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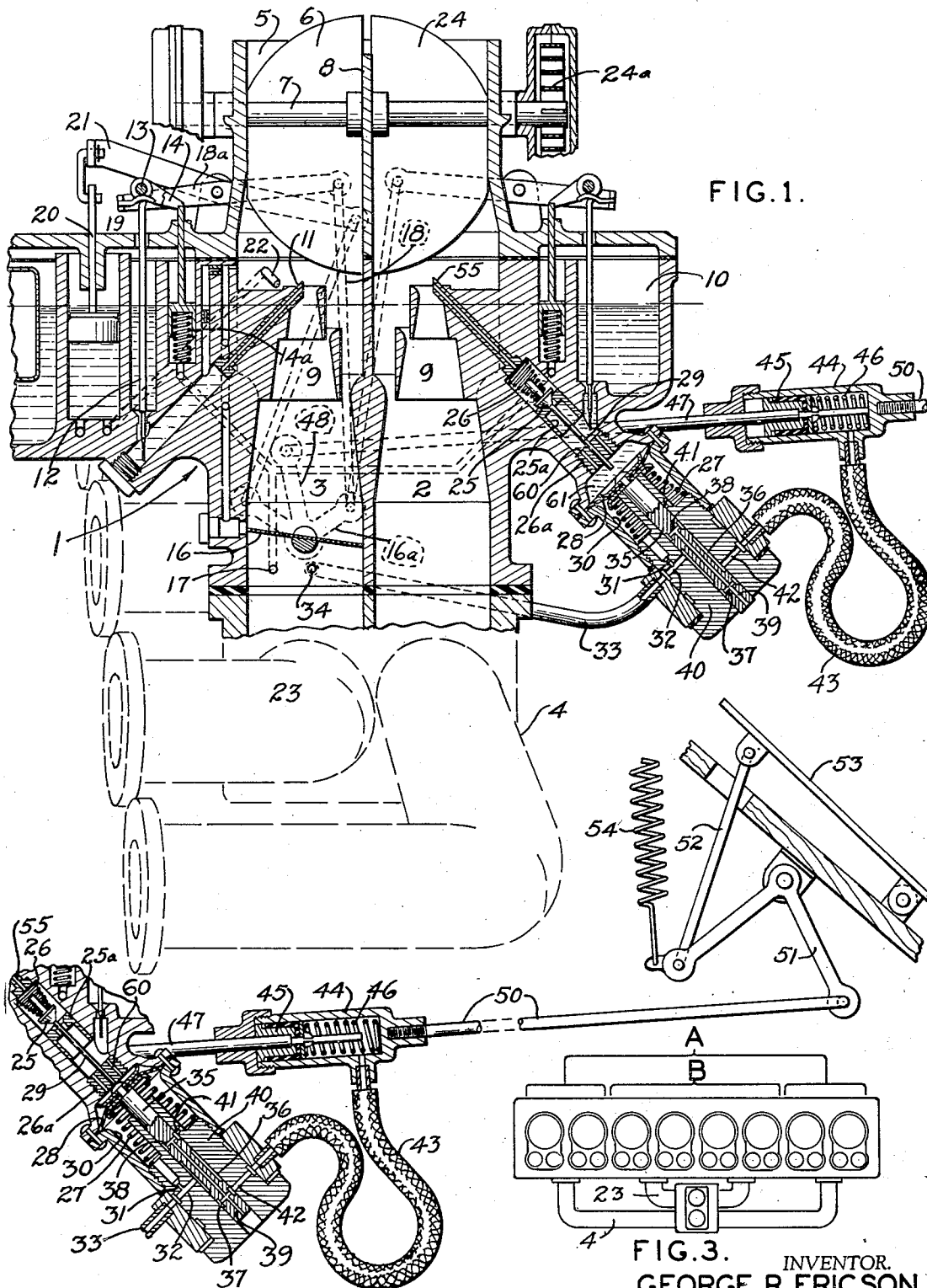


FIG. 1.

FIG. 2.

FIG. 3.

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ENGINE CONTROL DEVICE

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This invention relates to engine control devices and particularly to engine control devices for engines of the multi-cylinder type in which different cylinders or different groups of cylinders are supplied with fuel through separate intake conduits, and in which it may be desirable to cut off the flow of fuel to one or more groups of cylinders when the power required to be delivered by the engine is comparatively low. Various devices for cutting off or turning on the supply of fuel to the auxiliary cylinder groups have been devised, see, for instance, my applications, Serial No. 453,116, filed July 31, 1942, and Serial No. 468,564, filed December 10, 1942. Devices of this type operate satisfactorily for the purpose intended, but the strong surge of power when the auxiliary cylinder group is set in operation is objectionable to some drivers under some conditions. Also, the sharp drop in power upon deceleration may be objectionable in installations which do not have free wheeling, unless the driver is in the habit of declutching upon deceleration.

In order to give maximum satisfaction to inexperienced drivers, a device for cutting part of the cylinders in and out should operate so smoothly that the driver does not notice the shift. This is particularly true in cases where the throttle is omitted from the auxiliary group of cylinders. In installations of this kind, the added power surge from the auxiliary cylinders may cause an undesirable increase in acceleration unless compensated for by closing of the throttle in the other cylinder group. Also, the cutting off of the auxiliary cylinder group should be compensated for by a sudden opening of the throttle to the main cylinder group.

It is the object of this invention to produce a generally new and improved device and method for the purpose indicated.

The invention will be better understood upon reference to the following description and accompanying drawing, in which

Fig. 1 is a diagrammatic elevation of an engine control device and carburetor embodying my invention.

Fig. 2 is a diagram showing a part of the throttle operating mechanism and control in a different operative position.

Fig. 3 is a plan diagram of an internal combustion engine with which the control device may be advantageously used.

The reference numeral 1 indicates the main body member of a carburetor having two mixing conduits generally indicated at 2 and 3. Mixing conduit 2 is preferably unthrottled and dis-

charges into an intake manifold duct 4 which supplies the auxiliary cylinder group A of the associated internal combustion engine (Fig. 3). The engine indicated is an ordinary eight-in-line engine, the cylinders being arranged in two groups of four cylinders each, each group providing a power stroke for each 180° of crankshaft travel and the two groups being set to fire at 90° to each other, so that equally spaced power impulses and smooth running of the engine will be obtained regardless of whether one or both groups of cylinders are operating. In the present disclosure, the inside group B of the cylinders is shown as receiving fuel constantly, and the outer group A is supplied with fuel intermittently, but either group may be selected to operate constantly, and the present invention may be applied regardless of which group is selected.

Main mixing conduit 3 is provided with an air inlet 5 controlled by choke valve 6 eccentrically mounted on the shaft 7 which is journaled in suitable bearings in the wall of the air inlet 5 and the partition 8. This choke valve may be controlled by a thermostat and suction control mechanism of the type shown in Coffey Patent No. 2,085,351 or my prior Patent No. 1,915,851, in which the choke position at low temperatures and during warm-up is the resultant of the temperature or rate of air flow past the choke valve and the degree of suction existing posterior to the throttle. The mechanism is well understood in the art and need not be more completely described.

Main mixing conduit 3 is provided with a Venturi stack 9 and supplied with fuel from the fuel chamber 10 by means of the nozzle 11. The admission of fuel to the nozzle is controlled by the metering rod 12 which is connected by means of a cross pin 13 to the suction piston mechanism 14 normally held in upward position by a spring 14a, but responsive to suction posterior to the throttle 16 applied through the passage 17. Throttle 16 is connected by crank 16a and link 18 to a lever 18a having a lip 19 which underlies cross pin 13 so as to force the metering rod upwardly regardless of suction when the throttle is moved to substantially wide open position. The usual accelerating pump 20 operated by linkage 21 connected to the throttle is provided. This pump discharges through the nozzle 22 to provide an accelerating charge when the throttle is opened.

Main mixing conduit 3 discharges into the manifold duct 23 and supplies fuel to cylinder group B, and while I have shown a particularly pre-

ferred form of carburetor, it will be understood that other forms of carburetors may be used for this group of cylinders.

The auxiliary cylinder group A is supplied by mixing conduit 2, and this is provided with a Venturi stack 9, the same as mixing conduit 3. Unbalanced choke valve 24 is controlled by a coiled thermostat 24a so that the valve will be closed when the temperature is low and so that the valve responds only to the direct action of air flow therepast which moves it toward open position against the force of the thermostat. When normal running temperature is reached, both choke valves will remain in wide open position.

The fuel control mechanism for the auxiliary group of cylinders comprises a valve 25 normally biased toward closed position by a spring 26 which is weaker than a spring 27 controlling the diaphragm 28 which operates the push rod 29. This rod is slidable in guide plugs 25a and 26a, the former constituting a seat for valve 25 and the latter having apertures 60 leading to pump pressure chamber 61. The diaphragm chamber opposite pressure chamber 61 is connected by means of a restriction 31, cross passage 32, and tube 33 to the port 34 posterior to the throttle in main mixing conduit 3.

A slide valve stem 35 is connected to the diaphragm 28 and has an intermediate annular recess 36, cross ducts 37 and 38, and a longitudinal channel 39 intersecting the cross ducts and opening to atmosphere outwardly. The slide valve casing 40 is provided with transverse ducts or ports 41 and 42, the latter opening into a flexible tube 43 leading to a cylinder 44. A piston 45 slides within the cylinder 44 and is constantly urged to the left by a spring 46. The piston is connected by a rod 47 to a lever 48 rigid with throttle 16. Cylinder 44 is connected by a rod 50, bell crank 51 and link 52 to throttle pedal 53. A spring 54 urges the pedal and linkage in the direction to close the throttle.

The mechanism operates as follows:

When the suction on port 34 is above a predetermined value, such as exists in the intake manifold when the engine is operating under light or "no load," diaphragm 28 will be retracted against spring 27 permitting seating of valve 25 to close auxiliary fuel nozzle 55. When the suction on port 34 drops below such value, because of opening of the throttle and/or increasing the load on the engine, spring 27 moves diaphragm 28 upwardly and eventually opens valve 25 (Fig. 2), whereupon fuel will pass through the auxiliary nozzle 55, mixing conduit 2, and manifold duct 4 to the auxiliary cylinders, bringing these into operation. The initial discharge of fuel through nozzle 55 is hastened and increased by the pumping action of diaphragm 28.

Just prior to the opening of valve 25, cross duct 38 in the slide valve stem will register with port or duct 41 in the valve casing so as to expose chamber 30 to atmosphere through longitudinal channel 39. By proper calibration of restrictions 31 and 41, the diaphragm can be caused to pass quickly between its valve seating and un-seating positions so that the valve cannot stop in an intermediate position. The quick full opening of the valve contributes to the prompt supply for an adequate quantity of fuel for wetting the manifold. Furthermore, this air bleed arrangement insures that the valve will be open when there is relatively low suction in the manifold, say 10" Hg, or less, but will not again close until

there is substantially higher manifold vacuum, say 15" Hg. This tends to stabilize the valve once it is opened and eliminate the "hunting" that would result if the valve opened and closed at suction closely below and above a critical point.

When the diaphragm is withdrawn by suction to its light load position, as in Fig. 1, manifold suction will be communicated to cylinder 44 past valve recess 36 to retract piston 45 and shorten the throttle linkage. As the diaphragm and stem valve 35 move upwardly, the suction connection to cylinder 44 is cut-off and cross duct 37 in the stem valve registers with port or duct 42 so as to expose the cylinder to atmosphere through channel 39. Spring 46 then moves piston 45 to the left (Fig. 2) so as to slightly close throttle 16 substantially coincidentally with the coming into operation of the auxiliary cylinders. Conversely, as the auxiliary cylinders are cut-out, throttle 16 will be slightly opened because of shortening of the throttle linkage. This has the effect of damping the power surge which would otherwise occur as the auxiliary cylinders are cut in and out.

The invention may be modified in various respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

I claim:

1. In combination with an internal combustion engine intake conduit having a fuel control valve, a device movable responsive to engine suction for actuating said valve, and valve means operable with said device to change the effective pressure conditions applied thereto as said valve approaches and leaves its seat whereby different pressure conditions are required for closing said valve than for opening the same.

2. The combination with an internal combustion engine fuel supply conduit having a control valve therein, of a suction responsive device for actuating said valve and capable of movement independently thereof, and means to sharply change the suction applied to said device approximately as it starts to actuate said valve to cause quick valve actuating movement thereof.

3. The combination with an internal combustion engine fuel supply conduit having a pair of fuel control valves, separate suction responsive devices for jointly actuating said valves, and means to sharply change the suction conditions applied to said devices approximately as they start to actuate the corresponding valves to produce quick action thereof.

4. The combination with an internal combustion engine having an induction conduit and a fuel nozzle discharging therein, of a valve controlling the discharge from said nozzle, a device responsive to engine suction for actuating said valve, and capable of substantial movement independently thereof, and means becoming effective just prior to actuation of said valve by said device for causing quick valve actuating movement of said device.

5. The combination with an internal combustion engine having an induction conduit and a fuel nozzle discharging therein, of a valve controlling the discharge from said nozzle, a device responsive to engine suction for actuating said valve, and capable of substantial movement independently thereof, and means rendered effective by approach of said device to valve actuating position for producing snap action of said

device to insure actuation of said valve to its extreme position.

6. The combination with an internal combustion engine having an induction conduit and a fuel nozzle discharging thereinto, of a valve controlling the discharge from said nozzle, a device movable responsive to engine operating conditions for actuating said valve and capable of substantial movement independently thereof, and means rendered effective by arrival of said device at a position for starting to open said valve for causing quick action of said device throughout the remainder of its stroke.

7. The combination with an internal combustion engine having an induction conduit and a fuel nozzle discharging thereinto, of a valve controlling the discharge from said nozzle, a device movable responsive to engine suction for actuating said valve, an air bleed for said device, and valving means operated by said device to control said air bleed for sharply changing the suction conditions applied to said device at a predetermined position thereof and thereby change the speed of movement thereof.

8. The combination with an internal combustion engine having an induction conduit and a fuel nozzle discharging thereinto, of a valve controlling the nozzle discharge and normally yieldingly maintained in one of its extreme positions, a suction responsive device for actuating said valve toward its other extreme position, an air bleed for said device, and valving means operated with said device for controlling said air bleed to provide a sharp change of suction conditions on said device and insure quick movement of said valve towards and from its seat.

9. The combination with an internal combustion engine intake conduit and a fuel duct discharging thereinto, of a valve controlling said duct, and means for actuating said valve comprising a spring normally closing said valve, an element for actuating said valve against said spring, a spring urging said element in the direction for opening said valve, a passage for applying engine suction to said element for moving the same against said last-mentioned spring to permit closing of said valve, an air bleed for said passage, and a valve device for said bleed operable with said element just prior to actuation of said valve thereby to sharply change the suction condition in said passage and insure quick actuation of said fuel valve.

10. The combination with an internal combustion engine intake conduit and a fuel duct discharging thereinto, of a valve controlling said duct and having an actuator projecting therefrom, a suction responsive diaphragm adjacent said actuator, a spring urging said diaphragm in one direction, suction and valve chambers on the opposite side of said diaphragm from said actuator, a slide valve in said valve chamber and connected to said diaphragm, a suction connection constantly communicating with said suction chamber, an air bleed connection in said slide valve, air bleed and suction ports connecting said valve and suction chambers, and channeling in said slide valve disposed to control said connections and ports so as to constantly apply suction to said diaphragm in opposition to said spring and to open said air bleed port as said spring and diaphragm is about to move said actuator.

11. The combination with an internal combustion engine intake conduit having a fuel nozzle discharging thereinto and a throttle therein, of a control valve in said nozzle, and suc-

tion responsive means separate from said throttle for actuating said fuel valve and coincidentally actuating said throttle.

12. The combination specified in claim 11 further including air bleed means rendered effective upon impending actuation of said fuel valve by said means to sharply change the pressure conditions applied to said means and produce quick action of said valve and throttle.

13. In an internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle in one only of said conduits, a valve controlling the fuel nozzle for the other conduit, and means responsive to suction in said first conduit for closing and opening said fuel valve and, coincidentally, partly opening and closing said throttle to damp the power surge due to actuation of said fuel valve.

14. In combination with an internal combustion engine intake conduit, a fuel chamber having a movable wall responsive to engine suction, a nozzle connecting said chamber and conduit, and a valve controlling said nozzle and having an actuator element adjacent said movable wall, said wall serving to actuate said valve but being capable of substantial movement independently of said valve for increasing or decreasing the pressure in said nozzle approximately as said valve is actuated.

15. In an internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle in only one of said conduits for regulating the fuel mixture passing there-through, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, means operating said valve to insure an initial charge capable of eliminating lag in operation due to dry manifold conditions, means for adjusting said throttle to cushion the initial application of power by said valve operation, and means for operating said throttle as said valve is closed to increase the power developed by the throttle controlled cylinders.

16. In an internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle in only one of said conduits for regulating the fuel mixture passing there-through, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, means operated by intake manifold suction for opening said valve and simultaneously urging fuel into said conduit in excess of the normal flow, and means for adjusting said throttle to retard the acceleration of the engine to a degree comprehending the elimination of the surging condition of the engine.

17. In an internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle in only one of said conduits for regulating the fuel mixture passing there-through, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, means operated by intake manifold suction for opening said valve and simultaneously urging fuel into said conduit in excess of the normal flow induced by the passage of air through said conduit, means for closing said valve, and means for adjusting said throttle to accelerate the engine to such a degree as to eliminate a surging condition initiated by the discontinuance of the fuel

supplied through said valve controlled fuel nozzle.

18. In an internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle in only one of said conduits for regulating the fuel mixture passing there-through, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, means operated by intake manifold suction for opening said valve and simultaneously urging fuel into said conduit in excess of the normal flow induced by the passage of air through said conduit, means for closing said valve, means for adjusting said throttle to retard the acceleration of the engine to a degree eliminating the surging condition initiated by said valve opening, and means for adjusting said throttle to accelerate said engine to eliminate surging conditions created by the closing of said valve.

19. The combination with an internal combustion engine fuel supply conduit, of a valve controlling the delivery of fuel through said conduit, a pressure responsive device to actuate said valve, and means for sharply changing the pressure conditions applied to said device prior to actuation of said valve thereby to produce quick movement of said valve to a substantially open position whereby a substantial quantity of fuel is immediately available for wetting said conduit.

20. An internal combustion power apparatus including a pair of power cylinders and means for transmitting power from said cylinders to a common source, an independent source of fuel supply for each cylinder including a carburetor and conduits connecting said carburetor with said power cylinders, fuel nozzles delivering fuel from said carburetor into said conduits, a throttle controlling the flow of fuel mixture through one of said conduits, a valve controlling the passage of fuel into the other conduit, means for opening said valve upon predetermined load conditions in the throttle controlled power cylinder, and means for automatically varying the throttle position to maintain a desired uniform flow of power to said source when said valve is opened supplying fuel to the second cylinder.

21. In an internal combustion engine, a carburetor, a pair of intake conduits feeding different engine cylinders and connecting said cylinders with said carburetor, a fuel nozzle discharging fuel into each of said conduits, a throttle in one of said conduits for regulating the fuel mixture passing therethrough, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, a device responsive to engine suction for actuating said valve, means for changing the suction conditions applied to said device whereby a relatively quick initial movement of the valve is provided, manual means for actuating said throttle, suction responsive means for actuating said throttle independent of the manual means, said suction actuated means being operable to position said throttle upon the opening of said valve by suction whereby the fuel supply to the throttle controlled cylinders is varied to cushion the power developed in the cylinder supplied by fuel controlled by said suction actuated valve.

22. In an internal combustion engine, intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle controlling at least one of said conduits, manual means for operating said throttle, and means responsive to suction in one of said con-

duits for shifting said throttle independent of said manual means to regulate the power developed in the cylinders controlled by said throttle to retard a racing of the motor in instances where excessive amounts of fuel are provided in other cylinders of said engine.

23. In an internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits, a throttle in one of said conduits for controlling the fuel mixture passing there-through, a valve controlling the fuel nozzle for the other conduit, means controlled by intake conduit suction for opening said valve with an initial snap action, and means simultaneously supplying additional fuel under pressure to said valve controlled nozzle.

24. In a multiple cylinder internal combustion engine, a pair of intake conduits feeding different engine cylinders, a fuel nozzle discharging into each of said conduits for supplying fuel from a suitable source, a throttle for controlling the passage of fuel mixture in one of said conduits, means normally shutting off the supply of fuel passing through the nozzle to the other conduit, said last named means being operable to permit the passage of fuel through said nozzle upon predetermined load conditions of said engine, and means regulating the flow of fuel mixture in the throttle controlled conduit when said predetermined load conditions of the motor are reached whereby surging in said motor is eliminated.

25. In an internal combustion engine, a carburetor, a pair of intake conduits feeding different engine cylinders and connecting said cylinders with said carburetor, a fuel nozzle discharging fuel into each of said conduits, a throttle in one of said conduits regulating the fuel mixture passing therethrough, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, a device responsive to engine suction for actuating said valve, means for changing the suction conditions applied to said device whereby a relatively quick initial movement of the valve is provided, and manual means for actuating said throttle, said manual means including a lever and an expansible chamber interposed between and connecting with said lever and said throttle, said expansible chamber being subject to manifold pressures from said throttle controlled conduit whereby the relative position of the throttle and said lever may be varied.

26. In an internal combustion engine, a carburetor, a pair of intake conduits feeding different engine cylinders and connecting said cylinders with said carburetor, a fuel nozzle discharging fuel into each of said conduits, a throttle in one of said conduits regulating the fuel mixture passing therethrough, a valve controlling the flow of fuel through the fuel nozzle of the other conduit, a device responsive to engine suction for actuating said valve, means for changing the suction conditions applied to said device whereby a relatively quick initial movement of the valve is provided, and manual means for actuating said throttle, said manual means including a lever and an expansible chamber interposed between and connecting with said lever and said throttle, means for supplying manifold pressures to said chamber, and means for regulating said manifold pressures by movement of the suction responsive device actuating said valve.

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