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(54) **CARBURETOR WITH FUEL NOZZLE**

VERGASER BRENNSTOFFDÜSE

CARBURATEUR A INJECTEUR DE CARBURANT

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(73) Proprietor: **BRIGGS & STRATTON
CORPORATION
Wauwatosa, Wisconsin 53222 (US)**

(72) Inventors:

- **RASMUSSEN, Jerome
Germantown, WI 53022 (US)**
- **SANTI, John, D.
West Allis, WI 53214 (US)**

• **GUNTLY, Thomas, G.
Hartford, WI 53027 (US)**

(74) Representative: **Carpenter, David
MARKS & CLERK,
Alpha Tower,
Suffolk Street Queensway
Birmingham B1 1TT (GB)**

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DescriptionFIELD OF THE INVENTION

[0001] The present invention generally relates to the field of carburetors that mix air and fuel for internal combustion engines and, more particularly, to the field of fuel nozzles that provide fuel to the throat of such carburetors.

BACKGROUND OF THE INVENTION

[0002] Background art includes French reference FR-E-26,901, which discloses a fuel nozzle (1) having a pair of upstream orifices (2) and which is interconnected to a fuel conduit (5). French reference FR-A-555,986 discloses a fuel nozzle (1) disposed in a carburetor and in fluid communication with a fuel line (6). Another background art reference is British reference GB-A-649,920, which discloses a fuel nozzle (13) having an upstream orifice (24) and a downstream orifice (23) disposed within a carburetor. The fuel nozzle is angled with respect to the flow of air through the carburetor, and fuel within the fuel nozzle blocks the upstream orifice (24) during high suction and low engine speeds. Another background art reference is British reference GB-A-148,507, which discloses a fuel nozzle or choke tube (g) having an air inlet orifice (k) and a orifice for the outflow of fuel (k1). Fuel is drawn through the choke tube (g) from a chamber (d) containing a constant level (indicated by line 1-1) of fuel. Another background art reference is GB-A-224 719 which discloses a carburetor according to the preamble of claim 1.

[0003] In conventional carburetors, air enters through an intake of a carburetor throat and travels through a venturi where the air is mixed with fuel and subsequently provided to a combustion chamber of the engine. Fuel is typically provided to the air by a fuel nozzle that is operatively interconnected with a fuel supply (e.g., a fuel bowl). The fuel nozzle extends transversely into the carburetor throat, and includes an outlet port in a tip thereof. The outlet port commonly faces transverse to the air flow such that air passing over the port will create a negative pressure, thereby resulting in fuel being drawn from fuel nozzle.

[0004] In some engines, air can also flow in the reverse direction (i.e., from the combustion chamber toward the carburetor intake), sometimes called "reverse flow." Reverse flow is typically caused by intake valve leakage, which can result from valve lash, inconsistent cam profiles or poor valve seals. Due to the presence of an air velocity, reverse flow creates a negative pressure at the outlet port, resulting in fuel being drawn from the fuel nozzle. When forward flow resumes, fuel is again drawn from the fuel nozzle, resulting in a "double charge" of fuel. This double charge creates an air/fuel ratio that is richer than the optimum air/fuel ratio of the carburetor, resulting in excess emissions and lower fuel

economy.

SUMMARY OF THE INVENTION

[0005] The present invention provides a carburetor with a fuel nozzle that alleviates the problem of double charging by positioning orifices in the fuel nozzle such that more fuel is dispensed during downstream gas flow than during upstream gas flow. According to the invention, a carburetor for use in an engine comprises a carburetor body (22) having a throat (24) extending from an intake (26) to a discharge (28), wherein a downstream direction is defined as extending from said intake toward said discharge, and wherein an upstream direction is defined as extending from said discharge toward said intake; and a fuel nozzle (32) having body, said body having a longitudinal axis positioned within said throat such that said longitudinal axis is substantially normal to said upstream and downstream directions, said nozzle including at least one upstream orifice (39) facing substantially upstream and at least one downstream orifice (40, 42, or 44) facing substantially downstream, said at least one upstream orifice being positioned closer to the carburetor body than said at least one downstream orifice, characterized in that a surface area of said at least one upstream orifice is less than about 50 percent of a surface area of said at least one downstream orifice, whereby said upstream orifice is sized and positioned to allow air to enter said fuel nozzle at a right angle to a flow of fuel in said nozzle during downstream flow of air in said carburetor throat to cause improved fuel atomization in said fuel nozzle before said fuel and air exit said downstream orifice during normal operation of the engine.

[0006] Further embodiments of the invention are disclosed in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a side section view of a carburetor embodying the present invention and including a fuel nozzle.

[0008] Fig. 2 is a longitudinal section view of the fuel nozzle illustrated in Fig. 1.

[0009] Fig. 3 is a section view of the fuel nozzle taken along line 3-3 in Fig. 2.

[0010] Fig. 4 is an end view of the fuel nozzle taken along line 4-4 in Fig. 2.

[0011] Fig. 5 is a side section view of a different carburetor embodying the present invention and including a fuel nozzle.

[0012] Fig. 6 is a longitudinal section view of the fuel nozzle illustrated in Fig. 5.

[0013] Fig. 7 is an end view of the fuel nozzle taken along line 7-7 in Fig. 6.

[0014] Figs. 8-12 illustrate various fuel nozzles embodying the present invention.

DETAILED DESCRIPTION

[0015] Fig. 1 illustrates a carburetor 20 having a carburetor body 22 with a carburetor throat 24 extending therethrough from an intake region 26 to a discharge region 28. The carburetor 20 further includes a throttle 30 that regulates the amount of air and fuel passing through the throat 24. A fuel nozzle 32 is positioned to provide fuel to the throat 24. The fuel nozzle 32 generally includes a base 34 mounted to the carburetor body 22, and a tip 36 extending from the base 34, through a carburetor wall 37, and at least partially positioned within the carburetor throat.

[0016] In accordance with the present invention, the tip 36 is provided with an upstream orifice and at least one downstream orifice having a surface area larger than a surface area of the upstream orifice. As used herein, the term "surface area" is used to describe the orifice's propensity to discharge fuel. That is, the larger the surface area of the orifice, the more fuel it is likely to discharge given a particular pressure. The surface area values used herein refer to the area of the orifice at the outer surface of the fuel nozzle. It should be appreciated, of course, that other techniques could be used to achieve the present invention. For example, by using narrow slot-shaped or pinhole openings, surface tension could also play a role in an orifice's propensity to dispense fuel. Further, orifices that change in area from the surface inward could also affect the orifice's performance.

[0017] In the embodiment illustrated in Figs. 1 and 2, the tip includes one upstream orifice 38 that is circular and has a diameter of about 0,5334 mm (.021 inches), corresponding with a cross-sectional surface area of about 0,226 square mm (.00035 square inches). The illustrated embodiment includes three downstream orifices 40,42,44 that are each circular and have a diameter of about 0,9398 mm (.037 inches), corresponding with a total cross-sectional surface area of about 2,084 square mm (.00323 square inches). It should be appreciated that the orifices do not need to be round in cross-section, and could instead be configured in other appropriate shapes.

[0018] As best shown in Fig. 2, the middle downstream orifice 42 is approximately centered with respect to the throat 24, and the other two downstream orifices 40,44 are equally spaced on either side of the middle downstream orifice 42. Accordingly, the downstream orifices 40,42,44 are positioned in a pattern that is evenly distributed across the throat 24. In contrast, the upstream orifice 38 is positioned off-center with respect to the throat 24. More specifically, the upstream orifice 38 is positioned closer to the carburetor wall 37 than any of the downstream orifices 40,42,44, as shown in Figs. 1 and 2.

[0019] By virtue of the positioning of the downstream side of the nozzle tip, double charging is significantly reduced. More specifically, forward flow will create a low

pressure at the downstream orifices, resulting in fuel being dispensed through the downstream orifices. During reverse flow, a high pressure is formed at the downstream orifices, resulting in little or no fuel being dispensed through the downstream orifices. Accordingly, double charging is significantly reduced.

[0020] The positioning of the upstream orifice allows air to enter the fuel nozzle at a right angle to the flow of fuel in the nozzle during forward flow. The right angle motion of the air relative to the fuel causes shearing of the fuel in the fuel nozzle, resulting in better fuel atomization as the fuel and air exit the downstream orifices. Because of the small surface area of the upstream orifice relative to the downstream orifices, reverse flow will not result in significant dispersal of fuel through the upstream orifice.

[0021] As noted above, the fuel nozzle 32 includes a tip 36 and a base 34. The tip 36 and the base 34 can be made from a wide variety of materials, including metals and plastics. In the embodiment illustrated in Figs. 1-4, the tip 36 and the base 34 are machined from metallic material, such as SAE CA 332 Brass, and the base 34 is press fit into the tip 36. The utilization of a two-piece fuel nozzle facilitates production of a fuel nozzle 32 having a tip 36 with a thinner wall than the base 34. The thinner wall allows the tip to occupy less space within the throat, thereby improving engine performance. To insure proper alignment of the base 34 with the tip 36, the base 34 includes a flat surface 46 that corresponds with a flat segment 48 on the tip 36, as shown in Fig. 3. Further, to insure that the assembled fuel nozzle 32 is properly inserted into the carburetor body 22, the base 34 includes a flat portion 50 that matches the shape of the carburetor body 22, as shown in Fig. 4.

[0022] The carburetor 60 illustrated in Fig. 5 includes an integral fuel bowl 62 and associated float 64 for providing fuel to the carburetor throat 66 via a metering orifice 68 and a fuel nozzle 70. Referring to Fig. 6, the fuel nozzle 70 is a one-piece design made from plastic, such as acetal resin. The lower portion of the fuel nozzle includes a D-shaped base portion 72, as shown in Fig. 7, to insure proper alignment of the fuel nozzle 70 with the carburetor body 74.

[0023] Fig. 8 illustrates another fuel nozzle 80 embodying the present invention. The fuel nozzle 80 is a two-piece design, including a tip 82 and a base 84. The tip 82 and the base 84 are both made of plastic material, such as Delrin, a trademark of E.I. Du Pont De Nemours of Wilmington, Delaware. The tip 82 and the base 84 are interconnected by a snap fit, wherein a ridge 86 on the tip 82 fits into a groove 88 on the base 84. In the illustrated embodiment, the tip 82 has a wall thickness that is about the same as the wall thickness of the base 84.

[0024] Fig. 9 illustrates another fuel nozzle 90 embodying the present invention. The illustrated fuel nozzle 90 is a one-piece design that is machined from a metallic material, such as brass. A tip portion 92 of the fuel nozzle

zle 90 is blocked by a ball plug 94.

[0025] Fig. 10 illustrates a fuel nozzle 100 embodying the present invention. Similar to the fuel nozzle illustrated in Fig. 8, the fuel nozzle 100 of Fig. 10 is a two-piece Delrin design wherein a tip 102 is snap fit with a base 104. The end of the tip 102 includes a ball plug 106 integrally formed therewith via a flexible interconnecting member 108. The open end of the tip 102 can be selectively closed by inserting the ball plug 106 into the open end.

[0026] Fig. 11 illustrates another fuel nozzle 110 embodying the present invention. The fuel nozzle 110 is identical to that illustrated in Fig. 8, except the tip 112 has a wall thickness that is significantly thinner than the wall thickness of the base 114.

[0027] Fig. 12 illustrates a two-piece brass fuel nozzle 120 having a tip 122 and a base 124 press fit into the tip 122. In contrast to the previously-described fuel nozzles, the tip 122 illustrated in Fig. 12 extends only partially (e.g., less than halfway) into the carburetor throat 126. Further, the tip 122 illustrated in Fig. 12 includes only one downstream orifice 128, rather than the three downstream orifices illustrated in the other fuel nozzles. As shown, the downstream orifice 128 has a cross-sectional surface area that is significantly larger than the surface area of the upstream orifice 130.

[0028] The foregoing description of the present invention has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and the skill or knowledge of the relevant art, are within the scope of the present invention, as defined in the appended claims. The embodiments described herein are further intended to explain best modes known for practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments and with various modifications required by the particular applications or uses of the present invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.

Claims

1. A carburetor (20) for use in an engine, said carburetor comprising:

a carburetor body (22) having a throat (24) extending from an intake (26) to a discharge (28), wherein a downstream direction is defined as extending from said intake toward said discharge, and wherein an upstream direction is defined as extending from said discharge toward said intake; and

a fuel nozzle (32, 70, 80, 100, 120) having a body, said body having a longitudinal axis po-

sitioned within said throat such that said longitudinal axis is substantially normal to said upstream and downstream directions, said nozzle including at least one upstream orifice (38, 130) facing substantially upstream and at least one downstream orifice (40, 42, 44 or 128) facing substantially downstream, said at least one upstream orifice being positioned closer to the carburetor body than said at least one downstream orifice, characterized in that a surface area of said at least one upstream orifice is less than about 50 percent of a surface area of said at least one downstream orifice, whereby said upstream orifice is sized and positioned to allow air to enter said fuel nozzle at a right angle to a flow of fuel in said nozzle during downstream flow of air in said carburetor throat to cause improved fuel atomization in said fuel nozzle before said fuel and air exit said downstream orifice during normal operation of the engine.

2. A carburetor as claimed in claim 1, wherein said surface area of said at least one upstream orifice is less than about 25 percent of said surface area of said at least one downstream orifice.
3. A carburetor as claimed in claim 1, wherein said surface area of said at least one upstream orifice is between about 5 percent and about 20 percent of said surface area of said at least one downstream orifice.
4. A carburetor as claimed in claim 1, wherein said at least one upstream orifice is positioned adjacent the carburetor body that forms the throat.
5. A carburetor as claimed in claim 1, wherein said at least one downstream orifice includes a second downstream orifice (40, 42, or 44).
6. A carburetor as claimed in claim 5, wherein said first and second downstream orifices have an average position that is centered with respect to said throat.
7. A carburetor as claimed in claim 5, wherein said at least one downstream orifice includes a third downstream orifice (40, 42, or 44).
8. A carburetor as claimed in claim 7, wherein said first downstream orifice is centered with respect to said throat, and wherein said second and third downstream orifices are evenly spaced on opposing sides of said first downstream orifice.
9. The carburetor as claimed in claim 7, wherein said at least one upstream orifice further comprises a second upstream orifice, and wherein a combined

surface area of said first and second upstream orifices is less than about 50 percent of a combined surface area of said first, second and third downstream orifices.

10. The carburetor as claimed in claim 1, wherein said fuel nozzle further comprises a base portion (34) that is keyed to fit into said carburetor body in a discrete orientation.
11. The carburetor as claimed in claim 1, wherein said fuel nozzle further comprises:
 a body including first (34, 84, 104, 114, or 124) and second (36, 82, 102, 112 or 122) distinct pieces, said body having an open first end and a second end closed by said first piece.

Patentansprüche

1. Vergaser (20) für einen Motor, wobei der Vergaser aufweist:

einen Vergaserkörper (22), der einen Hals (24) hat, der sich von einem Einlaß (26) bis zu einem Auslaß (28) erstreckt, wobei die Stromabwärtsrichtung als die Richtung von dem Einlaß nach dem Auslaß definiert ist, und wobei die Stromaufwärtsrichtung als die Richtung von dem Auslaß nach dem Einlaß definiert ist; und

eine Kraftstoffdüse (32, 70, 80, 100, 120), die einen Körper hat, wobei der Körper eine Längsachse hat, die innerhalb des Halses so positioniert ist, daß sie im wesentlichen senkrecht zu der Stromaufwärtsrichtung und der Stromabwärtsrichtung ist, wobei die Düse mindestens eine Stromaufwärtsöffnung (38, 130) hat, die im wesentlichen stromaufwärts gerichtet ist, und mindestens eine Stromabwärtsöffnung (40, 42, 44 oder 128) hat, die im wesentlichen stromabwärts gerichtet ist, wobei die mindestens eine Stromaufwärtsöffnung näher bei dem Vergaserkörper positioniert ist als die mindestens eine Stromabwärtsöffnung, dadurch gekennzeichnet, daß

die Mantelfläche der mindestens einen Stromaufwärtsöffnung kleiner als ungefähr 50 Prozent der mindestens einen Stromabwärtsöffnung ist, wodurch die Stromaufwärtsöffnung so dimensioniert und positioniert ist, daß während der Stromabwärtsströmung der Luft in dem Vergaserhals Luft unter einem rechten Winkel zu dem Kraftstofffluß in der Kraftstoffdüse in die Kraftstoffdüse eindringen kann, um während des normalen Betriebs des Motors eine verbesserte Kraftstoffzerstäubung in der Kraftstoffdü-

se zu bewirken, bevor der Kraftstoff und die Luft die Stromabwärtsöffnung verlassen.

2. Vergaser wie in Anspruch 1 beansprucht, wobei die Mantelfläche der mindestens einen Stromaufwärtsöffnung kleiner als ungefähr 25 Prozent der Mantelfläche der mindestens einen Stromabwärtsöffnung ist.
3. Vergaser wie in Anspruch 1 beansprucht, wobei die Mantelfläche der mindestens einen Stromaufwärtsöffnung zwischen ungefähr 5 Prozent und ungefähr 20 Prozent der Mantelfläche der mindestens einen Stromabwärtsöffnung beträgt.
4. Vergaser wie in Anspruch 1 beansprucht, wobei die mindestens eine Stromaufwärtsöffnung nahe bei dem Vergaserkörper, der den Hals bildet, positioniert ist.
5. Vergaser wie in Anspruch 1 beansprucht, wobei die mindestens eine Stromabwärtsöffnung eine zweite Stromabwärtsöffnung (40, 42 oder 44) umfaßt.
6. Vergaser wie in Anspruch 5 beansprucht, wobei die erste und die zweite Stromabwärtsöffnung eine mittlere Position haben, die bezüglich des Halses zentriert ist.
7. Vergaser wie in Anspruch 5 beansprucht, wobei die mindestens eine Stromabwärtsöffnung eine dritte Stromabwärtsöffnung (40, 42 oder 44) umfaßt.
8. Vergaser wie in Anspruch 7 beansprucht, wobei die erste Stromabwärtsöffnung bezüglich des Halses zentriert ist, und wobei die zweite und die dritte Stromabwärtsöffnung auf entgegengesetzten Seiten der ersten Stromabwärtsöffnung in gleichem Abstand angeordnet sind.
9. Vergaser wie in Anspruch 7 beansprucht, wobei die mindestens eine Stromaufwärtsöffnung weiterhin eine zweite Stromaufwärtsöffnung aufweist, und wobei die kombinierte Mantelfläche der ersten und der zweiten Stromaufwärtsöffnung kleiner als ungefähr 50 Prozent der kombinierten Mantelfläche der ersten, zweiten und dritten Stromabwärtsöffnung ist.
10. Vergaser wie in Anspruch 1 beansprucht, wobei die Kraftstoffdüse weiterhin einen Basisbereich (34) aufweist, der verkeilt ist, damit er mit einer bestimmten Orientierung in den Vergaserkörper eingesetzt wird.
11. Vergaser wie in Anspruch 1 beansprucht, wobei die Kraftstoffdüse weiterhin aufweist:
 einen Körper, der ein erstes Teil (34, 84, 104,

114 oder 124) und ein getrenntes zweites Teil (36, 82, 102, 112 oder 122) umfaßt, wobei der Körper ein offenes erstes Ende, und ein durch das erste Teil verschlossenes, zweites Ende hat.

Revendications

1. Carburateur (20) destiné à être utilisé dans un moteur, ledit carburateur comprenant:

un corps de carburateur (22) comportant un étranglement (24), s'étendant d'une entrée (26) vers une sortie (28), une direction allant vers l'aval étant définie comme s'étendant de ladite entrée vers ladite sortie, une direction allant vers l'amont étant définie comme s'étendant de ladite sortie vers ladite entrée; et

un injecteur de carburant (32, 70, 80, 100, 120) comportant un corps, ledit corps comportant un axe longitudinal positionné dans ledit étranglement, de sorte que ledit axe longitudinal est pratiquement perpendiculaire auxdites directions allant vers l'amont et vers l'aval, ledit injecteur englobant au moins un orifice d'amont (38, 130) orienté pratiquement vers l'amont, et au moins un orifice d'aval (40, 42, 44 ou 128), orienté pratiquement vers l'aval, ledit au moins un orifice d'amont étant plus proche du corps du carburateur que ledit au moins un orifice d'aval, caractérisé en ce que

une surface utile dudit au moins un orifice d'amont représente moins d'environ 50 pour cent d'une surface utile dudit au moins un orifice d'aval, ledit orifice d'amont étant ainsi dimensionné et positionné de sorte à permettre l'entrée d'air dans ledit injecteur de carburant à angle droit par rapport à un écoulement de carburant dans ledit injecteur au cours de l'écoulement vers l'aval de l'air dans ledit étranglement du carburateur pour entraîner une pulvérisation améliorée du carburant dans ledit injecteur de carburant avant la sortie dudit carburant et de l'air dudit orifice d'aval au cours du fonctionnement normal du moteur.

2. Carburateur selon la revendication 1, dans lequel ladite surface utile dudit au moins un orifice d'amont représente moins d'environ 25 pour cent de ladite surface utile dudit au moins un orifice d'aval.

3. Carburateur selon la revendication 1, dans lequel ladite surface utile dudit au moins un orifice d'amont représente entre environ 5 pour cent et environ 20 pour cent de ladite surface utile dudit au moins un orifice d'aval.

4. Carburateur selon la revendication 1, dans lequel

ledit au moins un orifice d'amont est positionné près du corps du carburateur formant l'étranglement.

5. Carburateur selon la revendication 1, dans lequel ledit au moins un orifice d'aval englobe un deuxième orifice d'aval (40, 42 ou 44).

6. Carburateur selon la revendication 5, dans lequel lesdits premier et deuxième orifices d'aval ont une position moyenne centrée par rapport audit étranglement.

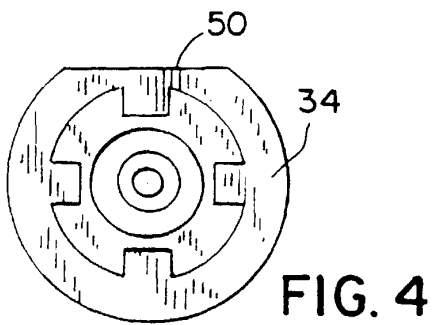
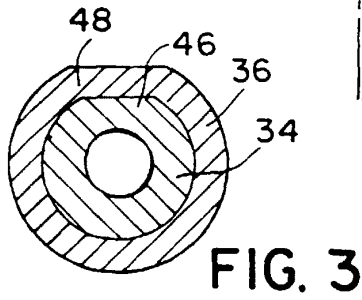
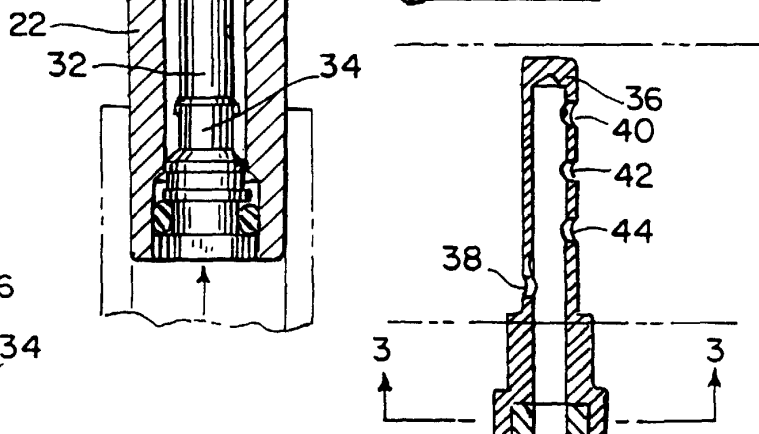
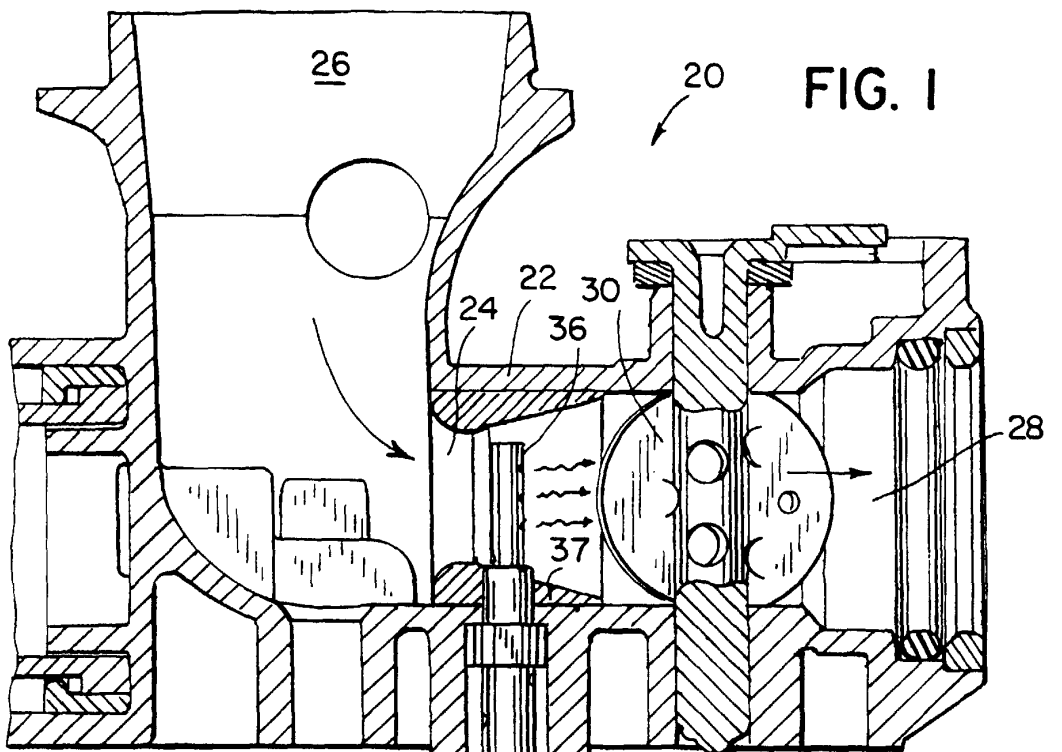
7. Carburateur selon la revendication 5, dans lequel ledit au moins un orifice d'aval englobe un troisième orifice d'aval (40, 42 ou 44).

8. Carburateur selon la revendication 7, dans lequel ledit premier orifice d'aval est centré par rapport audit étranglement, lesdits deuxième et troisième orifices d'aval étant espacés de façon égale sur les côtés opposés dudit premier orifice d'aval.

9. Carburateur selon la revendication 7, dans lequel ledit au moins un orifice d'amont comprend en outre un deuxième orifice d'amont, une surface utile combinée desdits premier et deuxième orifices d'amont représentant moins d'environ 50 pour cent d'une surface utile combinée desdits premier, deuxième et troisième orifices d'aval.

10. Carburateur selon la revendication 1, dans lequel ledit injecteur de carburant comprend en outre une partie de base (34), clavetée en vue d'un ajustement dans ledit corps du carburateur dans une orientation distincte.

11. Carburateur selon la revendication 1, dans lequel ledit injecteur de carburant comprend en outre: un corps englobant des première (34, 84, 104, 114 ou 124) et deuxièmes (36, 82, 102, 112 ou 122) pièces distinctes, ledit corps comportant une première extrémité ouverte et une deuxième extrémité fermée par ladite première pièce.



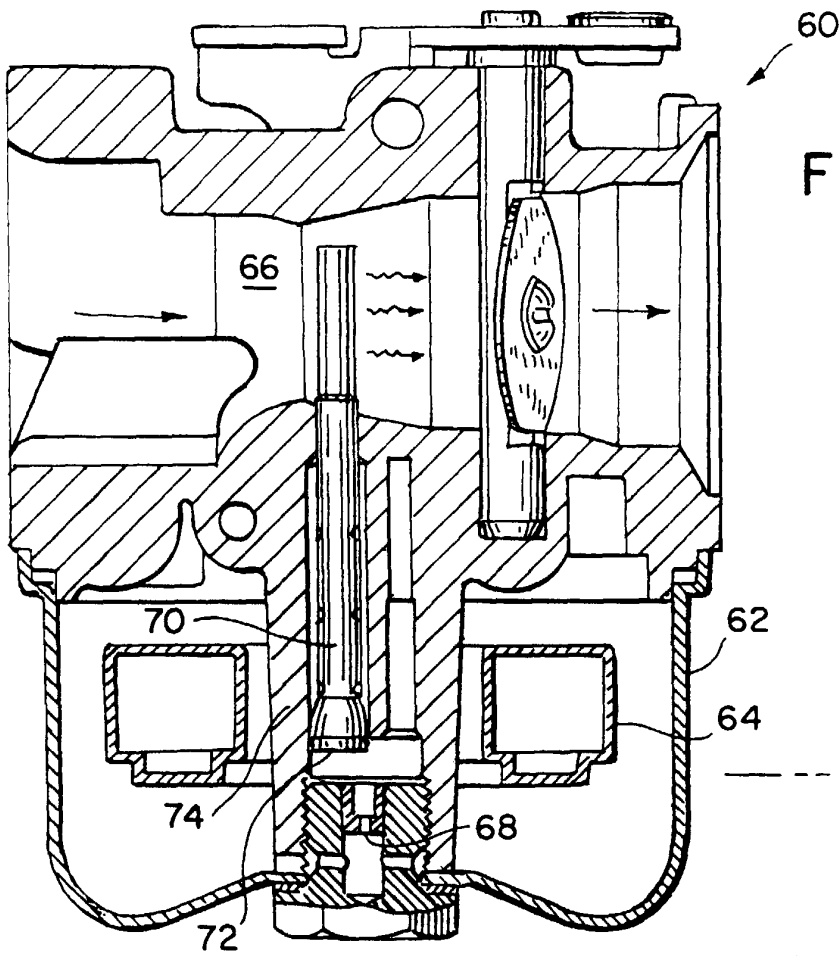


FIG. 5

FIG. 6

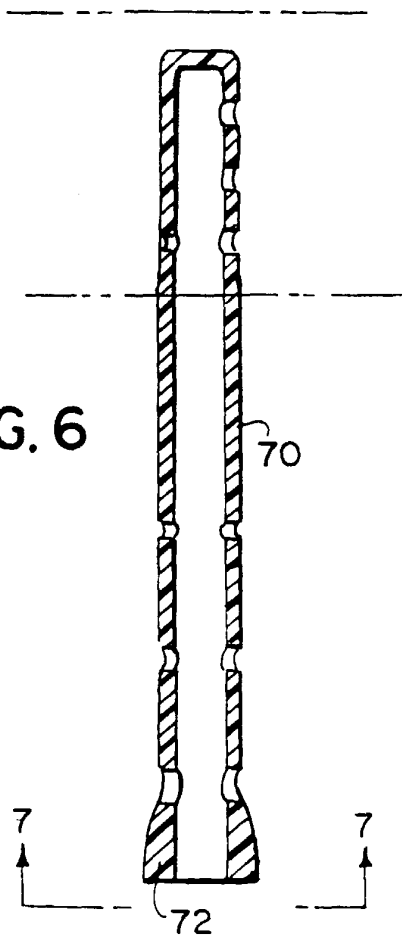
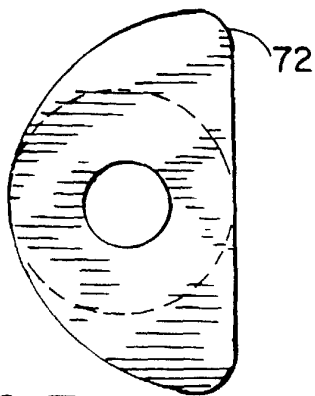


FIG. 7



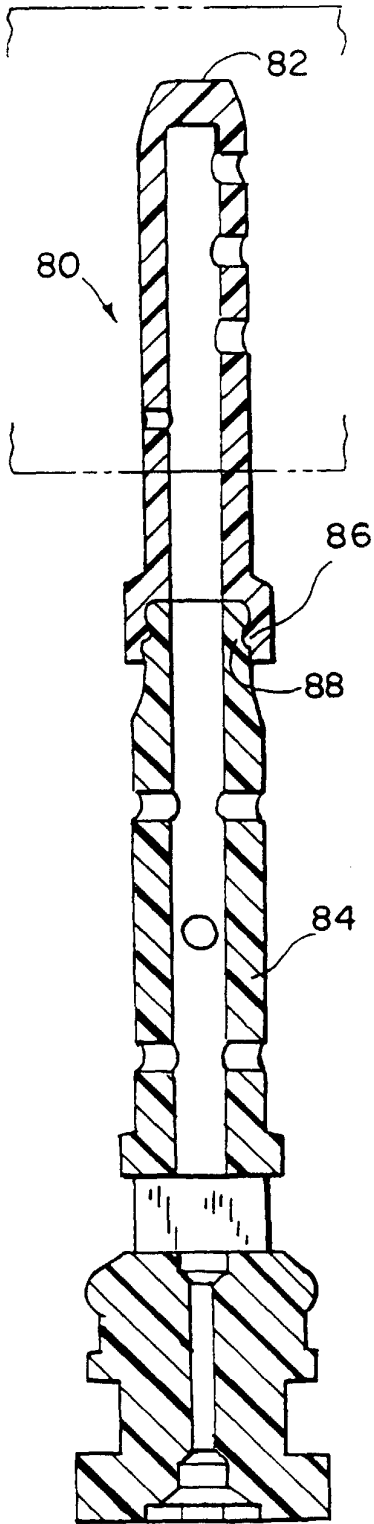


FIG. 8

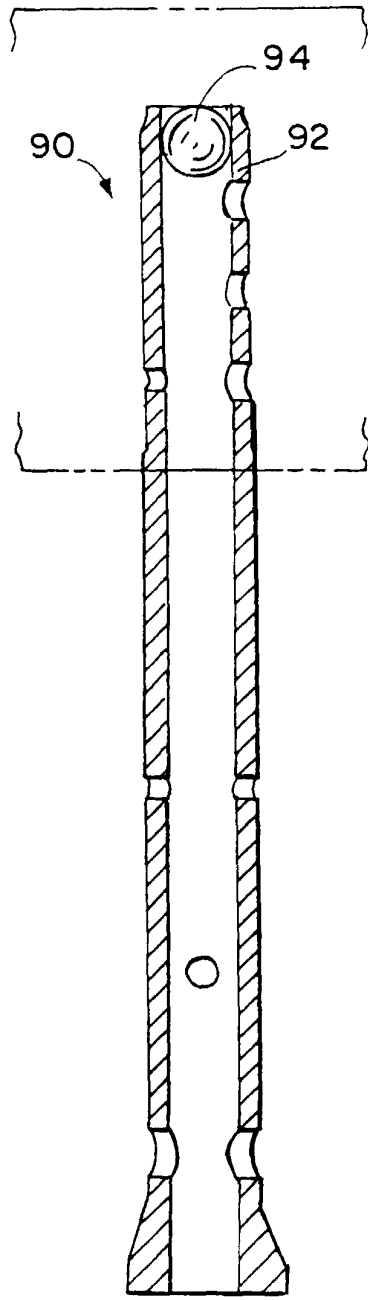


FIG. 9

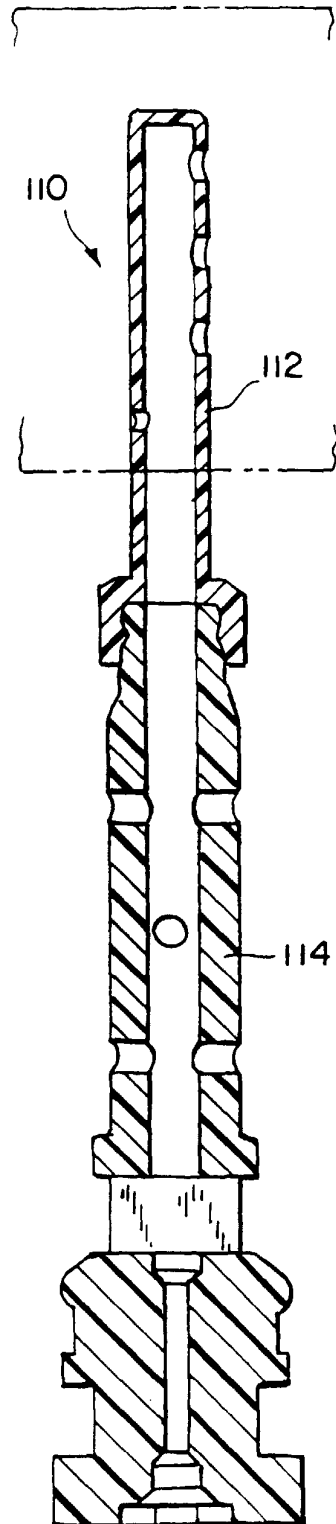


FIG. 11

FIG. 10

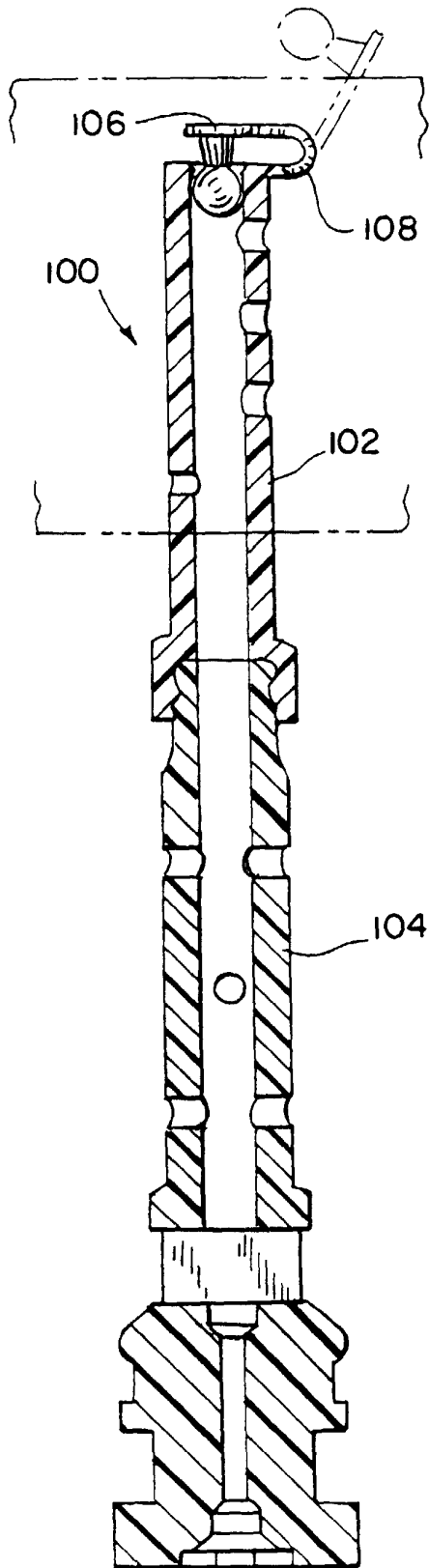


FIG. 12

