

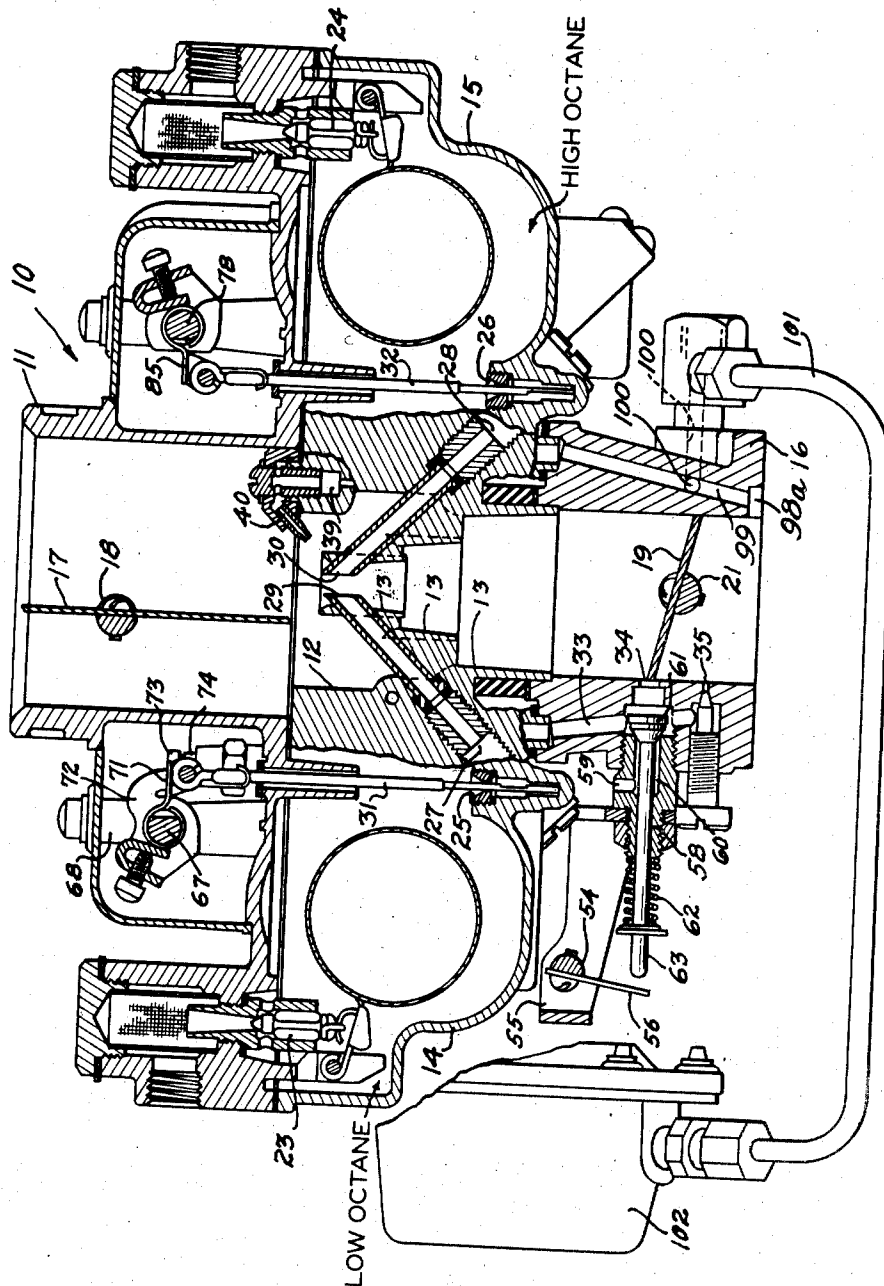
Sept. 15, 1953

H. A. BOLLER
TWO FUEL CARBURETOR

2,652,237

Filed June 19, 1950

7 Sheets-Sheet 1



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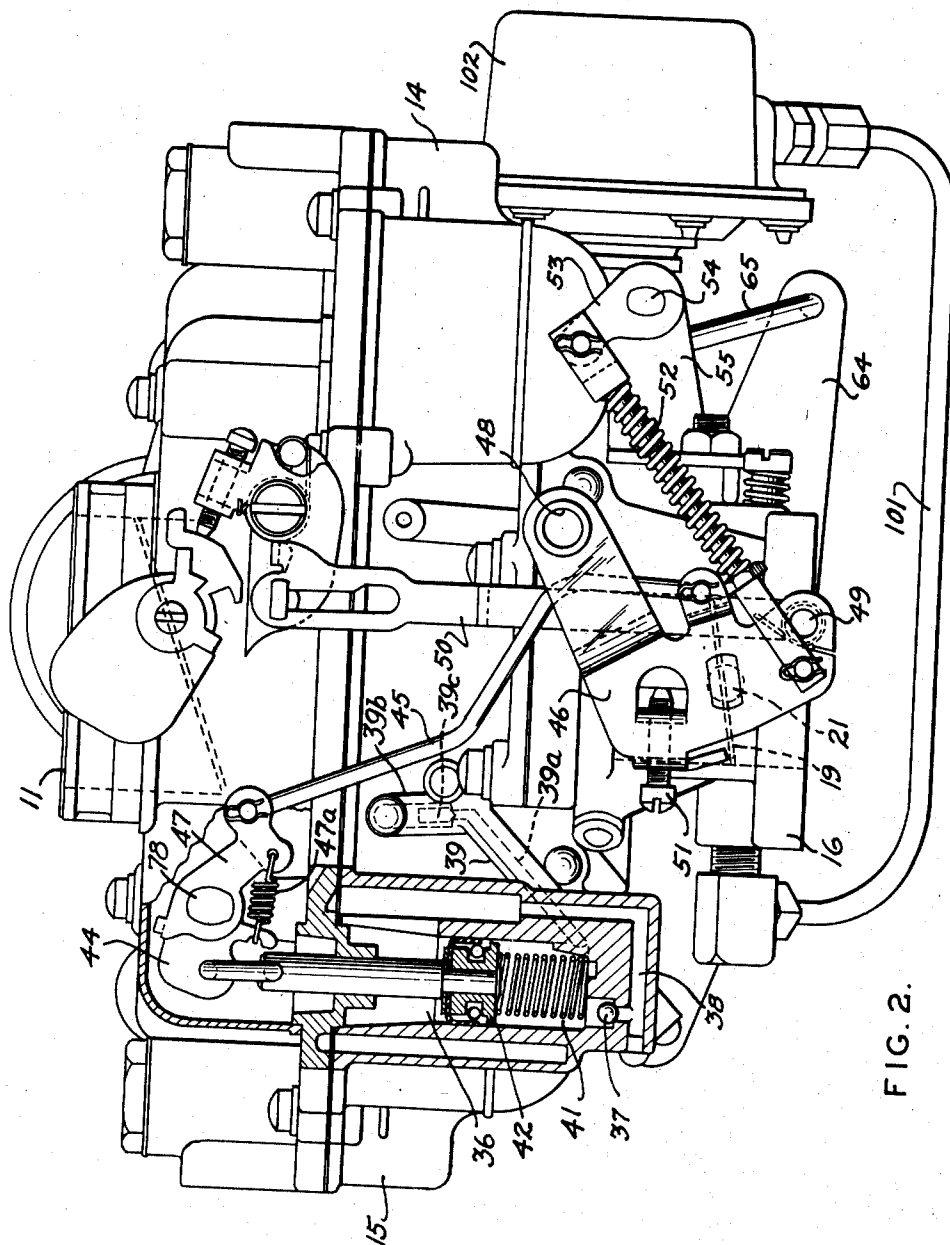


FIG. 2.

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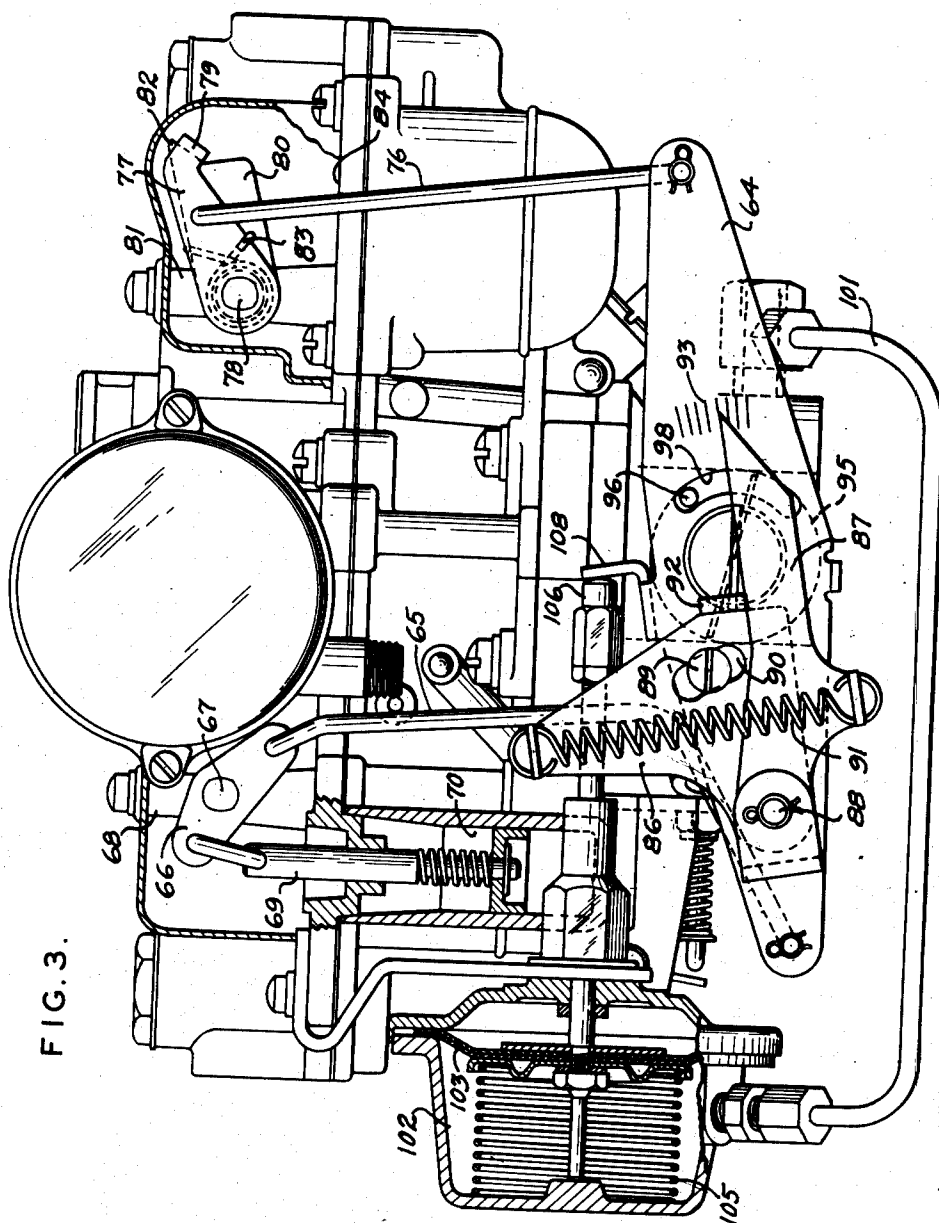


FIG. 3.

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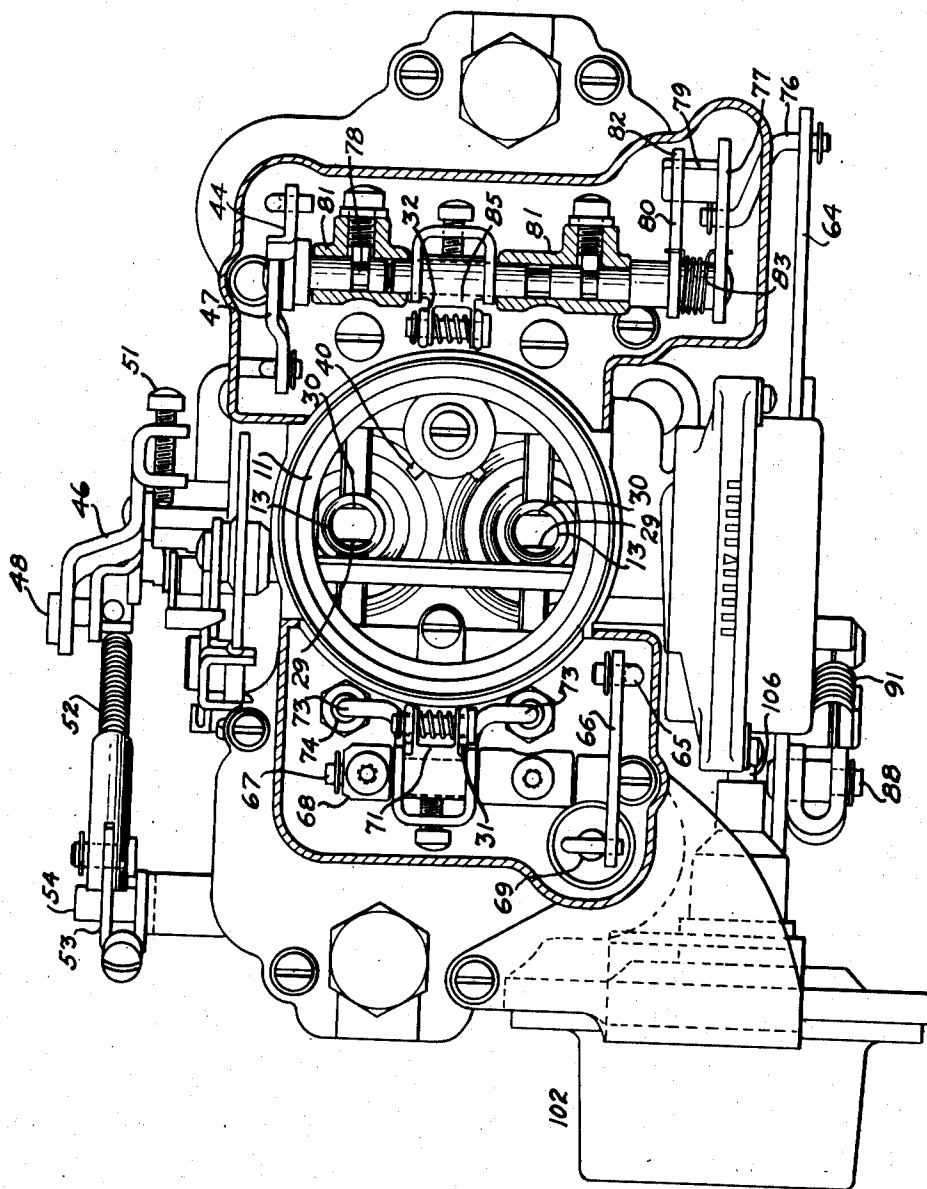


FIG. 4.

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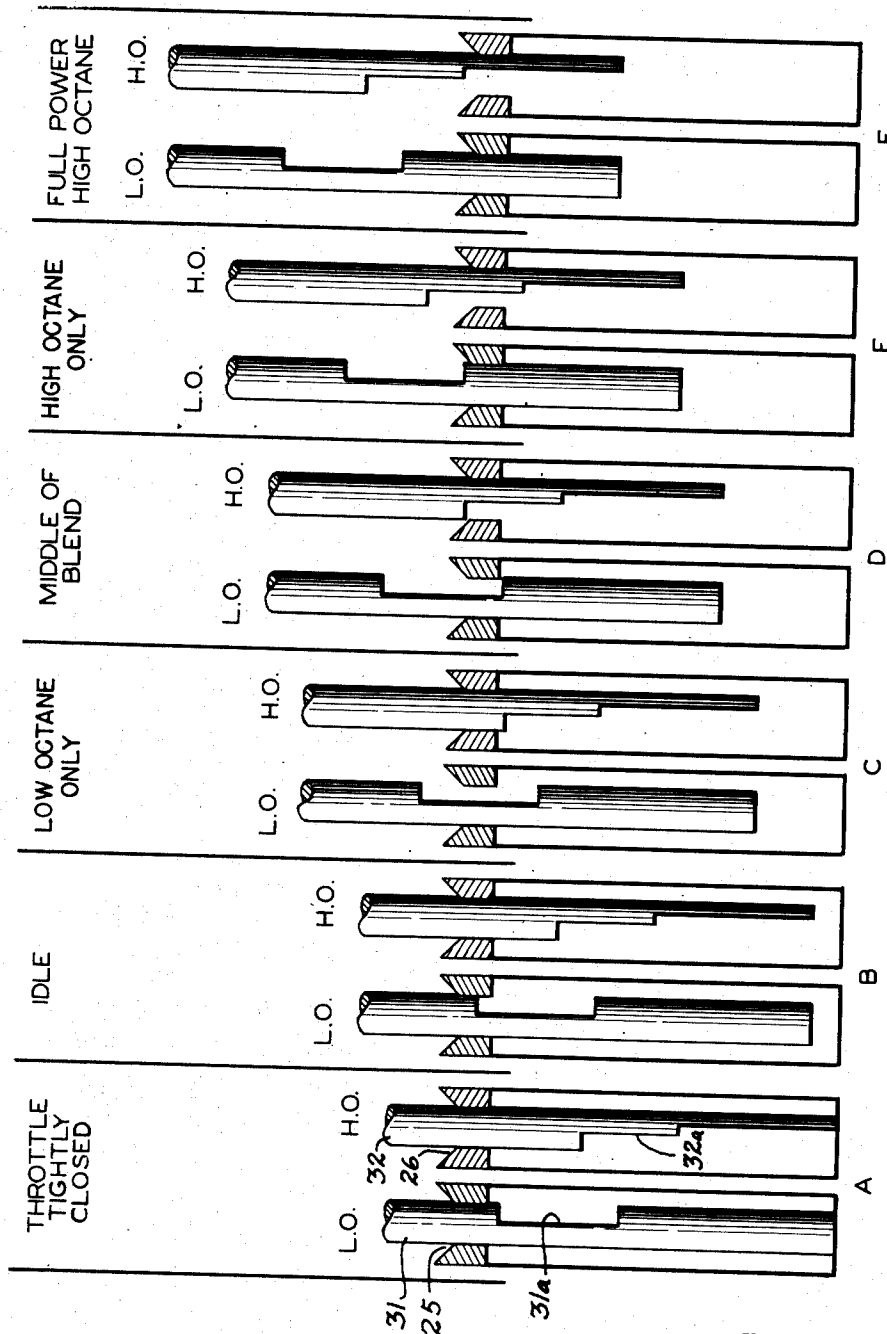
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FIG. 5.



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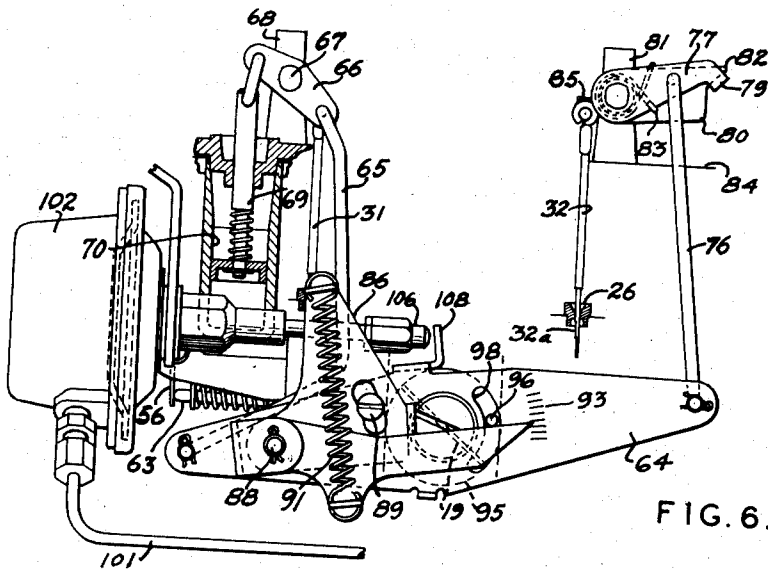


FIG. 6.

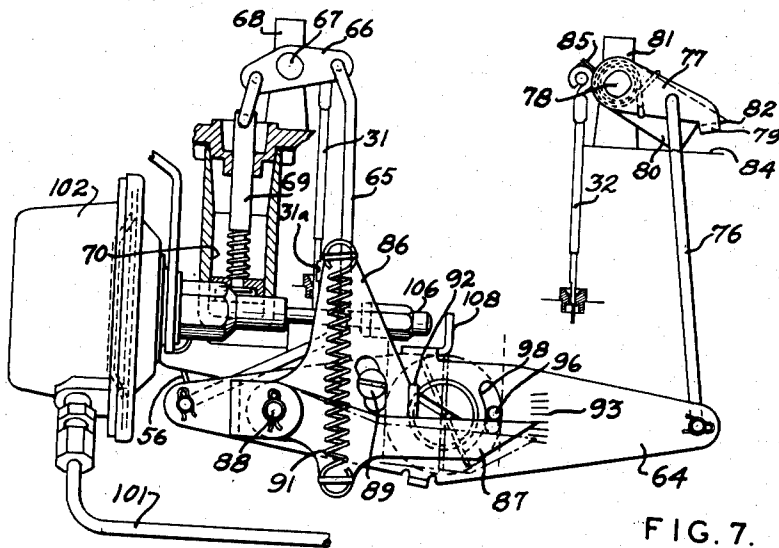


FIG. 7.

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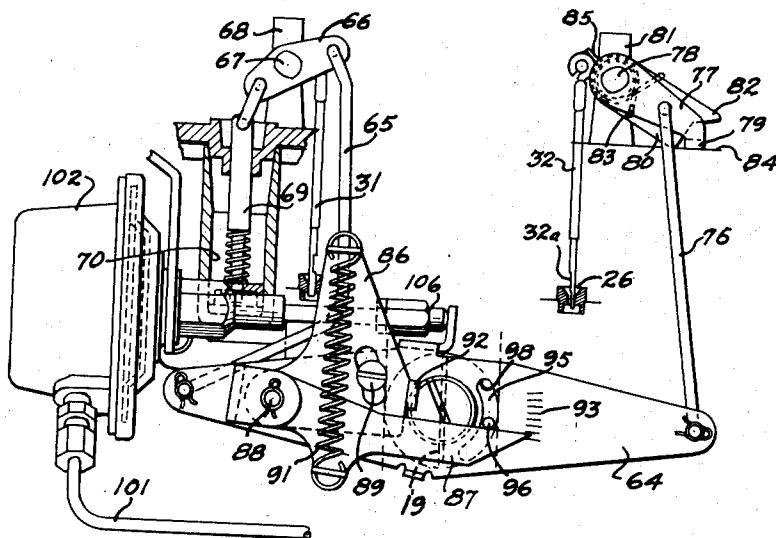


FIG. 8.

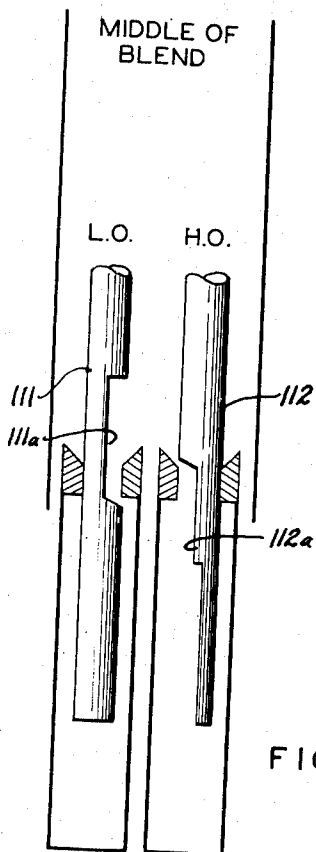


FIG. 10.

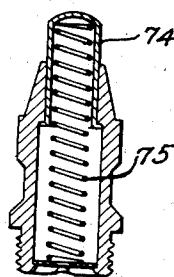


FIG. 9.

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UNITED STATES PATENT OFFICE

2,652,237

TWO FUEL CARBURETOR

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Application June 19, 1950, Serial No. 168,978

20 Claims. (Cl. 261-18)

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This invention relates to fuel supply devices for internal combustion engines and consists particularly in a novel means for improving the efficiency of engines by supplying fuels of different anti-knock qualities, according to the power demand on the engine, and means whereby the transition from low octane to high octane operation may be varied with respect to the degree of throttle opening, depending upon the anti-knock quality of the low octane fuel being used.

It is generally known that when the carburetor throttle valves are opened and/or the power demand on an internal combustion engine is increased, the compression in the cylinders increases with resultant detonation of ordinary low octane fuels. In order to permit operation at higher compressions, with consequent increased efficiency, it is necessary to use more expensive fuels having higher anti-knock qualities. However, during normal operation of a vehicle under low speed light load conditions, since relatively low compressions exist in the cylinders, less expensive fuels of lower anti-knock, or octane ratings will suffice. Since the octane ratings of various inexpensive low octane fuels are likely to vary considerably, the degree of throttle opening and/or the compression at which detonation is likely to occur will vary accordingly.

An object of this invention is, therefore, to produce a carburetor which will always provide a low octane fuel mixture for idling and for low speed light load operation but which will permit the transition from low to high octane operation to be varied in accordance with any desired throttle opening, until manifold vacuum reaches a predetermined low value, at which point the transfer to high octane fuel is always made.

An additional object of this invention is to provide a carburetor of this type in which the blending range during which the transition from low octane to high octane fuel occurs can easily be changed with respect to throttle opening by a mere mechanical adjustment.

Another object is to provide a carburetor of this type in which the speed range during which blending takes place may be varied by changing metering pins. As an example, utilizing one given set of metering pins will provide a blending range between 40 and 45 miles per hour, part throttle; whereas, by substituting a different set of metering pins made according to my invention the blending range may be increased from a 5 mile per hour speed differential to 20 miles per hour speed differential, as from 40 to 60 miles per hour.

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A further object is to provide a carburetor of this type in which the transition from low to high octane fuel or vice versa is accomplished so smoothly as to be unnoticeable.

A still further object is to provide a carburetor of this type in which the idle system, operated from the low octane fuel supply, may be rendered completely inoperative when the degree of throttle opening exceeds a small predetermined value, in order to prevent dilution of the high octane fuel, and to prevent alteration of the air-fuel ratio.

Additional objects and advantages will appear from the specification and the drawings, in which:

Fig. 1 is a vertical sectional view of a carburetor made according to this invention;

Fig. 2 is an elevation of one side of the carburetor of Fig. 1, partially sectionalized;

Fig. 3 is an elevation of the opposite side of the same carburetor, partially sectionalized;

Fig. 4 is a plan view of the carburetor, parts being sectioned;

Fig. 5 is a diagram showing the relative positions of the low octane and high octane metering pins during various throttle positions;

Fig. 6 shows the metering pin control mechanism in the part throttle, low octane position;

Fig. 7 shows the metering pin control mechanism in the part throttle, high octane position;

Fig. 8 shows the metering pin control mechanism in the full power high octane position;

Fig. 9 shows a sectional view of mechanism for advancing the metering pins to part throttle low octane position;

Fig. 10 shows a modified form of the metering pins.

Referring now to the drawings, the numeral 10 refers to a carburetor having an air horn 11, dual mixture conduits 12 formed with stacked venturis 13 therein, low octane fuel chamber 14 and high octane fuel chamber 15. A flange 16 is formed at the outlet end of mixture conduits 12 for attachment to the manifold of an internal combustion engine. Admission of air to the mixture conduits is automatically controlled by disk choke valve 17 mounted on shaft 18. Conventional throttle valves 19, mounted on shaft 21, control the outlets of mixture conduits 12.

Fuel is admitted to fuel chambers 14 and 15 and kept at constant level therein by float controlled needle valves 23 and 24, respectively, the outlet of fuel from the fuel chambers being through two calibrated low octane metering orifices 25 and two high octane orifices 26. Pas-

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sageways 27 and 28 provide fuel connections between orifices 25 and 26 and fuel nozzles 29 and 30 which discharge into the mixture conduits 12 through the uppermost venturis 13.

Passage of fuel through orifices 25 and 26 is regulated by metering pins 31 and 32, the characteristics and operation of which will be described in detail below. Fuel for idling passes directly, and not through orifices 25, from low octane fuel chamber 14 into and through conventional restricted idle tubes (not shown), through passages 33 and into mixture conduits 12 through idle ports 34 and idle adjustment ports 35.

Referring now to Fig. 2, it will be seen that additional fuel increments for acceleration are provided by an accelerating pump 36 of conventional piston type construction which forms a part of the wall structure of high octane fuel chamber 15 and receives its fuel therefrom through inlet check valve 37 and passageway 38. Passageway 39, from pump 36 to pump nozzles 40 (shown in Fig. 1) and, in part, passing through ribs 39a and 39b and including an outlet check 39c permits supply of accelerating charges from pump 36 into mixture conduits 12. Coil spring 41 mounted in the pump cylinder, normally urges plunger 42 upwardly, to eliminate slack in the pump linkage. Discharge movements of pump plunger 42 are effected by loosely pivoted rocker arm 44 which is operatively connected by shaft 73, tight lever 47, tension spring 47a, and link 48 to throttle lever 46, rigidly mounted at one end of throttle shaft 21.

Throttle operating lever 46 is in the form of a bell crank having at one end an opening 43 to receive the accelerator pedal connecting rod, and at the other a journal 49 to receive fast idle connecting link 50. For varying the minimum, normal idle opening of the throttle, a conventional adjustment screw 51 is provided on lever 46. Adjacent journal 49, a compressible spring loaded link 52 is connected at one end to lever 46, and at the other end to crank 53 which is secured to an end of shaft 54. Shaft 54 is rotatably journaled in bracket 55 and is provided with downwardly extending flaps 56 which are adapted to actuate combination shut-off and air bleed valves in the idle systems. The combination shut-off and air bleed valves, comprising housings 58 formed with atmospheric ports 59, connected air passages 60, and spring actuated closure members 61 slidably mounted therein, communicate with the idle systems adjacent idle ports 34; springs 62 normally urge stems 63 of closure members 61 outwardly to close air bleed passages 60. Throttle actuated flaps 56 are so positioned with respect to the outer end of plungers 63 that when throttle valves 19 are opened to a predetermined position flaps 56 urge stems 63 inwardly, thereby opening air passages 60 into communication with idle passages 33 and causing closure members 61 to close idle ports 34. Thus, at a predetermined throttle opening, air is bled into the idle system, and idle ports 34 are closed, thus rendering the idle system inoperative.

When this occurs, since the maximum permissible movement of flaps 56 is considerably less than that of throttle lever 46, compressible link 52 compresses to absorb additional throttle movement.

Referring now to Fig. 5, which utilizes one low octane and one high octane metering pin to show certain relative positions of the low and high octane metering pins in their simultaneous upward and downward movements, it will

be noted that low octane metering pin 31 is of substantially equal diameter with low octane metering orifice 25, and has formed in its cylindrical face an elongated relatively deep recessed flat 31a. Flat 31a is formed with upper and lower edges substantially normal to the axis of metering pin 31, and is so spaced with reference to metering orifice 25 that when the throttles are tightly closed the entire flat is below the metering orifice, thus permitting the cylindrical portion of the metering pin 31 to sealingly close the orifice.

High octane metering pin 32 is also of substantially equal diameter with its orifice 26 and is formed with a stepped recessed flat 32a having its upper edge at an intermediate level with respect to the upper and lower edges of flat 31a of low octane metering pin 31. The lower portion of stepped flat 32a is substantially deeper than the upper portion and extends to the lower end of high octane metering pin 32.

Movement of metering pins 31 and 32 is as shown in Fig. 5, and is controlled in a manner which will be described in detail below. When the throttles are tightly closed, both low octane and high octane metering pins 31 and 32 close their respective metering orifices 25 and 26, as shown at A. During idling, both metering pins are simultaneously elevated a slight distance, but still close their respective orifices, as shown at B. When the throttles are somewhat farther opened, the metering pins are raised an additional distance so that flat 31a is substantially bisected by metering orifice 25 as at C, permitting a maximum flow of low octane fuel there-through; at this point high octane metering pin 32 continues to close its orifice 26.

If it is desired that low octane fuel be used throughout the operating range, the carburetor may be, as explained hereafter, so adjusted that, as the throttle opening increases, there will be no further elevation of metering pins 31 and 32 after they have reached the part throttle low octane position shown at C, in Fig. 5. They will remain at position C until manifold vacuum declines to a predetermined value, in the order of 5 inches Hg; thereupon the pins are raised to the full power, or step-up position shown at F, in Fig. 5, with low octane metering orifice 25 closed and the deep portion of flat 32a in the high octane metering orifice 26, thus permitting a maximum flow of high octane fuel only to the engine.

If, on the other hand, it is desired that a transfer from low octane to high octane fuel be made at any desired throttle opening, the carburetor may be so adjusted that when the throttle reaches the desired opening the metering pins will resume their simultaneous upward movement, as shown at D, until the lower edge of flat 31a is just below low octane metering orifice 25, thus permitting only a very slight flow of fuel there-through, and the upper edge of notch 32a is just above the high octane metering orifice 26, thus permitting a slight passage of high octane fuel therethrough; during this range blending and changeover from low to high octane operation takes place. During remaining throttle opening movement, the metering pins continue their simultaneous upward movement, so that the low octane metering pin completely closes its orifice 25 and the upper relatively shallow portion of flat 32a is in the high octane orifice as at E, Fig. 5, thus permitting the passage therethrough of the maximum quantity of high octane fuel

desirable for part throttle operation. When manifold vacuum decreases to a predetermined low value, low octane metering pins 31 continue to close their orifice as at F, and the deeper flattened portion of high octane metering pins 32 pass into orifices 26, thereby permitting a passage therethrough of the full power requirement of high octane fuel.

Referring now to Fig. 3, a fuel selector lever 64 is rotatably journaled on the carburetor body in line with the throttle shaft. At its end adjacent the low octane fuel chamber, a link 65 connects fuel selector lever 64 to a crank 66 which is rigidly mounted on an end of countershaft 67 which in turn is rotatably journaled in posts 68 above the fuel bowl cover. At its other ends, crank 66 is connected to spring loaded plunger 69, in dashpot 70 which communicates with low octane fuel chamber 14, below the fuel level therein, so that any movements of plunger 69 are resisted by the necessity of displacing fuel in the dashpot. Thus, counterclockwise movements of fuel selector lever 64 are dampened by the retarding effect of upward movement of plunger 69, whereas clockwise movements are not substantially retarded, being facilitated by compression of the plunger spring.

Rigidly secured to countershaft 67 is metering pin arm 71 (shown in Fig. 1), to the outer ends of which are secured the eye portions of low octane metering pins 31, so that movements of metering pins 31 correspond to those of fuel selector lever 64. Conventional metering pin springs normally urge the unflatted sides of metering pins 31 into sealing engagement with metering orifices 25. A second arm 72 formed with outwardly extending lips 73 is clamped to countershaft 67. Lips 73 are adapted to abut against the upper surface of springloaded plungers 74 (shown in detail in Fig. 9), which are normally urged upwardly a limited distance by spring 75. The adjustment of lips 73 is such that when plungers 74 are depressed the metering pins are positioned as at A in Fig. 5, and as plungers 74 move upwardly toward their uppermost position, they urge arm 72, countershaft 67, and metering pin arm 71 counterclockwise, thereby elevating the metering pins to position C of Fig. 5 in which the maximum of low octane fuel is supplied.

A link 76 is journaled at its lower end in the high octane end of fuel selector lever 64 and at its upper end in crank 77. Crank 77 is mounted on an end of countershaft 78, and is provided with an inwardly directed nearly radial lip 79 on its outer end portion. Another crank 80 is rotatably journaled on the end of countershaft 78 between crank 77 and journal post 81. Crank 80 is of generally rectangular form except for an outwardly extending projection 82 from the upper portion of its free end. A torsion spring 83 normally urges projection 82 into abutting relation with the upper surface of lip 79 until crank 80 is rotated so far that its lower corner engages the bowl cover 84, which prevents crank 80 from following crank 77 any further. The purpose of this device is to limit the throttle produced, upward movement of the metering pins, as will be described hereafter, to the medium, high octane position shown at E in Fig. 5, yet to permit further movement of crank 77 and the metering pins to the full power, high octane position shown at F. The unflatted sides of metering pins 32 are urged into engagement with metering orifices 26 by a conventional metering pin spring mounted on arm 85.

For varying response of the metering pins and,

thus, the transfer from low to high octane operation with respect to throttle opening, the following mechanism is provided: adjacent the low octane end of fuel selector lever 64, a generally triangular member 86 and an adjustment finger 87 are rotatably mounted on a common pivot 88 on the fuel selector lever. A set screw 89, passing through an arcuate slot 90 in member 86 and into lever 64, serves to hold member 86 in any desired relation to fuel selector lever 64. Adjustment finger 87 is of relatively long, narrow shape, being pointed at its free end; a coil spring 91, secured at its lower end to finger 87 and at its upper to the upper apex of member 86, urges finger 87 into abutting engagement with a turned out lip portion 92 formed adjacent the lower free apex of member 86. Adjacent the free, pointed end of finger 87, a calibrated scale 93 is marked on fuel selector lever 64. Adjustment of finger 87 with respect to scale 93 is accomplished by moving member 86 until the pointer is set at the desired calibration 93, and then tightening set screw 89.

For transmitting throttle movement to fuel selector lever 64, and through it to the metering pins, a disk 95, provided with outwardly extending pin 96, is rigidly mounted on throttle shaft 21, adjacent fuel selector lever 64, so that pin 96 projects through an arcuate slot 98 in the selector lever. The greater weight of the low octane end of selector lever 64 and spring 52 (Fig. 2) normally urge selector lever 64 in a counterclockwise direction. When the throttles are fully closed, pin 96 bears against the upper end of slot 98, thereby preventing any clockwise movement of selector lever 64; at this position of selector lever 64 the metering pins are bottomed in their receiving pockets, as at A, Fig. 5. As the throttle is opened to the idle position, pin 96 moves a slight distance clockwise, thus permitting selector lever 64, urged by spring plungers 74, as described above, to move a slight distance clockwise; this movement elevates metering pins 31 and 32 to the idle position, as shown at B, Fig. 5. The maximum movement of the metering pins under the influence of spring plungers 74 is illustrated at C in Fig. 5.

When adjustment finger 87 is set at the lowest calibration (Fig. 8), the only movement of selector lever 64 occurs during initial throttle opening movement which moves pin 96 clockwise thus permitting clockwise movement of selector lever 64 and elevation of metering pins 31 and 32 to the part throttle, low octane position shown at C, Fig. 5. When the adjustment finger is set thus, further opening movement of throttles 19 has no direct effect on selector lever 64, so that during the entire operating range, except when manifold vacuum is very low, as will be described hereafter, the metering pairs remain stationary and the carburetor will continue to provide a low octane part throttle fuel mixture, as at C, Fig. 5. Preferably, the metering pin position C supplies an economy or low power fuel-air mixture.

Referring now to Figs. 6 and 7, as the setting of adjustment finger 87 is changed upwardly with respect to calibrated scale 93, obviously throttle pin 96 will engage finger 87 at relatively smaller throttle openings, thus causing greater response of the fuel selector lever 64 and the metering pins to full throttle movement. Position D represents the middle of the transfer range between the low and high octane fuels and position E represents the highest position to which the throttles can elevate the pins.

These positions are reached at progressively smaller throttle openings as finger 87 is moved upwardly and the degree of throttle opening at which this throttle actuated advance is initiated, can be varied throughout the operating or part throttle range.

In view of the above, it will be readily understood that by adjusting finger 87 at the uppermost calibration on scale 93, the carburetor will provide a high-octane fuel mixture only throughout practically the entire operating range. On the other hand, when finger 87 is set at the lowermost calibration, the carburetor will provide low octane fuel only throughout the entire operating range, except when manifold vacuum declines below a predetermined low value. By setting finger 87 at intermediate calibrations the changeover from low to high octane operation can be accomplished at any point between these two extremes where it is determined the anti-detonant property of the high octane fuel is required. Regardless of the setting of finger 87, throttle movements cannot move the metering pins past position E, of Fig. 5, at which position the fuel selector mechanism ceases further movement when lever 80 is stopped by the bowl cover.

This cessation of movement occurs because coil spring 91 is weaker than torsion spring 83, so that when lever 80 is stopped by contact with the bowl cover 84, throttle pin 96 will merely urge finger 87 downwardly, stretching coil spring 91, but not causing any further movement of fuel selector lever 64. When this occurs, the high test metering pins are at position E, of Fig. 5, with the shallow upper portion of flat 32a in the metering orifice.

Changes in manifold vacuum are transmitted from mixture conduit 12 posterior to throttles 19 (Fig. 3) via a port 98a, duct 99 and 100, and tubular passage 101 to suction chamber 102, where, at a predetermined low vacuum diaphragm 103 and its plunger 106 are urged rightwardly by spring 105. Diaphragm spring 105, is stronger than torsion spring 83, so that when manifold vacuum in suction chamber 102 becomes very low, spring 105 urges plunger 106 against a lip 108 on fuel selector plate 64, thereby urging plate 64 clockwise, link 76 downward, and lever 77 clockwise until lip 79 is stopped by the bowl cover 84 (Fig. 8), thus elevating the metering pins to their extreme upward position F, with the deep portion of flat 32a located in high octane metering orifice 26, thereby permitting a maximum flow of fuel therethrough. Metering pin position F can be reached only when the throttles are fully open, but this position is independent of the position of adjustment finger 87.

Referring now to Figs. 3, 6, 7 and 8, operation of the device at an intermediate setting can be seen. In Fig. 3, the throttles 19 are opened slightly beyond their idling positions and pin 96 thus rotated a short distance from its closed throttle position. Thereupon spring loaded plungers 74 act through arm 72, countershaft 67 and lever 64 to raise the metering pins to position C, of Fig. 5. In Fig. 6, throttles 19 have continued their opening movement and throttle pin 96 has moved a similar distance clockwise, but has not yet acted against adjustment finger 87, there intermediately positioned, so that fuel selector lever 64 and metering pins 31 and 32 are still in the part throttle low octane position of Fig. 5.

In Fig. 7, throttle opening movement has continued, thus causing pin 96 to urge intermediately located finger 87 downwardly. Downward movement of finger 87 is transmitted through spring 91 and member 86 to fuel selector arm 64, causing a clockwise movement thereof. This latter movement is transmitted to metering pins 31 and 32, ultimately causing them to move from position C through position D to position E of Fig. 5 with the throttles nearly fully open. Thus the transfer was made from low octane to high octane operation. At this point, crank 80 engages the bowl cover 84, and, through torsion spring 83 resists further clockwise movement of crank 77 and fuel selector lever 64. As throttle opening continues, and as throttle pin 96 moves clockwise additional distances, its movement is transmitted to finger 87, but not to fuel selector lever 64, since coil spring 91, not being sufficiently strong to overcome the resistance of torsion spring 83, stretches.

Regardless of additional throttle opening movement, fuel selector plate 64 and the metering pins 31 and 32 remain as shown in Fig. 7 until manifold vacuum decreases to a predetermined low value, in the order of 5 inches Hg.

Referring now to Fig. 8, when such a reduction in vacuum occurs, and as long as it exists, provided the throttles are wide open, the diaphragm coil spring 105 urges plunger 106 outwardly into abutting engagement with lip 108 on fuel selector lever 64. Since coil spring 105 is stronger than torsion spring 83 which thus far has resisted further rotation of crank 77 and of fuel selector lever 64, plunger 106 urges fuel selector lever 64 and crank 77 clockwise in opposition to spring 83 until lip 79 on crank 77 engages the bowl cover, as in Fig. 8. When this occurs, the metering pins 31 and 32 are in their full power, high octane positions, as at F, Fig. 5, so that a maximum flow of high octane fuel is permitted.

As manifold vacuum increases, or as the throttles are moved toward their closed position, the same sequence is repeated in reverse, the rate of transition from high to low octane fuel being slightly retarded by the necessarily relatively slow upward movement of dashpot plunger 69. It should be noted, in this regard, that downward movement of dashpot plunger 69, being absorbed by its spring, offers almost no resistance to elevation of the metering pins during throttle opening movements.

Referring now to Fig. 10, it will be noted that a modified form of the low and high octane metering pins is shown in a position similar to C of Fig. 5. Modified low octane metering pin 111 is identical with metering pin 31, except that the lower edge of its flat 111a, instead of being horizontal, is slightly bevelled. High octane metering pin 112 is identical with metering pin 32, except that the upper edge of its flat 112a is also slightly bevelled. Obviously this bevelling permits a longer simultaneous opening of the two metering orifices, and thus a more gradual blending of the low and high octane fuels. Thus, the speed range during which blending of the two fuels takes place can be increased, for example from 5 miles per hour, using metering pins 31 and 32 to 20 miles per hour, using the modified metering pins 111 and 112, the increase in the blending range depending, of course, on the angle and depth of the bevel.

The invention disclosed herein may be modified in various respects as will occur to those skilled in the art, and the exclusive use of all

such modifications as come within the scope of the appended claims is contemplated.

I claim:

1. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted, respectively, for storing low and high octane fuel, a fuel supply passage leading from each of said chambers to said conduit, valves controlling said passages, spring actuated throttle responsive means for opening said low octane valve to its maximum opening, throttle actuated means for closing said low octane valve and opening said high octane valve a predetermined amount, said throttle actuated means being adjustable for actuation at any desired throttle opening, and means responsive to suction in the intake conduit for advancing said high octane metering pin to its maximum opening.

2. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted, respectively, for storing low and high octane fuel, fuel supply passages leading from each of said chambers to said conduit, valves controlling said passages, spring actuated throttle responsive means for opening said low octane valve to its maximum opening, throttle actuated means for simultaneously closing said low octane valve and opening said high octane valve a predetermined amount, said throttle actuated means being adjustable for actuation at any desired throttle opening, means responsive to suction in the intake conduit for advancing said high octane metering pin to its maximum opening, additional fuel passage means including a restricted portion leading directly from said low octane fuel chamber to said intake conduit adjacent the throttle valves to provide fuel for idling, and additional throttle responsive means for rendering inoperative said additional fuel passage means at a predetermined small throttle opening.

3. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel supply passages leading from each of said chambers to said conduit, a calibrated metering orifice in each of said passages, metering pins slidably mounted in said metering orifices, said metering pins being adapted to sealingly close said orifices and being formed with elongated recessed portions to permit passage of fuel when said portions are in registry with said orifices, said recessed portion of said low octane metering pin being normally in close proximity with said low octane orifice, said recessed portion of said high octane metering pin being in relatively less proximity with its orifice, spring actuated throttle responsive means for moving said recessed portions toward said orifices until the recessed portion of said low octane pin is substantially bisected by its orifice, permitting a maximum flow of low octane fuel therethrough, and throttle actuated means for moving said pins until part of the recessed portion of each is in its metering orifice thereby permitting a blend of fuels and for further moving said metering pins until said low octane orifice is sealingly closed and said high octane orifice is opened a predetermined amount, said throttle actuated means being adjustable for actuation at any desired throttle opening.

4. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel supply passages

leading from each of said chambers to said conduit, a calibrated metering orifice in each of said passages, metering pins slidably mounted in said metering orifices, said metering pins being adapted to sealingly close said orifices and being formed with reduced portions to permit passage of fuel when said portions are in registry with said orifices, said reduced portion of said low octane metering pin being normally in close proximity with said low octane orifice, said reduced portion of said high octane metering pin being in relatively less proximity with its orifice, spring actuated throttle responsive means for moving said reduced portions toward said orifices until the reduced portion of said low octane pin is substantially bisected by its orifice, permitting a maximum flow of low octane fuel therethrough, throttle actuated means for moving said pins until part of the reduced portion of each is in its metering orifice thereby permitting a blend of fuels, said throttle actuated means further moving said metering pins until said low octane orifice is sealingly closed and said high octane orifice is opened a predetermined amount, said throttle actuated means being adjustable for actuation at any desired throttle opening, and means responsive to suction posterior to the throttle for moving said metering pins until said high octane orifice opening attains its maximum size, thereby permitting the full power requirement of high octane fuel to pass therethrough.

5. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel supply passages leading from each of said chambers to said conduit, a calibrated metering orifice in each of said passages, metering pins slidably mounted in said metering orifices for simultaneous movement, said metering pins being adapted to sealingly close said orifices and being formed with elongated reduced portions to permit passage of fuel when said reduced portions are in registry with said orifices, said reduced portion of said high octane metering pin being normally spaced a greater distance from its orifice than said reduced portion of said low octane metering pin and means responsive to power demand for moving said reduced portions of said metering pins toward and through said metering orifices to effectuate, successively, opening of said low octane metering orifice, substantially simultaneous closing of low octane, and opening of said high octane orifices until maximum full power opening of said high octane orifice.

6. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel supply passages leading from each of said chambers to said conduit, a calibrated metering orifice in each of said passages, metering pins slidably mounted in said metering orifices for simultaneous movement, said metering pins being adapted to sealingly close said orifices and being formed with elongated reduced portions to permit passage of fuel when said reduced portions are in registry with said orifices, said reduced portion of said low octane metering pin being normally in close proximity with said low octane orifice, said reduced portion of said high octane metering pin being in relatively less proximity with its orifice and being formed in two steps, the step farthest from the orifice being the deeper, spring actuated throttle responsive means for moving said re-

duced portions toward said orifices until the reduced portion of said low octane pin is substantially bisected by its orifice, permitting a maximum flow of low octane fuel therethrough, and throttle actuated means for simultaneously moving said pins until part of the reduced portion of each is in its metering orifice thereby permitting a blend of fuels and for further moving said metering pins until said low octane orifice is sealingly closed and said first step of said high octane metering pin is in said orifice to permit the maximum part throttle requirement of high octane fuel to flow therethrough, said throttle actuated means being adjustable for actuation at any desired throttle opening.

7. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel supply passages leading from each of said chambers to said conduit, a calibrated metering orifice in each of said passages, metering pins slidably mounted in said metering orifices for simultaneous movement, said metering pins being adapted to sealingly close said orifices, said metering pins being formed with elongated reduced portions to permit passage of fuel when said reduced portions are in registry with said orifices, said reduced portion of said low octane metering pin being normally in close proximity with said low octane orifice, said reduced portion of said high octane metering pin being in relatively less proximity with its orifice and being formed in two steps, the step farthest from the orifice being the deeper, spring actuated throttle responsive means for moving said reduced portions toward said orifices until the reduced portion of said low octane pin is substantially bisected by its orifice, permitting a maximum flow of low octane fuel therethrough, throttle actuated means for simultaneously moving said pins until part of the reduced portion of each is in its metering orifice thereby permitting a blend of fuels and for further moving said metering pins until said low octane orifice is sealingly closed and said first step of said high octane metering pin is in said orifice to permit the maximum part throttle requirement of high octane fuel to flow therethrough, said throttle actuated means being adjustable for actuation at any desired throttle opening, and means responsive to suction posterior to the throttle for moving said metering pins until said deeper step of said high octane metering pin is in its orifice, thus permitting a maximum flow of high octane fuel therethrough.

8. In an internal combustion engine having an intake conduit, a throttle valve therein, a pair of fuel chambers adapted, respectively, for storing low and high octane fuel, fuel supply passages leading from each of said chambers to said conduit, valves controlling said passages, spring actuated throttle responsive means for opening said low octane valve to its maximum opening, throttle actuated means for simultaneously closing said low octane valve and opening said high octane valve a predetermined amount, said throttle actuated means being adjustable for actuation at any desired throttle opening, additional fuel passage means including a restricted portion leading directly from said low octane fuel chamber to said intake conduits adjacent the throttle valves to provide fuel for idling, and additional throttle responsive means for rendering inoperative said additional fuel passage means at a predetermined small throttle opening,

said additional throttle responsive means comprising a throttle actuated combination cut-off and air bleed valve.

9. In an internal combustion engine having an intake conduit, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel passage means leading from each of said fuel chambers to said intake conduit, a calibrated metering orifice in each of said fuel passages, a metering pin normally sealingly closing each of said orifices, each of said pins having a reduced portion, and means responsive to throttle movement and to vacuum in the intake manifold for moving said metering pins in unison, said reduced portion on the low octane metering pin being adapted for positioning in the metering orifice during light load operation at low speeds, the reduced portions of said low octane and high octane pins being adapted for positioning in their respective orifices simultaneously to effect a blend of fuels and transfer from low to high octane operation, the reduced portion of said high octane metering pin being adapted for positioning in its orifice during the remainder of the operating range.

10. In an internal combustion engine having an intake conduit, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel passage means leading from each of said fuel chambers to said intake conduit, a calibrated metering orifice in each of said fuel passages, a metering pin normally sealingly closing each of said orifices, each of said metering pins having a reduced portion, means responsive to throttle movement and to vacuum in the intake manifold for moving said metering pins in unison, said reduced portion on the low octane metering pin being adapted for positioning in the metering orifice during light load operation at low speeds, the reduced portions of said low octane and high octane pins being adapted for positioning in their respective orifices simultaneously to effect a blend of fuels and transfer from low to high octane operation, the reduced portion of said high octane metering pin being adapted for positioning in its orifice during the remainder of the operating range, and manually adjustable means for determining at what throttle opening the metering pins shall advance.

11. In an internal combustion engine having a plurality of intake conduits, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel passage means leading from each of said fuel chambers to said intake conduits, a calibrated metering orifice in each of said fuel passages, a metering pin normally sealingly closing each of said orifices, a flattened portion on each of said metering rods, means responsive to throttle movement and to vacuum in the intake manifold for moving said metering pins in unison, said flattened portion on the low octane metering pin being adapted for positioning in the metering orifice during light load operation at low speeds, the flattened portions of said low octane and high octane pins being adapted for positioning in their respective orifices simultaneously to effect a blend of fuels and transfer from low to high octane operation, the flattened portion of said high octane metering pin being adapted for positioning in its orifice during the remainder of the operating range, manually adjustable means for determining at what throttle opening the metering pins shall advance, an independent idle system comprising passages leading from said low octane fuel chamber to said

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intake conduits and including a throttle actuated combination air bleed and shut-off valve for rendering said idle system inoperative at a predetermined small throttle opening prior to transfer from low to high octane operation.

12. In an internal combustion engine having a plurality of intake conduits, a pair of fuel chambers adapted respectively for storing low and high octane fuel, fuel passage means leading from each of said fuel chambers to said intake conduits, a calibrated metering orifice in each of said fuel passages, a metering pin normally sealingly closing each of said orifices, a flattened portion on each of said metering rods, means responsive to throttle movement and to vacuum in the intake manifold for moving said metering pins in unison, said flattened portion on the low octane metering pin being adapted for positioning in the metering orifice during light load operation at low speeds, the flattened portions of said low octane and high octane pins being adapted for positioning in their respective orifices simultaneously to effect a blend of fuels and transfer from low to high octane operation, the flattened portion of said high octane metering pin being adapted for positioning in its orifice during the remainder of the operating range, said high octane metering pin flattened portion being formed with a relatively deep part, and means responsive to low vacuum in the intake conduits for positioning the relatively deep part of said flattened portion in the high octane metering orifice to permit a maximum flow of high octane fuel therethrough.

13. In a carburetor, a mixture conduit, a throttle therein, a pair of fuel chambers, a fuel supply passage leading from each chamber into said conduit, a control valve for each passage, means operatively connecting said throttle and said valves, said means including a yielding part and being normally shiftable as a unit to differentially actuate said valves upon opening of said throttle, a stop normally cooperating with said part to limit movement of said valves, and means responsive to suction in said conduit for further shifting said control valves, said part yielding to permit such additional valve movement.

14. In a carburetor, a mixture conduit, a throttle therein, a pair of fuel chambers, a fuel supply passage leading from each chamber into said conduit, a control valve for each passage, means operatively connecting said throttle and said valves, said means including a first yielding part and a second, more resistant yielding part, a stop normally limiting shifting of said valves to predetermined positions, said first part yielding to permit continued throttle opening movement thereafter, and a device responsive to mixture conduit suction for causing further shifting of said valves beyond said predetermined position, said second part yielding to permit such last mentioned further movement of said valves.

15. In a carburetor, a mixture conduit, a throttle therein, a pair of fuel chambers, a fuel supply passage leading from each chamber into said conduit, a control valve for each passage, means operatively connecting said throttle and said valves, a lost motion part, a first yielding part constituting one of the elements of said

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lost motion part, and a second, more resistant, yielding part, said first yielding part being adjustable to vary the pick-up between said throttle and said operative connection means during throttle opening movement, a stop normally limiting shifting of said control valves by said throttle, said first yielding part yielding to permit continued throttle opening movement thereafter, and a device responsive to mixture conduit suction for causing further shifting of said control valve after said stop is engaged, said second part yielding to permit such second mentioned further movement of said control valves.

16. A carburetor as described in claim 15 in which said suction responsive device operates on said valves through said operative connection means irrespective of the position of said adjustable yielding first part.

17. In a carburetor, a mixture conduit, a throttle valve therein, a pair of fuel chambers, respectively, for high and low octane fuels, a main fuel supply passage leading from each chamber into said conduit, a control valve in each passage, a lever loosely pivoted adjacent and axially with relation to said throttle valve, an element movable with said throttle valve, a second lever pivoted to said first lever and normally positioned to be engaged by said throttle element to transmit throttle movement to said first lever, said second lever being adjustably mounted for varying the point in throttle opening movement at which said first lever is actuated thereby, and operative connections between opposite ends of said first lever and said control valves for causing shifting of the same upon movement of said first lever.

18. A carburetor as specified in claim 17 further including a device responsive to mixture conduit suction having a one-way connection with said first lever for shifting the same so as to actuate said valve when the conduit suction drops excessively.

19. A carburetor as specified in claim 17 in which said second lever is resiliently mounted on said first lever and further including a resilient stop for limiting actuation of said valves in one direction, the resilient mounting of said second lever yielding upon engagement of said stop to permit further throttle opening movement.

20. A carburetor as specified in claim 17 further including a yielding element carried by said operative connection, a stop engageable by said element to limit shifting of said first lever and said valves and a device responsive to relatively low suction in said mixture conduit for additionally shifting said valves against said stops.

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