April 28, 1942. W. R. HEARN ET AL 2,281,287

MANIFOLD VENT CONTROL

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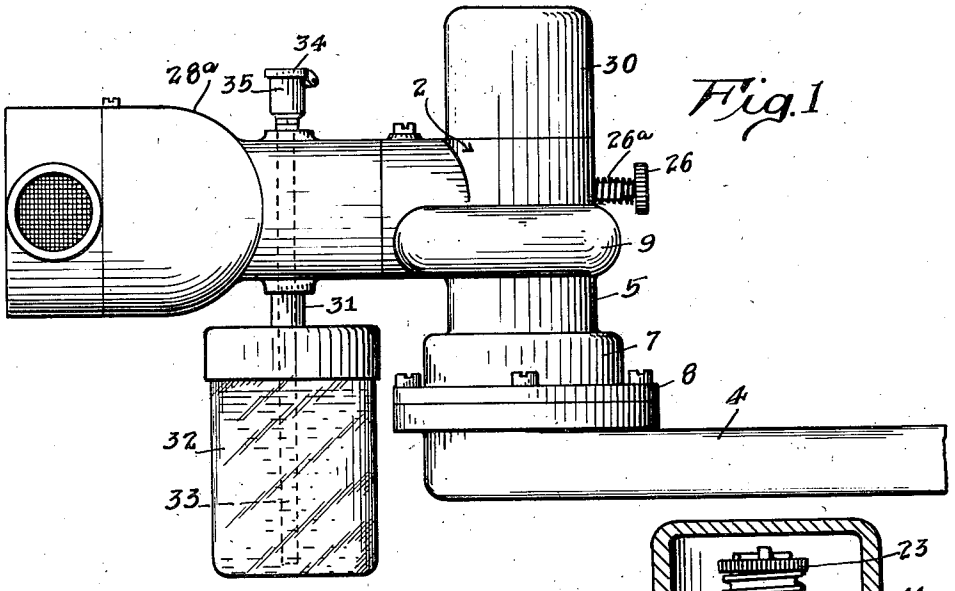


Fig. 1

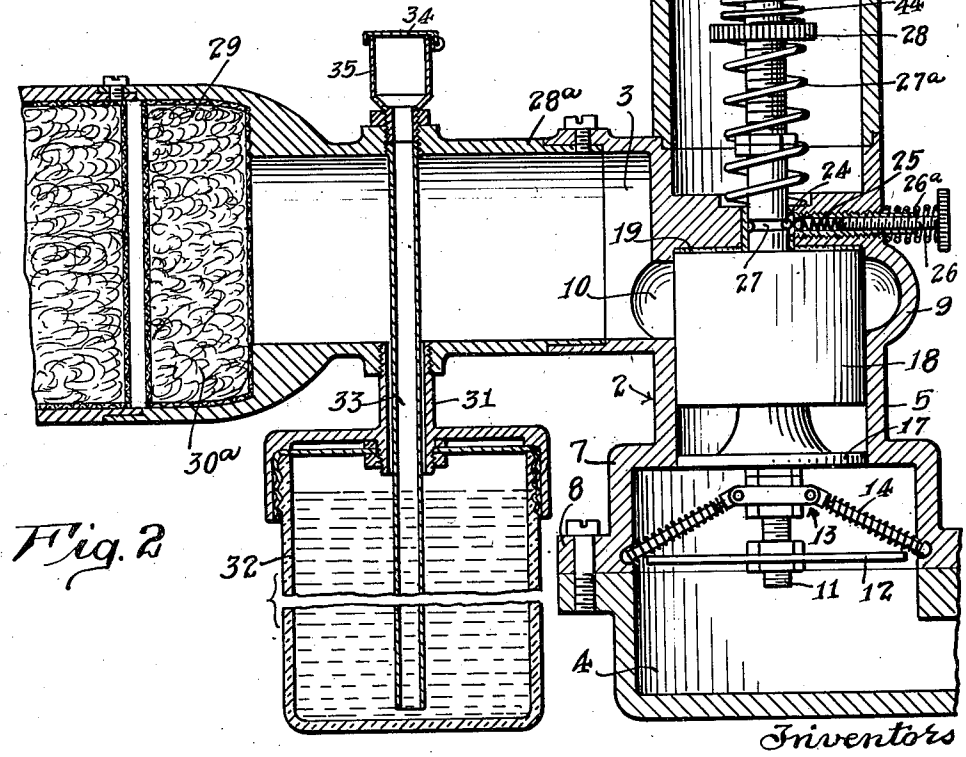


Fig. 2

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Fig. 3

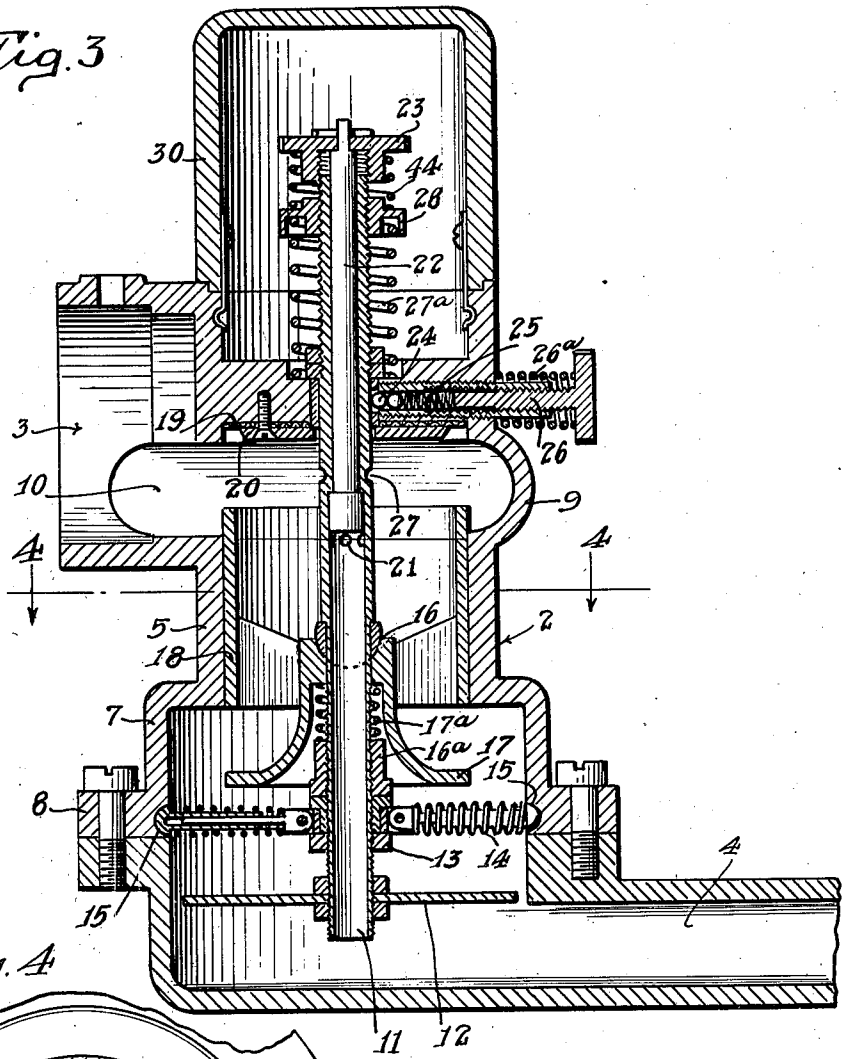
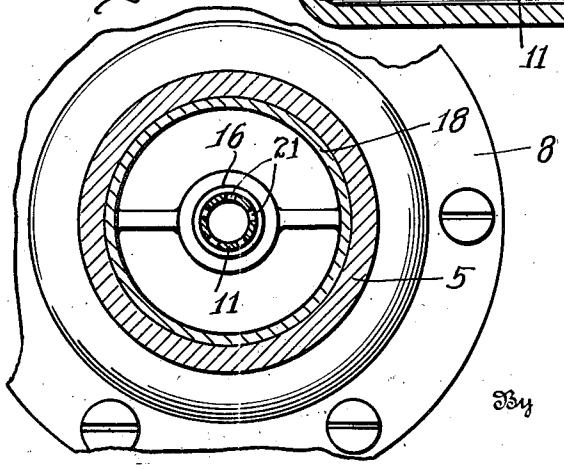


Fig. 4



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Fig. 5

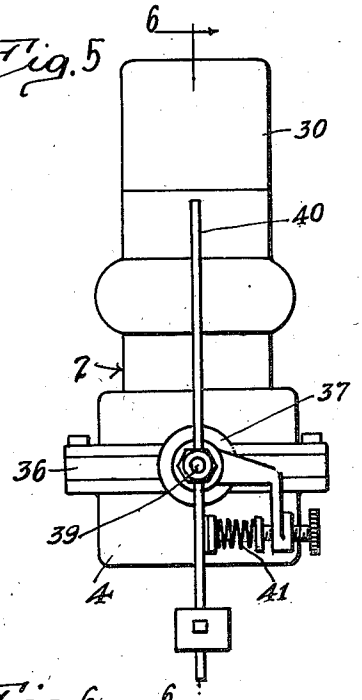


Fig. 6

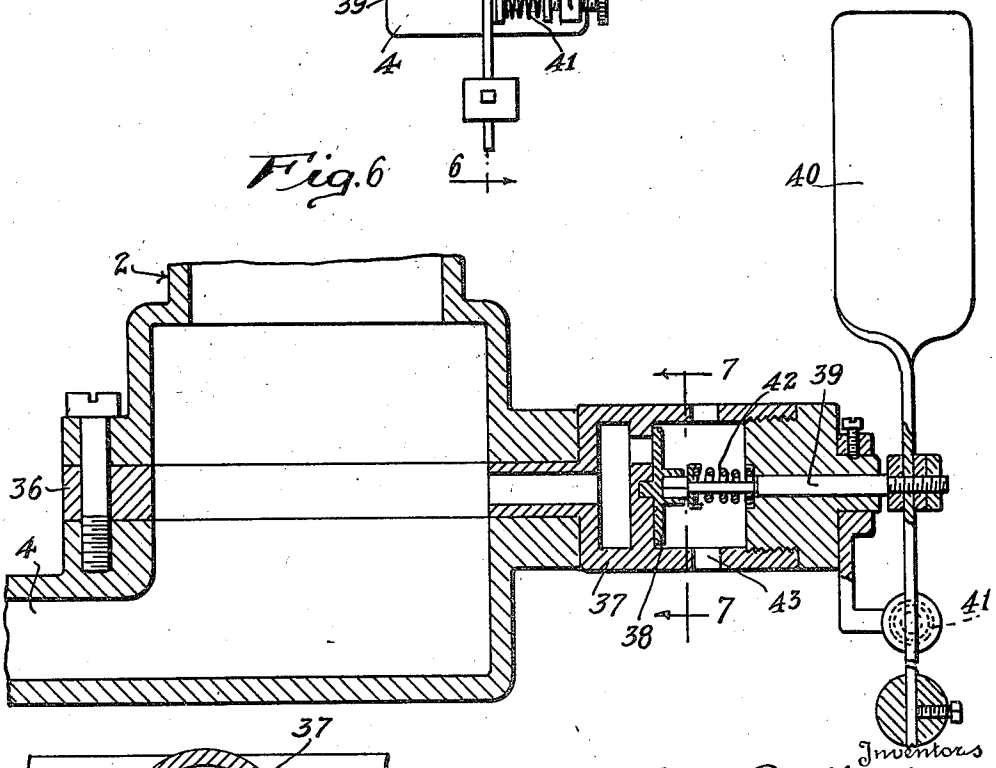
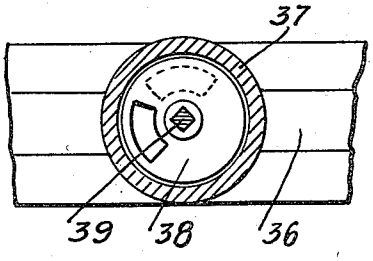


Fig. 7



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UNITED STATES PATENT OFFICE

2,281,287

MANIFOLD VENT CONTROL

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Application September 27, 1938, Serial No. 231,920

15 Claims. (Cl. 123—124)

This invention relates to a manifold vent control for internal combustion motors.

The general object of the present invention is to provide an apparatus adapted to automatically vent the intake manifold of an internal combustion engine to the atmosphere whenever the throttle of the motor is closed and the motor is being driven.

An internal combustion engine may be driven in various manner; for example, whenever the engine has been operating at high speed and the throttle quickly closed, the inertia of the fly-wheel will continue to drive the engine. Furthermore, in the case of a vehicle, when the vehicle is descending a grade with the clutch engaged and the throttle closed, the engine will be driven. Likewise, in the case of an aeroplane, when the aeroplane is diving towards the earth with the throttle closed, the motor will be driven by the propeller. In any of such cases, where the internal combustion engine is driven with the throttle closed, the engine places a relatively high vacuum in the intake manifold due to the pumping action of the pistons and valves. This high vacuum with a normal internal combustion engine operates to draw a considerable quantity of fuel through the carburetor and inject the same into the engine in the form of a very highly enriched fuel mixture. This fuel mixture is too rich for proper explosion and is discharged from the engine only at most in a partially combusted state.

Various disadvantages arise from the foregoing action of an internal combustion engine when it is being driven. These disadvantages are, for example—

(1) The creation of obnoxious gases;

(2) The dilution of the oil in the crank case of the engine with fuel;

(3) An unnecessary waste of fuel;

(4) Clogging of the engine so that it will not always start immediately on opening the throttle;

(5) Improper lubrication of the engine during this period.

Various devices have been proposed in the past for venting the intake manifold to the atmosphere, during the periods when the engine is being driven, for the purpose of removing the vacuum applied to the carburetor to thereby prevent fuel being drawn into the motor. The devices heretofore proposed have not proved practical in operation. For the successful operation of such a device, it is necessary that whenever the motor is being driven the vent control valve be snapped to a wide open position and maintained in said position as long as the engine is being driven with the throttle closed. The vent control apparatus must then automatically snap quickly to the closed position whenever the throttle is open, and it is intended that the power be supplied by the motor. Changes in the vacuum within the intake manifold of the engine may occur for various reasons in the operation of the engine, and previous devices have failed in practice because they have either failed to open or operate at the desired periods, or have been capable of frequently operating at undesired periods.

In accordance with the present invention, the vent control apparatus is rendered substantially unaffected by vacuum conditions in the intake manifold of the engine other than those changes in vacuum characteristic of an engine being driven. This is accomplished by providing the vent control valve with a secondary vacuum controlled chamber having a limited and controlled communication with the intake manifold, whereby the valve may become vacuum equalized under various conditions of vacuum existing in the intake manifold of the engine, except where a rapid increase in vacuum is created, such as characteristic of the engine being driven with the throttle closed. In this manner, the device is prevented from undergoing undesired operations.

Various auxiliary means are provided in the venting apparatus of the present invention for controlling the action of the device in order that it will be certain to operate only at desired periods of time. Such means include catch means for holding the valve inoperative until at least a predetermined high vacuum tends to open the same, and means for carefully regulating the rate of communication between the secondary vacuum chamber and the intake manifold whereby through the regulation of the rate of communication the apparatus may be set to snap open at any desired predetermined change of vacuum.

Another feature of the venting apparatus of the present invention is the provision therein of means for causing the air drawn through the apparatus to carry oil to the engine head. The difficulty of properly oiling the upper part of an internal combustion engine has long been appreciated, but not satisfactorily performed. With the device of the present invention, upon each closing of the throttle a certain amount of oil is drawn into the intake manifold and distributed in a most desirable manner during the

scavenging period or the interval of non-combustion. Furthermore, the oil drawn in with the air operates to lubricate the vent control device itself.

Further features of the present invention consist of the simplicity of the design of the apparatus which can be made at a low cost with relatively few parts and at the same time providing a device capable of taking care of a great variety of conditions of operation which may be easily and readily adjusted.

A further object of the present invention is to provide means for venting the manifold of an internal combustion engine to the atmosphere during the high speed operations of the engine. As internal combustion engines are at present designed, they are unable to secure a sufficient supply of air for proper combustion when operated at high speeds. The present invention provides means by which the high speed operation of the engine will vent the intake manifold to the atmosphere in order to permit additional air being supplied during such high speed operations.

A further advantage of the present invention is due to the fact that the opening of the manifold to air during the descent, for example, of a vehicle down a hill, increases the retarding action of the motor, eliminating the necessity of so much operation of the brake. Furthermore, the drawing of the air into the engine during these periods of operation cools the engine, which is of great value against the warping of valves.

Various further objects and advantages of the present invention will be apparent from a description of a preferred form or example of the device embodying the invention. For this purpose, we have hereinafter described, with reference to the accompanying drawings, a preferred form of the device.

In the drawings:

Figure 1 is an elevation.

Figure 2 is an enlarged elevation mainly in vertical section illustrating the device in the closed position.

Figure 3 is a similar elevation in vertical section with certain parts removed, showing the device in the open position.

Figure 4 is a section on the line 4—4 of Figure 3.

Figure 5 is an elevation of the apparatus as it is modified to provide for an additional vent control to be operated when the engine is operated at high speed.

Figure 6 is a fragmentary section on the line 6—6 of Figure 5.

Figure 7 is a fragmentary section on the line 7—7 of Figure 6.

Referring to the drawings, the device comprises a valve body member 2, which is provided with an inlet 3 for air which is to be vented to the manifold of an internal combustion engine, and with an outlet 4 for such air which may lead to the manifold, preferably making connection therewith between the intake manifold and its connection with the carburetor. The valve body comprises a cylindrical central portion 5, the lower end of which is enlarged as indicated at 7, and which is provided with a flange 8, by means of which the outlet 4 may be bolted thereto, the outlet preferably being formed separately from the valve body 2. Above the cylindrical portion 5 the body is enlarged, as indicated at 9, and provided with a lateral port 10 communicating with inlet 3.

The valve comprising a tube 11 threaded at its lower end to support a disc 12 and mounting 13 of compression spring members 14, one end of which spring members is secured to the swiveling mounting 13 and the other ends of which engage sockets 15 in the body member 2. These springs are normally tensioned to expand and are so mounted that in closed position, as indicated in Figure 2, they apply a force normally tending to maintain the valve closed. They are arranged in the form of a toggle, so that in the open position, as viewed in Figure 3, they are substantially on center, so that in open position they apply little force to move the valve. Above the spring mountings 13, tube 11 carries on a socket 16 the valve head proper 17, which is intended to close the valve by fitting into the cylindrical portion 5 of the body. A spring 17a and spacer 16a are provided for steadying the head 17. The tube 11 further carries a hollow sleeve 18 of sufficient length to abut against the top wall of the valve body in the closed position and shut off the port 10 from communication. In order to better seal the device, as well as eliminate noise from its opening and closing, the upper wall of the body is shown as provided with a packing 19 held in place by member 20.

The sleeve 18, together with the head 17 in the closed position, form what is herein referred to as a secondary vacuum chamber which is capable of balancing under certain conditions the vacuum existing on opposite sides of the head 17. For this purpose, the tube 11 is provided with openings 21 whereby vacuum in said secondary chamber may be established by the outlet line drawing air from said chamber through the openings 21 and hollow tube 11. If the openings are of sufficient size and unrestricted the variations in vacuum occurring in the intake manifold of the engine would have no influence on the operation of the apparatus, but, by suitably closing the openings 21, the rate of flow of air from the secondary vacuum chamber to the intake manifold may be so controlled that the apparatus while remaining resistant to certain vacuum changes will nevertheless be effectively actuated by the vacuum changes existing at the moment the throttle is closed and while the motor continues to operate under its momentum. The extent of communication between the secondary vacuum chamber and the intake manifold for this purpose must be accurately maintained. For this purpose, there is provided a rod 22 within the hollow tube 11 having a head capable of moving so as to close or partially close the openings 21, said rod being attached to a nut 23 threaded to the shaft 11.

As a further means for inhibiting undesired operation of the apparatus with certain limited vacuum changes in the intake manifold, we provide a catch means consisting of a ball 24 normally pressed against the tube 11 by spring 25, the tension of which may be controlled by the set screw 26. The ball 24 is adapted to engage the groove 27 on tube 11 when the apparatus is in the closed position and hold the apparatus in closed position against minor variations in vacuum. The set screw 26 is provided with a spring 26a which serves to retain the same in any adjusted position.

The device further comprises a retracting spring 27a engaging a head 28 on the tube 11 and the valve body 2. This spring is designed to apply just sufficient force to move the toggle spring 14 from its own center position when other forces acting on the valve have ceased. The head or collar 28 of the retracting spring also mounts a spring 44, the opposite end of which engages the adjusting nut 23 which controls the opening of the ports 21. The spring 44 operates to thus preserve the setting of the adjusting nut 23, thereby preventing undesired changes in the opening of the ports 21.

The controls consisting of the head 28 and the retracting spring 27a and head 23 for closing the ports 21 are preferably enclosed in a cap 30 fitted to the valve body 2.

The air inlet 3 of the valve body is preferably attached by suitable means, such as the fitting 28a, to an air filter 29a, indicated as provided with suitable filter screening material 30a of any preferred or customary design. While a separate air filter for the vent control apparatus may be used, if desired, it is also possible, and in most cases preferable, to use the same air filter connected with the carburetor of the internal combustion engine. In order to provide for the oiling of the vent control apparatus, and more particularly in order to inject oil into the engine, particularly around the valve ports thereof, during the scavenging period of operation, the fitting 28a supports a tube 31 mounting an oil container 32. Telescoped within the tube 31, but spaced therefrom, is provided a tube 33, which extends close to the bottom of the oil container 32 and passes through the fitting 28a, and is supported by a boss 33 thereof. At its upper end the inner tube 33 is provided by the cap 34, which may be opened into a filling enlargement 35. By the arrangement thus described, the passage of air through the fitting 28a places suction on the space between tubes 31 and 33, drawing air through the tube 33, through the oil container 32, and into the fitting 28a through the space between tubes 31 and 33. The air enters tube 33 from the atmosphere by leaking by the cap 34. This wets the air entering the intake manifold with a small quantity of oil sufficient for complete lubrication of the vent control device, and also the oil is drawn into the engine head lubricating the intake and exhaust valves as well as the upper portion of the cylinder head. This oiling operation performed by the apparatus of the present invention is of great value, inasmuch as the internal combustion engine and parts thereof have heretofore been inadequately lubricated above the cylinder head. By means of the present invention, a cycle of operations for the engine is provided where no combustion takes place. By introducing oil during this period, lubrication is accomplished in a manner superior to anything heretofore secured. This oiling of the engine is of particular value when, for example, the vehicle is descending a long grade, where in certain cases it may be operating for as much as half an hour without any desirable combustion. By the apparatus of the present invention the engine becomes adequately cooled during such descent and is moreover properly oiled. Similarly, in the case of an aeroplane diving from a height, the apparatus of the present invention results in properly lubricating the engine head throughout the dive, and furthermore the pilot is assured that the engine will immediately commence operating on opening of the throttle. As at present designed, when an aeroplane dives from a height, it is necessary for the pilot to frequently open the throttle in order to be certain that the engine will not become clogged with an over-supply of gasoline and, therefore, not operate immediately upon the opening of the throttle.

Now, referring to Figures 5, 6 and 7, the modification of the apparatus as shown consists of the addition between the valve body 2 and the outlet 4 of a fitting 36, which carries a valve chamber 37 having a rotating valve head 38. The valve head 38 is attached by a shaft 39 to a single blade fan 40. The fan 40 is provided with spring means 41 normally tending to hold the same in position to maintain the valve 38 closed. The fan 40 is disposed in a position to be affected by the blast of air leaving the fan (not shown) of the internal combustion engine. There is provided a spring 42 for holding the valve head 38 in place and ports 43 for the entrance of air to the valve head 38.

The apparatus thus described is designed for opening or venting the intake manifold of the engine to the atmosphere in order to provide for the entrance of additional air into the manifold during those periods of operations of the engine where the same is being driven with the throttle open and at high speed. Under these conditions, most internal combustion engines fail to secure a sufficient supply of air for complete combustion of the fuel. With the apparatus of the present invention, the tension of the spring 41 is so set that the pressure of air on the fan blade 40 will cause the valve 38 to open whenever the internal combustion engine is operating at such high speeds, thereby automatically supplying the intake manifold of the engine with this additional air desirable for these periods of operation.

While the particular form of the invention herein described is well adapted to carry out the objects thereof, it is to be understood that various modifications and changes may be made without departing from the principles of the invention, and the invention includes all such modifications and changes as come within the scope of the appended claims.

We claim:

1. A manifold vent control, comprising a valve chamber having an air inlet and an outlet, a normally closed valve member within said valve chamber operable to open position by vacuum within said outlet, means yieldingly maintaining said valve member in the closed position, a vacuum balancing means for said valve member having restricted communication with said outlet, and baffle means for said valve member operable for retaining the valve member in open position by the flow of air to said outlet.

2. A manifold vent control comprising a valve chamber having an air inlet and an outlet, a valve member within said valve chamber having a sleeve portion and a head portion movable to a closed position where said sleeve portion closes said air inlet, said sleeve portion and said head portion providing in the closed position a vacuum balancing chamber, said valve member being movable also to an open position wherein said chamber is open to the passage of air, means yieldingly maintaining said valve member in closed position, said valve member operable by vacuum within said outlet to the open position.

3. A manifold vent control comprising a valve chamber having an air inlet and an outlet, a

valve member within said valve chamber having a sleeve portion and a head portion movable to a closed position where said sleeve portion and said head portion provide vacuum balancing chamber and movable also to an open position wherein said chamber is open to the passage of air, means yieldingly maintaining said valve member in closed position, said valve member operable by vacuum within said outlet to the open position, and said valve member having baffle means permitting the flow of air to facilitate retaining the valve member in open position.

4. A manifold vent control comprising a valve chamber having an air inlet and an outlet to an engine manifold, a valve member including a sleeve and a valve head movable to close the valve chamber and form a vacuum balancing chamber at the rear of said valve head in the closed position and movable to an open position to permit flow of air through such sleeve to the manifold, means providing a controlled restricted communication between vacuum balancing chamber and manifold, and means yieldingly assisting to maintain the valve member in the closed position.

5. A manifold vent control comprising a valve chamber having an air inlet and an outlet to an engine manifold, a valve member including a sleeve and a valve head movable to close the valve chamber and form a vacuum balancing chamber at the rear of said valve head in the closed position and movable to an open position to permit the flow of air through such sleeve to the manifold, means providing a controlled restricted communication between vacuum balancing chamber and manifold, and toggle spring means normally assisting to maintain said valve member in the closed position and movable to a nearly on center position in the open position of said valve member.

6. A manifold vent control comprising a valve chamber having an air inlet and an outlet to an engine manifold, a valve member including a sleeve and a valve head movable to close the valve chamber and form a vacuum balancing chamber at the rear of said valve head in the closed position and movable to an open position to permit flow of air through such sleeve to the manifold, means providing a controlled restricted communication between vacuum balancing chamber and manifold, spring means operating to urge the valve member to the closed position, said spring means including toggle members moving towards the on center position as the valve member is opening to reduce the force of the spring means tending to close said valve member, and means for adjusting the spring means to provide a predetermined closing tendency in the open position of said valve member.

7. A manifold vent control comprising a valve chamber having an air inlet and an outlet to an engine manifold, a valve member including a sleeve and a valve head movable to close the valve chamber and form a vacuum balancing chamber at the rear of said valve head in the closed position and movable to an open position to permit flow of air through such sleeve to the manifold, means providing a controlled restricted communication between vacuum balancing chamber and manifold, baffle means for said valve member operable to assist in retaining the valve member in the open position by the flow of air to said manifold, spring means operating to urge the valve member to the closed position, said spring means including toggle members moving towards the on center position as the valve member is opened to reduce the tendency of the spring means to close said valve member, and means for adjusting said spring means to provide in the open position of said valve member a predetermined tendency for said spring means to close said valve member.

8. A manifold vent control having a valve body, means for connecting the valve body with a source of air, means for connecting the valve body with a manifold, said valve body having a sleeve chamber with a lateral port connected to said source of air, a valve member carrying a sleeve movable in said sleeve chamber movable to close said lateral port, said valve member having a head movable simultaneously to close said sleeve chamber and define with said sleeve a vacuum balancing chamber, a restricted communicating means between said vacuum chamber and the connection with said manifold, and means yieldingly urging the valve member into the closed position.

9. A manifold vent control having a valve body, means for connecting the valve body with a source of air, means for connecting the valve body with a manifold, said valve body having a sleeve chamber with a lateral port connected to said source of air, a valve member carrying a sleeve movable in said sleeve chamber, movable to close said lateral port, said valve member having a head movable simultaneously to close said sleeve chamber and define with said sleeve a vacuum balancing chamber, a restricted communicating means between said vacuum chamber and the connection with said manifold, means yieldingly urging the valve member in the closed position, said valve member having a baffle arranged to permit the flow of air through the device to apply a force holding the valve member in the open position.

10. A manifold vent control, comprising a sleeve chamber having near one end a lateral air inlet port and having at its other end an outlet to an engine manifold, a valve member including a sleeve and a head, the sleeve being movable to close said lateral port and said head being movable to close the other end of said sleeve chamber, said sleeve being designed to close said lateral port slightly in advance of the closing of said sleeve chamber by said head, said sleeve chamber, sleeve, and head operating in a closed position to form a vacuum balancing chamber, and a restricted communication between said vacuum balancing chamber and said manifold.

11. A manifold vent control, comprising a valve chamber having an air inlet and an outlet, a valve member within said valve chamber operable to the open position by vacuum within said outlet, means yieldingly urging said valve member to the closed position, and a vacuum balancing means for said valve member effective to normally prevent the vacuum within said outlet opening said valve member and provided with a restricted communication with said outlet effective to unbalance the vacuum on said valve member so as to allow said valve member to open upon rapid increases in the vacuum in said outlet.

12. A manifold vent control, comprising a valve chamber having an air inlet and an outlet, a valve member within said valve chamber operable to the open position by vacuum within said

outlet, means yieldingly urging said valve member to the closed position, vacuum balancing means for said valve member effective to normally prevent the vacuum within said outlet opening said valve member and provided with a restricted communication with said outlet effective to unbalance the vacuum on said valve member so as to allow said valve member to open upon rapid increases in the vacuum in said outlet, and means for controlling the restriction between said balancing means and outlet.

13. A manifold vent control, comprising a valve chamber having an air inlet and an outlet, a normally closed valve member within said valve chamber operable to open position by vacuum in said outlet, means yieldingly maintaining said valve member in closed position, said valve member having means forming a vacuum balancing chamber for the same in the closed position normally effective to prevent the vacuum from opening said valve member, said means having a controllable communication with said outlet effective under sudden vacuum changes for permitting the vacuum to open said valve member.

14. A manifold vent control comprising a sleeve chamber having an air inlet and an outlet, a valve member within said sleeve chamber and having a sleeve portion normally closing said air inlet and a head portion normally closing said outlet and operable to open position by vacuum in said outlet, means yieldingly maintaining said valve member in closed position, said valve member having means forming a vacuum balancing chamber for the same in the closed position, and a controllable communication between said vacuum balancing chamber and said outlet effective to normally prevent the vacuum within said outlet opening said valve and effective under sudden vacuum changes for allowing the vacuum within said outlet to open said valve member.

15. A manifold vent control, comprising a valve chamber having an air inlet and an outlet, a valve member within said valve chamber operable to open position by vacuum within said outlet, yielding means normally maintaining said valve member in closed position, and means forming a vacuum balancing chamber for said valve member in the closed position, said means having a restricted communication with said outlet normally effective to prevent the vacuum within said outlet opening said valve member and effective under sudden vacuum changes for allowing the vacuum within said outlet opening said valve member, said vacuum balancing chamber connecting with said air inlet in the act of opening said valve member to facilitate rapid and full opening thereof.

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