July 14, 1970 R. L. CHESKEY 3,520,520

CHARGE FORMING DEVICE

Filed Sept. 18, 1968 2 Sheets--Sheet 1

Fig. 1

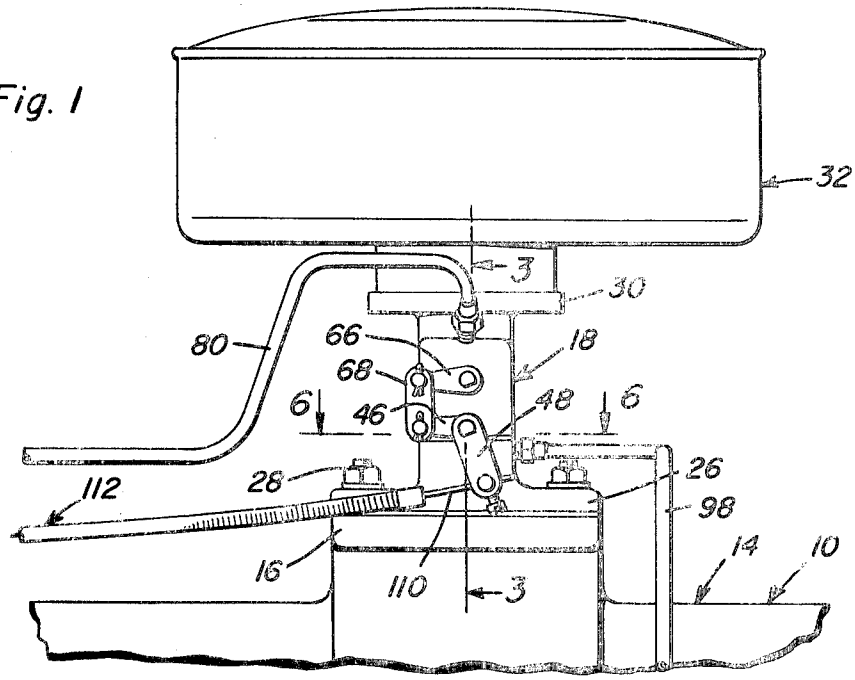


Fig. 8

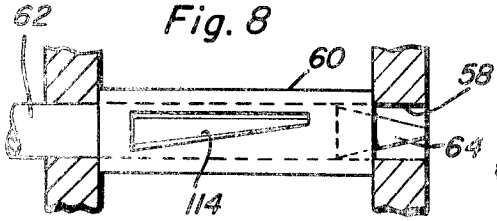


Fig. 9

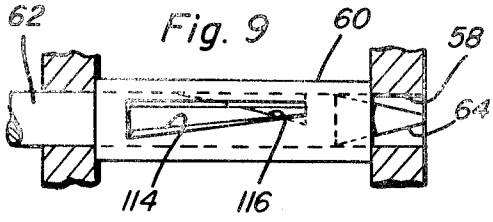


Fig. 10

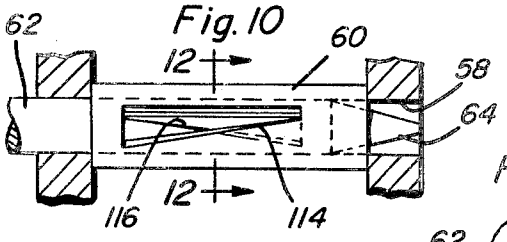


Fig. 11



Fig. 2

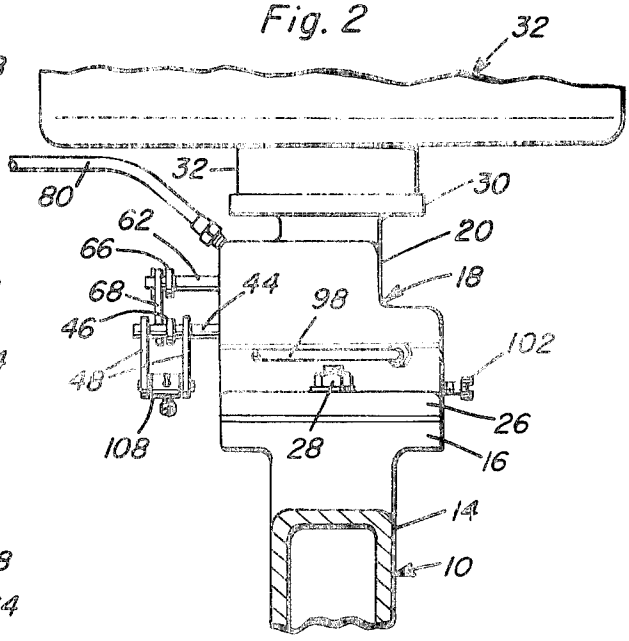
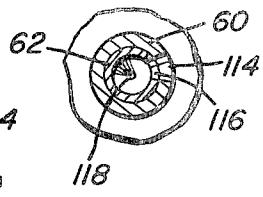


Fig. 12



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Fig. 3

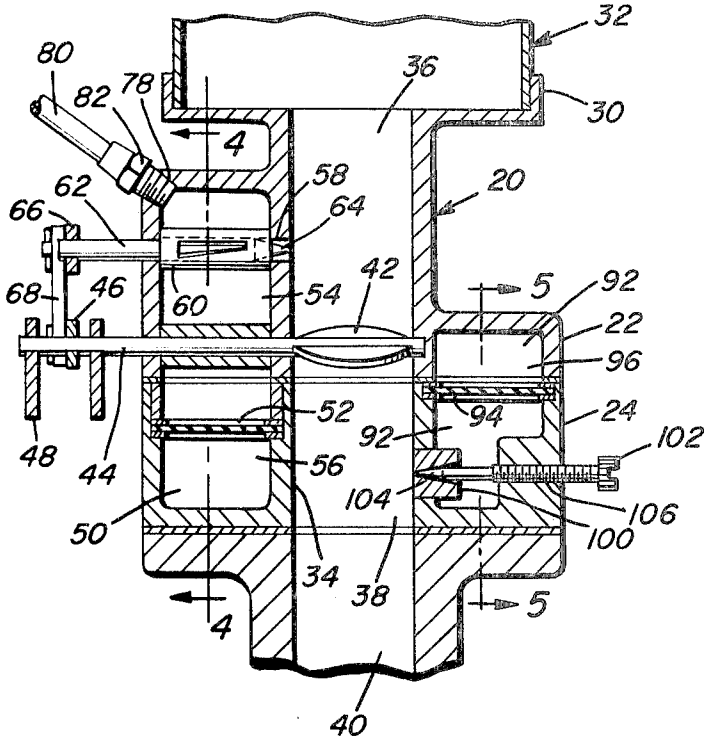


Fig. 4

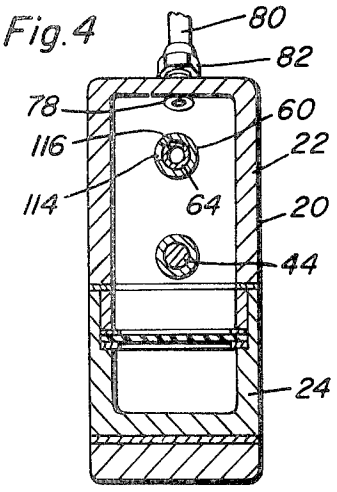


Fig. 5

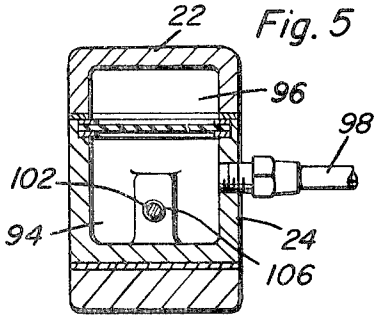


Fig. 6

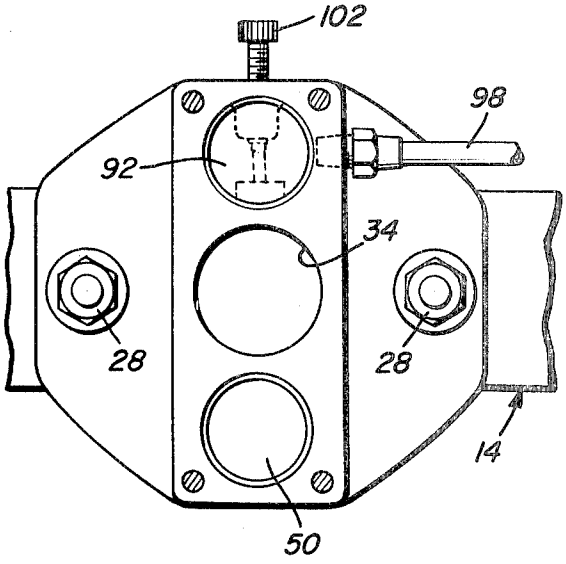
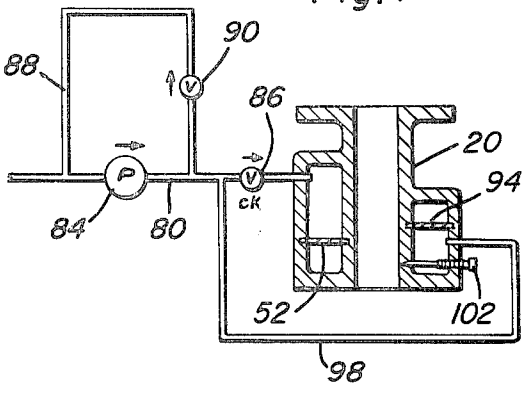


Fig. 7



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3,520,520

CHARGE FORMING DEVICE

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Int. Cl. F02m 19/04
U.S. Cl. 261—41 6 Claims

ABSTRACT OF THE DISCLOSURE

A body defining an air and fuel mixture passage extending therethrough with variable air valve means operatively associated with the passage for controlling the flow of air through the passage. A liquid fuel chamber is supported from the body and includes a fuel inlet and a fuel outlet opening into the air and fuel mixture passage. Also, a metering sleeve is disposed in the fuel chamber with one outlet end portion registered with and opening into the inlet end of the fuel outlet passage and a tubular fuel jet is rotatably disposed in the sleeve. The tubular fuel jet and sleeve are provided with longitudinally extending and registrable openings formed through wall portions thereof and liquid fuel flow from the fuel chamber into the air and fuel mixture passage through the outlet passage of the fuel chamber leading into the air and fuel mixture passage is controlled by variable registry of the openings formed in the sleeve and the fuel jet.

The charge forming device of the instant invention has been designed primarily for providing a means of accurately producing an air and fuel mixture of proper ratio throughout a given range of air and fuel mixture flow through the charge forming device. The device has been specifically designed for use in forming a proper air and fuel mixture for vehicular internal combustion engines. However, as will be readily apparent from the simplicity of construction and operation to be hereinafter more fully set forth the charge forming device is also particularly well adapted to provide air and fuel mixtures for different purposes.

The main object of this invention is to provide an apparatus capable of more accurately controlling the formation of an air and fuel mixture throughout a predetermined range of air and fuel mixture flow.

Another object of this invention is to provide a charge forming device which is particularly well adapted for use in connection with the formation of proper air and fuel mixtures for vehicular internal combustion engines.

Yet another object of this invention is to provide a charge forming device in accordance with the preceding objects and which, because of its capability of more precisely forming an air and fuel mixture of correct ratio, will afford increased fuel economy, greater power and less tendency to support the formation of "smog" due to excessive amounts of unburned hydrocarbons in the exhaust of an associated internal combustion engine.

A final object of this invention to be specifically enumerated herein is to provide a charge forming device in accordance with the preceding objects which will conform to conventional forms of manufacture, be of simple construction and easy to service so as to provide a device that will be economically feasible, long lasting and relatively trouble-free in maintenance.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein

like numerals refer to like parts throughout, and in which:

FIG. 1 is a fragmentary side elevational view of an internal combustion engine with which the charge forming device of the instant invention is operatively associated;

FIG. 2 is a fragmentary vertical sectional view taken substantially upon a plane passing through the right hand portion of FIG. 1 and as seen from the right hand portion of FIG. 1;

FIG. 3 is an enlarged fragmentary vertical sectional view taken substantially upon the plane indicated by the section line 3—3 of FIG. 1;

FIG. 4 is a fragmentary vertical sectional view taken substantially upon the plane indicated by the section line 4—4 of FIG. 3;

FIG. 5 is a fragmentary vertical sectional view taken substantially upon the plane indicated by the section line 5—5 of FIG. 3;

FIG. 6 is an enlarged fragmentary horizontal sectional view taken substantially upon the plane indicated by the section line 6—6 of FIG. 1;

FIG. 7 is a schematic sectional view similar to FIG. 3 but with some details of the charge forming device omitted and including a diagrammatic representation of the fuel lines operatively associated with the charge forming device;

FIG. 8 is a fragmentary vertical sectional view taken substantially upon a plane passing through the fuel metering valve of the charge forming device with the relatively rotatable portions of the metering valve in relative positions blocking the flow of fuel therethrough;

FIG. 9 is a view similar to FIG. 8 but with the relatively rotatable portions of the metering valve in relative positions affording minimum flow of fuel therethrough;

FIG. 10 is a view similar to FIGS. 8 and 9 but with the relatively rotatable portions of the metering valve positioned to afford substantially maximum flow of fuel therethrough;

FIG. 11 is a fragmentary elevational view of the tubular fuel jet portion of the metering valve; and

FIG. 12 is a fragmentary sectional view taken substantially upon the plane indicated by the section line 12—12 of FIG. 10.

Referring now more specifically to the drawings, the numeral 10 generally designates an internal combustion engine of the conventional automotive type including an intake manifold referred to in general by the reference numeral 14 having a carburetor mounting boss 16 thereon. The charge forming device of the instant invention is generally referred to by the reference numeral 18 and includes a body referred to in general by the reference numeral 20 consisting of upper and lower sections 22 and 24 removably secured together in any convenient manner such as by fasteners (not shown). The lower section 24 includes a mounting flange 26 which is secured to the mounting boss 16 in a conventional manner by means of fasteners 28 and the upper section 22 includes an air inlet neck 30 upon which a conventional air cleaner assembly referred to in general by the reference numeral 32 is mounted.

The body 20 defines a first air and fuel mixture passage 34 extending vertically therethrough whose upper inlet end 36 opens upwardly into the inlet neck 30 and whose outlet end 38 opens downwardly into the air and fuel passage 40 formed in the mounting boss portion 16 of the intake manifold 14.

A butterfly air valve plate 42 is mounted on a control shaft 44 journaled in the body 12. The plate 42 is supported from one end of the control shaft 44 which extends diametrically of the passage 34 and the other end of the

control shaft **44** extends outwardly from the body **20** and has a lever arm **46** secured thereto as well as a pair of parallel lever arms **48**.

The body **20** includes a hollow fuel chamber **50** through which the control shaft **44** extends and which has a flexible diaphragm **52** of resilient material therein dividing the chamber **50** into an upper section **54** and a lower section **56**. The lower section **56** is sealed and has any suitable atmosphere disposed therein.

The upper section **54** includes a fuel outlet opening **58** which opens into the upper section **54** at its inlet end and outwardly into the passage **34** at its outlet end. A tubular stationary sleeve **60** is secured in and extends transversely of the upper section **54** and has one end thereof registered with the fuel outlet opening **58**. In addition, a fuel jet shaft **62** is journaled from the body **20** and includes a hollow end portion rotatably received through the sleeve **60** and includes a hollow tapered or pointed end **64** which projects into the fuel outlet opening **58**. The end of the fuel jet shaft **62** remote from the pointed end **64** is rotatably received through the body **20** and includes an outer end portion having a lever arm **66** mounted thereon in vertical registry with and connected to the lever arm **46** through a connecting link **68** whose opposite ends are pivotally connected to the free ends of the lever arms **46** and **66**.

The fuel chamber **50** includes a fuel inlet opening **70** which is internally threaded and has one end of a fuel line **80** secured therein by means of a suitable fitting **82**. The fuel line **80** extends to a suitable source (not shown) of fuel and has a pump **84** disposed therein as well as a one-way check valve **86**. A bypass line **88** is provided and its inlet end is communicated with the line **80** downstream from the pump **84** and its outlet line is communicated with the line **80** upstream from the pump **84**. The bypass line **88** has a pressure release valve **90** disposed therein and is operative to recirculate liquid fuel back to the pump **84** in the event fuel pressure beyond a predetermined pressure is present in the line **80** downstream from the pump **84**.

The body **20** also defines an idle fuel chamber **92** on the side of the passage **34** remote from the chamber **50** and the chamber **92** has a diaphragm **94** similar to the diaphragm **52** disposed therein which divides the chamber **92** into an upper section **96** and a lower section **94**. The upper section **96** is sealed and filled with a suitable atmosphere and a fuel **98** has its inlet end communicated with the line **80** intermediate the inlet end of the bypass line **88** and the one-way check valve **86**. The outlet end of the line **98** opens into the lower section **94** of the chamber **92**.

The lower section **94** of the chamber **92** is communicated with the passage **34** through a fuel jet orifice element **100** with which an idle jet needle valve member **102** is operatively associated. The idle jet needle valve member **102** is threadedly supported from the body **20** and includes a pointed end **104** which may be moved into and out of seated engagement with the fuel jet orifice element **100** by rotation of the valve member **102** in the threaded bore **106** of the body **20** in which the valve member **102** is threadedly engaged.

A connecting fitting **108** is connected between the free ends of the lever arms **48** and one end of the core **110** of a Bowden cable assembly referred to in general by the reference numeral **112** is anchored through the connecting fitting **108** whereby longitudinal shifting of the core **110** will cause the lever arms **48**, the control shaft **44**, the lever arms **46** and **66** and the shaft **62** to oscillate.

With attention now invited more specifically to FIGS. 8–12 of the drawings it may be seen that the sleeve **60** has a longitudinally extending slot **114** formed in one wall portion thereof and that the slot **114** is of greater transverse width at its end remote from the pointed end **64** of the fuel jet shaft **62**. In addition, it may be seen from FIGS. 9–12 that the hollow end portion of the fuel jet shaft **62** includes a longitudinally extending slot **116** formed therein and which is of greater transverse dimension at its end adjacent the pointed end **64** of the fuel jet shaft **62**.

The fuel jet shaft **62** is rotatable relative to the sleeve **60** and the opening **116** may be moved into and out of selected registry with the opening **114** whereby the flow of fuel from the upper section **54** of the fuel chamber **52** into the interior of the hollow end of the fuel jet shaft **62** may be varied. The fuel within the chamber **50** is under pressure and substantially the same pressure is maintained within the hollow end of the fuel jet shaft **62** when the openings **114** and **116** are in partial registry with each other and therefore liquid fuel is sprayed outwardly through the small orifice **118** defined at the apex of the pointed end **64**. This liquid fuel is of course jetted into the passage **34** for mixture with the air entering the passage **34** from the air cleaner **32** before the air passes the plate **42**.

While the orifice **116** is obviously smaller than the effective cross-sectional areas of the registered portions of the openings **114** and **116** illustrated in FIGS. 9 and 10 of the drawings, the cross-sectional areas of the registered portions of the openings **114** and **116** does control the rate of fuel flow into the interior of the hollow end of the fuel jet shaft **62** and therefore variation in the registry of the openings **114** and **116** will change the amount of liquid fuel that is jetted outwardly from the interior of the pointed end **64** of the fuel jet shaft **62** into the passage **34**. Of course, the diaphragms **52** and **94** are provided to modulate any pulses in fuel pressure caused by the pump **84** and the valve member **102** may be adjusted as desired to provide the desired amount of fuel for idling purposes. Also, the one-way check valve **86** is provided to prevent fuel under pressure within the chamber **50** from flowing backward through the line **80**, into the line **98** and then into the chamber **92** when operation of the associated internal combustion engine is terminated.

What is claimed as new is as follows:

1. A charge forming device comprising a body defining a first air and fuel mixture passage extending therethrough and adapted to comprise a portion of the air and fuel intake passages of a combustion apparatus, said body including adjustable variable air valve means operatively associated with said passage for controlling the flow of air through said passage, a liquid fuel chamber supported from said body to one side of said passage and including a wall portion common with said passages, said chamber also including a fuel inlet and a second fuel outlet passage extending through said common wall portion and whose outlet end opens into said first passage, a metering sleeve disposed in said fuel chamber with one outlet end portion registered with an opening into the inlet end of said second passage, said sleeve having a first fuel metering opening formed through one wall thereof, a tubular fuel jet rotatably disposed in said sleeve and having a second fuel metering opening formed through one wall thereof and a first open end portion disposed in said one end portion, said first and second openings, upon rotation of said jet relative to said sleeve having different areas thereof in registry with each other to vary the effective cross-sectional area of the fuel passage defined thereby communicating said chamber with the interior of said jet, said jet including a hollow open-ended tapered outlet end portion extending through the outlet end portion of said sleeve and at least to the outlet end of said second passage for direct discharge of fuel therefrom directly into said first passage, said fuel chamber including an interiorly disposed fluid impervious flexible diaphragm constructed of resilient material dividing the interior of said chamber into at least two sections, said fuel inlet opening into and said sleeve being disposed in a first of said sections and the second of said sections being closed and having a compressible fluid disposed therein whereby said diaphragm and fluid will act to reduce pressure pulses of liquid fuel discharged into said first section.

2. The combination of claim **1** wherein said first and

second fuel metering opening are elongated and extend longitudinally of said sleeve and jet and include a first pair of remote end portions greater in transverse dimensions than the transverse dimensions of a second pair of remote end portions thereof.

3. The combination of claim 1 wherein said body includes a second fuel chamber including an inlet and a fuel outlet opening into said first passage, and an idle jet adjustably supported from said body and operatively associated with second chamber outlet for controlling the flow of fuel therethrough.

4. The combination of claim 1 including connecting means operatively connecting said adjustable variable air valve means to said rotatable fuel jet for rotation of the latter in response to adjustment of said variable air valve means.

5. The combination of claim 4 wherein said air valve means includes a butterfly plate disposed in said air and fuel mixture passage mounted on a control shaft journaled from said body and having one end portion disposed exteriorly of said body.

6. The combination of claim 5 wherein said connecting means comprises generally parallel laterally projecting lever arms carried by said control shaft and fuel jet

exteriorly of said body and a connecting link whose opposite ends are pivotally connected to the free ends of said lever arms.

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TIM R. MILES, Primary Examiner

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