Dec. 23, 1969 J. H. POHLMAN **3,485,483**

DOWNDRAFT CARBURETOR

Filed June 20, 1967 3 Sheets-Sheet 1

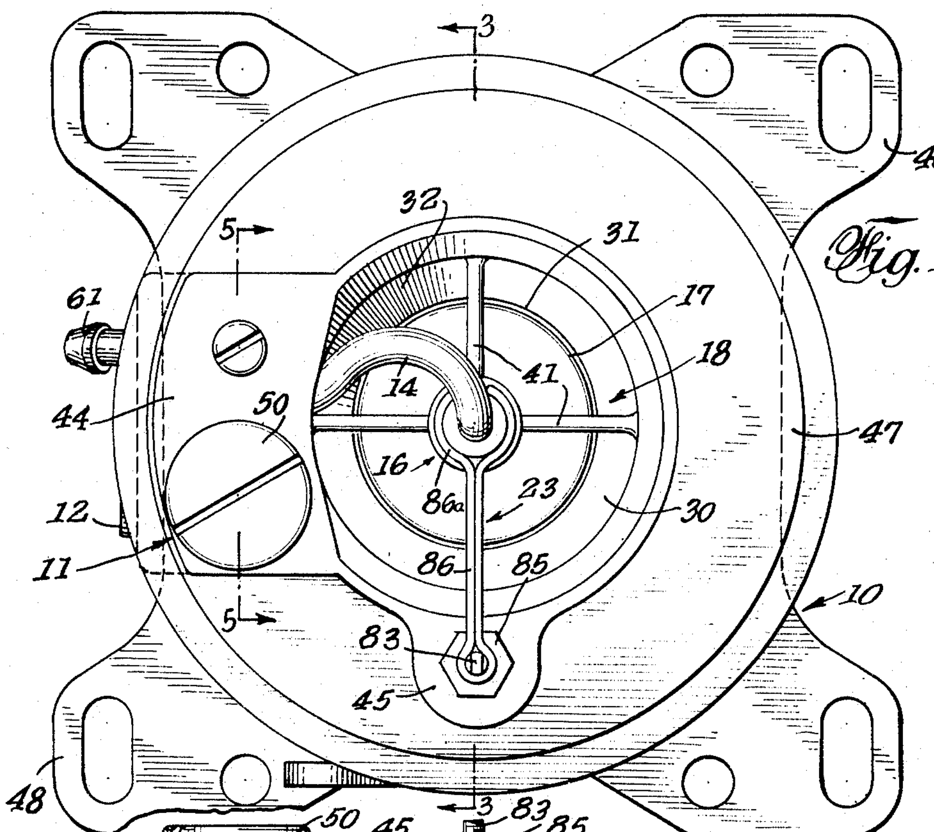


Fig. 1.

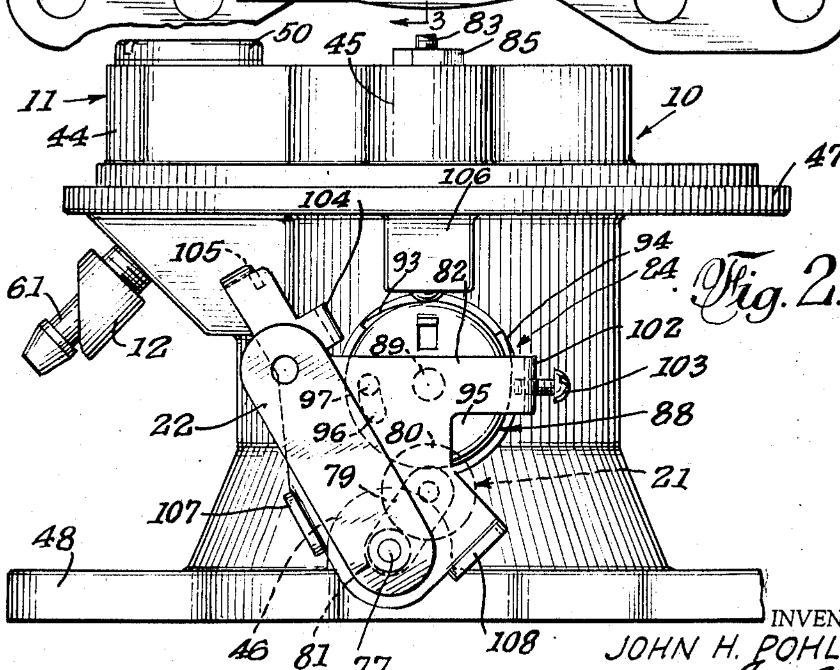


Fig. 2.

INVENTOR.
JOHN H. POHLMAN
BY C. G. Stratton
ATTORNEY

DOWNDRAFT CARBURETOR

Filed June 20, 1967 3 Sheets-Sheet 2

Fig. 3.

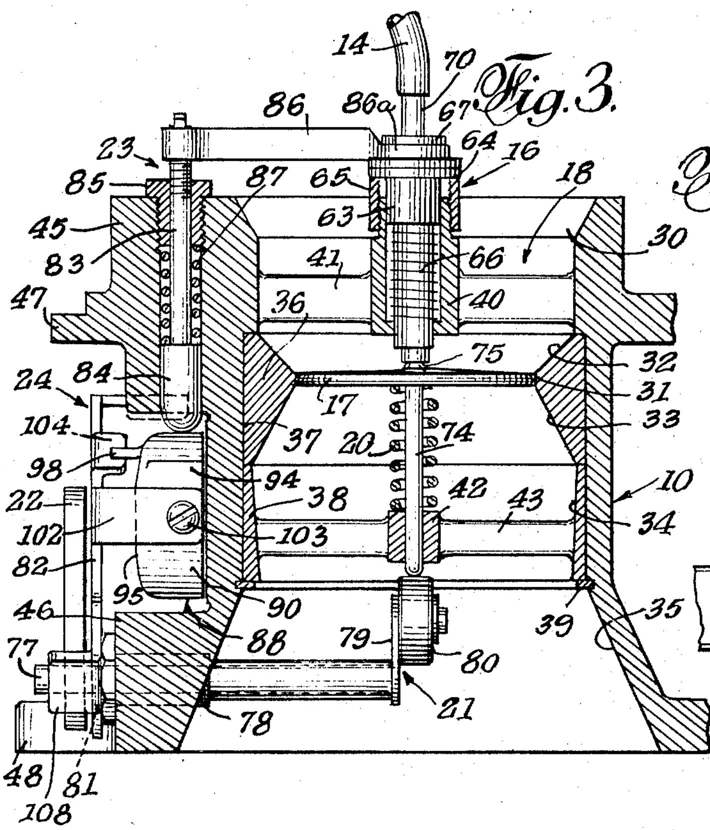


Fig. 4.

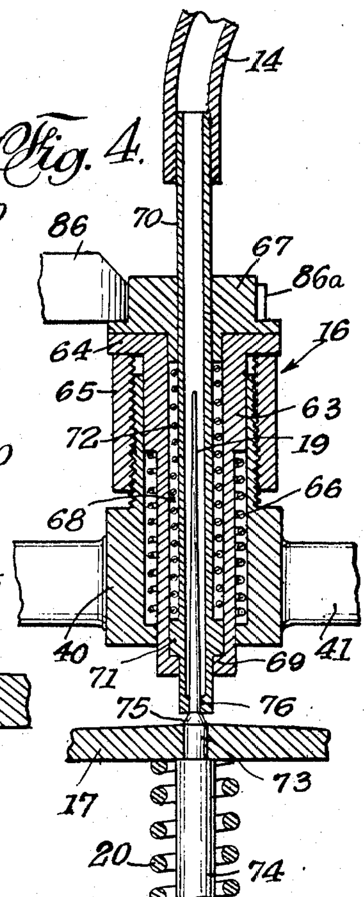


Fig. 5.

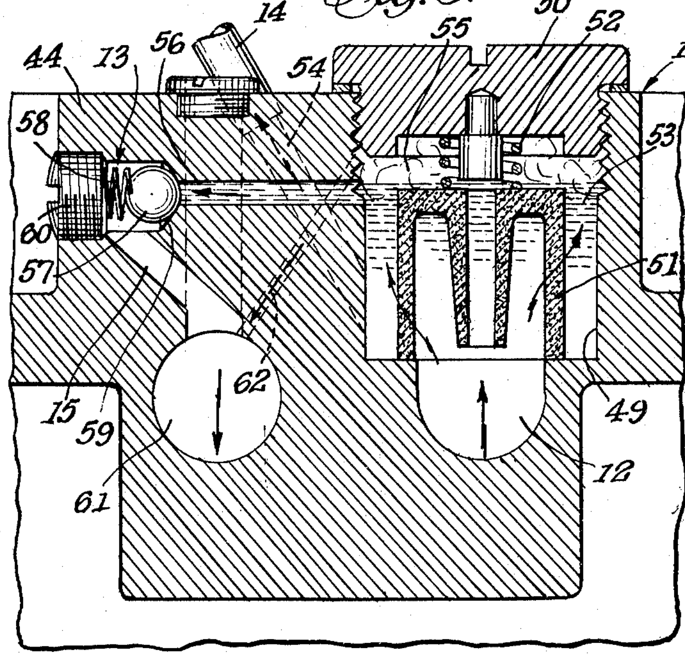
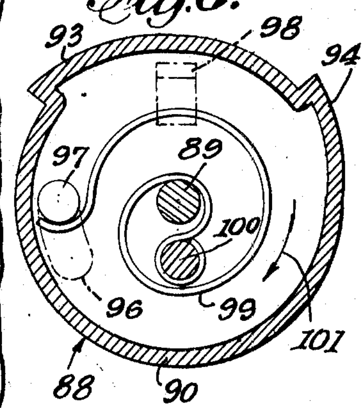


Fig. 6.



INVENTOR.
JOHN H. POHLMAN
BY C. G. Stratton
ATTORNEY

DOWNDRAFT CARBURETOR

Filed June 20, 1967 3 Sheets-Sheet 3

Fig. 8.

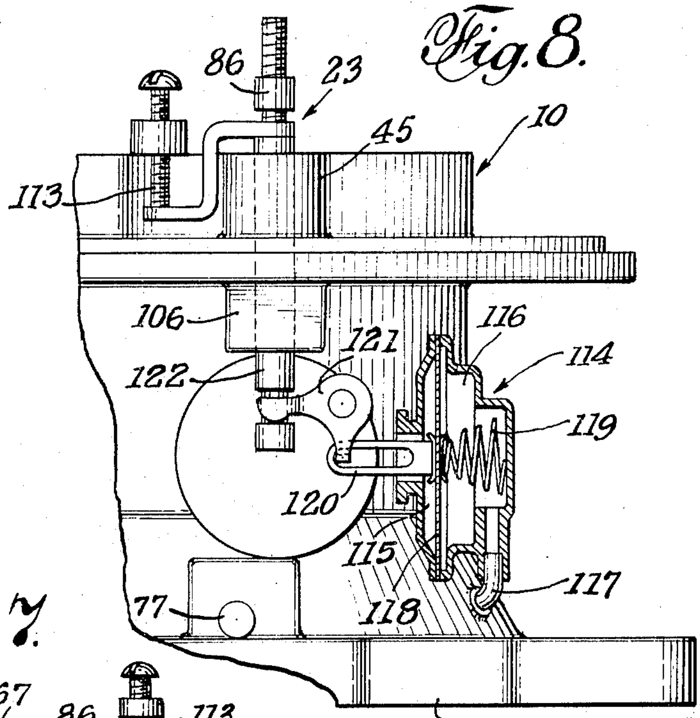
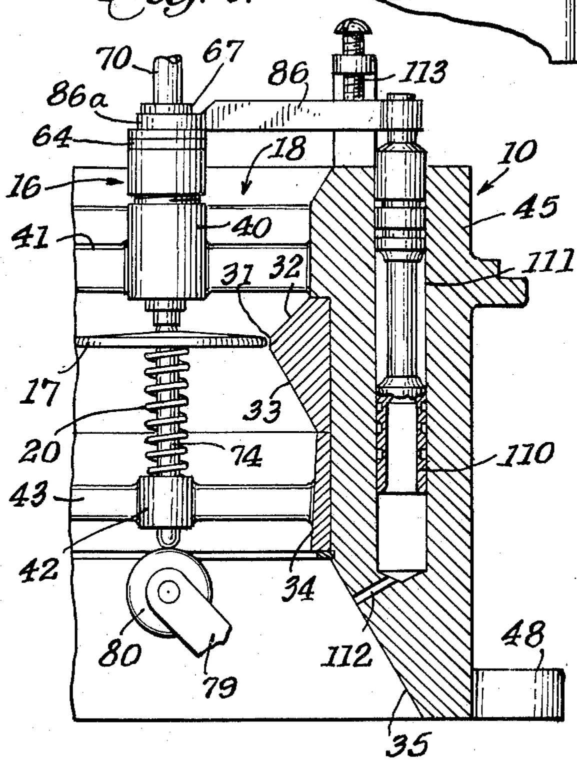


Fig. 7.



INVENTOR.
JOHN H. POHLMAN
BY C. G. Stratton
ATTORNEY

United States Patent Office

3,485,483
Patented Dec. 23, 1969

1

3,485,483

DOWNDRAFT CARBURETOR

John H. Pohlman, 3190 Elaine Way, Sparks, Nev. 89431

Filed June 20, 1967, Ser. No. 647,542
Int. Cl. F02m *1/10*
U.S. Cl. 261—39 3 Claims

ABSTRACT OF THE DISCLOSURE

A downdraft carburetor having a fuel inlet provided with a combined fuel filter and vapor separator, with means to return the vapors to the fuel tank, and embodying an integral pressure regulator so only liquid fuel at a predetermined pressure is fed to the carburetor; having either automatic cam, diaphragm or piston means, to provide increased fuel flow that increases idling speed, enriches the mixture under cold weather or other cold-starting conditions, and under throttle control; and having means to vent excessive pressures as caused by backfires and the like.

CROSS-REFERENCE TO RELATED APPLICATION

Reference is made to pending application Ser. No. 580,488, over which the present novel features are improvements.

BACKGROUND OF THE INVENTION

The present carburetor includes, as an integral part thereof, a combination fuel filter and vapor separator utilizing a means of returning vapor to the fuel tank, thereby feeding only filtered liquid fuel to the engine; an internal pressure regulator pre-set to a fixed and constant relief pressure with the excess being bypassed for return to the tank together with the gas vapors; an automatic mechanism acting to enable fuel enrichment when needed, as when the engine is cold, when the throttle is opened from the idling position of no throttle, and when faster idling speed is desired; and a valve assembly that yields to and vents backfire gases, thereby protecting the elements of the valve.

The invention has for an object to provide a carburetor embodying the above novel and automatic features.

This invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description, which is based on the accompanying drawings. However, said drawings merely show, and the following description merely describes, preferred embodiments of the present invention, which are given by way of illustration or example only.

SUMMARY OF THE INVENTION

The present carburetor, generally, comprises a housing **10** that is adapted to be connected at the top to an air intake and at the bottom to the suction or intake of an internal combustion engine, means **11** to filter liquid fuel, as gasoline, kerosene, etc., from an inlet **12** and to accumulate vapors of said fuel above the level of the filtered fuel, a pre-set pressure regulator **13** for maintaining predetermined pressure on said fuel so the outlet **14** for said fuel remains at a constant pressure, the regulator including a bypass **15** that opens under excess pressure to return excess fuel to the tank serving said engine with fuel, a metering valve assembly **16** to receive the flow from the outlet **14**, a fuel-metering disc **17** disposed in a through passage **18** and embodying a metering needle **19** that comprises part of the metering valve assembly **16**, a spring **20** to bias the disc **17** to valve-closing or nearly closed position, a position-limiting accelerator arm **21** controlled by a level **22**, which is connected to and controlled by the throttle or accelerator pedal of the vehicle on which the carburetor is provided, means **23** for resiliently retaining the valve assembly in normal flow-closing position, and means **24** to automatically increase metered flow of the valve under low-temperature conditions.

2

In the drawings, like reference characters designate similar parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a downdraft carburetor showing a preferred form of the invention.

FIG. 2 is a side elevational view thereof, as seen from the bottom of FIG. 1.

FIG. 3 is a vertical sectional view as taken on the line 3—3 of FIG. 1.

FIG. 4 is an enlarged vertical sectional view of the metering valve of the invention.

FIG. 5 is a similarly enlarged and broken vertical sectional view as taken on the plane of the line 5—5 of FIG. 1.

FIG. 6 is an enlarged vertical sectional view, on a plane parallel to that of FIG. 2, of the cam assembly of the invention.

FIG. 7 is a broken vertical sectional view showing a modified form of the invention.

FIG. 8 is a broken side elevational view, partly in section of another form of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred form shown in FIGS. 1 to 6, the housing **10** is formed with an air inlet passage **30** in its upper portion, with a restricted passage **31** defined by an inwardly and downwardly sloping face **32** above the passage **31**, a downwardly and outwardly sloping face **33** below said passage **31**, a generally cylindrical passage **34** below the face **33**, and a conically flaring passage enlargement **35** below the passage **34**. In practice, the passage **31** and faces **32** and **33** are formed on a ring member **36** fitted into an enlargement **37** of the passage **30**, and the face **34** is formed on a ring member **38** fitted in said passage enlargement below the ring member **36**, both ring members being retained in fixed position by a snap ring **39** engaged with the lower edge of the member **38**.

Said housing **10** is provided with a mounting hub **40** axially disposed in the passage **30** and connected to the housing by four spider arms **41**. In a similar manner, a boss **42** is coaxially held by spider arms **43** that extend from the ring member **38**. An outer enlargement **44** is provided on the upper end of the housing for the filter means **11**, inlet **12** and pressure regulator **13**, a boss **45** for guiding the means **23**, a boss **46** for bearing the arm **21** and lever **22**, a flange **47** for engagement with an air filter or a connection duct thereto, and mounting flanges **48** for connection to an intake manifold or a connection thereto.

The filter means **11** is housed in a chamber **49** formed in the enlargement **44** of the housing **10**, the same, at the bottom, being open to the inlet **12**, and closed at the top by a cap **50**. A filter unit, preferably of sintered bronze, **51** is disposed in said chamber and resiliently held by a spring **52** in position over the inlet **12** and with clearance between itself and the wall of said chamber **49** so a pool of fuel **53** may be accommodated between the filter and said chamber wall. An outlet passage **54** extends from the lower portion of the chamber through the top of the housing enlargement **44** and terminates in a flexible tube forming the outlet **14**. Said chamber **49**, between the cap **50** and the filter unit **51**, defines an upper space **55** for vapors released by the liquid fuel. An outlet passage **56** extends laterally from said upper space.

The regulator **13** is formed as check valve having a ball **57** biased by a spring **58** against a seat **59** in an enlargement of the passage **56**. Said spring **58** has a predetermined pressure on the ball as, for instance, four pounds, the same being maintained by a plug **60** backing up the spring. The passage **56** conducts the excess of fuel from the chamber **49** toward the return **61** to the tank, such return flow being had when the pressure in said chamber exceeds the relief pressure of the regulator **13**. Therefore, only fuel at the predetermined pressure will be conducted through the flexible tube **14**. Some of the vapor in the space **55** will exit by way of the passage **56**, but most of it will vent through a passage **62** for return through the outlet to the tank.

The metering valve assembly **16**, best shown in FIG. 4, is mounted on the hub **40**. The same comprises an outer tubular retainer **63** having an upper flange **64** and slidingly fitted in an axial through bore in said hub, a threadedly adjustable split spacer collar **65** supporting said retainer by its flange, and a compression spring **66** biasing the retainer in an upward direction. A cap member **67** closes the bore **68** of the retainer at the top, and an inwardly directed flange **69** on the lower end of the retainer forms a ledge at said end.

Said assembly **16** further comprises a fuel tube **70** that has an enlargement **71** that rests upon said ledge **69**, is slidingly fitted in axial bores in the retainer **63** and its cap member **67**, and a compression spring **72** around said tube that acts to exert a positioning bias of the tube enlargement **71** on the mentioned ledge. The upper end of said spring exerts an upward bias on the cap member **67**. The tube **70** is connected, by the tube **14**, to the outlet passage **54** from the fuel inlet chamber **49**.

The fuel-metering disc **17**, with but little clearance, is normally located in the restricted portion **31** of the through passage **18** in the housing **10**. Said disc is mounted on the reduced portion **73** of a stem **74** that is guided in the boss **42**, said stem being coaxial with the tube **70**. A conical upper extension **75** on the stem portion **73** is provided with the upwardly extending and tapered metering needle **19** which passes through a port **76** in the end of the tube **70**. The lower thicker end of the needle fits said port with minimal clearance—a matter of about .001 to .002 inch—so the tube **70** and needle **19** may move relatively vertically from said normal position of the disc **17**, as retained by the accelerator arm **21**. It will be clear that the passage formed between the needle and the port **76** increases in size as the disc **17** is moved in a direction away from the valve assembly **16**.

The arm **21** is carried on a pivot shaft **77** which is journaled in the support **78** that is threadedly engaged in the lower portion of the housing **10**. A lever **79** on the inner end of said shaft **77** is provided with a roller **80** that is aligned with the end of the stem **74**. A forward projection **81** is provided on the outer end of the support **78** and constitutes a stationary bearing for a striker member **82** that is a component of the cam assembly **24**. The lever **22** is mounted on and keyed to the outer end of the shaft **77** and, in typical manner, is connected to the accelerator or throttle pedal. Thus, the roller **80**, normally in raised position as shown, may be moved by action of said pedal to a lowered position to create a gap, between the stem **74** and itself, that varies according to the degree of pedal depression. Thus, as indicated, said lever **22** constitutes a variable-limit stop for the stem **74** and the needle **19** on the upper end thereof.

The means **23** is shown as a striker pin **83** that is vertically guided in the boss **45** and has a cam-follower end **84** that is downwardly directed. Said pin **83** extends upwardly through a guide nut **85** and has threaded engagement with one end of an arm **86**, the other end **86**a of which is clamped to the cap member **67**. A spring **87** around said pin **83** and between the end **84** thereof and the nut **85**, biases said end downwardly. The force of said spring is greater than that of the springs **66** and **72**, to normally retain the valve assembly **16** in the position of FIG. 4.

The means **24** is shown as a cam assembly comprising a cam **88** (FIGS. 2, 3 and 6) and the mentioned striker member **82**. Said cam **88** is rotationally mounted on a pivot **89** at the side of the housing to which the support **78** is secured, and the striker member is pivotally mounted on the mentioned end **81** of said support **78** to be positioned between the arm **22** and the cam **88**.

The cam **88** is formed as a shell having a peripheral wall **90** that is provided with arcuately spaced cam rises **93** and **94**. Said cam rises, in this case, are shown as circumferentially spaced 100°. The cam is positioned so the end **84** of the pin **83** rides the cam rise **93**. The front wall **95** of the cam is provided with a slot **96** through which a fixed stud **97** extends and which limits rotational movement of the cam according to the radial extent of said slot. Said wall **95** is also provided with an outwardly directed stop lug **98**.

A bimetallic spring **99** is housed within the hollow of the cam shell with one end thereof anchored, at **100**, to the cam wall **95** and the other end to the fixed stud **97**, the normal bias of said spring **99** being clockwise, as indicated by the arrow **101**.

The striker member **82** is provided with an ear **102** for an adjusting screw **103** engaged with the cam rise **94**, with an ear **104** for engaging the lug **98** after the cam has been rotated counterclockwise and moving the cam clockwise, a stop lug **105** to engage a boss **106** on the outside of the housing **10** to limit the acceleration movement of the striker member, and a pair of lugs **107** and **108** directed to have engagement with the opposite edges of the acceleration lever **22**.

OPERATION OF THE PREFERRED FORM

It is common practice to operate a typical fuel pump at six to ten p.s.i. The present regulator valve **13** has its spring **58** set to allow opening of the valve **13** at four p.s.i., safely below the low pressure level in the fuel line.

The fuel reaching the filter unit **51** is normally at six to ten p.s.i. and is forced through the porous mass of said filter at such pressure, the filtered fuel then filling chamber **49** to the level of the passage **56**. If the pressure in the chamber **49** exceeds four p.s.i., the valve **13** opens, allowing excess fuel to be bypassed back to the fuel tank by way of the outlet **61**. As before explained, any vapors entrained in the flow through the passage **56** will return to the fuel tank for re-condensation.

The vapors that are accumulated in the upper part **55** of chamber **49**, due to engine heat or other reason, are carried off by the passage **62**. While shown larger, said passage in practice is approximately .030″ to .050″. The passage **54** to the tube **14** supplies all the fuel necessary for carburetion, the same being free of vapors, either totally or to such degree as to obviate formation of a vapor lock in the fuel supply to the tube **14**.

Tube **14** discharges its fuel flow into the fuel tube **70**, the bottom of which is normally closed by the engagement between the upper, smaller end of the conical extension **75** and the lower edge of the port **76**. Thus, under forces from beneath, by a backfire, the disc **17**, receiving these forces through the conical extension **75**, urges the tube **70** upwardly against the bias of the spring **72** while the greater resistance of spring **87** retains the pin **83** in position to counter any forces tending to displace the retainer upwardly. Since a considerable annular space is developed between the edge of the disc **17** and the housing face **32**, the backfire gases and pressure are vented.

Twenty-five degree clockwise rotation of the cam member 88 (the limit of slot 96) causes the cam rise 93 to raise the pin 83, thereby actuating the orifice or valve assembly 16 upwardly to bring the port 76 opposite a smaller portion of the needle 19 to provide for an increase of fuel flow through said port. Said cam member 88 also moves clockwise 25° when urged by the throttle lever 22. This lever must be in full open position to so move the cam member, since it is at the time of full-open throttle that there is need for a richer mixture of fuel, thereby enabling the engine to provide a maximum response to the fuel supplied thereto. Such response is provided whenever the throttle is in "wide open" position.

At temperatures of 30° F. and lower, the bimetallic spring element 99 holds the cam member 88 in its maximum clockwise position, i.e., with the lower end of the slot 96 engaged with the pin 97, a position assumed by said cam member upon opening of the throttle. This position is maintained until the engine warms up, i.e., there is a temperature of at least 70° F. around the element 99. It is then that said element rotates the cam member 88 to maximum counter-clockwise position, thereby returning the same to normal position, as in FIGS. 2 and 6, thereby restoring the fuel flow through the port 76 to normal.

The ear 104 of the striker 82 engages the lug 98 to cause clockwise rotation of the cam member 88. This is caused by the arm 22 when the throttle is actuated, the lug 108 of the striker being engaged by said arm. During this action, by rotation of the shaft 77, the roller 80 is lowered. This lowering of the stop for the end of the stem 74 allows the disc 17 and the needle 19 to lower, thereby increasing the effective size of the port 76 and the rate of fuel feed for carburetion with air from above.

The lug 107, when engaged by the lever 22 on easing off on the throttle, returns the striker 82 to its retracted position, as in FIG. 2.

The adjusting stop screw 103 engages the cam rise 94, the adjustment allowing for control of idling speed. This cam rise operates in concert with the cam rise 93 to increase idling speed when the engine is operating under "cold" conditions.

In the modification of FIG. 7, a vacuum piston 110 is substituted for the member 83 of the preferred form and is nonadjustably affixed to the arm 86, the same being disposed in a cylinder 111 formed in the housing 10 and is open at its bottom, by a metered passageway 112, to the passage 18 below the disc 17 and, therefore, to engine vacuum in said passage 18. The passageway 112 affords a means for controlling access of vacuum to the bottom of the piston 110. Said vacuum acts against the bias of spring 66 of the valve assembly 16.

At partial throttle with the engine operating under moderate load, the engine vacuum will have a value sufficiently high to pull downwardly on the piston 110, arm 86, and assembly 63, 64 and 70 against the bias of spring 66, to cause a lean, cruising relationship between orifice 76 and needle 19. This provides an economical setting, as regards fuel consumption. Upon advance of the throttle under load increase, the vacuum will be lowered to a value that exerts a lesser downward force on the piston 110 and to a value lower than the force of the spring 66. Therefore, said spring will lift the orifice assembly to a fuel-enriching position by opening the orifice 76 for greater fuel flow into the air draft in the passage 18 of body 10.

An adjustable stop 113 is provided to arrest the upward movement of the mentioned assembly to a predetermined amount of travel, thereby placing a value in the extent of fuel enrichment.

In the modification of FIG. 8, a diaphragm assembly 114 is located on the outside of the housing 10, the same replacing the cam assembly 88 of the form of the invention, as in FIGS. 1 to 6. Said diaphragm assembly is shown as having an outer chamber 115 open to atmosphere, an inner chamber 116 open to engine vacuum through a tube 117 that leads to the passage 18 below the disc 17, a flexible membrane 118 separating said chambers. A balancing spring 119 in chamber 116 serves to resist atmospheric pressure on the outside of said diaphragm, thereby holding a slotted link 120 projected. A rock lever 121 has one arm engaged in the slot of link 120, the other arm engaged with the lower end of a pin 122 which is substituted for the member 83.

Engine-controlled vacuum in the chamber 116 lowers the pressure in said chamber allowing atmospheric pressure to overcome the bias of spring 119, thereby causing the membrane 118 to be drawn inwardly. The link 120 on said membrane moves inwardly rocking the lever 121 in a direction to pull downwardly on the pin 122, thus duplicating the function performed by the means of FIG. 7.

The combined forces of spring 66 and the spring 119, of FIG. 8, bear similar relationship to the greater cross-sectional area of the membrane 118 as does said spring 66 alone, in relation to the lesser cross-sectional area of the vacuum piston 110 of FIG. 7, the same being adjustable to function similarly under similar vacuum conditions.

In the form of FIG. 8, adjustability between the pin 122 and the arm 86 is desired, as before.

While the foregoing has illustrated and described what is now contemplated to be the best mode of carrying out the invention, the constructions are, of course, subject to modification without departing from the spirit and scope of the invention. Therefore, it is not desired to restrict the invention to the particular forms of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a downdraft carburetor having a housing with a vertical passage, with a disc mounted for vertical movement in said passage, and with a tapered needle extending upwardly from said disc,

(a) a valve assembly above and into which said needle extends and having a port controlled by said needle,

(b) means resiliently mounting said assembly for axial movement relative to the needle,

(c) means, including a flexible connection to the valve assembly and leading to said port, to conduit liquid fuel thereto for carburetion mixture with downdraft air in said passage,

(d) a combination fuel filter and vapor separator in the fuel line to the flexible connection and housed in said housing,

(e) means to bypass the vapors and to return the same to storage,

(f) the filter comprising:

(1) a chamber between the fuel inlet and the flexible connection with a passage from the bottom of said chamber to said connection,

(2) a sintered metal filter unit in said chamber, and

(3) means to resiliently hold said unit in the path of fuel flow into said chamber,

(4) a vapor-accumulating space being provided above said unit,

(g) a pre-set pressure regulator housed in said housing to relieve pressure in the flow to the flexible connection above the set pressure of the regulator,

(h) temperature-controlled cam means to shift the port of the resiliently-mounted valve assembly to change the effective size of the port as controlled by the needle, and

(i) a spring having a bias greater than and counter to the resilient mount of the valve assembly to retain the same in a position relative to the needle that closes the port to fuel flow.

2. In a downdraft carburetor according to claim **1**, said cam means comprising:

(a) a rotationally mounted cam having one cam rise to shift the mentioned port under temperature control, and a second cam rise to shift the port under throttle control,

(b) a striker operatively associated with said cam, and

(c) a throttle-controlled lever arm engaged with the striker to operate the same to return the cam to normal position after movement thereof to valve- and port-shifting position.

3. In a downdraft carburetor according to claim **2**:

(a) a member to limit the downward movement of the disc,

(b) said member being affixed to and movable with the throttle-controlled lever arm.

References Cited

UNITED STATES PATENTS

1,972,374	9/1934	Brannigan.	
2,646,265	7/1953	Bareham et al.	261—44 X
2,985,160	5/1961	Armstrong.	
2,988,345	6/1961	Kolbe et al.	
3,016,345	1/1962	Price.	
3,281,130	10/1966	Braun et al.	
3,285,585	11/1966	Mennesson.	
3,301,536	1/1967	Swatman et al.	261—44
3,330,542	7/1967	Taylor.	
3,336,014	8/1967	Shorrock	261—44 X

FOREIGN PATENTS

1,372,580	4/1964	France.

TIM R. MILES, Primary Examiner

U.S. Cl. X.R.

261—44, 50, 69