

April 23, 1957

E. J. DURBIN

2,789,801

LOAD COMPENSATING CARBURETOR

Filed Sept. 9, 1954

2 Sheets-Sheet 1

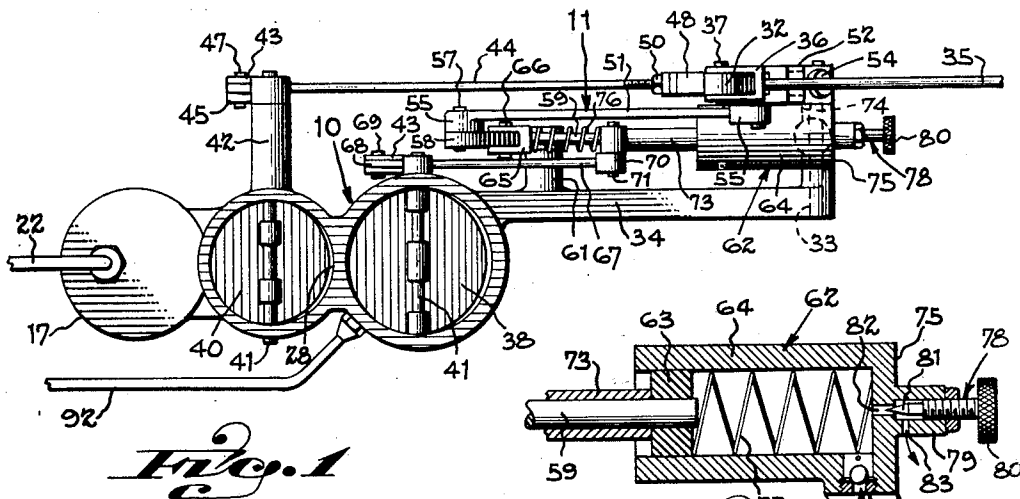
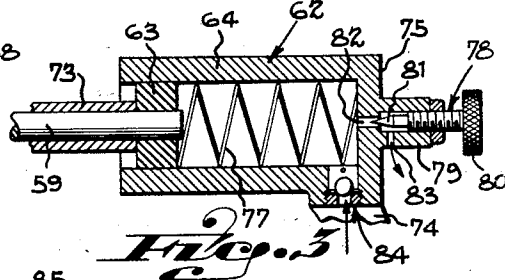
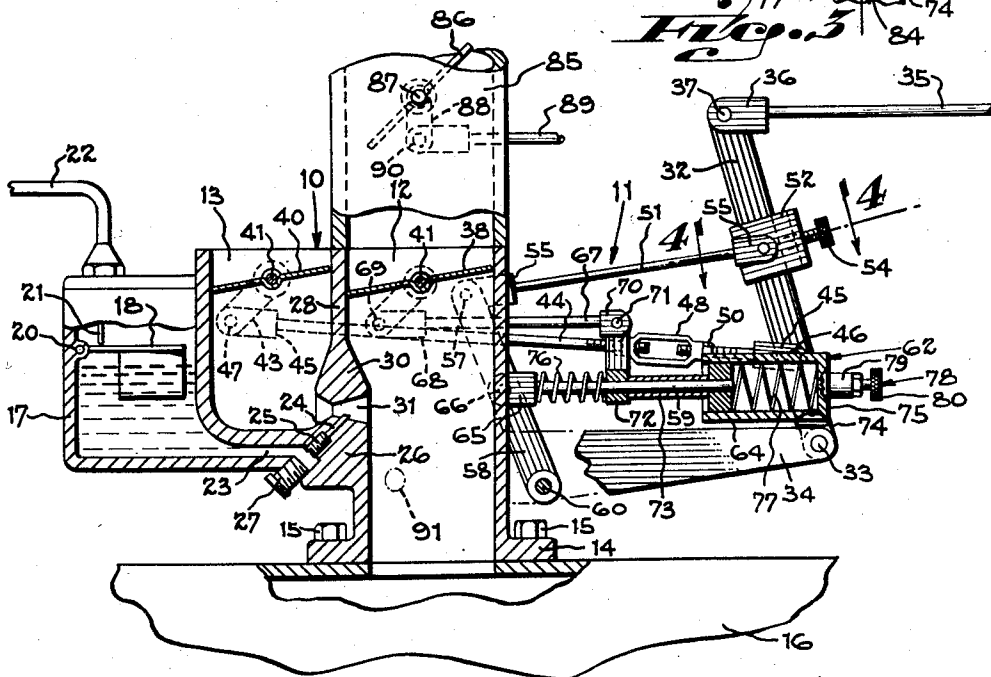


Fig. 2

INVENTOR.
Eugene J. Hurbin.
BY
Wood, Heron & Evans.
ATTORNEYS.

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E. J. DURBIN

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2 Sheets-Sheet 2

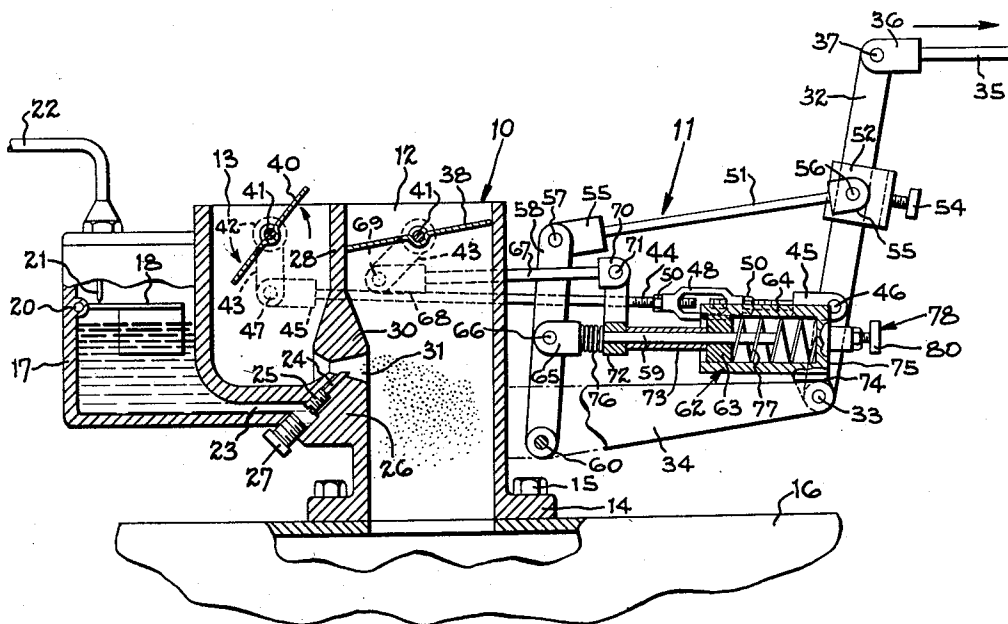


Fig. 5

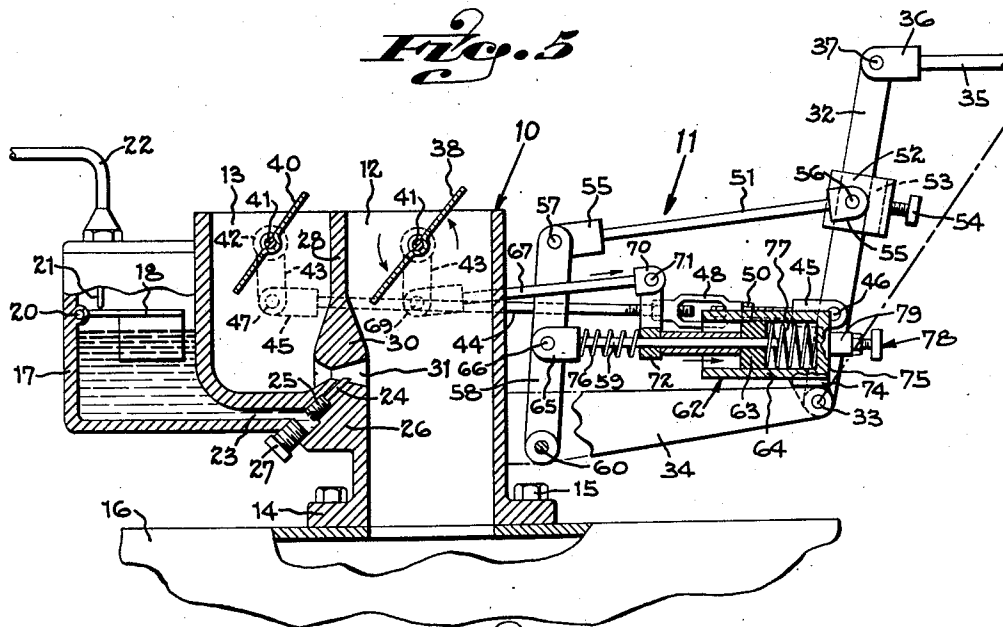


Fig. 6

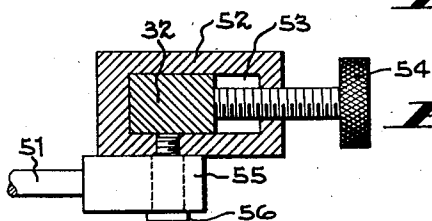


Fig. 4

INVENTOR.
Eugene J. Durbin.
BY Wood, Herron & Evans.
ATTORNEYS.

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LOAD COMPENSATING CARBURETOR

Eugene J. Durbin, St. Bernard, Ohio

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6 Claims. (Cl. 261—46)

This invention relates to an improved carburetor for gasoline engines which are subjected to variable loads, such as automobile and truck engines. The present carburetor is intended to create an enriched mixture of air and vaporized fuel when the throttle is opened, so as to provide greater power as the engine picks up the load, either when starting the vehicle from a standstill or when accelerating from a given speed.

It is well known in the art, that temporarily enriching the fuel mixture when the throttle initially is opened or when its opening is increased, greatly improves engine response. Thereafter, as the engine accelerates to a speed corresponding to its throttle opening, the mixture should be leaned out to create the most efficient performance and to conserve fuel. For this purpose, it has been conventional in the past to equip the carburetor with a mixture control device, for example an accelerator pump, which is connected to the throttle control linkage in such a way that it delivers a supplemental spurt of raw gasoline to the carburetor or manifold in response to the movement of the throttle toward open position. While this arrangement improves engine pick-up, it is not the ideal solution because the spurt of fuel is of short duration although the engine usually requires a sustained enriched mixture while it is gaining speed and torque. Moreover, the degree of richness under these conditions is not related to the changing needs of the engine as it progressively gains speed.

One of the principal objects of the present invention has been to provide a carburetor which creates an enriched mixture of atomized fuel and air which is fed to the engine for a sustained period of time while the engine picks up speed and torque, and which progressively is leaned out at a rate correlated to the response of the engine, thereby to provide sustained maximum performance and efficiency whether accelerating from a standstill or from a given running speed.

The invention is based upon the concept of providing a carburetor having a mixture intake passageway having venturi passageway including a fuel jet communicating with a main intake passageway, the air flow through the passageways being controlled by individual throttle valves, one for each passageway, thereby providing a variable mixture from rich to lean, in accordance with the relative positions of the two throttle valves.

A further object has been to provide a control linkage of simplified construction connected in common to both throttle valves, the linkage including a time delay device arranged to open the mixture control valve immediately when the accelerator pedal is depressed, so as to provide a rich mixture, while the time delay device opens the main throttle valve gradually over a predetermined time period to lean out the mixture as the engine picks up speed.

The relative positions of the two valves are thus controlled in unison by the linkage to produce a rich mixture initially, followed by a sustained rich but increasingly leaner mixture correlated with the gain in engine speed.

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At full engine speed for a given throttle opening, the related positions of the two throttle valves provide the leanest mixture consistent with engine performance at maximum efficiency.

- 5 When starting from a standstill at which the throttle is shifted from closed to open position, the time delay device provides the greatest amount of relative motion between the two valves, thereby producing a mixture of maximum richness as the engine takes over its load, followed by the sustained change from rich to lean as engine speed increases. When the engine is running at a given speed after initial acceleration, shifting the linkage further in the throttle opening direction again enriches the mixture temporarily in the same manner but to a lesser extent, since the proportionate gain in engine speed and power is less than at starting. This action provides immediate engine response when driving conditions require quick acceleration.

- 20 The time delay device of the present disclosure is in the form of a dash pot having an adjustable needle valve for bleeding air from it, so as to regulate its time delay action. The dash pot includes an intake check valve providing quick return and immediate closing of both valves when the linkage is shifted in throttle closing direction, that is, when the accelerator pedal is released. It will be understood that the invention is not limited to the specific linkage and time delay device disclosed, since various other mechanisms providing a similar action can be utilized in the present combination of valves and passageways.

- 30 Various features and advantages of the invention, in addition to those outlined above, are disclosed in the following detailed description in conjunction with the drawings.

- 35 In the drawings:

- Figure 1 is a general top plan view showing the carburetor and its operating components, the throttle being shown in closed position.

- 40 Figure 2 is a sectional view projected from Figure 1 further illustrating the assembly.

- Figure 3 is an enlarged fragmentary sectional view taken from Figure 1, detailing the construction of the time delay device which regulates the mixture during acceleration.

- 45 Figure 4 is an enlarged sectional view taken on line 4—4 of Figure 2, detailing the adjustable link connection of the mixture control arm.

- 50 Figure 5 is a diagrammatic view similar to Figure 2, showing the movement of the parts as the throttle is shifted from closed to open position to provide an enriched starting mixture.

- Figure 6 is similar to Figure 5, showing the position of the parts after a predetermined time delay to provide the lean running mixture.

- 55 Referring to Figures 1 and 2 illustrating one embodiment of the invention, the apparatus consists generally of the carburetor casing indicated at 10 and the mixture control linkage, indicated at 11, which compensates for the opening of the throttle by enriching the gas and air mixture. The casing 10 preferably is of one-piece construction such as a die casting having a main air intake passageway indicated at 12 and a mixture intake passageway indicated at 13. The lower portion of the main intake passageway includes a flange 14 which is bolted as at 15 to the intake manifold 16 of the engine in the conventional way.

- 60 Casing 10 includes a float valve chamber 17 which is generally conventional and which includes a float valve 18 pivotally connected as at 20 to the wall of the chamber. A needle valve 21, connected to the float, operates within a needle valve seat (not shown) to control the

flow of gasoline from the gasoline line 22 to the float chamber.

The lower portion of the float chamber includes a passageway 23 which supplies the liquid gasoline to a fixed jet tube 24. The jet includes a head 25 which is threaded into the wall 26 of the chamber. An external threaded plug 27 provides access to the head of the jet. The arrangement is such that an interchangeable jet may be installed to suit the particular operating characteristics of various engines.

As best shown in Figure 2, the wall 28 between the main intake passageway 12 and mixture passageway 13 has a thick section 30 providing a venturi passageway 31 leading from the mixture intake passageway to the main air passageway. The venturi passageway provides accelerated air flow and the open end of the jet tube 24 projects into the diverging throat of the venturi passageway. The air flow provides an inspirator effect to draw the liquid gasoline from the passageway 23 to be vaporized as it enters the venturi passageway and flows into the main air intake passageway. The venturi passageway and jet arrangement is generally conventional and is well understood by those skilled in the art.

The actuating linkage 11 for the mixture control valve and main throttle valve consists of a mixture control arm 32 having its lower end pivotally connected by a shaft 33 extending laterally from a fixed bracket arm 34 which forms a part of the casing 10. To the upper or swinging end of arm 32 there is pivotally connected to an end of the main throttle control rod 35 by means of a clevis 36 pivoted as at 37 to the arm. This rod is attached to the accelerator pedal and hand throttle control of the car in the usual way. The parts are shown in Figure 1 in the position they assume with the accelerator pedal and hand throttle in closed position. The carburetor is provided with the usual adjustable stop (not shown) which holds the main throttle valve sufficiently open for idling the engine with the throttle closed.

The mixture is varied from rich to relatively lean during acceleration by the main throttle valve 38 and the mixture control valve 40. These valves are of the butterfly type and their movements are correlated with one another, the mixture control valve being caused to open in advance of the main throttle valve during acceleration. Each valve is pivotally mounted upon a respective cross shaft 41, the shafts being pivoted in the conventional manner in the respective passageways. In order to properly locate the linkage, the mixture intake passageway 13 includes a lateral boss 42 journalling the cross shaft of the mixture control valve 40. Upon the outer end of each cross shaft 41 there is keyed a respective crank 43 for actuating the valves.

The actuating linkage 11 interconnects both throttle valves with the mixture control arm 32. The main throttle valve 38 is connected to the mixture control arm through the linkage 11 which is controlled by the time delay device as explained in detail below. The mixture control valve 40 is connected directly to the mixture control arm by the link 44, such that the mixture valve opens immediately in response to throttle movement while the main throttle valve opens after a predetermined time delay.

Described in detail, the direct acting mixture control link 44 includes a clevis 45 pivotally connected as at 46 to the lower portion of the mixture control arm. The opposite end of the link includes a similar clevis 45 which is pivotally connected as at 47 to the end of crank 43 which controls the movement of the mixture control valve 40. In order to provide adjustment for the position of the mixture valve relative to the main throttle valve, link 44 is of sectional construction, the two sections being joined by a turn buckle 48 which is threaded upon the adjoining end portions of the link. The threaded portions are left hand and right hand threads such that rotation of the turn buckle lengthens or shortens the

link as required. The turn buckle is locked in its adjusted position by the nuts 50. It will be noted in Figure 5 that movement of the mixture control arm 32 in throttle open direction swings the mixture control valve 40 immediately to open position while the main throttle valve 38 remains closed by operation of its delayed action control linkage 11.

Movement of the mixture control arm is imparted to the main throttle valve 38 by means of the link 51 which is connected to a selected point along the length of the mixture control arm 32 by the slide block 52. Slide block 52 is adjustable along the arm to vary the degree of motion which is imparted to the main throttle valve. Referring to Figure 4, the slide block 52 includes an opening 53 embracing arm 32 and clamped in position by an adjustment screw 54. The link 51 is connected to the slide block by means of a bearing block 55 pivotally connected to the slide block by a shoulder screw 56. The opposite end of the link 51 includes a similar bearing head 55 pivotally connected as at 57 to an intermediate lever 58. The lower end of the lever is pivotally connected as at 60 to the bracket arm 34 which is provided with a boss 61 for this purpose (Figure 1). The swinging motion of the mixture control arm 32 is thus transmitted directly to the intermediate lever 58 and the degree of motion is varied as required by the adjustment of the slide block 52 relative to the mixture control arm.

The movement of the intermediate lever 58 is imparted to the main throttle valve 38 by operation of the time delay dash pot, indicated generally at 62, which is actuated by the intermediate lever 58. For this purpose there is provided a piston rod 59 which establishes a sliding connection with the piston 63 of dash pot cylinder 64. The outer end of piston rod 59 includes a clevis 65 pivotally connected to the intermediate lever as at 66. The piston of the dash pot is connected to the main throttle valve by a link 67 having a clevis 68 pivotally connected as at 69 to the crank 43 of the main throttle valve 38. To provide a yieldable connection, the opposite end of link 67 includes a bearing block 70 pivotally connected as at 71 to a lug 72 slidably mounted upon piston rod 59. A spacer sleeve 73 slidably disposed on the piston rod maintains lug 72 in fixed position relative to the piston. A compression spring 76 is confined between bearing clevis 65 and lug 72. The dash pot 62 is pivotally mounted for rocking movement in response to the swinging movements of the intermediate lever 58. For this purpose the outer end of the dash pot is provided with a spaced pair of lugs 74, pivotally mounted upon the shaft 33 which journals the mixture control lever 32 as previously described.

Referring to Figure 3, the dash pot cylinder 64 has a head 75 seating one end of a relatively light compression spring 77. The opposite end of the spring seats against piston 63, normally urging the piston to the position shown in Figures 2 and 3. The time delay motion of piston 63 is regulated by a needle valve 78 threaded into a boss 79 formed on the head of the cylinder 62. The needle valve is adjusted by rotating the knurled head 80 which moves the tapered end 81 of the valve axially with respect to the outlet passageway 82, the air being bled out of the cylinder by way of the passageway 83 as indicated by the arrow in Figure 3. The needle valve thus regulates the rate of motion of the piston toward the end of the cylinder when the throttle control is shifted to open position, thus regulating the movement of the main throttle valve toward open position.

It should be understood at this point that the spring 76 is compressed when the throttle control rod 35 and mixture control arm are advanced to throttle open position. This spring has substantially greater resistance to deflection than the cylinder spring 77; hence the energy stored in the compressed spring 76 is sufficient to compress spring 77 and move the piston toward the closed end of the cylinder to open the main throttle valve under the delay action of the needle valve.

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When the controls are moved to throttle closed position, pressure against the piston is relieved, allowing the weaker cylinder spring 77 to return the piston to its closed throttle position shown in Figure 2. To provide a rapid return motion, cylinder 64 is provided with a rapid return intake check valve 84 which opens as the piston moves toward the open end of its cylinder.

As indicated in Figure 2, the main intake passageway is provided with an intake tube 85 having a butterfly choke valve 86 pivotally mounted within it as at 87. The choke valve includes an operating crank 88 having an actuating rod 89 pivotally connected to it as at 90. The actuating rod is operated by the conventional hand or automatic choke control mechanism which is not shown.

In addition to its function as a choke in starting the engine, it is also contemplated to utilize the choke valve as a means for enriching the mixture when extra power is needed. For example, a richer mixture may be required while climbing a grade with both the main throttle and mixture throttle wide open or in passing another car on the open road at high speed. For this purpose, it is contemplated to provide means for partially closing the choke valve when the accelerator pedal is depressed beyond full open position, such as a connection from choke to accelerator pedal. It will be understood that partial closing of the choke valve will increase the air flow through the mixture intake passageway and thus enrich the mixture even though both throttle valves are wide open.

As indicated at 91 in Figures 1 and 2, the main intake passageway is provided with an opening below the throttle valve which is connected to a vacuum line 92. The vacuum line is connected to the spark control apparatus of the engine in the conventional manner to advance or retard the spark according to the throttle opening.

Operation

The diagrammatic views shown in Figures 5 and 6 represent the motions of the parts when the throttle control mechanism is shifted from the closed position shown in Figure 2 to an intermediate open position. As shown, the mixture control valve 40 is opened immediately by the direct acting link 44 when the mixture control arm 32 swings to throttle open position, while the main throttle valve remains closed. This represents the operation when the car is accelerated from a standstill with the engine idling. As soon as the mixture control valve opens, air flows through the mixture intake passageway 13 at an accelerated rate and through the venturi passageway 31, the rapid air flow picking up a relatively rich mixture of raw gasoline vapor, as indicated by the stippling, due to the rapid air flow. It will be understood that a limited amount of air also enters the main air intake as determined by the adjustment of the main throttle valve in its idling position.

As the mixture control arm 32 is shifted toward open position, it shifts the intermediate lever 58 in the same direction by operation of link 51. It will be noted in Figure 5 however, that piston 63 remains stationary and that the piston rod 59 slides forwardly, compressing the spring 76. It will be seen therefore, that spring 76 tends to force the piston inwardly, compressing the weaker spring 77, so as to open the main throttle valve at a rate controlled by the needle valve 78. As the air bleeds through the needle valve, the piston, sleeve and lug are shifted along the piston rod by operation of spring 76, thus swinging the main throttle valve gradually to open position as indicated in Figure 6. As the main throttle valve opens, the mixture progressively becomes leaner since a greater proportion of the air flows through the main intake passageway, decreasing the air flow through the mixture passageway.

It will be understood from the foregoing that the richest mixture, consistent with efficient engine performance, is produced when the throttle is first opened, and that

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the mixture progressively leans out as the engine picks up speed and requires a leaner mixture for maximum efficiency. The change in mixture is progressive from rich to lean and is related to the gradually increasing engine speed as dictated by the setting of the needle valve. At cruising speed, the same sequence occurs when the throttle opening is increased, thus providing temporarily an enriched mixture when greater power is called for. When the throttle is closed, the check valve allows the piston and component parts to return immediately to throttle closing position by operation of the cylinder spring 77.

Having described my invention I claim:

1. A carburetor comprising a casing having a main intake passageway and a mixture control passageway, the casing having a connecting passageway extending from the mixture control passageway to the main intake passageway, means for supplying fuel to said connecting passageway, a mixture control valve pivotally mounted relative to said mixture control passageway, a main throttle valve pivotally mounted relative to said main intake passageway, respective cranks on said valves for actuating the same, said valves controlling the admission of air to said respective passageways, a mixture control arm pivotally mounted relative to said casing including actuating means, a link extending from the mixture control arm to the crank of the mixture control valve for shifting the mixture control valve to open position upon movement of said mixture control arm, thereby enriching the mixture of air and fuel passing through the connecting passageway to the intake passageway, an intermediate lever pivotally mounted relative to said casing and spaced from the mixture control arm, a second link pivotally connecting the intermediate lever to the mixture control arm, a dash pot cylinder having a metering aperture, said cylinder mounted relative to the intermediate arm, a piston slidably disposed in said cylinder, a third link connecting the crank of the main throttle valve to said piston for opening said valve as the piston moves into the cylinder, and spring means connecting the intermediate lever to said piston for yieldably urging the piston into the cylinder at a controlled rate when the mixture control arm shifts the mixture control valve to open position, said piston movement being transmitted by said third link to the main throttle valve to open the same progressively after the intake valve has been opened, thereby to lean out the mixture passing through the connecting passageway to the main intake passageway.

2. A carburetor comprising a casing having a main intake passageway and a mixture control passageway, the casing having a connecting passageway extending from the mixture control passageway to the main intake passageway, means for supplying fuel to said connecting passageway, a mixture control valve pivotally mounted relative to said mixture control passageway, a main throttle valve pivotally mounted relative to said main intake passageway, said valves controlling the admission of air to said respective passageways, a mixture control arm pivotally mounted relative to said casing, a link extending from the mixture control arm to the mixture control valve for shifting the mixture control valve to open position upon movement of said mixture control arm thereby enriching the mixture of air and fuel passing through the connecting passageway to the intake passageway, an intermediate lever pivotally mounted relative to said casing and spaced from the mixture control arm, a second link pivotally connecting the intermediate lever to the mixture control arm, a dash pot cylinder having an adjustable metering communicating therewith for controlling the flow of air therefrom, said cylinder mounted relative to the intermediate arm, a piston slidably disposed in said cylinder, a third link connecting the main throttle valve to said piston for opening said valve as the piston moves into the cylinder, and spring means interposed between the intermediate lever and said piston for yieldably urging the piston into the cylinder at a rate regulated by said

adjustable metering valve when the mixture control arm shifts the mixture control valve to open position, said piston movement being transmitted by said third link to the main throttle valve to open the same progressively after the intake valve has been opened, thereby to lean out the mixture passing through the connecting passageway to the main passageway.

3. A carburetor comprising a casing having a main intake passageway and a mixture control passageway, the casing having a connecting passageway extending from the mixture control passageway to the main intake passageway, means for supplying fuel to said connecting passageway, a mixture control valve pivotally mounted relative to said mixture control passageway, a main throttle valve pivotally mounted relative to said main intake passageway, said valves controlling the admission of air to said respective passageways, a mixture control arm pivotally mounted relative to said casing, a link extending from the mixture control arm to the mixture control valve for shifting the mixture control valve to open position upon movement of said mixture control arm, thereby enriching the mixture of air and fuel passing through the connecting passageway to the intake passageway, an intermediate lever pivotally mounted relative to said casing and spaced from the mixture control arm, a second link having an end pivotally connected to the intermediate lever, adjustable means connecting the opposite end of the second link at a selected point along the mixture control arm, a dash pot cylinder having an adjustable metering valve communicating therewith for controlling the flow of air therefrom, said cylinder mounted relative to the intermediate arm, a piston slidably disposed in said cylinder, a third link connecting the main throttle valve to said piston for opening said valve as the piston moves into the cylinder, and spring means interposed between the intermediate lever and said piston for yieldably urging the piston into the cylinder at a rate regulated by said adjustable metering valve when the mixture control arm shifts the mixture control valve to open position, said piston movement being transmitted by said third link to the main throttle valve to open the same progressively to a position determined by the adjustment means of the second link after the intake valve has been opened, thereby to lean out the mixture passing through the connecting passageway to the main intake passageway.

4. A carburetor comprising a casing having a main intake passageway and a mixture control passageway, the casing having a connecting passageway extending from the mixture control passageway to the main intake passageway, means for supplying fuel to said connecting passageway, a mixture control valve shiftably mounted relative to said mixture control passageway, a main throttle valve shiftably mounted relative to said main intake passageway, said valves controlling the admission of air to said respective passageways, a mixture control arm pivotally mounted relative to said casing, a link extending from the mixture control arm to the mixture control valve for shifting the valve to open position, an intermediate lever pivotally mounted relative to said casing, a second link connecting the intermediate lever to the mixture control arm, a dash pot cylinder mounted relative to the intermediate arm, the cylinder having a metering aperture communicating therewith, a piston slidably disposed in said cylinder, a piston rod passing slidably through said piston and having an outer end connected to said intermediate lever, a lug slidably mounted on the piston rod, a third link having one end pivotally connected to said lug and having an opposite end pivotally connected to the main throttle valve, and a compression spring on said piston rod interposed between said lug and the intermediate lever urging the lug against said piston, said mixture control arm opening the mixture control valve when the mixture control arm is shifted to open position, said second link shifting the intermediate lever and compressing said compression spring, whereby said piston is forced

progressively into said cylinder at a rate regulated by said metering aperture, said movement being transmitted by said lug and said third link to the main throttle valve to open the same progressively after the mixture control has been opened.

5. A carburetor comprising a casing having a main intake passageway and a mixture control passageway, said passageways having individual air intake openings at the outer ends thereof, the casing having a connecting passageway extending from the control passageway to the main intake passageway, said connecting passageway residing in a plane spaced inwardly from the air intake openings of the main intake and mixture control passageway, means for supplying fuel to said connecting passageway, a mixture control valve shiftably mounted in said mixture control passageway, a main throttle valve shiftably mounted in said main intake passageway, said valves controlling the admission of air to said respective passageways, a mixture control arm pivotally mounted relative to said casing and including actuating means, a link directly connecting the mixture control arm to the mixture control valve, said link shifting the valve to open position upon movement of the control arm, an intermediate lever pivotally mounted relative to said casing, a second link connecting the intermediate lever to the mixture control valve, a time delay device mounted relative to said casing and including a movable element, said movable element being shiftably lineally relative to the time delay device at a retarded rate of motion, a rod element pivotally connected to the intermediate lever and slidable lineally relative to the said movable element, and compressible means carried on the rod element and interposed between the intermediate lever and the movable element of the time delay device, a third link connecting the movable element of the time delay device to said main throttle valve for opening said valve, said compressible means being compressed upon motion of the mixture control arm in a direction which opens the mixture control valve, the energy stored in the compressible means shifting the movable element, third link and main throttle valve at said retarded rate of motion toward open position after the mixture control valve has been opened, thereby progressively to lean out the mixture passing through the connecting passageway to the main intake passageway.

6. A carburetor comprising a casing having a main intake passageway and a mixture control passageway, said passageways having individual air intake openings at the outer ends thereof, the casing having a connecting passageway extending from the control passageway to the main intake passageway, said connecting passageway residing in a plane spaced inwardly from the air intake openings of the main intake and mixture control passageways, means for supplying fuel to said connecting passageway, a mixture control valve shiftably mounted in said mixture control passageway, a main throttle valve shiftably mounted in said main intake passageway, said valves controlling the admission of air to said respective passageways, a mixture control arm pivotally mounted relative to said casing and including actuating means, a link directly connecting the mixture control arm to the mixture control valve, said link shifting the valve to open position upon movement of the control arm, an intermediate lever pivotally mounted relative to said casing, a second link connecting the intermediate lever to the mixture control valve, a time delay device mounted relative to said casing and including a movable element, said movable element being shiftably lineally relative to the time delay device at a retarded rate of motion, compressible means interposed between said intermediate lever and the movable element of the time delay device, a third link connecting the movable element of the time delay device to said main throttle valve for opening said valve, said compressible means being compressed upon motion of the mixture control arm in a direction which opens the mixture control valve, the energy stored in said compressible means shifting the

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said movable element, third link and main throttle valve at said retarded rate of motion toward open position after the mixture control valve has been opened, thereby progressively to lean out the mixture passing through the connecting passageway to the main intake passageway, and means in said time delay device providing motion of said movable element at an unretarded rate upon motion of the mixture control arm in a direction which closes said valves, whereby the main throttle valve and mixture control valves are closed concurrently.

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