Nov. 3, 1936. J. C. A. STRAUB ET AL 2,059,410

VACUUM CONTROL DEVICE FOR ENGINES

Filed Aug. 24, 1935 2 Sheets-Sheet 1

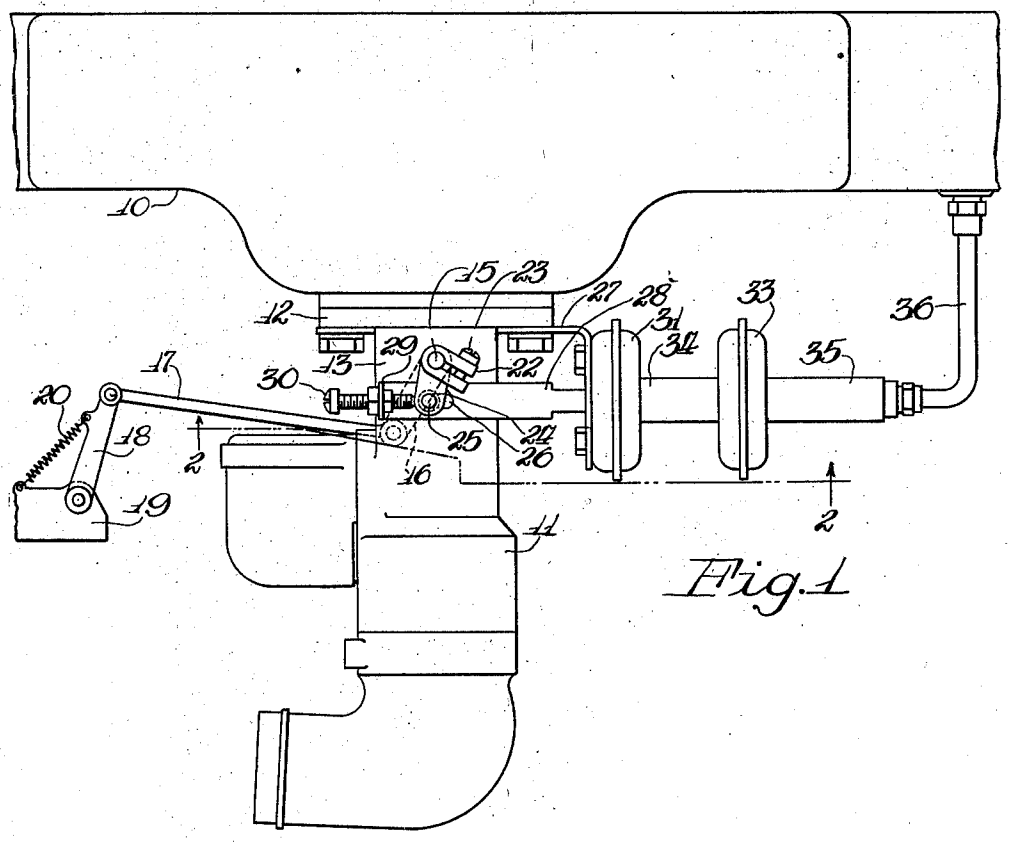
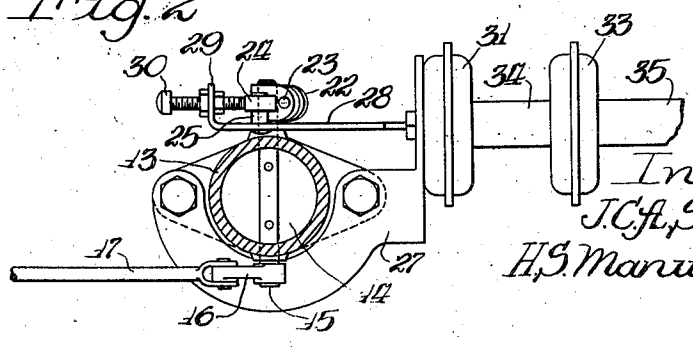


Fig. 1

Fig. 2



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VACUUM CONTROL DEVICE FOR ENGINES

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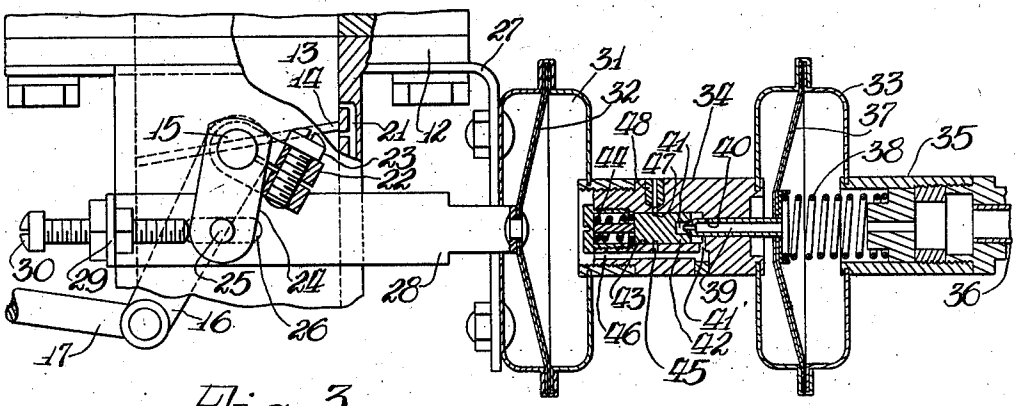


Fig. 3

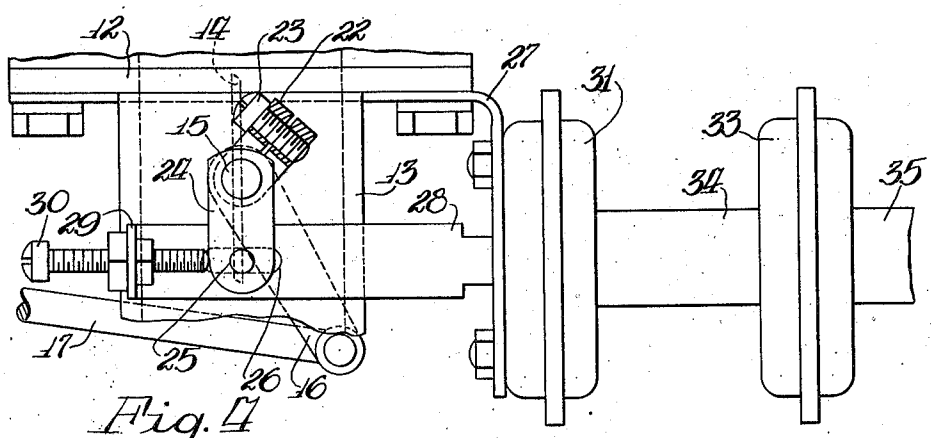


Fig. 4

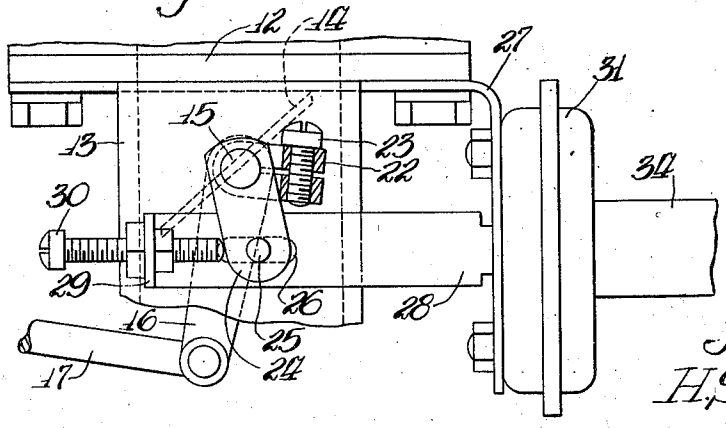


Fig. 5

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Patented Nov. 3, 1936

2,059,410

UNITED STATES PATENT OFFICE

2,059,410

VACUUM CONTROL DEVICE FOR ENGINES

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Application August 24, 1935, Serial No. 37,679

9 Claims. (Cl. 123—103)

This invention relates to charge forming devices for internal combustion engines. More specifically it relates to a controlling device for the throttle valve of a carbureter.

In the conventional gasoline engine utilizing a carbureter for forming a mixture and a manifold for distributing the mixture to the cylinders, the throttle valve of the carbureter is often closed rapidly from an open or nearly open position with the engine operating at high speed to a substantially closed position. An appreciable time is required for deceleration of the engine during which a high intake vacuum is established in the inlet manifold. As a rich mixture is required for recovery of an engine following deceleration and for idling, carbureters are constructed to provide a rich mixture when the throttle is in closed position. It is, therefore, evident that during deceleration with a closed throttle the mixture is excessively rich. Moreover, with a high suction, fuel accumulated on the manifold or in any location to which the low pressure is transmitted evaporates rapidly and further enriches the already excessively rich mixture. This condition is very objectionable in cold weather or at any time when using the less volatile fuels. The exhaust is filled with objectionable smoke and fumes resulting from the unburned excessively rich mixture.

The object of the present invention is to devise and construct a throttle valve controlling device which is effective to prevent the building up of excessively high intake vacuum during deceleration of an engine from open throttle operation. A more specific object is the provision of a novel throttle valve control operative to close the valve with a delayed action depending on a gradual drop in the manifold vacuum.

Another object is the provision of a diaphragm type of fluid pressure device as a retarding device on a throttle valve. These and other objects, which will be apparent from the detailed description to follow, are attained by the use of a construction as shown in the drawings, in which:

Figure 1 is an elevational view showing a portion of a manifold and a carbureter with the device of the invention incorporated;

Figure 2 is a section taken on the line 2—2 of Figure 1;

Figure 3 is an enlarged view of a portion of the structure shown in Figure 1 with the upper part of the carbureter and the vacuum control unit broken away in section. The throttle valve is in closed position with a small vacuum in the manifold representing an idling condition of the engine;

Figure 4 is similar to Figure 3 with all parts in elevation except those shown in dotted lines with the throttle in wide open position; and,

Figure 5 is similar to Figure 3, showing the throttle being closed with the vacuum unit in its corresponding functional position.

In Figure 1 of the drawings a portion of the manifold 10 is shown. A conventional carbureter 11 is secured to the manifold by a flange 12 at the upper end of the carbureter surrounding a mixture outlet portion 13. A throttle valve 14 is secured to a throttle shaft 15 which extends transversely through the outlet portion of the carbureter and beyond the outside thereof at both ends.

At the side of throttle shaft 15 adjacent the engine, a control lever 16 is secured. A link 17 is pivotally secured to the control lever and to a lever 18 mounted on a bracket 19. A spring 20 secured to the bracket and to the lever 18 provides means for resiliently urging the throttle valve toward closed position through the connecting linkage. Any suitable means may be provided for manually operating the lever 18 or for connecting it to the conventional foot accelerator pedal.

The throttle valve 14 does not close to a position perpendicular to the axis of the mixture outlet, but is at a slight angle thereto, as shown in Figure 3. An idling fuel supply conduit 21 communicates with the mixture outlet passage above the edge of the throttle valve when it is in closed position. This construction is conventional in the carbureter art. As the throttle valve approaches closed position the manifold vacuum above the throttle valve is applied directly to the idling fuel supply passageway which supplies the necessary rich mixture for idling of the engine. The regular jets for supplying fuel come into operation after the throttle valve has been opened a sufficient distance to produce a substantial air flow through the venturi of the carcureter.

At the outside end of the throttle shaft 15 an adjustable clamp 22 is secured by means of a cap screw 23 to the shaft. Said clamp is slotted at right angles to the shaft to form an opening axially of the shaft. A lever 24 is freely pivoted on the shaft in the opening formed by said slot. Said lever may rotate with respect to the shaft within the limits defined by the clamp 22. A centering pin 25 carried by the lever 24 is slidably fitted in a slot 26 formed in a controlling member

28. Said member includes a right angled end portion 29 in which a regulating screw 30 is adjustably mounted. Said screw is positioned as a stop to determine the movement of the lever 24. The other end of the member 28 extends into a diaphragm casing 31 and is secured therein to a diaphragm 32.

The casing 31 is supported on the manifold by a bracket 27. A second diaphragm casing 33 is rigidly secured to the diaphragm casing 31 by a connecting member 34. Said member includes a valve arrangement for providing a delayed action of the second diaphragm, as will be hereinafter described.

A coupling member 35 connects the diaphragm casing 34 with a conduit 36 leading to the intake manifold 10 and communicating the pressure therein to the diaphragm 37 of the casing 33. Said diaphragm is resiliently urged by a spring 38 toward the second diaphragm casing. A hollow tube 39 carried by the diaphragm 37 and communicating with the casing at the manifold side of the diaphragm 37 slidably extends into a bore 40 formed in the member 34. Said tube is formed with a metered nozzle at its end, which seats in a substantially gas-tight manner in a small bore 41 formed in a piston 42. Said piston is slidably mounted in a bore 43 formed in the member 34 coaxially with respect to the bore 40. The piston 42 is resiliently urged by a spring 44 into contact with the nozzle end of the tube 40, or in the direction of said tube, if the tube is withdrawn by movement of the diaphragm 37. A small metered opening 45 joins a conduit 46 formed in the member 34 with the bore 43. Said opening is in alignment with an annular recess 47 when the piston is in the position shown in Figure 3. With the piston in this position the recess 47 is also in alignment with a vent opening 48 leading from the bore 43 to the atmosphere. The conduit 46 connects with the casing 31 on the side of the diaphragm at which the member 34 is mounted.

In the operation of the device as above described, the parts may first be considered as being in the positions shown in Figure 3. In this position the manifold vacuum or depression with the engine idling is not sufficient to overcome the pressure of the spring 38 which is carefully calibrated to overcome the idling depression in the manifold. The controlling member 28 is in the position shown with the result that the throttle valve may be closed completely without any restraining action by the lever 24 against the clamp 22 acting as a stop.

The position of wide open throttle is illustrated in Figure 3. In this position the manifold vacuum is substantially the same in so far as action on the diaphragms is concerned as in the idling position. It will be noted that suction is somewhat more, as illustrated, with the result that the lever 24 has been moved a few degrees in an anticlockwise direction. These two positions, namely idling and wide open throttle, are not involved in the present invention, the purpose of which is to control the fuel mixture and its effect on combustion during deceleration.

In Figure 4 a position of the elements is shown during deceleration. It will be understood that with the engine running at wide open throttle it it running under normal conditions at a comparatively high R. P. M. It is, therefore, evident that with a sudden closing of the throttle valve, giving a high restriction in the carbureter mixture outlet, a high vacuum, or, as it is sometimes spoken of, a low depression is attained in the manifold and in the portion of the carbureter beyond the throttle valve.

With a device as illustrated and described the high vacuum displaces the diaphragm 37 to the right and at the same time, by communicating through the hollow tube 40 and the opening 41' with the conduit 46, the diaphragm 32 is moved to the right to its maximum position which carries the control member 28 to the position shown in Figure 4. The screw 30 then abuts the lever 24 and prevents closing of the throttle until the speed of the engine is reduced sufficiently to reduce the manifold vacuum. The control member 28 moves to the left as the vacuum drops and allows the throttle to close gradually whereby a gradual reduction of speed is accomplished without building up a very high manifold vacuum. In some installations a single simple diaphragm may be sufficient to accomplish the desired object. For a more even control a double diaphragm, as illustrated, has been utilized.

It will be understood by referring to Figure 3 that, when both diaphragms are in high vacuum positions, that is, deflected toward the opposite sides in the casings from the positions shown, the diaphragm 32 may move only as fast as air is supplied thereto through the small openings 41' and the small opening in the nozzle of the tube 40. These openings may be metered to provide a slow movement of the diaphragm 32 and of the controlling member 28 carried thereby. When the piston 43 has reached the position shown in Figure 3 by pressure of the tube 40 against its end, air is bled in through the opening 45, which may also be metered to provide a slow movement of the diaphragm 32 similar to the action of a dash pot. By this means an additional control is provided, more or less independent of the manifold vacuum, in the nature of a dash pot. This type of control alone may be utilized for some installations and applicants claim this controlling means alone as a feature of their invention.

It is to be understood that applicants have shown and described only a preferred embodiment of their improvement in carbureting devices to prevent rapid closing of a throttle valve when releasing the accelerator and that they claim as their invention all modifications in fluid pressure operated devices falling within the scope of the appended claims.

What is claimed is:

1. In a fuel supply device for internal combustion engines, a carbureter including throttle means, means for operating said throttle means, means for resiliently urging the throttle means towards closed position, and means actuated by a condition of pressure in the fuel supply device on the engine side of the throttle means to retard rapid closing of the throttle means.

2. In a fuel supply device for internal combustion engines, a carbureter including throttle means, means for operating said throttle means, means for resiliently urging the throttle means towards closed position, and means actuated by fluid pressure on the engine side of the throttle valve operable to retard rapid closing of the throttle means.

3. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, means for operating said valve, means for resiliently urging the valve towards closed position, and vacuum actuated means connected to the manifold and to the throttle valve operative to counteract action of the resilient means and to delay closing thereof

thereby maintaining a substantially constant manifold vacuum during deceleration.

4. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, means for operating said valve, and vacuum actuated means connected to the manifold and to the throttle valve operative to delay closing thereof.

5. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, a shaft carrying said valve, an idling fuel conduit terminating adjacent the edge of the throttle valve when it is in closed position, means for operating said valve, means for resiliently urging the valve to closed position, a control member pivotally mounted on the throttle shaft, stop means for limiting the movement of said member with respect to the shaft in both angular directions, and vacuum actuated means connected to the manifold and to the control member operative to delay closing of the throttle valve.

6. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, means for resiliently urging the valve to closed position, a control member pivotally mounted on the throttle shaft, a casing containing a diaphragm mounted adjacent the carburetor, a link connecting the diaphragm with the control member, a conduit communicating with the casing at one side of the diaphragm and with the manifold, and vacuum operated valve means for delaying the action of the suction on the diaphragm.

7. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, means for resiliently urging the valve to closed position, a control member pivotally mounted on the throttle shaft, a stop secured to the shaft for limiting the movement of said member in both angular directions, a casing containing a diaphragm mounted adjacent the carburetor, a link including a lost motion connection joining the diaphragm with the control member, a conduit communicating with the casing at one side of the diaphragm and with the manifold, and vacuum operated valve means for delaying the action of the suction on the diaphragm.

8. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, a shaft carrying said valve, an idling fuel conduit terminating adjacent the edge of the throttle valve when it is in closed position, a throttle actuating lever on the throttle shaft, an actuating member connected to said lever, means for resiliently urging the valve to closed position, a control member pivotally mounted on the throttle shaft, a stop secured to the shaft for limiting the movement of said member in both angular directions, and vacuum actuated means connected to the manifold and to the control member operative to delay closing of the throttle valve.

9. In a charge supplying device for internal combustion engines, a manifold, a carburetor, a throttle valve in the carburetor, a shaft carrying said valve, an idling fuel conduit terminating adjacent the edge of the throttle valve when it is in closed position, a throttle actuating lever on the throttle shaft, an actuating member connected to said lever, means for resiliently urging the valve to closed position, a control member pivotally mounted on the throttle shaft, a stop secured to the shaft for limiting the movement of said member in both angular directions, a casing containing a diaphragm mounted adjacent the carburetor, a link including a lost motion connection joining the diaphragm with the control member, a conduit communicating with the casing at one side of the diaphragm and with the manifold, and vacuum operated valve means for delaying the action of the suction on the diaphragm.

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