Feb. 12, 1952 W. A. McDONALD 2,585,814

CONTROL MEANS FOR THE THROTTLE VALVES OF INTERNAL-COMBUSTION ENGINES

Filed March 25, 1948

Fig. 1.

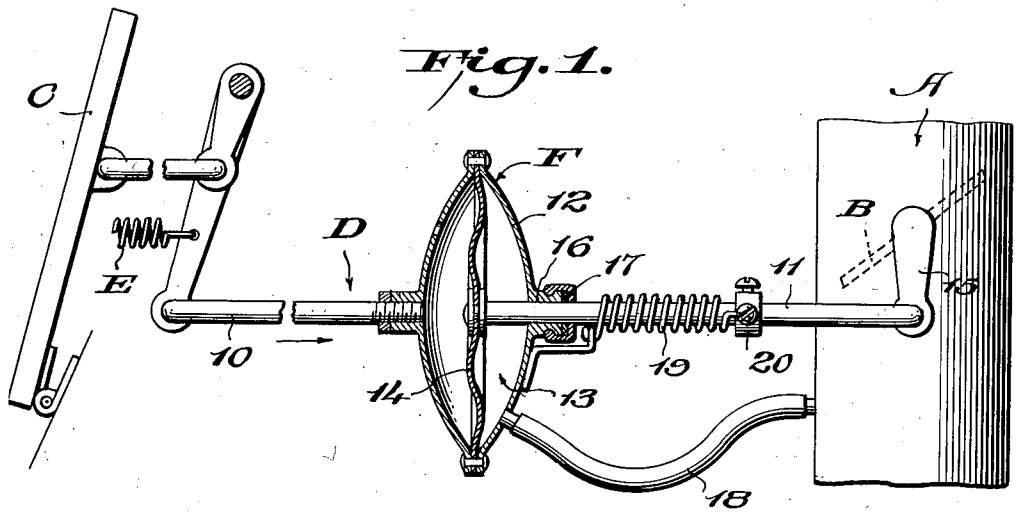


Fig. 3.

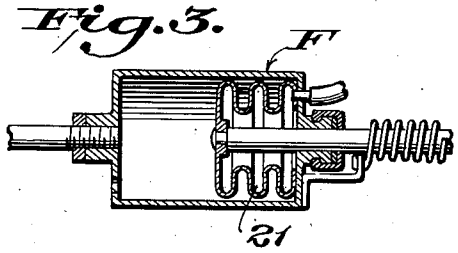


Fig. 2.

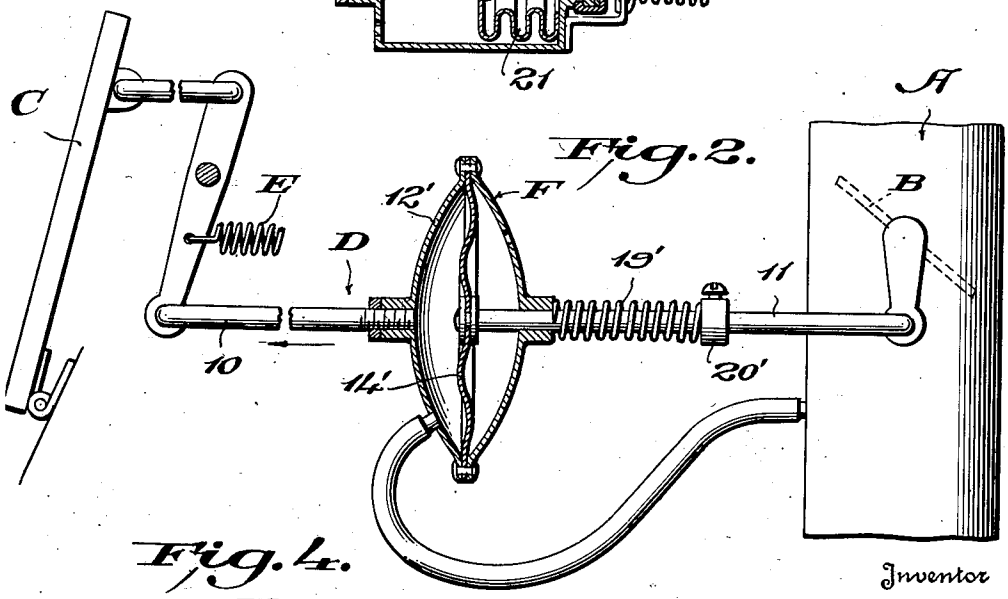
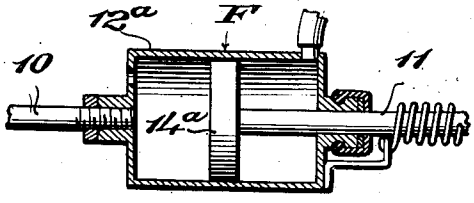


Fig. 4.



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Patented Feb. 12, 1952 2,585,814

UNITED STATES PATENT OFFICE

2,585,814

CONTROL MEANS FOR THE THROTTLE VALVES OF INTERNAL-COMBUSTION ENGINES

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Application March 25, 1948, Serial No. 16,978

3 Claims. (Cl. 123—103)

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This invention relates to automatic control means for the throttle valves of internal combustion engines, and has for its general object to provide automatic means to regulate the opening of engine throttle valves so that more fuel will not be supplied to an engine at any given time than the engine can consume.

As is well known, the rate of acceleration of any internal combustion engine is limited and decreases with increase in the load imposed upon the engine. Consequently, if the throttle valve of an internal combustion engine is opened more or suddenly an amount such that more fuel is admitted to the engine than the rate of acceleration of the engine will enable the engine immediately to consume, there will result more or less choking of the engine and waste of fuel with dilution of the engine lubricant and accompanying abnormal wear of the engine in general. Accordingly, it is these disadvantages which the present invention is primarily designed to avoid.

In accordance with the present invention, the negative pressure which exists in the intake conduit of an internal combustion engine when the engine is running, and which increases and decreases with increase and decrease in the speed of the engine, is utilized to govern operation of the present throttle valve control means and also as a power source for actuating the latter. In this connection, a special and important object of the present invention is to provide a throttle valve control means which operates in response to decrease in the negative pressure in the intake conduit of an engine to effect closing and to restrict opening of the engine throttle valve and upon increase in negative pressure in said conduit to effect opening and to retard closing of said valve, whereby the supply of fuel to the engine will be regulated in accordance with the capacity of the engine to consume the same and more fuel will not, at any time, be admitted to the engine than the engine immediately can consume.

Another special and important object of the present invention is to provide an engine throttle valve control means which does not act either to retard the rate of acceleration or to limit the speed of an engine.

If the throttle valve of an internal combustion engine suddenly is closed, the negative pressure in the intake conduit of the engine suddenly will increase to a greater or lesser extent, depending upon the speed of the engine, and cause the engine to consume an excessive amount of lubricant with many attendant disadvantages. Accordingly, another special and important object of the present

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invention is to provide an engine throttle valve control means which is effective to prevent sudden closing of the throttle valve so as to avoid sudden increase in the negative pressure in the intake conduit of the engine.

Another special and important object of the present invention is to provide a throttle valve control means which is operable to accomplish the purposes stated and which is of simple, practical, inexpensive construction, readily capable of incorporation in conventional types of throttle valve actuating means, readily adjustable to adapt it best to serve its purposes in any particular installation of the same, and which is thoroughly reliable and highly efficient in operation.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in an engine throttle valve control means embodying the novel features of construction combination and arrangement of parts as are illustrated by way of example in the accompanying drawings and as will be hereinafter more fully described and claimed.

In the accompanying drawings:

Fig. 1 is a somewhat diagrammatic view, partly in elevation and partly in section, of a throttle valve control means constructed in accordance with one practical embodiment of the invention; and

Fig. 2 is a view similar to Fig. 1 illustrating an alternative embodiment of the invention; and

Figs. 3 and 4 are detail views illustrating other alternative embodiments of the invention.

Referring to the drawings in detail, A designates in each of Figs. 1 and 2 a portion of the fuel supply conduit of an internal combustion engine; B designates a throttle valve of the butterfly type for regulating flow of fuel through said conduit to the engine; C designates an accelerator pedal; D designates generally a connection between said accelerator pedal and said throttle valve whereby depression of said pedal is effective to open said throttle valve, and E designates a spring which is operable through said connection D to raise the accelerator pedal C upon release of foot pressure upon the same and to close said throttle valve.

11. According to each of the different illustrated embodiments of the invention the connection D between the accelerator pedal C and the throttle valve B includes a pair of rods 10 and 11 and an expansible and contractable chamber structure F interposed between and connecting said rods, whereby the effective length of

said connection D is increased with expansion and is decreased with contraction of said chamber structure.

Referring now particularly to the Fig. 1 embodiment of the invention, it will be observed that the connection D is of a type such that, upon depression of the accelerator pedal C, a pushing force is exerted through the rods 10 and 11 to open the throttle valve B. Also it will be observed that the expansible and contractable chamber structure F comprises a housing 12 having a chamber 13 therein, and a flexible diaphragm 14 which cooperates with said housing to close said chamber, the latter being expansible and contractable by outward and inward movement, respectively, of said diaphragm relative to said housing.

The rod 10 is interposed between the accelerator pedal C and housing 12 and is suitably connected firmly to the latter. On the other hand, the rod 11 is interposed between the diaphragm 14 and a lever arm 15 on the shaft of the throttle valve B and is suitably connected at its ends to said diaphragm and said lever arm. In this connection and as shown, the diaphragm 14 is located at the side of the chamber 13 remote from the throttle valve B so that if the housing 12 is held stationary and said diaphragm is moved inwardly relative to said chamber, opening movement is imparted to the throttle valve B, while if said diaphragm is moved outwardly relative to said chamber, closing movement is imparted to said throttle valve.

Appropriately, the rod 11 may extend slidably through an opening 16 in the housing 12 and through the chamber 13 to the diaphragm 14 and any suitable means 17 may be provided to seal said opening 16. Or, if desired, said rod 11 may be extended around the housing 12 to the diaphragm 14. In any event, a flexible tube 18 connects the conduit A with the chamber 13 whereby said chamber is subjected to the same negative pressure as exists in said conduit when the engine is running. Moreover, a contractile spring 19 is interposed between and connected at its ends to the rod 11 and the housing 12 so as to tend constantly to move the diaphragm 14 outwardly relative to said housing and thus effect closing movement of the throttle valve B if the housing 12 is held stationary.

Appropriately the spring 19 may surround and may be fastened to the rod 11 by a collar 20 which is adjustable along said rod, whereby the strength of said spring may be adjusted.

At idling or low engine speed and with the accelerator pedal C fully retracted, the housing 12 is stationary, the chamber 13 is subjected to low negative pressure tending to move the diaphragm 14 inwardly relative to said chamber and to open the throttle valve B, and the spring 19 is in tension and tending to move the diaphragm 14 outwardly relative to the chamber 13 and to close said throttle valve, the strength of said spring 19 being such that it balances the low negative pressure force acting inwardly upon said diaphragm and holds the diaphragm in an intermediate position. Accordingly, while sudden depression of the accelerator pedal will result in movement of the rod 10 and the housing 12 toward the throttle valve B, a commensurate amount of opening movement of said throttle valve will not be effected for the reason that, immediately said throttle valve is partly opened, the negative pressure in the conduit A and the chamber 13 will diminish and the tensioned spring 19 therefore will be permitted to act to move the diaphragm 14 outwardly relative to said chamber 13, thus reducing the effective length of the connection D and limiting the amount of opening movement of the throttle valve. In this connection, the strength of the spring 19 is such as to continue to act in the manner stated, even upon full depression of the accelerator pedal, until acceleration of the engine results in progressive increase in the negative pressure in the conduit A and the chamber 13, whereupon said spring is overcome by the higher negative pressure acting inwardly upon the diaphragm 14 and the rod 11 is shifted relative to the housing 12 to progressively open the throttle valve A to admit more fuel to the engine. The strength of the spring 19 is such, of course, as to insure admission of fuel to the engine in accordance with its capacity, as determined by its rate of acceleration, to consume the same. Accordingly, it is apparent that more fuel will not be supplied to the engine at any given time than the engine can consume, and that the amount of fuel supplied to the engine will be in accordance with its rate of acceleration or, in other words, will automatically increase with increase in the speed of the engine until the negative pressure in the conduit A and the chamber 13 becomes so high as to move the diaphragm 14 to its limit of inward movement relative to the chamber 13, which occurs at high speed of the engine.

If, during medium or higher speed of the engine, the accelerator pedal C should suddenly be released, closing movement of the throttle valve B will result in increase in the negative pressure in the conduit A and the chamber 13 with the result that the diaphragm 14 will be drawn inwardly relative to the chamber 13, thus retarding closing movement of the throttle valve and preventing any sudden drop in negative pressure in the conduit A with consequent avoidance of the disadvantages of any such sudden drop in pressure.

Referring now particularly to the Fig. 2 embodiment of the invention, it will be observed that the connection D is of a type such that, upon depression of the accelerator pedal C, a pulling force is exerted through the rods 10 and 11 to open the throttle valve B. It will further be observed that the expansible and contractible chamber structure F is substantially the same as the Fig. 1 expansible and contractible chamber structure, but is reversed as compared with the Fig. 1 chamber structure; i. e., the diaphragm 14' is located at the side of said structure nearer the throttle valve B. In the Fig. 2 construction, a compression spring 19' corresponding to the tension spring 19 of the Fig. 1 form of the invention, is interposed between the expansible and contractible chamber housing 12' and a stop collar 20' on the rod 11 and tends constantly to move the diaphragm 14' outwardly relative to said housing 12' and to effect closing of the throttle valve B. It will thus be apparent that the Fig. 2 structure has the same mode of operation as the Fig. 1 structure and that it amounts in substance merely to a reversal of the Fig. 1 structure for use in any instance where the connection D is pulled rather than pushed to open the throttle valve B.

Fig. 3 of the drawings illustrates that a bellows 21 may be used in lieu of a flexible diaphragm in the expansible and contractible chamber structure F. Otherwise the Fig. 3 form of the invention is generally the same, both structurally

and in mode of operation, as the Fig. 1 form of the invention. Obviously, the expansible and contractible chamber structure of Fig. 3 might readily be reversed in accordance with the Fig. 2 teaching to adapt the same for use in any instance where the connection D is pulled rather than pushed to open the throttle valve B.

Fig. 4 of the drawings illustrates that a cylinder 12a and a piston 14a may be used in lieu of the housing 12 and the flexible diaphragm 14 of the Fig. 1 embodiment of the invention to form the expansible and contractible chamber structure F. Otherwise, the Fig. 4 form of the invention is generally the same, both structurally and in mode of operation, as the Fig. 1 form of the invention. Obviously, the Fig. 4 expansible and contractible chamber structure might also readily be reversed in accordance with the Fig. 2 teaching to adapt the same for use in any instance where the connection D is pulled rather than pushed to open the throttle valve B.

According to each of the different forms of the invention the rod 16 may be threaded or otherwise adjustably connected to the housing of the expansible and contractible chamber structure F to facilitate installation of the control means.

From the foregoing description considered in connection with the accompanying drawings, it is believed that the construction and mode of operation of the present automatic throttle control means will be clearly understood and its advantages appreciated. It is desired to point out, however, that while only certain specific structural embodiments of the invention have been illustrated and described, the same is readily capable of specifically different structural embodiments within its spirit and scope as defined in the appended claims.

I claim:

1. In an internal combustion engine, a fuel supply conduit, a throttle valve for controlling supply of fuel through said conduit to the engine, spring means for closing said valve, manually operable means for opening said valve comprising an accelerator pedal and a connection between said pedal and said valve including a pair of rods one connected to said pedal and the other to said valve, a housing connected to and movable with said first mentioned rod and having a chamber therein, a flexible diaphragm connected to and movable with said second mentioned rod and constituting a wall of said chamber movable inwardly and outwardly with respect to the latter, a connection between said conduit and said chamber whereby the latter is subjected to the same negative pressure as the former, a spring disposed exteriorly of said chamber and interposed between said housing and said second mentioned rod and effective to move said flexible diaphragm outwardly relative to said chamber and to effect closing movement of said valve when said conduit and said chamber are subjected to a predetermined low pressure, said spring being disposed in surrounding relationship to said second mentioned rod and being effective to prevent inward movement of said flexible diaphragm relative to said chamber and consequent opening movement of said valve when said conduit and said chamber are subjected to a predetermined higher negative pressure, and means comprising a collar on said second mentioned rod adjustable along the latter to adjust the strength of said spring.

2. In an internal combustion engine, a fuel supply conduit, a throttle valve for controlling supply of fuel through said conduit to the engine, spring means for closing said valve, manually operable means for opening said valve comprising an accelerator pedal and a connection between said pedal and said valve including a pair of rods one connected to said pedal and the other to said valve, a housing connected to and movable with one of said rods and having a chamber therein, a flexible diaphragm connected to and movable with the other of said rods and constituting a wall of said chamber, a connection between said conduit and said chamber whereby the latter is subjected to the same negative pressure as the former, a collar mounted on said second mentioned rod for adjustment therealong, means for securing said collar to said rod in different positions of adjustment therealong, and a spring connected between said housing and said collar and of a strength to move said housing and said diaphragm relative to each other to effect closing movement of said valve when said conduit and said chamber are subjected to a predetermined low negative pressure, said spring being of insufficient strength to prevent relative movement between said diaphragm and said housing and consequent opening movement of said valve when said conduit and said chamber are subjected to a predetermined higher negative pressure.

3. In an internal combustion engine, a fuel supply conduit, a throttle valve for controlling supply of fuel through said conduit to the engine, spring means for closing said valve, manually operable means for opening said valve comprising an accelerator pedal and a connection between said pedal and said valve including a pair of rods one connected to said pedal and the other to said valve, a housing connected to and movable with said first mentioned rod and having a chamber therein, a flexible diaphragm connected to and movable with said second mentioned rod and constituting a wall of said chamber, a connection between said conduit and said chamber whereby the latter is subjected to the same negative pressure as the former, a collar mounted on said second mentioned rod for adjustment therealong, means for securing said collar to said rod in different positions of adjustment therealong, and a spring connected between said housing and said collar and of a strength to move said diaphragm and said housing relative to each other to effect closing movement of said valve when said conduit and said chamber are subjected to a predetermined low negative pressure, said spring being of insufficient strength to prevent relative movement between said diaphragm and said housing and consequent movement of said valve when said conduit and said chamber are subjected to a predetermined higher negative pressure.

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