Sept. 6, 1938. A. G. H. VANDERPOEL 2,129,609

AUTOMATIC FUEL MIXTURE AND SCAVENGING GAS CONTROL DEVICE

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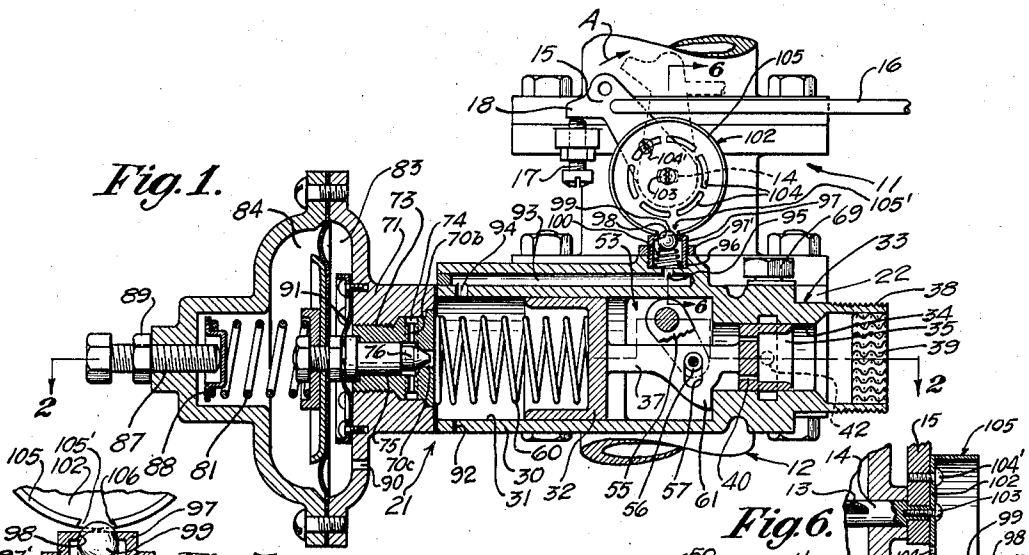


Fig. 1.



Fig. 7.

Fig. 2.

Fig. 6.

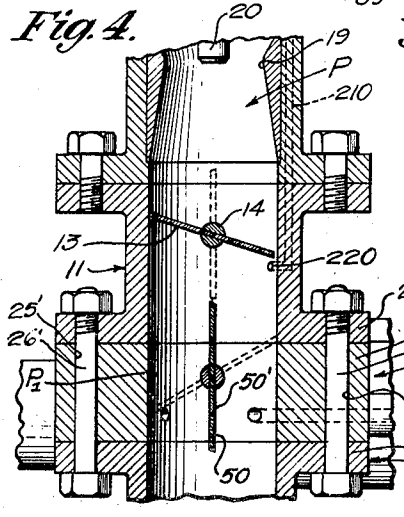


Fig. 4.

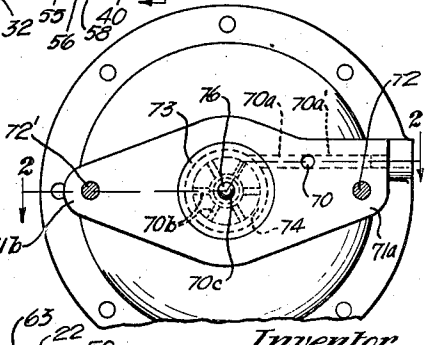


Fig. 3.

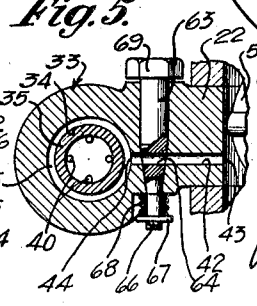


Fig. 5.

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2,129,609

AUTOMATIC FUEL MIXTURE AND SCAVENGING GAS CONTROL DEVICE

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20 Claims. (Cl. 123—119)

This invention has to do with fuel saving devices or "deceleration control devices" of the general character shown and described in United States Letters Patent No. 2,017,878, issued to me on October 22, 1935, and my copending applications, Ser. No. 20,997, filed May 11, 1935, and Ser. No. 95,126, filed August 10, 1936. The present invention is more particularly directed to improvements in the type of device shown in my copending application last referred to above, such improvements being designed to increase the universal adaptability of the device as an attachment for all conventional types of carbureters.

The general object of the present invention, as was the case in my copending application last referred to above, is to provide means, auxiliary to the carbureter, for controlling the flow of gas to the intake manifold. The chief purpose of such auxiliary means is to automatically cut off the carbureter proper from the intake manifold when the throttle valve is retarded to idling position with the engine running on momentum at a speed greater than idling speed thereby preventing the admission of raw fuel to the intake manifold and the disadvantages attending such admission under these operating conditions. This control of flow of gas to the intake manifold is further effected by the admission of a scavenging gas during such time as the carbureter is cut off in the manner pointed above.

The present invention like that of my copending application, Ser. No. 95,126, makes use of two factors, attending the operation of the engine and the carbureter throttle valve, for obtaining this control of gas flow to the intake manifold, such two factors being the manifold depression and the throttle position. The device is so designed that the initial action (that is the closure or shutting off of the suction passage to the intake manifold and the opening of the scavenging gas inlet) makes use of both these factors, and the secondary action (that is the opening of the suction passage and the closure of the scavenging gas inlet) may be effected by either of these factors independently of each other depending upon which control factor comes into action first.

In both the device of my present application and that of my application last referred to above, an abnormally high depression in the intake manifold, which attends "closure" of the throttle valve with the engine running at above idling speed, is utilized to operate a suction actuated member which is operatively associated with the means for controlling the flow of gas to the intake manifold just mentioned above. Also in both devices vent means, controlled by throttle position, are provided to relieve or break the suction applied to the suction actuated member thereby permitting the return of the flow control means to their normal operating position.

In the device of my copending application the communication of suction from the intake manifold or suction passage was controlled by a pilot piston associated with a suction control valve and the venting of the suction actuated member was accomplished through the use of a sleeve valve normally held in an open position by a yieldable member such as a compression spring.

As has been previously indicated my present invention is primarily designed for use as an attachment, and in such capacity, it will be seen that the position which the attachment unit occupies when in use, will depend entirely upon the design of the intake manifold and carbureter connection in the particular engine on which it is used. In this regard I have found that the pilot piston arrangement of my copending application last discussed above is quite sensitive to changes in position and in order that the adaptability of the device in different types of connections may be enhanced, it becomes the chief object of the present invention to provide an improved pilot member for actuating the suction control valve which will operate with equal sensitiveness irrespective of the position of the unit.

The sleeve valve venting arrangement of my copending application requires the use of a special throttle valve actuating lever to effect its operation, and since the position of the throttle valve shaft varies with different types of carbureters, this former device required a special throttle lever for each different carbureter design. It therefore becomes a further object of this invention to provide an improved vent valve and vent valve actuating means which does not require the replacement of any standard parts on the carbureter, but employs a simple and inexpensive cam member or cam plate which may be adjustably attached to a standard throttle lever. Thus it will be seen that by providing cam plates for the different throttle lever designs, the unit can be sold as a complete attachment and does not reqiure the replacement of any standard parts.

The details in the construction of a preferred embodiment of my invention together with other objects attending its production, will be best appreciated from the following description of the

accompanying drawing, which is chosen for illustrative purpose only and in which:

Fig. 1 is a sectional elevation showing a preferred form of my invention in conjunction with the carbureter and manifold connections, such section having been taken in front of the carbureter, in a plane represented by the line 1—1 of Fig. 2;

Fig. 2 is a plan section taken in a plane represented by the line 2—2 of Fig. 1, a portion of said section through the diaphragm chamber being off-set along the line 2—2 of Fig. 3;

Fig. 3 is a sectional elevation taken in a plane represented by the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional elevation taken along the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary section taken along the line 5—5 of Fig. 2;

Fig. 6 is a fragmentary sectional elevation taken along the line 6—6 of Fig. 1 with the throttle lever advanced to the dotted line position shown in Fig. 1; and

Fig. 7 is an enlarged fragmentary section illustrating details in the construction of the vent valve shown in Fig. 1.

More particularly describing the invention as herein illustrated, reference numeral 11 indicates the bottom portion of a conventional down draft carbureter and numeral 12 indicates the inlet connection of an intake manifold to which the carbureter is ordinarily attached. The carbureter, as mentioned above, is here shown as being of the down-draft type, but may be either up-draft or down-draft, and is shown as having a suction passage P adapted to communicate with the intake manifold and equipped with a conventional butterfly throttle valve 13. The throttle valve 13 is mounted upon a shaft 14 which has a throttle actuating lever 15 secured to its extending end. The lever 15 may be of any conventional form and is adapted to be actuated by a throttle actuating rod 16. It is the usual practice to associate the throttle valve with some means for adjusting its idle position and for the purpose of illustration herein, I have shown such means as comprising an adjusting screw 17 adapted to engage a projection 18 on the throttle lever.

The suction passage P of the carbureter is also shown as being equipped with a Venturi throat 19, a main fuel jet diagrammatically illustrated at 20, and an idling by-pass shown in dotted lines at 210 with its outlet port 220 positioned between the throttle valve 13, in its closed position, and the intake manifold.

Reference numeral 21 indicates the attachment contemplated by this invention which is designed to cooperate with the carbureter 11, for controlling the flow of gas to the intake manifold connection 12 at certain stages in the operation of the engine. The attachment 21 is housed in what I may term a block member. This block member, to which the numeral 21 more specifically applies, is shown as being comprised of several interconnected parts or sections and is chambered and bored to receive the various cooperating parts that go to make up the attachment.

The block member 21 in this form of my invention includes a flat block portion 22, which is shaped to conform with the connecting flanges 23 and 24 on the carbureter and intake manifold respectively, and has bolt holes 25 and 25' therethrough, whereby it is bolted between the flanges 23 and 24 through the medium of bolts 26 and 26'. The block portion 22 has a passage P_1 therethrough, which communicates between the suction passage P of the carbureter and the intake manifold.

Formed or mounted on the side of the block portion 22 is what I may term a suction cylinder 30 having a bore 31 therein adapted to receive a piston 32. Also formed or mounted on the block portion 22 in substantially concentric relation with the bore 31 is a scavenging gas inlet cylinder 33 which has a bore 34 therein, adapted to receive a sleeve valve or piston valve 35. The piston valve 35 is shown as being connected to the piston 32 in the suction chamber through a rigid connecting rod 37. The scavening gas inlet cylinder 33 is shown as being externally threaded at 38 to receive a connection from any suitable source of scavenging gas such as the exhaust manifold, and is also shown as being provided with a filtering medium indicated by reference numeral 39. The piston or sleeve valve 35 is shown as being provided with end ports 40.

For the purpose of admitting a scavenging gas to the passage P_1, from which it can be drawn into the intake manifold, I provide a scavenging gas duct 42 in the block portion 22, such duct having an outlet port 43 in the wall of the passage P_1 and having an inlet port 44 located in an annular groove 45 formed in the wall of the bore 34 and adapted to be normally covered or closed by the sleeve valve or piston member 35. The scavenging gas duct 42 therefore, with the attending valve and inlet connection just described serves as one medium for controlling the flow of gas to the intake manifold.

In addition to this, the flow of gas to the intake manifold is controlled by an auxiliary shut-off valve 50, which is mounted in the passage P_1 on a shaft 51, said shaft having one end 52 projecting into a chamber 53, formed between the two cylinders 30 and 33 on the member 21. The end 52 of the shaft is provided with a crank 55, such crank having a pin 56 located in a slot 57 in the connecting rod 37. The chamber 53 is shown as being provided with a cover plate 58.

The relative positions of the valve 50, the crank 55 and the sleeve valve member 35, with respect to the piston 32, are such that when the piston 32 is in its fully advanced position (as shown in Fig. 2) the auxiliary or shut-off valve 50 is open, and the scavenging gas control valve 35 is closed, that is the sleeve valve 35 covers the annular groove 45. The piston 32 is normally held in this advance position by a compression spring 60, a stop 61 being provided on the connecting rod 37 to limit its advancing movement.

The scavenging gas duct 42 is provided with an adjustable valve to control the volume of gas admitted therethrough, such valve being shown as comprising a tapered stem 63 having a valve port 64 therethrough, adapted to cooperate with the duct 42. The stem 63 is held in place by a pin 66, a washer 67 and a compression spring 68, and has a polygonal head 69 whereby it may be adjusted to vary the valve opening.

The parts described above, comprising the two valves 50 and 35 and the piston member 32 for actuating such valves, constitute, broadly, means for controlling the flow of gas to the intake manifold, and the structure so far described is similar to that described and illustrated in my copending application, Ser. No. 95,126, hereinabove referred to, and forms no part of the present invention except insofar as the parts thereof cooperate to form

combinations with the improved features about to be described.

For the purpose of communicating suction from the passage P_1 to the bore 31 of the suction cylinder to retract the piston 32 against the action of the spring 60, I provide what may be termed a suction duct comprised of duct sections 70, 70*a*, 70*b* and 70*c*. The duct section 70 is formed in the block portion 22 and communicates with the duct section 70*a* which is formed in a second block segment 71 mounted on the end of cylinder 30 through the medium of flanges 71*a*—71*b* and bolts 72—72'. Duct sections 70*b* are formed radially in a valve supporting plug 73 which is mounted in the block 71 coaxially with the bore 31. The radially extending ducts 70*b* communicate with an annular groove 74, formed on the plug 73, such groove being positioned in alignment with the duct section 70*a*. The duct section 70*c* comprises a bore or port through the end of plug 73, such port communicating with an enlarged bore within the plug and having a valve seat formed at its end within the enlarged passage.

The communication of suction to the bore 31 of suction cylinder 30 from the passage P_1, through the suction duct (70—70*a*—70*b*—70*c*) is controlled by a valve member 75, slidably mounted in the enlarged bore of the plug 73 and having a reduced inner end 76 tapered to seat on the edge of port 70*c*.

The suction control valve member 75 is normally held in this closed position and is adapted to be opened when the suction in the passage P_1 is "abnormally high", that is, when the depression in the passage P_1 is in excess of the normal idling depression for the engine. In this form of my invention, the opening movement of the valve 75 is obtained through the medium of a diaphragm which is mounted on the outer threaded end 78 of the valve member 75 and is indicated by reference numeral 79. This diaphragma 79 is interposed between the outer face 80 of the block segment 71 and a diaphragm cover section 82. The segment 71 and the cover member 82 are oppositely recessed as indicated at 83 and 84 to provide a diaphragm chamber, and that portion of the chamber confined within the recess 84 behind the diaphragm 79 constitutes what will hereinafter be referred to as the diaphragm suction chamber.

For the purpose of communicating suction from the passage P_1 to the diaphragm suction chamber 84, I provide auxiliary suction duct, comprised of duct sections 70*a*', 85 and 86, which are interconnected with each other and which communicate with the suction duct 70, so that the depression or suction in the passage P_1 is always communicated to the diaphragm suction chamber 84.

In order that a valve opening movement will be imparted to the diaphragm 79 only when the suction in the chamber 84 exceeds the suction obtaining at normal idling speed in the engine, I provide a compression spring 81 shown as being interposed between the diaphragm and an adjusting screw 87 which bears against a cup 88 mounted on the outer end of the spring 81. This adjusting screw 87 is set and locked through the medium of a lock nut 89 to hold the desired compression in the spring 81 so that it will permit valve opening movement of the diaphragm only when a predetermined suction (normal idling depression) is applied thereto from the passage P_1. Once this setting has been made or once the compression valve for the spring has been determined for a given carbureter installation, it may be desirable to positively lock the screw 87 in position, or it may even be preferable to use a solid cover member for the diaphragm without the adjusting screw, in which case the spring 81 would be calibrated to suit the particular type of installation. The chamber in front of the diaphragm formed by recess 83 is provided with a vent opening 90, and an auxiliary diaphragm 91 is provided to prevent the possibility of leakage around the valve member 75 to the chamber surrounding its reduced inner end 76.

From the foregoing description it will be seen that when the throttle valve 13 is released and permitted to return to idling position with the engine running at a speed greater than normal idling speed, the engine will continue to run either on its own momentum or the momentum of the vehicle if the driving wheels are in gear, which will result in the establishment of an abnormally high depression in the intake manifold and the passage P_1. This high depression is communicated to the diaphragm suction chamber 84 where it is effective to retract the diaphragm against the action of the spring 81 and open the duct control valve member 75, thereby establishing suction in the suction cylinder 31 which retracts the piston 32 against the action of the compression spring 60. The retraction of the piston closes the auxiliary or shut-off valve 50 and opens the scavenging intake valve 35 in the manner previously described. Thus the flow of gas to the intake manifold is controlled by substantially completely cutting off the carbureter from the intake manifold and admitting scavenging gas thereto. When such a condition is maintained in certain types of carbureters, it is difficult to keep the chambers of the carbureter filled with vaporized fuel and the motor may stall when the throttle is again open. In order to safeguard against this, the auxiliary valve 50 is provided with a small bleeding orifice 50' which will communicate a small depression to the suction passage P so as to keep the chambers of the carbureter filled with vaporized fuel when the auxiliary valve 50 is closed.

If the engine is decelerating, after the throttle valve has been retarded to its "closed" or idling position, the depression in the intake manifold and the passage P_1 will decrease until it has returned to normal idling depression, at which time the compression of the spring 81 is sufficient to overcome the suction in the chamber 84 and therefore closes the suction control valve member 75. When this takes place the spring 60 forces the piston 32 to its fully advanced position, a small bleeding orifice 92 being provided in the suction cylinder wall to permit a rapid advance of the piston 32, thereby quickly opening the auxiliary valve 50 and closing the scavenging gas valve 35.

In the event it is desired to accelerate the engine by opening the throttle while the depression in the passage P_1 is still "abnormally high," means must be provided for breaking the suction, which under those conditions has been established and is existing in the suction cylinder 30 through the action described above. Also for automatic operation it is important that the means for breaking the suction be controlled by the throttle valve actuating member 15. In the improved form of the invention shown in the present application this is accomplished by providing a vent duct 93 in the wall of suction cylinder 30, such duct having an outlet port 94 communicating with the bore 31 and having an inlet port 95 which is preferably situated in a plane containing the axes of the passage P_1 in the block

and the suction passage P of the carbureter. In other words, the position of the inlet port 95 for the vent duct is preferably situated in a vertical plane which will contain the axis of the throttle valve shaft 14 when the attachment is mounted on a carbureter. The port 95 opens into an enlarged threaded bore 96, which contains a valve cap 97, such cap being locked in position by a jamb nut 97' and having a vent opening 98 within which a ball valve 99 is seated. The valve 99 and its associated seat are so shaped that a portion of the valve member protrudes through the opening 98, (see Fig. 1). The valve is held in its closed position with a portion thereof thus protruding by means of a compression spring 100, the strength of which is such as to always hold valve 99 seated against the action of such suction as may ever be applied within the suction cylinder bore 31.

For the purpose of depressing the valve 99 to break the suction in the bore 31 when the throttle actuating lever 15 is moved in an opening direction, I employ what may be termed a cam plate or cam member 102, which is shown as comprising a disc secured to the end of the throttle shaft through a pivot screw 103, such disc being provided within a plurality of arcuate slots 104 whereby it may be adjustably locked against pivotal movement on various types of throttle levers through the medium of a screw indicated at 104'. The edge of the cam plate 102 is provided with a flange 105 which is notched at 105'. The plate is mounted so that the notch 105' normally lies over the valve 99 when the throttle valve is in idling position. In other words the plate is adjusted through the medium of one of the slot connections 104 so that one edge 106 of the flange 105 is just adjacent the valve 99 when the throttle lever is retracted to idling position. In this way it will be seen that the flange 105 constitutes an arcuate cam which has its nose (106) adjacent the valve 99. The slot connection 104—104' makes it extremely easy to adjust this cam for different adjustments of the throttle valve adjusting screw 17. It will be apparent that the shape and the radius of the cam plate 102 (aside from the circular cam edge 105 and the relation of such edge to the axis of the throttle valve) may vary for different types of carbureters. For example, instead of being circular the "cam" plate may be formed as a segment which may be either flat, flanged, or offset, depending upon the position which the end of the throttle valve shaft occupies with respect to the location of the valve 99 on the attachment.

Assuming that suction has been applied in the suction cylinder bore 31 in the manner previously described so as to close auxiliary valve 50 and open the scavenging valve 35, and assuming further that the throttle valve is open before the depression in the passage P_1 has dropped to normal idling depression, it will be seen that as soon as the throttle valve lever 15 receives any movement in the direction of the arrow A of Fig. 1, the circular cam edge 105 will engage and depress the vent control valve (as illustrated in Fig. 6), thereby breaking the suction in the suction cylinder and permitting the return of valves 50 and 35 to their normal positions, shown in full lines in Fig. 2. Furthermore, in view of the arcuate edge or flange 105, the valve 99 will be held in this depressed position for any open position of the throttle beyond its normal idling position.

It is believed that the operation of the invention will be clearly understood from the foregoing description, and it is to be understood that while I have herein described and illustrated one preferred form of the invention, the invention is not limited to the precise details of construction shown and described, but includes within its scope whatever changes fairly come within the spirit of the appended claims.

I claim:

1. In combination with the intake manifold, the carburetor and throttle valve of an internal combustion engine; an open block between the carburetor throttle valve and the intake manifold; an auxiliary valve in the opening through said block; means biasing said auxiliary valve to open position; a housing having a suction chamber mounted on said block; means in said suction chamber actuated by suction applied therein for closing said auxiliary valve; and means for selectively communicating suction from the suction passage in said carburetor and manifold to said suction chamber comprising a suction duct in said block having its outlet in the suction passage therethrough, a diaphragm housing mounted on said suction chamber housing, a duct in said diaphragm housing communicating with said first mentioned duct and having an outlet port in said suction chamber, a valve member in said diaphragm housing adapted to seat in said outlet port, a diaphragm mounted in said diaphragm housing and attached to said valve member, a duct communicating between said first mentioned duct and the region of said diaphragm housing behind said diaphragm whereby said diaphragm is adapted to be moved in a control valve opening direction, yieldable means biasing said diaphragm to a valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when a predetermined suction is applied thereto.

2. In combination with the intake manifold, the carburetor and throttle valve of an internal combustion engine; an open block between the carburetor throttle valve and the intake manifold; an auxiliary valve in the opening through said block; means biasing said auxiliary valve to open position; a housing having a suction chamber mounted on said block; means in said suction chamber actuated by suction applied therein for closing said auixiliary valve; means for selectively communicating suction from the suction passage in said carburetor and manifold to said suction chamber comprising a suction duct between said passage and said chamber, a control valve in said duct, a diaphragm housing mounted on said suction chamber housing, a diaphragm in said diaphragm housing attached to said control valve, means communicating suction from said passage to said diaphragm housing for imparting control valve opening movement to said diaphragm; and yieldable means biasing said diaphragm to a control valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the throttle valve is closed to idling position and the attending depression communicated to the diaphragm from the suction passage is in excess of normal idling depression, and positive means for breaking the suction in said suction chamber comprising a vent duct in said suction chamber housing, a valve in the inlet to said vent duct, a throttle valve actuating member, and means on said throttle valve actuating member for positively engaging and opening said vent valve independently of said control valve when the throttle valve is opened, said last mentioned means being operative to hold said vent

valve open for all open positions of said throttle valve.

3. In combination with the intake manifold, the carburetor and throttle valve of an internal combustion engine; an open block between the carburetor throttle valve and the intake manifold; an auxiliary valve in the opening through said block; means biasing said auxiliary valve to open position; a housing having a suction chamber mounted on said block; means in said suction chamber actuated by suction applied therein for closing said auxiliary valve; means for selectively communicating suction from the suction passage in said carburetor and manifold to said suction chamber comprising a suction duct between said passage and said chamber, a control valve in said duct, a diaphragm housing mounted on said suction chamber housing, a diaphragm in said diaphragm housing attached to said control valve, means communicating suction from said passage to said diaphragm housing for imparting control valve opening movement to said diaphragm; and yieldable means biasing said diaphragm to a control valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the throttle valve is closed to idling position and the attending depression communicated to the diaphragm from the suction passage is in excess of normal idling depression, and positive means for breaking the suction in said suction chamber comprising a vent duct in said suction chamber housing, a valve in the inlet to said vent duct, a throttle valve actuating member, and means on said throttle valve actuating member for opening said vent valve when the throttle valve is opened, said last mentioned means comprising a cam shaped so as to hold the vent valve open for any position of the throttle valve beyond idling position.

4. In combination with the intake manifold, the carburetor and throttle valve of an internal combustion engine; an open block between the carburetor throttle valve and the intake manifold; an auxiliary valve in the opening through said block; means biasing said auxiliary valve to open position; a housing having a suction chamber mounted on said block; means in said suction chamber actuated by suction applied therein for closing said auxiliary valve; means for selectively communicating suction from the suction passage in said carburetor and manifold to said suction chamber comprising a suction duct between said passage and said chamber, a control valve in said duct, a diaphragm housing mounted on said suction chamber housing, a diaphragm in said diaphragm housing attached to said control valve, means communicating suction from said passage to said diaphragm housing for imparting control valve opening movement to said diaphragm; and yieldable means biasing said diaphragm to a control valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the throttle valve is closed to idling position and the attending depression communicated to the diaphragm from the suction passage is in excess of normal idling depression, and positive means for breaking the suction in said suction chamber comprising a vent duct in said suction chamber housing, a valve in the inlet to said vent duct, a throttle valve actuating member, and means on said throttle valve actuating member for opening said vent valve when the throttle valve is opened, said last mentioned means comprising a cam plate adjustably mounted on said throttle actuating member and shaped so as to hold the vent valve open for any position of the throttle valve beyond idling position.

5. In combination with the carburetor and intake manifold of an internal combustion engine; a block interposed between the carburetor and the intake manifold, said block having a passage communicating between the carburetor suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; means controlled by a predetermined depression in said block passage for communicating suction from said block passage to said suction cylinder; a vent duct communicating with said suction cylinder; a valve in said vent duct; yieldable means holding said vent duct valve closed; a throttle valve actuating member on said carburetor; means on said throttle valve actuating member for positively opening said vent valve immediately as the throttle valve is opened beyond idling position, said last mentioned means being operative to hold the vent open for all positions of the throttle valve beyond idling position; and means actuated by said piston for controlling flow of gas to the intake manifold.

6. In combination with the carburetor and intake manifold of an internal combustion engine; a block interposed between the carburetor and the intake manifold, said block having a passage communicating between the carburetor suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; means controlled by a predetermined depression in said block passage for communicating suction from said block passage to said suction cylinder; a vent duct communicating with said suction cylinder; a valve in said vent duct; yieldable means holding said vent duct valve closed; a throttle valve actuating member on said carburetor; means comprising a cam attached to said throttle valve actuating member, adapted to engage and hold said vent valve in open position whenever the throttle valve actuating member is moved to open the throttle valve beyond idling position; and means actuated by said piston for controlling flow of gas to the intake manifold.

7. In combination with the carburetor and intake manifold of an internal combustion engine: a block interposed between the carburetor and the intake manifold, said block having a passage communicating between the carburetor suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; valve means actuated by said piston for controlling flow of gas to said intake manifold; yieldable means biasing said piston to an advanced position; and means for applying suction in said cylinder to retract said piston comprising a suction duct having an outlet in said block passage and an inlet in the end of said suction cylinder, a valve member in said duct inlet movable in a direction parallel to the axis of said cylinder, a diaphragm attached to said valve member, a suction chamber behind said diaphragm, an auxiliary duct for communicating suction from said block passage to said diaphragm suction chamber, and yieldable means biasing said diaphragm to a duct valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the suction communicated to said diaphragm suction chamber exceeds a predetermined limit.

8. In combination with the carburetor and intake manifold of an internal combustion engine: a block interposed between the carburetor and the intake manifold, said block having a passage com-

municating between the carburetor suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; valve means actuated by said piston for controlling flow of gas to said intake manifold; yieldable means biasing said piston to an advanced position; and means for applying suction in said cylinder to retract said piston comprising a suction duct having an outlet in said block passage and an inlet in the end of said suction cylinder, a valve member in said duct inlet, a diaphragm attached to said valve member, a suction chamber behind said diaphragm, an auxiliary duct for communicating suction from said block passage to said diaphragm suction chamber, and yieldable means biasing said diaphragm to a duct valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the suction communicated to said diaphragm suction chamber exceeds a predetermined limit; said duct valve and said diaphragm being arranged coaxially with said suction cylinder.

9. In combination with the carburetor and intake manifold of an internal combustion engine: a block interposed between the carburetor and the intake manifold, said block having a passage communicating between the carburetor suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; valve means actuated by said piston for controlling flow of gas to said intake manifold; yieldable means biasing said piston to an advanced position; and means for applying suction in said cylinder to retract said piston comprising a suction duct having an outlet in said block passage and an inlet in the end of said suction cylinder, a valve member in said duct inlet, a diaphragm attached to said valve member, a suction chamber behind said diaphragm, an auxiliary duct for communicating suction from said block passage to said diaphragm suction chamber, and yieldable means biasing said diaphragm to a duct valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the suction communicated to said diaphragm suction chamber exceeds a predetermined limit; a vent duct in said suction cylinder; a valve in said vent duct; yieldable means for holding said vent valve closed; a throttle valve actuating member on said carburetor; means comprising a cam attached to said throttle valve actuating member adapted to engage and hold said vent valve open whenever the throttle valve actuating member is moved to open the throttle beyond idling position.

10. For use in combination with the carburetor and intake manifold of an internal combustion engine, an attachment for controlling the flow of gas to the intake manifold comprising: a block member having a portion adapted to be interposed between the carburetor and the intake manifold, said last mentioned portion having a passage therethrough; a suction chamber in said block member; a suction responsive member in said suction chamber; valve means in said block member for controlling flow of gas through said block passage; means associated with said suction responsive member for actuating said valve means; a suction duct in said block member having an inlet in the end of said suction chamber and an outlet in said block passage; a control valve in said suction duct; a pilot suction responsive member attached to said suction duct control valve; a pilot suction chamber in said block member behind said pilot suction responsive member; an auxiliary duct communicating between said suction duct and said pilot suction chamber; and yieldable means biasing said pilot suction responsive member to normally close said suction duct valve, said duct valve and said pilot suction responsive member being arranged substantially coaxially with said suction chamber.

11. For use in combination with the carburetor and intake manifold of an internal combustion engine, an attachment for controlling the flow of gas to the intake manifold comprising: a block member having a portion adapted to be interposed between the carburetor and the intake manifold, said last mentioned portion having a passage therethrough; a suction cylinder in said block member; a piston in said suction cylinder; valve means in said block member for controlling flow of gas through said block passage; means associated with said piston for actuating said valve means; a suction duct in said block member having an inlet in the end of said suction cylinder and an outlet in said block passage; a control valve in said suction duct; a diaphragm attached to said suction duct control valve; a diaphragm suction chamber in said block member behind said diaphragm; an auxiliary duct communicating between said suction duct and said diaphragm suction chamber; and yieldable means biasing said diaphragm to normally close said suction duct valve, said suction duct valve and said diaphragm being arranged in coaxial relation with said suction cylinder.

12. For use in combination with the carburetor and intake manifold of an internal combustion engine, an attachment for controlling the flow of gas to the intake manifold comprising: a block member having a portion adapted to be interposed between the carburetor and the intake manifold, said last mentioned portion having a passage therethrough; a suction cylinder in said block member; a piston in said suction cylinder; valve means in said block member for controlling flow of gas through said block passage; means associated with said piston for actuating said valve means; means including a suction duct communicating with said suction cylinder for applying suction therein; a vent duct in the wall of said suction cylinder having an opening communicating with said suction cylinder and a vent opening through the wall of said cylinder; a valve in said vent opening; a seat in said vent opening adapted to be engaged by said vent valve; and yieldable means normally holding said vent duct valve closed agains its seat.

13. For use in combination with the carburetor and intake manifold of an internal combustion engine, an attachment for controlling the flow of gas to the intake manifold comprising: a block member having a portion adapted to be interposed between the carburetor and the intake manifold, said last mentioned portion having a passage therethrough; a suction cylinder in said block member; a piston in said suction cylinder; valve means in said block member for controlling flow of gas through said block passage; means associated with said piston for actuating said valve means; means including a suction duct communicating with said suction cylinder for applying suction therein; a vent duct communicating with said suction cylinder said vent duct being independent of and separate from said suction duct; a valve in said vent duct; and yieldable means normally holding said vent duct valve closed, said vent duct valve having a protruding portion adapted for engagement by an external member for opening said valve.

14. In combination with the carbureter and intake manifold of an internal combustion engine: a block interposed between the carbureter and the intake manifold, said block having a passage communicating between the carbureter suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; valve means actuated by said piston for controlling flow of gas to said intake manifold; yieldable means biasing said piston to an advanced position; and means for applying suction in said cylinder to retract said piston comprising a suction duct having an outlet in said block passage and an inlet in the end of said suction cylinder, a valve member in said duct inlet, chambers in front of and behind said diaphragm, an auxiliary duct for communicating suction from said block passage to the chamber behind said diaphragm, yieldable means biasing said diaphragm to a duct valve closing position, said yieldable means being set to permit valve opening movement of said diaphragm when the suction communicated to said diaphragm suction chamber exceeds a predetermined limit, and a secondary diaphragm interposed between said duct control valve member and the wall of the chamber in front of said diaphragm.

15. For use in combination with the carbureter and intake manifold of an internal combustion engine, an attachment for controlling the flow of gas to the intake manifold comprising: a block member having a portion adapted to be interposed between the carbureter and the intake manifold, said last mentioned portion having a passage therethrough; a suction cylinder in said block member; a piston in said suction cylinder; valve means in said block member for controlling flow of gas through said block passage; means associated with said piston for actuating said valve means; a suction duct in said block member having an inlet in the end of said suction cylinder and an outlet in said block passage; a control valve member in said suction duct; a diaphragm attached to said suction duct control valve member; a diaphragm suction chamber in said block member behind said diaphragm; a diaphragm relief chamber in front of said diaphragm; auxiliary duct means communicating between said diaphragm suction chamber and said block passage; yieldable means biasing said diaphragm to normally close said suction duct valve; and an auxiliary diaphragm interposed between said duct control valve member and the wall of said relief chamber.

16. In combination with the carbureter and intake manifold of an internal combustion engine: a throttle actuating member associated with said carbureter; a block interposed between the carbureter and the intake manifold, said block having a passage communicating between the carbureter suction passage and the manifold; a suction cylinder on said block; a piston in said suction cylinder; means controlled by a predetermined depression in said block passage for communicating suction from said block passage to said suction cylinder; a vent duct communicating with said suction cylinder; a valve in said vent duct; yieldable means holding said vent duct valve closed; means comprising a flanged disc mounted on said throttle actuating member with an edge thereof in alignment with said vent duct valve adapted to engage and hold said vent valve in open position whenever the throttle actuating member is moved to open the throttle, said disc having an edge opening adapted to align with said vent valve when the throttle is in idling position; and means actuated by said piston for controlling flow of gas to said intake manifold.

17. In combination with an internal combustion engine carbureting system having a suction passage, a throttle, and a throttle actuating member: a suction chamber; a suction responsive member in said suction chamber; means controlled by a predetermined depression in said suction passage for communicating suction therefrom to said suction chamber; a vent duct communicating with said chamber; a valve in said vent duct; yieldable means holding said vent duct valve closed; and means associated with said throttle actuating member adapted to engage and open said vent valve immediately as said throttle is opened from idling position, said last mentioned means being adapted to permit continued throttle opening movement at the same time holding said vent valve in open position; and means actuated by said suction responsive member for controlling flow of gas through said suction passage.

18. In combination with an internal combustion engine carbureting system having a suction passage, a throttle, and a throttle actuating member: a suction chamber; a suction responsive member in said suction chamber; means controlled by a predetermined depression in said suction passage for communicating suction therefrom to said suction chamber; a vent duct communicating with said chamber; a valve in said vent duct; yieldable means holding said vent duct valve closed; and means associated with said throttle actuating member adapted to engage and open said vent valve immediately as said throttle is opened from idling position, said last mentioned means comprising a cam member adapted to hold said vent valve open with continued throttle opening movement; and means actuated by said suction responsive member for controlling flow of gas through said suction passage.

19. In combination with an internal combustion engine carbureting system having a suction passage, a throttle, and a throttle actuating member: a suction chamber; a suction responsive member in said suction chamber; means controlled by a predetermined depression in said suction passage for communicating suction therefrom to said suction chamber; a vent duct communicating with said chamber; a valve in said vent duct; yieldable means holding said vent duct valve closed; and means associated with said throttle actuating member adapted to engage and open said vent valve immediately as said throttle is opened from idling position, said last mentioned means comprising a flanged disc mounted on said throttle actuating member with an edge thereof in alignment with said vent duct valve adapted to engage and hold said vent valve in open position whenever the throttle actuating member is moved to open the throttle, said disc having an edge opening adapted to align with said vent valve when the throttle is in idling position; and means actuated by said suction responsive member for controlling flow of gas through said suction passage.

20. In combination with the suction passage of a carbureter and the intake manifold of an internal combustion engine: a suction chamber; a suction responsive member in said suction chamber; valve means actuated by said suction responsive member for controlling flow of gas to

said intake manifold; yieldable means biasing said suction responsive member to an advanced position; and means for applying suction in said suction chamber to retract said suction responsive member comprising a suction duct having an outlet in said suction passage and an inlet in said suction chamber, a control valve member in said duct inlet, a diaphragm for actuating said control valve member, chambers in front of and behind said diaphragm, an auxiliary duct communicating suction from said suction passage to the chamber behind said diaphragm, yieldable means biasing said diaphragm to a control valve closing position, and a secondary diaphragm interposed between said duct control valve member and the wall of the chamber in front of said diaphragm.

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