

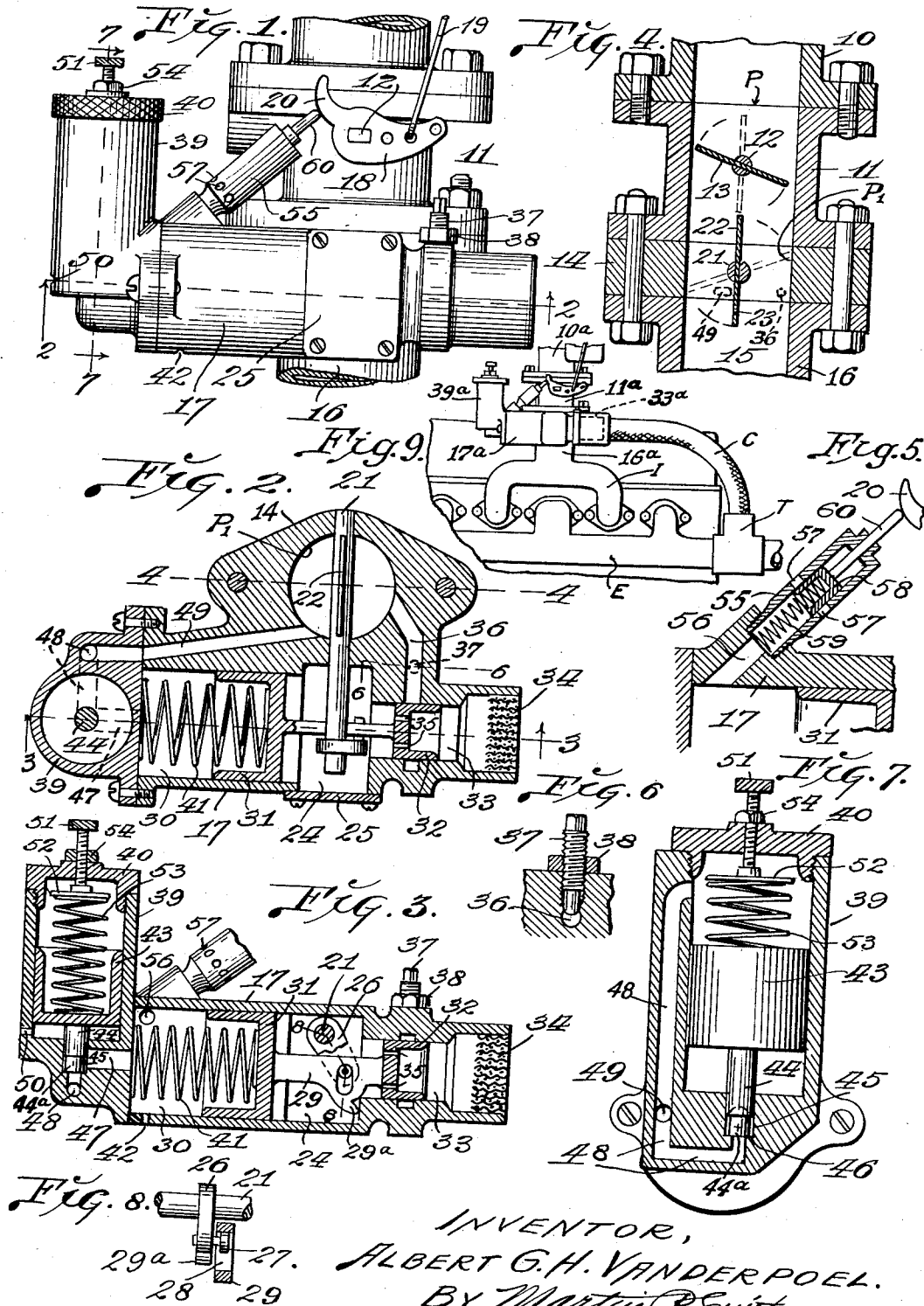
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A. G. H. VANDERPOEL

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AUTOMATIC DECELERATION CONTROL DEVICE

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AUTOMATIC DECELERATION CONTROL
DEVICE

Albert G. H. Vanderpoel, Los Angeles, Calif., assignor of one-third to James O'Lavery and one-third to David E. Seward, both of Los Angeles, Calif.

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My invention relates to an automatic deceleration control device that is associated with the conventional types of carburetors now generally employed for furnishing gaseous fuel to internal combustion engines, and my present invention is an improvement on a somewhat similar invention disclosed in United States Letters Patent No. 2,017,878 issued October 27, 1935; and also a similar invention forming the subject matter of an application for United States Letters Patent filed by me May 11, 1935, Serial No. 20,997.

The principal objects of my invention are to generally improve upon and simplify the construction and operation of the deceleration control devices disclosed in my aforesaid issued patent, and pending patent application, and further to provide a relatively simple, practical and positively acting device that is actuated and controlled by the vacuum prevailing in the intake manifold of an internal combustion engine and which device acts automatically, when the main throttle valve of the carburetor is closed as a result of deceleration, to cut off or materially reduce the flow of fuel vapor from the carburetor into the intake manifold and consequently eliminate the production and discharge of noxious fumes and gases from the exhaust manifold of the engine and which objectionable result in the absence of preventive means occurs immediately following the deceleration action of the main throttle valve.

It will be understood that when the throttle valve of a carburetor is moved to its position of maximum closure which is set to permit the engine to run at idling speed, the high degree of vacuum or the abnormally high depression prevailing in the intake manifold during the deceleration or coasting of the engine which attends the "closure" of the throttle valve is effective in sucking a considerable amount of gaseous fuel into the intake manifold from whence it passes into the engine cylinders and under such conditions the excess fuel delivered to the engine cylinders is burned and produces objectionable noxious gases and fumes that discharge through the exhaust manifold. The same objectionable action takes place when the engine is being propelled by the car, as in coasting down grade with the engine in gear. It is one of the principal objects of my invention, to provide simple and automatically operating means for positively overcoming this objectionable result and which means operates automatically and without in any way affecting the proper functioning of the throttle valve of the carburetor.

In addition to providing means for cutting off the supply of fuel mixture to the intake manifold, my invention has, as a further object, the provision of means for automatically admitting a scavenging gas to the intake manifold whenever the fuel mixture is thus cut off. In this way the manifold and combustion chambers are scavenged of products of combustion and unburned or partially burned fuel mixture; also the admission of this scavenging gas alleviates the sucking or drawing of lubricating oil up past the engine piston into the combustion chambers.

With the foregoing and other objects in view my invention consists in certain novel features of construction and arrangements of parts that will be hereinafter more fully described and claimed and illustrated in the accompanying drawing in which:

Fig. 1 is a side elevational view of an automatic deceleration control device as contemplated by my invention, and showing the same associated with a carburetor.

Fig. 2 is a horizontal section taken approximately on the line 2—2 of Fig. 1.

Fig. 3 is a vertical longitudinal section taken approximately on the line 3—3 of Fig. 2.

Fig. 4 is a vertical cross section taken on the line 4—4 of Fig. 2.

Fig. 5 is a detailed section of an air inlet valve utilized in connection with my improved device, and which air inlet valve is controlled by the throttle valve of the carburetor with which the deceleration control device is associated.

Fig. 6 is a detailed section taken on the line 6—6 of Fig. 2.

Fig. 7 is an enlarged vertical section taken on the line 7—7 of Fig. 1.

Fig. 8 is a detailed section taken approximately on the line 8—8 of Fig. 3.

Fig. 9 is a fragmentary diagrammatic view illustrating the manner in which exhaust gas may be used to scavenge the engine.

Referring by numerals to the accompanying drawing which illustrates a preferred embodiment of my invention, 10 designates the tubular lower portion of a carburetor which has a main air passage or "suction" passage P therein. Secured to the lower end of the portion 10 and depending therefrom, is a short tubular riser 11 and passing diametrically through this riser is a shaft 12 carrying the usual throttle valve 13. The parts described are typical of a carburetor here shown as "down draft".

Secured to the lower end of the riser 11 is a block 14, provided with an opening 15 that coin-

cides with the opening through riser 11, and secured to the under side of block 14, is a tubular member 16 that is directly connected to the intake manifold of the engine with which the device is associated. It will be seen that the passages through 11, 14, and 16 all communicate with the suction passage P and for general purposes of description may be considered as part of the suction passage.

Formed integral with block 14 to the side of the riser 11 and the tube 16, is a horizontally disposed hollow cylindrical body or housing 17 that forms the main body of my improved deceleration control device. One end of shaft 12 projects through the wall of riser 11, and mounted on said projecting end is a short crank arm 18, and adjustably connected thereto, is the accelerator push rod 19.

Projecting from the end of the arm 18 that is mounted on shaft 12, is a short upwardly curved finger 20.

Journalled in block 14 and extending diametrically therethrough, is a shaft 21, and carried thereby within the opening 15, is an auxiliary valve 22. Formed in this valve is a relatively small aperture 23 which will communicate a small depression to the region above the auxiliary valve 22, when it is closed, for the purpose of maintaining the carburetor channels filled with vaporized fuel while the engine is decelerating or is being driven by momentum with the suction from the intake manifold otherwise completely cut off by the auxiliary valve 22.

One end of shaft 21 that carries the auxiliary valve extends into a chamber 24 that is formed in the central portion of housing 17, and the outer end of this chamber is closed by a removable plate 25. Carried by the end of shaft 21, within chamber 24, is a depending crank arm 26, and carried by the lower end of this crank arm is a roller 27 that occupies a vertically disposed slot 28 formed in a piston rod 29 that extends through chamber 24 lengthwise of the cylindrical housing 17.

Formed in the cylindrical housing 17 to one side of chamber 24, is a cylindrical chamber or suction cylinder 30, in which is arranged for sliding movement, a piston 31, that is rigidly connected to one end of the piston rod 29, and a much smaller piston 32 that is rigidly connected to the other end of piston rod 29 is arranged for reciprocatory movement in a cylindrical chamber 33. The outer end of chamber 33 is open to the atmosphere, and positioned in said open end is a screen 34 that functions as an air filter.

A lug 29a depends from piston rod 29, which lug engages a shoulder at one side of chamber 24 to limit the movement of rod 29 and pistons carried thereby in one direction, to the position in which auxiliary valve 22 is in full open position, as illustrated in Figs. 2 and 4.

Formed through piston 32 is a plurality of vent openings 35. Leading from the intermediate portion of chamber 33, through block 14 to the opening 15 is a scavenging gas duct 36 which has its inlet port in the housing 17 through the wall of chamber 33, such port being controlled by the piston 32 acting as a sleeve valve and hereinafter referred to as a scavenging gas control valve. The outlet port of duct 36 communicates with the suction passage P in block 14 just below the auxiliary valve 22, when the same is in closed position.

The volume of air that passes through duct 36 when the end thereof is uncovered by piston 32,

is controlled by a screw 37 that is seated in block 14, the point of which screw is adapted to enter duct 36, and said screw is locked in its adjusted position by means of a lock nut 38. (See Fig. 6.)

Detachably secured to the end of the cylindrical housing 17 that contains the cylinder 30, is the lower portion of a vertically disposed cylinder block 39, having a cylinder bore 39a which may be termed a "pilot cylinder" and which has its upper end closed by a removable cap 40. The lower portion of cylinder block 39 forms a closure for the end of cylindrical housing 17, and interposed between the lower portion of block 39 and piston 31 is an expansive coil spring 41.

Formed in the lower portion of the wall of housing 17, adjacent the end that is closed by cylinder block 39, is a small bleeding orifice 42. Arranged for reciprocatory movement within the cylinder 39a, is a pilot piston 43, and depending therefrom is a suction valve stem 44 that occupies a small axial bore 45 in the lower portion of cylinder block 39, and said bore being provided at its lower end with a shoulder 46 that functions as a seat for the reduced lower end 44a of stem 44.

A duct 47 connects the bore 45 with the cylinder 30, and leading from the lower end of bore 45 downwardly, thence laterally and thence upwardly through the wall of cylinder block 39 is a duct 48 that communicates with the upper portion of cylinder 39a. Leading from the lower portion of duct 48 through block 14 to the passage P1, in which the auxiliary 22 is mounted is a duct 49. The ducts 47, 48 and 49 cooperate to form what will hereinafter be referred to as a suction duct controlled by valve 44a and connecting cylinder 30 with passage P1 at a point under the auxiliary valve 22 when that valve is closed.

A vent 50 is formed through the lower portion of the wall of cylinder 39a for the purpose of maintaining communication between the bottom portion of this cylinder below piston 43 and the atmosphere.

Threaded into cap 40 is a screw 51, the lower end of which carries a plate 52, and interposed between said plate and the piston 43, is an expansive coil spring 53 that normally exerts downward pressure on the piston so as to hold the valve formed by the lower end of the stem 44 on said seat 46. Screw 51 may be moved upwardly or downwardly through cap 40 to adjust the compression of spring 53, and after such adjustment, the screw is locked by means of a lock nut 54.

Seated in the end of the cylindrical housing 17 adjacent the cylinder block 39, is the lower end of a small inclined hollow cylinder 55, and the lower end of the cylinder bore therein communicates with a duct 56 hereinafter referred to as an air vent, the lower end of which communicates with the cylinder 30.

Formed through the wall of cylinder 55 is a plurality of air inlet openings 57 that are adapted to be closed by a piston 58 that is mounted for reciprocatory movement within the cylinder. The piston 58 is normally urged upwardly through said cylinder to clear port 57 by an expansive coil spring 59, and functions as a valve to control the admission of air to cylinder 30 through the air vent 56.

Projecting from the upper end of piston 58, upwardly through the closed outer end of cylinder 55, is a piston rod 60, the upper end of which is engaged by the curved finger 20 on crank arm 18. (See Fig. 5).

The operation of the device contemplated by this invention in conjunction with an internal combustion engine is substantially as follows:

Assuming the engine to be normally operating at idling speed, the various elements which go to make up the combination contemplated by this invention are in the relative positions shown in full lines in the drawing. That is the throttle valve 13 has been "retarded" to its position of maximum closure which has been previously set to afford sufficient clearance around the valve to supply the intake manifold with an idling fuel mixture from the carbureter; the auxiliary valve 22 is in its full open position as shown in Fig. 2 and in full lines in Fig. 4, and the scavenging gas control valve 32 is in its closed position as shown in Figs. 2 and 3. The depression or suction in the intake manifold and the suction passage P—P₁, which is communicated to the pilot cylinder 39 through duct 49, is insufficient at this stage of the operation to overcome the action of the compression spring 53, which is set to close the valve at normal idling depression, so the piston 43 is depressed by the spring 53 to bring the lower end of stem 44, which constitutes the suction control valve, into engagement with its seat 46. The curved finger 20 on the throttle actuating member 18 has depressed the plunger 58 so as to close the vent ports 57.

As the throttle valve is opened to accelerate the engine, it may be advanced to any position from the full line position shown in Fig. 4 to the dotted line position shown in that figure. Since, during such acceleration or during normal power operation at these various accelerated speeds, the depression in the intake manifold is usually less than at normal idling and does not exceed the compression value for which the spring 53 has been set, the auxiliary valve 22 and the scavenging gas intake valve 32 remain in the same position described above. When the throttle is opened, the spring 59 is effective to lift the piston valve 58 so that the ports 57, and as a result the air vent 56 to the suction cylinder 30, are open and remain open during such time as the engine is operating normally at any speed above idling speed.

Whenever the throttle valve 13 is permitted to return to its "closed" position or its position of idling opening, the following operation takes place. Immediately as the lever 18 returns to the full line position shown in Fig. 1, the curved finger 20 engages the end of the rod 60 to press the piston valve 58 against the action of the compression spring 59 and close the vent port 57, thus excluding air from cylinder 30. If on throttle closure the engine is still running at a speed substantially above normal idling, the depression in the intake manifold in that region of the suction passage below the throttle valve 12 immediately rises to an abnormally high level, that is, above the normal idling depression. Such depression being communicated through the duct 49 to the pilot cylinder 39, it is effective to raise the piston 43 against the action of the compression spring 53, air being admitted through the bottom of the pilot cylinder 39a below the piston through the bleeding orifice 50. As the pilot piston 43 is elevated, it opens the suction control valve 45a so the abnormally high depression of the intake manifold is communicated to the suction cylinder 30. The air vent 56, 57 to this suction cylinder having been closed, in the manner pointed out above, this high suction is effective to retract the piston 31 against

the action of the spring 41 and through such retractive movement closes the auxiliary valve 22 and opens the scavenging gas intake valve 32. The ports 35 in the piston valve 32 admit air to the interior of the housing during this retraction of the piston 31 to facilitate its movement.

With the device as illustrated in the drawing, the scavenging gas which is drawn into the intake manifold when the valve 32 is open, is merely atmosphere drawn through the filter member 34, but it will be readily apparent that if it is desired other gas such as gases of combustion may be drawn into the intake manifold through this connection by providing a suitable connection to the exhaust manifold. For example certain types of engines of the older design contain pockets in which fuel vapor accumulates during normal operation. In the event air is used to scavenge an engine of this character, such air will effect the combustion of the fuel in these pockets and the engine will continue to run on the power derived therefrom for a brief interval after the auxiliary valve is closed. Under such conditions, it is preferable to employ an inert gas such as may be obtained from the exhaust manifold for the purpose of scavenging the pockets in the engine of this fuel. One manner of accomplishing this is diagrammatically illustrated in Fig. 9 in which the parts corresponding to those described above in connection with Figs. 1 to 8, inclusive, are indicated by the same reference numerals described with the letter a.

In Fig. 9, the letter I indicates the intake manifold which has an intake pipe 16a corresponding to the connection 16 upon which the block which carries the cylinder housing 17a is mounted. The air or scavenging gas inlet portion 33a of the member 17a is provided with a conduit connection preferably of the flexible type indicated by reference letter C which communicates with the exhaust manifold E through a T-fitting indicated at T. With this arrangement, it will be seen that when the scavenging gas valve 32 is opened, exhaust gases rather than air are drawn into the engine through the intake manifold and thus the fuel vapor accumulated in the pockets is expelled without developing any additional power.

Now with regard to the admission of this scavenging gas, it will be understood that the adjustment valve 37 is set so as to restrict the scavenging gas duct 36 to such an extent that the amount of gas admitted is just sufficient to scavenge the engine cylinders and attending connections, but is insufficient to reduce the manifold depression to the point at which it is lower than or equal to the compressive value of the pilot valve piston spring 53. In this connection it will be noted that when auxiliary valve 22 closes, air or gas can be admitted to the manifold, through orifice 23 of valve 22 and through duct 36, in an amount equal to the amount of air admitted past the throttle 13 when in "closed" (idling) position; without lowering the manifold depression below that amount which initially actuated the pilot piston 43. Consequently, if those air or gas admissions are no more than just stated, and if the pilot valve spring 53 is set to allow pilot valve 44a to open at a depression just above normal idling depression, then as the engine slows down and the manifold depression falls the pilot valve will not again open until normal idling is reached.

It will be understood that the position of the parts last described above, that is the auxiliary

valve 22 being closed, the scavenging gas control valve 32 being open and the air vent valve port 57 being closed, will obtain until the manifold depression has decreased to a point at which its action will be overcome by the action of the spring 53 or until the throttle lever 18 is moved in a throttle valve opening direction to release the suction in the suction chamber 30. The condition of high manifold depression will of course normally exist as long as the engine is running under momentum with the throttle valve closed, such momentum in the case of a motor vehicle, being derived either from the engine itself or from the combined action of the engine and the motion of the vehicle if the engine is geared to the driving wheels. As the momentum decreases with the deceleration of the engine or the vehicle, the depression in the manifold will of course drop and when the engine reaches idling speed the depression there will be the normal idling depression which the spring 53 has been set to overcome.

At this point then, when the engine has decelerated substantially to idling speed, the spring 53 is effective to close the suction control valve 44a so that the cylinder 30 is no longer in communication with the suction of the intake manifold. It is of course important at the time when the engine has decelerated to idling speed that the auxiliary valve 22 be immediately opened so that the engine will not stall. In order that the immediate opening of the auxiliary valve 22 may attend the closure of the suction control valve port 46 just described above, it is desirable to provide some means for bleeding air into the suction cylinder 30 so that spring 41 can immediately advance the piston 31 to open the auxiliary valve and close the scavenging gas intake valve. It is for this purpose that the small bleeding orifice 42 is provided, the size of said orifice being such that it does not interfere with the action of the high suction when applied in the suction cylinder 30 but does pass enough air to allow piston 31 to move valve 22 partly open and close air duct 36 before the engine stalls.

In the event of throttle opening at any time that the above described actions are taking place, the movement of the throttle lever 18 in a throttle valve opening direction releases the piston valve 58 so that it is immediately pressed upwardly by the action of compression spring 59 to uncover ports 57 and break the suction in the suction cylinder 30. When the suction is thus broken the spring 41 is effective to advance the piston 31, thereby opening the auxiliary valve 22 and closing the scavenging gas intake valve 32 immediately upon any movement of the throttle valve in an opening direction. This last mentioned operation is attended by a drop in the depression within the intake manifold and the pilot cylinder 39 so that the pilot piston 43 is also depressed to seat and close the suction control valve port 46.

From the foregoing description it will be seen that my invention contemplates a valve for substantially closing the suction passage at a point between the carburetor proper and the intake manifold and valve means for admitting a scavenging gas to the intake manifold, when the throttle valve is "closed" to idling position and the engine is operating under momentum at a speed in excess of normal idling speed. It will also be seen that the closure of the auxiliary valve in the suction passage (as well as the opening of the scavenging gas valve) is controlled

jointly by the manifold depression and the position of the throttle valve. It follows, therefore, that the opening of the auxiliary valve (as well as the closure of the scavenging gas valve) is controlled either by manifold depression or throttle valve position.

In other words the throttle actuated vent valve 58—57 must be closed and the depression in the passage P₁ must be "abnormally high" in order to retract the piston 31 for closing valve 22 and opening valve 32, but either the opening of valve 58—57 or the return of the manifold depression to normal idling depression will operate to permit the piston 31 being advanced by spring 41 to open valve 22 and close valve 32.

Thus it will be seen that I have provided a relatively simple practical and inexpensive device that is highly effective in preventing the high degree of vacuum prevailing in the intake manifold during deceleration or during such other times as the motor may be driven by its own momentum or the momentum of the vehicle which it normally drives from sucking an abnormal amount of gaseous fuel and raw gases through the intake manifold of an internal combustion engine, and the consequent production of noxious gases that are expelled from the muffler on the subsequent acceleration operation.

It will be understood that minor changes in the size, form, and construction of the various parts of my improved automatic deceleration control devices may be made and substituted for those herein shown and described without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. The combination with an internal combustion engine carburetor, its throttle valve and the intake manifold to which said carburetor is connected, of an auxiliary valve for controlling the flow of gaseous fuel from the carburetor to the intake manifold, a cylinder, a pair of connected pistons arranged for operation within said cylinder, means actuated by the movement of said connected pistons within said cylinder for imparting opening and closing movements to the auxiliary valve, vacuum actuated means controlled by the degree of vacuum prevailing in the intake manifold following the closing movement of the throttle valve for establishing communication between the end of said cylinder adjacent one of said pistons and said intake manifold whereby said connected pistons are actuated to close said auxiliary valve, adjustable means for controlling the operation of said vacuum actuated means, means actuated by the throttle valve during its opening movement for admitting air to the cylinder to break the vacuum that imparted auxiliary valve closing movement to the connected pistons in said cylinder and means controlled by one of said connected pistons for admitting a scavenging gas to said intake manifold.

2. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold: a throttle valve in said suction passage; means for actuating said throttle valve to partially close said suction passage for supplying idling mixture to said manifold; an auxiliary valve in said suction passage between the throttle valve and the manifold; a suction chamber; a suction responsive means in said suction chamber; means actuated by said suction responsive means for opening and closing said auxiliary valve; means biasing said auxiliary valve

toward an open position; means including a control valve operable by an abnormally high depression in said manifold occasioned by closing said throttle for communicating suction from said manifold to said suction chamber thereby moving said piston to close said auxiliary valve; an air vent communicating with said suction chamber; and valve means independent of said control valve and actuated by opening movement of said throttle actuating means for opening said air vent to break the suction in said suction chamber.

3. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold: a throttle valve in said suction passage; means for actuating said throttle valve to partially close said suction passage for supplying idling mixture to said manifold; an auxiliary valve in said suction passage between the throttle valve and the manifold; a suction chamber; suction responsive means in said suction chamber; means actuated by said suction responsive means for opening and closing said auxiliary valve; means biasing said auxiliary valve toward an open position; means including a control valve operable by an abnormally high depression in said manifold occasioned by closing said throttle for communicating suction from said manifold to said suction cylinder thereby moving said piston to close said auxiliary valve; air vent means directly communicating with said suction cylinder; a valve associated with said air vent; means actuated by said throttle actuating means at the limit of its closing movement for closing said air vent valve; and yieldable means for opening said air vent valve immediately as the throttle is opened to break the suction in said suction cylinder.

4. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold: a throttle valve in said suction passage; means for actuating said throttle valve to partially close said suction passage for supplying idling mixture to said manifold; means for fully closing said suction passage; means including a valve for admitting scavenging gas to said manifold; a suction chamber; suction responsive means in said suction chamber; means actuated by said suction responsive means for actuating said passage closing means and said scavenging gas admitting valve; means cooperatively biasing said passage closing means to open position and said scavenging gas admitting valve to a closed position; means including a control valve operable by an abnormally high depression in said manifold occasioned by closing said throttle for communicating suction from said manifold to said suction chamber thereby moving said suction responsive means to close said suction passage and open said scavenging valve; and means including a vent valve operable independently of said control valve by said throttle actuating means for breaking the suction in said suction chamber when said throttle is opened.

5. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold; a throttle valve in said suction passage; means for actuating said throttle valve to partially close said suction passage for supplying idling mixture to said manifold; means for fully closing said suction passage; means including a valve for admitting scavenging gas to said manifold; a suction chamber; suc-

tion responsive means in said suction chamber; means actuated by said suction responsive means for actuating said passage closing means and said scavenging gas admitting valve; means cooperatively biasing said passage closing means to open position and said scavenging gas admitting valve to a closed position; means including a control valve operable by an abnormally high depression in said manifold occasioned by closing said throttle for communicating suction from said manifold to said suction chamber thereby moving said suction responsive means to close said suction passage and open said scavenging valve; an air vent directly communicating with said suction chamber; and valve means actuated by opening movement of said throttle actuating means and operable independently of said control valve for opening said air vent to break the suction in said suction chamber.

6. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold; a throttle valve in said suction passage; means for actuating said throttle valve to partially close said suction passage for supplying idling mixture to said manifold; means for fully closing said suction passage; means including a valve for admitting scavenging gas to said manifold; a suction chamber; suction responsive means in said suction chamber; means actuated by said suction responsive means for actuating said passage closing means and said scavenging gas admitting valve; means cooperatively biasing said passage closing means to open position and said scavenging gas admitting valve to a closed position; means including a control valve operable by an abnormally high depression in said manifold occasioned by closing said throttle for communicating suction from said manifold to said suction cylinder thereby moving said suction responsive means to close said suction passage and open said scavenging valve; air vent means directly communicating with the interior of said suction chamber; a valve associated with said air vent; means actuated by said throttle valve means at the limit of its closing movement for closing said air vent valve; and yieldable means for opening said air vent valve immediately as the throttle is opened to break the suction in said suction cylinder.

7. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold, said carburetor including a throttle valve, automatic means for substantially closing said suction passage when the throttle valve is closed to idling position comprising: a block interposed between said carburetor and said manifold and having an opening communicating with said suction passage; an auxiliary valve in said block adapted to close the opening therethrough; a housing mounted on said block; a suction chamber in said housing; suction responsive means in said suction chamber; a duct communicating between said chamber and the opening through said block; a normally closed control valve in said duct; means operable by a predetermined depression in said block opening to open said control valve; a scavenging gas duct having an inlet port in said housing and an outlet port in said block opening; a scavenging control valve in said housing associated with said inlet port; means actuated by reciprocation of said suction responsive means for operating said auxiliary valve and said scav-

enging control valve; and means cooperatively biasing said auxiliary valve to its open position and said scavenging control valve to its closed position, said suction responsive means being

operative to close said auxiliary valve and open said scavenging control valve under the application of suction.

8. For use in combination with the carburetor and intake manifold of an internal combustion engine, an attachment for automatically closing the suction passage of the carburetor and admitting scavenging gas to the intake manifold when the depression therein becomes abnormally high comprising: an open block adapted to be interposed between the carburetor and the intake manifold; an auxiliary valve in the opening through said block; a housing on said block having a suction chamber therein; a suction duct communicating between said suction chamber and said block opening; suction responsive means in said chamber adapted to be retracted by suction applied therein; a scavenging duct having an outlet port in said block opening and an inlet port in said housing; a scavenging control valve in said housing associated with said inlet port; yieldable means cooperatively holding said auxiliary valve open and said scavenging control valve closed; means operable upon retraction of said suction responsive means for closing said auxiliary valve and opening said scavenging control valve; a normally closed suction control valve in said suction duct; means operable by a predetermined depression in said block opening for opening said suction control valve and means including a valve operable independently of said control valve for venting said suction chamber.

9. An attachment of the class described embodying: an open block adapted to be interposed between the carburetor and the intake manifold of an engine; a shut off valve in said block opening; a housing mounted on said block having a closed suction chamber and an open scavenging valve cylinder therein; a suction duct communicating between said suction chamber and said block opening; a scavenging gas duct having an inlet port in said scavenging valve cylinder and an outlet port in said block opening; suction responsive means in said suction chamber adapted to be retracted by suction applied therein; a sleeve valve in said scavenging valve cylinder adapted to open and close said inlet port; means connecting said piston with said shut off valve and said sleeve valve whereby said valves are normally held in open and closed positions respectively and whereby retraction of said piston is effective to close said auxiliary valve and open said sleeve valve; and means controlled by a predetermined depression in said block opening for applying suction in said suction chamber.

10. An attachment of the class described embodying: an open block adapted to be interposed between the carburetor and the intake manifold of an engine; a shut off valve in said block opening; a housing mounted on said block having a closed suction chamber and an open scavenging valve cylinder therein; a suction duct communicating between said suction chamber and said block opening; a scavenging gas duct having an inlet port in said scavenging valve cylinder and an outlet port in said block opening; suction responsive means in said suction cylinder adapted to be retracted by suction applied therein; a sleeve valve in said scavenging valve cylinder adapted to open and close said inlet port; means connecting said piston with said shut off valve

and said sleeve valve whereby said valves are normally held in open and closed positions respectively and whereby retraction of said suction responsive means is effective to close said auxiliary valve and open said sleeve valve; and means controlled by a predetermined depression in said block opening for applying suction in said suction chamber; said last mentioned means comprising a normally closed control valve in said suction duct and auxiliary suction responsive means communicating with said block opening for opening said control valve.

11. In combination with an engine carbureting system having a suction passage and a throttle valve therein: auxiliary valve means for controlling flow of fluid through said suction passage; a suction chamber; suction responsive means in said suction chamber for actuating said auxiliary valve means; means including a control valve operable by abnormally high depression in said suction passage, occasioned by closing said throttle, for communicating suction from said suction passage to said suction chamber; and means including a vent communicating directly with said suction chamber and a vent valve operating independently of said control valve and controlled by actuation of said throttle, for breaking the suction in said suction cylinder when said throttle is opened thereby permitting a return movement of said suction responsive means.

12. In combination with an engine carbureting system having a suction passage and a throttle valve therein: auxiliary valve means for controlling the flow of fluid through said suction passage; a suction chamber; suction responsive means in said suction chamber for actuating said auxiliary valve means; means including a control valve operable by abnormally high depression in said suction passage occasioned by closure of said throttle valve for communicating suction from said suction passage to said suction chamber; vent means communicating directly with said suction chamber; means for actuating said throttle valve; means associated with said throttle valve actuating means for closing said vent valve when said throttle valve is closed and opening said vent valve whenever said throttle valve is opened beyond idling position, said last mentioned means being arranged to permit full opening movement of said throttle valve while said vent valve is open.

13. In combination with the intake manifold and the carburetor of an engine: a cut off valve in the passage between the carburetor and the manifold; a reciprocating suction responsive element; a connecting rod attached to said element; crank means interposed between said connecting rod and said cut-off valve and adapted to close said valve with suction responsive movement of said element; means including a duct for admitting scavenging gas to said manifold; a valve attached to said connecting rod normally closing said duct and adapted to open said duct upon suction responsive movement of said element.

14. The combination with an internal combustion engine carburetor, its throttle valve and the intake manifold to which said carburetor is connected, of an auxiliary valve located between the throttle valve and the intake manifold, means including a chamber communicating with said manifold, and a pressure responsive member in said chamber actuated by the increase in the degree of vacuum in the intake manifold resulting from the closing of the throttle valve for closing said auxiliary valve and for simultaneously admitting

a scavenging gas to the intake manifold at a point beyond said auxiliary valve in the direction of air flow, and means associated with and actuated by the throttle valve upon its opening movement to admit air directly to said chamber to effect opening movement of the auxiliary valve.

15. The combination with an internal combustion engine carburetor, its throttle valve and the intake manifold to which said carburetor is connected, of an auxiliary valve located between the throttle valve and the intake manifold, means including a chamber communicating with said manifold, and a pressure responsive member in said chamber actuated by the increase in the degree of vacuum in the intake manifold resulting from the closing of the throttle valve for closing said auxiliary valve and for simultaneously admitting a scavenging gas to the intake manifold at a point beyond said auxiliary valve in the direction of air flow, means associated with and actuated by the throttle valve upon its opening movement to admit air directly to said chamber to effect opening movement of the auxiliary valve and to cut off the admission of scavenging gas to the intake manifold.

16. The combination with an internal combustion valve carburetor, its throttle valve and the intake manifold to which said carburetor is connected, of an auxiliary valve located between the throttle valve and the intake manifold, vacuum actuated means for imparting closing movement to said auxiliary valve, means whereby a scavenging gas is admitted to the intake manifold through a passage connecting therewith at a point beyond the closed position of the auxiliary valve in the direction of air flow, means actuated by the increase in the degree of vacuum prevailing in the intake manifold following the closing of the throttle valve for effecting operation of the vacuum actuated auxiliary valve closing means, and means actuated by the throttle valve during its opening movement and operating independently of the admission of gas to the manifold through said passage, to cause said vacuum actuated auxiliary valve closing means to open said auxiliary valve.

17. The combination with an internal combustion engine carburetor, its throttle valve and the intake manifold to which said carburetor is connected, of an auxiliary valve located between the throttle valve and the intake manifold, vacuum actuated means for imparting closing movement to said auxiliary valve, means whereby a scavenging gas is admitted to the intake manifold through a passage connecting therewith at a

point beyond the closed position of the auxiliary valve in the direction of air flow, means actuated by the increase in the degree of vacuum prevailing in the intake manifold following the closing of the throttle valve for effecting operation of the vacuum actuated auxiliary valve closing means, means actuated by the throttle valve during its opening movement and operating independently of the admission of gas to the manifold through said passage to cause said vacuum actuated auxiliary valve closing means to open said auxiliary valve and to simultaneously cut off the further flow of scavenging gas to the intake manifold.

18. In combination with the intake manifold of an internal combustion engine and a carburetor having a suction passage communicating with said intake manifold: a throttle valve in said suction passage; means for actuating said throttle valve to partially close said suction passage for supplying an idling mixture to said manifold; an auxiliary valve in said suction passage between said throttle valve and said manifold; means including a separate valve outside of said suction passage for admitting a scavenging gas to said manifold at a point beyond the closed position of said auxiliary valve in the direction of air flow; and means including a pilot valve and a pressure responsive member, both controlled by the movement of said throttle valve to idling position and succeeding operation of the engine by momentum at above idling speed for simultaneously and positively actuating both of said valves to close said auxiliary valve and open said scavenging gas valve.

19. In combination with an engine carbureting system having a suction passage and a throttle valve therein; an auxiliary valve acting to substantially fully close said passage between the carburetor and the intake manifold; means including a valve for admitting scavenging gas to said manifold beyond the auxiliary valve in the direction of air flow, means including a chamber containing a pressure responsive member actuated by manifold depression communicated to said chamber upon movement of said throttle valve to idling position and operation of the engine at above idling speed to simultaneously close said auxiliary valve and open the scavenging gas valve, and means controlled by opening movement of the throttle for relieving the depression in said chamber to cause the auxiliary valve to open and the scavenging gas valve to close.

ALBERT G. H. VANDERPOEL.

CERTIFICATE OF CORRECTION.

Patent No. 2,129,608.

September 6, 1938.

ALBERT G. H. VANDERPOEL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 72, claim 2, before "suction" strike out the article "a"; page 6, second column, line 28, claim 11, for "cylinder" read chamber; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of November, A. D. 1938.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.