United States Patent

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[54] **AIR-FUEL METERING SYSTEM**
8 Claims, 13 Drawing Figs.

[52] U.S. Cl. .... 261/50 A, 261/36 A, 261/55
[51] Int. Cl. F02m 7/04
[50] Field of Search .... 261/1, 50.1, 44, 69, 36.1, 50 R, 55; 48/184

[56] **References Cited**

UNITED STATES PATENTS

1,013,214	1/1912	Noyles	48/184
1,312,468	8/1919	Barricklow	261/51
1,312,469	8/1919	Barricklow	261/51
1,809,387	6/1931	Melkman	261/50.1
2,122,705	7/1938	Welborne et al.	261/36.1 X
2,130,884	9/1938	Lafitte et al.	261/51
2,828,116	3/1958	Bascle, Jr.	261/44
3,224,425	12/1965	Arpaia	261/69 X
3,282,664	11/1966	Baverstock	261/69 X
912,998	2/1909	Eckert	261/50 (.1)

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ABSTRACT: The fuel discharge jet of a carburetor is supported by the lower end of a vertically adjustable fuel supply tube in which is affixed a cam contoured to cooperate with a member of a fuel valve actuator in a relation in which descent of the tube progressively widens the port area of the valve and increases the volumetric supply of fuel to the mixing chamber, which latter is contained within the confines of a cylindrical skirt, open at upper and lower ends, which skirt is part with a horizontal ring of a primary air valve, the ring adapted to close upwardly against a seat on the inside of the cover section incident to closing movement of the throttle valve which acts through spring tension means to elevate the fuel tube to fuel shutoff position and concurrently raise the ring of a secondary air valve into lifting position against the underside of the ring of the primary air valve achieving the closing of both rings together and the ring of the primary air valve against its seat and incidentally compress springs in the carburetor lid section which bias the primary valve to open position, the secondary air valve having a cylindrical skirt of greater diameter than the skirt of the primary valve and forming therewith a supplemental annular air channel open at its lower portion to the manifold and at its upper portion to throttle-controlled incoming air when the two rings are separated, there being spider arms affixed to the lower end of the fuel tube connected to the skirt of the secondary valve for lifting the secondary valve and subsequently entraining with the secondary valve the primary valve to close both valves when the throttle valve shall have been closed.

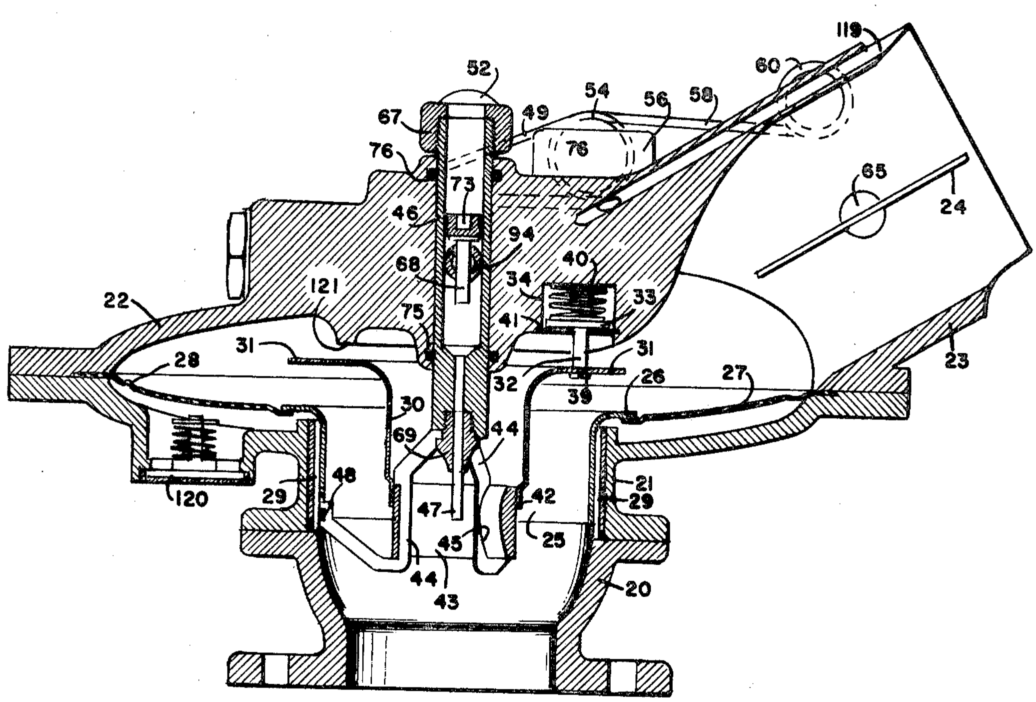

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FIG. 1

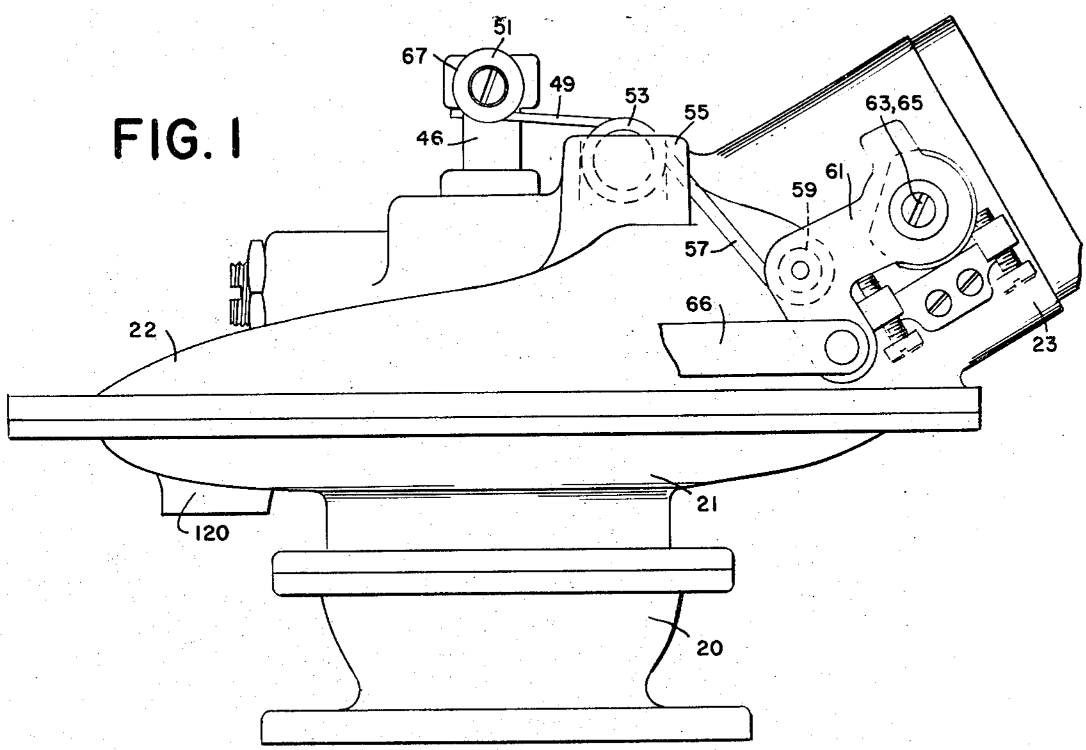
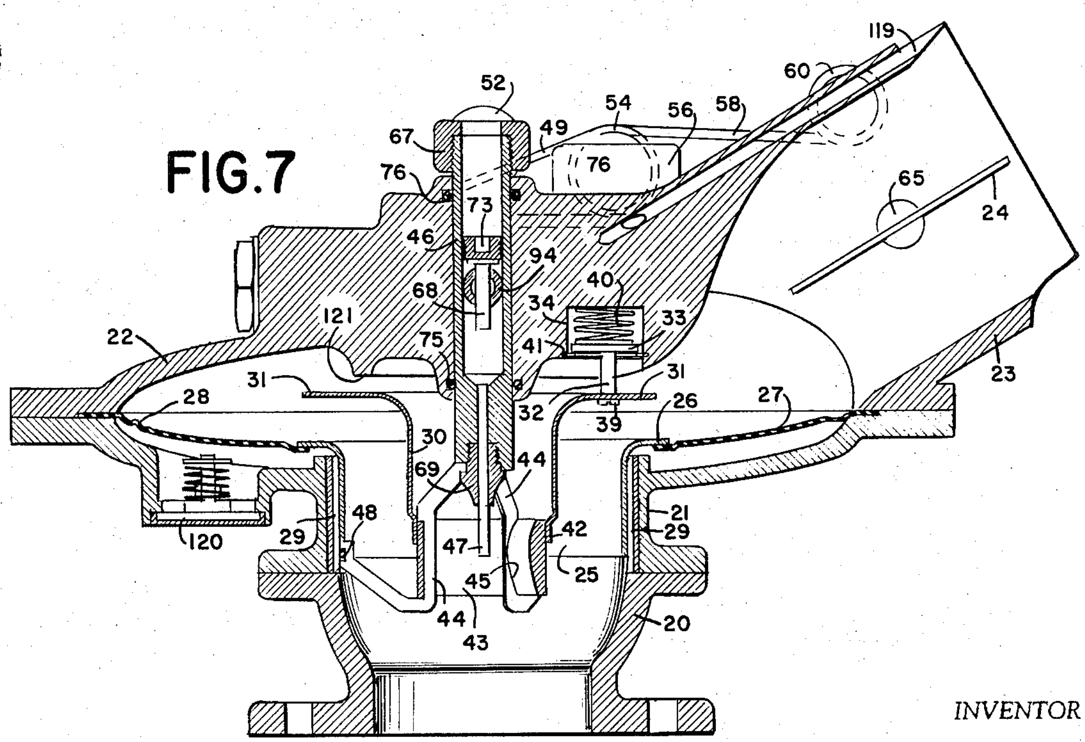


FIG. 7



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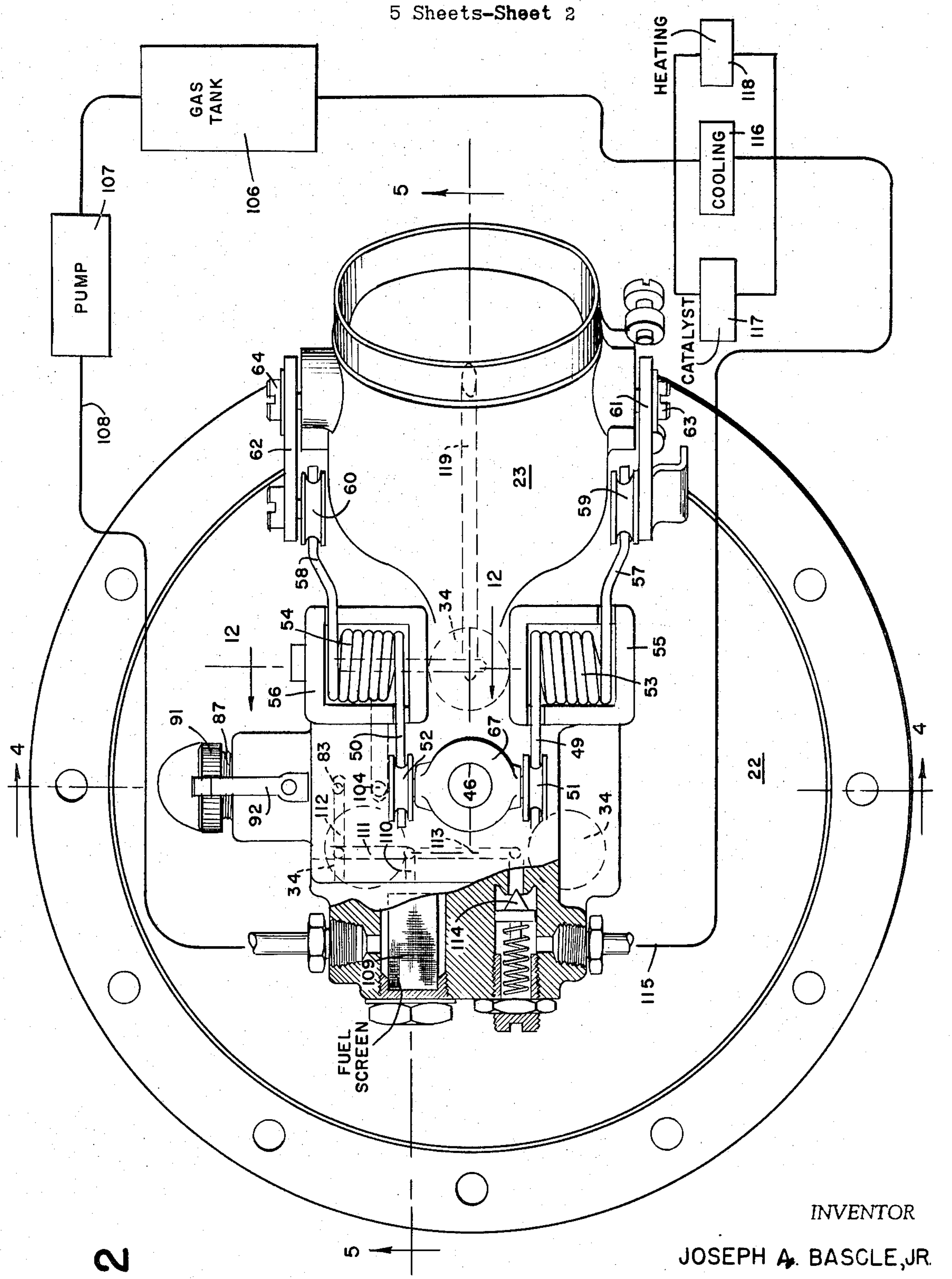

FIG. 2

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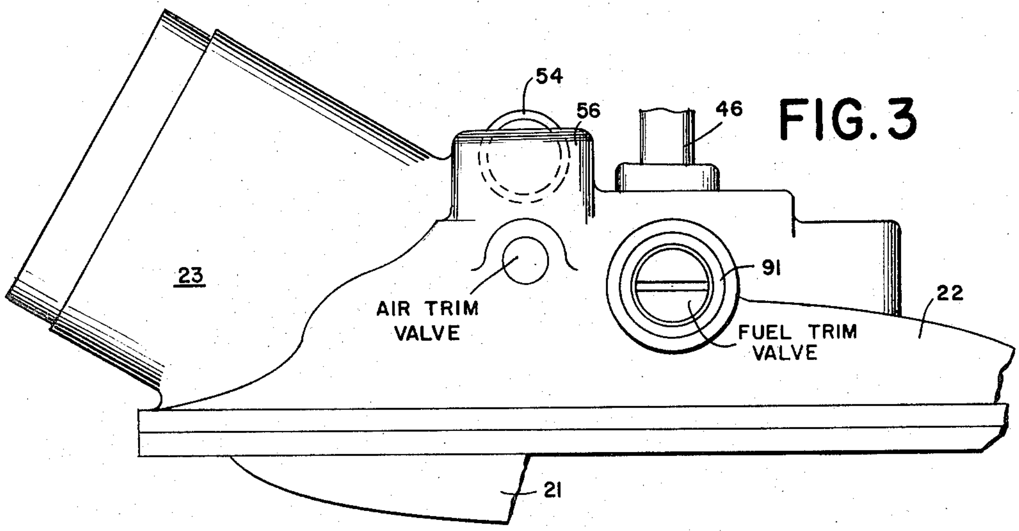

FIG. 3

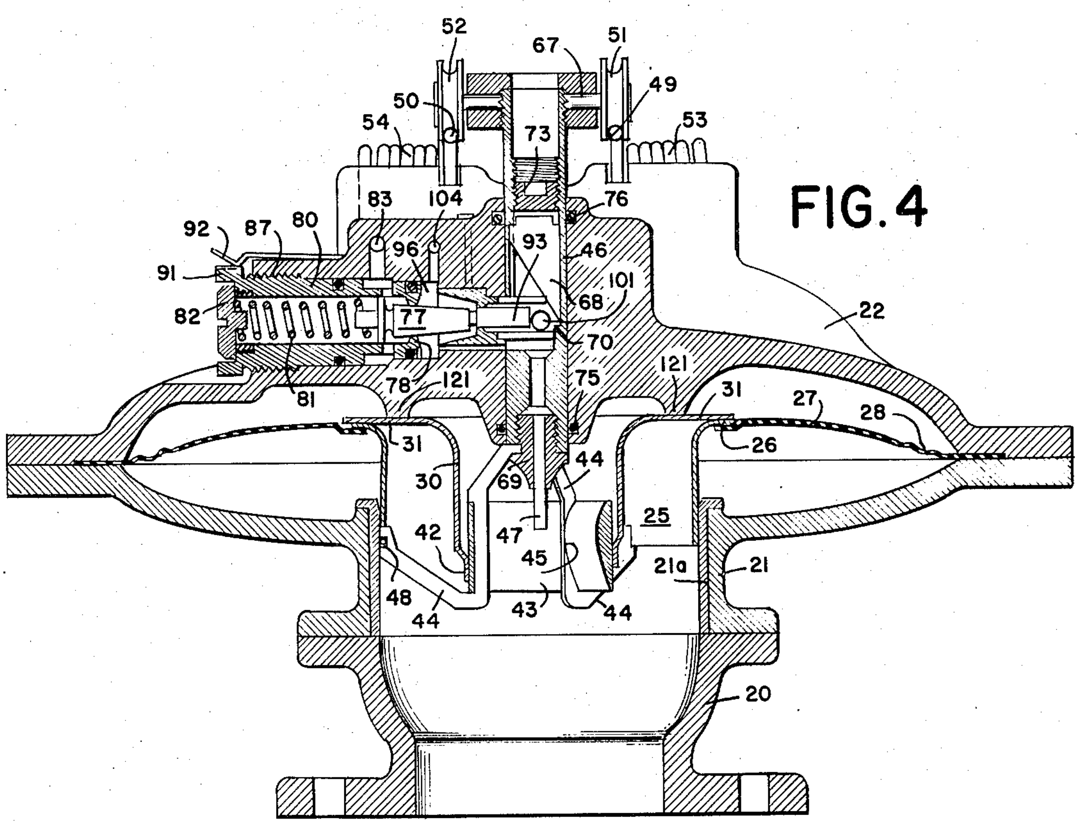

FIG. 4

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FIG. 5

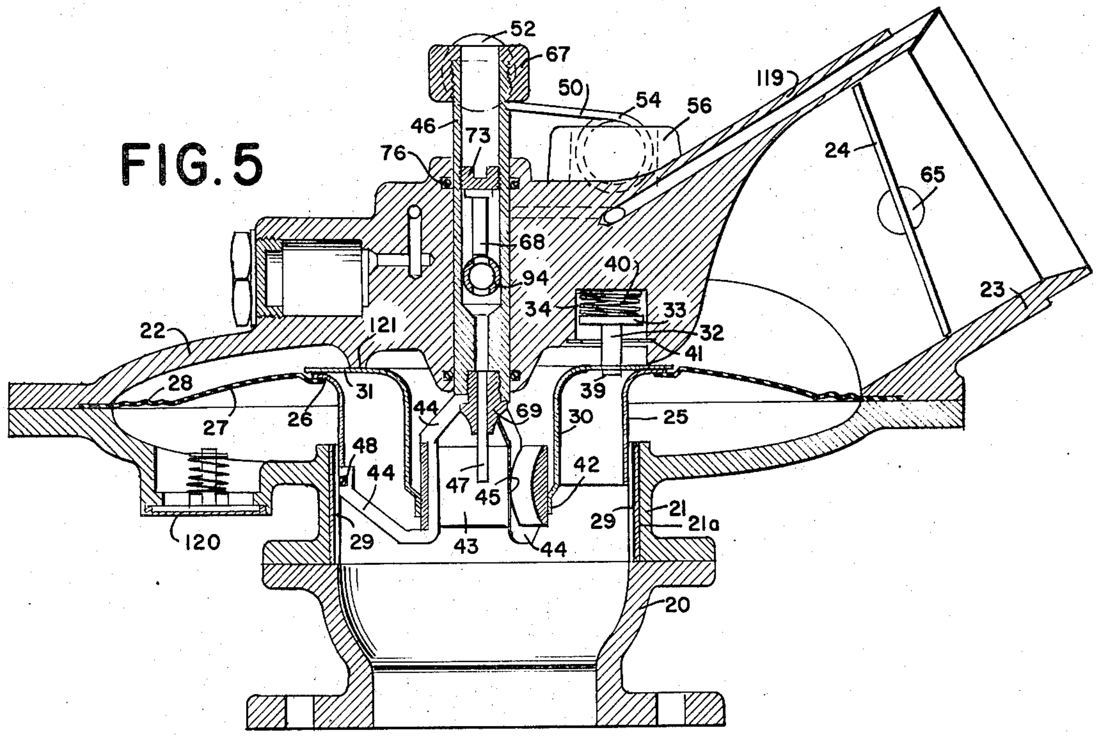
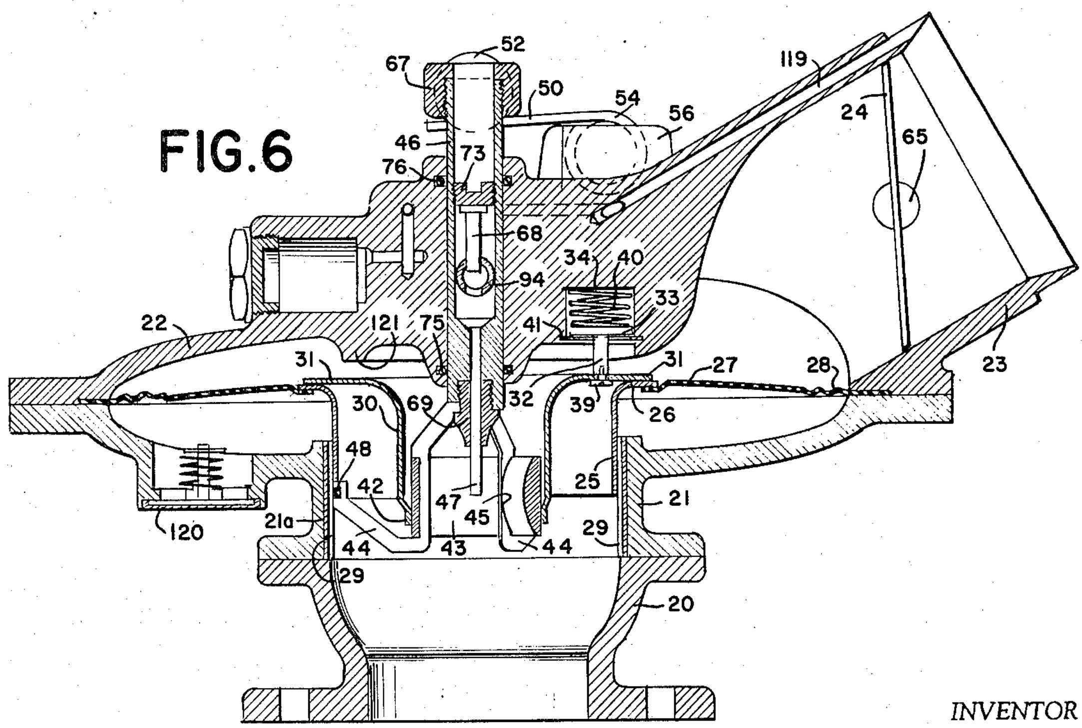


FIG. 6



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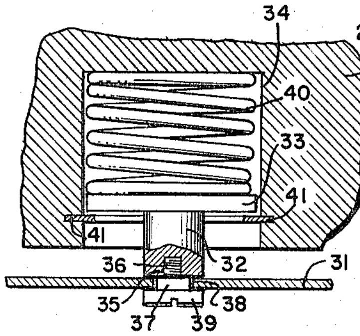


FIG.8

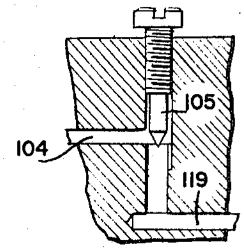


FIG.12

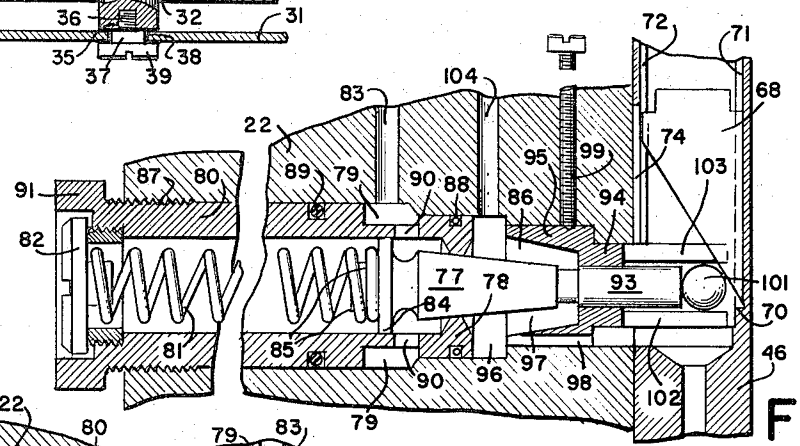


FIG.9

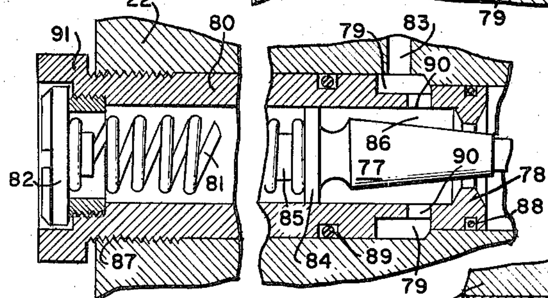


FIG.10

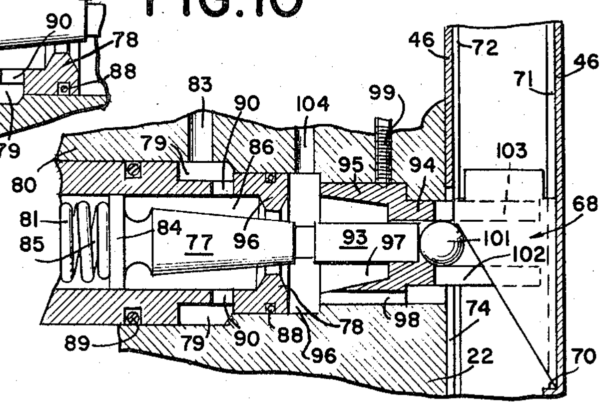
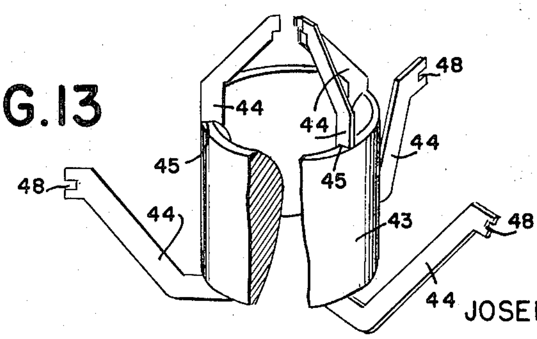


FIG.11

FIG.13



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AIR-FUEL METERING SYSTEM

The present invention relates to an Air-Fuel Metering system and a primary object of the invention is to eliminate all possible sources of overdosage of fuel components or evaporative escape of fuel elements to atmosphere directed to overcome air pollution in all systems and all receiving means relating to air pollution control or enforcement.

Another object of the invention is to provide an Air-Fuel Metering System of a minimum number of moving parts devoid of changeable elements and short life components.

A further object of the invention is to avoid employment of great numbers of small parts and complicated channels which in normal service are affected by wear and accumulations of carbon dust, and gum formations.

A still further object of the invention is to contain, regulate and condition the fuel at all times with respect to pressures, volume and temperatures for purposes conducive to maximum combustion efficiency.

With the foregoing and other objects in view, the invention will be more fully described hereinafter and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

FIG. 1 is a side elevational view of a form of Air-Fuel Metering System constructed according to the invention.

FIG. 2 is a top view thereof.

FIG. 3 is a side elevational view taken from the opposite side of FIG. 1.

FIG. 4 is a cross-sectional view taken on the line 4—4 of FIG. 2.

FIG. 5 is a longitudinal central sectional view taken on the line 5—5 of FIG. 2, showing the closed positions of both primary and secondary valves and the shut-off position of the fuel supply.

FIG. 6 is a similar view showing the fuel supply tube lowered to an initial degree and the primary valve moved to its full open position being arrested in downward movement by the spring plungers.

FIG. 7 is view like FIG. 5 with the fuel supply tube lowered and the secondary air valve opened to its full extent.

FIG. 8 is a vertical sectional view taken on an enlarged scale, illustrating one of the three spring-loading devices for biasing the primary valve to open position and limiting the degree of such opening movement.

FIG. 9 is an enlarged longitudinal sectional view through the fuel supply control valve showing the closed position of the valve with the fuel tube and cam in uppermost position.

FIG. 10 is a similar section with the septum forming the fuel port advanced slightly relatively to the conical valve to achieve enrichment of mixture on initial starting.

FIG. 11 is a similar section with the cam fully lowered and the fuel supply control valve fully open.

FIG. 12 is a cross-sectional view taken on line 12—12 in FIG. 2, showing partially the idling air channel with its corresponding adjusting valve.

FIG. 13 is a perspective view with parts broken away and shown in section of the venturi ring and associated spider arms.

Referring more particularly to the drawings 20, designates the lower attaching section of a carburetor body, 21 being the intermediate section and 22 the lid section, all bolted or otherwise connected together in accordance with customary practice.

The lower section 20 is attached to a manifold of an internal-combustion engine or other receiving means. The lid section is formed with the usual air intake horn 23 open to atmosphere and equipped with the conventional butterfly valve 24.

The cylindrical skirt 25 of a secondary air valve is slidably mounted in a cylindrical wall portion 21*a* of the intermediate body section 21 and such skirt has at its upper end an out-turned valve ring 26 connected to the inner circular edge of a flexible diaphragm 27, the outer circular edge of which is clamped between the attaching flanges of the intermediate and lid sections of the body. Included in the diaphragm 27 are corrugations 28 to compensate for the vertical movement of the skirt 25.

One or more slots 29, preferably two diametrically opposite slots, are made in the wall 21*a* opening through the inner face of the wall 21*a* to establish breathing communication between the space below the diaphragm 27 and the main internal channel of the carburetor.

Cooperating with the secondary air valve is a primary air valve comprising a cylindrical skirt 30 and an out-turned valve ring 31 at its upper end overlapping the valve ring 26 of the secondary valve. The skirts 25 and 30 are of substantially differing diameters to create therebetween an annular air passage.

Attached to the out-turned valve ring 31 of the primary air valve are plunger rods 32 projecting down from plungers 33 mounted for substantial vertical movement in cylinders 34 fixedly fitted in the carburetor body lid 22.

As shown more particularly in FIG. 8, the lower ends of the rods 32, abut the upper faces of the valve ring 31, and are provided with screw sockets 35 to receive the threaded shanks of screws 36 having smooth-surfaced shoulders 37 received in smooth bores 38 of the ring 31 and also having enlarged heads 39, taking against under surface of the primary valve ring 31. The plungers 33 are yieldably projected downwardly by coil springs 40, in the cylinders 34 to the limit allowed by removable snap rings 41. It has been found satisfactory to employ three of such spring devices located at substantially 120° locations about the circle of the primary air valve as indicated in FIG. 2 by the dotted circles.

The lower cylindrical end of the primary air valve skirt 30 has an inwardly offset edge portion 42 fitted to slide up and down on the smooth outer cylindrical surface of a venturi ring 43 and such venturi ring 43 likewise has independent relative vertical sliding movement on said edge portion 42 of the skirt 30.

The venturi ring 43 is supported for vertically adjusting movement by spider arms 44, three such arms being illustrated, such arms have vertical components fitted in substantially vertical slots 45 opening inwardly of the ring 43. The spider arms 44 have lateral components on which the venturi ring 43 rests, such lateral components extending radially and in an upward direction to the lower edge of the skirt 25 of the secondary valve whereby the venturi ring 43 and the secondary valve are entrained by the spider arms 44 to move up and down in unison.

Such spider arms 44, the venturi ring 43 and the skirt 30 are entrained to move up and down with a fuel supply tube 46 which has substantially vertical movement in the carburetor secton 22. The lower end of the tube 46 is threaded to receive a threaded plug 69 having a dependent fuel discharge nozzle 47 positioned with its discharge end within the restricted section of the venturi ring 43. The plug 69 is shouldered to receive and clamp to the lower end of the tube 46 the inturned upper ends of the spider arms 44 is shown in FIGS. 4, 5, 6, 7, and 13.

The fuel supply tube 46 is biased to the raised position of FIG. 5 by the elastic action of spring arms 49, and 50, engaging beneath spools 51 and 52 at opposite sides of upper portions of the tube 46, such arms 49 and 50 deriving elastic tension support form spring helices 53 and 54 occupying wells 55 and 56 mounted atop the lid section 22.

At opposite ends of the helices 53 and 54 similar spring arms 57 and 58 are entered beneath the spools 59 and 60 rotatably affixed to throttle-actuated arms 61 and 62 pivoted at 63 and 64 to the throttle shaft 65 mounted in the horn 23. In FIG. 1 is shown an accelerator connection 66 to the throttle-actuating arm 61.

The manner of affixing the spools 51 and 52 to the fuel supply tube may conveniently be by a collar 67 removably threaded to the upper end of the tube to which collar the spools are attached.

A cam 68 for operating a fuel supply to the tube 46 may be mounted to the tube in any suitable manner as by sliding the cam down into the open upper end of the tube in diametrically opposite grooves 71 and 72 made internally of the tube wall with the lower edge of the cam coming to rest upon a shoulder stop 70 formed by the termination of one of the grooves. A suitable internal section of the tube may be supplied with threads to receive an externally threaded plug 73 above the cam for maintaining the cam in proper location with its leading edge against the shoulder stop 70.

Opposite the slope of the cam 68 is a longitudinal slot 74 in the tube wall to permit the fuel tube 46 to move down relatively to a fuel induction assembly.

As shown in FIGS. 4, 5, 6 and 7 suitable packing or sealing rings for instance O-rings 75 and 76 are fitted about the vertically movable fuel supply tube 46.

Referring more particularly to FIGS. 9, 10 and 11 illustrating a fuel valve assembly, 77 designates a fuel inlet valve of conical section movable with respect to a fuel port in a septum 78, which is part of a hollow barrel 80. A bearing disc 84 is affixed to or made a part of a stub projection 85 extending outwardly of the large end of the conical valve 77, such disc 84 is spaced from the large rear end of the conical valve 77 to provide an annular fuel space 86 from which the incoming fuel has direct access to the valve port in the septum 78. The bearing disc 84 slides in the hollow barrel 80 and stabilizes the movement of the conical valve 77 from one end in its movement through the valve seat 78.

A coil spring 81 at its inner end abuts the bearing disc 84 and has adjacent end convolutions fitted about the stub projection 85.

The function of the spring 81 is to yieldably maintain the conical valve 77 in closed position at septum seat 78. The outer end of the coil spring 81 is engaged by a sealing cap 82, which is threaded into the outer end of the hollow barrel 80.

The hollow barrel 80 has external threads 87 taking into similar threads of the carburetor lid section 22 in harder to adjust the barrel 80 lengthwise for moving the septum seat 78 with respect to the conical valve 77, which permits an opening of the septum ports area without movement of the conical valve 77, whereby the septum port 78 may be opened without any direct movement of the conical valve 77. This action is useful in providing initial fuel mixture to the fuel supply tube 46 for starting purposes.

As best shown in FIGS. 9, 10 and 11, the annular fuel chamber 79 is supplied with fuel from an appropriate source through a supply passage 83 formed in the carburetor lid section 22 as shown in FIG. 4. The annular fuel chamber 79 is located between two sealing rings (O-rings) 88 and 89. As shown in FIG. 9 radial passages 90 connect the annular fuel chamber 79 and annular fuel space 86.

A knurled ring 91 is exposed at the outer end of the hollow barrel 80 for manual rotation of the barrel to adjust the septum port 78 with relation to the conical valve 77 and the adjustment may be secured by a spring catch 92 as shown in FIGS. 2 and 4.

A cylindrical pilot stem 93, as shown in FIGS. 9, 10 and 11 inclusive, Projecting from the small end of the conical valve 77 to stabilize the movements of the valve from the small end thereof has bearing in a cylindrical bearing sleeve 94 which is part of an enlarged annular section 95 spaced form the inner end of the hollow barrel 80 to provide an intermediate annular air-receiving channel 96 which communicates directly with an internal annular mixing chamber 97. In the lower portion of the enlarged annular section 95 is a through passage 98 setting up communication between the mixing chamber 96, 97 and the interior of the fuel supply tube 46. In FIG. 9 an anchoring setscrew 99 in the lid section 22 may be employed to position and stabilize the enlarged annular section 95. The section 94 extends crosswise into the fuel supply tube 46 through a longitudinal slot 74 in the adjacent wall which permits freedom of vertical movement of the fuel supply tube 46 relative to the cylindrical bearing sleeve 94.

Forwardly of the pilot stem 93 is a hardened pilot ball 101 which is engaged by the sloping surface of the cam member 68 which slides up and down through vertical slots 102 and 103 in the cylindrical bearing sleeve 94.

Referring to FIG. 4 the annular air receiving port 96 is shown as supplied with air from a conduit 104 made in the lid section 22 and controlled by an idling air trim valve 105 shown in FIG. 12. The origin of this air is from atmosphere through channel 119 bypassing the throttle as shown in FIGS. 2, 5, 6 and 7.

As 111 in FIG. 2 fuel is supplied form a source 106 under pressure by a fuel pump 107 through a supply line 108 to a screen-filtering chamber 109 and thence through passage 110, 111 and 112, and downward through fuel delivery passage 83 to the annular fuel chamber 79 (FIG. 9).

Reverting to FIG. 2, fuel passage 110 also connects with bypass 113 which communicates with pressure-relief valve 114 which opens under adjustable and predetermined spring tension to stabilize pressure and recirculate excess fuel through return line 115 back to source 106 through one of several selective fuel-conditioning devices or elements 116, 117, and 118.

In operation, FIGS. 1 and 5 show the position of the parts prior to starting the engine. The throttle valve is completely closed and as the spools 58 and 59 are in the lowermost position the spring helices 53 and 54 are wound to highest elastic tension thereby lifting the arms 49 and 50 to raise the fuel supply tube 46 to its highest position as indicated in FIG. 5 where both primary and secondary air valves are completely and the plungers 33 raised to their highest position.

In this raised position of the fuel supply tube 46 the cam 68 has been lifted to its highest position shown in FIGS. 4 and 9, and consequently the coil spring 81 has moved the fuel valve 77 to closed position.

FIG. 6 shows initial starting position of the parts including the throttle valve 24 slightly open whereupon engine suction asserts a downward pull upon both primary and secondary valve rings 31 and 26 opening the primary valve while the downward pressure of springs 40 initially keeps the secondary valve 26 closed so that incoming air from the horn 23 will pass across the primary valve ring 31 and enter central chamber circumscribed by the primary valve skirt 30 and through the venturi ring 43 drawing fuel from the nozzle 47 and thence passing downward into the manifold or receiving means. Concomitantly with the movement of said air valves the fuel supply tube 46 has been drawn down proportionately with its cam 68 operating to open the fuel valve 77, as shown in FIG. 11, thus furnishing a proportionate volume of fuel to the tube 46 and fuel nozzle 47.

As soon as the plungers 33 encounter the snap rings 41 the downward motion of the primary valve 30, 31 is arrested. However due to increased throttle opening and/or increased suction of the engine or receiving means the secondary valve 25, 26 will automatically continue in downward opening movement away from the primary valve ring 31 incident to positive pressure pulled down through the horn and negative pressure having access to the lower side of the ring 26 and its diaphragm 27 through the passages 29. FIG. 7 shows the fully open position of the secondary valve 25, 26. Thus a secondary annular channel circumscribed by the skirt 25 opens to open additional air to the space below the venturi ring 43. Such additional air is constantly being enriched by the continuing flow of air down through the space circumscribed by the primary valve skirt 30.

During this descent of the secondary valve 25, 26 the fuel supply tube 46 has been proportionately pulled down as shown in FIG. 7 in which figure the fully open position of all parts is shown. As the fuel tube 46 has further descended its cam 68 has moved down to further open the fuel valve 77, which latter valve is shown in FIG. 11 in its fully open position.

FIG. 7 shows in dotted lines the fully open position of the throttle valve 24 and the fully raised positions of the spools 59, 60, so that substantially all tension is relieved from the fuel supply tube 46. On closing of the throttle valve 24 these spools 59, 60, will be pulled down to the position of FIG. 5, thus lifting the fuel supply tube 46 to its highest position and raising therewith the spider arms 44, the venturi ring 43 and the secondary valve 25, 26 as the latter engages its ring 26 with the overlapping ring 31 of the primary valve, such primary valve will be closed and the parts restored automatically to the position of FIG. 6.

A safety or backfire relief valve 120 in the intermediate section 21 provides protection for the entire mechanism in the event of crossfiring.

Referring to FIG. 2, provision is made not only for recycling excess fuel back to the fuel supply source 106 through return conduit 115, but selectively the operator may subject such fuel to heating, cooling or treatment with a catalyst accordingly as the operation is preformed in cold or hot climates or requires catalyst reconstitution.

A valve seat 121 is provided projecting down from the ceiling of the cap section 22 into the air trunk in position to receive the ring section 31 of the primary valve in closed position. Such seat is shown in FIGS. 4, 5, 6 and 7.

Although I have disclosed herein the best form of the invention known to me at this time, I reserve the right to all such modifications and changes as may come within the scope of the following claims.

I claim:

1. In a fuel preparation system for internal-combustion engines,

a. a carburetor body having an air channel therethrough open at its lower portion for communication with the manifold of the engine,

b. a throttle-controlled air induction to an upper lateral portion of the air channel,

c. a lid enclosing the air channel,

d. an annular valve seat projecting downwardly from the lid into the air channel,

e. a primary air valve movable to and from the valve seat,

f. a secondary air valve underlapping an outer portion of the primary air valve,

g. spaced annular primary and secondary skirts depending from the primary and secondary air valves forming central and outer downdraft divisional air channels,

h. a fuel supply tube movable up and down in and through the lid with its lower open end entered in the central downdraft divisional air channel,

i. a venturi ring,

j. means for supporting the venturi ring for movement with the fuel supply tube with the upper end of the ring open to the central downdraft air channel, and

k means for entraining the secondary air valve to move up and down with the venturi ring and fuel supply tube to cause closing movement of the primary valve onto its seat by virtue of the underlapping entrainment when the venturi ring and fuel supply tube are in raised positions.

2. In a fuel preparation system for internal-combustion engines as claimed in claim 1 in which the annular lower edge of the primary skirt has close contact with the external surface of the venturi ring for preventing air in the central downdraft channel from bypassing the venturi ring and escaping into the outer downdraft air channel.

3. The combination of claim 2 in which the annular lower edge portion of the primary valve skirt is offset radially inward into air tight engagement with the external surface of the venturi ring but allowing free relative movement of the ring and primary valve and its skirt.

4. The combination of claim 1 in which elements *j* and *k* comprise

1. spider arms having vertical sections internally of the venturi ring, lower radial sections beneath the lower edge of the ring and continuing over to the lower end portion of the secondary valve skirt to which said arms are attached.

5. The combination of claim 1 further comprising 1. a fuel discharge nozzle projecting from the lower end of the fuel supply tube and into the central area of the venturi ring.

6. The combination of claim 1 further comprising

1. a normally closed fuel control valve mounted in the lid in close proximity to the air channel for substantially horizontal movement,

m. a pilot valve extension on the fuel control valve projecting into the fuel supply tube, and

n. means in the fuel supply tube movable up and down with the tube positioned to react with the pilot valve incident to descending movement of the fuel supply tube.

7. The combination as claimed in claim 6 further comprising

o. means biasing the fuel supply tube to raised fuel-cutoff position, and

p. means for lowering the fuel supply tube to open the fuel control valve and open the secondary air valve and remove the restraint to opening of the primary air valve.

8. The combination as claimed in claim 7 further comprising

g. means biasing the primary air valve to open position whereby same may open and permit air to enter the central divisional channel when the fuel supply tube is in the lower position.

* * * * *