# United States Patent

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[54] **CARBURETION**
7 Claims, 5 Drawing Figs.

[52] U.S. Cl. 261/41, 261/51, 261/121, 261/62
[51] Int. Cl. F02m 7/04
[50] Field of Search 261/53, 62, 41.4, 51, 47, 121.2

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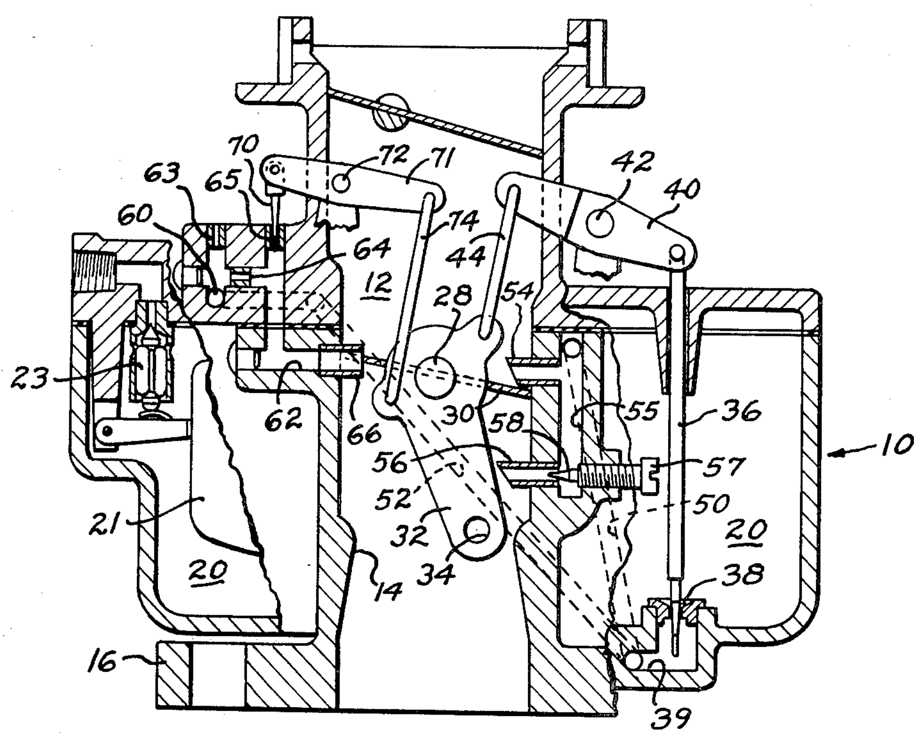
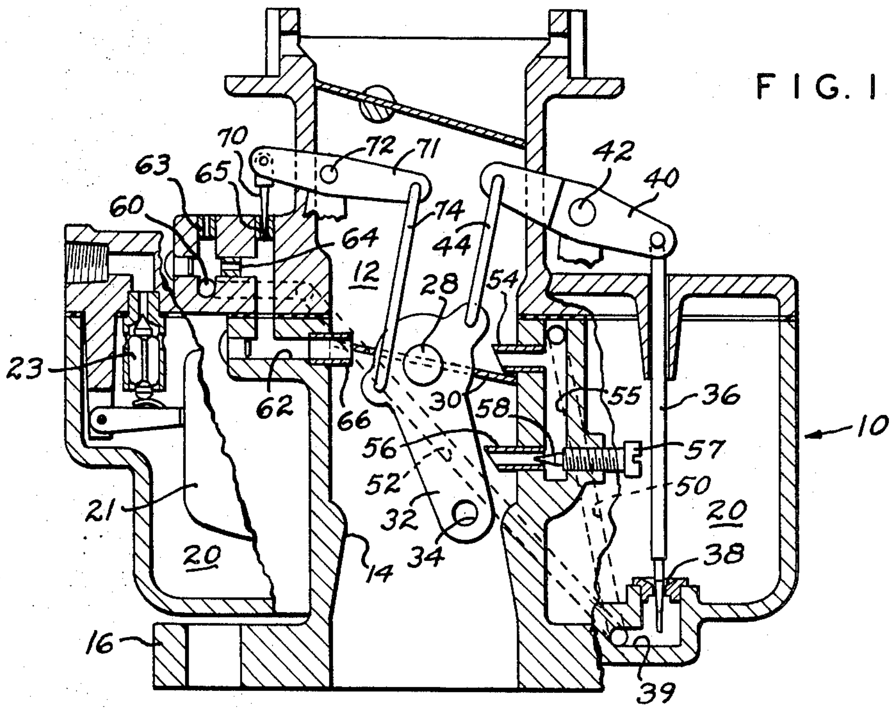
ABSTRACT: A carburetor having a constant level fuel supply and a mixing conduit has a throttle valve mounted above the fuel level. Two fuel supply circuits are provided. A first fuel circuit discharges through a nozzle located adjacent the high edge of the throttle valve and a second fuel circuit discharges fuel at a point located above the low edge of the throttle valve. The high and low edges referring to the position of the throttle when in curb idle position.





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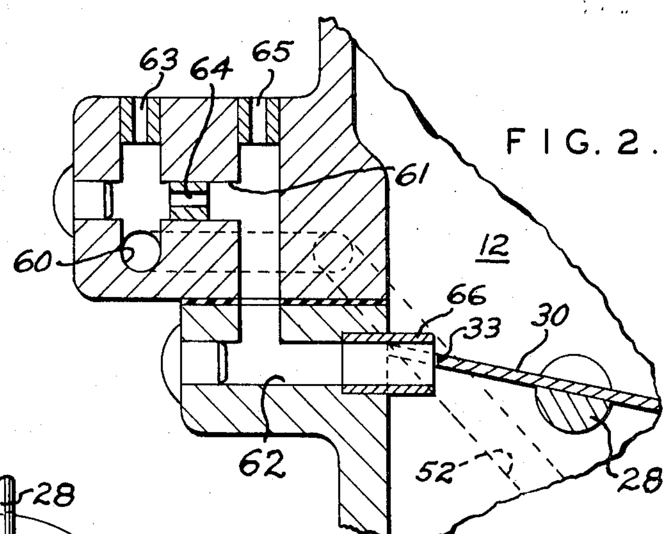

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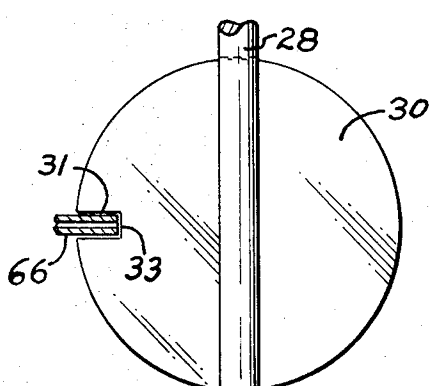

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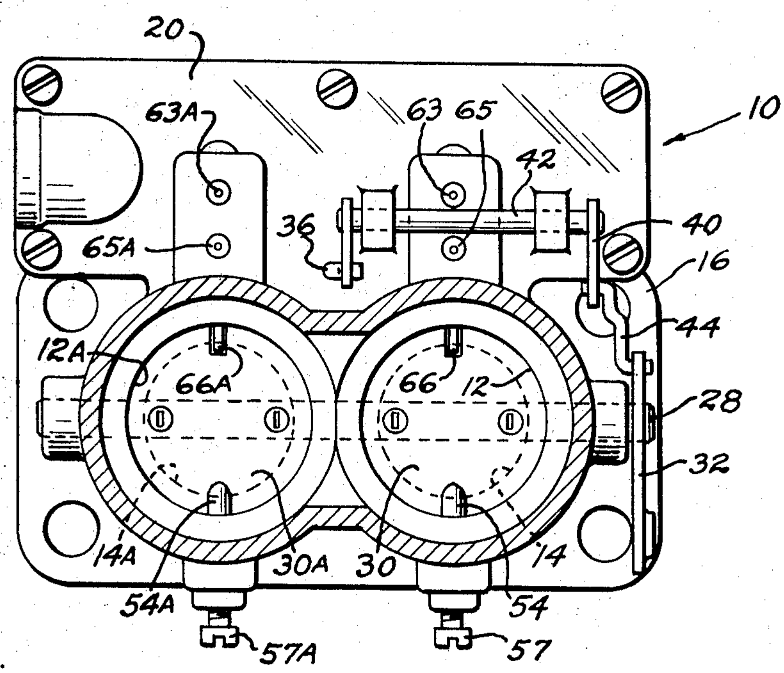

FIG. 4.

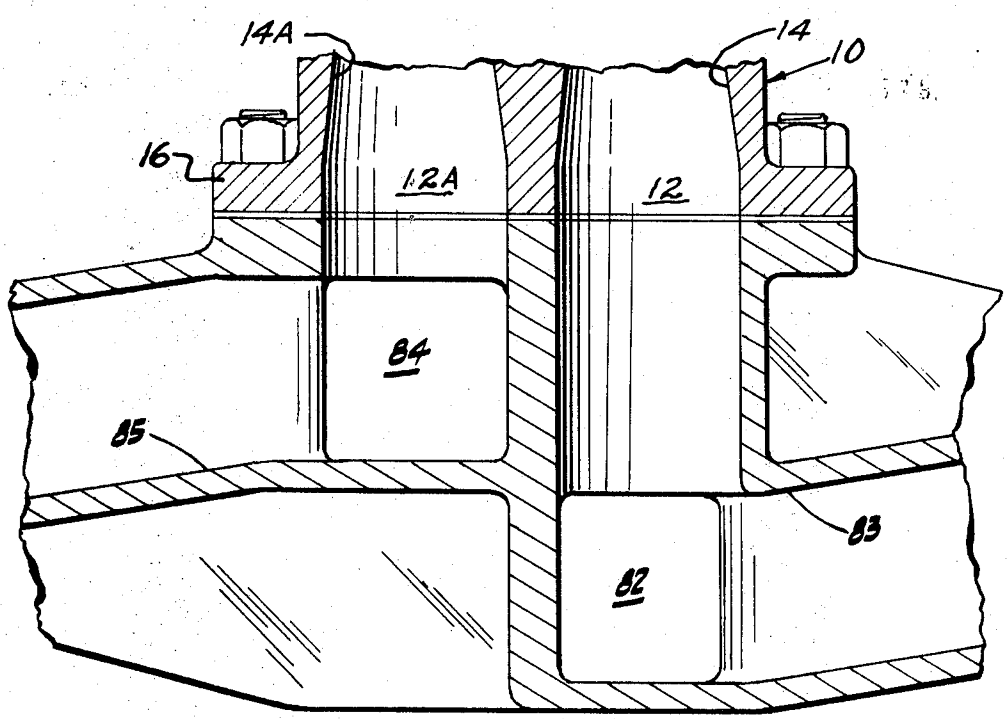

FIG. 5.

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CARBURETION

BACKGROUND OF THE INVENTION

For many years carburetors used on automotive internal combustion engines ran somewhere near stoichiometric mixture ratios or richer than stoichiometric. As used herein stoichiometric ratio is that ratio of fuel and air delivered to a combustion space in such proportions as to result in complete combustion of both fuel and air. Where more fuel is supplied than there is air for combustion, the mixture is said to be rich. If less fuel is supplied than is necessary, the mixture is said to be lean. Although combustion can be initiated in the combustion chamber of any cylinder in an internal combustion engine when the ratio is lean, there are limits beyond which combustion will be erratic or where it will not occur at all. Erratic combustion or complete failure of combustion is to be avoided because such results in an increase of noxious gases discharged to the atmosphere by way of the exhaust system of the engine. Recent legislation has required a reduction in the discharge of such noxious gases and all present day fuel induction systems are being designed with this end in view.

Much can be and has been done to improve the combustion chamber itself, the intake manifold as well as the carburetor. Even so present day carburetors have certain deficiencies which result in undesirable operation during at least a part of the range for which the carburetor was designed. Present day carburetors utilize a butterfly-type throttle valve. If more fuel is discharged on one side of this valve than on the other side there can be, and usually is, an inefficient mixing of air and fuel below the throttle valve. Moreover the throttle valve is normally located immediately above the mounting flange of the intake manifold so that there is minimum time and space available for correcting any unfavorable mixing of air and fuel.

In conventional carburetors the idle fuel system is a particularly troublesome area. Usually in such a system fuel is supplied through an elongated port in the wall of the mixing conduit as well as by an idle fuel adjusting port located below the elongated port and also in the wall of the mixing conduit. Under many conditions of curb idle and part throttle operation, fuel is discharged from this portion of the system with insufficient velocity to project it out into the airstream with the result that some of the fuel merely trickles down the side of the mixing conduit. Such trickling of fuel, of course, cannot result in good vaporization and/or atomization of the fuel.

When the throttle is opened more widely the main fuel system will begin to discharge fuel and this normally is into the center of the mixing conduit at a point above the throttle valve. At part throttle operation, even though fuel is discharged in the center of the conduit, there may yet result an unequal flow of air about the butterfly-type throttle plate so that again there is not produced below the throttle a completely homogeneous mixture of air and fuel.

From the foregoing it is apparent that the carburetor utilizing a fuel system calculated to promote better mixing of fuel and air will be advantageous.

DESCRIPTION OF THE INVENTION

The carburetor herein disclosed utilizes a butterfly-type throttle valve that is removed a substantial distance from the mounting flange. In fact the throttle valve conveniently is located above the fuel level in the fuel bowl. Two fuel supply circuits are provided each of which coacts with one of the moving edges of the throttle valve. A first of these fuel supply circuits is provided with a fuel nozzle which is in part obstructed by an edge of the throttle plate. The second of the fuel supply circuits utilizes a fuel nozzle located immediately above the upper surface of the low side of the throttle plate. Additionally the second fuel circuit is provided with a second nozzle which by means of a metering screw provides the adjustment required for setting the fuel requirements of the carburetor at normal curb idle conditions. Additionally the carburetor is provided with a fuel metering rod which is controlled by throttle position and which in turn meters all of the fuel supplied to both of the fuel circuits. A further fuel metering means controlled by throttle position is provided in the first fuel circuit to enable it to continue to deliver fuel over a greater range of throttle opening. Desirably the fuel nozzles of both fuel circuits will discharge fuel inside the mixing conduit at points removed from the wall of the conduit. To promote even better mixing of the air and fuel there is provided a venturi restriction at a point between the throttle valve and the mounting flange of the carburetor.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of a preferred embodiment of the carburetor.

FIG. **2** is a detail view of a fuel nozzle.

FIG. **3** is a plan view of a portion of FIG. **2**.

FIG. **4** is a plan view of a two-barrel carburetor and,

FIG. **5** is a partial section showing the mounting of a two-barrel carburetor on an intake manifold.

DETAILED DESCRIPTION

A carburetor is indicated generally at **10** in FIG. **1**. Carburetor **10** comprises a mixture conduit **12** which may be equipped with a venturi section **14** below the throttle and above the usual mounting flange **16**. Flange **16** is used for bolting the carburetor to an intake manifold in the customary fashion. The carburetor is also provided with a fuel bowl **20** equipped with customary float **21** and a needle valve **23** for controlling the admittance of fuel to the fuel bowl. The float **21** and needle valve **23** insure that there is always maintained a constant level of fuel in the bowl **20**.

A rotatable throttle shaft **28** is located in mixture conduit **12** above the level of fuel in bowl **20**. Mounted on shaft **28** is a throttle valve **30**. Shaft **28** is also provided with a lever arm **32** which is provided with an eye **34** for connection to a throttle control rod which in turn is connected to the usual foot pedal of an automobile.

A mechanically actuated metering rod **36** is suspended in the fuel bowl. Rod **36** is provided at its lower extremity with sections of varying diameter for metering fuel flow through a metering jet **38**. Rod **36** in metering jet **38** controls the flow of fuel into passage **39**. Rod **36** moves in response to movement of the throttle and as shown accomplishes movement by way of connection to rocker arm **40** which is pivoted at **42**. One end of arm **40** connects to throttle lever **32** by way of link **44**. As lever **32** rotates in a clockwise direction the link **44** is pulled down and the rocker arm **40** pivots to raise the metering rod **36**. As rod **36** moves in an upward direction a smaller diameter of the rod is placed in jet **38** thereby allowing additional fuel to flow into passage **39**.

At one end thereof, fuel passage **39** branches into two separate passages **50** and **52**. Passage **50** terminates in a fuel nozzle **54** located inside the mixture conduit immediately above throttle plate **30**. Depending from a horizontal portion of passage **50** is another passage **55** which terminates in a nozzle **56** which also extends a short distance into the mixture passage **12**. An adjustment screw **57** having a tapered end **58** coacts with the inner end of the nozzle **56** to regulate flow therethrough.

Branch fuel passage **52** extends to the opposite side of the carburetor and connects with a vertical passage **60** which in turn communicates with a horizontal passage **61** and fuel well **62**. Passage **61** is provided with an air bleed **63** an economizer **64** and a second air bleed **65**. A nozzle **66** is pressed into the wall of the conduit to communicate well **62** with the interior of the mixture conduit.

Either one of air bleeds **63**, **65** can be provided with air metering means. As shown the metering of air is done at bleed **65**. A metering valve **70** is connected to a rocker arm **71** which is pivoted at **72**. An opposite end of arm **71** is connected by way of link **74** to throttle lever **32** in such a manner that as the throttle valve is opened the metering head **70** progressively closes off the bleed **65**.

As shown in FIGS. **2** and **3** nozzle **66** is rectangular in shape and fits into a slot **31** of the throttle valve **30** when the throttle is in the closed or curb idle position. The inner end **33** of slot **31** coacts with the outer end of nozzle **66** in much the same fashion as the edge of the throttle plate coacts with the idle fuel port in conventional carburetors.

The carburetor as just described is adequate for all normal running conditions of the carburetor including the range from curb idle to wide open throttle. No provision has been made in the carburetor as shown for compensating for transient or temporary conditions. It will be appreciated that such things as an accelerating pump and cold starting and warmup enrichment means can be added to adjust fuel delivery for transient and temporary changes. In this connection it may be mentioned that control of the metering rod may be further enhanced by provision for further movement of the rod in response to engine manifold vacuum. Such control of a metering rod is taught in Edelen 2,329,748 dated Sept. 21, 1943. Such control of the metering rod allows for maximum flow of fuel whenever manifold vacuum drops below a predetermined amount such as might occur at a part throttle condition with the engine heavily loaded.

OPERATION

Assuming the engine running and at curb idle, there will be a quantity of air flowing through the carburetor sufficient to operate an engine at that condition. The throttle plate **30** is substantially closed and some air will be passing by the throttle plate. At this time air will enter the upper portion of nozzle **66** sweep past the edge **33** of the throttle plate picking up some fuel and discharging a mixture of fuel and air below the throttle plate. On the opposite side of the mixing conduit air entering nozzle **54** picks up some fuel from passage **50** and mixes with the fuel in passage **55** to be discharged through nozzle **56**. Final adjustment of idle fuel requirements is made by the adjusting screw **57**. Under these conditions it is seen that the required fuel is delivered not only from both sides of the mixing conduit but at points away from the conduit walls so that the air sweeping by the throttle plate picks up the fuel and thoroughly mixes with it to produce a homogeneous mixture. The venturi **14** below the nozzles further enhances the mixing of the air and fuel.

As the throttle valve moves away from curb idle position, nozzle **66** is opened more fully and as soon as the throttle plate is above the nozzle, nozzle **66** is then exposed to manifold vacuum and a greater flow of fuel from that nozzle results. Shortly after the throttle plate clears the nozzle **66**, fuel begins to flow from nozzle **54**. This is so because air sweeping by nozzle **54** creates a negative pressure at the end of the nozzle and this negative pressure is enough to start fuel flow. At this time fuel will be flowing from nozzle **66**, nozzle **54** and nozzle **56** but as before all fuel is discharged at points removed from the wall of the conduit whereby most efficient mixing of fuel and air results.

As the throttle opens more widely and with fuel being delivered from all three of the nozzles as described, the mechanical connection of the metering rod to the throttle lever withdraws metering rod **36** from the jet **38** to position a diameter of the end of rod **36** in the jet such that the correct quantity of fuel will flow into passage **39**. Of course, at wide open throttle the smallest diameter of the rod **36** is in the jet. The fuel in passage **39** is still distributed to all three of the nozzles **54**, **56** and **66**.

Once throttle **30** has cleared the nozzle **66**, fuel flow normally would be expected to decrease from that nozzle. However, this is not so because valve **70** in response to throttle movement begins to close off the idle bleed **65**. Shutting off the flow of air at bleed **65** has the effect of enrichening the mixture in the cavity **62** which results in more fuel flowing from the nozzle **66**. In other words, valve member **70** and the bleed **65** constitute a metering arrangement for the fuel system which delivers fuel to nozzle **66**. It would be possible to achieve this metering in other manners as for example use of a variable orifice at the economizer **64**, use of a valve similar to **70** at air bleed **63**. Or even a metering rod installed in the passage **60**.

The carburetor just described has many advantages over prior art conventional carburetors. Placement of the fuel nozzles away from the conduit wall insures that there will be intimate mixing of air and fuel as the air sweeps by the throttle plate. Moreover in the part throttle ranges the quantities of air and fuel flowing on each side of the throttle plate are more nearly equal than has been possible heretofore. This is especially important when considering exhaust emissions because most driving in the large metropolitan areas where smog is a problem is restricted to speeds below 50 m.p.h. Of course a speed of 50 m.p.h. is only a part throttle range for the carburetor. It is also to be mentioned that the mixing and hence ultimate distribution to the individual cylinders is further enhanced by the venturi section **14** which is located well below the throttle plate and below the nozzles.

The carburetor as just described can also be fabricated into a two- or even a four-barrel carburetor. A two-barrel version is shown in plan view in FIG. **4** where identical barrels of a two-barrel carburetor are mounted side-by-side. The numerals applied to the carburetor are the same as the numerals applied in FIG. **1** excepting that the numerals for one side of the carburetor bear the superscript A.

FIG. **5** shows a portion of an intake manifold such as is commonly used with V–8 engines. Mixing conduit **12** of the two-barrel carburetor discharges the mixture of air and fuel into a plenum **82** from whence a branch passage **83** conducts the mixture to the respective cylinders. In similar manner mixing conduit **12A** discharges into a plenum **84** which conducts the mixture to the various cylinders by way of branch passage **85**. It is common practice with V–8 engines to separate the respective mixing chambers so that one bank of cylinders will be served by one of the mixing conduits and the other bank of cylinders will be served by the other mixing conduit. In some instances the intake manifolds are arranged so that the plenum of one portion of the intake manifold will serve two cylinders on one side of the engine and two additional cylinders on the other side of the engine. However, this is a matter of choice with the individual engine designer and either system can be used.

It will be appreciated that various modifications can be made to the carburetor described above without departing from the full intent and scope of the invention which is defined in the appended claims.

We claim:

1. A downdraft carburetor comprising a bore including a mixing chamber, a constant level fuel supply, and a butterfly-type throttle valve the improvement characterized in that;

a. The throttle valve is positioned near the level of fuel in the said constant level fuel supply thereby leaving an elongated mixing zone below the throttle valve,

b. the said throttle valve having a high side and a low side.

c. a first fuel circuit for supplying fuel adjacent the high side of the throttle valve,

d. a second fuel circuit for supplying fuel in the vicinity of the low side of said throttle valve, and

3. at least one air bleed for the said first fuel circuit and further including fuel enrichment means in said air bleed, said fuel enrichment means comprising a tapered metering element and being connected by bellcrank and connecting rod means to said throttle for movement therewith.

2. The carburetor of claim **1** including a restricted zone comprising a venturi located below the said throttle.

3. The carburetor of claim **1** including a nozzle for the said first fuel circuit, the said nozzle projecting a short distance into the said mixing chamber for a progressive coaction with the said high side of the said throttle whereby fuel delivery increases as said throttle opens.

4. The carburetor of claim 3 including a slot in the said high side of said throttle, said slot partially surrounding said nozzle.

5. The carburetor of claim 1 including upper and lower fuel discharge tubes for said second fuel circuit, the said upper tube positioned above the low side of said throttle and the said lower tube positioned below the said throttle and both of said tubes discharging fuel away from the wall of said bore.

6. The carburetor of claim 5 including idle fuel adjustment means cooperable with said lower tube.

7. The carburetor of claim 1 in which the said first and second fuel circuits are branch passages from a main fuel supply well and the said well is provided with an entrance having a throttle position controlled metering rod.