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2,889,850

GOVERNOR FOR INTERNAL COMBUSTION ENGINE

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2 Sheets-Sheet 1

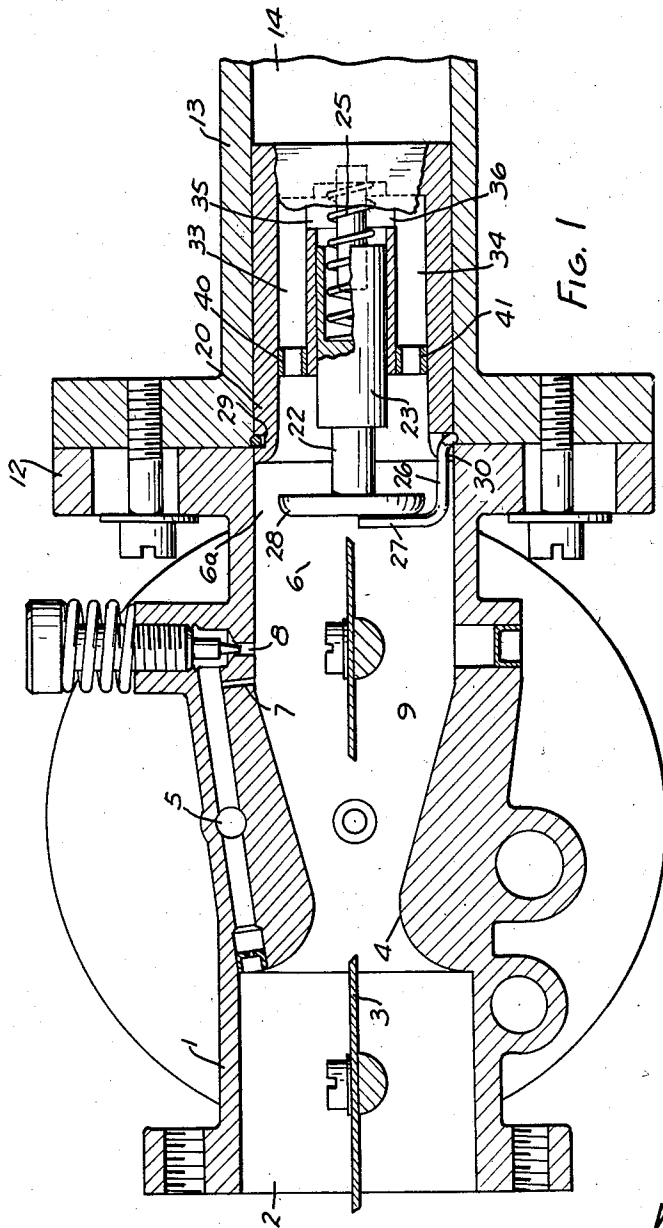


Fig. 1

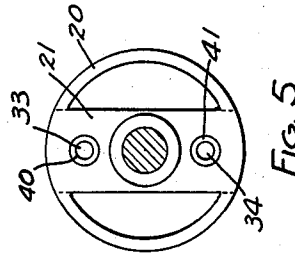


Fig. 5

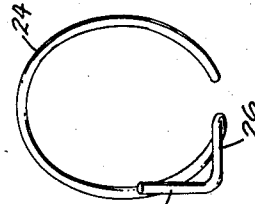


Fig. 6

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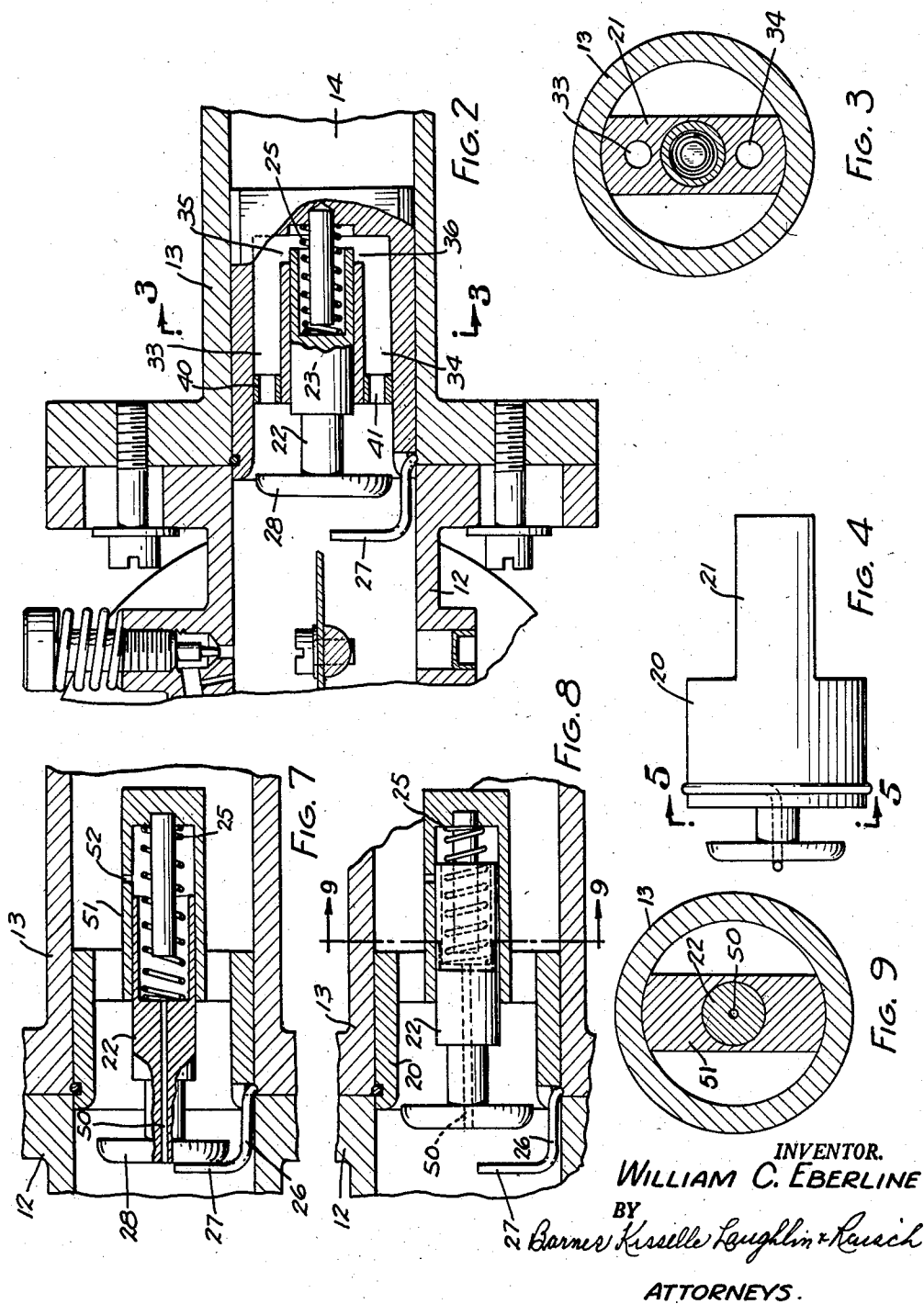
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GOVERNOR FOR INTERNAL COMBUSTION ENGINE

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10 Claims. (Cl. 137—514.5)

This invention relates to a governor for internal combustion engines and it is concerned particularly with a governor to be disposed in the fuel supply line and which is influenced by differential pressures in the fuel supply line incident to the velocity head of the fuel mixture and operation of the engine.

The invention is believed to be particularly adaptable to motors used on various and divers utility machinery, such, for example, as lawn mowers, chain saws, small garden tractors, or any other machine or apparatus, although the invention is not limited to such applications. The invention is applicable to larger engines used for any purpose.

An object of the invention is to provide an improved governor which will permit adequate fuel to flow to the engine to produce the torque which the engine is supposed to supply, and one which prevents the engine from operating at excessively high speeds which condition may occur, for example, when the engine is being operated by a relatively unskilled person.

In carrying out the object of the invention it is the purpose to provide a governor of simple operating parts, which will provide a nicety of action which will operate silently and which, although influenced by the velocity head of the fuel mixture and differential pressures, will take relatively stable positions even though influenced by the pulsations of the fuel mixture of an engine having only one or two cylinders. To this end, the movable element of the governor is more or less in pneumatic balance.

The accompanying drawings show governors constructed in accordance with the invention.

Fig. 1 is a sectional view illustrating a carburetor with a governor applied thereto showing the governor in wide open position.

Fig. 2 is a view similar to Fig. 1 showing the governor in a position for restricting flow of fuel.

Fig. 3 is a sectional view of the governor taken substantially on line 3—3 of Fig. 2 and showing some of the governor construction.

Fig. 4 is a view of the governor removed from the carburetor.

Fig. 5 is a view taken substantially on line 5—5 of Fig. 4.

Fig. 6 is a view of a stop member.

Fig. 7 is a view similar to Fig. 1 illustrating a modified form of the invention showing the governor in open position.

Fig. 8 is a partial view similar to Fig. 7 showing the governor in a position for restricting flow of fuel.

Fig. 9 is a sectional view taken on line 9—9 of Fig. 7.

The governor may be directly associated with the carburetor and positioned between the outlet side of the carburetor and an intake manifold leading to the engine or to a passage directly in the engine block. The carburetor shown in Fig. 1 has a body 1 with an air inlet passage 2 and a throttle valve 3. The carburetor has a venturi passage 4 and the liquid fuel passage is shown

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at 5 and the fuel enters the passage 6 downstream from the restricted throat of the venturi through ports 7 and 8. A choke valve is shown at 9.

The carburetor may have a suitable flange 12 for connection to a manifold conduit 13 although, as stated above, the conduit 13 forming the fuel passage 14 may be a part of the engine block.

The governor, as shown in Fig. 4, has a body of hollow circular form. In other words, the body 20 is of ring-like form and it has an extension 21 projecting therefrom so that the fuel mixture may flow through the ring-body 20 and past the extension 21 which, as shown in Fig. 3, is of flattened form. The extension 21 has a bore therein constituting a cylinder 22, closed at its bottom end and opening into the ring member 20. The movable throttling member 22 has a piston portion 23 positioned in this cylinder and a coil spring 25 is positioned back of the piston. For this purpose, the piston portion may be hollow on its downstream side to provide adequate spring length. The governing member 22 has a head 23 which is slidable relative to and within the body 20 with some clearance. The spring normally projects the head to the position shown in Fig. 1 and a stop is provided. One form of stop is shown in Fig. 6; it comprises a length of suitable wire-like metal formed with a single convolution 24, a projecting part 26 and an inwardly extending end 27 which serves as the stop proper. The body 20 has a circumferential groove 29 which, at least in one place, is provided with a notch 30 which extends through the end of the body 20. The convolution 25 is snapped into the groove 29 and the portion 26 passes out through the groove 30 so that the stop part 27 is positioned to engage the head 23. The spring normally holds the movable governing member with its head against the stop 27. In this position the fuel mixture may pass around the head through the portion 6a of the passage through the body 20 and into the manifold passage 14.

The extension 21 in the form shown in Fig. 1 has two passages therein as indicated at 33 and 34. These passages open forwardly, so to speak, into the body 20 and are connected into the cylinder 22 by ports 35 and 36. These ports are preferably positioned forwardly, or above, so to speak, of the back end of the cylinder 22. In each passage 33 and 34 a restricted orifice or jet 40 and 41 may be placed for reasons which will presently appear.

The governor may be mounted by positioning the body so that the ring 20 projects into the passage 6 and the convolution 25 seats against the edge of flange 12. Then the carburetor and the member 13 may be connected through their respective flanges, or other means, and the passage 14 may snugly fit the external surfaces of the body 20 and extension 21. The convolution 25 is engaged between the members 12 and 13 to hold the governor in position.

In the operation of this governor air flows in through the venturi and the fuel is mixed therewith downstream from the venturi restriction and the operation of the motor is generally controlled by the throttle valve 9. At low speeds, the governing member lies against the stop 27 for a substantially unrestricted flow of the fuel mixture through the governor and into the manifold passage 14. Obviously the presence of the governor restricts the passage but the passage and the governor are to be so proportioned that adequate fuel reaches the motor to provide for the maximum motor or engine torque. As the speed of the motor increases, the rate of flow of the fuel mixture increases and the head 23 is subjected to the velocity head of the fuel mixture. Also the operation of the engine causes a reduction of pressure on the engine side of the head 23. These two factors may

be considered as differential pressures. The differential pressures on the head 28 causes the governor member 22 to retract against the spring 25 and in this movement the passage for the fuel between the head 28 and the ring body 20 is decreased. If the head be retracted completely into the ring, a very small passage is provided which then, of course, materially cuts the flow of fuel to the engine.

In addition, however, the member 23 is pneumatically balanced. The pressure incident to the velocity head is communicated into the passages 33 and 34 thence through ports 35 and 36 to the back side of the piston 23. Thus this pressure, which varies with the velocity head, exerts a counter-balancing force on the pressure applied to the head 28. The effective area of the piston is less than that of the head 28. This balances the member 22 and stabilizes it. In other words, the member 22 has a minimum of fluttering. This is especially advantageous in small engines having only one or two cylinders where the flow of fuel is subjected to impulses. This pneumatic balance irons out the impulses and the governor member remains relatively stable. When conditions are such that the governor member is retracted rapidly or quickly against the action of the spring, the piston 23 closes off the ports 35 and 36 and then the pressure under the piston is trapped in the cylinder 22 and the structure serves as a dash pot thus to prevent the member 20 from striking the bottom of the cylinder and causing an audible impact. It might be pointed out too that there is a flexibility to the stop 27 and the blow of the head 28 striking it is cushioned.

The governor structure shown herein can be used with several different types or sizes of engines but the orifice members 40 and 41 may be varied to adapt the governor to different engines. In other words, one engine may require smaller jet orifices and another may require larger jet orifices.

In the form shown in Fig. 7 many of the carburetor parts are the same as those heretofore described and therefore the same reference characters applied. Indeed, the same reference characters are applied to identical parts of the governor. In this form, however, there is a single passage 50 in the governor member which opens through its head and extends to the underside of the piston. The cylinder 51 has a port 52. This structure operates essentially the same as the previous form in that the governor moves incident to the differential pressures and throttles the flow of fuel, and the movable member is partially pneumatically balanced by the pressure which is communicated through the passage 50 to the underside of the piston. The small port 52 provides for a bleeding action but offers sufficient restriction so that some pressure is built up back of the piston to effect the pneumatic balance of the governor member and thus stabilized its movements. However, when the movable member moves far enough rearwardly the piston closes off the port 52 and a dash pot is thus established since the pressure is then trapped back of the piston.

When the dash pot action is established in either form of the invention, it will be appreciated that the fluid contents under pressure is not absolutely trapped tight therein since there is an escape through the relatively loosely fitting surfaces of the piston and its cylinder. In other words, the piston fits in the cylinder with a nice sliding fit but there are no piston rings or other elements to seal the interfaces. However, as the differential pressures lessen, for example, due to the closing or partial closing of the throttle or deceleration of the engine under load, the governing member moves to the left as Figs. 1 and 7 are viewed. The first increment of this movement may be decelerated because the ports are closed. But as soon as the ports 33 and 34 of Fig. 1 or the port 52 of Fig. 7 are open, the governing member is free to move to the left as controlled by the differential pressures and spring.

As stated above, the governor and the sizes of the passageways are selected relative to the size and capacity of the engine with which they are to be used. As an example, it may be pointed out that an engine with a wide open throttle may operate at about 7000 r.p.m. A governor may be selected for holding down the engine speed to about 4000 r.p.m. Due regard must be given to the supply of adequate fuel for maximum torque of the engine which, for example, may be at about 3600 r.p.m. Therefore, it will be seen that the governor should be so arranged with reference to the differential areas subjected to pressure and the strength of the spring so that the passage remains widely open at the speed where the engine develops maximum torque, to thus pass a full supply of fuel to the engine. The governor is preferably arranged to begin to exert its governing action in the vicinity of or perhaps slightly above that r.p.m. where the engine develops its maximum torque.

I claim:

1. A governor structure for an internal combustion engine comprising, a cylindrical member adapted to be telescopically received and frictionally retained in a fuel supply conduit and being of hollow form for passage of fluid fuel therethrough, said member having an interior extension of cylinder form spaced from the interior walls of said member, a governing member having a piston portion disposed in the cylinder and a head portion with a diameter substantially that of the interior walls of said cylindrical member for metering the hollow of said member, spring means acting upon the governing member for holding the head in open position spaced from said member, said governing member being under the influence of differential pressures and fuel mixture velocity, so that under said influences it moves toward metering position with the head moving into the hollow of the member, and conduit means with an open end facing directly upstream into the flowing fuel and connecting into the cylinder to place the governor member in partial pneumatic balance.

2. A governor structure for an internal combustion engine comprising, a body member adapted to be slipped into a fuel supply conduit to engage the walls of said conduit in a close relation and being of hollow form for passage of fluid fuel therethrough, said member having an interior cylinder with the outer walls spaced from the inner walls of said body member, a governing member having a piston portion disposed in the interior cylinder and a head portion of about the diameter of the inner walls of said body member for metering the hollow of said member, spring means acting upon the governing member for holding the head in open position spaced from said body member, said governing member being under the influence of differential pressures and fuel mixture velocity, so that under said influences it moves toward metering position with the head moving into the hollow of the member, and conduit means with an open end facing upstream and connecting into the cylinder to place the governor member in partial pneumatic balance, and orifice means in the interior cylinder separate from the hollow form for the passage of fuel for controlling the piston motion into said cylinder.

3. A governor structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit and being of hollow form for passage of fluid fuel therethrough, said member having an extension of cylinder form, a governing member having a piston portion disposed in the cylinder and a head portion for metering the hollow of said member, spring means acting upon the governing member for holding the head in open position spaced axially from said member, said governing member being under the influence of differential pressures and fuel mixture velocity, so that under said influences it moves axially toward metering position with the head moving into the

5 hollow of the member, and conduit means with an open end facing upstream and connecting into the cylinder to place the governor member in partial pneumatic balance, a port interconnecting the cylinder with the conduit means downstream from the head portion of the governing member, said port being opened and closed by movements of the piston, the body having an external groove therein, and a member of elongated wire-like form having a convolution mounted in said groove and a part projecting upstream from the body member, said part having an extreme end portion projecting inwardly of the fuel supply passage and positioned to be engaged by and to form a stop for the governing member to limit its movement incident to the action of said spring.

4. A governor structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit and being of hollow form for passage of fluid fuel therethrough, said member having an extension of cylinder form, a governing member having a piston portion disposed in the cylinder and a head portion for metering the hollow of said member, spring means acting upon the governing member for holding the head in open position spaced from said member, said governing member being under the influence of differential pressures and fuel mixture velocity, so that under said influences it moves toward metering position with the head moving into the hollow of the member, conduit means opening upstream and connecting into the cylinder, whereby pressure incident to velocity head is communicated to the underside of the piston to place the governing member in partial pneumatic balance, and a port in the cylinder positioned to be opened and closed by movements of the piston, whereby when closed, the cylinder at the underside of the piston is closed to thereby check movements of the governing member, the body having an external groove therein, and a member of elongated wire-like form having a convolution mounted in said groove and a part projecting upstream from the body member, said part having an extreme end portion projecting inwardly of the fuel supply passage and positioned to be engaged by and to form a stop for the governing member to limit its movement incident to the action of said spring.

5. A governor structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit and being of hollow form for passage of fluid fuel therethrough, said member having an extension of cylinder form, a governing member having a piston portion disposed in the cylinder and a head portion for metering the hollow of said member, spring means acting upon the governing member for holding the head in open position spaced from said member, said governing member being under the influence of differential pressures and fuel mixture velocity, so that under said influences it moves toward metering position with the head moving into the hollow of the member, the cylinder having a port in its wall communicating with the fuel passageway downstream from the governing member, said port being closed by the piston as the governing member shifts incident to pressure to thereby close the cylinder, whereby further movement of the governing member is checked, the body having an external groove therein, and a member of elongated wire-like form having a convolution mounted in said groove and a part projecting upstream from the body member, said part having an extreme end portion projecting inwardly of the fuel supply passage and positioned to be engaged by and to form a stop for the governing member to limit its movement incident to the action of said spring.

6. A governor structure for an internal combustion engine comprising, a body member adapted to be slipped into a fuel supply conduit to engage the walls of said conduit in a close relation and being of hollow form

6 for the passage of fluid fuel therethrough, a governing member slidably mounted in the body member and being under the influence of differential pressures and velocity head, said governing member having a governing part about the size of the hollow portion of the body member for metering the passage through the body member when it is shifted by said pressures, the mounting including a cylinder in one member and a piston on the other member mounted within and spaced from the inner walls of the body member, spring means acting on the governing member in opposition to the forces exerted by the differential pressures, and conduit means with an open end facing upstream and connecting into the cylinder on the underside of the said piston through the space between the body member and the mounting to place the governing member in partial pneumatic balance, whereby to minimize fluttering of the governing member.

7. A governor structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit and being of hollow form for the passage of fluid fuel therethrough, a governing member slidably mounted in the body member and being under the influence of differential pressures and velocity head, said governing member having a governing part for metering the passage through the body member when it is shifted by said pressures, the mounting including a cylinder in one member and a piston on the other member, spring means acting on the governing member in opposition to the forces exerted by the differential pressures, and conduit means with an open end facing upstream and connecting into the cylinder on the underside of said piston to place the governing member in partial pneumatic balance, whereby to minimize fluttering of the governing member, a port in the cylinder positioned to be closed by the piston therein when the governing member moves toward restricting position, to thereby close the cylinder so that the same effects a dash pot action to check movements of the governing member.

8. A governor structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit and being of hollow form for the passage of fluid fuel therethrough, a governing member slidably mounted in the body member and being under the influence of differential pressures and velocity head, said governing member having a governing part for metering the passage through the body member when it is shifted by said pressures, the mounting including a cylinder in one member and a piston on the other member, spring means acting on the governing member in opposition to the forces exerted by the differential pressures, a passage in the governing member opening through the metering part and communicating into the cylinder under said piston, whereby pressure is communicated into the cylinder to place the governing member in partial pneumatic balance to minimize fluttering thereof, the body having an external groove therein, and a member of elongated wire-like form having a convolution mounted in said groove and a part projecting upstream from the body member, said part having an extreme end portion projecting inwardly of the fuel supply passage and positioned to be engaged by and to form a stop for the governing member to limit its movement incident to the action of said spring.

9. A governor structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit and being of hollow form for the passage of fluid fuel therethrough, a governing member slidably mounted in the body member and being under the influence of differential pressures and velocity head, said governing member having a governing part for metering the passage through the body member when it is shifted by said pressures, the mounting including a cylinder in one member and a piston on the other member, spring means acting on the governing member in

opposition to the forces exerted by the differential pressures, a passage in the governing member opening through the metering part and communicating into the cylinder under said piston, whereby pressure is communicated into the cylinder to place the governing member in partial pneumatic balance to minimize fluttering thereof, and a port in the cylinder communicating with the fuel passageway downstream from the governing part, said port being positioned to be closed by the piston upon movement of the governing member substantially to restricted position, whereby to effect a dash pot action and check movements of the governing member, the body having an external groove therein, and a member of elongated wire-like form having a convolution mounted in said groove and a part projecting upstream from the body member, said part having an extreme end portion projecting inwardly of the fuel supply passage and positioned to be engaged by and to form a stop for the governing member to limit its movement incident to the action of said spring.

10. A governing structure for an internal combustion engine comprising, a body member adapted to be disposed in a fuel supply conduit, a governing member slid-

ably disposed in the body member and which is shiftable in its governing action, spring means acting upon the governing member in opposition to said movement thereof, the body having an external groove therein, and a member of elongated wire-like form having a convolution mounted in said groove and a part projecting upstream from the body member, said part having an extreme end portion projecting inwardly of the fuel supply passage and positioned to be engaged by and to form a stop for the governing member to limit its movement incident to the action of said spring.

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