Nov. 12, 1929. C. S. BRAGG ET AL 1,735,635

APPARATUS FOR OPERATING SUCTION ACTUATED DEVICES IN CONNECTION WITH THE SUCTION PASSAGE OF AN INTERNAL COMBUSTION ENGINE

Original Filed Feb. 26, 1925 2 Sheets-Sheet 1

Fig. 1.

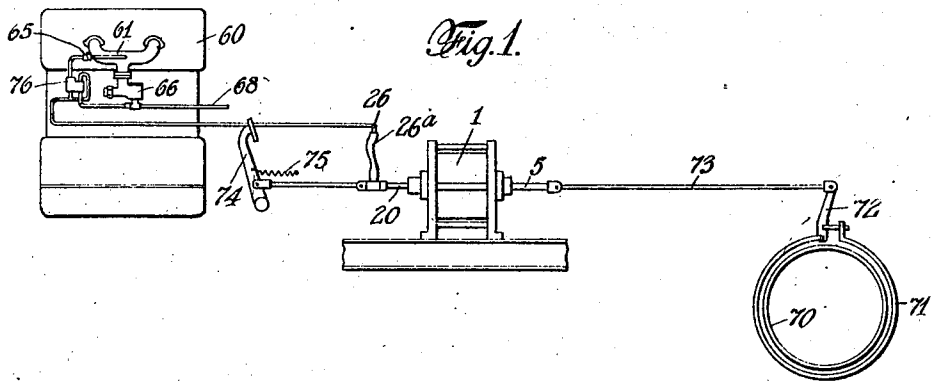
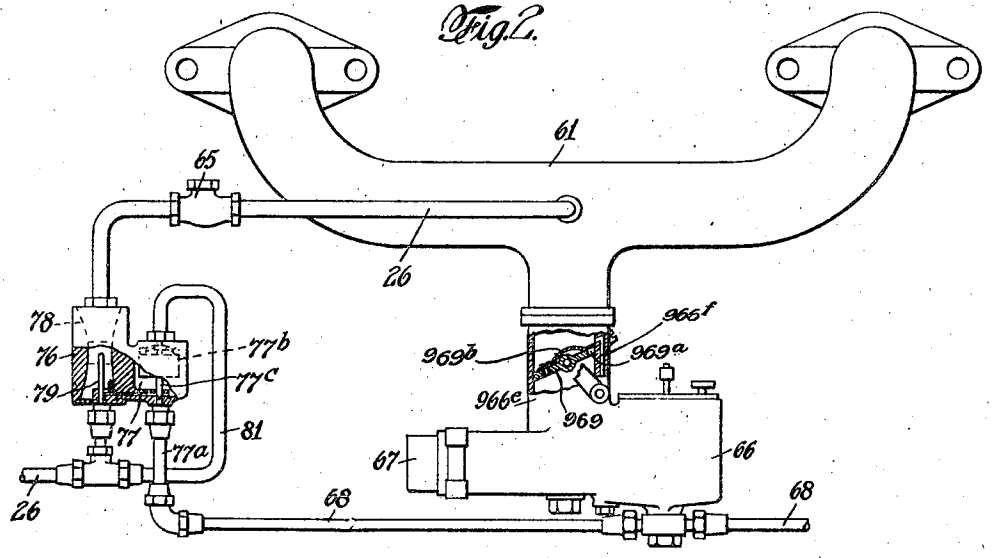


Fig. 2.



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Fig. 3.

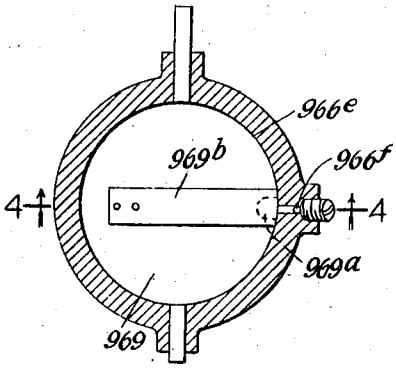


Fig. 5.

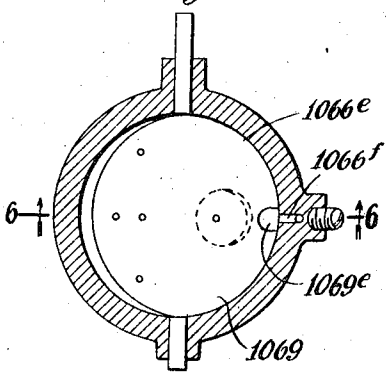


Fig. 4.

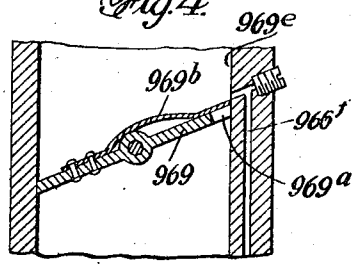


Fig. 6.

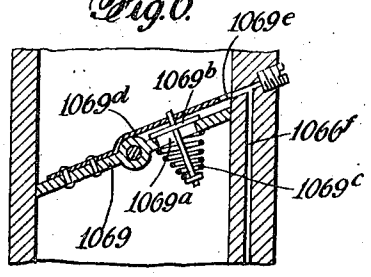
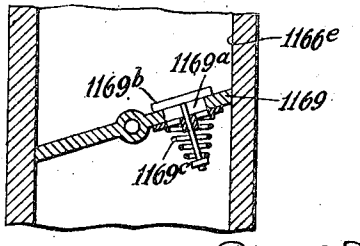


Fig. 7.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR OPERATING SUCTION-ACTUATED DEVICES IN CONNECTION WITH THE SUCTION PASSAGE OF AN INTERNAL-COMBUSTION ENGINE

Original application filed February 26, 1925, Serial No. 11,683. Divided and this application filed June 11, 1926, Serial No. 115,166. Renewed August 21, 1928.

Our invention consists in the novel features hereinafter described, reference being had to the accompanying drawings which illustrate several embodiments of the same, selected by us for purposes of illustration and the said invention is fully disclosed in the following description and claims.

This application is a division of our former application for Letters Patent of the United States, filed by us February 26, 1925, and given Serial No. 11,683.

In the operation of vacuum brakes for automotive vehicles, it is extremely convenient to obtain the necessary suction, or partial vacuum from a suction passage of the internal combustion engine, ordinarily employed for the propulsion of the vehicle, and located between the throttle valve for controlling the supply of mixture, and the cylinder. To this end it is convenient and desirable to connect the vacuum brake mechanism with the intake manifold of the engine. It will be understood, further, that all the air exhausted from the brake actuating mechanism and delivered into the intake manifold of the engine necessarily has a tendency to either prevent the drawing in of the proper quantity of liquid fuel from the atomizer by reduction of the partial vacuum in the suction passage, or to dilute the explosive mixture passing through the suction passage. and such dilution may in some instances bring about a mixture which will not readily ignite in the engine. In either case the engine, if turning over idly, would be likely to stall and the admission of air into the manifold in this manner, may also materially delay the starting of the engine. For the proper operation of the vacuum brake mechanism of the vehicle, it is desirable that the air exhausted into the manifold shall be withdrawn from the brake actuating mechanism as rapidly as possible in order to insure quick operation of the brake mechanism, and if the connection between the brake actuating mechanism and the intake manifold is restricted for the purpose of avoiding the stalling of the engine, and delay in starting, the result will materially retard the operation of the brake mechanism.

According to our present invention, we locate in the connection between the vacuum brake actuating mechanism and the intake manifold of the internal combustion engine of an automotive vehicle, means operating independently of the engine carburetor for supplying to the air withdrawn from the brake actuating mechanism, the proper quantity of fuel, so that this air when it arrives in the intake manifold, is in fact an explosive mixture which readily combines with the explosive mixture furnished by the main carburetor, and passes to the cylinders of the engine as part of the normal charges drawn into the same and ignited. The operation of the vacuum brake mechanism which results in delivering a quantity of air therefrom to the intake manifold, has no diluting effect on the normal explosive mixture passing from the carburetor and will not have the effect of slowing down or stalling the engine. If anything, it will tend ordinarily to increase the efficiency of the engine and speed it up rather than slow it down, so that it is in efficient running condition to take up the load and propel the vehicle when the brakes are released.

In carrying out our invention, we provide separate carbureting means located in the connection between the suction actuated device and the intake manifold of the engine, the ordinary check valve being provided in said connection, and located preferably between the auxiliary carburetor and the intake manifold, and in connection with the means for carbureting the air withdrawn from the suction actuated device. We prefer to provide a special form of throttle valve interposed between the main carburetor and the intake manifold, and provided with an aperture for admitting a small quantity of explosive mixture from the engine carburetor for idling the engine when the throttle valve is closed, or in case the engine carburetor is provided with an auxiliary fuel inlet above the throttle valve for carbureting the idling mixture, this aperture in the throttle valve will admit the air necessary for the idling charge adjacent to said auxiliary fuel inlet, and in conjunction with this aperture, we provide a normally closed auxiliary valve for

closing said aperture, which valve will be opened by the suction in the suction passage, to admit the idling mixture when the throttle valve is closed, but will instantly close on a reduction of the suction, or in other words, a rise of pressure in the suction passage above the throttle valve, to which portion of the suction passage the suction pipe from the suction actuated device is connected. When, therefore, the suction actuated device is operated while the throttle valve is closed, and carbureted air is drawn from the suction actuator device into the intake manifold, it will reduce the degree of vacuum therein, and permit the auxiliary valve to close by means of a spring with which it is provided, thus shutting off the normal supply of idling mixture, the carbureted air from the suction actuator temporarily supplying the idling mixture to the engine, in whole or in part, according to the extent of the reduction of the partial vacuum in the suction passage. As the manifold ceases to receive air from the actuator, the degree of exhaustion in the manifold will increase to the normal amount for idling, and the auxiliary spring valve in the throttle valve will open as soon as a predetermined degree of exhaustion in the suction passage is reached, and admit explosive mixture from the engine carburetor.

Our invention also comprises certain novel features of construction hereinafter fully described, and particularly pointed out in the claims.

Referring to the accompanying drawings, in which we have shown several embodiments of our invention selected by us for purposes of illustration,

Fig. 1, is a diagrammatic view showing an installation in an automotive vehicle comprising an internal combustion engine, brake mechanism for the vehicle, and a vacuum operated power actuator for the brake mechanism, and having our present invention embodied therein.

Fig. 2, is an enlarged view of certain parts illustrated in Fig. 1, showing the intake manifold, the engine carburetor connected therewith, and a separate carburetor in the suction line from the intake manifold to the suction actuated device for the brake mechanism.

Fig. 3, is a horizontal section of the passage leading from the engine carburetor to the intake manifold, showing it provided with a special fuel inlet passage for idling, and showing our improved form of throttle valve with auxiliary valve for closing the idling aperture therein.

Fig. 4, is a vertical sectional view on line 4, 4, of Fig. 3.

Fig. 5, is a view similar to Fig. 3, showing a modified form of throttle valve and auxiliary valve.

Fig. 6, is a vertical sectional view of line 6, 6, of Fig. 5.

Fig. 7, is a view similar to Figs. 4 and 6, showing a form of throttle valve adapted for use in connection with a suction passage not provided with a separate fuel inlet for idling.

In Figure 1, we have illustrated our invention applied in connection with an automotive vehicle propelled by an internal combustion engine, and having a vacuum or suction actuated device for operating the brake mechanism of the vehicle. In this figure, 1, represents a suction actuated device or power actuator of the kind illustrated in our former application for Letters Patent of the United States, filed January 5, 1925, and given Serial No. 506, and in our former application for Letters Patent of the United States, filed February 26, 1925, and given Serial No. 11,683, of which this application is a division.

It will be understood, that, the actuator comprises a cylinder having a piston therein, in this case a double acting piston, connected with a piston rod indicated at 5, which in this instance is connected by link, 73, to brake lever, 72, for operating an ordinary brake mechanism, diagrammatically indicated in Fig. 1, and comprising in this instance a brake band, 71, brake drum, 70, so that the movement of the piston in one direction applies the brake, and in the opposite direction, releases the brakes. It will also be understood, that, the actuator is provided with reversing valve mechanism which may be conveniently located in the hub of the actuator piston, and operated by a longitudinally movable valve actuating sleeve, 20, extending therethrough and projecting from the opposite end of the cylinder from the piston rod through a suitable stuffing box, said valve mechanism being so constructed as to place one end of the cylinder in communication with a suction line to the intake manifold of the engine, and the other end of the cylinder in connection with the atmosphere, and vice versa, according as the valve actuating sleeve is moved in one direction or the other. The valve sleeve, 20, is operatively connected with a foot lever or other operator operated device indicated at 74, and provided with a retracting spring, 75. The specific details of construction of the actuator and connected parts form no part of our present invention, and they will not, therefore, be more particularly described herein.

66, represents the engine carburetor having the main air intake, 67, and fuel supply pipe, 68. 969, represents the throttle valve of the engine illustrated in detail in Figs. 3 and 4. 26, represents the suction pipe extending from the suction actuated device, 1, to which it is connected, in this instance by means of a flexible pipe section, 26^a, connected with the valve mechanism of the suc-

tion actuated device through the hollow valve sleeve, 20, the suction pipe being also connected to the intake manifold, 61, of the internal combustion engine, 60, between the throttle valve and the engine cylinders. As best seen in Fig. 2, the suction pipe, 26, is provided with means for carbureting the air withdrawn from the actuator, and in this instance, we have shown for this purpose a separate carburetor, 76, provided with the float chamber, 77, and float, 77^b, controlling the usual float valve, 77^c. The float chamber, 77, in this instance, is connected by pipe, 77^a, with the auxiliary feed pipe, 68, which also supplies the main carburetor, but it may be supplied with liquid fuel in any desired way. The particular form of separate carburetor shown is provided with the usual Venturi pipe, 78, connected in the suction line pipe, 26, at both ends, and provided with the usual atomizing nozzle, 79, communicating with the float chamber. Whenever air is withdrawn from the actuator by the suction of the manifold, it will be mixed with atomized liquid fuel in the separate carburetor 76, and pass on preferably through a check valve, 65, into the manifold as combustible mixture, and will there mix with the combustible mixture passing through the main carburetor, 66, in the ordinary way, except as hereinafter explained. The auxiliary carburetor is shown as provided with a pressure equalizing pipe, 81, connected with the float chamber, 77, above the liquid level therein, and with the suction pipe, 26. The specific details of the separate carburetor do not, however, form any part of our present invention, and will not be further described or illustrated.

966^e, represents the passage leading from the engine carburetor to the intake manifold, in which passage the pivoted throttle valve, 969, is mounted. In this instance, the wall of the passage is shown as provided with an auxiliary liquid fuel inlet, 966^f, for supplying the necessary fuel when the engine is idling, the said auxiliary liquid fuel passage discharging into the passage, 966^e, above the closed position of the throttle valve. The throttle valve is shown as provided with an aperture, 969^a, which is in this instance located closely adjacent to the delivery orifice of the liquid fuel passage, 966^f, and said aperture is normally closed by a yielding or spring actuated valve, 969^b. In this construction the throttle valve is permitted to close when the engine is idling and the suction or vacuum in the intake manifold, assuming that the actuator is not in operation, will open the auxiliary yielding valve, 969^b, in the throttle valve, so as to supply air to mix with the liquid fuel from the auxiliary fuel inlet, 966^f, and provide the explosive charges for the engine. Whenever air is drawn into the manifold from a vacuum operated device, as the power actuator, connected therewith in sufficient quantity to affect the operation of the engine, and cause said air so admitted to be carbureted so that the degree of rarification in the manifold falls below the degree of rarification normally present while idling, the auxiliary spring valve, 969^b, will close and the motor will be operated by the explosive mixture received from the actuator without the acceleration which would result if the opening in the throttle valve remained as before with a normal idling opening. As soon as the manifold ceases to receive air from the actuator, the vacuum in the manifold will be increased to the normal amount for idling, and the auxiliary spring valve, 969^b, will again open to admit the proper amount of gaseous mixture from the engine carburetor. While we prefer the form of throttle valve illustrated in Figs. 3 and 4, we have also shown slight modifications thereof in Figs. 5, 6, and Fig. 7.

In Figs. 5 and 6, 1066^e, represents the passage from the engine carburetor to the intake manifold provided with the auxiliary fuel inlet, 1066^f, and 1069 represents the throttle valve, which in this instance, instead of being provided with an aperture closely adjacent to the said auxiliary fuel inlet, is provided with an aperture, 1069^a, at some distance therefrom, said aperture being closed by an auxiliary valve, 1069^b, normally held in closed position by a spring, 1069^c, the throttle valve being provided with a deflector plate, 1069^d, for deflecting the air or gas drawn from the opening, 1069^a, when the valve is in open position toward the auxiliary fuel inlet. The deflector or shield may be provided with an aperture, or recess, 1069^e, adjacent to the auxiliary fuel inlet, as shown. The operation of the device shown in Figs. 5 and 6, in combination with the suction actuated device, the suction pipe and auxiliary carbureting means therein, is exactly the same as that previously described with reference to Figs. 3 and 4, in all substantial respects.

Fig. 7, represents a slight modification of the construction of the throttle valve previously described with reference to Figs. 3 to 6, inclusive, and adapted for use especially where the passage, 1166^e, leading from the engine carburetor to the intake manifold is not provided with an auxiliary fuel inlet passage for idling. In this case the throttle valve, indicated at 1169, is provided with an aperture, 1169^a, normally closed by an auxiliary valve, 1169^b, held in closed position by a spring, 1169^c. When the throttle valve is closed, to idle the engine, and the actuator is not being operated, the suction in the manifold will cause the auxiliary valve, 1169^b, to open sufficiently to draw from the main carburetor explosive mixture for the explosive charges of the engine. When the actuator is operated, and air withdrawn therefrom through the separate carburetor enters the

intake manifold in sufficient quantities to supply the idling mixture, the valve, 1169[b], will close and the engine will be operated by the mixture produced by the air withdrawn from the suction actuated device through the separate carburetor. The operation of the throttle valve, shown in Fig. 7, in combination with the suction pipe and separate carbureting means located therein, will be exactly the same as that previously described with reference to Figs. 3 to 6 inclusive, except that when the auxiliary valve in the throttle valve is in open position, explosive mixture of air and fuel from the engine carburetor will pass through the aperture in the throttle valve for idling the engine.

What we claim and desire to secure by Letters Patent is:—

1. The combination with an internal combustion engine, provided with a suction passage communicating with the engine cylinder or cylinders, an engine carburetor connected with said passage, a throttle valve for controlling said passage, a suction actuated device, an air connection therefrom to said suction passage, connected to the latter between the throttle valve and the engine cylinders, of means for introducing fuel into the air withdrawn from the suction actuated device, whereby said air will reach the said suction passage of the engine in the form of a combustible mixture, said throttle valve being provided with an aperture therein, a yielding normally closed valve for said aperture, adapted to be opened by the maximum rarification in the suction passage, when the engine is idling, and to close when carbureted air is drawn into said suction passage from the suction actuated device so as to reduce the degree of rarification in said passage below a predetermined point.

2. The combination with an internal combustion engine, provided with a suction passage communicating with the engine cylinder or cylinders, an engine carburetor connected with said passage, a throttle valve for controlling said passage, a suction actuated device, an air connection therefrom to said suction passage, connected to the latter between the throttle valve and the engine cylinders, of means for introducing fuel into the air withdrawn from the suction actuated device, before it enters the suction passage of the engine, means for establishing a communicating passage between the portions of the suction passage on opposite sides of the throttle valve, when the throttle valve is in closed position, and a normally closed auxiliary valve controlling said communicating passage, adapted to be opened when a predetermined degree of rarification exists in said suction passage of the engine between the throttle valve and the engine cylinders, said main carburetor being provided with an auxiliary fuel inlet cooperating with said communicating passage.

3. The combination with an internal combustion engine, provided with a suction passage communicating with the engine cylinder or cylinders, an engine carburetor connected thereto, a throttle valve for controlling said passage, a suction actuated device, and an air connection extending therefrom to said suction passage, and connected therewith between the throttle valve and the engine cylinders, of means for introducing motor fuel into the air withdrawn from the actuator cylinder, whereby said air will reach the said suction passage in the form of a combustible mixture, and will be combined with the charge forming mixture flowing through said suction passage, said engine carburetor being provided with an auxiliary liquid fuel inlet between the throttle valve and said suction passage for operating the engine when idling, and the throttle valve being provided with an aperture therein, a yielding normally closed valve for said aperture, and being constructed so as to direct the gaseous fluid passing through said aperture when said yielding valve is open, adjacent to said auxiliary liquid fuel inlet.

4. The combination with an internal combustion engine, provided with a suction passage communicating with the engine cylinder or cylinders, an engine carburetor connected thereto, a throttle valve for controlling said passage, a suction actuated device, and an air connection extending therefrom to said suction passage, and connected therewith between the throttle valve and the engine cylinders, of means for introducing motor fuel into the air withdrawn from the actuator cylinder, whereby said air will reach the said suction passage in the form of a combustible mixture, and will be combined with the charge forming mixture flowing through said suction passage, said engine carburetor being provided with an auxiliary liquid fuel inlet between the throttle valve, and said suction passage, and the throttle valve being provided with an aperture therein adjacent to the said auxiliary fuel inlet, and a yielding normally closed valve for said aperture.

5. The combination with an internal combustion engine having a carburetor, a suction passage therefrom to the engine cylinders, and a throttle valve for said passage, a suction actuated device connected with said suction passage between the throttle valve and engine cylinders, means for fuelizing air if and when withdrawn from the suction actuated device, before it reaches the suction passage, means for by-passing air through the suction passage from one side of the throttle valve to the other, and an automatic valve for said by-passing means constructed to be held open by suction when the throttle valve is closed and the suction actuated device is inoperative, and

held closed when the suction actuated device is operated.

6. The combination with an internal combustion engine having a carburetor, a suction passage therefrom to the engine cylinders, and a throttle valve for said passage, a suction actuated device connected with said suction passage between the throttle valve and engine cylinders, means for fuelizing air if and when withdrawn from the suction actuated device, before it reaches the suction passage, means for by-passing air through the suction passage from one side of the throttle valve to the other, located in the throttle valve, an automatic valve for said by-pass, and means for closing said valve constructed to be overcome when a predetermined degree of rarification exists in the suction passage between the throttle valve and engine cylinders.

In testimony whereof we affix our signatures.

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