Sept. 29, 1953 O. R. CEDARHOLM 2,653,804

FUEL METERING CONTROL FOR INJECTION CARBURETORS

Filed April 21, 1952 2 Sheets-Sheet 1

Fig. 1.

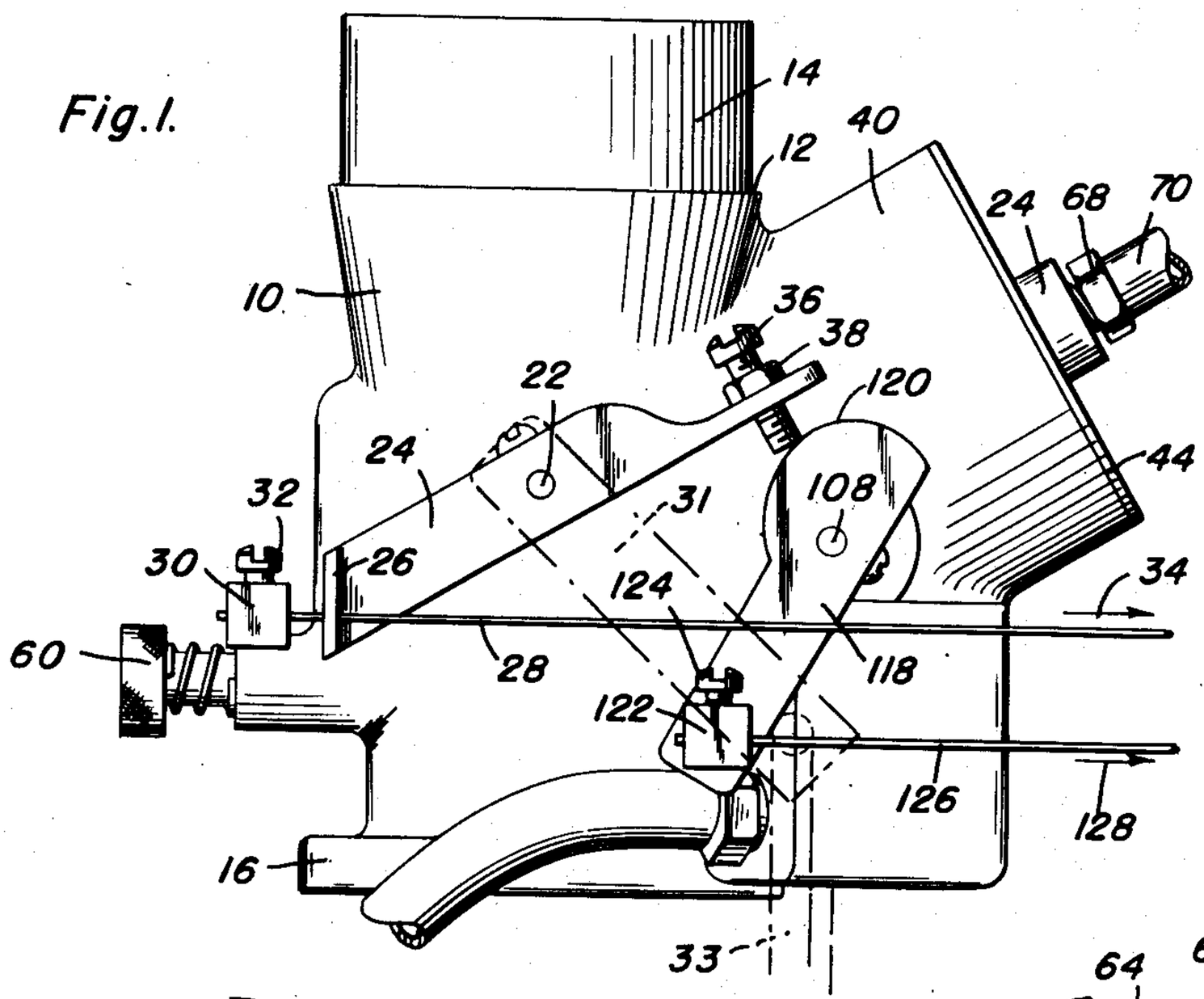


Fig. 3.

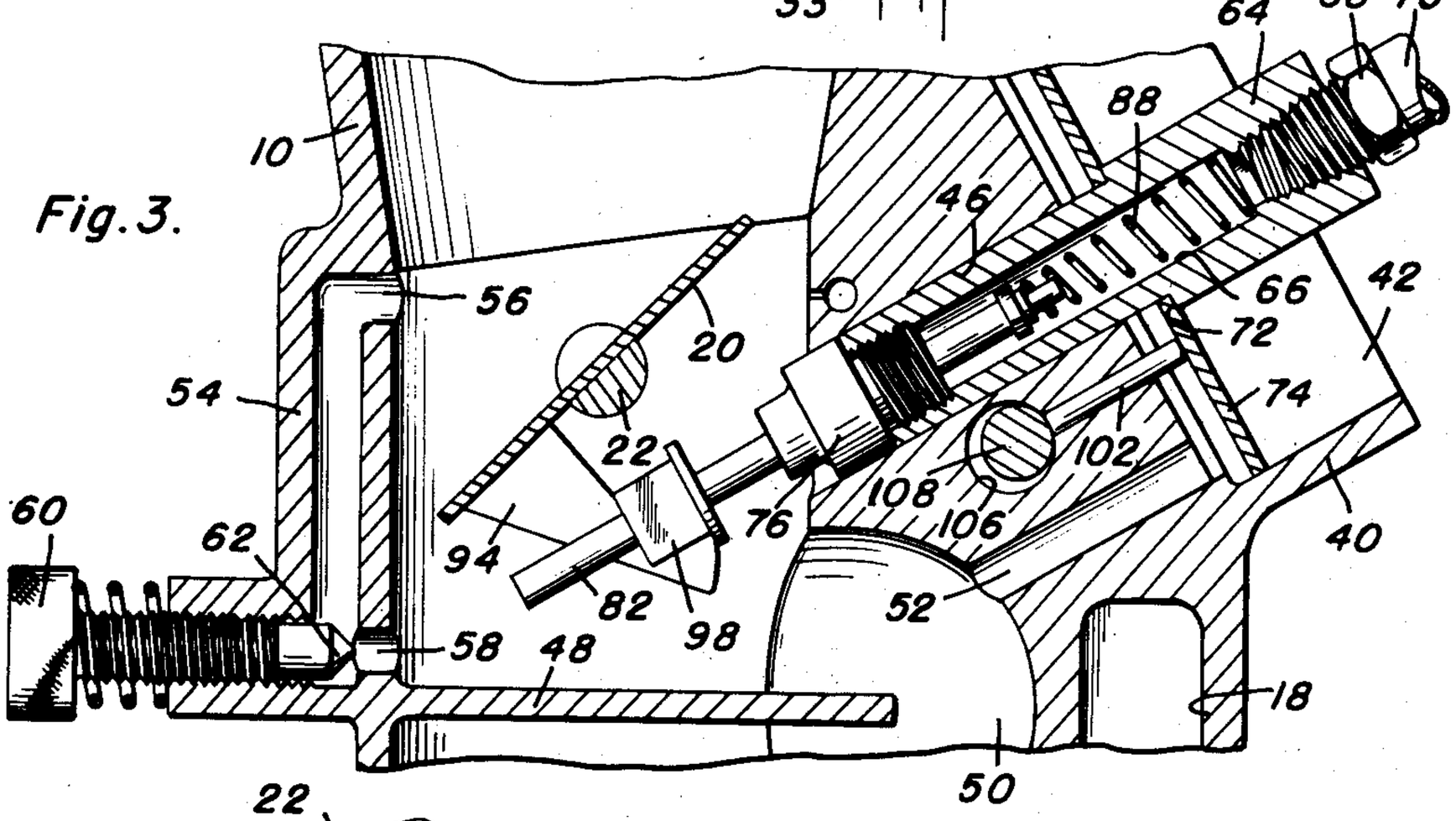
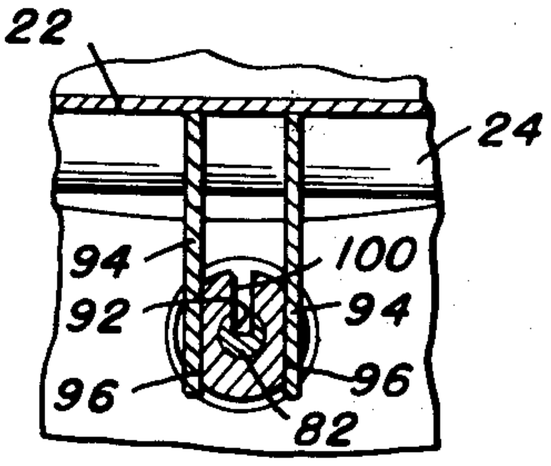


Fig. 4.



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FUEL METERING CONTROL FOR INJECTION CARBURETORS

Filed April 21, 1952 2 Sheets-Sheet 2

Fig. 2.

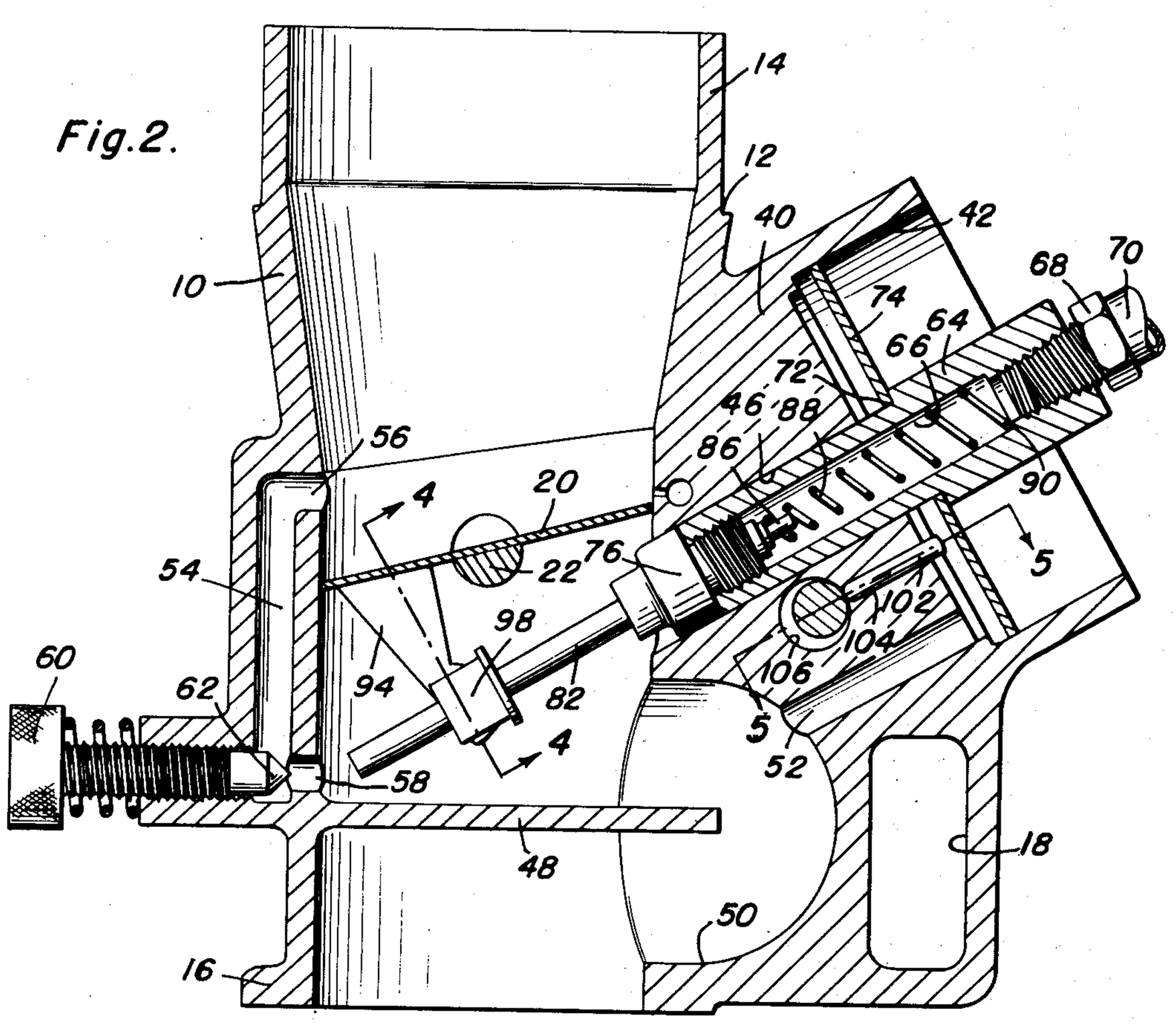


Fig. 5.

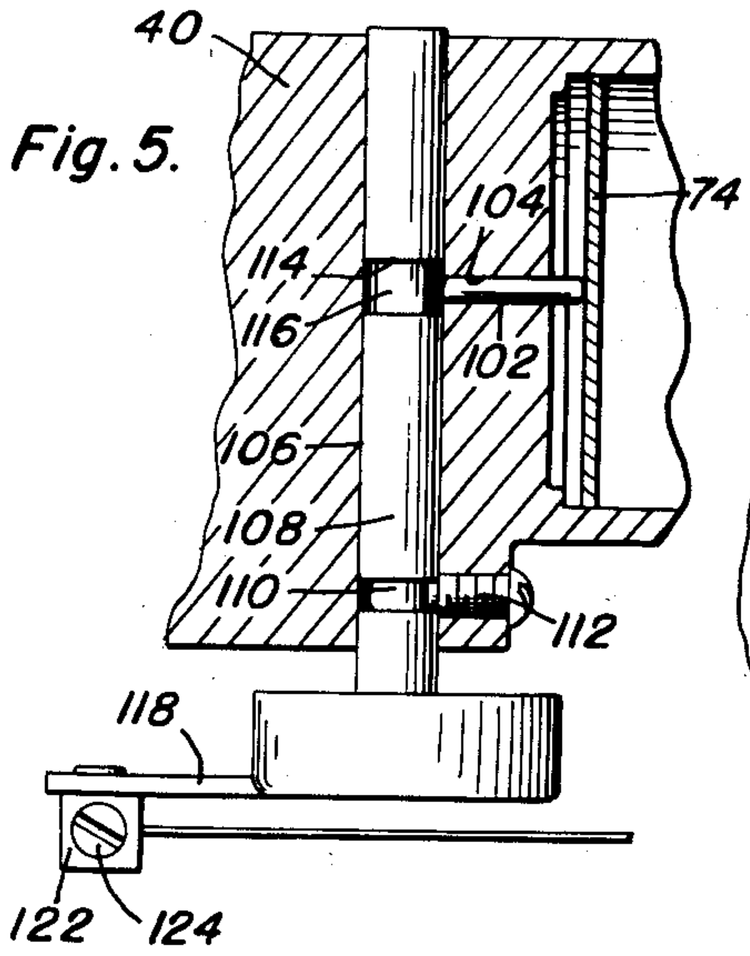
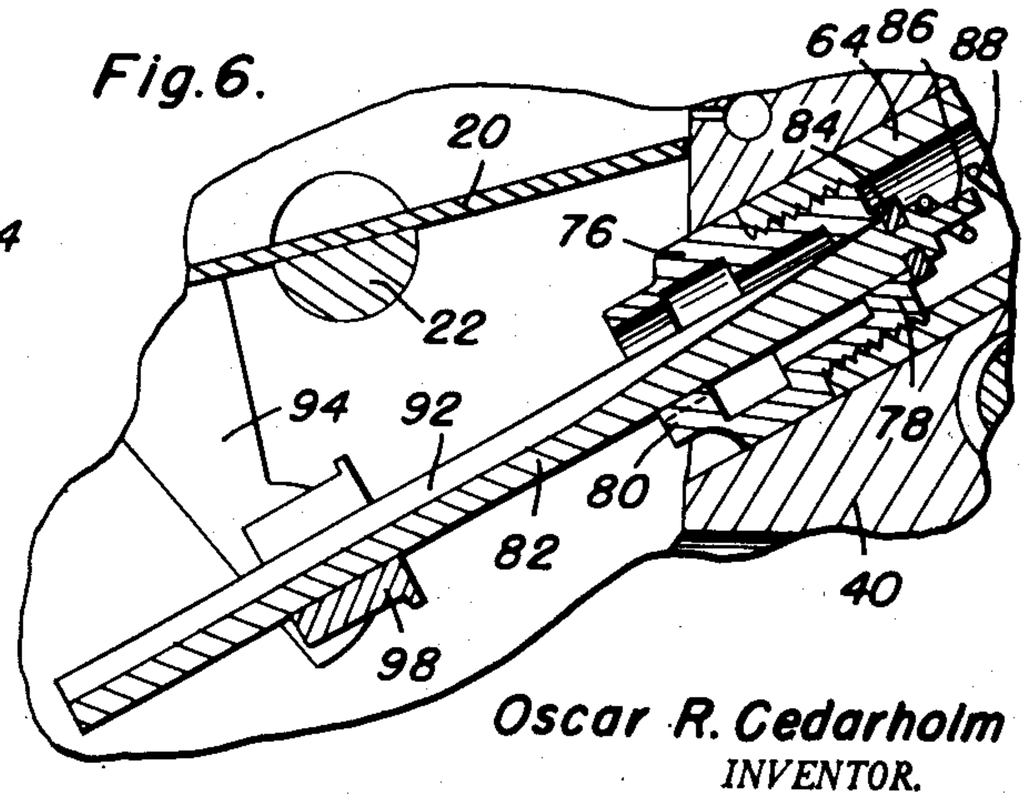


Fig. 6.



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FUEL METERING CONTROL FOR INJECTION CARBURETORS

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Application April 21, 1952, Serial No. 283,403

11 Claims. (Cl. 261—51)

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This invention comprises novel and useful improvements in an automatic control for injection carburetors and relates to similar subject matter and constitutes an improvement over my prior copending application Serial No. 174,927, filed July 20, 1950, for Injection Carburetor, now Patent No. 2,636,488, issued April 28, 1953.

This primary object of this invention is to provide an improvement in the type of carburetor disclosed in my above identified patent and other carburetors operating upon analogous principles of operation, by providing an attachment capable of providing a limit, either upper or lower, depending upon the desire of the user of the attachment, which will govern the richness of fuel-air mixtures which pass through the riser into each cylinder, usually by way of an intake manifold.

A further object of this invention is to provide an injection type carburetor having a greatly simplified construction inasmuch as the customary float, float valve, float chamber, venturi and other analogous structures have been omitted entirely.

A further object of the invention is to provide an improved carburetor in which the fuel-air ratio shall be automatically varied in response to changes in the manifold pressure and in response to the throttle valve opening, together with means operable to vary the fuel-air ratio for choking the carburetor for starting.

A further important object of the invention is to provide a carburetor construction in accordance with the foregoing objects and in which a more effective mixing of the components of the fuel charge shall be obtained.

These, together with various ancillary features and objects of the invention, which will later become apparent as the following description proceeds, are attained by the present invention, a preferred embodiment of which has been illustrated, by way of example only, in the accompanying drawings, wherein:

Figure 1 is a side elevational view showing a carburetor constructed in accordance with the principles of this invention;

Figure 2 is a vertical sectional longitudinal view through the carburetor of Figure 1, the parts of the mechanism being shown in their position when the throttle valve is closed and the engine is not running;

Figure 3 is a fragmentary view similar to Figure 2 but showing the position of the parts during operation of the engine;

Figure 4 is a fragmentary detail view taken in

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section upon the plane indicated by the section line 4—4 of Figure 2, and showing in particular the manner in which the throttle valve is connected to the metering fuel valve for effecting operation of the same;

Figure 5 is a fragmentary detail sectional view taken upon an enlarged scale substantially upon the plane indicated by the section line 5—5 of Figure 2 and illustrating the mechanism for operating the fuel valve metering assembly during the choking operation of the device; and,

Figure 6 is a fragmentary sectional view taken upon an enlarged scale and showing the valve core and valve body of the fuel metering valve in accordance with this invention.

Reference is now made more specifically to the accompanying drawings, wherein like numerals designate similar parts throughout the various views. The improved carburetor incorporating the principles of this invention consists of a riser 10 whose upper end is provided with a shoulder 12 and a cylindrical upstanding sleeve extension 14 which are adapted to receive the conventional air cleaner with which automobile engines are customarily equipped. The lower end of the riser is provided with an annular flange 16 by means of which the riser is adapted to be secured to the intake manifold of an internal combustion engine for supplying a carbureted mixture thereto.

If desired, the carburetor may be water jacketed as by providing a jacket 18 thereabout whereby the carburetor may be preheated in accordance with standard practice.

A conventional form of butterfly throttle valve 20 is mounted in an appropriate portion of the riser 10, being pivotally secured therein as by a transverse throttle valve pivot pin 22 extending through the opposite walls of the riser, this pin having one extending end provided with a throttle valve lever 24, see Figure 1, which at one end is provided with a flanged portion 26 through which extends a throttle valve actuating member 28 which may conveniently comprise a flexible cable or the like having a collar 30 secured thereto adjustably as by a set screw 32 and manually operable from the vehicle dash. Obviously by operating the cable 28 in the direction indicated by the arrow 34, the throttle valve will be moved to its open position as will be apparent by comparing Figures 2 and 3.

The conventional foot or accelerator pedal control of the throttle valve 20 is accomplished through a lever 31 and link 33, shown in dot and dash lines in Figure 1 and fixedly connected to the shaft 22. It will be evident that operation

of the throttle valve by the lever and link 31 and 33 will not affect 28, since the lever 24 will slide upon the cable 28.

The other end of the throttle valve lever 24 is provided with an adjusting screw 36 having a lock nut 38 thereon, for a purpose to be hereinafter specified.

Intermediate its ends, the riser 10 is provided with an integral upwardly inclined projection 40 which at its upper and outer end is provided with a cylindrical bore 42 comprising a chamber, that portion of the body 40 which surrounds the chamber 42 comprising a casing for the same and being provided with a closure member 44, as shown in Figure 1, of any desired character.

A bore 46 extends axially from the bottom wall of the chamber 42 in the projection 40 and intersects the passage in the riser 10 at a position which is below or downstream of the throttle valve 20. This passage is adapted to receive a fuel injecting metering valve of the same general character and construction as that set forth and claimed in my above identified patent, and the axis of this bore is inclined so as to be directed towards the opposite side of the riser, and in fact being preferably so positioned as to impinge upon the intersection of the opposite wall of the riser and a horizontally extending baffle 48 which is mounted upon the opposite wall of the riser, extends across the entire width of the air passage through the riser and into a recess 50 in the wall of the riser which recess thus provides a passage around the end of the horizontally disposed baffle. A suction conduit 52 extends from the interior of the recess 50 above the baffle 48 into the chamber 42 through the bottom wall thereof.

A by-pass passage 54 is provided in the riser having an inlet end 56 disposed above the throttle valve 20 when the latter is at its closed or substantially closed position, and having its exit or discharge end 58 in the form of a port entering the passage through the riser immediately above and adjacent to the connection of the horizontal baffle 48 with the wall of the riser. A manually operated adjusting screw 60 is provided having a conical metering tip 62 engaging in the orifice 58 for regulating and controlling the rate of flow through the by-pass passage, to thus facilitate and permit idling of the engine when the throttle valve is closed.

As so far described, it will now be apparent that air passing into the riser 10 will be discharged upon the baffle plate 48 by the by-passage 54 when the throttle valve is closed, and will be discharged by both the by-passage 54 and by the main flow coming past the throttle valve when the latter is opened, this air supply then flowing across the baffle 48 transversely thereof and in the recess 50 and thereafter passing downwardly through the riser and into the intake manifold. The metered fuel charge, controlled by the metering control valve assembly to be hereinafter described, is injected into this air flow at the port 58, whereby the air streams will intermingle with and mix with the fuel supply and will be thoroughly intermixed therewith before passing around the end of the baffle and into the riser for delivery to the intake manifold. Thus, a very efficient mixing of the air and fuel is provided, both for engine idling operation and for normal running conditions of the engine.

A valve body 64 in the form of a sleeve is movably and slidably received in the bore 46, and extends through the chamber 42 and through

the cover 44. This valve body is provided with a cylindrical hollow interior 66 extending axially therethrough, the upper end of which is internally threaded to receive a sleeve coupling member 68 by which a flexible fuel supply conduit 70 is attached to the valve body. Fuel from any suitable source and in any desired manner is applied to the flexible conduit 70 and under the control of the metering valve as set forth hereinafter is discharged into the interior of the riser to form the fuel constituent of the combustible charge. The valve body 64 has its exterior surface of two different diameters, to thus provide an annular shoulder 72 which forms a seat for a disk or plate 74 which constitutes a partition member which is slidably received within the chamber 42. The member 74 has a fluid tight engagement with the walls of the chamber, this engagement being effected in any desired manner, whereby suction supplied from the recess 50 of the riser 10 is communicated by the passage 52 into the chamber 42 below the partition for yieldingly urging the partition member towards the bottom of the bore of the chamber 42 during operation of the engine.

It will of course be understood that atmospheric pressure is admitted to the chamber 42 upon the upper or other side of the partition member 74 in any desired manner to permit the suction of the intake manifold to be thus effected. The partition member 74 is of course fixedly secured to the valve body 64 whereby movement of the partition member will in turn cause movement of the valve body relative to the projection 40.

The lower end of the valve body is likewise internally threaded to receive a plug 76, see also Figure 6. This plug is hollow being provided with apertured walls 78 and 80 at its opposite ends, which walls serve as guides for slidingly supporting a valve core 82, whose upper end extends into the valve body 64 and is slidable axially of the chamber 66 therein. As shown in Figure 6, the upper end of the valve core 82 is provided with a valve ring or sealing member 84 seated in an annular groove in the valve core which is adapted to abut against the wall 78 to prevent further downward movement of the valve core within the plug 76 and to seal off the fuel supply, and is further provided with an axial upward extension 86 which serves to position the lower end of a compression spring 88 whose upper end bears against the spring seat 90 which is constituted by an internal rib at the upper end of the passage 66.

The valve ring 84 possesses the very important function of seating on the wall 78, which thus is a valve seat, when the engine stops, to thus protect leakage of fuel from the fuel supply line, which is still under pressure from the fuel pump for some time after the engine stops, and would leak past the valve core and wall 78 and flood the engine.

It will thus be apparent that the spring 88 yieldingly urges the valve core downwardly with respect to the bore 46, and the valve body 64 upwardly with respect thereto, thus urging both of the valve members in opposite directions with respect to the riser and bore 46, and with respect to each other.

The valve core is provided with a longitudinally extending fuel supply passage or channel 92 of a progressively increasing depth from its shallow upper end to its lower end as will be apparent from Figure 6. The arrangement is such that

when the valve core is at its lowermost position with respect to the valve body as shown in Figure 6, with the valve ring 84 abutting against the wall 78 of the plug 76, the liquid fuel supplied to the passage 66 by the conduit 70 is cut off from passage through the channel 92. However, when the valve core is displaced upwardly into the valve body, liquid fuel passes into the channel 92 through a port of varying cross section area depending upon the extent of movement of the channel 92 into the chamber 66.

As will now be apparent by comparing Figures 2, 3 and 6, the liquid passing through the valve core is discharged from the lower end of the channel 92 into the air stream at the junction of the by-pass with the baffle 48. This liquid fuel is then mixed with the incoming air either moving through the by-pass and/or moving through the riser past the throttle valve and during the passage of the air and fuel across the baffle 48 into the recess 50 will be throughly intermixed with the same.

As will now be further apparent, the position of the valve body 64 in the bore 46 is controlled by the suction of the intake manifold applied to the underside of the partition 74 through the passage members 50 and 52. The position of the valve core is independently adjusted with respect to the adjustment of the valve body by connecting the valve core to the throttle valve 20 for simultaneous action therewith. For this purpose, as will be apparent from Figures 2, 4 and 6, the undersurface of the throttle valve 20 is provided with a pair of parallel arm 94 in the form of plates which engage and are attached to opposed parallel flat surfaces 96 recessed in the sides of a collar 98 which is fixedly attached in any desired manner upon the valve core 82. It will thus be apparent that upon pivotal movement of the throttle valve, the engagement of the arms 94 carried thereby with the collar 98 will cause a corresponding upward movement of the valve core 82. It will thus be understood that since relative movement of the valve core and valve body will vary the metering of the liquid fuel supplied through the valve assembly into the carburetor, variation of this fuel supply can be controlled by absolute movement of either the valve body through the suction operated partition member 74, the valve core 82 through the operation of the throttle 20, or both.

It should be noted that with the engine stopped and the valve assembly in the position shown in Figure 6, and with the valve ring 84 seated on the member 78, the fuel is sealed off from the carburetor and the entire valve assembly, consisting of the members 82, 98, 76, 88, 64, 84, is actually floating freely as a unit in the bores 42 and 46. For example, with the engine at rest, if the throttle valve 20 were opened, the arms 94 would merely cause the above mentioned valve assembly to float ahead or slide in the bores 42 and 46, with the valve ring 84 remaining seated on seat 78 and with no fuel passing the seal.

Attention is also directed to Figure 4 where it will be seen that the collar 98 is longitudinally and axially slotted as at 100 in registry with the channel 92 previously mentioned. Thus, the liquid fuel supplied by the metering valve can freely flow along the length of the valve core to be discharged from the lower end of the same in close proximity to the air stream from the orifice 58 of the by-pass or the air passing the throttle valve.

The above described metering valve construction, except as to the manner of connecting the valve core to the throttle valve for simultaneous operation therewith, is substantially identical with that set forth in my above identified patent.

However, in the present application and in the present construction, a novel form of stop means is provided for limiting the downward travel of the partition 74 in the chamber 42 and a downward movement of the valve body 64 in the bore 46. This stop means consists of a plunger 102 which is slidable in a bore 104 in the projection 40, this plunger engaging the underside of and abutting the underside of the partition member 74. At its lower end, the bore 104 intersects the transverse bore 106, see also Figure 5, which extends through the projection 40 of the riser 10. Rotatably seated within the bore 106 is an actuating shaft 108 which adjacent one end is provided with an annular groove 110 which is engaged by a retaining screw 112 which thus permits rotational but prevents axial movement of the actuating shaft. Intermediate its ends, the actuating shaft is provided with an annular groove 114 whose bottom surface constitutes an eccentric member 116 which is engaged by the lower end of the plunger 102. It will thus be apparent that upon rotation of the actuating shaft 108, the plunger will be reciprocated in its bore and thus will constitute an adjustable abutment for limiting the downward travel of the partition member and consequently of the valve body.

With the engine at rest, as shown in Figure 2, it is assumed that the engine is cranked for starting. A suction is then developed below the throttle valve 20 which is communicated by passage 52 to the partition 74. Now, if any gap exists between the bottom side of 74 and the end of the plunger 102, before starting the engine, it will be closed when the suction brings the partition 74 down into contact with 102. However, as mentioned earlier herein, the valve core 82 with its collar 98 was already resting upon the arms 94 and therefore cannot move. It will now be clear that parts 76, 64, 74 will move down to plunger 102, closing the gap, which movement will open the seal at 84 and 78 and permit flow of fuel. The movement will be equal to the gap between 74 and 102. It should be noted that during the above procedure, the throttle valve and its arms 94 were not moved from their closed positions of Figure 2.

Referring now again to Figure 1 it will be seen that the end of the actuating shaft 108 has an actuating lever 118 secured thereto, this lever having at one extremity a cam surface 120 which rides against and is engaged by the end of the adjusting screw 36 previously mentioned. Consequently, as the actuating shaft is rotated, the cam surface 120 through the adjusting screw 36 causes rotation of the lever 24 and of the throttle valve shaft 22, thereby opening the throttle valve as the actuating shaft is rotated in a direction to lower the plunger 102 and permit further movement of the partition member 74 towards the bottom of the chamber 42, and thereby cause downward movement of the valve body 64 within the bore 46.

As best seen in Figure 5, the other end of the lever 118 is provided with a pivoted connection 122 having a set screw 124 which is adapted to adjustably clamp upon the end of a choke rod or choke wire 126. The latter extends to any convenient place as the dash of a vehicle whereby the same may be readily actuated by the driver of the vehicle.

This arrangement is such that when it is desired

to start the internal combustion engine the driver will pull the choke rod 126 in the direction indicated by the arrow 128, thereby simultaneously opening the throttle valve to increase the flow of air passing the throttle, simultaneously lifting the valve core to open the fuel passage 92; and will also rotate the actuating shaft 108 in a direction to permit the valve plunger 102 to move inwardly thus adjusting the stop member to permit the partition member 74 to move downwardly under the influence of suction arising from the crank operation, thereby effecting a downward movement of the valve body within the bore 46 further increasing the flow of fuel through the metering device.

It will be noted that the operation of the throttle to its further open position is independent of the choking device.

This valve assembly is especially effective in preventing the undesirable conditions known as vapor lock which renders engines hard to start. If any liquid fuel passes the valve ring 84 and seat 78 and enters the interior of the plug 76 by way of the passage 92, and vaporizes, the vapor is dissipated readily through the openings in the walls 80 of the plug and into the riser. Thus, the development of a vapor pressure in the valve assembly, which might impede the next desired fuel flow is completely prevented.

From the foregoing, the construction and operation of the device will be readily understood and further explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art after a consideration of the foregoing specification and accompanying drawings, it is not desired to limit the invention to the exact construction shown and described, but all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means on the downstream side of said throttle valve connected to the valve core for displacing the same in said valve body upon movement of said throttle valve, means carried by said riser for adjustably limiting the range of movement of said partition.

2. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means on the downstream side of said throttle valve connected to the valve core for displacing the same in said valve body upon movement of said throttle valve, manually operable

plunger carried by said riser and engaging said partition for adjustably limiting the range of movement of the partition.

3. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means on said throttle valve connected to the valve core for displacing the same in said valve body upon movement of said throttle valve, means carried by said riser for adjustably limiting the range of movement of said partition, said last means including a plunger engaging said partition and an eccentric engaging said plunger.

4. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means for actuating said valve core in said valve body upon movement of said throttle valve, a stop in said riser limiting movement of said partition, said riser having a pair of intersecting bores, a plunger in one bore constituting said stop and having one end abutting said partition, an adjusting shaft in the other bore having an eccentric engaging the other end of said plunger, means for rotating said shaft.

5. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means on the downstream side of said throttle valve connected to the valve core for displacing the same in said valve body upon movement of said throttle valve, means connected to said last means and to said throttle valve for operating the latter upon movement of the former.

6. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means on the downstream side of said throttle valve connected to the valve core for displacing the same in said valve body upon movement of said throttle valve, said last means comprising a pair of parallel arms, a collar mounted on said valve core, said collar having parallel

flat sides to which said arms are connected for moving said core.

7. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means on the downstream side of said throttle valve connected to the valve core for displacing the same in said valve body upon movement of said throttle valve, said last means comprising a pair of parallel arms, a collar mounted on said valve core, said collar having parallel flat sides to which said arms are connected for moving said core, said core and collar being slotted to form a fuel discharge channel into said riser.

8. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means for actuating said valve core in said valve body upon movement of said throttle valve, said riser having a baffle extending from one wall of the riser and positioned downstream of said throttle valve and said valve core, a by-pass around said throttle valve discharging upon the upstream side of said baffle, said valve body discharging fuel upon said baffle adjacent the by-pass inlet thereto.

9. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means for actuating said valve core in said valve body upon movement of said throttle valve, said riser having a baffle extending from one wall of the riser and positioned downstream of said throttle valve and said valve core, a by-pass around said throttle valve discharging upon the upstream side of said baffle, said valve body discharging fuel upon said baffle adjacent the by-pass inlet thereto, said riser having a recess extending around the other end of said baffle, whereby fuel and air impinging upon the baffle from the valve body and the by-pass and air passing the throttle valve will be mixed prior to the passage around the baffle through the recess.

10. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a source of fuel, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means for actuating said valve core in said valve body upon movement of said throttle valve, said riser having a baffle extending from one wall of the riser and positioned downstream of said throttle valve and said valve core, a by-pass around said throttle valve discharging upon the upstream side of said baffle, said valve body discharging fuel upon said baffle adjacent the by-pass inlet thereto, said riser having a recess extending around the other end of said baffle, whereby fuel and air impinging upon the baffle from the valve body and the by-pass and air passing the throttle valve will be mixed prior to the passage around the baffle through the recess, said passage means opening into said recess.

11. In an internal combustion engine, an intake manifold, a carburetor including an air intake riser communicating with said intake manifold, a throttle valve in said riser, a valve body movably mounted in said riser and adapted to be connected to a fuel source, a casing, a movable partition in said casing connected to said valve body, passage means connecting said intake manifold and casing for actuation of said partition in response to pressure variations in said intake manifold, a valve core movable in said valve body, means for actuating said valve core in said valve body upon movement of said throttle valve, said riser having a baffle extending from one wall of the riser and positioned downstream of said throttle valve and said valve core, said valve body discharging fuel upon said baffle.

OSCAR R. CEDARHOLM.

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