Oct. 9, 1962 K. R. KUHN ET AL 3,057,607

NOZZLE BAR

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FIG. 1.

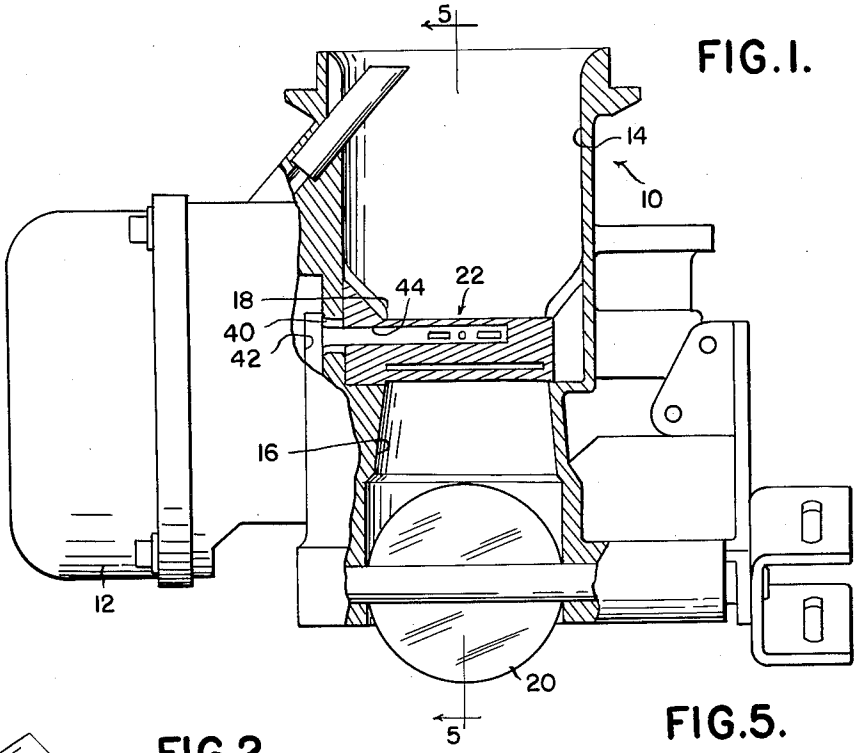


FIG. 2.

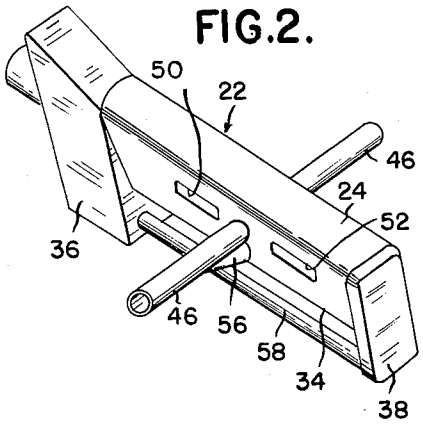
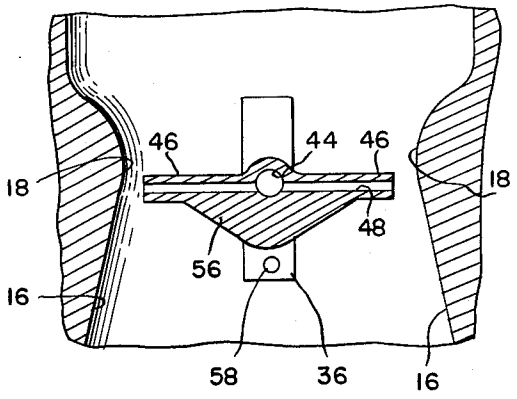


FIG. 5.



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FIG.3.

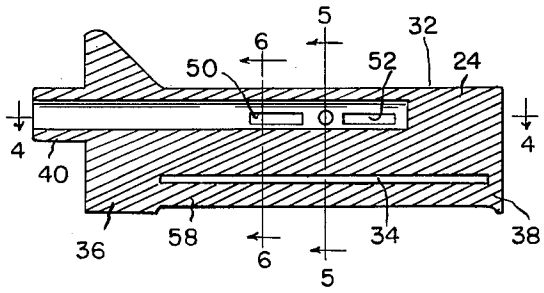


FIG.6.

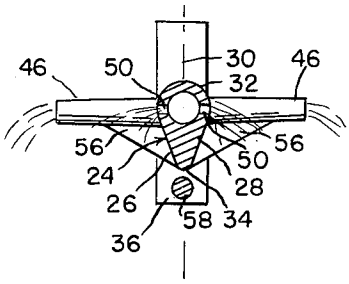


FIG.4.

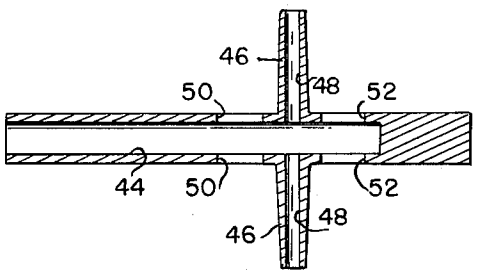
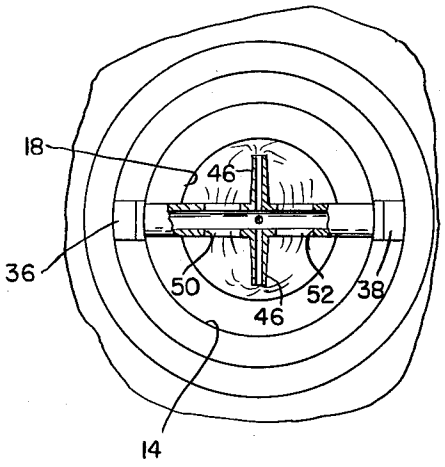


FIG.7.



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NOZZLE BAR

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9 Claims. (Cl. 261—78)

The present invention relates to carburetors for internal combustion engines and more particularly, to a device for improving the character of the fuel discharge from the main nozzle of the carburetor.

Past carburetor designs were for the most part successful where fuel economy was not a major concern or problem. However, the increasing popularity of compact cars has resulted in new demands for more economical fuel systems.

A major factor contributing to poor fuel economy is that the fuel droplets being discharged from the main nozzles are too large and are not evenly distributed in the air supply. This results in a fuel-air mixture which varies from rich to lean, depending upon the uneven fuel distribution. This further results in poor engine performance, thereby requiring some means or type of fuel-air adjustment in order to improve the engine performance. In most cases, the engine performance with a rich fuel-air mixture is considerably better than with a lean mixture. Consequently, the most common way of correcting the poor engine performance is to provide sufficient additional fuel to the air stream so that the lean portion of the fuel-air mixture is enriched to a minimum fuel-air ratio which results in better engine performance. This addition of fuel enriches the lean portion of the fuel-air mixture, but it also enriches the other portions of the mixture. Thus, better engine performance and poorer fuel economy result.

In compact cars, the addition of fuel is not desired, so other means must be provided to give better engine performance. One of the means or ways tried was the changing of the configuration of the discharge nozzle so that the fuel droplets would break up into smaller particles and be distributed evenly throughout the air flow. Certain types of discharge nozzles were reasonably successful, but were too expensive to produce.

It is an object of the present invention to provide means for improving the character of discharge of liquid fuel in a carburetor from the main nozzle into the venturi.

It is another object of the present invention to provide a discharge nozzle which will distribute the fuel so that it will be broken up into smaller particles and form a more homogeneous fuel-air mixture which will require less fuel for maximum engine performance than has heretofore been required.

Still another object of the present invention is to provide a carburetor characterized by its ability to deliver completely atomized fuel and to avoid irregularity in flow which would result from entrance into the air stream of relatively large drops of liquid fuel.

A still further object of the present invention is to provide a carburetor characterized by its construction in that the main fuel discharge nozzle comprises a relatively narrow elongated body located in the air stream immediately below the throat of the venturi, a passage in the body having a plurality of fuel discharge ports opening radially into the venturi and means fixedly located in the venturi and spaced below the trailing edge or side of the body for dispersing the fuel droplets from the ports into smaller fuel particles at various engine vacuum conditions.

Another object of the present invention is to provide a carburetor having an improved discharge nozzle which is characterized by its simplicity of design and construction, ease of operation and maintenance and which is economical to manufacture.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, illustrating a preferred embodiment of the invention, wherein:

FIGURE 1 is an elevational view, partly in section, showing the invention embodied in the carburetor.

FIGURE 2 is a perspective view showing the novel discharge nozzle bar in greater detail.

FIGURE 3 is an enlarged sectional elevational view showing more details of the discharge nozzle bar.

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

FIGURE 5 is a sectional view showing the relationship of the nozzle bar to the venturi taken along the line 5—5 of FIGURES 1 and 3.

FIGURE 6 is an end elevational view showing the flow pattern of the fuel taken along the line 6—6 of FIGURE 3.

FIGURE 7 is a top view of the carburetor looking into the venturi and showing the flow pattern of the fuel being discharged from the nozzle bar.

Referring now to the drawings, a carburetor is illustrated in FIGURE 1 and is designated by the numeral **10** and includes a bowl **12** which contains liquid fuel, the level of which is maintained in the bowl **12** by suitable means such as a float controlled inlet valve, not shown. Carburetor **10** includes an air induction passage and mixing chamber indicated generally at **14** which is provided with a venturi **16** having a throat as indicated at **18**. The usual type of throttle plate **20** is pivotally mounted in the fuel-air mixture passage below the venturi **16**.

A novel main discharge nozzle or nozzle bar **22** is transversely fixed in the venturi **16** immediately below the throat **18**. The nozzle bar **22** has aerodynamic airfoil-shaped main body **24**, as is best illustrated in FIGURE 6, which includes a pair of side portions **26** and **28** which taper inwardly toward the vertical axis **30** of the body **24**. The forward edge or side **32** of the body **24** is crowned or curved on a radius. The bottom edges of the tapering sides **26** and **28** are connected by a slightly curved trailing edge or side **34**.

The main body **24** has its ends **36** and **38** fixed in the side walls of the passage **14** so that the aforesaid trailing edge **34** of the body **24** faces the discharge end of the passage **14**. The end **36** of the main body **24** has a tubular extension **40** connected to the main well **42** which is in communication with the interior of the fuel bowl **12**. Fuel is adapted to be supplied through the main well **42** to the main fuel passage **44** of the nozzle bar **22**. A pair of discharge tubes **46** extends outwardly in a radial direction from the sides of the main body **24**.

The discharge tubes **46** are centrally located on each side of the main body **24** and have their passages **48** in communication with the main fuel passage **44**. Two pairs of slots **50** and **52** are transversely formed in the main body **24** in a predetermined relationship with the forward or leading edge **32** of the main body **24** as is illustrated in FIGURE 6. The pairs of slots **50** and **52** are also in communication with the main fuel passage **44**.

Wedge shaped abutments **56**, as is best illustrated in FIGURES 2, 5 and 6, support the arms **46** on the main body **24**. A distribution bar **58**, which is integrally connected with the ends **36** and **38** of the nozzle body **24**, is located below and spaced from the trailing edge or side **34** of the main body **24** a predetermined distance. The distribution bar **58** is circular in cross section and is of a predetermined size and length.

The operation of the invention is as follows. Located in the air-fuel mixture passage **14** is the discharge nozzle

bar 22 which is adapted to deliver fuel into the passage 14. Fuel is drawn through the nozzle 22 as a result of a partial vacuum existing in the passage 14. Fuel in the bowl 12 flows through the main conduitry, not shown, into the well 42 and then through the passage 44 in the nozzle 22 to the discharge slots or ports 50 and 52 and the discharge passages 48. More specifically, the flow of fuel through the main well 42 and the nozzle 22 is the result of a pressure differential between the substantially atmospheric pressure existing within the bowl 12 and the partial vacuum existing in the passage 14.

In accordance with the present construction, the nozzle 22 is of a particular design and configuration to produce an improved action on the fuel as it is sprayed or discharged into the passage 14. In the first place, the sides 26 and 28 of the main body 24 are tapered, with the lower ends thereof being rounded as indicated at 34 and located at a predetermined distance from the distribution bar 58.

At or during the lower range of engine operation, only a small amount of fuel is discharged from the nozzle bar 22. This is due to the fact that the pressure differential between the fuel bowl 12 and the venturi 16 is low, thus causing little fuel to be aspirated. At this time, fuel flows through the slots 50 and 52 down the sides 26 and 28 of the main body 24. As the relatively large fuel droplets leave the trailing edge 34 of the main body 24, the fuel droplets hit or strike the bar 58 which causes the large droplets to break up into smaller particles which will mix more readily with the air to form the desirable homogeneous mixture. Accordingly, the fuel is presented to the air stream in a manner best calculated to produce complete and fine atomization.

As the engine reaches its higher range of operation, the differential pressure increases due to the increase in velocity of the onrushing air through the air-fuel mixture passage 14. As a result, the increased differential pressure acts upon the main body 24 of the fuel nozzle 22 and causes or results in more fuel being aspirated from the slots 50 and 52. FIGURES 6 and 7 show the flow pattern of the fuel delivered or discharged through the slots 50 and 52 and the passages 48. As a result, the fuel breaks up into smaller droplets causing better distribution in the air. Note that in such instances, the distribution bar 58 usually does not come into play.

It should be observed that the aspirating of the fuel from the slots 50 and 52 is in a rectangular pattern as is best illustrated in FIGURE 7. The discharge tubes 46 are provided so as to extend in a radial direction outwardly from the body 24 so as to be in a position to deliver fuel to the outer edge of the periphery of the fuel-air mixture passage 14. If the tubes 46 were not provided, the outer edge of the periphery would tend to be lean.

From the foregoing, it will be observed that the improved nozzle bar 22 is characterized by its ability to produce a continuous, smooth, finely atomized flow completely devoid of irregularities due to introduction into the air stream of relatively large drops of fuel and is further sensitive in relation to fuel supply in accordance with extremely small variations in manifold vacuum. Such an arrangement insures that the large droplets of fuel are broken up into small particles so as to form a more homogeneous mixture which requires less fuel for maximum engine performance than has heretofore been required or obtained.

The drawings and the foregoing specification constitute a desciption of the improved nozzle bar in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. In a carburetor comprising a body having an induction passage in which air and liquid fuel are mixed, said passage having a venturi provided with a restricted throat, a fuel supply system including a discharge nozzle having a downwardly facing trailing edge, said nozzle extending completely across said venturi and having its ends fixed in the opposite walls of said body, a passage in said nozzle having a plurality of longitudinally spaced ports opening into said venturi, and fuel distribution means located in said venturi below and spaced from the trailing edge of said nozzle for dispersing the fuel droplets from said ports into smaller fuel particles at various engine vacuum conditions.

2. In a carburetor comprising a body having an induction passage in which air and liquid fuel are mixed, said passage having a venturi provided with a restricted throat, a fuel supply system including a discharge nozzle extending completely across said venturi and having its ends fixed in the opposite walls of said body, said nozzle comprising an elongated nozzle body having a forward edge facing the restricted throat and a trailing edge, a passage in said nozzle body having a plurality of longitudinally spaced ports opening laterally into said venturi, and fuel distribution means located in said venturi and spaced below the trailing edge of said nozzle body for dispersing the fuel droplets from said ports into smaller fuel particles at various engine vacuum conditions.

3. The carburetor defined in claim 2 wherein said fuel distribution means comprises a bar having a width greater than the width of the nozzle body at the trailing edge thereof.

4. The carburetor defined in claim 2 wherein the sides of said body are inclined and said fuel distribution means comprises a bar having a width greater than the width of the nozzle body at the trailing edge thereof.

5. The carburetor defined in claim 2 wherein the sides of said body are inclined from the forward edge toward the trailing edge and said fuel distribution means comprises a bar having a width greater than the width of the nozzle body at the trailing edge thereof.

6. The carburetor defined in claim 2 wherein the ends of said nozzle body extend downwardly beyond the trailing edge and said fuel distribution means comprises a bar which extends across the venturi and has its ends anchored in the ends of said nozzle body.

7. The carburetor defined in claim 2 wherein said nozzle includes a pair of tubular discharge members extending radially outwardly from the sides of said nozzle body and terminating near the periphery of said induction passage, each member having a passage therein in communication with the passage in said nozzle body.

8. In a carburetor comprising a body having an induction passage in which air and liquid fuel are mixed, said passage having a venturi provided with a restricted throat, a fuel supply system including a discharge nozzle extending into said venturi, said nozzle comprising an elongated nozzle body having a forward edge facing the restricted throat and a trailing edge, the sides of said body being tapered from the forward edge toward the trailing edge of said nozzle body, a passage in said nozzle body, a plurality of longitudinally spaced ports at opposite sides of said nozzle body in communication with the passage in said nozzle body and opening laterally into said venturi, a pair of tubular discharge members extending radially outwardly from the opposite sides of said nozzle body and terminating near the periphery of said induction passage, said members each having a passage therein in communication with the passage in said nozzle body, and a fuel distribution bar located in said venturi and spaced below the trailing edge of said nozzle body for dispersing the fuel droplets from said ports into smaller fuel particles at various engine vacuum conditions, said bar having a width greater than the width of the nozzle body at the trailing edge thereof.

9. In a carburetor comprising a body having an induction passage in which air and liquid fuel are mixed, said passage having a venturi provided with a restricted throat, a fuel supply system including a discharge nozzle ex-

tending into said venturi, said nozzle comprising an elongated nozzle body having a forward edge facing the restricted throat and a trailing edge, the sides of said body being tapered from the forward edge toward the trailing edge of said nozzle body, a passage in said nozzle body, a plurality of longitudinally spaced ports at opposite sides of said nozzle body in communication with the passage in said nozzle body and opening laterally into said venturi, a pair of tubular discharge members extending radially outwardly from the opposite sides of said nozzle body and terminating near the periphery of said induction passage, said members each having a passage therein in communication with the passage in said nozzle body, and a fuel distribution bar located in said

venturi and spaced below the trailing edge of said nozzle body for dispersing the fuel droplets from said ports into smaller fuel particles at various engine vacuum conditions, said bar being integral with said nozzle body and having a width greater than the width of the nozzle body at the trailing edge thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

1,632,279	Eckles	June 14, 1927
1,672,923	Zarracina	June 12, 1928
1,673,136	Bennett	June 12, 1928
2,541,316	Winkler	Feb. 13, 1951