June 20, 1967 J. R. PHIPPS 3,326,539

CARBURETOR

Original Filed Jan. 10, 1964 4 Sheets-Sheet 1

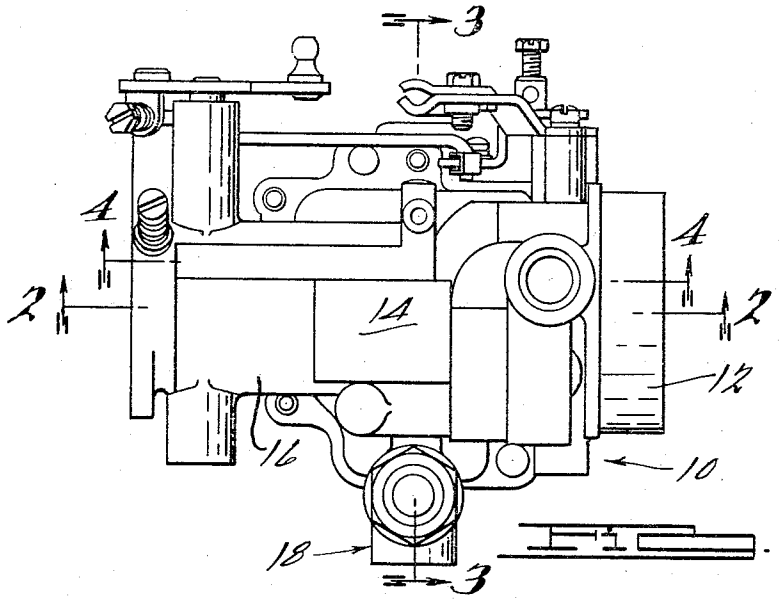


FIG. 1.

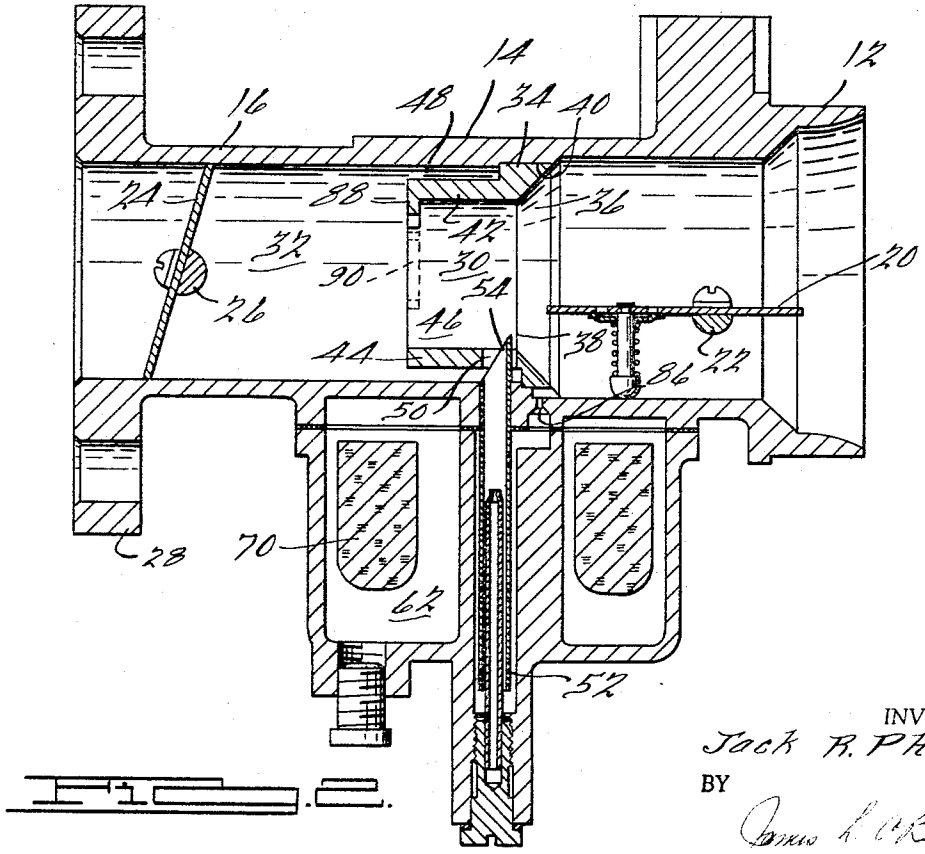


FIG. 2.

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FIG. 3.

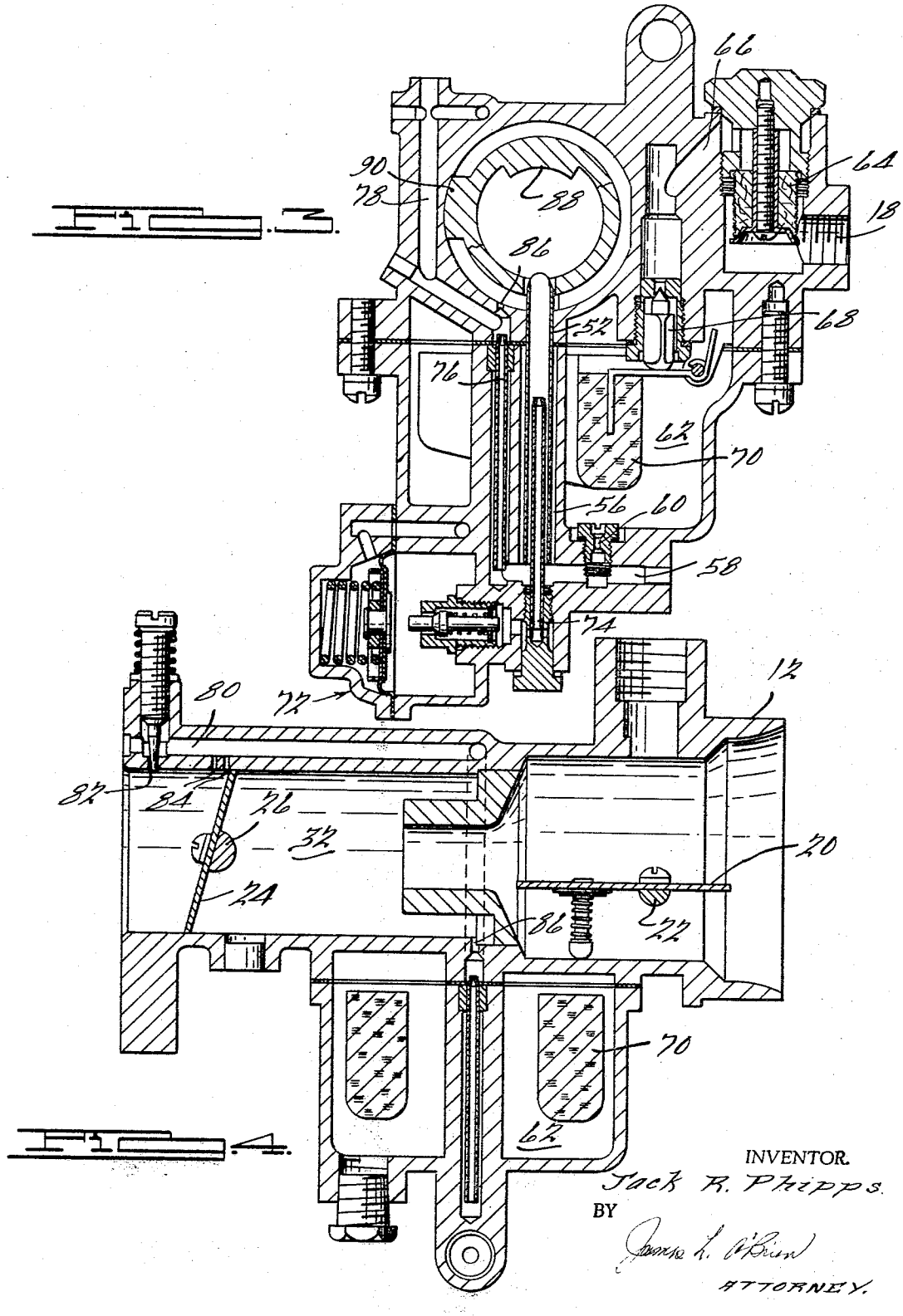


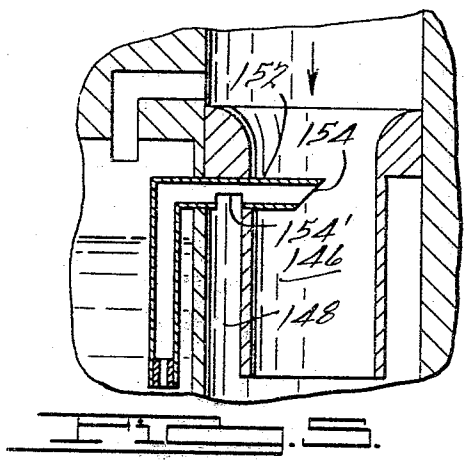
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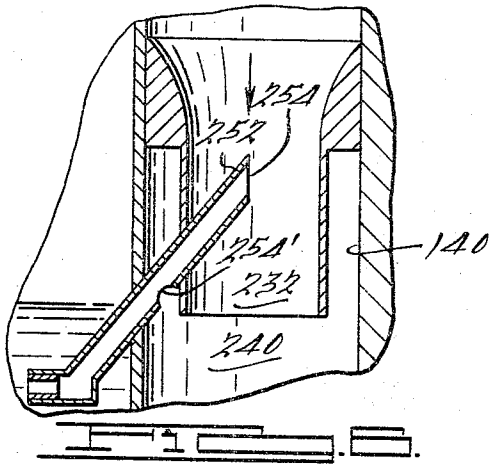
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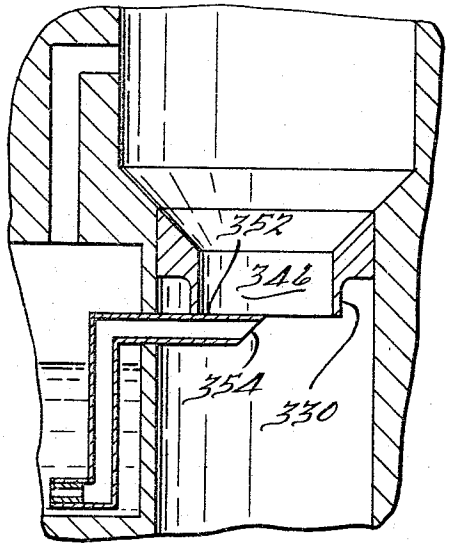
CARBURETOR

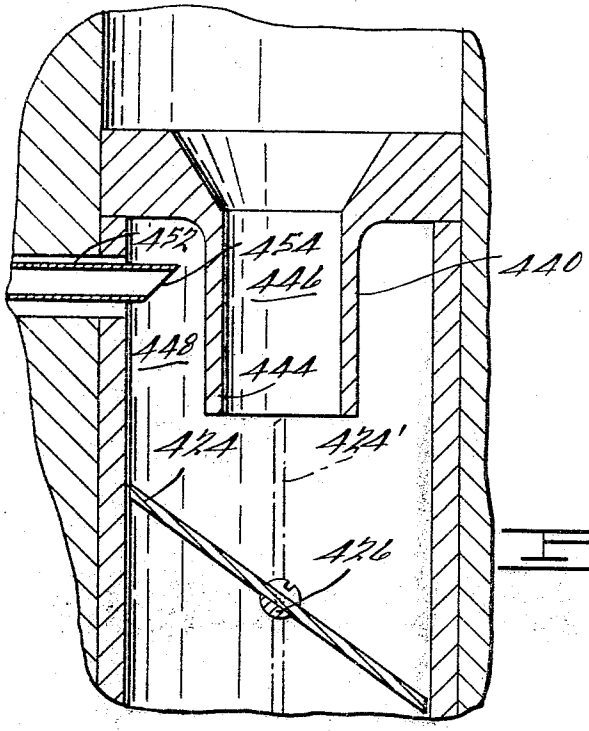
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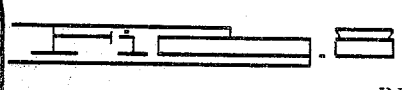










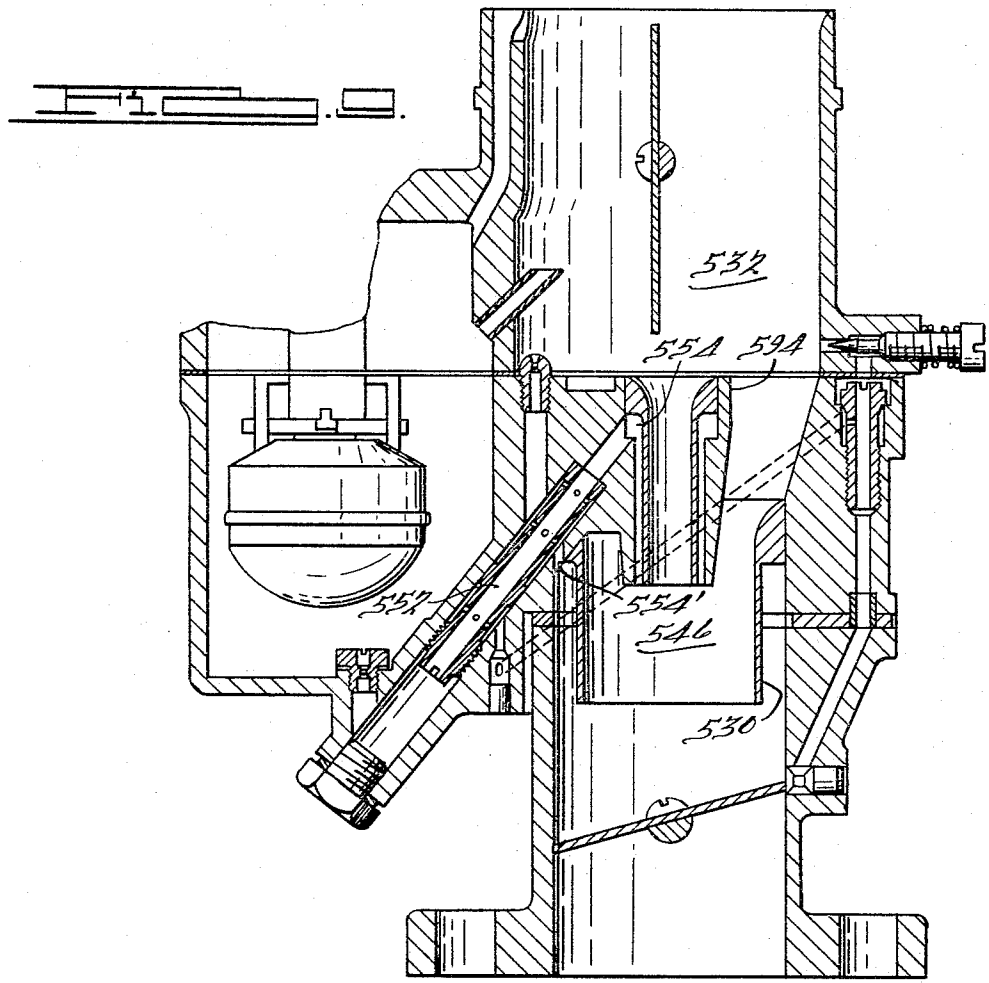


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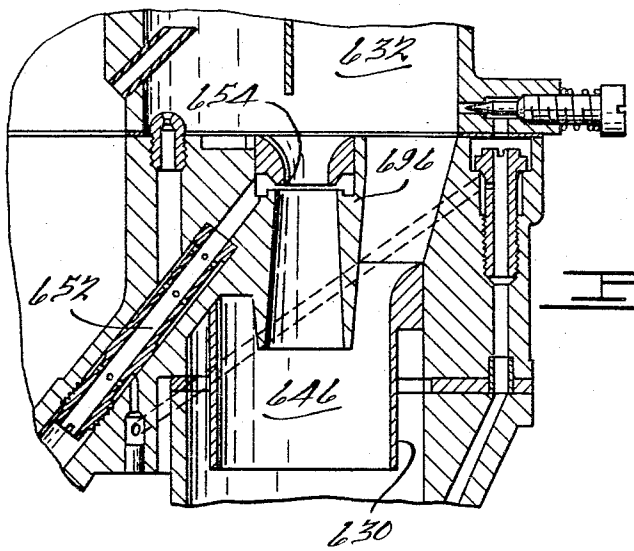


FIG. 10

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United States Patent Office 3,326,539
Patented June 20, 1967

3,326,539

CARBURETOR

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Continuation of application Ser. No. 337,092, Jan. 10, 1964. This application Aug. 24, 1966, Ser. No. 578,957
1 Claim. (Cl. 261—41)

ABSTRACT OF THE DISCLOSURE

A carburetor having an induction passage with a flow nozzle therein having a discharge portion of substantially constant cross-sectional flow area and a butterfly type throttle mounted downstream of said nozzle in a manner such that when fully opened said throttle creates a decrease in pressure in said nozzle without substantially decreasing the flow area of said nozzle.

This is a continuation of application Serial No. 337,092, filed January 10, 1964, now abandoned.

This invention relates generally to carburetors for internal combustion engines and more particularly to improvements in air flow metering means for such carburetors.

A venturi is normally used in conventional carburetors to meter air flow. Theoretically a venturi provides the lowest pressure loss of the head type fluid meters and should therefore be best suited for use on internal combustion engines. However, in practice a number of difficulties are experienced with venturis. In some engines pulsations are created in the induction passage which render the venturi unsatisfactory as an air flow meter. The venturi also has a relatively narrow zone of lowest pressure into which the fuel discharges. The size and location of this zone make the location of the discharge rather critical in order to obtain satisfactorily uniform performance from mass produced carburetors. In carburetors used on present day engines, space requirements are such as to prevent the use of a classically designed venturi and modified shorter venturi forms are actually used. The theoretical advantage of the venturi is not only degraded by the change in shape from the classical design, but it also degraded in practice by the effect of adding fuel to the air stream. This is true in liquid gasoline carburetors and is even more pronounced in LPG (liquified petroleum gas) carburetors which a much larger volume of fuel is introduced into the air stream.

I have found that a flow nozzle may be used in a carburetor in place of a venturi with many attendant advantages and few, if any, penalties. The flow nozzle has a curved entrance to lead the fluid to throat portion and from thence through a straight cylinder having essentially the same diameter as the throat. The flow nozzle differs from the venturi in not having a long tapered diffuser on the outlet side. The use of the air nozzle in an induction passage subject to pressure pulsations has given surprisingly good results. On one engine, for example, an increase in power output of more than 5%, and a decrease in specific fuel consumption of more than 3%, was obtained by changing from a venturi to an air flow nozzle of the same diameter in the same model carburetor. The use of the air nozzle has reduced criticality in design and manufacture thereby enhancing the uniformity of characteristics among mass produced carburetors. Additionally, it has been noted that the air nozzle of the present invention provides better distribution, mixing and evaporation of the fuel than a comparable carburetor equipped with a venturi. Also, it has been found that by properly locating the throttle with respect to the air nozzle, and by properly selecting the regions of the carburetor into which fuel is discharged, a richer fuel-air mixture ratio may be obtained at wide open throttle than at part throttle operation. Such power enrichment is, of course, required by many engines and is usually supplied by supplementary power enrichment apparatus in the carburetor.

It is an object of the present invention to provide, in a carburetor, an air flow meter which has improved fuel distribution and mixing characteristics and which is relatively unaffected by pressure pulsations in the induction passage.

It is a further object of this invention to provide a carburetor construction which may be readily reproduced to provide substantially uniform performance at relatively low cost.

It is another object of the invention to provide a carburetor construction in which the fuel-air ratio may readily be increased during high power operation.

These and other objects and advantages of the invention will become readily apparent from the following detailed description taken in connection with the appended drawings, in which:

FIGURE 1 is a top view of a horizontal carburetor embodying the present invention,

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1,

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1,

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 1,

FIGURES 5, 6 and 7 are fragmentary schematic views showing modifications of the fuel discharge tube,

FIGURE 8 is a schematic view showing a modification of the fuel discharge tube and also the location of the throttle with respect to the air nozzle to provide for power enrichment operation,

FIGURE 9 is a schematic view of a modification using a secondary air nozzle, and

FIGURE 10 is a schematic view of a modification utilizing a secondary venturi.

Referring now to the drawings and more particularly to FIGURE 1, numeral **10** designates a carburetor having an air horn section **12**, a mixing section **14** and a throttle body section **16** and a fuel inlet **18** which is supplied with fuel from a suitable supply (not shown).

As shown in FIGURE 2, a choke valve **20** is mounted on a choke shaft **22** in air horn section **12** and a throttle valve **24** is mounted on a throttle shaft **26** in section **16**. Section **16** is provided with a flange **28** which is adapted for a connection with an engine (not shown). An air nozzle **30** is mounted in induction passage **32** and is provided with an inlet or entrance section **34** having curved converging walls **36** leading to a throat indicated at **38**. The exterior of entrance **34** is mounted in sealing engagement with the walls **40** of induction passage **32** whereby the entire flow through induction passage **32** is received by the entrance section **34** of air nozzle **30**. A discharge section **42** extends from the entrance section **34** of nozzle **30** and is provided with substantially cylindrical walls or skirt **44** which define a substantially constant cross sectional flow path **46** through the discharge section. The skirt **44** is spaced substantially equidistantly over its length from the walls **40** of the induction passage **32** to thereby define an annulus **48** between the skirt and passage. Skirt **44** is provided with a port **50** into which a fuel discharge tube or jet **52** projects. At its discharge end, the fuel discharge tube **52** is provided with an oblique orifice **54** which opens or faces downstream and which overlaps port **50** such that a portion of the fuel discharged from the tube **52** enters the flow path **46** and another part enters the annulus **48**.

As best seen in FIGURE 3, fuel discharge tube **52** extends into a fuel well **56** which is connected by means

of conduit **58** and main metering restriction **60**, with a fuel bowl or source of fuel **62**. Fuel is supplied to float bowl **62** from the inlet **18** via filter **64**, conduit **66** and float needle **68** which is controlled by float mechanism **70**. A combination accelerating pump and power enrichment mechanism is designated generally at **72** and provides for the discharge of fuel through tube **74** which is concentric with main fuel discharge tube **52**. In some installations the mechanism **72** may be eliminated as not being required in view of the improvements resulting from the use of the present invention. Fuel for idling is discharged from float bowl **62** via metering restriction **60**, conduit **58**, idle tube **76**, conduits **78** and **80** to ports **82** and **84**. An idle air bleed is provided at **86**.

As best seen in FIGURES 2 and 3, baffles **88** and **90** may be jointly or severally provided, as desired to readily control the direction and distribution of the fuel mixture discharge. A baffle such as **88** provided on the inside diameter of the flow path **46** creates an additional suction at its location and tends to draw an increased discharge in the direction of the baffle. The size, circumferential extent and location are determined empirically for each engine requirement. A baffle such as is shown at **90** between skirt **44** and the walls **40** of the induction passage closes off the discharge from the annulus and, therefore, causes a reduced flow at the location of the baffle. The size, location and circumferential extent of the baffle **90** is also empirically determined.

When air flows through induction passage **32**, a depression is created in annulus **48** and fuel discharged from orifice **54** into annulus **48** is caused to move or flow around the annulus such that fuel-air mixture is discharged from substantially the entire circumference of annulus **48** into the induction passage **32**. As the fuel is discharged into the annulus the pressure is increased slightly at that point and the zones of lower pressure in the annulus lying remote from the orifice then cause fuel to flow from the higher pressure discharge point around the annulus whereby the fuel-air mixture is uniformly discharged from the entire circumference of the annulus.

In FIGURE 5, the fuel discharge tube **152** is provided with two discharge orifices **154** and **154'** to discharge respectively into flow path **146** and annulus **148**. In FIGURE 5, tube **152** is substantially perpendicular to the walls **40** of the induction passage **32** whereby the two discharge orifices **154** and **154'** lie substantially in the same pressure zone.

In FIGURE 6, a modification is shown in which the fuel discharge tube **252** is at an angle to the walls **240** of induction passage **232** for manufacturing convenience and is provided with discharge orifices **254** and **254'** which are subjected to substantially the same pressure.

In FIGURE 7, a discharge tube **352** is provided with a single discharge orifice **354** located to discharge into the outlet of the flow path **346** of air nozzle **330**.

In FIGURE 8, a fuel discharge tube **452** is shown discharging entirely at a single orifice **454** into annulus **448** between skirt **444** of air nozzle **430** and walls **440** of induction passage **432**. A throttle valve **424** is mounted on a shaft **426** disposed a predetermined distance from the end of skirt **444** such that when the throttle valve is in substantially the wide open position as shown by the dotted lines, the end **424'** of the throttle is disposed in the outlet from the flow path **446** which creates an effect similar to a decrease in the size of the flow path which results in higher fluid velocities at the outlet which in turn results in a lower pressure in the flow path and consequently an increase in fuel flow. This results in a power enrichment similar to that obtained by means of the mechanism shown at **72** in FIGURE 3 and will obviate the need for such mechanisms in some installations.

FIGURES 9 and 10 respectively show modifications in which a secondary air nozzle and secondary venturi are combined with a main air nozzle. Referring to FIGURE 9, a secondary air nozzle **594** is disposed in induction passage **532** to discharge into the substantially constant cross sectional flow path **546** of main flow nozzle **530**. Fuel is discharged from main fuel discharge tube **552** via orifices **554** and **554'**. The use of the secondary air nozzle **594** provides for greater suction than the single air nozzle version shown in the prior embodiments.

The embodiment shown in FIGURE 10 is similar to that of FIGURE 9 except that a secondary venturi **696** is provided in the induction passage **632** to discharge into the flow path **646** of main air nozzle **630**. Main discharge tube **652** is provided with an annular discharge port **654** at the throat of the throat of the secondary venturi.

In carburetors embodying the present invention, the carburetor designed is given a rather large leeway in determining where to have the main fuel discharged. In the prior art venturi carburetors, the designer was limited to the throat of the venturi. The present invention gives the carburetor designer a great deal of latitude in positioning the main discharge orifice either in the flow path **46** or in the annulus **48** or a combination of the two so as to provide the proper mixture and distribution for a given engine. Also the location of the main fuel discharge jet is not as critical from a manufacturing standpoint in carburetors embodying the present invention as it is in prior art carburetors utilizing venturis. Carburetors embodying the present invention tolerate minor manufacturing differences without affecting the characteristics of the carburetor thereby enhancing the manufacturing of the carburetors by mass production methods with a minimum number of rejects. The carburetors embodying the present invention have also shown substantial improvements when used with engines such as four cylinder engines wherein pressure pulsations are normally experienced in the induction pipe. The air flow nozzle of the present invention operates relatively unaffected by such pulsations in situations where a comparable carburetor equipped with the venturi would be wholly ineffective to operate the engine. Although the invention has been shown and described with reference to specific embodiments, it will be readily apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit of the invention.

I claim:

A carburetor for supplying fuel to an internal combustion engine having a source of fuel comprising: an induction passage, a butterfly type throttle in said passage, a flow nozzle mounted in said passage and forming a part of said passage, said flow nozzle having a converging upstream end and a downstream end disposed upstream of said throttle, a throat section is said flow nozzle having a predetermined cross-sectional flow area, a discharge section in said flow nozzle having a substantially constant cross-sectional flow area equal to said predetermined cross-sectional flow area extending from said throat to said downstream end of said flow nozzle, fuel discharge means communicating with said induction passage and being responsive to the pressure in said passage between a cross-sectional plane through said throat section and a cross-sectional plane adjacent said discharge end for discharging fuel into said passage, said flow nozzle being constructed such that said planes define a volume of substantially equal pressure in said passage, means adapted to connect said source to said fuel discharge means, said throttle being rotatably mounted in said induction passage a predetermined distance downstream of said downstream end of said nozzle such as to provide a predetermined small clearance between the downstream end of said nozzle and an edge of said throttle when said throttle is in the wide open position, said throttle creating a decrease in pressure in said volume of substantially equal pressure without decreasing the flow area of said nozzle to thereby influence the quantity of fuel discharged by said fuel discharge means.

(References on following page)

5

References Cited

UNITED STATES PATENTS

1,414,035	4/1922	Mayer	261—41
1,716,988	6/1929	Tacconi	261—41 X
2,152,057	3/1939	Killmeyer et al.	261—78
2,736,540	2/1956	Dorland	261—65 X
3,030,084	4/1962	Phillips.	

6

FOREIGN PATENTS

1,137,354	1/1957	France.
6,629	7/1914	Great Britain.
286,975	2/1930	Italy.
9,742	10/1923	Netherlands.

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