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METHOD OF AND APPARATUS FOR OPERATING SUCTION ACTUATED DEVICES IN CONNECTION WITH THE SUCTION PASSAGES OF INTERNAL COMBUSTION ENGINES

Original Filed May 5, 1925

Fig:1.

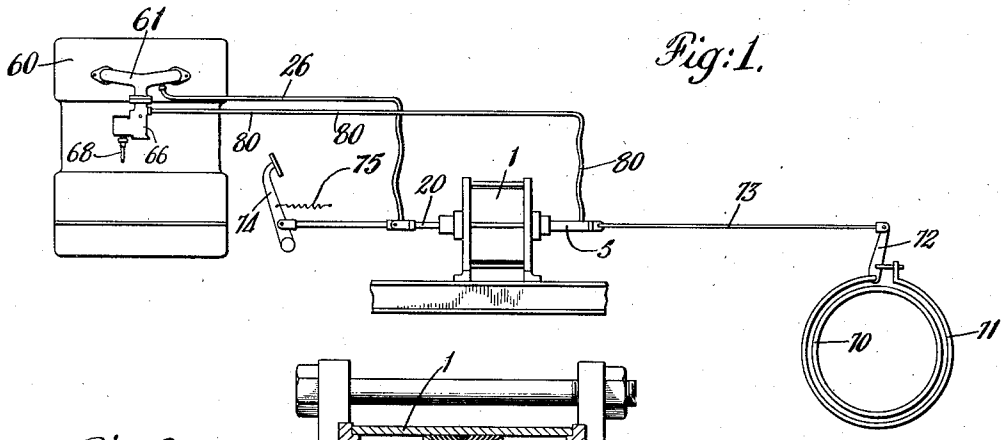


Fig:2.

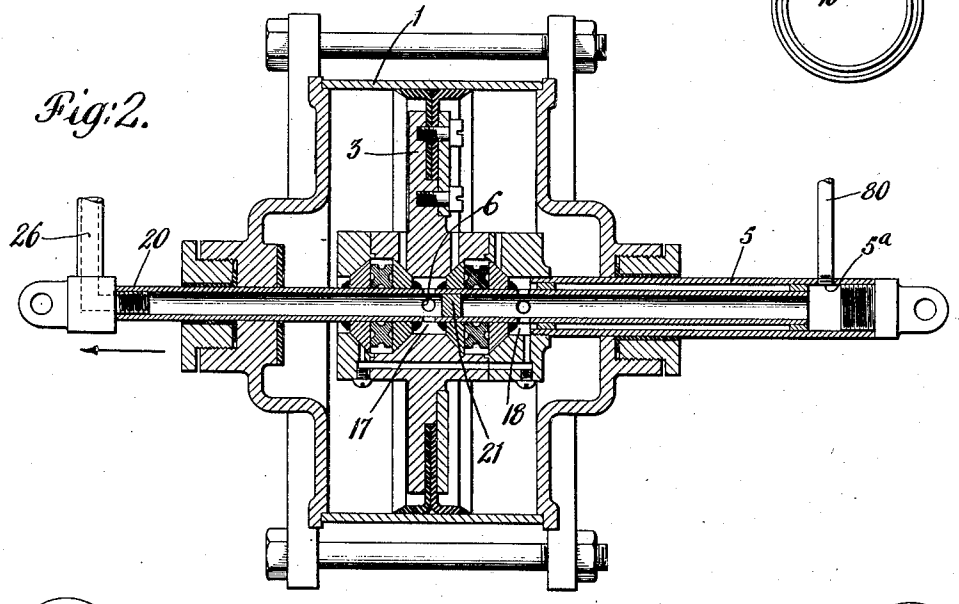
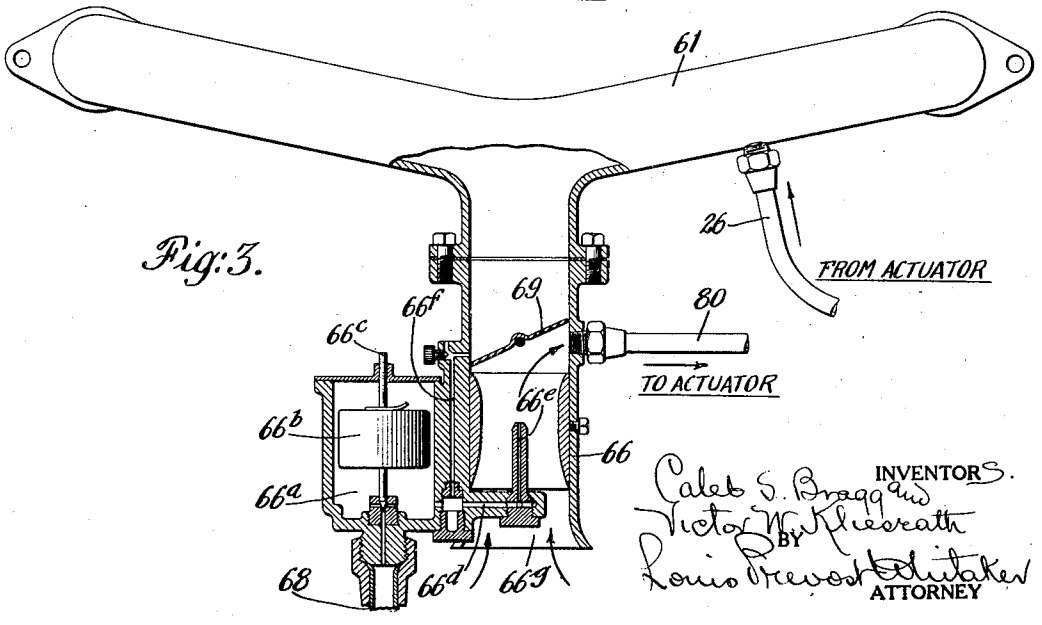


Fig:3.



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METHOD OF AND APPARATUS FOR OPERATING SUCTION-ACTUATED DEVICES IN CONNECTION WITH THE SUCTION PASSAGES OF INTERNAL-COMBUSTION ENGINES

Application filed May 5, 1925, Serial No. 28,104. Renewed July 13, 1929.

Our invention consists in the novel features hereinafter described, reference being had to the accompanying drawing which illustrates one embodiment of the invention selected by us for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

In the operation of vacuum brakes or other suction actuated devices in connection with 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 preferably between the throttle valve for controlling the supply of explosive mixture and the cylinder. To this end it is convenient and desirable to connect such suction actuated device with the intake manifold of the engine which forms a part of such suction passage. It will be understood further that the air exhausted from the suction actuating mechanism and delivered into the intake manifold necessarily has a tendency to reduce the degree of rarification therein and therefore to prevent the drawing in of the proper quantity of liquid fuel from the atomizer, or to dilute the explosive mixture passing through the suction passage frequently to such an extent that the resulting mixture will not readily ignite. 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.

It is also to be understood that for the proper operation of the vacuum brake mechanism of a motor vehicle, it is desirable that the air shall be withdrawn from the brake actuating mechanism as rapidly as possible in order to insure quick operation of the brake mechanism, and that 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 necessarily retard the operation of the brake mechanism to a greater or lesser extent.

It is also to be understood that in the operation of vacuum brake mechanism, and other suction actuated devices, the moving part, as the piston, is acted upon by differential pressures, brought about by producing a condition of rarification on one side of the piston and admitting a higher pressure fluid, usually atmospheric air, on the other side of the piston, under the control of a suitable reversing valve mechanism, and that the air so admitted is subsequently withdrawn and delivered into the suction passage of the engine, where the suction is provided by a connection between the actuator and the intake manifold between the throttle and the cylinder ports.

In our former application for Letters Patent of the United States, filed February 26, 1925, and given Serial No. 11,683, we have described a method of and apparatus for operating suction actuated devices in connection with the suction passage of an internal combustion engine, for the purpose of preventing the objectionable features above mentioned and the stalling of the engine, if idling, or otherwise interfering with its operation, by supplying motor fuel to the air, exhausted from the suction actuated device, before it reaches the intake manifold, so that when it does enter the manifold, it will be in the form of an explosive mixture which will combine with the explosive charges delivered into the manifold from the carburetor and will therefore not in any way tend to diminish the speed or interfere with the operation of the engine.

According to our present invention, we obviate the difficulties hereinbefore described in a different manner, to wit, by admixing motor fuel with the air admitted to the suction actuated device, for the purpose of operating the same in conjunction with the suction connection, so that the air so admitted will be in the form of an explosive mixture, and passing through the reversing valve mechanism will be withdrawn by the suction connection and delivered into the intake manifold, and will arrive at the intake manifold in the form of an explosive mixture, there combining with the explosive charges passing through the manifold, so that there will be no danger

of stalling the engine or impairing its efficient operation.

According to our invention, the admixing of motor fuel with the air admitted to the suction actuated device may be accomplished in any desired manner, but in the preferred form of our invention, we connect the inlet passage of the suction actuated device with the passage connecting the carburetor and the intake manifold, and preferably between the throttle valve and the jet nozzle of the carburetor, where the pressure is approximately that of the atmosphere, while the outlet passage is connected with the intake manifold between the throttle and cylinder ports. It will be understood that the explosive mixture so admitted to the actuator acts in connection therewith merely as an inert gas and is not exploded until after it enters the manifold and passes to the cylinders as a part of the charge forming mixture.

In the accompanying drawing,

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 suction or vacuum operated power actuator for the brake mechanism, and having our present invention embodied therein.

Fig. 2 is an enlarged sectional view of one form of power actuator which may be conveniently employed in an installation of this kind.

Fig. 3 is an enlarged view of certain parts illustrated in Fig. 1, showing the intake manifold, the carburetor connected therewith, and the connections between the said parts and the actuator.

In Fig. 1 we have shown our invention applied in connecion with an automotive vehicle propelled by an internal combustion engine, and having a vacuum or suction operated actuator for operating the brake mechanism of the vehicle. In this figure, 1 represents the cylinder of a power actuator, of the kind illustrated for example in our former application for Letters Patent of the United States, above referred to. The cylinder is provided with a double acting piston, 3, having a hollow piston rod, 5, connected by a link, 73, to a brake lever, 72, for operating any form of brake mechanism, diagrammatically indicated in Fig. 1, and comprising in this instance a brake band, 71, and brake drum, 70, so that the movement of the piston in one direction applies the brakes, and in the opposite direction releases the brakes. The actuator is provided with suitable reversing valve mechanism, in this instance located in the hub of the piston and indicated as a whole at 6, the valve mechanism being operated by means of a valve actuating sleeve indicated at 20, connected by a suitable link to the usual brake operating lever, 74, provided with a retracting spring, 75. As the specific form of valve mechanism has no bearing on our present invention, it will not be described in detail. 26 represents a suction pipe having a flexible portion, which is connected at one end with the valve actuating sleeve, 20, and communicates therewith, and at the other end is connected with the intake manifold, 61, of the internal combustion engine, 60, or in other words with the suction passage of the engine between the throttle valve, 69, and the cylinders. The valve sleeve, 20, communicates with a suction chamber, 17, in the interior of the piston hub, which can be placed in communication with the cylinder on either side of the piston by means of suitable ports controlled by the reversing valve mechanism. The piston hub is also provided with an inlet chamber, 18, for higher pressure fluid, as atmospheric air, which chamber is in communication through the sleeve, 20, and hollow piston rod, with an inlet aperature, 5^a, formed in the latter. The valve sleeve, 20, is provided with a plug or partition, indicated at 21, separating the air inlet passage to the chamber 18, from the suction passage to the suction chamber, 17.

It will be understood that in the operation of the actuator, a forward movement of the sleeve, 20, in the direction of the arrow in Fig. 2, will admit air into the cylinder in the rear of the piston, the forward portion of the cylinder being connected with the intake manifold by the suction pipe, 26, thereby causing the forward movement of the piston, while the movement of the sleeve, 20, in opposite direction, will reverse the connections with the cylinder, withdrawing the air previously admitted in the rear of the piston, through the suction chamber 17, and suction pipe, 26, and delivering it into the manifold, air at atmospheric pressure being admitted to the cylinder forward of the piston and thus effecting its return movement.

In carrying out our present invention, we mix motor fuel with the atmospheric air admitted to the inlet passage leading to the higher pressure inlet chamber, 18, of the actuator, and it will be readily understood from the foregoing description that the result of this will be to pass the air and fuel, constituting an explosive mixture, but acting as an inert gas with respect to the power actuator, through the power actuator and to deliver it as an explosive mixture into the intake manifold. The higher pressure inlet passage of the actuator may be supplied with air mixed with fuel in any desired way; for example by connecting the inlet, 5^a, of the actuator with an auxiliary carburetor, or with any other supply of carbureted air or explosive mixture. We prefer, however, to connect the inlet, 5^a, by means of a pipe, 80, with the carburetor, 66, at a point between the fuel nozzle and the throttle valve, 69, as indicated in Figs. 1 and 3.

In Fig. 3 we have shown one form of carburetor which can be conveniently employed in carrying out our invention, and which is of usual or well known type, provided with a float chamber, 66^a, connected by a pipe 68, with a supply of fuel, in this instance gasoline, the float chamber containing the usual float, 66^b, and needle valve, 66^c. The carburetor is provided with a liquid passage, 66^d, from the float chamber to the atomizing nozzle, 66^e, in the usual Venturi tube, and the liquid passage, 66^d, is also provided with a branch liquid passage, 66^f, discharging into the upper part of the passage communicating with the intake manifold, above the position of the throttle valve, 69, when in closed position, so as to supply the necessary liquid fuel for operating the engine when the throttle is closed. The Venturi tube is open at the bottom and communicates directly with the atmosphere at 66^g, as indicated by the arrows in Fig. 3.

It will be understood that when the throttle valve is in a closed position, as indicated in Fig. 3, the suction in the manifold will be greatest, while the lower portion of the carburetor air inlet passage will be substantially at atmospheric pressure.

Assuming that the parts are connected in the manner indicated in Figs. 1 and 3, and as previously described, when the actuator is operating the air admitted in rear of the piston of the actuator, through the inlet aperture, 5^a, and inlet chamber, 18, will be drawn from the carburetor through the pipe, 80, just below the throttle valve, and as this air is drawn past the atomizing nozzle, 66^e, it will be mixed with fuel so as to constitute an explosive mixture which passes into the actuator and performs its function as the higher pressure fluid in connection therewith and is thereafter withdrawn from the actuator through the pipe, 26, as explosive mixture, and delivered into the intake manifold, 61, where it will combine with the charge forming mixture passing through to the manifold from the carburetor direct. There will therefore be no tendency of the mixture so drawn from the actuator and delivered to the intake manifold, no matter in how large quantities, to stall the engine if idling, or otherwise interfere with the operation of the engine, and no dilution whatever of the explosive mixture drawn from the carburetor to the intake manifold can result.

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

1. The combination with an internal combustion engine provided with a suction passage for supplying an explosive mixture to the engine cylinders, means for supplying the normal charge forming explosive mixture to said passage, and a throttle valve for controlling said passage, of a suction actuated device connected with said suction passage between the throttle valve when in normal, closed, or partially closed operative position, and the engine cylinders, and provided with a higher pressure fluid inlet, means for delivering a portion of said explosive mixture to said inlet to effect the operation of the suction actuated device, and for withdrawing the said mixture through the connection between the suction actuated device and said portion of the suction passage when the throttle valve is in position to produce rarification therein.

2. The combination with an internal combustion engine provided with a suction passage for supplying explosive charges to the engine cylinders, a carburetor for supplying a charge forming mixture of air and fuel to said passage, and a throttle valve for controlling said suction passage, of a suction actuated device operatively connected with said suction passage between the throttle valve when in normal, closed, or partially closed operative position, and the engine cylinders, said suction device being provided with an inlet for higher pressure fluid, and means for withdrawing said higher pressure fluid by the suction in said portion of said suction passage, and a connection from said inlet to said carburetor for supplying explosive mixture to said inlet regardless of the position of the throttle valve.

3. The combination with an internal combustion engine provided with a suction passage for supplying explosive charges to the engine cylinders, a carburetor for supplying a charge forming mixture of air and fuel to said passage, and a throttle valve for controlling said suction passage, of a suction actuated device operatively connected with said suction passage between the throttle valve when in normal, closed, or partially closed operative position, and the engine cylinders, said suction device being provided with an inlet for higher pressure fluid, and means for withdrawing said higher pressure fluid by the suction in said portion of said suction passage, and a connection from said inlet to said carburetor on the opposite side of the throttle valve from said suction connection for supplying explosive mixture thereto, regardless of the position of the said throttle valve.

4. The combination with an internal combustion engine provided with a suction passage for supplying explosive charges to the engine cylinders, a carburetor for supplying a charge forming mixture of air and fuel to said passage, and a throttle valve controlling said suction passage, of a power actuator comprising a cylinder closed at both ends, a piston in said cylinder, and controlling valve mechanism for said actuator, a suction pipe for connecting the cylinder on one side of the piston, with a portion of said suction passage between the throttle valve when in normal operative closed, or partially closed position,

and the engine cylinders, and a pipe for connecting the cylinder on the opposite side of the piston with said suction passage between the carburetor and the throttle valve, to admit explosive mixture from the carburetor to the cylinder to effect a stroke of the piston, said valve mechanism being constructed to connect the portion of the cylinder to which the said explosive mixture was admitted with the said portion of the suction passage.

5. The combination with an internal combustion engine, provided with a suction passage, for supplying explosive charges to the engine cylinders, a carburetor for supplying a charge forming mixture of air and fuel to said passage, and a throttle valve for controlling the flow of fuel and air through said suction passage, of a suction operated power actuator comprising a cylinder and a piston therein, and a reversing valve mechanism, connections from said suction passage on opposite sides of the throttle valve to said actuator, and means controlled by said valve mechanism for connecting said cylinder on either side of the piston with the suction passage of the engine on either side of said throttle valve.

6. The combination with an internal combustion engine, provided with a suction passage, for supplying explosive charges to the engine cylinders, a carburetor for supplying a charge forming mixture of air and fuel to said passage, and a throttle valve controlling said suction passage, of a power actuator comprising a cylinder, a piston therein and a controlling valve mechanism for said actuator, means for supplying the actuator with a portion of said charge forming mixture at a pressure higher than that in the suction passage of the engine between the throttle valve and engine cylinders when the throttle valve is closed to produce the rarification therein, and means for withdrawing said combustible mixture by suction and delivering it to said suction passage.

7. In an automotive vehicle provided with an internal combustion engine for propelling the vehicle, having a suction passage from the carburetor, and a throttle valve for said passage, of brake mechanism for the vehicle, a power actuator comprising a cylinder, a piston connected with said brake mechanism, controlling valve mechanism for said actuator, tubular connections between said controlling valve mechanism and said suction passage on either side of the throttle valve, and an operator operated part operatively connected with said valve mechanism.

8. The method of operating a suction actuated device from an internal combustion engine, which consists in introducing a combustible mixture into said suction actuated device at a pressure higher than the pressure existing in the intake manifold of the engine, and simultaneously withdrawing a previously admitted combustible mixture from the suction actuated device and utilizing the same to supplement the normal charges admitted to the engine.

9. The method of operating a suction actuated device by the differentials of pressure created in the operation of an internal combustion engine, which consists in introducing a portion of an engine charge into said suction actuated device at a pressure higher than the pressure existing in the intake manifold of the engine while restricting the charges to said engine, and simultaneously withdrawing a previously admitted combustible mixture from the suction actuated device and utilizing the same to supplement the restricted explosive charges admitted to the engine.

10. The method of actuating a suction actuated device deriving its suction from an internal combustion engine, which consists in producing differentials of pressure by admitting a combustible mixture at substantially atmospheric pressure to one side of the piston of said actuator, and connecting the other side of said piston to the intake manifold of said engine to remove a previously admitted charge.

In testimony whereof we affix our signatures.

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