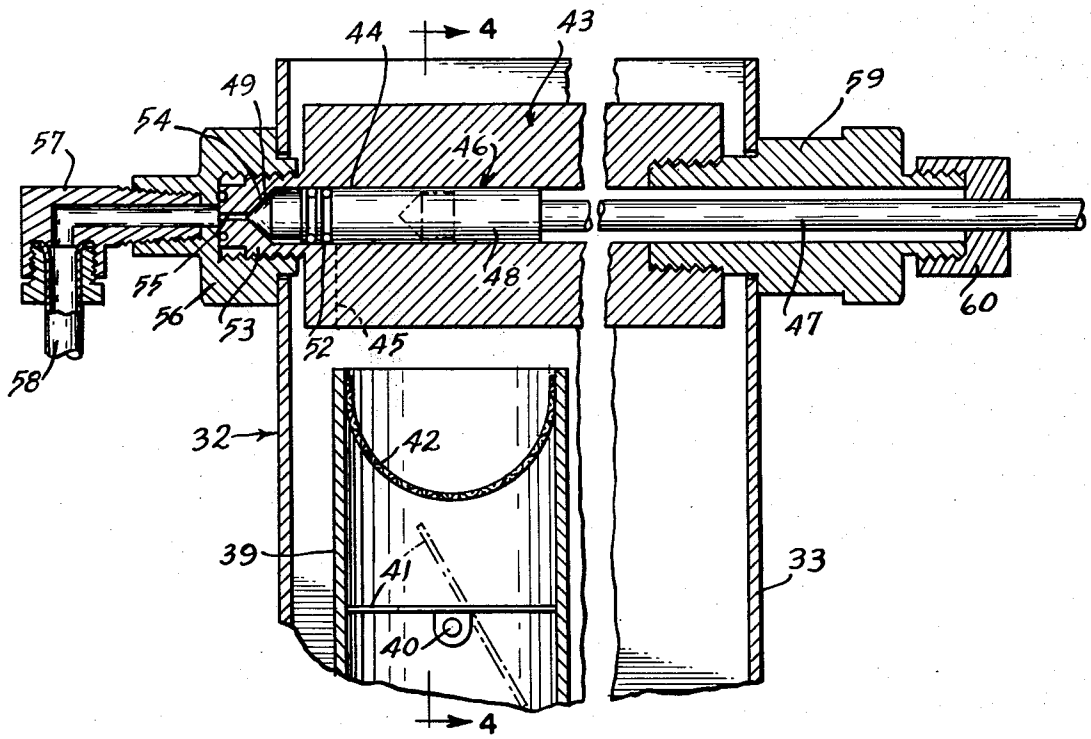
177,876	4/1922	United Kingdom	261/51
1,112,266	3/1956	France	261/51

Primary Examiner—Tim R. Miles
Assistant Examiner—William Cuchlinski, Jr.
Attorney, Agent, or Firm—Sherman Levy

[57] **ABSTRACT**

A fuel injector is provided in an internal combustion engine whereby a mixture of fuel and air can be introduced into the intake manifold of the engine. The device includes a plunger or piston-like member that serves to selectively expose portions of slots through which fuel passes so that the fuel and air can be introduced into the intake manifold with maximum efficiency whereby increased mileage and the like can be accomplished.

2 Claims, 6 Drawing Figures



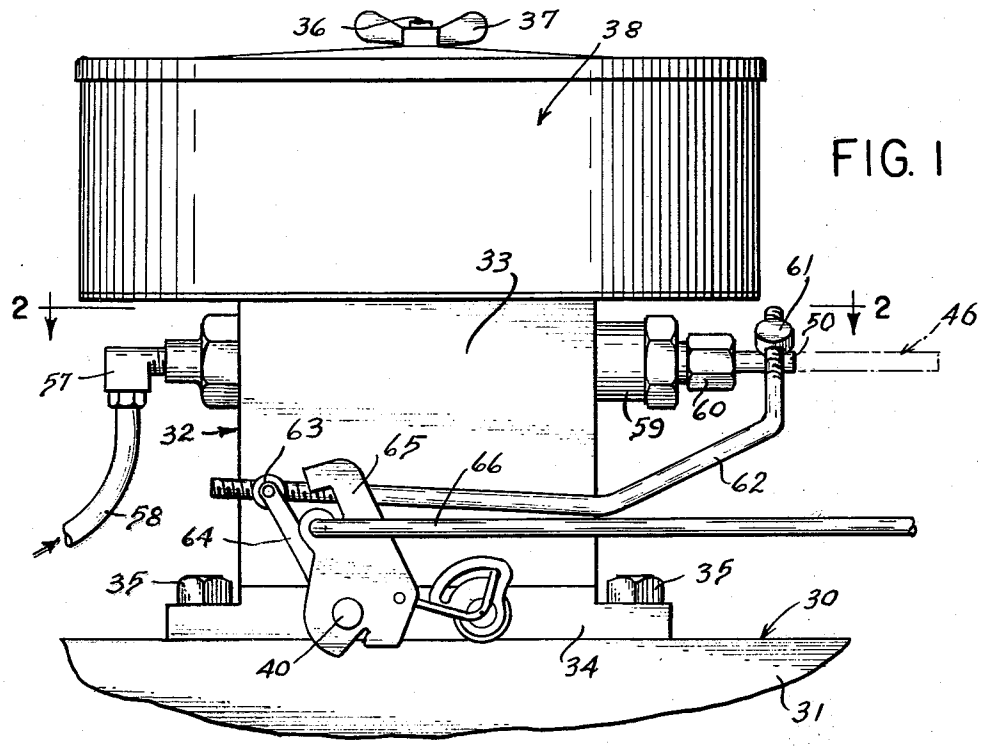

36
37
38
33
61
2
2
50
46
57
32
63
65
66
62
59
60
58
64
35
35
30
40
34
31

FIG. 1

FIG. 2

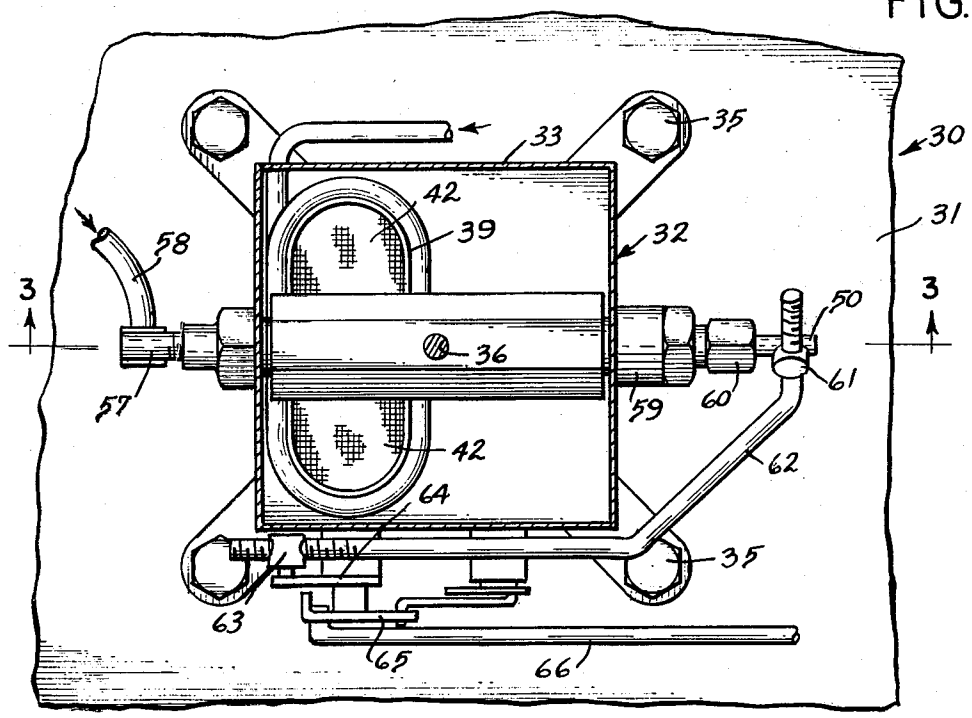
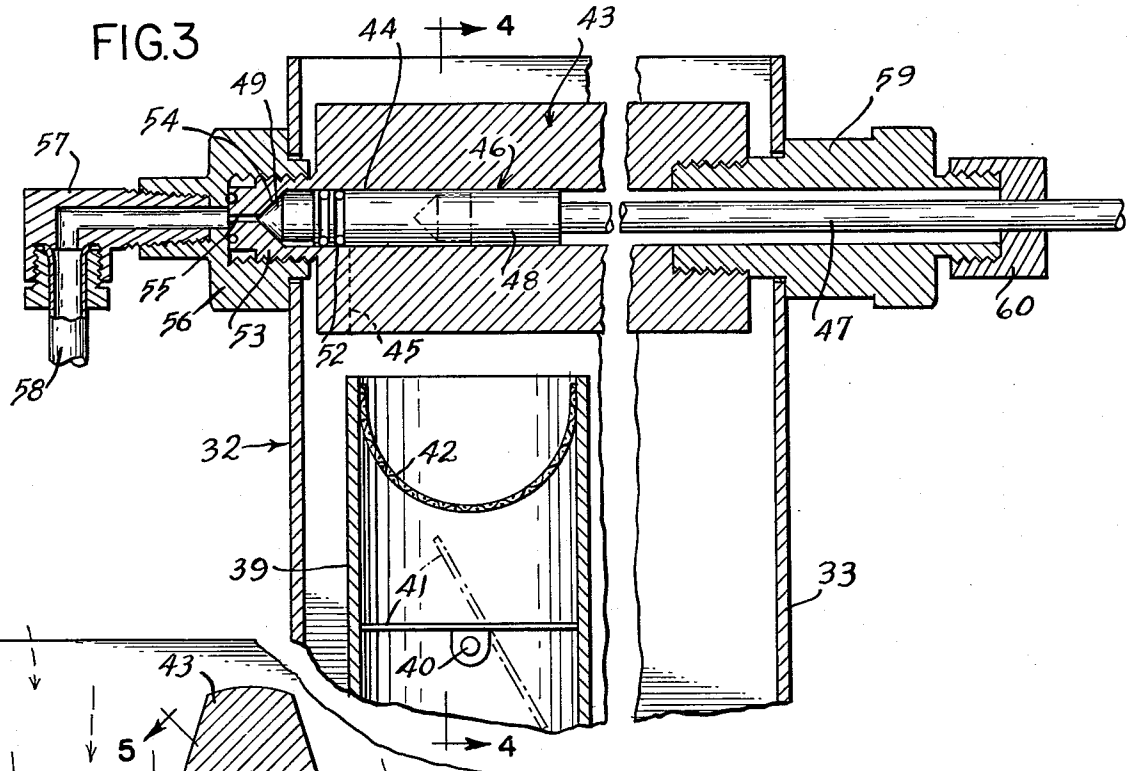

33
35
30
42
39
31
58
32
3
3
50
36
61
57
59
60
42
62
64
35
63
65
66

FIG. 3



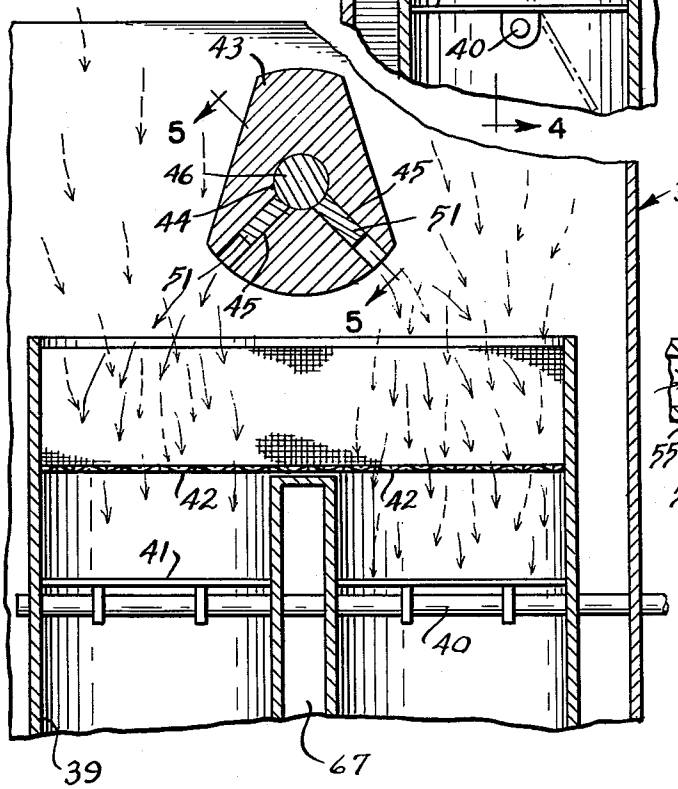
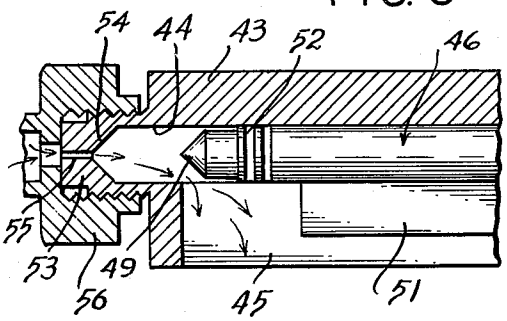


FIG. 4

FIG. 5



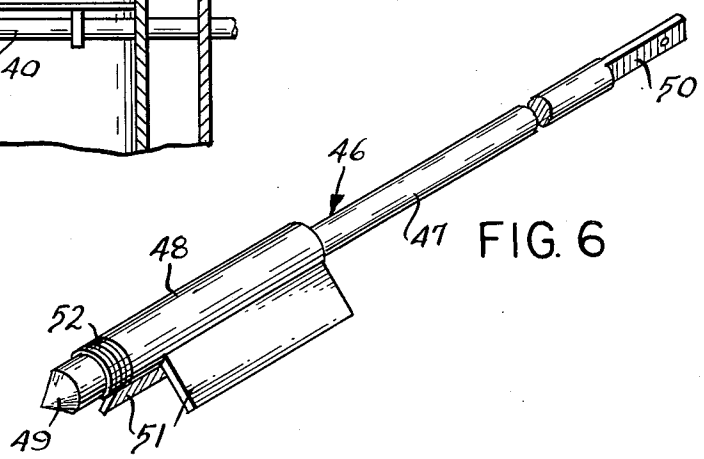


FIG. 6

FUEL INJECTOR

This invention relates to internal combustion engines, and more particularly to a fuel injector that is adapted to take the place of the usual carburetors for such engines.

It is accordingly a principle object of the present invention to provide a fuel injector or fuel control device that includes a movably mounted member that can be extended or retracted to control the amount of fuel entering the intake manifold of the engine, and wherein the fuel is adapted to be atomized or sprayed into the engine in such a manner that maximum efficiency and increased mileage will be assured.

Still another object of the present invention is to provide a fuel injector or fuel control device that provides a more efficeint way of supplying fuel to internal combustion engines than have heretofore been available, and wherein improved mileage will be accomplished, and in addition ecological benefits will be provided because pollutants will not be as likely discharged into the atmosphere from the engine, and wherein the present invention can be used to eliminate the usual carburetor of internal combustion engines.

Still another object of the present invention is to provide a fuel injector that can be adapted to various types of engines such as piston engines, rotary engines, or the like and wherein improved flow will result and wherein all of the cylinders will be fed evenly, the present invention creating a more efficient mixture of air and fuel for the engine, and wherein the device can be provided a new equipment on new vehicles or engines or else it can be used to replace existing carburetors on existing vehicles or engines.

Still another object of the present invention is to provide a fuel injector or control unit that is ruggedly constructed and fool-proof in use and generally simple and inexpensive to manufacture and install.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings, FIG. 1 is a side elevational view showing the fuel injector or fuel control unit of the present invention;

FIG. 2 is a sectional view taken on the line 2-2 of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is a perspective view of the movable needle or piston-like member.

Referring in detail to the drawings, the numeral 30 indicates a portion of a conventional internal combustion engine that includes an intake manifold 31, and the numeral 32 indicates the fuel supply unit or fuel injector of the present invention. As shown in the drawings,

the fuel supply unit 32 includes a hollow housing 33 that has a base portion 34 that is secured as in 35 to the engine 30, FIG. 1. The numeral 36 indicates a rod that has a securing element such as a wing nut 37 thereon whereby the usual air filter 38 can be maintained in place relative to the device.

As shown in the drawings, there is provided barrels 39 that have a shaft 40 extending therethrough, and butterfly valves 41 are movably mounted on the shaft 40, FIG. 3. The numeral 42 indicates arcuate screens that are positioned in the barrels 39 above the valves 41.

Also, as shown in the drawings, the numeral 43 indicates a support member or block that has a cylindrical bore 44 therein. Communicating with the bore 44 is a pair of angularly arranged slots 45, FIG. 4.

The numeral 46 indicates a plunger or piston-like member that includes a stem 47 that has an enlarged cylindrical portion 48 thereon, FIG. 6, and the portion 48 is reciprocably or slidably mounted in the bore 44 of the support member 43. One end of the plunger 46 is tapered to a point as indicated by the numeral 49, and the opposite end of the plunger 46 is adapted to be flattened as at 50. The numeral 51 indicates a pair of angularly arranged flanges or ribs that are secured to or formed integral with the plunger 46, and the flanges 51 are mounted for sliding movement in the slots 45 for a purpose to be later described. The numeral 52 indicates O rings that are provided on an end of the plunger 46 to assure a tight fit between the parts.

The numeral 53 indicates a reduced diameter end portion on the support member 43, FIG. 3, whereby there is provided an externally threaded fitting 53, and the fitting or reduced end portion 53 includes an internal tapered recessed 54 for snuggly receiving therein the tapered end 49 of the plunger 46. There is also provided in the fitting 53 a port or small passageway 55 that communicates with the recess 54. The numeral 56 indicates a bushing that is arranged in threaded engagement with the fitting 53, and a connector 57 serves to connect a fuel supply line 58 to the device whereby fuel can be supplied from a suitable source of supply such as a vehicle gasoline tank to recess 54 through the passageway or port 55. The numeral 59 indicates a bushing that is threadedly connected to the opposite end of the support member 43, FIG. 3, and a retainer 60 may be arranged as shown in the drawings.

The numeral 62 indicates an arm that is connected as at 61 to the end portion 50 of the plunger 46, and the opposite end of the arm 62 is connected as at 63 to a link 64. The link 64 is mounted on the shaft 40, and there is also provided a link or bracket 65 that is connected to the shaft 40, there being a lever or arm 66 for operatively connecting the bracket 65 to the accelerator pedal of the vehicle through the usual linkage.

From the foregoing, it will be seen that there has been provided a fuel supply unit or fuel injector, and in use with the parts arranged as shown in the drawings, the unit 32 of the present invention is adapted to be arranged as shown in the drawings so that the fuel supply line 58 can connect the fuel tank of a member such as a vehicle to the device. The arm 66 can be suitably connected with the accelerator pedal or other element that is moved. Then, with the engine operating, it will be seen that as the operator applied pressure to the pedal, the arm 66 will be moved to pivot the element 65 about an axis extending through the shaft 40 and this will ro-

tate the shaft **40** whereby the link **64** will be turned or pivoted. The arm **62** has its end connected as at **63** to the link **64** so that this movement will result in corresponding movement of the arm **62**, and because the arm **62** is connected as at **61** to the end portion **50** of the plunger **46**, it will be seen that this movement will result in reciprocation or sliding movement of the plunger **46** in the bore **44**.

As the plunger **46** moves outwardly as for example from the solid line position of FIG. **3** to the dotted line position of FIG. **3**, the tapered tip **49** will move away from the recess **49** whereby fuel can enter the device from the line **58**, and through the orifice or passageway **55**. This fuel can then enter the bore **44** as shown by the arrows in FIG. **5** and the fuel can then be sprayed outwardly through the slots **45** as indicated by the arrows in FIGS. **4** and **5** so that the fuel can mix with air and pass through the screens **42**. The screens **42** help atomize or breakup the fuel to the desired particle size.

At the same time that the shaft **40** is being turned by its linkage, the pair of butterfly valves **41** on the shaft **40** will be moved so that, for example, the valves **41** will move from a position such as that shown in solid lines in FIG. **3** to the broken line position whereby the atomized fuel can pass through the barrels **39** and into the intake manifold **31** of the engine **30** whereby the air and fuel mixture will be burned or used by the engine with maximum efficiency.

The parts can be made of any suitable material and in different shapes and sizes as desired or required.

It is to be noted that the harder the user presses on the accelerator pedal, the greater the distance that the lever **66** will be moved. This will cause corresponding movement of the plunger **46** to its connecting linkage. Thus, the greater the amount of pressure or force that is applied to the accelerator pedal or other element being actuated, the greater the distance that the plunger **46** will be retraced away from the recess **49** whereby the size of the exposed slots **45** will be increased so that the amount of fuel that is introduced into the engine will be increased in proportion to the amount of pressure that is applied to the accelerator pedal. It is to be understood that a suitable spring mechanism of conventional construction can be provided for returning the accelerator pedal and associated parts to a closed position whereby the plunger **46** will be urged or biased towards the seat **54** when pressure is released from the accelerator pedal whereby upon release of pressure, the amount of air and fuel introduced into the engine will be decreased.

In FIG. **4** the numeral **67** indicates a separator for the parts such as the barrels **39**.

The rings such as the rings **52** help assure that there will be a gas tight fit between certain of the parts.

In using the device, when a person steps on the gas pedal, the element **62** is moved to pull the plunger **46** outwardly whereby the fuel can enter the orifice **51** and be sprayed down through the slots **45** and then past the screens **42**, and past the open valves **41** into the manifold. At the same time, air can enter the system to mix with the fuel being atomized to supply the engine with the fuel of the proper consistency. The screens **42** help atomize the fuel so that the fuel will be burned more efficiently. When the linkage such as the linkage **62** is actuated, the parts will be moved as previously described, and at the same time the shaft **40** will be turned to open the butterfly valves **41** to let the gas and air enter into the manifold.

The present invention can be used with different types of engines such as two or four barrel carburetor type of engines, and the device is automatically adjustable for the proper openings. The plunger, as it is retracted, releases fuel in the chamber. The present invention provides a more efficient way of supplying fuel to internal combustion engines, and helps assure mileage and also will cause less pollutants or contaminants to be discharged into the air because the amount of fuel that is supplied to the engine will be directly controlled or determined by the movement of the accelerator pedal so that only the proper amount of fuel and air will be introduced whereby the amount of unburned fuel will be minimized. Thus, wasted fuel will be minimized.

The present invention will eliminate the usual engine carburetors as well as eliminating the automatic choke. The device can be used with various types of engines such as rotary or piston engines. The present invention creates better flow of fuel and, for example, when using the device with an eight cylinder engine, all of the eight cylinders will be fed with fuel evenly. Also the device can be used for smaller engines such as four cylinder engines, lawn mower engines and the like and a more efficient mixture of air or oxygen and fuel is provided. The present invention loads the intake manifold and the device can be adapted as a universal member so that, for example, it can be conveniently mounted on existing vehicles by removing the usual carburetor, or it can be provided new equipment on new engines or vehicles. The device utilizes the actuating linkage that is already in vehicles, and the device is characterized by its simplicity and low cost in manufacture and installation and use.

As shown in the drawings, the plunger **46** has the angularly arranged fins or flange portions **51** which are slidably mounted in the slots **45** so that when the needle or plunger **46** is retracted, the slots **45** are exposed so that the gas can spray through the slots **45** to be mixed with air and then drawn down into the intake manifold through the screens **42**. The screens **42** help atomize the liquified or liquid gas. Also, the more pressure that is applied to the accelerator, the more the plunger will be retracted to introduce more fuel into the system.

The actual use, as the fuel passes through the orifice **55**, the fuel is broken up from its liquid form and then it is sprayed out through the slots **45** where it is mixed with air and then the air-fuel mixture passes through the screens **42** where it is atomized even further, and finally the atomized air-fuel mixture passes through the open butterfly valves **41** and into the engine manifold so that the air-fuel mixture can be compressed by the usual mechanism in the engine to be subsequently fired in the most advantageous manner. Also, the more fuel that is needed will be supplied by applying increased pressure to the accelerator pedal so that the amount of fuel that is supplied will be automatically taken care of in the most advantageous manner.

Also, with the present invention, the engine does not have to be modified, and the device will provide the exact or proper mixture of air and fuel to assure that the efficient fuel use is provided. Furthermore, the screens **42** are such that some of the fuel can form a film on the screens whereby instead of just having a steady stream of fuel as in a carburetor, the air-fuel and the like will provide the films on the screens to be sub-

sequently discharged in the proper quantity into the intake manifold. The device will assure that the engine idles with maximum efficiency and will also permit more efficient use of gasoline or other fuel.

The fine spray of fuel hits the screens **42** and distributes itself about the screens to provide a film. The present invention distributes the fuel properly while the engine is idling or not idling. Also, when using carburetors, the carbon often develops and such disadvantages are eliminated with the present invention. Furthermore, heat burns are minimized, and also spark plugs and the like will last longer, and in general the engine will function or operate with increased efficiency. Also the engine will operate smoothly and with increased precision. The device can be used on racing vehicles or other members, and the device will also improve operation even in cold weather, and as previously noted the engine only uses as much fuel as is actually required, and this is to be contrasted with a conventional carburetor that wastes fuel. As shown in FIG. **4**, the fuel being discharged from the slots **45** has a tendency to have a swirling motion due to the inclined slots **45**, so that the fuel will be forced out as a spray instead of letting fuel drip out, which would be the case if there were no angles or inclined slots **45**. Furthermore, maintenance problems of engines will be greatly simplified or minimized and other disadvantages associated with conventional carburetors will be minimized or prevented.

While a preferred embodiment in accordance with the present invention has been illustrated and described, it is understood that various modifications may be resorted to without departing from the spirit and scope of the appended claims.

I claim:

1. Apparatus for injecting a selected quantity of fuel into the air supply of an internal combustion engine to form a combustible mixture comprising a housing, a support member carried by said housing and having an axial bore extending substantially therethrough, one end of said support member having a fuel inlet port communicating with said bore, fuel supply means for supplying fuel to said inlet port, said support member having at least one elongated slot extending radially from said bore to the exterior thereof, a plunger slidably mounted for axial movement within said bore, a fin fixed to said plunger and slidably received within said slot, said fin completely closing the end of said slot adjacent to said inlet port when said plunger is positioned at said one end of said support member, and means for selectively moving said plunger axially of said bore so that fuel only is discharged from said inlet port and through a portion of said bore and said slot into the air flow, whereby the air supply for said engine flows through said housing and around said support member and movement of said plunger varies the quantity of fuel entrained in the air flow.

2. The structure of claim **1** including at least one intake barrel mounted within said housing adjacent to said support member, screen means mounted within said barrel for atomizing the fuel entrained in the air, and valve means operatively mounted in said barrel for regulating the flow of air and fuel to the internal combustion engine.

* * * * *