

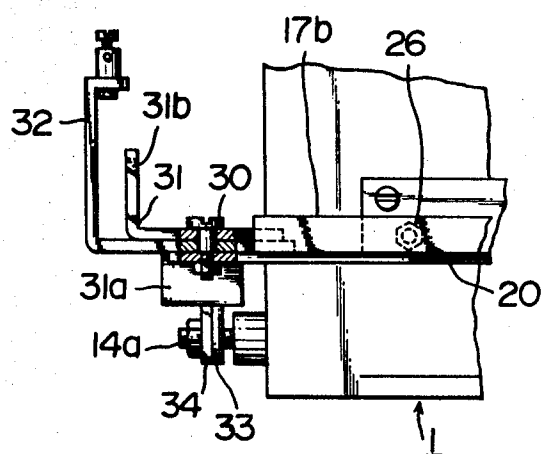
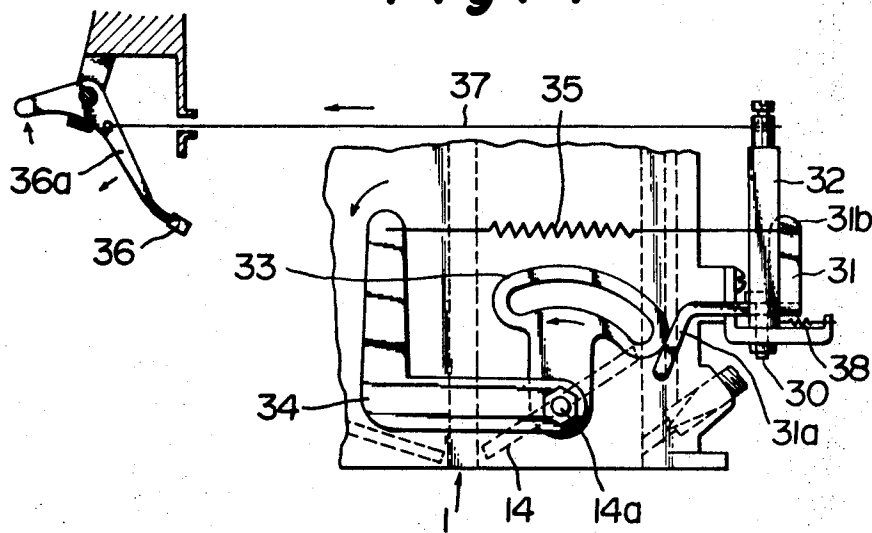
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HAJIME ARIGA ET AL

DEVICE FOR INTERRUPTING IDLE FUEL CIRCUIT OF A CARBURETOR

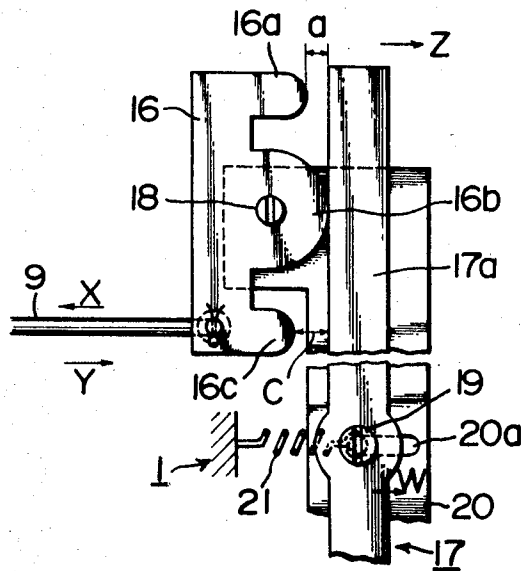
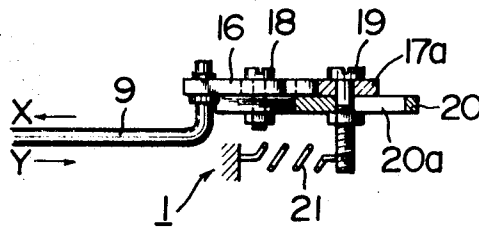
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DEVICE FOR INTERRUPTING IDLE FUEL CIRCUIT OF A CARBURETOR

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DEVICE FOR INTERRUPTING IDLE FUEL CIRCUIT OF A CARBURETOR

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Fig. 8

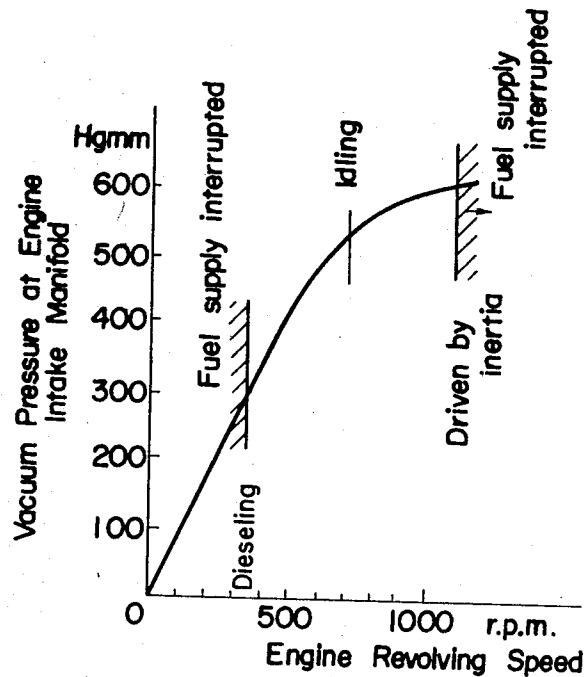
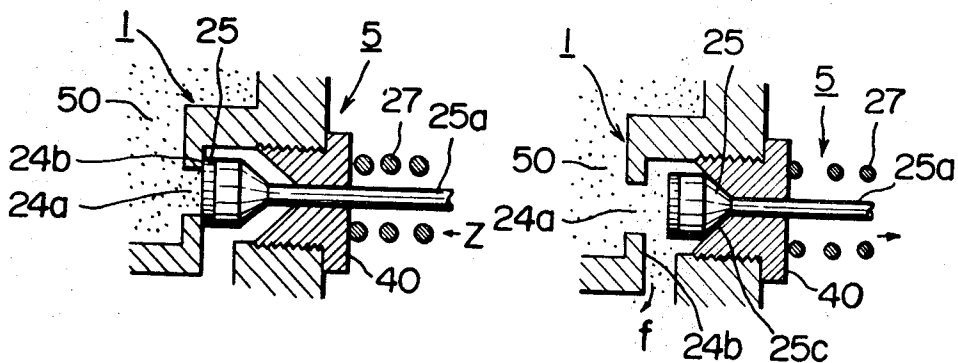


Fig. 9

Fig. 10



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DEVICE FOR INTERRUPTING IDLE FUEL CIRCUIT OF A CARBURETOR

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U.S. Cl. 123—97

3 Claims

ABSTRACT OF THE DISCLOSURE

A device for selectively interrupting the idle fuel circuit of a carburetor of an engine, which operates when the engine is driven by an outside inertia and when the engine is in run-on state. The device comprises a diaphragm means capable of detecting the vacuum pressure in the intake manifold of the engine, an interrupting valve means engageable with a valve port formed on the idle fuel circuit, and a link means connecting said diaphragm means with said interrupting valve means.

This invention relates to an interrupter of a idle fuel circuit of a carburetor, more particularly to an improvement of a fuel feeding means in the slow system of a carburetor for feeding fuel to an internal combustion engine, such as an automobile engine.

In a known carburetor, if an engine is idling or run at a low speed with a throttle valve slightly open, fuel is supplied to the engine through idle fuel circuit which is separate from a main nozzle; namely through idle fuel circuit jets located in the proximity of the full close position of a throttle valve vane, for supplementing fuel supply during transition from slow stage to intermediate stage of the engine operation. Such fuel feeding system for low speed operation of the engine has a disadvantage in that fuel is fed to the engine in vain under certain conditions. Firstly, when an automobile moves by inertia, for instance when it moves down along a slope, the throttle valve of the engine produces an increased negative pressure underneath the rotary valve vane thereof, so that excessive fuel is delivered to the engine through the idle fuel circuit jets of the carburetor. As a result of it, such excessive fuel produces incompletely burned gas as an exhaust from the engine, which is one of the major causes of air pollution. Secondly, under the so-called dieseling conditions, the fuel combustion is maintained even after electric circuitry of the engine ignition system is interrupted for stopping the engine, because of high compression ratio of the engine and other reasons. When an automobile is in such dieseling state, the revolving speed of the engine is comparatively low, and the negative pressure at the carburetor slow fuel supply system is not very high but sufficient for sucking fuel through the jets of the fuel circuit, so as to sustain the dieseling state. Such dieseling state is apparently dangerous, for the engine cannot be stopped when the driver definitely wants to stop it.

Therefore, an object of the present invention is to obviate the aforesaid difficulties of known carburetor, by improving the idle fuel circuit thereof. In the interrupting device of idle fuel circuit, according to the present invention, there are provided a diaphragm means, a link means, and an interrupting valve means, so as to stop the fuel supply to the engine both when the automobile is run by inertia and when the engine is in the dieseling state. Thus, air pollution by incomplete fuel combustion is prevented, and the so-called dieseling conditions can be safely interrupted without failure.

Another object of the present invention is to provide an

interrupting device of carburetor idle fuel circuit of the aforesaid construction, in which the interruption of the fuel supply through the idle fuel circuit can be released as soon as the automobile acceleration or speed change ratio shift is initiated without any delay.

For a better understanding of the invention, reference is made to the accompanying drawings, in which:

FIG. 1 is a schematic plan view, partly in section, of a carburetor incorporating an interrupting device according to the present invention;

FIG. 2 is an enlarged partial sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a perspective view of a valve seat member usable in the carburetor of FIG. 1, shown with a part thereof cut away;

FIG. 4 is an elevation of the carburetor, taken from the direction as shown by arrows IV—IV of FIG. 1;

FIG. 5 is a side view of the carburetor of FIG. 4;

FIG. 6 is an enlarged partial sectional view, taken along the line VI—VI of FIG. 1;

FIG. 7 is a plan view of FIG. 6;

FIG. 8 is a graph illustrating the relation between the negative pressure at the engine intake manifold and the revolving speed of the engine, with a throttle valve held in the state as fully closed;

FIG. 9 is an enlarged partial sectional view of a carburetor slow fuel passageway, shown in the state as interrupted;

FIG. 10 is a view similar to FIG. 9, showing the idle fuel circuit in the state as open; and

FIG. 11 is a schematic sectional view of a known carburetor idle fuel circuit, shown in an intermediate state during modification for mounting an interrupting device according to the present invention.

Like parts are designated by like numerals and symbols throughout the drawings.

Referring to FIGS. 1 and 2, a carburetor body 1 is connected to an engine intake manifold 2. An interrupting device according to the invention comprises a diaphragm means 3, a link means 4, an interrupting valve means 5 of idle fuel circuit, and a release means 6, each mounted on the carburetor body by suitable means. The diaphragm means 3 comprises a spring 7 and a diaphragm 8 secured to an elongated rod 9. A vacuum chamber 10 formed within the diaphragm means 3 is communicated with the engine intake manifold 2 through a hose 11, while an atmospheric chamber 12, formed within the diaphragm means 3 on the side opposite to said vacuum chamber with respect to the diaphragm 8, is communicated with the outside atmosphere through small holes 13 bored through the housing of the diaphragm means. Thus, the vacuum pressure in the engine intake manifold 2 is detected by the deflection of the diaphragm 8.

Referring to FIGS. 1 and 8, the elastic force of the spring 7 and the effective area of the diaphragm 8 are such that when the engine is driven by automobile inertia at a speed higher 1,100 r.p.m. to produce a vacuum pressure in excess of 600 mm. Hg in the engine intake manifold, the elongated rod 9 is pulled toward the diaphragm means 3, or in the direction as shown by the arrow X of FIG. 1. On the other hand, when the engine somehow enters into the dieseling state at a speed below 300 r.p.m. to produce a vacuum pressure below 300 mm. Hg, the elongated rod 9 is pushed away from the diaphragm means 3, or in the direction as shown by the arrow Y in the figure. When the engine idles at an intermediate revolving speed, e.g. about 700 r.p.m., the elongated rod 9 is kept at the neutral position. In any of the above operative conditions of the elongated rod 9, it is assumed that the rotary vane 14 of a throttle valve is held at its full close position, as best shown in FIG. 2. A bracket 15 is

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provided to secure the diaphragm means 3 on the carburetor body 1.

The link means 4 comprises the elongated rod 9, a cam 16 connected to said rod 9 at one end thereof, and a link member 17 engageable with said cam 16. The cam 16 is pivotally supported by a shaft 18 mounted on a bracket 20 secured to the carburetor body 1, while the link member 17 is also pivotally supported by a shaft 19 mounted on the bracket 20. As best shown in FIG. 7, the cam 16 has three projections 16a, 16b, and 16c. The central projection 16b extends furthest and is kept in contact with an actuating end portion 17a of the link member 17 as long as the cam 16 is at its neutral position. Both end projections 16a and 16c of the cam 16 face the actuating end portion 17a with spacings a and c, respectively. The spacings a and c provide for the idling operation of the engine without interrupting the fuel supply to the engine through the idle fuel circuit of the carburetor.

The shaft 19 to support the link member 17 is slidably fitted in a slot 20a bored on the bracket 20, and pulled toward the carburetor body 1 by a spring 21, as best shown in FIGS. 6 and 7. With such construction of the cam 16 and the actuating portion 17a of the link member 17, upon movement of the elongated rod 9 in excess of a certain stroke, in either X or Y direction, the actuating portion 17a is forced to move in the Z direction, as shown in FIGS. 1 and 7.

The interrupting valve means 5 comprises a valve 25 engageable with a valve seat 24b around a valve port 24a bored through a valve seat member 24, which seat member 24 is mounted on an idle fuel circuit 23 upstream of the two jets 21 and 22, as shown in FIGS. 2 and 3. When the valve 25 engages the valve seat 24b of the valve seat member 24, the valve port 24a is blocked so as to interrupt the fuel passage through the idle fuel circuit 23. A spring 27 is inserted between the carburetor body 1 and a valve head 26 integrally formed with said valve 24, so that the valve 25 is biased away from the valve port 24a by the elasticity of the spring 27. Only when the link member moves in the Z direction to depress the valve head 26, the valve 25 is brought into operative engagement with the valve seat 24b to block the fuel circuit 23 against the elasticity of the spring 27, so as to block the idle fuel circuit 23.

The idle fuel supply system further comprises a slow adjusting screw 28 and a slow air bleed 29, as shown in FIG. 2. The upstream of the idle fuel circuit 23 communicates with a fuel reservoir 60 through a slot jet 61, in the same manner as known carburetor.

The valve seat member 24 is dispensable, if the idle fuel circuit 23 is suitably formed, as will be described hereinafter.

Referring to FIG. 1 again, the release means 6 comprises separately rotatable levers 31 and 32 pivotally mounted on a common shaft 30 secured to the bracket 20. The release means 6 forcibly releases the idle fuel passageway 23 from interruption, in a very quick mechanical action, upon depression of a clutch or accelerator pedal, regardless of whether the cam 16 is actuated by the negative pressure at the engine intake manifold or not. To release the interruption of the slow fuel passageway 23 by actuating the release means 6, one of the levers 31 and 32 engages the opposite end 17b of the link member 17 in such manner that upon clockwise rotation of the lever 31 or 32, the link member 17 rotates counterclockwise around the tip of the projection 16b or 16a of the cam 16 acting as the fulcrum. Accordingly, the shaft 19 of the link member 17 moves rightwards, as shown by the arrow W in FIG. 7.

FIGS. 4 and 5 illustrate relations between the levers 31, 32 and pedals for acceleration and clutch operation. Referring to FIG. 4, the lever 31 is associated with an accelerator pedal (not shown) through an accelerating lever 33 integrally secured to the shaft 14a of the throttle

valve rotary vane 14. A pull lever 34 is also integrally secured to the shaft 14a. A spring 35 is spun between a projection 31b of the lever 31 and the corresponding bent end portion of the pull lever 34, in such manner that the left side bent portion 31a of the lever 31 of the release means 6 is urged against the extreme right end of the accelerating lever 33. Thus, upon depression of the acceleration pedal, the accelerating lever 33 and the pull lever 34 rotate counterclockwise, as shown by arrows in FIG. 4. Thereby, the lever 31 rotates clockwise around the shaft 30 (FIG. 5) by means of the spring 35.

Another lever 32 of the release means 6 is associated with a clutch pedal 36 through a wire rope 37 connected to an arm 36a of the clutch pedal, as shown in FIG. 4. Upon depression of the clutch pedal 36, the lever 32 rotates clockwise around the shaft 30, and as soon as the clutch pedal 36 is released, the lever 32 returns to its original position by a spring 38.

The overall operation of the interrupting device of carburetor idle fuel circuit of the aforesaid construction, according to the present invention, will now be described.

When an automobile is driven by the inertia thereof, or when the automobile runs in the state as engine brake being actuated, the engine revolves at comparatively high speed with the throttle valve rotary vane 14 fully closed, as shown in FIG. 2. Accordingly, the air flow rate at the Venturi portion 39, located upstream of the throttle valve rotary vane 14, is too low to suck fuel from the main nozzle 40. On the other hand, there is produced a considerable negative pressure in the proximity of the jets 21 and 22, located downstream of said throttle valve rotary vane 14. Thus, in the case of known carburetor, a considerably large amount of fuel is supplied to the engine through the idle fuel circuit 23.

On the other hand, in the case of a carburetor having an interrupting device according to the present invention, the negative pressure at the engine intake manifold 2, located below the throttle valve rotary vane 14, is detected by the diaphragm means 3, so as to pull the elongated rod 9 toward the diaphragm means 3. Consequently, the projection 16a of the cam 16 urges the link member 17 in the Z direction around the shaft 19, so that the valve 25 of the interrupting valve means 5 comes into engagement with the valve seat 24b to block the idle fuel circuit 23 at the valve port 24a. Thus, the excessive fuel flow through the idle fuel circuit 23 is interrupted to prevent air pollution effectively.

Under the dieseling condition, the engine revolves at a comparatively low speed, with a comparatively low negative pressure at the engine intake manifold 2, and hence, the elastic force of the spring 7 surpasses the gaseous pressure on the diaphragm 8 in the diaphragm means 3. Accordingly, the elongated rod 9 is pushed in the Y direction, so that the projection 16c of the cam 16 urges the link member 17 in the Z direction around the shaft 19. As a result of it, the valve 25 of the interrupting valve means 5 comes into operative engagement with the valve seat member 24, so as to close the valve port 24a to block the idle fuel circuit 23. Thus, the fuel flow through said idle fuel circuit 23 stops completely to immediately terminate the dangerous run-on condition.

During normal idling or slow driving, the elastic force of the spring 7 and the gaseous pressure substantially balance in the diaphragm means 3, and the elongated rod 9 does not move at all. Even when the balance between the elastic force and the gaseous pressure is broken to cause the movement of the elongated rod 9 to a certain limited extent, the spacings a or c between the projections 16a, 16c of the cam 16 and the operative portion 17a of the link member 17, as shown in FIG. 7, absorbs such small movement, or displacement, of the elongated rod 9 in the X or Y direction. Thus, the link means 4 does not actuate the interrupting valve means 5, so that the fuel supply through the slow fuel supply system of the carburetor is

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not interrupted for such normal idling and slow running operation of the automobile.

Furthermore, according to the present invention, there is provided a release means 6, so that the fuel flow interruption at the idle fuel circuit 23 is released upon the slightest depression of a clutch pedal or accelerator pedal, even when the automobile is run by its own inertia or when it is in the dieseling state. Responsive to such depression of the accelerator or clutch pedal, the lever 31 or 32 rotates clockwise, to shift the opposite end 17b of the link member 17 in the W direction. As a result of it, the movable shaft 19 of the link member 17 slides along the slot 20a of the bracket 20, and the link member 17 itself rotates counter-clockwise around the tip of the projection 16a or 16b of the cam 16 acting then as a fulcrum of the lever 17, as can be seen from FIGS. 6 and 7. Thus, the pressure on the interrupting valve means 5, in the Z direction, is removed to allow quick delivery of the fuel stored in the valve seat member 24 through the jets 22 and 21. Thus, the idle fuel circuit 23 is released from interruption. Moreover, in the aforesaid releasing operation of the interruption, there is no danger of causing mechanical shock or engine stop by depression of the accelerator and clutch pedal.

Referring to FIG. 2, it should be noted here that the valve seat member 24 has a pocket space 50, located at the lower end of the idle fuel circuit 23. As explained in the foregoing, the fuel stored in such pocket space 50 can be quickly delivered to the engine release of the interruption, or deblocking, of the idle fuel circuit 23 by removing the valve 25 from the valve port 24a, so as to allow smooth acceleration of the automobile without any mechanical shocks and danger of engine stop. The location of such pocket 50 is not limited to the lower end of the circuit 23, but it can be provided at any other intermediate portion of the circuit 23.

According to a feature of the present invention, a valve seat member 24, prefabricated in a factory on a mass-production basis, can be mounted on any conventional carburetor, which have no interrupting means for the idle fuel supply system, with only very simple modification. For instance, in order to perform such modification, the carburetor body 1 can be separated from a slot channel chamber 35 (FIG. 2), and then an enlarged bore 51 can be formed at the lower end of the idle fuel circuit 23, as shown in FIG. 11. Then a valve seat member 24, as shown in FIG. 3, can be easily fitted in the bore 51.

It is of course possible to form such pocket space 50 and the valve port 24a as an integral part of the idle fuel circuit 23 of the carburetor body 1. FIG. 9 shows the manner in which the interrupting valve means 5 can be mounted on the carburetor body 1 having such pocket space 50 preformed as an integral part thereof. An adapter 40, which holds a valve stem of the valve 25, is secured to the carburetor body 1 by a suitable means, such as screwing, so that the valve 25 is aligned with the valve port 24a. It is apparent to those skilled in the art that the same process of mounting the interrupting valve means 5 is also applicable to any known carburetor bodies, which are subjected to the aforesaid modification to have the prefabricated valve seat members 24 embedded therein.

FIG. 10 shows the interrupting valve means 5 of FIG. 9, in the state as opened. Upon removal of the valve 25 from the valve seat 24b, the fuel stored in the pocket space 50 is delivered quickly to the engine, as shown by the arrow f. In this particular embodiment, as shown in FIG. 10, the rear surface 25c of the valve 25, which is opposite to the surface engageable with the valve seat 24b, is cone-shaped. Hence, when the valve 25 is fully opened, the back surface 25c thereof comes into tight contact with a similarly shaped inner surface of the adapter 40. Thereby, the sealing of the carburetor at the interrupting valve means 5 is reinforced, so as to prevent fuel and air leakage therethrough. The shape of the back side 25c of

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the valve 25 and the inside surface of the adapter 40 is not limited to conical shape, but any other mating or complementary shapes can be satisfactorily used.

Thus, with the provision of a pocket space in the slow fuel passageway, a certain amount of fuel can be stored therein during interruption of the idle fuel circuit, so that the fuel thus stored can be delivered quickly to the engine. Thereby the danger of mechanical shocks or engine stop, following the interruption of the slow fuel supply system, can be effectively eliminated.

As described in the foregoing, according to the present invention, the wasteful fuel supply through the idle fuel circuit of a carburetor can be selectively interrupted and resumed by a completely mechanical means, responsive to the negative pressure at the engine intake manifold. Thus, operational troubles due to electric circuitry faults, as experienced in the case of known electric interrupting and releasing systems, can be fully eliminated. Furthermore, the interrupting device including both the interrupting valve and releasing means can be mounted on the carburetor body in a very compact fashion. In addition, the structure of the interrupting device according to the present invention is very simple, so that the device can be mounted on carburetors very easily. Accordingly, the device can be manufactured at a low cost and operated in a very safe and reliable manner without any trouble.

What is claimed is:

1. A device for interrupting an idle fuel circuit of a carburetor for use with an engine having an ignition system, a fuel intake manifold, a carburetor having a body and delivering fuel gas-air mixture to said intake manifold, which carburetor has a main fuel circuit and an idle fuel circuit, and an accelerator for increasing the flow of the fuel-gas mixture through said main fuel circuit, said device comprising:

- (a) a valve port disposed in said idle fuel circuit,
- (b) an interrupting valve means engageable with said valve port for blocking said idle fuel circuit,
- (c) a diaphragm means communicating with said intake manifold so as to assume a first position upon increase of negative pressure at said intake manifold in excess of a first value above a normal operating pressure, while assuming a second position upon decrease of the negative pressure at said intake manifold below a second value smaller than said operating pressure in response to occurrence of dieseling of said engine without firing said ignition system,
- (d) a bracket secured to said carburetor,
- (e) a cam means being pivotally supported by a first pin secured to said bracket, said diaphragm means being connected to one side of said cam means with respect to said first pin,
- (f) a link means being pivotally supported by a second pin held by said bracket, one end of said link means being engageable with said interrupting valve means while the opposite end of said link means with respect to said second pin being engageable with said cam means, and
- (g) a release lever being pivotally supported by a third pin secured to said bracket, one end of said release lever being connected to said accelerator while the opposite end of said release lever with respect to said third pin being engageable with said opposite end of said link means whereby said idle fuel circuit is blocked not only in response to the increase of the negative pressure at said intake manifold above said first value by moving said diaphragm means to said first position for causing said one side of said cam means to engage said one end of said link means so as to bring the opposite end of said link means into operative engagement with said interrupting valve means, but also in response to the decrease of the negative pressure below said second value by moving said diaphragm means to said second position for

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causing said opposite side of said cam means to engage said one end of said link means so as to bring the opposite end of said link means into operative engagement with said interrupting valve means, while actuation of said accelerator causes the opposite end of said release lever to come into engagement with said opposite end of said link means for preventing engagement of the link means with said interrupting valve means.

2. A device according to claim 1, wherein said release lever is connected to an accelerating lever secured to a throttle valve vane of the carburetor, which accelerating lever constitutes part of said accelerator.

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3. A device according to claim 1 wherein said release lever is connected to the accelerator pedal for said engine.

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U.S. Cl. X.R.

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