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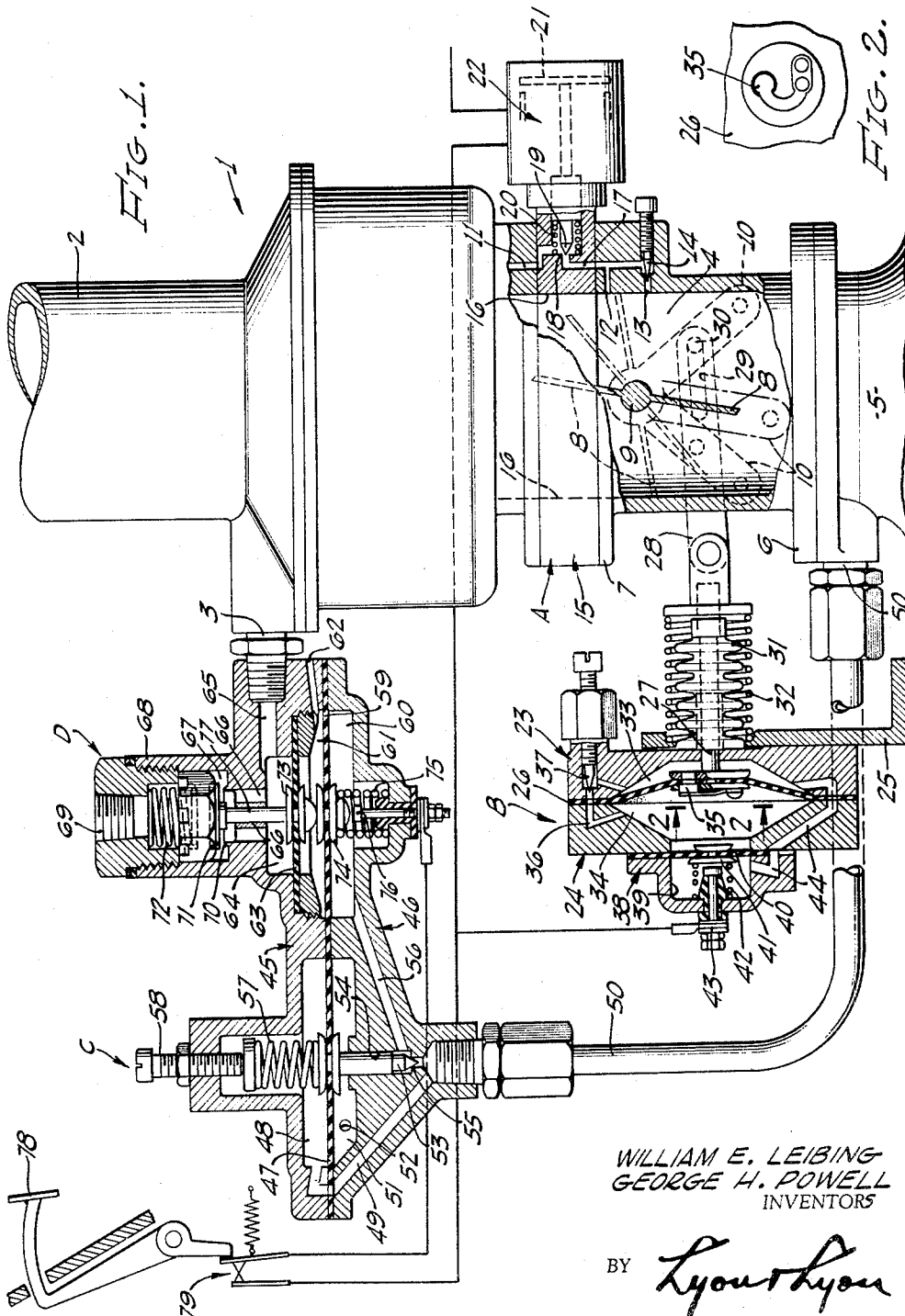
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DECELERATION CONTROLLED FUEL SHUT-OFF MEANS

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2 Sheets-Sheet 1



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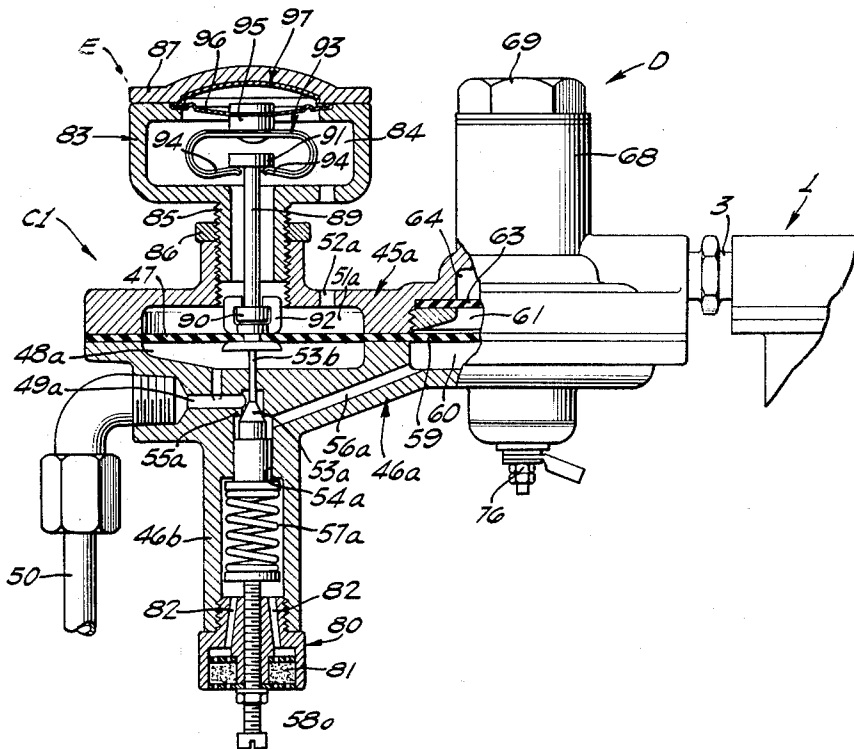


FIG. 3.

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DECELERATION CONTROLLED FUEL SHUT-OFF MEANS

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14 Claims. (Cl. 192—.084)

This invention relates to deceleration controlled fuel shut-off means for the engines of motor vehicles, and included in the objects of this invention are:

First, to provide a deceleration controlled fuel shut-off means which is arranged to shut off the idling fuel system of the engine carburetor immediately upon release of the accelerator, and if the deceleration is prolonged, as for example in descending a grade under compression, the main fuel supply to the carburetor is also shut off.

Second, to provide a fuel shut-off means wherein fuel is retained in the carburetor, and particularly in the passages of the idler system, so that the instant deceleration is terminated and the accelerator pedal is engaged, fuel is immediately available for the engine.

Third, to provide a fuel shut-off means which is adaptable to vehicles having manually-operated gear transmissions as well as those having automatic transmissions.

Fourth, to provide a fuel shut-off means which not only effects a substantial saving in fuel consumption, but also materially reduces the discharge of unburned fuel.

Fifth, to provide a fuel shut-off means which is particularly applicable to engines equipped with afterburners or other devices associated with the engine exhaust system of an engine, to minimize the loads otherwise imposed on such devices.

Sixth, to provide a deceleration controlled fuel shut-off means which incorporates novel means arranged to compensate for the effect of changes in temperature and altitude on operation of the fuel shut-off means, so as to eliminate the need of readjustment when the vehicle is used in mountainous country or in desert areas.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings in which:

Figure 1 is a substantially diagrammatical view of the deceleration controlled fuel shut-off means, with portions shown in cross section and with all the parts shown by solid lines in the positions assumed when the throttle valve is in its fully open position, and indicating by broken lines and by dotted lines an intermediate and a closed position of the throttle valve;

Fig. 2 is a fragmentary elevational view taken through 2—2 of Fig. 1, showing the diaphragm check valve utilized in the throttle delay unit;

Fig. 3 is a substantially diagrammatical, partial sectional, partial elevational view of the regulator valve unit and fuel supply shut-off valve unit to which is added a temperature and pressure compensating unit.

The deceleration control fuel shut-off means is intended to be used with any conventional internal combustion engine utilizing a carburetor. Such carburetor, designated 1, includes an air intake 2, a fuel inlet 3, and a throat 4 which communicate with an intake manifold 5. In the construction shown, the throat 4 is shown as a tubular member secured by a flange 6 to the intake manifold 5. The throat 4 is also shown as provided with a second flange 7 which is normally connected to the preceding parts of the carburetor 1, but which in the

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exercise of the present invention is separated therefrom, as will be described hereinafter.

Mounted within the throat 4 is a throttle valve 8 secured to a transverse shaft 9, which is rotated by an operating arm 10 connected by suitable linkage to an accelerator pedal, not shown.

The carburetor 1 includes an idler jet fuel supply duct 11 which communicates with idler jets 12 and 13 communicating with the throat 4 at points immediately preceding and following the throttle valve 8 when the valve is in its closed position. One or both of the idler jets may be provided with needle valves 14.

The carburetor 1 so far described is representative of the conventional carburetor. In actual practice the arrangement and number of idler jets differs with various carburetor constructions, and the shape and arrangement of the throat likewise varies; but in any case there exists in the conventional carburetor one or more idler jets and one or more main fuel jets.

In the exercise of the present invention, there is interposed between the carburetor 1 proper and the throat 4 an idler jet shut-off assembly A. This assembly includes an adapter disk 15 which is interposed between the flange 7 of the throat 4 and the preceding part of the carburetor.

The adapter disk 15 includes a throat passage 16 corresponding to the carburetor throat 4 and a duct 17 which is interposed between the separated portions of the idler fuel supply duct 11.

The duct 17 is intersected by a valve seat 18 which is controlled by a valve 19, which may be in the form of a small needle valve. The valve 19 is normally urged clear of its seat by a spring 20. The valve 19 is suitably connected to an armature 21 of a solenoid 22, so arranged that on energizing the solenoid the valve 19 is closed against the valve seat 18.

Mounted at one side of the throat 4 is a throttle delay unit B which includes a pair of housing members 23 and 24 suitably supported by a bracket 25. Clamped between the housing members 23 and 24 is a diaphragm 26 to which is attached a stem 27 extending from the housing member 23 toward the operating arm 10 of the throttle valve 8.

The stem 27 is connected to the operating arm 10 by means of a link 28. The link is provided with a lost motion slot 29 in which rides a pin 30 connected to the operating arm 10. The arrangement of the slot 29 is such that the throttle valve 8 may move from its solid line fully open position to an intermediate position indicated by broken lines before movement is imparted to the link 28. The stem 27 is preferably enclosed in a flexible boot 31, and is provided with a spring 32 which urges the stem 27 and the link 28 toward their extended positions.

The housing members 23 and 24 form with the diaphragm 26 a pair of chambers 33 and 34. The diaphragm is provided with a check valve 35 which permits free flow of air from the chamber 33 to the chamber 34 when the diaphragm is moved to the right, as viewed in Fig. 1; that is, in a direction corresponding to movement of the throttle valve 8 toward its open position.

The chambers 33 and 34 are connected by a bleed passage 36 in which is interposed a needle valve 37, which is adjusted to regulate the rate of flow from the chamber 34 to the chamber 33, so that movement of the diaphragm to the left, as viewed in Fig. 1, is at a rate controlled by the needle valve 37. Thus, after the lost motion of the pin 30 in the slot 29, the continued rate of closing of the throttle valve 8 from the broken line to the fully closed dotted line position is determined by the needle valve 37.

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Mounted on the housing member 24 is a switch housing 38. The housing 24 is provided with a central opening, and the switch housing 38 is provided with a registering recess 39 which is separated by a diaphragm 40. The diaphragm 40 is provided with a contact button 41 which is grounded through a spring 42.

Mounted in the switch housing 38 is an insulated terminal 43 positioned to be engaged by the contact button 41 when the diaphragm 40 is deflected to the left, as viewed in Fig. 1. An equalizing passage 44 extends from the recess 39 to the chamber 33.

The flow of fuel to the carburetor 1 is controlled by a dual valve structure which includes a regulator valve unit C and a fuel supply shut-off valve unit D. The dual valve structure includes complementary upper and lower valve body members 45 and 46 which are utilized by both valve units.

The regulator valve unit C includes a diaphragm 47 clamped between portions of the body members 45 and 46. The diaphragm 47 forms with the upper body member 45 a manifold pressure chamber 48. This chamber is connected by a passage 49 extending through the lower valve body 46 to a manifold pressure line 50, which extends from the regulator valve unit C to the intake manifold 5. The opposite side of the diaphragm 47 forms with the lower valve body member 46 an atmosphere chamber 51 having an atmosphere port 52.

The diaphragm 47 is provided with a needle valve 53 which is slidably mounted in a bore 54 provided in the body member 46 which communicates through a valve seat 55 with the manifold pressure line 50. A manifold pressure duct 56 leads laterally from the bore 54 to the fuel supply shut-off valve unit D to be described hereinafter.

The side of the diaphragm 47 opposite from the needle valve 53 is engaged by a spring 57 backed by a set screw 58 which is screw-threaded in the valve body 45 overlying the manifold pressure chamber 48.

The fuel supply shut-off valve unit D includes a diaphragm 59 clamped between portions of the valve body members 45 and 46. The diaphragms 47 and 59 may be formed of a single piece of yieldable material clamped between the housing members 45 and 46. The diaphragm 59 forms with the housing member 46 a manifold pressure chamber 60 to which the manifold pressure duct 56 is connected.

The diaphragm 59 forms with the body member 45 an atmosphere pressure chamber 61 having an atmosphere port 62. Secured in the body member 45 in coaxial relation with the diaphragm 59 is a fuel diaphragm 63. The fuel diaphragm 63 forms a portion of the wall of the atmosphere chamber 61. The side of the fuel diaphragm 63 opposite from the atmosphere chamber 61 forms with the body member 45 a fuel chamber 64, which is provided with a fuel outlet port 65 connected with the fuel inlet 3 of the carburetor 1.

The fuel chamber 64 is joined by a ring of connecting ports 66 with a fuel inlet chamber 67 formed within a tubular extension 68 of the valve body member 45. The tubular extension, and thus the fuel inlet chamber, is closed by a plug 69 which is screw-threaded for connection to a fuel line, not shown. The connecting ports 66 are surrounded by a valve seat 70 within the fuel inlet chamber 67. Slidably mounted for limited movement between the plug 69 and the valve seat 70 is a valve disk 71 which is urged toward the valve seat 70 by a spring 72.

The fuel diaphragm 63 is provided with a central force transfer button 73 which bears against a contact button 74 carried by the diaphragm 59. The contact button 74 is grounded by a spring 75 which normally holds the contact button 74 clear of an insulated terminal 76 carried by the housing member 46. A stem 77 is interposed between the force transfer button 73 and the valve disk 71.

It should be noted that the spring 75 is stronger than the spring 72 so that normally force is transmitted through

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the contact button 74, transfer button 73, and stem 77 to hold the valve disk 71 above the valve seat 70, and thus permit flow of fuel into the fuel inlet 3 of the carburetor 1.

The terminals 43 and 76 are electrically connected in parallel with each other and in series with the solenoid 22, so that grounding of either terminal closes the circuit through the solenoid 22 to close the valve 19.

If the deceleration controlled fuel shut-off means is installed on vehicles having automatic transmissions, only the terminals 43 and 76 need be utilized to control the solenoid 22. However, in installations on vehicles having a manual shift which requires manual operation of a clutch, as indicated by 78 in Fig. 1, then it is desirable to provide a clutch-controlled switch 79, which is normally closed when the clutch is engaged and the operator's foot is clear of the clutch pedal, but is arranged to open the instant the clutch pedal is moved from its fully engaged position and before the clutch pedal is moved far enough to initiate its clutch disengaging operation. The switch 79 is in series with both of the terminals 43 and 76 so that the solenoid 22 cannot be operated if the switch 79 is open.

Operation of the deceleration controlled fuel shut-off means is as follows:

Assuming the initial full throttle position of the throttle valve 8, the various parts of the apparatus are in the positions shown in Fig. 1. There is no appreciable vacuum in the intake manifold, consequently the needle valve 53 of the regulator valve unit C is closed. There is sufficient pressure in the manifold pressure chamber 60 of the fuel shut-off valve unit D to permit the spring 75 to hold the contact button 74 clear of the terminal 76.

The diaphragm 26 in the throttle delay unit B is deflected to the right as viewed in Fig. 1 so that the pressure within the chamber 34 is insufficient to deflect the switch diaphragm 40 to cause the contact button 41 to engage the terminal 43. Consequently, under conditions of full throttle the solenoid 22 is deenergized and the idler jet fuel duct 11 is open.

If the accelerator pedal is released, the throttle valve 8 tends to move clockwise, as viewed in Fig. 1, from its solid line or open position to its dotted line or closed position. It should be noted that the conventional linkage between the throttle valve 8 and the accelerator pedal includes a spring of suitable strength to effect the closing movement of the throttle valve.

During initial movement of the throttle valve 8, the lost motion slot 29 absorbs the movement of the operating arm 10 without imparting movement to the diaphragm 40. However, at some predetermined intermediate point, such as indicated by broken lines of the throttle valve in Fig. 1, the operating arm 10 tends to move the link 28, stem 27, and diaphragm 26 to the left, as viewed in Fig. 1, causing a pressure build-up in the chamber 34 which is sufficient to close the circuit through the terminal 43 and thus energize the solenoid 22 to shut off the idler jets 12 and 13.

Inasmuch as the jets 12 and 13 are the only jets, or at least the principal jets, operative as the throttle valve 8 moves towards its closed position, it follows that most, if not all, of the fuel which would otherwise enter the carburetor is closed off. This condition obtains until the air from the chamber 34 may bleed into the chamber 33 through the needle valve 37. When the pressure equalizes, the circuit through the terminal 43 opens, deenergizing the solenoid 22 to again reestablish flow of fuel through the idler jets. It should be noted that the idler jets ducts 11 and 17 remain full of liquid so that the instant the valve 19 is open fuel is available.

If the deceleration is of a relatively short period, the regulator valve unit C and fuel supply shut-off valve D with its terminal 76 does not come into play. Such condition obtains when a vehicle is decelerated for the purpose of making a stop or slowdown normally in traffic.

Under such conditions the vacuum build-up in the mani-

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fold may not be sufficient to operate the regulator valve unit C or the fuel supply shut-off valve D.

If, however, the deceleration condition is prolonged, as is the case when a vehicle is descending a grade under compression, then the vacuum pressure created within the intake manifold is of sufficient intensity to overcome the spring 57 of the regulator valve unit C, and thus open the needle valve 53 so that the vacuum pressure is applied under the diaphragm 59 in the manifold pressure chamber 60. The immediate effect of this is to close the circuit through the terminal 76 so that the solenoid valve 22 is energized, closing flow through the idler jets 12 and 13. It is preferable to adjust the controls so that the circuit through terminal 76 will close just before the circuit through the terminal 43 opens, so that the solenoid valve 22 will remain energized rather than open momentarily.

Operation of the fuel supply shut-off valve unit D enclosing the circuit through the terminal 76 also causes the valve disk 71 to engage the valve seat 70 and close off further flow of fuel to the carburetor. It should be observed that the conditions under which the fuel supply is shut off are such that the idler jet fuel supply is also shut off. Thus there is little or no flow of fuel through the carburetor. The carburetor float chamber thus retains its reserve quantity of fuel, but an over supply of fuel is not delivered due to closure of the fuel valve.

It should be explained that while normally a carburetor float valve can be depended upon to keep the carburetor from flooding, under normal conditions of driving there is a tendency, due to the vibration and bouncing of the vehicle and to centrifugal force as the vehicle passes around the curves, to disturb the position of the float and cause the float needle valve to continue to admit small quantities of fuel until the carburetor float chamber is flooded.

It is important, therefore, that under prolonged deceleration the main fuel be shut off, otherwise fuel will be wasted and unburned fuels will be delivered through the exhaust or aggravate the operation of an afterburner, either during prolonged operation under compression or during an initial interval after the throttle valve is again opened.

Assuming a prolonged deceleration or operation under compression, supply of fuel is immediately reestablished as soon as the accelerator pedal is again engaged, for there occurs a sudden raise in pressure in the intake manifold which opens the circuit through the terminal 76, and the mechanical movement of the throttle valve operating arm 10 shifts the diaphragm 40 to relieve the pressure in the chamber 34 and open the circuit through the terminal 43.

In the above description of the operation of the deceleration controlled fuel shut-off means, it has been assumed that the vehicle is equipped with any one of the various types of automatic transmissions. Such automatic transmissions provide sufficient continued linkage between the wheels and the engine that there is no danger of the engine stalling. Such is not the case, however, of a vehicle equipped with a manual shift and with a manually-operated clutch. In such installations it is desirable that the deceleration controlled fuel shut-off means be rendered inoperative whenever the manually-operated clutch is disengaged. This is accomplished by the switch 79.

It is conventional to arrange manually-operated clutch pedals so that they have about 1" free movement, and usually there is another 1" or so of movement before physical disconnection occurs between the engine and the wheels. Consequently, the switch 79 is so arranged as to utilize the initial portion of the free movement of the clutch pedal to open the switch 79 and render the deceleration control inoperative.

If the fuel to the idler jets is shut off at the time the clutch pedal is touched by the operator's foot, the circuit through the solenoid is broken, and the flow of fuel to

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the idler jets is reestablished before the vehicle operator can push the clutch pedal to its disengaged position. As a consequence, the engine is turned over a sufficient number of times by the vehicle wheels to prevent stalling before fuel is supplied. By this arrangement a vehicle may be back-shifted from a higher to a lower gear when descending a hill, without danger that the engine will stall and without interfering with the shut off of fuel during deceleration. In other words, the deceleration controlled fuel shut-off means does not interfere with normal operation of the vehicle.

Reference is now directed to Fig. 3 which distinguishes from the construction previously described in that a temperature and pressure compensating unit E is added to the regulator valve unit C. In this case the regulator valve unit C is modified in several respects to accommodate the temperature and pressure compensating unit E and is designated C1.

The fuel supply shut-off valve unit D is essentially the same as shown in Fig. 1.

The elements of the modified regulator valve unit C1, which correspond to the elements of the regulator valve unit C, bear corresponding reference numbers with the suffix "a." Thus modified complementary upper and lower valve body members 45a and 46a are provided. The body members clamp therebetween the diaphragm 47.

The diaphragm 47 forms with the lower body member 46a a manifold pressure chamber 48a. The manifold pressure chamber 48a is connected by a passage 49a to the manifold pressure line 50. The diaphragm 47 forms with the upper body member 45a an atmosphere chamber 51a having an atmosphere port 52a.

The lower body member 46a is provided with a depending hollow boss 46b having a bore 54a which intersects the manifold pressure chamber 48a. A needle valve 53a is slidable in the bore 54a and moves upwardly to engage a valve seat 55a formed by a shoulder constricting the bore 54a.

The needle valve 53a includes a stem 53b which projects upwardly into the manifold pressure chamber 48a to engage the diaphragm 47. A branch of the passage 49a intersects the bore 54a above the valve seat 55a. A manifold pressure duct 56a intersects the bore 54a below the valve seat 55a. The duct 56a communicates with the chamber 60 of the fuel shut-off valve unit D.

The bore 54a is counterbored within the boss 46b and receives a spring 57a. The end of the boss 46b is closed by a cap 80 having a screw-threaded bore which receives a set screw 58a engageable with the spring 57a to adjust the tension thereof. The cap 80 is provided with a cup portion at its lower end which receives a filter element 81. Passages 82 extend upwardly from the filter element 81 into the bore 54a so that the bore is subjected to atmospheric pressure.

The regulator valve unit C1 so far described functions similarly to the regulator valve unit C.

The upper body member 45a is provided with a tubular internally screw-threaded boss 45b centered above and communicating with the atmosphere chamber 51a. The boss 45b supports the temperature and pressure compensating unit E.

The temperature and pressure compensating unit E includes a cup-shaped housing 83 forming a chamber 84 having an externally screw-threaded tubular stem 85 adapted to be adjustably screw-threaded into the boss 45b and locked into position by a lock nut 86. The chamber 84 is closed by a cover 87 suitably secured thereto. An atmosphere port 88 is provided in a wall of the chamber 84 so that the chamber 84 is subjected to atmospheric pressure.

Freely mounted within the tubular stem 85 is a force transfer rod 89 having heads 90 and 91 at its extremities. The lower head 90 is restrained within a yoke 92 secured to the upper side of the diaphragm 47. The upper head 91 of the transfer rod 89 is engaged by a yoke-

shaped thermostat element 93 having inturned fingers 94 extending under the head 91. The thermostat element 93 extends across and clear of the end of the rod 89 and is secured to a button 95, which in turn is secured to a diaphragm wall 96 of a vacuum chamber cell 97 secured between the chamber 24 and the cover 87.

Operation of the deceleration controlled fuel shut-off means equipped with the temperature and pressure compensating unit E is essentially the same as the first described structure. The spring 57a, however, is arranged so that it supplies only a portion of the force necessary to close the needle valve 53a against a preselected manifold pressure in the chamber 48a, for example, approximately three-quarters of the required force.

For a given temperature the vacuum chamber cell 97 maintains a constant reference vacuum pressure, that is, the vacuum pressure originally established is maintained within the cell. However, changes in temperature change the reference pressure. The thermostat element is so constructed that the force it exerts changes with the temperature in opposition to the effect of temperature change on the vacuum chamber cell.

As a consequence, a supplementary force is maintained on the rod 89 which is unchanged by temperature change, but which does change to compensate for the change in atmospheric pressure, such as occurs with changes in altitude. Thus the deceleration controlled fuel shut-off means may be adjusted for operation at sea level, and can be depended upon to function properly when a vehicle is climbing or descending in mountainous territory.

While a particular embodiment of this invention has been shown and described, it is not intended to limit the same to the exact details of the construction set forth, and it embraces such changes, modifications, and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

What is claimed is:

1. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, an intake manifold for receiving an air-fuel mixture from said carburetor, and a control for manually operating said throttle valve, said means comprising: a valve means interposed in said idler jet system to shut off flow therethrough; automatic means for predetermining the minimum closing rate of movement of said throttle valve irrespective of said manual throttle control; and a device actuated by said automatic means for causing closure of said valve means upon operation of said automatic closing rate predetermining means.

2. A deceleration controlled fuel shut-off means for vehicles having a clutch actuator, and an engine including a carburetor having a throttle valve and an idler jet system, an intake manifold for receiving an air-fuel mixture from said carburetor, and a control for operating said throttle valve, said fuel shut-off means comprising: a valve means interposed in said idler jet system to shut off flow therethrough; automatic means for predetermining the minimum closing rate of movement of said throttle valve irrespective of said throttle valve control; a device actuated by said automatic means for causing closure of said valve means upon operation of said automatic closing rate predetermining means; and means controlled by said clutch actuator for rendering said valve means inoperative to shut off fuel during operation of said clutch actuator means.

3. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a solenoid valve for closing flow of fuel through said idler jet system; means for predetermining the closing rate of movement of said throttle valve; and a switch operable by said predetermining

means as said throttle valve approaches its closed position to actuate said solenoid valve.

4. A deceleration controlled fuel shut-off means for vehicles having a clutch actuator, and an engine including a carburetor having a throttle valve and an idler jet system, an intake manifold for receiving an air-fuel mixture from said carburetor, and a control for operating said throttle valve, said fuel shut-off means comprising: a solenoid valve for closing flow of fuel through said idler jet system; automatic means for predetermining the minimum closing rate of movement of said throttle valve irrespective of said throttle control; a first switch operable by said automatic predetermining means as said throttle valve approaches its closed position to actuate said solenoid valve; and a second switch in series with the first switch and connected with said clutch actuator to open on manipulation of said clutch actuator, thereby to render said solenoid inoperative during shifting of said transmission.

5. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a valve means interposed in said idler jet system to shut off flow therethrough; means for predetermining the closing rate of movement of said throttle valve; a device for causing closure of said valve means upon operation of said closing rate predetermining means; a fuel supply valve for said carburetor; and means responsive to a predetermined vacuum pressure in said manifold, to cause closure of said supply valve and to maintain closure of said idler jet system valve means after closing of said throttle valve.

6. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a solenoid valve for closing flow of fuel through said idler jet system; a first switch operable during closing movement of said throttle valve for closing said solenoid valve to shut off said idler jet system; and a second switch responsive to a predetermined vacuum pressure in said manifold, for holding said solenoid valve in its closed condition while said throttle valve is in its closed position and said predetermined vacuum pressure obtains.

7. A deceleration controlled fuel shut-off means for vehicles having a clutch actuator, and an engine including a carburetor having a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said fuel shut-off means comprising: a solenoid valve for closing flow of fuel through said idler jet system; a first switch operable during closing movement of said throttle valve for closing said solenoid valve to shut off said idler jet system; a second switch responsive to a predetermined vacuum pressure in said manifold, for holding said solenoid valve in its closed condition while said throttle valve is in its closed position and said predetermined vacuum pressure obtains; and a third switch operative to open the circuit through said solenoid valve during manipulation of said clutch actuator, to permit flow through said idler jet system irrespective of the condition of said first and second switches.

8. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a solenoid valve for closing flow of fuel through said idler jet system; means for predetermining the closing rate of movement of said throttle valve; a first switch operable by said predetermining means as said throttle valve approaches its closed position to close said solenoid valve thereby to shut off said idler jet system; a vacuum pressure responsive main

shut-off valve operable in response to a predetermined vacuum pressure in said intake manifold to shut off the fuel supply to said carburetor; a second switch operable in concert with said vacuum responsive main shut-off valve, to maintain said solenoid valve closed while said throttle valve is closed and said predetermined vacuum pressure obtains in said intake manifold.

9. A deceleration controlled fuel shut-off means for vehicles having a clutch actuator, and an engine including a carburetor having a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said fuel shut-off means comprising: a solenoid valve for closing flow of fuel through said idler jet system; means for predetermining the closing rate of movement of said throttle valve; a first switch operable by said predetermining means as said throttle valve approaches its closed position to close said solenoid valve thereby to shut off said idler jet system; a vacuum pressure responsive main shut-off valve operable in response to a predetermined vacuum pressure in said intake manifold to shut off the fuel supply to said carburetor; a second switch operable in concert with said vacuum responsive main shut-off valve, to maintain said solenoid valve closed while said throttle valve is closed and said predetermined vacuum pressure obtains in said intake manifold; a third switch operative to open the circuit through said solenoid valve during manipulation of said clutch actuator, to permit flow through said idler jet system irrespective of the condition of said first and second switches.

10. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a valve means interposed in said idler jet system to shut off flow therethrough; means for predetermining the closing rate of movement of said throttle valve; a device for causing closure of said valve means upon operation of said closing rate predetermining means; a fuel supply valve for said carburetor; and means responsive to a predetermined vacuum pressure in said manifold, to cause closure of said supply valve and to maintain closure of said idler jet system valve means after closing of said throttle valve; said means including a device operable in response to change in atmospheric pressure to effect a compensating change in the response of said means to the vacuum pressure in said manifold.

11. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a valve means interposed in said idler jet system to shut off flow therethrough; means for predetermining the closing rate of movement of said throttle valve; a device for causing closure of said valve means upon operation of said closing rate predetermining means; a fuel supply valve for said carburetor; and means responsive to a predetermined vacuum pressure in said manifold, to cause closure of said supply valve and to maintain closure of said idler jet system valve means after closing of said throttle valve; said means including a device operable in response to change in atmospheric pressure to effect a compensating change in the response of said means to the vacuum pressure in said manifold, and thermostat means to cancel the effect of temperature change on said device.

12. A deceleration controlled fuel shut-off means for vehicles having a clutch including a clutch actuator, and an engine including a carburetor having a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said fuel shut-off means comprising: a valve means interposed in said idler jet system to shut off flow therethrough; means for predetermining the closing rate of movement

of said throttle valve; a device for causing closure of said valve means upon operation of said closing rate predetermining means; a fuel supply valve for said carburetor; means responsive to a predetermined vacuum pressure in said manifold, to cause closure of said supply valve and to maintain closure of said idler jet system valve means after closing of said throttle valve; said means including a device operable in response to change in atmospheric pressure to effect a compensating change in the response of said means to the vacuum pressure in said manifold; and means actuated on manipulation of said clutch actuator prior to disengagement of said clutch, to maintain said idler jet valve means and said fuel supply valve open while said clutch is disengaged.

13. A deceleration controlled fuel shut-off means for an engine having a carburetor including a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said means comprising: a solenoid valve for closing flow of fuel through said idler jet system; means for predetermining the closing rate of movement of said throttle valve; a first switch operable by said predetermining means as said throttle valve approaches its closed position to close said solenoid valve thereby to shut off said idler jet system; a vacuum pressure responsive main shut-off valve operable in response to a predetermined vacuum pressure in said intake manifold to shut off the fuel supply to said carburetor; a second switch operable in concert with said vacuum responsive main shut-off valve, to maintain said solenoid valve closed while said throttle valve is closed and said predetermined vacuum pressure obtains in said intake manifold; atmospheric pressure sensitive means for controlling the response of said main shut-off valve to the vacuum pressure in the intake manifold to compensate for changes in atmospheric pressure; and a temperature sensitive means arranged to compensate for the effect of temperature change on said atmospheric pressure sensitive means.

14. A deceleration controlled fuel shut-off means for vehicles having a clutch actuator, and an engine including a carburetor having a throttle valve and an idler jet system, and an intake manifold for receiving an air-fuel mixture from said carburetor, said fuel shut-off means comprising: a solenoid valve for closing flow of fuel through said idler jet system; means for predetermining the closing rate of movement of said throttle valve; a first switch operable by said predetermining means as said throttle valve approaches its closed position to close said solenoid valve thereby to shut off said idler jet system; a vacuum pressure responsive main shut-off valve operable in response to a predetermined vacuum pressure in said intake manifold to shut off the fuel supply to said carburetor; a second switch operable in concert with said vacuum responsive main shut-off valve, to maintain said solenoid valve closed while said throttle valve is closed and said predetermined vacuum pressure obtains in said intake manifold; a third switch operative to open the circuit through said solenoid valve during manipulation of said clutch actuator, to permit flow through said idler jet system irrespective of the condition of said first and second switches; atmospheric pressure sensitive means for controlling the response of said main shut-off valve to the vacuum pressure in the intake manifold to compensate for changes in atmospheric pressure; and a temperature sensitive means arranged to compensate for the effect of temperature change on said atmospheric pressure sensitive means.

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