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De Pontac

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[54] **CARBURETOR**

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[51] **Int. Cl.** **F02m 1/10**

[58] **Field of Search** ..... 261/50 A, 50 AA, 261/121 B

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Attorney—Irvin S. Thompson and Robert J. Patch

[57] **ABSTRACT**

A carburetor has a main throat, a separate constant level chamber for fuel, means to introduce liquid fuel into said constant level chamber, a separate injection chamber, a nozzle through which fuel passes from the constant level chamber to the injection chamber, a needle of variable cross section movable in that nozzle to vary the total cross section of said nozzle, and means by which the injection chamber communicates with the throat. A first lower cover plate has openings therethrough and a second upper cover plate has openings therein that communicate with the openings of the first cover plate. Some of the openings of the second cover plate are disposed in and extend laterally of the lower face thereof. An atmospheric pressure corrector is carried by the upper plate to open and close one of those openings according to atmospheric pressure. A fuel richness corrector operates through one of the openings to adjust the richness of the fuel mixture. An air inlet to the throat is formed on the second plate, and a control shutter is rotatably mounted in that inlet.

10 Claims, 8 Drawing Figures

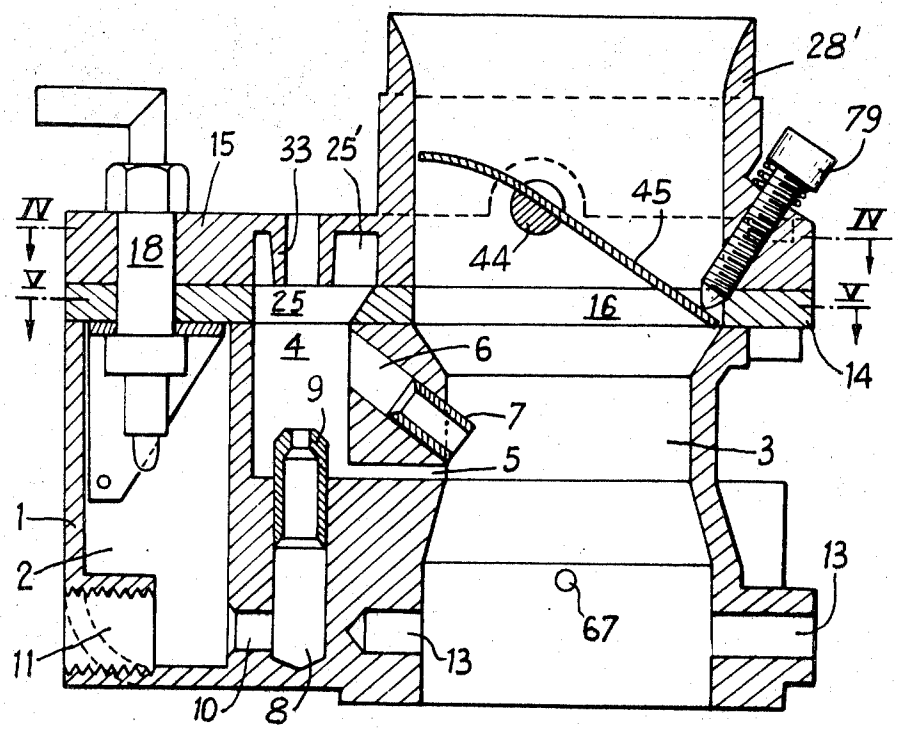
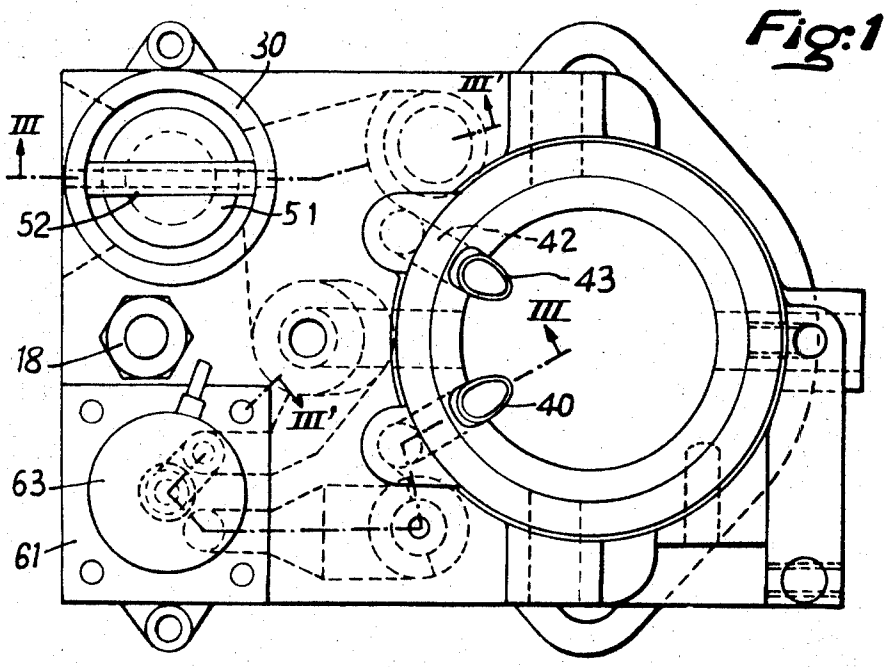


Fig:1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III'
III
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51
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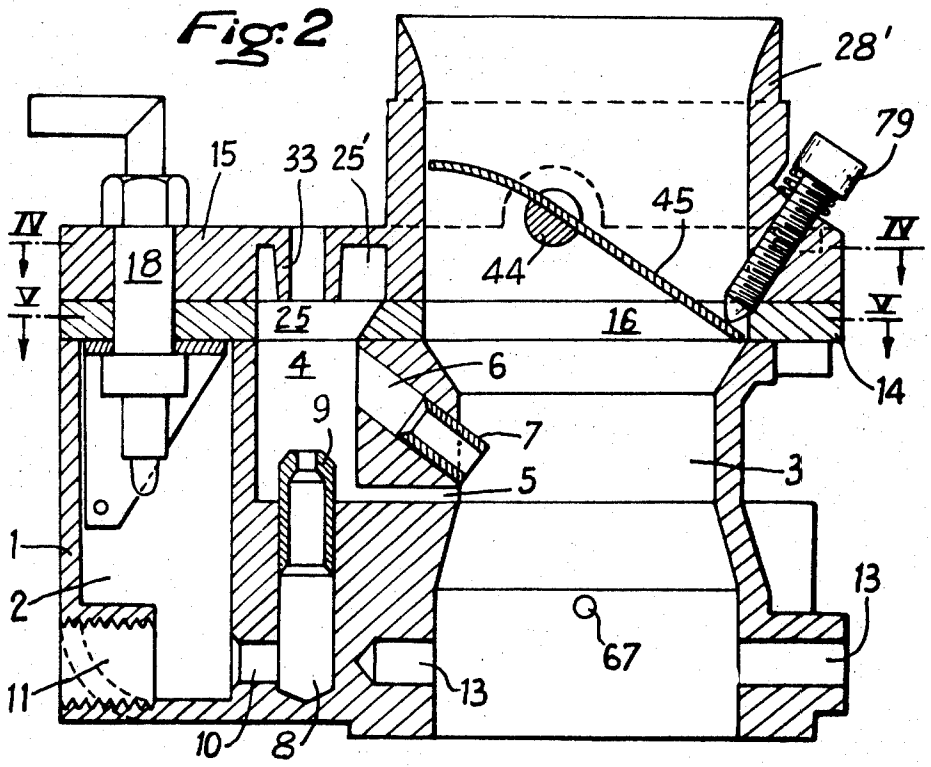
43
III
18
III'
40
63
61

Fig:2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79
15
33
25'
45
IV
18
44
IV
V
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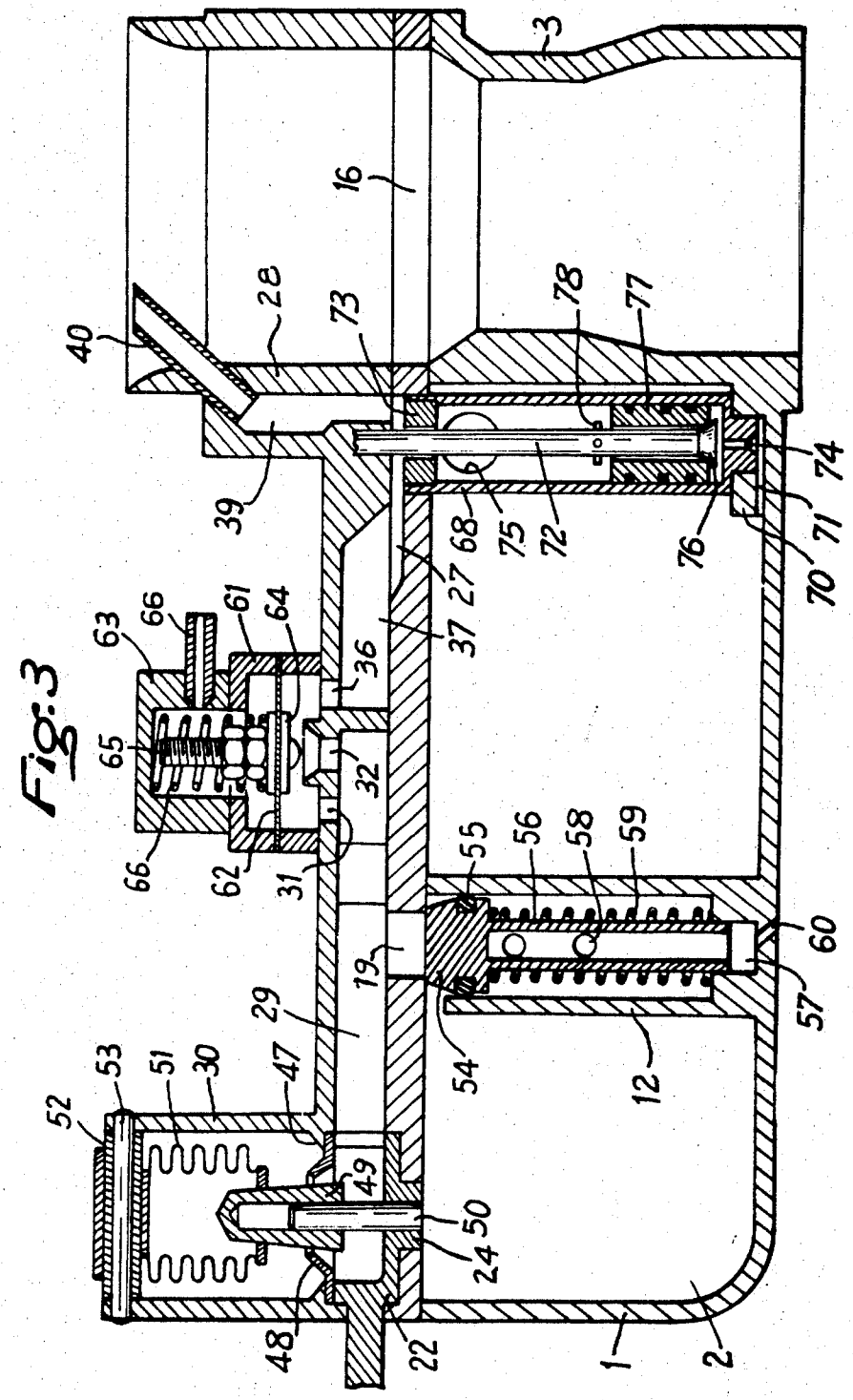
16
V
4
6
14
9
7
5
3
1
2
13
67
11
13
10
8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31
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59
60
57
19
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30
47
52
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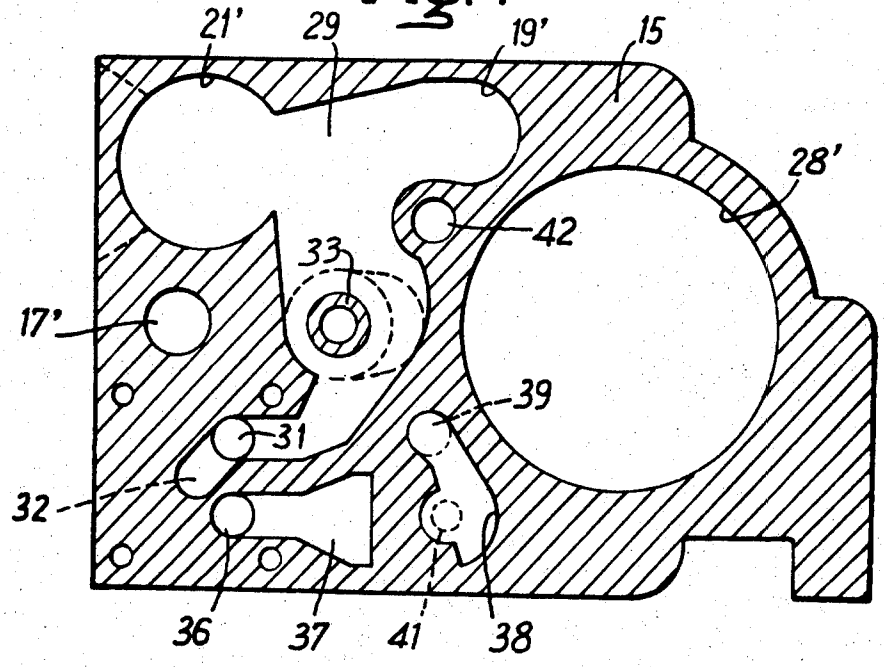
50
24
48
22
1
2

Fig. 3

Fig:4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17'
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36
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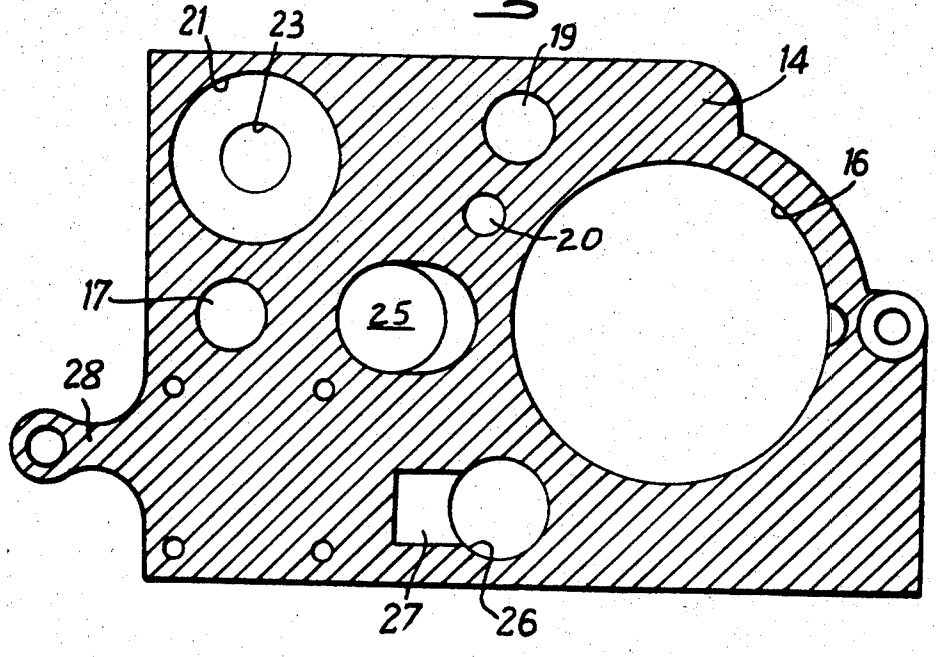
41
38

Fig:5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23
19
14
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17
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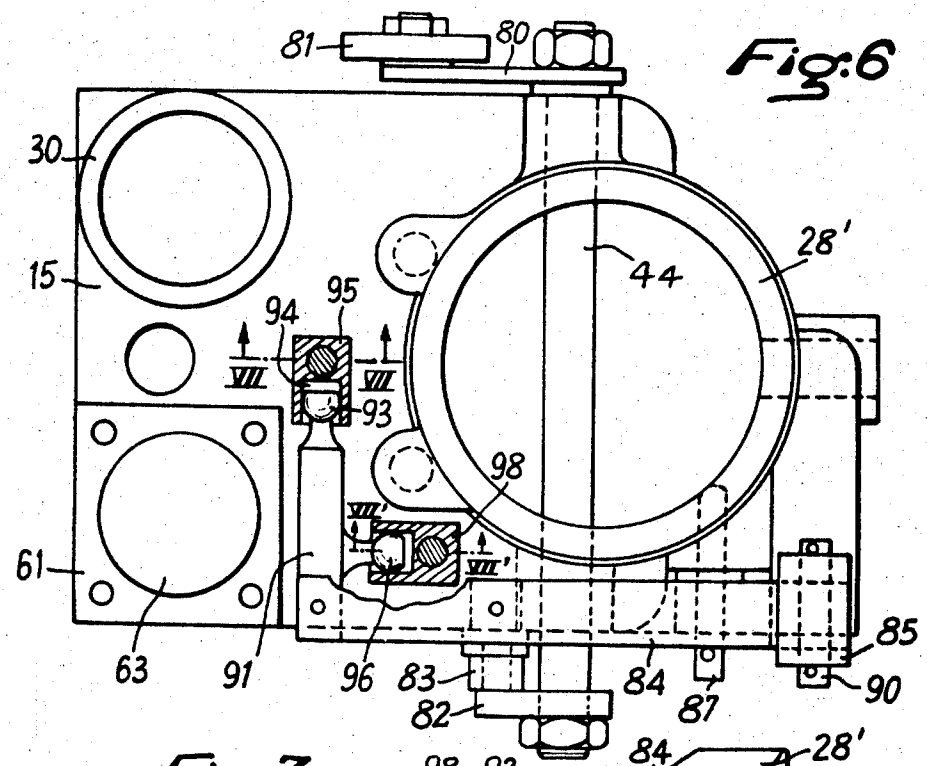
27
26

Fig:6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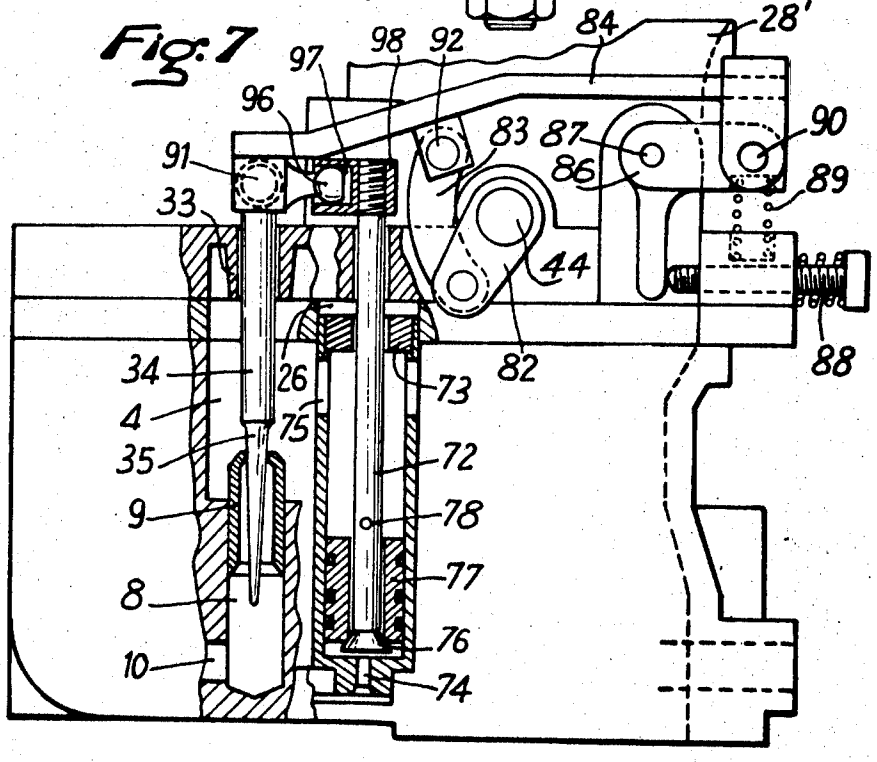
90

Fig:7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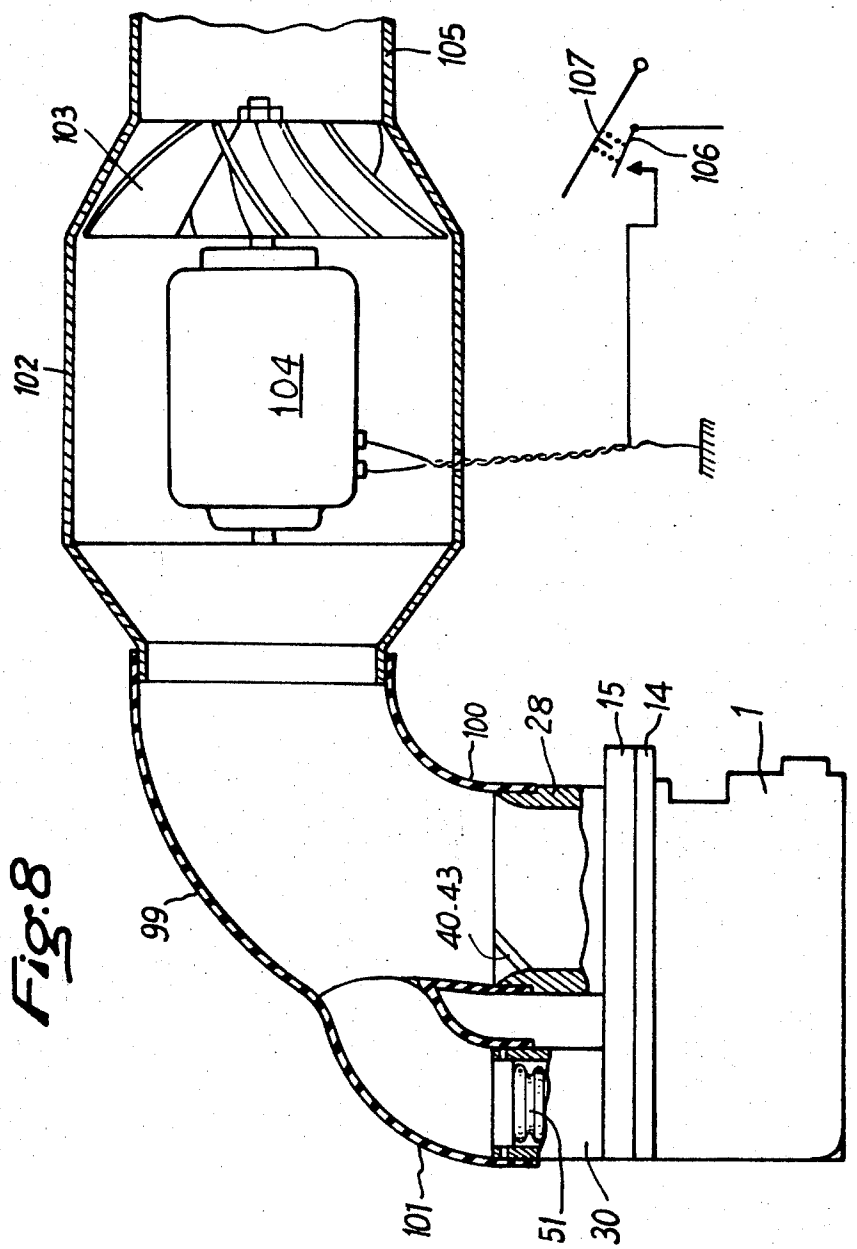

Fig. 8

CARBURETOR

The present invention relates to carburetors of the type in which fuel injection is performed in an injection chamber separate from the main body of the carburetor and is controlled by a needle of variable cross section displaceable in the orifice of a nozzle, the position of the needle being operated by a vacuum shutter disposed upstream of the control shutter in the main throat of the carburetor. In such a carburetor, the fuel metered by the position of the needle in the nozzle in the injection chamber in which an under pressure prevails which is intermediate the vacuum in the main body and atmospheric pressure, is injected in the throat by the air flow resulting from the vacuum prevailing in that throat. In such a carburetor the fuel flow is a function of the cross section of the passage left free by the needle and the difference in vacuum in the injection chamber and in the constant level chamber.

It has already been proposed to adjust the vacuum prevailing in the injection chamber as a function of the atmospheric pressure and of the temperature so as to regulate the fuel flow as a function of the density of the ambient air. It has also been proposed to regulate this vacuum to enrich the mixture upon demand and to make the mixture lean when the demand is low. Finally, it has been proposed to place the constant level chamber under vacuum momentarily so as to interrupt fuel flow without emptying the fuel lines.

However, the practical embodiment of such a carburetor is plagued with difficulties because of the necessary precision of such a carburetor and the many automatic controls of the vacuum prevailing in the injection chamber, that are necessary in order to achieve correct fuel injection.

The present invention has for its object to avoid these difficulties and to permit the production of a carburetor of the above type which, although of simple construction, nevertheless is characterized by durability and high precision.

These and other objects, features and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a plan view of a carburetor according to the invention;

FIG. 2 is a cross sectional view of the carburetor of FIG. 1;

FIG. 3 is a composite view on the interrupted lines III–III′ and III′–III in FIG. 1;

FIG. 4 is a cross sectional view on the line IV—IV of FIG. 2 and showing the upper cover plate;

FIG. 5 is a cross sectional view on the line V—V of FIG. 2 showing the lower cover plate;

FIG. 6 is a schematic plan view of the carburetor showing the needle control mechanism;

FIG. 7 is an elevational view in partial cross section on the lines VII—VII and VII′—VII′ of FIG. 6; and

FIG. 8 is a schematic view of the carburetor in combination with a compressor.

Referring now to the drawings in greater detail, there is shown a carburetor having a main body 1 in which is provided a constant level chamber 2, the principal air passageway 3 of the carburetor, the injection chamber 4 with a passageway 5 at its bottom for feeding fuel into the passageway 3 comprising the main throat of the carburetor, and in its lateral wall a passageway 6 terminating in a conduit 7 for conducting primary atomization air for the fuel jet and the passageway 8 through which the fuel passes to the lower pressure chamber through the nozzle 9, the passageway 8 being connected to the constant level chamber 2 by a passageway 10. The chamber 2 has a discharge passageway 11 coaxial with passageway 10, the passageway 11 permitting the calibration during manufacture of the nozzle 9 and its associated needle to be described.

The body 1 also has a cylindrical chamber 12 provided in the constant level chamber for the vacuum valve associated with the chamber 2, to be described hereafter, and an opening 13 extending through the body wall at the lower portion of air passageway 3 for diametrically mounting in the opening 13 the control butterfly valve of the carburetor, this butterfly valve being conventional and accordingly not being illustrated.

On the principal body of the carburetor are mounted a first cover plate 14 (FIG. 5) and a second cover plate 15 (FIG. 4).

The first cover plate 14 comprises an opening 16 corresponding to the principal air passageway, an opening 17 for the passage of conduit 18 for fuel fed to the constant level chamber 2, an opening 19 for ensuring the underpressure of the constant level chamber, an opening 20 comprising a part of the passageway through which the constant level chamber 2 is placed in communication with the passageway 3, a cylindrical recess 21 on its upper face for the control cylinder 22 for the mixture richness, the cylindrical recess 21 having an axial opening 23 through its bottom for the axial boss 24 of the cylinder, an opening 25 communicating between the vacuum injection chamber 4 and the control circuits for the vacuum, a cylindrical opening 26 for guiding the valve to be described later, this opening terminating on the upper face of the plate in a recess 27, and a lug 28 for securing the control of the richness control cylinder 22.

The second cover plate 15 is fixed to the intake 28′ of the carburetor, and has an opening 17′ for passage of the fuel intake tube 18, an opening 29 in its lower face which merges with a cylindrical recess 21′ in which the richness regulation cylinder 22 is received, the latter cylindrical recess communicating with a cylindrical tube 30 on the upper face of plate 15, this tube providing a housing for the atmospheric pressure corrector which will be described hereinafter, a recess 19′ to the right of opening 19 of the plate 14, two openings 31 and 32 which pass through plate 15 and open on the upper face thereof, the opening 32 terminating on the upper face in an enlargement providing a valve seat, and a recess 25′ corresponding to the opening 25 of the plate 14, the latter recess being traversed by an opening 33 for the shaft 34 of needle 35, an opening 36 communicating with a recess 37 on the lower face and a recess 38 which places the recess 26′ in communication with the recess 26, and a channel 39 traversing the body of the plate for connection to a tube 40 emptying into the inlet 28′ of the carburetor. In the body of plate 15 are also provided a vertical through opening 41, coaxial with the recess 26 of the cover plate 14, for the control rod 72 of the valve, a channel 42 ending in a tube 43 analogous to the tube 40 to place the recess 19′ in communication with the carburetor inlet, and a transverse through opening displaced from the axis of the inlet for

the reception of the axle **44** of the vacuum or automatic shutter **45.**

The two cover plates are secured together by the fuel intake tube **18** which locates them relative to each other and the plates are secured together and to the carburetor body in a known manner by assembly screws (not shown).

Turning now to FIG. **3**, the automatic control of the vacuum in the injection chamber **4** will now be described, comprising the recesses **29, 36** and **37** of the cover plate **15** and the recess **27** of the cover plate **14.** The first element in the circuit thus provided is the atmospheric pressure corrector mounted in the cylindrical tube **30** of the upper plate **15.** This corrector is coaxial with the richness control cylinder **22** mounted in the cylindrical chamber constituted by the recesses **21** and **21'** of the plates **14** and **15,** this cylinder being comprised by a wall of cylindrical section which may be displaced by an arm to close partially or completely when the engine is still cold, the passage between the recess **21'** and the recess **29,** that is, the first control circuit of the vacuum. Between the upper face of the cylinder **22** and a flange **47** provided on the lower portion of the tube **30** is mounted an interchangeable calibrated collar **48** with an opening with which a truncated conical core cooperates whose displacement is effected by a manometric enclosure. This core **49** is mounted for axial sliding movement on a rod **50** fixed to the axle **24** of the cylinder **22.** The manometric chamber is constituted by a flexible accordion membrane **51** full of air and closed at its two ends by plates of which one is fixed to the core **49** and the other is carried on a transverse diametral tube **52.** Tube **52** is slidably disposed on an axle **53** which diametrically traverses the upper part of the tubular housing **30.** According to the atmospheric pressure, the diaphragm **51** will elongate or contract to move the core **49** in the collar **48** thereby to adjust the cross sectional area of the air passage.

The vacuum valve for the constant level chamber, which is the valve that establishes the communication of that chamber through opening **19** with the opening **29,** is disposed in the cylindrical chamber **12.** It comprises a head **54** whose end face closes the opening **19** and an annular recess in its peripheral surface, a seal **55** being disposed in this recess. The head is guided by a tube **56** whose end slides in a cylindrical recess **57** of reduced diameter disposed in the bottom of the chamber. Openings **58** place the interior of the tube in communication with the surrounding chamber. A spring **59** urges the valve toward its seat, and a passageway **60** is connected to a point below the control shutter of the carburetor. During rapid deceleration, this vacuum is momentarily higher than that during acceleration and may be for example **65** cm. of mercury. This vacuum, transmitted to the interior of chamber **12,** exceeds the force of spring **59** and forces the valve **54** to open the opening **19,** which establishes in the constant level chamber a vacuum and reduces the flow of fuel with respect to deceleration while the needle **35** is in the corresponding deceleration position.

The economy valve controls communication between the openings **37** and **39** of the second circuit to the open air, by openings **31, 32** and **36.** It comprises a housing **61** secured to the upper face of the cover plate **15,** across which housing an elastic diaphragm **62** extends. Housing **61** has an opening in its upper face and is topped by a cover **63** providing a cylindrical chamber. At the center of the diaphragm **62** and coaxially with the orifice **32** is mounted a valve head **64** including a rod **65** that limits upward movement of the valve, and about rod **65** a calibrated spring **66** which acts downwardly in the cylindrical chamber of cover **63.** The side wall of cover **63** is provided with a connection for a tube which communicates with an orifice **67** (see FIG. **2**) in the body of the carburetor somewhat upstream of the principal shutter of the carburetor. It will be seen that communication between the upstream opening **37** and the lower opening **29** is established by the opening **36,** the chamber of housing **61** being disposed below the diaphragm and the openings **31** and **32,** the opening **32** being closable by the valve **64.** Spring **66** is calibrated so that normally, having regard for the vacuums prevailing in the two chambers of housing **61,** the valve **64** will bear against its seat to close orifice **32.** The cross section of the circuit that communicates with the open air is therefore limited to the section of the orifice **31,** which thus creates a higher vacuum in injection chamber **4** and therefore a higher rate of fuel flow. The vacuum prevailing to the right of the orifice **67** is equal to that prevailing in the body, this vacuum being small because the control shutter is closed or only slightly open. On the other hand, as soon as the edge of the shutter passes the orifice **67,** the vacuum becomes that prevailing below the control shutter, which is much higher and which decreases thereafter according to the opening of the control shutter. This vacuum, acting on the upper chamber of housing **61,** ensures that the orifice **32** will be open, corresponding to a reduced fuel flow, during normal operation and promotes fuel economy while it will be closed during deceleration and for full operation so as to increase the vacuum in the injection chamber **4.**

A second circuit connecting with the open air extends through the opening **37** of plate **15,** through opening **27** and cylindrical chamber **26** of the plate **14** and through passageway **39** of plate **15** to discharge through tube **40** into the entry end of the carburetor. In the cylindrical opening **26** is slidably guided the upper end of a cylindrical chamber **68** which is disposed in the constant level chamber **2.** The lower end of chamber **68** has a cylindrical projection which slides in an opening in a boss **70** at the bottom of the chamber, this opening communicating with the chamber **2** by a passageway **71.**

The cylindrical projection at the lower end of chamber **68** is axially pierced by a calibrated passageway **74** which places the lower part of chamber **68** in communication with the constant level chamber **2,** by passageway **71.** The chamber **68** receives the control rod **72** for the recovery valve, rod **72** sliding fluid tightly in plug **73** which closes the upper end of chamber **68.** Chamber **68** has near its upper end openings **75** by which the extremity of chamber **68** communicates with chamber **2.** The lower end of rod **72** has a conical bearing surface **76** and a piston **77** sliding in chamber **68** is freely mounted with play on rod **72** to be displaceable between the conical surface **76** and a stop pin **78.** It will be seen that if the rod **72** is drawn upward, the arrival of fuel in the lower chamber, below piston **77** bearing fluid tightly on conical surface **76,** on the chamber **68** is retarded by the passageway **74.** Chamber **68** is moved upward and will thus occupy all the opening **26,** thereby interrupting the second circuit to the outside

air while increasing the vacuum in the injection chamber 4. Chamber 68 returns downwardly as fuel enters the lower chamber by passageway 74. The descent of rod 72 is on the other hand unrestrained, the piston 77 rising from the cylindrical bearing surface 76, thereby establishing a passageway between the two chambers comprising the clearance between the internal bore of the piston 77 and the rod 72.

So that the valve assembly described above will fulfill its role of recovery valve, the rod 72 is mechanically coupled to the automatic shutter 45 and to the needle 35 in a manner that will be described hereinafter with reference to FIGS. 6 and 7 and also FIG. 2.

The vacuum or automatic shutter 45 is mounted on an axle 44 traversing the air intake 28 and eccentric by about 5 mm. with respect to the axis of the air passageway so that the respective surfaces of the shutter will be unequal. The small side of the shutter is curved and its edge forms an angle of 5° to 10° with a radius to the axis of the air passageway. The large side of the shutter is flat and forms an angle of about 25° to 30° with a radius to the axis of the air passageway. The axle 44 has, along the portion which supports the shutter, a half round cross section.

These novel characteristics of the shutter assure an opening as uniform as possible for the automatic shutter. In effect, during opening of the automatic shutter under the influence of the difference in surface of its two parts, air passing the large side of the shutter is not retarded by any constriction, the axle having the form of a half round. When the shutter is fully opened, the same is true of the air which passes the large side of the shutter but that which passes the other side is retarded twice, by the reduced passage between the edge of the small side of the shutter and the body of the carburetor, and by the reduced passage between the axle of the shutter and the body of the carburetor, which ensures a greater vacuum on the rear face of the large side of the shutter. The rest position of the automatic shutter 45 is regulated with the aid of a screw 29 which also permits a first regulation of the deceleration position of the needle 35 in the nozzle 9.

On the portion of axle 44 that is disposed outside the body of the carburetor is mounted a crank 80 having a counterweight 81. The angle of opening of the shutter being about 60°, the crank is so disposed that at rest it forms an angle of about 20° to the horizontal, whereby it will form an angle of about 80° when the shutter is fully opened. This arrangement permits varying progressively the return force of the automatic shutter and therefore the vacuum which prevails in the body of the carburetor. A second crank 82 is also mounted on the axle 44 and drives by means of a curved crank 83, the control arm 84 of the needle and of the recovery valve. At one of its ends, the arm 84 is mounted in a stirrup 85 pivoted to the end of one arm of a crank 86 which is rotatably mounted about a horizontal axle 87 fixed to the body of the carburetor. The other arm of the crank 86 is maintained in abutment against an adjustment screw 88 by a spring 89. Screw 88 permits, for a given position of the axle 44 and thus of the automatic shutter 45, to modify the height of the pivot 90 of the arm 84, and therefore the position of the needle 35 in the nozzle 9. The adjustment of the shaft 34 of needle 35 on the arm 84 is effected by means of a transverse arm 91 perpendicular to the arm 84 and located at the opposite end of stirrup 85 with respect to the pivot 92 of the crank 83 on the arm 84.

Arm 84 ends in a partial sphere 93 which is engaged in a cylindrical recess 94 of a member 95 threaded to the upper threaded end of the rod 34. This partial sphere, comprised by a sphere whose end has been cut off on a plane located from the diametral plane a distance equal to half the radius, may turn and slide in the cylindrical recess 94. The raising of the needle along a rectilinear axial path is thus possible despite the displacement along a circular arc of the partial sphere 93, the needle turning only about its own axis. The control rod 72 of the recovery valve is also secured to the arm 91 by means of a partial sphere 96 perpendicular to the arm which engages it in a recess 97 of a member 98 screwed to the screw-threaded end of the rod 72.

Needle 35, which has not been described in detail, has a decreasing cross section such that as a function of the degree of opening of the automatic shutter 45, that is to say of the vacuum prevailing in the body 3 and the vacuum that results in the injection chamber 4, the injection will always be optimal, specifically, corresponding to 15 parts by weight of air to one part by weight of fuel.

The above-described carburetor may be mounted in any known fashion, the air inlet 28 being connected to the air filter and the lower outlet of the carburetor to the admission conduit. At the same time, the carburetor is responsible for a pressure drop of about 50 g/cm², which makes the carburetor less able to fill the cylinders than would injection feed. To remedy this, the assembly may be used which is shown schematically in FIG. 8. This assembly comprises a flexible tube 99 subdivided into two branches 100 and 101 which are connected to the air inlet 28 of the carburetor and to the tube 30 of the atmospheric corrector. This tube 99 is connected to the housing 102 of a compressor comprised by a rotor 103 and a small electric motor 104, the inlet 105 of the compressor being connected to the usual air filter, not shown. The current supply to the electric motor 104 may be effected by means of a switch 106 which is closed when the accelerator peddle 107 is depressed to a certain extent. A lower pressure compressor compensates the loss due to the carburetor particularly at full throttle operation, and the motor can burn lead-free fuel if the compressor is activated only when the engine is running at high speed.

Although the present invention has been described and illustrated in connection with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

Having described my invention, I claim:

1. A carburetor having a main throat, a separate constant level chamber for fuel, means to introduce liquid fuel into said constant level chamber, a separate injection chamber, a nozzle through which fuel passes from said constant level chamber to said injection chamber, a needle of variable cross section movable in said nozzle to vary the total cross section of said nozzle, means by which said injection chamber communicates with said throat, a first lower cover plate having openings therethrough, a second upper cover plate having

openings therein that communicate with said openings of said first cover plate, some of said openings of said second cover plate being disposed in and extending laterally along the lower face of said second cover plate, an atmospheric pressure corrector carried by said upper plate to open and close one of said openings according to atmospheric pressure, a fuel richness corrector operable through one of said openings to adjust the richness of the fuel mixture, means operable through two of said openings to control the position of said needle in said nozzle, an air inlet to said throat formed on said second plate, and a control shutter rotatably mounted in said inlet.

2. A carburetor as claimed in claim **1**, said means to supply fuel to said constant level chamber comprising a fuel conduit that passes through and interconnects said two plates.

3. A carburetor as claimed in claim **1**, and means establishing a vacuum control means for the injection chamber, said vacuum control means comprising two fluid circuits in parallel, the first fluid circuit comprising an air inlet opening controlled by said atmospheric pressure corrector, a richness control cylinder for closing said first circuit to start the motor and for partially closing said first circuit when the motor is cold and an opening for communication between said first circuit and the constant level chamber, a valve for closing the last-named opening responsive to the vacuum prevailing in the carburetor, said second circuit comprising an air intake upstream of a vacuum shutter, a valve for temporarily closing said second circuit when the carburetor rapidly opens, and a passage controlled by an economizer valve responsive to vacuum in the throat immediately upstream of said shutter when said shutter is in a closed position.

4. A carburetor as claimed in claim **1**, said atmospheric corrector comprising a disc having a calibrated opening therethrough interchangeably mounted in an opening of the upper cover plate, a rod coaxial with the opening of the disc and carried by the lower cover plate, a cone slidably mounted on said rod, a manometric bellows to which said cone is secured, a sleeve secured to said bellows, and a shaft passing through said sleeve and secured at its ends to the walls of a tubular chamber that houses the bellows and that is secured to said upper cover plate.

5. A carburetor as claimed in claim **4**, said richness corrector comprising a cylinder mounted rotatably in a cylindrical chamber defined by recesses in said upper and lower cover plates below said atmospheric corrector, said calibrated disc being disposed between said cylinder and said upper cover plate, said rod being carried by said cylinder.

6. A carburetor as claimed in claim **3**, the valve which temporarily closes said second circuit comprising a rod secured to an arm that swings with said shutter, said rod passing fluid tightly through the upper cover plate and descending into a cylindrical chamber disposed in said constant level chamber, a piston on said rod that slides in said cylindrical chamber, said cylindrical chamber being closed at both ends but having a calibrated orifice at its lower end for the admission of fuel from the constant level chamber and having an opening through said cylindrical chamber that communicates between the constant level chamber and said cylindrical chamber above said piston.

7. A carburetor as claimed in claim **6**, said piston being mounted with clearance on said rod and bearing on a conical support surface at the lower end of the rod so as to comprise a one-way valve.

8. A carburetor as claimed in claim **7**, said rod and said needle being interconnected with said arm by means of cylindrical sleeves in which are rotatably and slidably disposed truncated spheres.

9. A carburetor as claimed in claim **1**, and a compressor for feeding compressed air both to said throat and to said atmospheric corrector.

10. A carburetor as claimed in claim **9**, and means actuating the compressor only at high speed operation of the motor to which the carburetor is attached.

* * * * *