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Shibata

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[54] APPARATUS FOR FORCIBLY CLOSING AN ENGINE THROTTLE VALVE

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **123/198 R**, 74/512, 180/82, 200/61.9

[51] **Int. Cl.** **F02b 77/00**

[58] **Field of Search** ....74/512 B; 123/198 R; 180/82, 180/103, 105; 200/61.9; 340/53

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[57] **ABSTRACT**

An apparatus for forcibly closing a throttle valve in a suction passage of an internal combustion engine, the throttle valve being movable to open and close by an acceleration operation member such as an acceleration pedal or the like. The apparatus for forcibly closing the throttle valve is mounted on one side of the throttle valve, and is operated when the throttle valve is not closed and the acceleration operation member is released from operation. The apparatus for forcibly closing the throttle valve comprises an electromagnetic solenoid with a core which is advanced with rotation when the solenoid is energized, there being a first detecting switch which is closed when the acceleration operation member is released from operation and a second detecting switch which is closed when the throttle valve is in its open position, the two switches being interposed in series in an electrical circuit containing the solenoid and an electric source.

9 Claims, 3 Drawing Figures

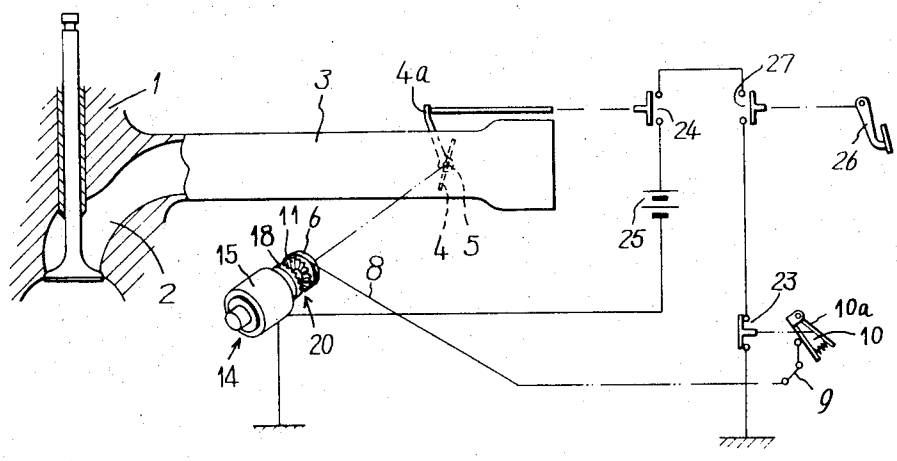


Fig. 1

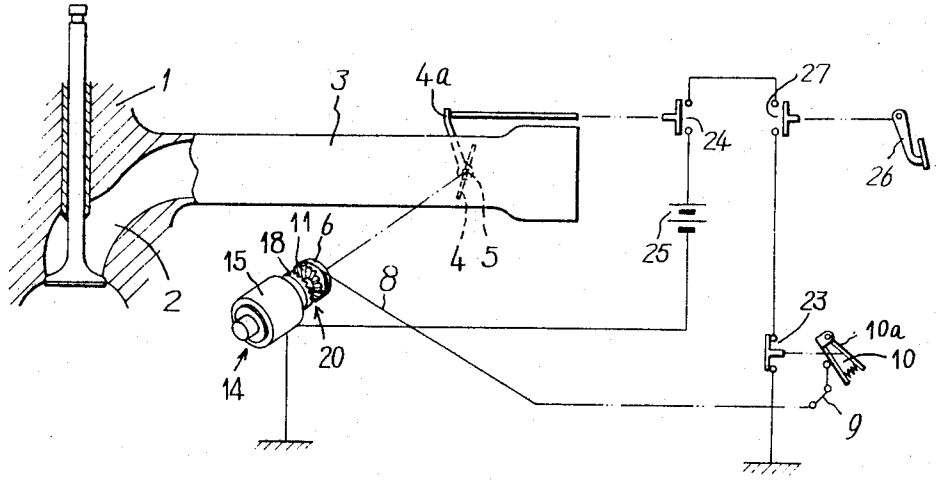


Fig. 2

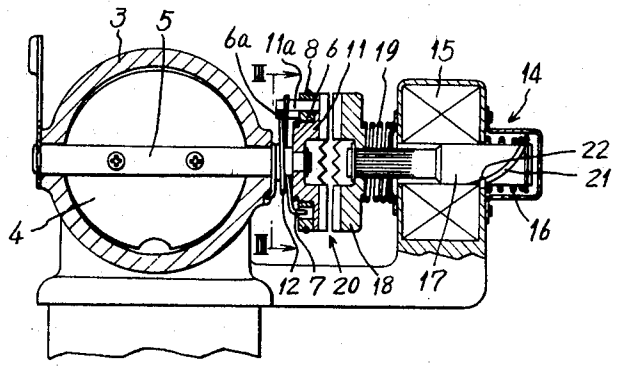
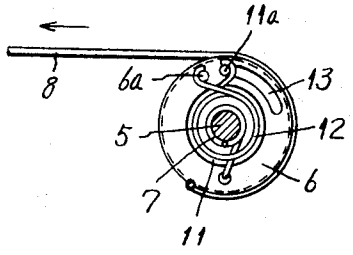


Fig. 3



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APPARATUS FOR FORCIBLY CLOSING AN ENGINE THROTTLE VALVE

BRIEF SUMMARY OF THE INVENTION

This invention relates to apparatus for forcibly closing a throttle valve in a suction passage in an internal combustion engine for a motorcar or the like.

If, during the operation of an internal combustion engine for a motorcar or the like, the throttle valve remains open due to a defect in a control cable or the like, the engine continues to operate at high speed and this is dangerous.

An object of this invention is to provide an apparatus which in a case such as that above will forcibly close the throttle valve.

According to the invention, the throttle valve which is opened and closed by an acceleration operation member, such as an accelerator pedal or the like, is provided within the suction passage of an internal combustion engine, and a forcible valve closing apparatus is provided on one side of the throttle valve for driving the throttle valve to its closing side, said valve closing apparatus being operated when it is detected that the throttle valve is not closed even if the acceleration operation member is released from operation.

The forcible valve closing apparatus may comprise an electromagnetic solenoid and a core which is advanced while rotating against the action of a spring when the solenoid is energized. In this case, there are provided a first detecting switch which is closed when the acceleration operation member is released from its operated condition and a second detecting switch which is closed when the throttle valve is in its open position, and these two switches are interposed in an electric circuit connecting the solenoid and an electric source.

Furthermore, it is preferable that a lost motion mechanism comprising a pin and a slot be interposed between the throttle valve and the acceleration operation member, so that on the occasion where the acceleration operation member or a member such as a wire or the like connected thereto is locked in the condition in which the throttle valve is opened, only the throttle valve can be forcibly closed regardless thereof.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic illustration of one embodiment according to the invention;

FIG. 2 is an enlarged sectional view of a major portion thereof; and

FIG. 3 is a sectional view taken along the line III-III in FIG. 2.

DETAILED DESCRIPTION

Referring to the drawing, numeral 1 denotes an internal combustion engine, numeral 2 denotes a suction opening thereof, numeral 3 denotes a suction passage connected to the suction opening 2, and a throttle valve 4 is pivoted within the passage 3 on a shaft 5 so as to be freely opened and closed. The throttle valve 4 is coupled with a pulley 6 connected to the shaft 5 and is urged by a return spring 7 interposed between the pulley 6 and the outer wall of the suction passage 3 and the valve 4 is connected through the pulley 6 with an accelerator pedal 10 serving as an acceleration operation

member through an acceleration wire 8 and a bell crank 9, such that if the pedal 10 is pushed down, the throttle valve 4 is opened against the action of the return spring 7 and if the pedal is released, the throttle valve 4 is closed by the action of the return spring 7. In addition, for the purpose to be described hereinafter, the pulley 6 is not connected directly to the shaft 5 but is connected indirectly to the shaft 5 through a rotary disk 11 fixed to the shaft 5. Namely, the pulley 6 is loosely mounted on the disk 11 so as to be rotatable in relation the shaft 5 and the rotary disk 11 is fixedly mounted on the shaft 5. The pulley 6 and shaft 11 are interconnected by a spring 12 applied between respective fixed pins 6a and 11a and the pin 11a of the rotary disk 11 is engaged in a slot 13 in the pulley 6 to constitute a lost motion mechanism. Thus, if from the condition of FIG. 3 the acceleration wire 8 is moved to the left to rotate the pulley 6 in the counterclockwise direction, the rotary disk 11 is also rotated in the same direction through the spring 12, so that the throttle valve 4 is opened by the shaft 5. If, then, the pull on the wire 8 is released, the pulley 6 is rotated in the clockwise direction by the action of the return spring 7 and the left end of the slot 13 pushes the pin 11*a* to the right, so that the rotary disk 11 is also rotated in the clockwise direction and the throttle valve 4 is closed by the shaft 5. However, if, for example, the wire 8 is locked in the condition in which the throttle valve is opened, as will be further explained hereinafter, and if the rotary disk 11 is forcibly subjected to a rotating force in the clockwise direction by a forcible valve closing apparatus which will be mentioned hereinafter, the rotary disk 11 can be rotated thereby only against the comparatively weak spring 12 and it is not required in this case that the disk 11 be accompanied by the pulley 6, and thus the foregoing rotating force can be comparatively small.

The forcible valve closing apparatus is generally denoted by the reference numeral 14 and comprises an electromagnetic solenoid 15 with a core 17 which is advanced with rotation against the action of a return spring 16 when the solenoid 15 is energized, and a rotary disk 18 facing the rotary disk 11 is in spline engagement with the end of the core 17 and is urged forward by a spring 19. The facing surfaces of the rotary disks 11 and 18 are provided with teeth to form a clutch 20. Numeral 21 denotes a spiral groove in the outer surface of the core 17 and numeral 22 denotes a pin cooperating therewith.

Thus, if the core 17 is advanced with rotation upon the energization of the solenoid 15, the clutch 20 is brought into engagement and the shaft 5 of the throttle valve 4 is driven in rotation so that the valve 4 is forcibly closed.

It is intended that this action be automatically effected upon detection that the throttle valve 4 is not closed when the acceleration operation member 10 has been released from operation. For achieving this purpose, there are provided a first detecting switch 23 which is closed when the acceleration operation member 10 is released from operation and a second detecting switch 24 which is closed when the throttle valve 4 does not return to its closed position, i.e., the valve 4 is retained in its open position. The switches 23 and 24 are interposed in series in an electrical circuit

containing the solenoid **15** and an electric source **25** for energizing the solenoid. The first detecting switch **23** comprises a pressure switch operable by a pressure plate **10***a* disposed on the front surface of the accelerator pedal **10**, and the second detecting switch **24** comprises a switch member operable by a side arm **4***a* of the throttle valve **4**.

In the illustrated embodiment, a switch **27** operable by a brake pedal **26** is also interposed in the circuit, so that the foregoing action is effected only when the pedal **26** is pushed down.

The operation will now be described.

When the throttle valve **4** does not return to its closed position, due to a deficiency, for example, rusting of fasteners of the wire **8** or the like, when the accelerator pedal **10** is released from its pushed condition, this is detected by closing of the switches **23** and **24**, so that the electromagnetic solenoid **15** is energized and the core **17** is advanced with rotation, whereupon the forcible valve closing apparatus **14** is operated, and the throttle valve **4** is closed with force.

Thus, according to this invention, if the throttle valve remains opened, the forcible valve closing apparatus is automatically operated to close the valve, so that the danger that the throttle valve remains open can be positively prevented.

What is claimed is:

1. For a throttle valve in a suction passage of an internal combustion engine wherein the throttle valve is opened by the operation of an acceleration operation member and is closed when the acceleration operation member is released, an improvement comprising first means for forcibly closing said throttle valve, and second means including detecting means to detect when the acceleration operation member is released and the throttle valve remains opened, and means coupling the first and second means to effect operation of the first means when the second means detects release of the acceleration operation member and an open throttle valve.

2. An improvement as claimed in claim **1** wherein said first means comprises a displaceable and turnable member having an inoperative position and being displaceable to an operative position with rotation to close the throttle valve, and an electromagnet acting on said displaceable and turnable member upon activation of said second means.

3. An improvement as claimed in claim **2** wherein said second means comprises an electrical circuit containing said electromagnet, an electrical power source therefor, a first switch means which is closed when the throttle valve is open, and a second switch means in series with the first switch means and being closed when the acceleration operation member is released.

4. An improvement as claimed in claim **3** comprising a rotatable shaft supporting said throttle valve, a disc fixedly mounted on said shaft, a pulley loosely mounted for rotation on said disc and coupled to the acceleration operation member for being rotated on said disc by the operation of said acceleration operation member, and a lost motion mechanism coupling said pulley and disc.

5. An improvement as claimed in claim **4** wherein said lost motion mechanism comprises a spring having one end fixedly connected to the disc and means connected to the other end of the spring and supported for relative travel in a slot provided in said pulley.

6. An improvement as claimed in claim **4** wherein said displaceable and turnable member is a second disc facing the first disc and in spaced relation therewith when said first means is inoperative, said discs being coupled in rotation when the first means is operated.

7. An improvement as claimed in claim **6** comprising teeth on said discs engageable with one another when the discs are coupled in rotation.

8. An improvement as claimed in claim **6** wherein said electromagnet comprises a displaceable core connected to the second disc, said core having a helical slot therein, and a fixed pin engaged in said slot to produce turning of the second disc as the core is displaced.

9. An improvement as claimed in claim **6** comprising a return spring acting on said pulley to return the same to an initial position after the acceleration operation member is released.

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