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Hisatomi

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[54] **THROTTLE OPERATING MECHANISM FOR CARBURETOR**

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

[58] **Field of Search** .... 123/198 DB, 198 R, 97 R, 123/DIG. 11, 103 R, 103 E

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[57] **ABSTRACT**

A throttle operating mechanism adapted to open and close a carburetor throttle valve of an internal combustion engine, which mechanism has a throttle actuating arm rotatable with the throttle valve and biased in a direction to close the throttle valve by a first biasing means, and a dashpot cooperating with the throttle actuating arm, which dashpot is arranged to dampen the rotation of the throttle actuating arm and to release dampening effect to allow quick rotation of the throttle actuating arm to prevent running or dieselling of the engine.

7 Claims, 3 Drawing Figures

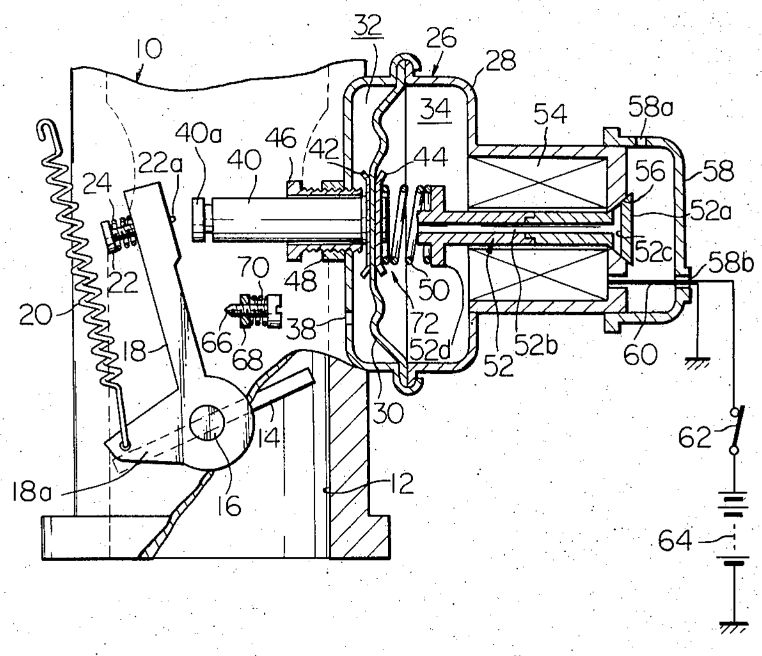
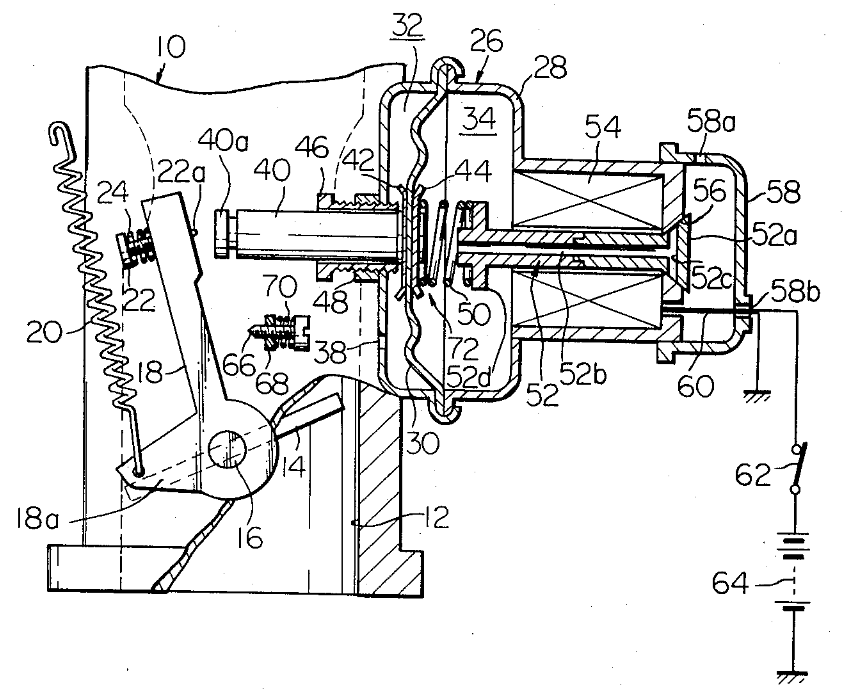


Fig. 1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58a
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58b
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22
70
48
50
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52d
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52b
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18a
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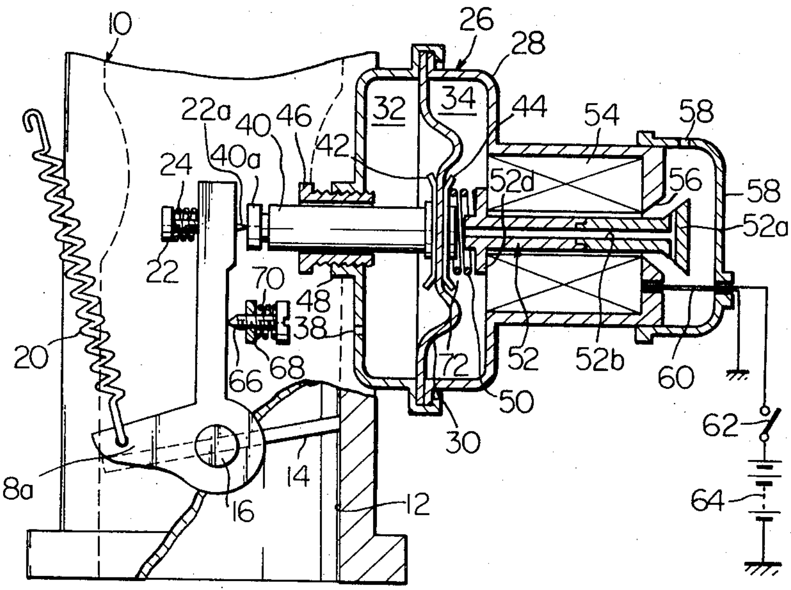
12
64

Fig. 2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52b
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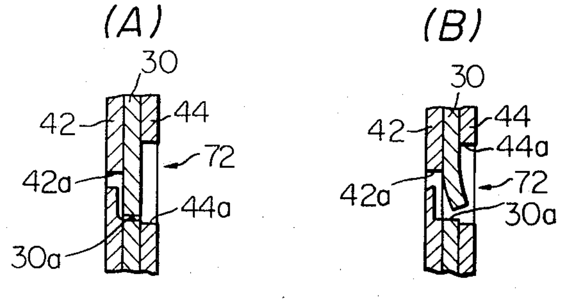
18a
16
14
12
64

Fig. 3


(A)
30
42
44
72
42a
44a
30a
(B)
30
42
44
44a
72
42a
30a

THROTTLE OPERATING MECHANISM FOR CARBURETOR

This invention relates in general to a carburetor for an internal combustion engine of a motor vehicle and, more particularly, to a throttle operating mechanism for the carburetor.

In a conventional internal combustion engine of a motor vehicle, it has heretofore been proposed to retard the ignition spark timing for providing high speed idling operation thereby to eliminate the concentration of the toxic compounds such as hydrocarbons and carbon monoxide in engine exhaust gases discharged into the atmosphere. In this prior method, it is desired that, in order to provide highly stability in idling operation, the engine speed be increased during this particular operating condition. This is reflected by the fact that a large smount of intake air flows through an engine carburetor and, therefore, the engine does not cease to operate in the shortest period of time even when an ignition switch of the engine is opened.

In the conventional internal combustion engine, it has also been proposed to have the carburetor equipped with a dashpot which functions to prevent a carburetor throttle valve from being closed too fast after an accelerator pedal is released for thereby effecting smooth deceleration of the engine. A drawback is also encountered with this dashpot in that the engine continues to run on or diesel even when the ignition switch is opened.

It is, therefore, an object of the present invention to provide a throttle operating mechanism for a carburetor of an internal combustion engine which mechanism eliminated the drawbacks encountered in the prior art.

Another object of the present invention is to provide a throttle operating mechanism having means for damping the movement of a carburetor throttle valve and means for preventing running or dieselling of the engine.

Another object of the present invention is to provide a throttle operating mechanism adapted to slightly open a carburetor throttle valve during engine starting thereby to insure easy starting.

Still another object of the present invention is to provide a throttle operating mechanism which is simple in construction and economical to manufacture.

A further object of the present invention is to provide a throttle operating mechanism which is adapted to be readily installed in existing engine carburetors.

These and other features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings, in which:

FIGS. 1 and 2 are schematic views illustrating a throttle operating mechanism according to the present invention, the mechanism being shown as incorporated in a conventional carburetor of an internal combustion engine; and

FIGS. 3(A) and (B) are enlarged sectional views illustrating a structural part of the mechanism shown in FIGS. 1 and 2.

Referring now to FIGS. 1 and 2 of the drawings, there is shown a throttle operating mechanism implementing the present invention. The throttle operating mechanism proposed by the present invention is used with a conventional carburetor of an internal combustion engine of a motor vehicle. As shown, the carburetor comprises a casting **10** in which an air-fuel mixture passage **12** is formed. The air-fuel mixture passage **12** is adapted to communicate with an intake manifold (not shown) of the engine. A throttle valve **14** is rotatably mounted within the air-fuel mixture passage **12** for controlling the amount of intake air and accordingly the air-fuel mixture to be fed to the engine cylinders. The throttle valve **14** is fixedly connected to a throttle shaft **16** for rotational movement therewith.

In FIGS. **1** and **2**, the throttle operating mechanism embodying the present invention is shown attached to the carburetor casting **10** and comprises a throttle actuating arm **18** which is rotatably mounted at one end on the throttle shaft **16**. The throttle actuating arm **18** has formed at its one end with a laterally projecting portion **18***a* and is biased clockwise as viewed in FIGS. **1** and **2** by a first biasing means such as a tension spring **20,** one end of which is connected to the laterally projecting portion **18***a* and the other end in an opening (not shown) or suitable part of the carburetor casting **10.** The throttle actuating arm **18** is provided at its other end with a throttle adjusting screw **22,** which is threaded in the arm **18** and held in any adjusted position by a retaining spring **24.**

As shown, the throttle operating mechanism further comprises a dashpot, generally designated by reference numeral **26,** which has a casing **28** secured to the carburetor casting **10** by some suitable means, though not shown. Diaphragm means such as a flexible diaphragm **30** is disposed in the casing **28** and divides the same into first and second chambers **32** and **34.** The first chamber **32** communicates with the atmosphere through an air vent **38** formed in the casing **28.** An actuating rod **40** is connected to the diaphragm **30** by means of a pair of disc plates **42** and **44** and extends from the first chamber **32** into the atmosphere through an adjustable guide member **46.** Preferably, the actuating rod **40** extends in such a manner that an end **40***a* of the rod **40** faces an end **22***a* of the throttle adjusting screw **22.** The adjustable guide member **46** is threaded in the bottom part of the casing **28** and held in adjusted position by a nut **48.**

As seen, the adjustable guide member **46** has an end portion extending into the first chamber **32** of the casing **28** and, therefore, the disc plate **42** of the diaphragm **30** abuts against the opposing end of the adjustable guide member **46** when the diaphragm **30** is moved to its one extreme position, that is, the leftmost position as shown in FIG. **1.** It will thus be seen that the amount of outward displacement of the actuating rod **40** can be adjusted by varying the position of the adjustable guide member **46** with respect to the bottom surface of the casing **28.**

In FIGS. **1** and **2,** the dashpot **26** also includes a second biasing means such as a compression spring **50,** which is disposed in the second chamber **34** of the casing **28** between the diaphragm **30** and a valve plunger **52** extending through a solenoid coil **54** supported by the casing **28.** The force of second biasing means **50** is determined to be less than that of the first biasing means **20** so that, when the solenoid coil **54** is deenergized, the second biasing means **50** is yeilded and therefore the diaphragm **30** is moved to its another extreme position shown in FIG. **2** by the action of the first biasing means **20.**

The valve plunger **52** is formed at its one end with a tapered valve head **52***a* which is engageable with a tapered valve surface **56** formed in the casing **28.** The valve plunger **52** also has formed therein an axially extending air passage **52***b* merging with a laterally extending air passage **52***c* which opens at the tapered surface of the valve head **52***a*. Formed at the other end of the valve plunger **52** is an annular flange **52***d* which serves as a spring seat for the compression spring **50.** Indicated by reference numeral **58** is a covering which is made of resilient material such as rubber. The covering **58** has formed therein an air vent **58***a* and is tightly fitted on the casing **28** at an upper portion thereof. The covering **58** also has an opening **58***b* formed therein through which lead wires **60** extend from the solenoid coil **54.** The solenoid coil **54** is grounded through one of the lead wires **60** and is connected through another one of the lead wires **60** to an ignition switch **62,** which in turn is connected to a source of electric power supply such as a battery **64.**

Indicated by reference numeral **66** is an adjustable stop screw which is threaded in a laterally projecting flange **68** and held in any adjusted position by a retaining spring **70.** As seen in FIG. **2,** the adjustable stop screw **66** is adapted to be engageable at its terminal end with the opposing surface of the actuating lever **18** so that an excessive rotation of the same is prevented.

As best seen in FIGS. 3(A) and (B), the disc plate **42** is formed with an aperture **42***a* which communicates through a variable opening **30***a* formed in the flexible diaphragm **30** with an aperture **44***a* formed in the disc plate **44.** Thus, a check valve **72** is formed on the diaphragm **30.** With this construction, the first and second chambers **32** and **34** are held in communication with each other through apertures **42***a* and **44***a* and the variable opening **30***a* formed in the disc plates **42** and **44** and diaphragm **30,** respectively.

When, in operation, the ignition switch **62** is closed, the solenoid coil **54** is energized to cause the valve plunger **52** to be retracted thereby moving the diahragm **30** and accordingly the actuating rod **40** leftwardly as viewed in FIG. **1.** Under this circumstance, the valve head **52***a* of the valve plunger **52** is brought into engagement with the valve surface **56** formed on the casing **28.** Thus, the laterally extending air passage **52***c* formed in the valve head **52***a* is presenved from communicating with the air vent **58***a* formed in the covering **58.** During leftward movement of the actuating rod **40,** the end **40***a* of the actuating rod **40** is brought into engagement with the end of the throttle adjusting screw **22** thereby rotating the throttle actuating arm **18** counterclockwise, that is, in a direction to slightly open the throttle valve **14** against the action of the first biasing means **20.** In this instance, the degree of opening of the throttle valve **14** is determined to have a proper value for effecting easy starting of the engine and for maintaining a desirable idling operation of the engine by the adjustments of the throttle adjusting screw **22** and the adjustable guide **46.** If, in this condition, an accelerator pedal is depressed, then the throttle actuating arm **18** is further rotated counterclockwise against the force of the first biasing means **20.** Accordingly, the throttle valve **14** is further rotated in a direction to provide a greater opening degree as seen in FIG. **1** so that a greater amount of air-fuel mixture is supplied into the engine intake manifold (not shown) to increase engine speed. It is noticed in this instance that the throttle adjusting screw **22** is brought into disengagement with the end **40***a* of the actuating rod **40.** Under these circumstances, the diaphragm **30** is held in one extreme position, that is, in the leftmost position as viewed in FIG. **1** by the action of the second biasing means **50** disposed between the diaphragm **30** and the spring seat **52***d* of the valve plunger **52.**

As previously mentioned, the valve head **52***a* of the valve plunger **52** is held in engagement with the valve surface **56** of the casing **28** by the action of the solenoid coil **54** and, therefore, the air passages **52***b* and **52***c* formed in the valve plunger **52** is shut off. In this condition, the second chamber **34** is held in communication with the first chamber **32** through the apertures **42***a* and **44***a* and the variable opening **30***a* of the disc plates **42** and **44** and the diaphragm **30,** respectively, whereas the first chamber **32** communicates with the atmosphere through the air vent **38** formed in the casing **28.** Under these circumstances, if the accelerator pedal is released to cause deceleration or idling of the engine, the throttle actuating arm **18** is forced to rotate clockwise by the action of the first biasing means **20** thereby to quickly rotate the throttle valve **14** in a direction to decrease opening degree. However, upon engagement of the throttle adjusting screw **22** with the end **40***a* of the actuating rod **40,** the speed of rotations of the throttle actuating arm **18** and accordingly the throttle valve **14** is decreased or dampened to effect smooth deceleration of the engine. This is due to the fact that the air passages **52***b* and **52***c* of the valve plunger **52** is blocked off from communicating with the air vent **58***a* of the covering **58** while the air in the second chamber **34** expels into the first chamber **32** only through the apertures **42***a* and **44***a* and the variable opening **30***a* of the disc plates **42** and **44** and the diaphragm **30,** respectively, in a manner as shown in FIG. 3(A) when the diaphragm **30** is biased in rightward direction by the action of the first biasing means **20** against the action of the second biasing means **50.** Thus, the diaphragm **30** serves as a damping means and gradually moves rightwardly of the drawing to slowly decrease the throttle opening. This continues until the tension force of the first biasing means **20** balances the compression force of the second biasing means **50.**

It is to be noted that the damping effect on the throttle valve movement due to the inherent construction of the present mechanism is obtained to provide delayed decrease in the throttle opening during deceleration of the engine and also the engine speed is maintained at a relatively higher level during idling operation of the engine by adjusting the position of the guide **46** and the throttle adjusting screw **22** whereby the quantity of toxic compounds such as hydrocarbons and carbon monoxide contained in the engine exhaust gases is significantly reduced. It is also understood that the mechanism embodying the present invention effect stabilized idling operation of the engine to reduce the above-mentioned toxic compounds in the engine exhaust gases.

It should be appreciated that if the atmospheric pressure in the second chamber **34** is equalized with that in the first chamber **32** whereas the first biasing means **20** overcomes the force of the second biasing means **50,** the diaphragm **30** is held in its other extreme position, that is, the rightmost position in which the throttle valve **14** is maintained in a position to have a predetermined opening degree for continuing high speed idling operation of the engine. If, in this condition, the accelerator pedal is depressed, the actuating rod **40** is quickly moved leftwardly of the drawing by the action of the second biasing means **50** as already stated hereinabove. In this instance, the air in the first chamber **32** flows out into the atmosphere through the air vent **38** formed in the casing **28** and is partly delivered into the second chamber **34** through the apertures and opening of the discs and diaphragm disposed therebetween in a manner as shown in FIG. 3(B). Thus, the smooth leftward movement of the actuating rod **40** is obtained.

When, in contrast, the ignition switch **62** is opened, the solenoid coil **54** is de-energized so that the valve plunger **52** is moved rightwardly of the drawing as shown in FIG. 2 by the action of the second biasing means **50.** In this condition, the valve head **52***a* of the valve plunger **52** is brought into disengagement with the valve surface **56** of the casing **28.** Consequently, the air passages **52***b* and **52***c* of the valve plunger **52** is brought into communication with the atmosphere through the air vent **58***a* of the covering **58.** Under this circumstance, the second chamber **34** is in communication with the atmosphere and, therefore, the diaphragm **30** is quickly moved rightwardly of the drawing by the force of the first biasing means **20** which is transferred to the throttle actuating rod **18** and to the actuating rod **40** connected to the diaphragm **30.** Thereafter, the diaphragm **30** is held in its other extreme position shown in FIG. **2.** Thus, the throttle valve **14** is quickly rotated to its closed position so that the engine ceases to operate in the shortest period of time after opening of the ignition switch **62** or the engine is prevented from running off.

It will now be appreciated from the foregoing description that the throttle operating mechanism according to the present invention has incorporated therein a mechanism for damping the movement of the carburetor throttle valve and a valve plunger having an air passage for releasing the damping effect whereby the stable idling operation of the engine is achieved just by energizing a solenoid coil cooperating with the valve plunger to provide a predetermined throttle opening whereas the engine quickly ceases to operate without running off and accordingly the quantity of the toxic compounds in the engine exhaust gases is reduced.

What is claimed is:

1. A throttle operating mechanism for a carburetor of an internal combustion engine, comprising a throttle actuating arm rotatable with a carburetor throttle valve to vary throttle opening and biased in a direction to close said carburetor throttle valve, a diaphragm disposed in a casing to define first and second chambers therein and having a check valve providing communication therebetween, an electromagnetically controlled plunger means connected to one side of said diaphragm and movable therewith, said plunger means having formed therein an air passage communicating with one of said first and second chambers, and an actuating rod connected to the other side of said diaphragm and movable therewith, said throttle actuating arm having an end portion engageable with said actuating rod, said air passage being closed by a valve head formed on said plunger means when the same is moved in one direction whereby movements of said actuating rod and accordingly said diaphragm are dampened whereas, when said plunger means is moved in another direction, said air passage is opened to release dampening effect thereby to allow quick return of said actuating rod.

2. A throttle operating mechanism as claimed in claim **1,** further comprising first biasing means for biasing said throttle actuating arm in a direction to close said carburetor throttle valve, and second biasing means disposed between said diaphragm and said plunger means for biasing said diaphragm and said actuating rod in a direction in which said actuating rod engages said throttle actuating arm.

3. A throttle operating mechanism for a carburetor of an internal combustion engine, comprising a throttle actuating arm rotatable with a carburetor throttle valve, first biasing means connected to said throttle actuating arm for biasing the same in a direction to close said carburetor throttle valve, a casing attached to a carburetor casting, a diaphragm disposed in said casing to define first and second chambers therein and having check valve providing communication therebetween, said first chamber communicating with the atmosphere, an actuating rod connected to said diaphragm and extending from said first chamber outwardly of said casing, said actuating rod being engageable with an end portion of said throttle actuating arm, a valve plunger disposed in said second chamber of said casing and having formed therein an air passage providing communication between said second chamber and the atmosphere, said valve plunger also having a valve head engageable with a valve surface formed on said casing, an electrically controlled solenoid coil surrounding said valve plunger and supported by said casing, and second biasing means disposed between said diaphragm and said valve plunger, said valve plunger being moved against the force of said second biasing means in a direction to cause said valve head to close said air passage thereby to prevent said second chamber from communicating with atmosphere whereby the atmospheric air in said first chamber is allowed into said second chamber through said check valve in said diaphragm for thereby allowing slow movement of said actuating rod connected to said diaphragm, and said valve plunger being moved in another direction to open said air passage to provide communication between said second chamber and the atmosphere whereby said actuating rod is allowed to quickly move to a position in which said carburetor throttle valve is closed.

4. A throttle operating mechanism as claimed in claim **3,** further comprising a throttle adjusting screw threaded in an end portion of said throttle actuating arm, said throttle adjusting screw having an end engageable with an end of said actuating rod.

5. A throttle operating mechanism as claimed in claim **3,** further comprising an adjustable guide threaded in said casing and accommodating therein said actuating rod.

6. A throttle operating mechanism as claimed in claim **3,** further comprising an adjustable stop screw threaded in a laterally extending flange and held in adjusted position to prevent excessive rotation of said throttle actuating arm and accordingly said carburetor throttle valve.

7. A throttle operating mechanism as claimed in claim **3,** in which said check valve has apertures formed in disc plates disposed at both sides of said diaphragm, and a variable opening formed in said diaphragm and communicating with said apertures of said disc plates.

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