Dec. 23, 1941. C. R. FLINT 2,267,020

ENGINE IMPROVEMENT

Filed March 24, 1941

Fig. 1.

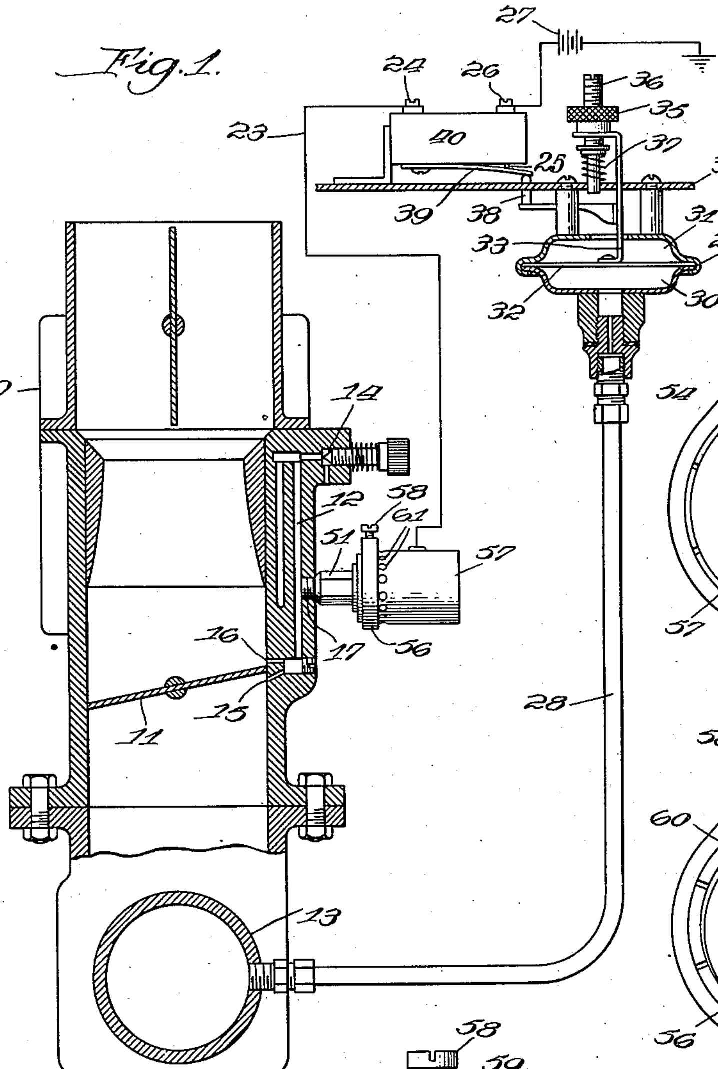



Fig. 2.

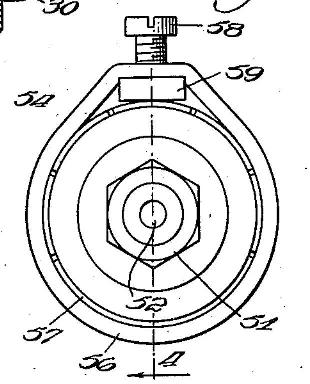



Fig. 3.

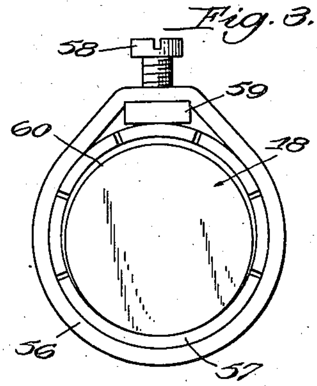



Fig. 4.

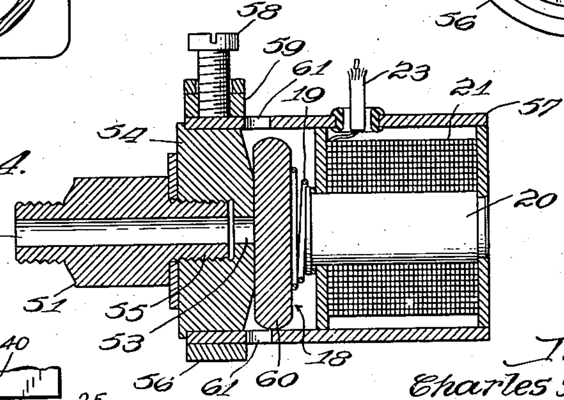
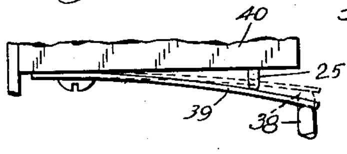



Fig. 5.

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# UNITED STATES PATENT OFFICE

2,267,020

## ENGINE IMPROVEMENT

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Application March 24, 1941, Serial No. 384,994

3 Claims. (Cl. 123—124)

This invention relates to an engine improvement and more particularly to a device for more economical use of fuel during periods of deceleration and the elimination of noxious exhaust fumes.

The present invention is an improvement upon that shown in my co-pending application Serial No. 321,582, filed February 29, 1940.

It is well known that the carburetor, incorporated with internal combustion engines of the type used in automotive service, controls engine pressures and vacuums between the carburetor and cylinders under all power conditions. It is necessary that the carburetor supply the cylinder with the proper fuel and air ratio. However, when the engine is not dependent on such a supply, as when its moving parts are revolved under momentum conditions, such as slowing down, shifting gears or coasting from high to lower speeds when the car is in gear and carburetor throttle closed to its minimum setting, carburetors are not equipped to offset the conditions that come into effect when the momentum factor is present. It is also well known that when an engine is operated by other forces than its own power and at a speed greater than that obtained by the carburetor throttle setting, an extreme vacuum exists within the cylinders and intake manifold. This vacuum tends to draw oil past the pistons into the combustion chamber, as well as fuel from the carburetor. Such vacuums do not permit sufficient compression efficiently to burn the cylinder contents. Therefore, noxious gases are emitted from the exhaust and carbon deposits are formed within the cylinder chamber, the exhaust valve ports and the entire exhaust system.

The present device operates to cut off excess fuel during periods when extraordinary high vacuum conditions exist in the intake manifold, and in certain modifications thereof will in addition prevent the existence of such extraordinarily high vacuums during deceleration of the vehicle. In instances of the latter type the drawing of fuel into the engine is likewise prevented during such deceleration. The device also includes means for restoring normal operation of the carburation system whenever the engine's speed has reached a predetermined low limit, which is generally just above idling speed.

There have, of course, been numerous devices suggested for the reduction of fuel feed under high vacuum or momentum controlled conditions, but all of these devices have proved unsatisfactory. In general this has been due to the fact that such devices relied upon methods of control which were too delicate or which were not adapted to withstand, over a long period, the wear and tear to which they are normally subjected. In the present device the fuel control comprises a vacuum-actuated member connected to the intake, which is responsive only to vacuums above normal running vacuums of the engine, and an electro-magnetic snap member operative thereby which opens a small auxiliary air vent to the idle well of the carburetor. This system is instantly actuated under all deceleration conditions and is instantly disengaged upon any opening of the throttle under load conditions. Thus the idle well device will be responsive to super-normal vacuums which may result from partial closing of the throttle where the vehicle is thus placed under momentum conditions and will be thrown out of operation by any opening of the throttle because the engine is then placed under load conditions. Previous devices necessitated complete closing of the throttle during the sequence of operations.

The device is illustrated in the drawing in which Fig. 1 represents a somewhat diagrammatic elevational view of the device as attached to the engine of an automotive vehicle, the intake and the vacuum member being shown in section; Fig. 2 represents a front view of the electro-magnetic valve mechanism taken along the line 4 in Fig. 1; Fig. 3 is a similar view with part of the interior of the valve removed; Fig. 4 is a longitudinal section through the valve device; and Fig. 5 is a view on an enlarged scale showing in more detail the action of the differential snap action switch.

As shown in Fig. 1, the device is designed for attachment to an ordinary automotive engine (not shown) which is provided with a carburetor 10 having a throttle valve 11 and an idle well feed 12. The carburetor is of course installed on the intake manifold 13 and the idle well feeds fuel from the idle well gas jet 14 through the line 12 and out of the openings 15 and 16 into the intake. When the throttle valve is in closed position, as shown in Fig. 1, opening 16 acts as a bleed line for air which enters through 16 and passes out of the opening 15. When it is only partially closed, both 15 and 16 act as feeders. In my device a small auxiliary opening 17 is provided leading to the line 12 and normally closed by the valve 18. The size of the opening 17 is large compared with 15 and 16 but obviously will not materially affect the vacuum in the intake manifold. Upon opening of the valve 18, however, any suction effect produced through the line 12 upon jet 14 is effectually removed. The valve 18 is normally held in its closed position by the spring 19 about the stem 20 of the solenoid 21. The solenoid is connected through the line 23 to the connector 24 of the switch which normally is in open position. The other connector 26 of the switch is electrically connected to the battery 27. Likewise, connected to the intake manifold, is a conduit 28 communicating with the vacuum member 29 which preferably is in the form of a diaphragm valve having a lower chamber 30 and an upper chamber 31 separated by the diaphragm 32. Attached to the upper surface of the diaphragm 32 is an arm 33 which extends through an opening in the plate 34 upon which the diaphragm valve is mounted. The upper end of the arm 33 engages an adjustment nut 35 which is threaded upon the rod 36. A spring 37 normally holds the arm 33 in raised position but is adjusted so that any vacuum above the normal operating vacuum of the engine will permit the arm to be depressed by the movement of diaphragm 32.

40 indicates a conventional electrical snap switch operated by the spring arm 39 in contact with the spring pressed pin 25. Switches of this type are well known and the details need not be described. Such a switch is equipped with a toggle or equivalent so that it will have snap action and so that there will be a differential between the opening and closing positions of the operating arm 39. The arm 39 of the switch is operated by the pin 38 connection to the arm 33 carried by the diaphragm 32 so that movement of the diaphragm will operate the switch. When the switch is closed an electrical circuit is completed from the battery 27 through the solenoid 21 to withdraw the valve 18 from the member 53 connected to the vent 17 and thereby open the latter. The solenoid 21 when energized has sufficient strength to draw the valve 18 against the spring 19 a substantial distance from the member 53 to open the vent completely. When the solenoid is deenergized the spring 19 forces the valve 18 against the member 53 to close the vent 17 completely. The vent is therefore either completely open or completely closed. When the pressure in the intake manifold 13 increases to a point within the range of normal operating conditions, the diaphragm 32 rises to push the operating arm 39 of the switch 40 upwardly to open the switch. This deenergizes the solenoid 21 and allows the spring 19 to force the valve 18 against the member 53 to close the vent 17. It is to be understood that the diaphragm 32 always is responsive to pressures in the manifold 13 below that produced by normal idling. By this is meant that the spring 37, the switch 40, the diaphragm 32 and related parts are so proportioned and adjusted that pressure in the intake manifold produced by normal idling will not lower the diaphragm 32 sufficiently to close the switch 40. In other words, the switch 40 is closed and the vent 17 opened through operation of the diaphragm 32 only by pressure in the manifold 13 below that produced by normal idling. The parts are so set and adjusted that when an abnormally high vacuum exists in the intake manifold, as, for example, when the vehicle is coasting at a relatively high rate of speed with the throttle closed, or in any retarded position below its normal power setting for that particular speed, the diaphragm 32 is lowered to close the switch 40 and open the vent. It is obvious, however, that opening the vent will in itself tend to raise the pressure in the intake manifold to some extent. The switch 40 is, however, set with a differential between the opening and closing thereof greater than the change in pressure in the intake manifold produced by opening said vent. In other words, due to the differential in the switch 40, a greater change in pressure in the manifold is required to operate the switch 40 than the change in pressure produced solely by opening the vent 17. From the foregoing it will be seen that the solenoid 21 constitutes independent power means for positively opening and closing the vent and that the switch 40 constitutes differential control means for said power means; and that because of the snap action construction of the switch, said solenoid also operates with snap action to positively open or close the vent.

The improved valve mechanism shown in Figures 2, 3 and 4, is designed for easy cleaning and for long life without cleaning. It comprises a conduit member 51 which is threaded at both ends. One end screws into the opening 17. The conduit member 51 is provided with a central conduit 52 which connects with an extension 53 contained in the base 54 of the valve 18. The end 55 of the conduit member screws into a depression in the base 54.

A collar 56 surrounds the base 54 and the cylindrical container 57, and may be tensioned thereon by the screw 58 which passes through the nut 59.

The valve seat is formed by the circular button or disk 60 which is made of magnetic non-corrodable material, such as stainless steel. The button is pressed by the spring 19 against the opening 53. The disk or button is slightly smaller in diameter than the inside of the container and, therefore, is free to move slightly in all directions when not forced by the spring against the opening. It may be considered as universally mounted, and its movement is unpredictable. This assists in disengaging any particles of dirt which become lodged upon the disk, or upon the opposing face of the base 54, but, if such particles are not disengaged, they are less likely to spoil the action of the valve, because it tends to seat at different points each time it is pressed against the opening.

The button 60, which is held in position by the spring 19, is withdrawn therefrom by actuation of the solenoid 20. The drawing shows the disk horizontally offset from the opening, but it may be vertically offset where desired.

The container 57 is provided with a number of small perforations 61 adjacent the collar 56 in order to provide ample air supply when the valve is open.

In the operation of the device, so long as the engine is operating under normal running conditions, the diaphragm 32 remains in its normal position. However, whenever abnormally high vacuum conditions exist, the diaphragm is lowered and thereby the solenoid 21 is actuated to uncover the opening 17. This effectually cuts off or substantially reduces the flow of fuel to the engine through the line 12.

It is obvious that the vacuum may increase to such a point that the diaphragm will be moved before the throttle has reached the position shown in Fig. 1. In such a case the control of fuel feed through the line 12 is of less importance inasmuch as the engine may still be drawing upon other fuel supply jets in the carburation system. However, to the extent of the fuel supplied through line 12 there is a saving which has proved in practice to be material.

It will be noted that the conventional electrical switch **40** is provided with a flexible member **39** of such form that the arm **38** is not in the same position when the current goes on as when it goes off. For example, as shown in the solid lines in Fig. 5 the pressure in the manifold may be holding the diaphragm **32** in position so that the switch **40** is closed and the vent **42** open. With an increase in pressure in the manifold the diaphragm **32** will rise to move the pin **38**, the arm **39**, and pin **25** upwardly to the dotted line position at which the switch **40** will open. Upon decrease in pressure in the manifold and downward movement of the diaphragm **32**, however, the switch **40** will not again close until the arm **39** reaches the solid line position. It will be seen, therefore, that the switch **40** is set with a differential as explained heretofore. This is illustrated in Fig. 5. The arm **39** must move upwardly to the dotted line position before the switch **40** opens and then must move downwardly to the solid line position before the switch closes. Following this, upon increase of pressure in the manifold, the switch will not again open until the arm **39** moves upwardly to the dotted line position, and so on.

This difference is highly important in the correct functioning of the device because it means that the pressure of the spring **37** is different at the two times specified. In the present system the valve **19** is opened whenever the overrunning vacuum becomes too high. When that occurs there is an extra flow of air into the carburetor through the valve, which lowers the vacuum. This of course has a tendency to cause the apparatus to flutter. In some cases natural friction of the apparatus is sufficient to offset this lowering, and fluttering may be avoided. In most cases, however, it is insufficient and it is advisable to have other means for this purpose. In the present system the arm **38** must move about ⅛ inch farther on the up movement than it must move on the down movement in order to actuate switch **40**. This means that when it actuates the switch to close valve **19**, the spring **37** is less compressed than when the switch is actuated to open valve **19**. This difference can be adjusted by varying the characteristics of the flexible member **39** or the spring. It provides a form of lost motion which is quite essential in the smooth operation of the device. In practice the spring **37** and the switch **40** are so correlated to the size of the opening **17**, that the fall in vacuum which occurs upon opening of the valve **19**, is offset sufficiently to avoid fluttering. The same principle may be applied in reverse upon a system which cuts off the idle well gas supply, although in that case the relationship of spring and arm is reversed because the vacuum increases somewhat when the gas supply is cut off.

This application is a continuation-in-part of my co-pending application Serial No. 321,582, filed February 29, 1940.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom.

What I claim as new, and desire to secure by Letters Patent is:

1. In combination with an internal combustion motor: a carburetor; an intake manifold connected to the carburetor; a throttle valve between the carburetor and intake manifold; a pressure actuatable member connected to the intake manifold responsive to pressures in the manifold below that produced by normal idling; a vent into the fuel passage of the carburetor; independent power means for positively opening and closing the vent; and differential snap action control means actuated by the pressure actuatable member for operating the opening and closing actions of the independent power means, said control means being set with a differential, whereby a greater change in pressure in the manifold will be required to operate said control means than the change in pressure in said manifold produced by opening said vent.

2. In combination with an internal combustion motor: a carburetor having an idle well with a fuel supply at one end and a discharge opening at the other end; an intake manifold connected to the carburetor; a throttle valve between the carburetor and intake manifold, the discharge opening in the idle well being adjacent said throttle valve; a pressure actuatable member connected to the intake manifold responsive to pressures in the manifold below that produced by normal idling; a vent in the idle well; independent power means for positively opening and closing the vent; and differential snap action control means actuated by the pressure actuatable member for operating the opening and closing actions of the independent power means, said control means being set with a differential, whereby a greater change in pressure in the manifold will be required to operate said control means than the change in pressure in said manifold produced by opening said vent.

3. Apparatus as claimed in claim 2 in which the pressure actuatable member is connected to the intake manifold a substantial distance from the throttle valve.

CHARLES R. FLINT.