

April 9, 1940.

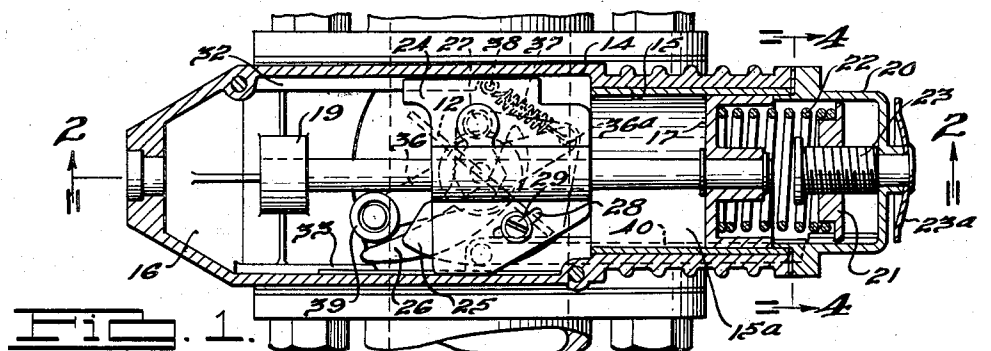
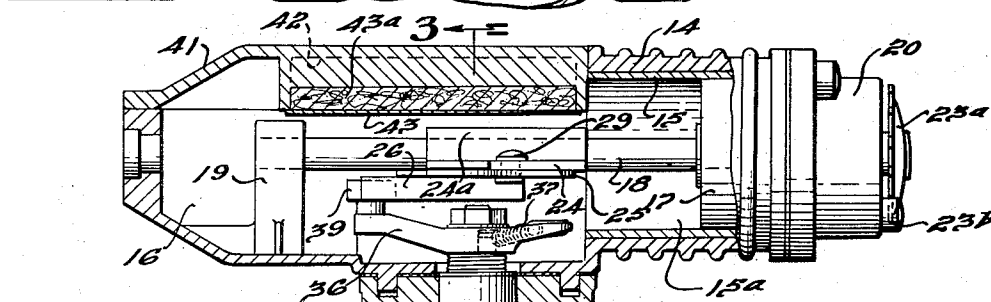
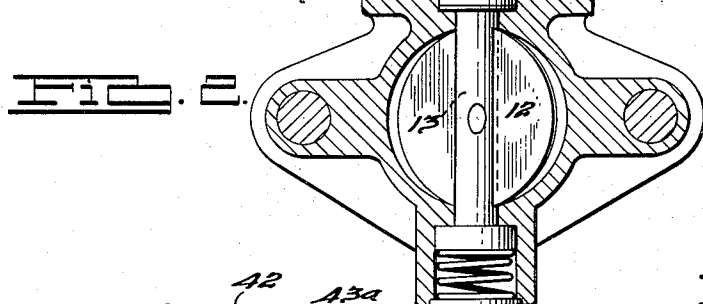
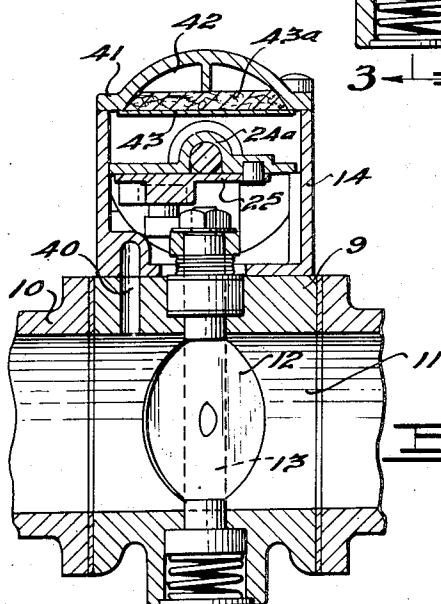
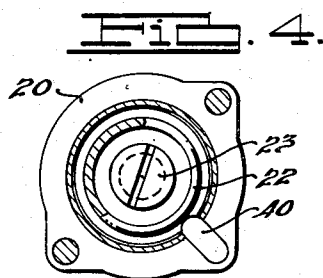
J. S. JENNINGS, JR

2,196,498

GOVERNOR

Original Filed March 4, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

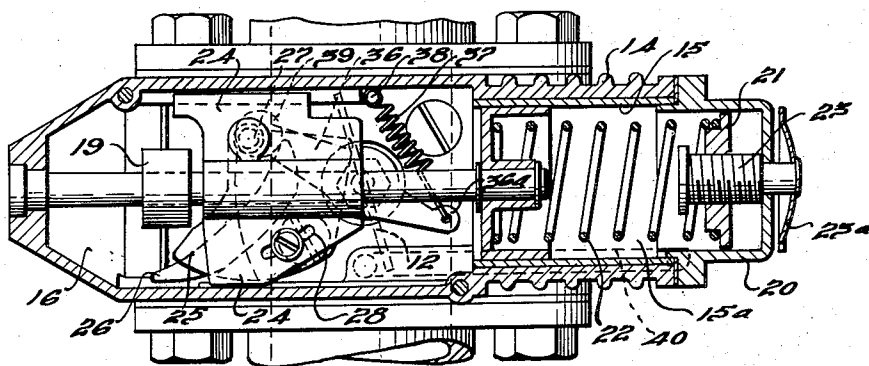


FIG. 5.

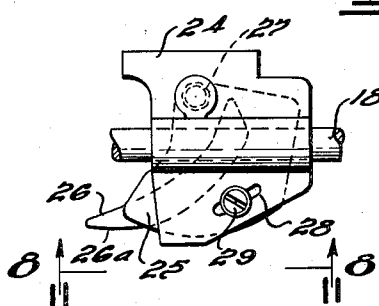


FIG. 6.

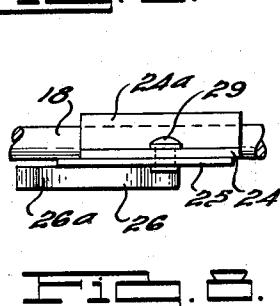


FIG. 7.

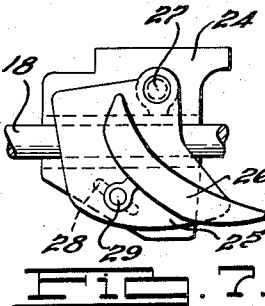


FIG. 8.

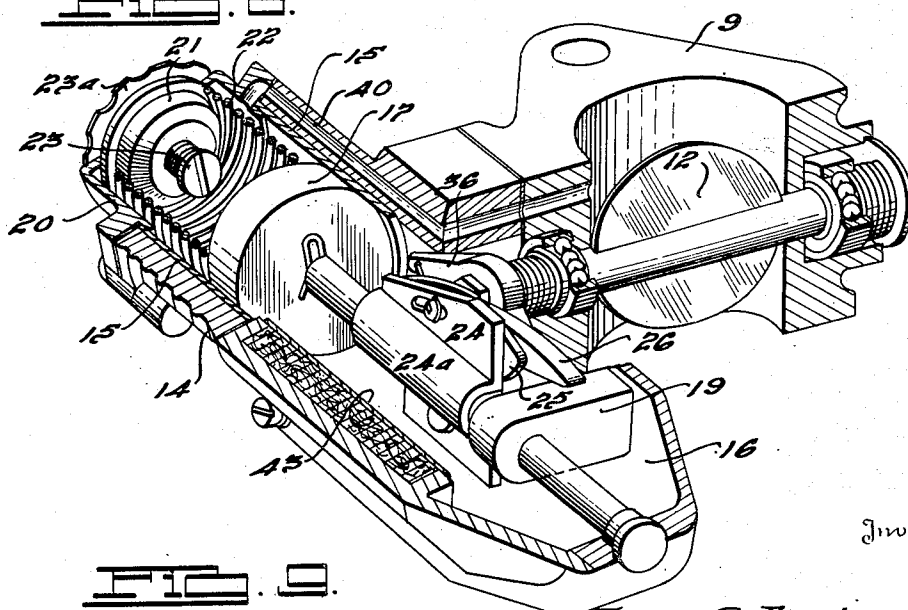


FIG. 9.

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UNITED STATES PATENT OFFICE

2,196,498

GOVERNOR

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Continuation of application Serial No. 520,060,
March 4, 1931. This application December 23,
1936, Serial No. 117,412

10 Claims. (Cl. 137—153)

This invention relates to governors for internal combustion engines and more particularly to a governor of the type shown in my prior Patent No. 1,379,186, patented May 24, 1921, wherein a vacuum operated governor is provided which is capable of maintaining a set or predetermined speed of the engine under varying load conditions.

In said governor a vacuum or suction responsive device is provided which is subject to the varying degrees of vacuum in the intake passage of the engine, closing movement thereof being counteracted by a spring. In accordance with said invention the governor is so constructed as to correlate the varying effective sizes of the governing valve opening to the deflection of the spring by means of a differentiating mechanism, thereby providing a constant balance between the vacuum force in the intake passage and the opposing spring tension under varying loads at a predetermined speed. More specifically, this is accomplished in said patented governor by varying the effective opening through the intake passage of the engine so as to control the degree of suction or vacuum so that the vacuum force exerted upon the vacuum responsive device of the governor to move it in one direction will balance the force exerted by the spring upon said device to move it in the other direction.

The present application is a continuation of my co-pending application Serial No. 520,060, filed March 4, 1931.

One of the objects of the present invention is to provide a governor embodying the principles and features of said patent, while at the same time provide a governor of compact structure which will possess a high degree of accuracy due to the elimination of friction in the moving parts and to the greater responsiveness of the governing valve in all positions thereof to variations, however slight, in the vacuum force within the engine intake. By virtue of the invention, therefore, a more accurate and sensitive governor is provided which will maintain a substantial balance of forces so as to produce the desired control of the engine during operation under varying loads at a given speed.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is in part a longitudinal sectional elevation of a governor embodying the invention.

Fig. 2 is a longitudinal section taken substan-

tially along the line 2—2 of Fig. 1, looking in the direction of the arrows.

Fig. 3 is a transverse section taken substantially along the line 3—3 of Fig. 2, in the direction of the arrows.

Fig. 4 is a transverse section taken substantially along the line 4—4 of Fig. 1, in the direction of the arrows.

Fig. 5 is a view similar to Fig. 1 but illustrating the operating parts in different position.

Figs. 6 and 7 are elevational views illustrating opposite sides of the cam.

Fig. 8 is an edge view of the cam of Figs. 6 and 7; and

Fig. 9 is a perspective view, partly broken away, of the governor shown in the preceding views and embodying the invention.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention herein claimed beyond the requirements of the prior art.

The balancing of the vacuum force and the counteracting spring force under varying load conditions at a predetermined speed of the engine is obtained in the present instance in a manner similar to that provided in my prior patent, No. 1,379,186, that is by disproportionately varying the degree of throttle opening so as to induce in the intake a vacuum force equal to the resisting force of the spring. Instead of transmitting to the governing valve a movement directly proportionate to the movement of the piston, or the deflection of the counteracting spring as by means of a constant ratio mechanism connecting the piston with the valve and a differential spring mechanism to substantially balance the vacuum force, as in the Pierce patent, No. 1,461,933, the angular movement of the governing valve is regulated by a differential mechanism between the piston or spring and valve producing the same result as in my prior patent, namely, to disproportionately vary the throttle opening so as to induce a vacuum force effective to balance the counteracting force of the spring.

In the present instance, however, two forces are preferably utilized for effecting angular movement of the governing valve from wide open posi-

tion to closed position, and as a result thereof the valve is responsive to very slight variations in the vacuum force in the intake passage. The valve is preferably mounted on an eccentric axis so as to be slightly unbalanced, whereby under normal conditions the differential pressure in the intake at opposite sides of the valve will tend to move the valve toward closed position. I have found that this force is ineffective under some conditions to move the valve, particularly when the latter is in its wide open position, and for the purpose of rendering the valve sensitive to variations in pressure when the valve is wide open I have provided an auxiliary spring to insure proper closing action.

The governor in the present instance comprises a valve casing or body 9 adapted to be interposed in the intake pipe 10 from the carburetor to the engine, there being a passage 11 through this body which forms a part of the intake passage. Disposed within the passage 11 is a governing butterfly valve 12 secured to a rock shaft 13 journaled in suitable bearings in the opposite walls of the casing. This governing valve is mounted on a slightly eccentric axis to unbalance the valve a slight degree so that normally the differential pressure within the intake passage at opposite sides of the valve will tend to move it toward closed position.

Secured to the body portion 9 is an elongated casing 14 which is formed at its forward end with a cylinder liner or wall 15 within the cylinder or piston chamber 15a, said chamber opening rearwardly thereof into an enlarged chamber 16 within which is housed certain of the operating mechanism. A piston 17 is mounted for reciprocation within the cylinder 15, and bolted to the piston is a rearwardly extending piston rod 18 having a sliding bearing at its free end in a boss 19. The forward end of the piston chamber 15 is closed by means of a removable end cap 20 bolted thereto, and interposed between the piston 17 and an adjustable collar 21 is a compression spring 22. The collar 21 may be adjusted longitudinally within the chambered cap 20 by means of an adjusting screw 23 having a finger piece or wheel 23a so as to vary the tension of the spring 22. The wheel has a notched periphery, the notches being adapted to successively and frictionally engage a fixed pin or stud 23b (Fig. 2) which holds the wheel in releasable adjusted positions.

Secured to the piston rod 18 is a cam carrier member 24. This member has a central arched portion 24a channeled to snugly fit over the piston rod 18, as shown in Fig. 3. The member 24 carries at its under side a templet or cam plate 25 to the bottom of which is secured a templet 26, see Figs. 6, 7 and 8. The cam plate 25 is pivoted at 27 to the carrier member 24, the latter having a slot 28 through which extends a set screw 29 effective to clamp the cam plate 25 and carrier 24 together but, when loosened, permitting angular adjustment of the cam plate about the axis of the pivot 27. Upon loosening the set screw 29, the cam plate 25 will be shifted angularly about the axis of the pivot 27 so as to vary the angular position of the cam 26, and the cam plate will be held in adjusted position by tightening the set screw 29 to clamp the cam plate and carrier together.

At the lower side of the piston rod 18 the carrier member 24 at one side thereof is supported and guided during its movement by a guide or trackway 32 formed in one wall of the casing 14 whereas the opposite side of the member 24 is

adapted to slide on an integral ledge or guideway 33 formed in the diametrically opposite wall of said casing.

The shaft 13, which carries the governing valve 12, extends through the wall of the body 9 into the chamber 16. A lever 36 is secured intermediate its ends to the end of this shaft. A light tension spring 37 is connected at one end to the forward end 36a of the lever and at its opposite end is anchored at 38 to a fixed part such, for example, as the bottom of the casing. The opposite end of the lever 36 carries a cam roller 39 which is in position to contact with the inclined or cam face of the member 26, as shown in Figs. 1 and 5.

The piston chamber 15a is subject to the vacuum or static pressure in the intake passage at the engine side of the governing valve 12, and for this purpose a duct 40 is extended through the wall of the casing 14 and end cap 20, opening at one end into the passage 11 and at its opposite end into the front end of the chamber 15a. In Fig. 5 the valve 12 is shown in its wide open position, and it will be seen that with an increase in the suction or vacuum in the intake passage the piston 17 will be drawn forwardly within the chamber 15 against the resistance of the spring 22 moving the piston rod and the cam carrier in a rectilinear path toward the right in Fig. 5. Since the auxiliary spring 37 is under its greatest tension when the valve is in its open position shown in Fig. 5, the spring will exert sufficient force on the lever 36 to turn the governing valve 12 and maintain the cam roller against the cam 26. As previously stated, the closing movement of the governing valve, in the embodiment of the invention herein illustrated, is effected by means of the auxiliary spring 37 and the slight unbalance of the valve, the force exerted on the valve due to its unbalanced condition being greatest when the valve is near its closed position, and the force 40 exerted by the spring 37 being greatest when the valve is in its wide open position. These two forces in conjunction control the turning movement of the governing valve from open to closed position, the rate of movement, however, being regulated by the travel of the cam roller 39 on the cam 26. Closing of the valve is, therefore, accomplished with practically a minimum of frictional resistance since the roller 39 is held very lightly in contact with the cam.

The chamber 16 is closed by means of a cover member 41, this member having a chamber 42 closed at its bottom by means of a plate 43. The chamber 42 contains a suitable air filtering medium 43a, such as oiled copper wool, and air entering the housing of the governor passes through an aperture (not shown) in the cover 41, through the filtering medium and thence through an aperture or series of apertures (not shown) in the bottom plate 43. This construction prevents ingress into the casing of dirt and other foreign particles which would otherwise collect within the governor and tend to interfere with the proper functioning of the moving parts.

From the foregoing it will be seen that the piston is responsive to the static pressure in the intake manifold, and movement of this piston is resisted by the main spring which has a constant effort equal to the force of the piston at all times. The longitudinal travel of the piston rod together with the cam carrier and cam corresponds to the movement of the piston and this movement is directly proportionate to the deflection of the main spring. In the present instance, as in my prior patent, the desired movement of the governing

valve is obtained by a suitable differential mechanism, a cam and lever arrangement being employed herein in place of the links and levers in my prior patent. In either case the function of this mechanism is to regulate the relative motions of the governing valve and piston, and the motion of the valve with relation to the spring deflection, so as to provide at all times a throttle opening effective to produce a vacuum force at the engine side of the throttle valve which will correspond to the force exerted by the main spring.

Thus, the intermediate differential leverage produces, for equal increments of valve movement, a relatively small deflection or movement of the spring 22 near the open position of the valve and a disproportionately large deflection of the spring near the closed position of the valve. Conversely, for equal increments of spring deflection and of piston movement, the valve, on account of the intermediate differential cam leverage, has a disproportionately less movement near its closed position than near its open position.

Closing of the governing throttle valve will ordinarily increase at an accelerated rate in accordance with the normal accelerating rate of increase of the vacuum force as the valve approaches its closed position. Normally, therefore, the main spring will not provide a corresponding resistance effective to balance this vacuum force under varying loads. If, however, as in my prior patent the normal closing movement of the governing valve is retarded, i. e., the rate of movement of the valve from open to closed position is decelerated it is possible to thus control the rate of increase of the vacuum force and to induce in the intake during the closing movement of the valve an increase in vacuum force which will be equal to the opposing spring tension. As a result the varying positions of the governing valve are directly related to the varying degrees of tension of the spring by virtue of the intermediate differentiating mechanism and hence the balance of vacuum and spring forces is obtained.

In the present construction movement of the governing valve from wide open position to closed position is effected independently of the vacuum operative piston preferably by two forces acting on the valve. With the governing valve wide open, when the vacuum increases the piston will be moved to compress the main spring causing the cam carrier to travel in a rectilinear path away from the roller. At this time the auxiliary spring will swing the lever and turn the valve toward closing position thus maintaining contact between the roller and the face of the cam. This force exerted by the auxiliary spring diminishes as the throttle valve closes while the vacuum force acting on the valve due to its slight unbalance, increases as the valve moves toward its closed position. It is thus possible to maintain a substantially constant torque on the valve to hold the roller lightly in contact with the cam but without any substantial friction between these parts during the entire range of closing movement of the valve.

Ordinarily where an unbalanced governing valve is employed I have found that even though there is a tendency for the valve to close under normal conditions there will at times be a countertorque or a countertorque on the valve tending to open it. This is particularly true when the valve is in its wide open position, in which position it is not sensitive to small changes

in vacuum and consequently will not respond at such times to effect the desired closing movement. For instance, when the hand throttle is partially closed in advance of the governor throttle valve eddy currents are frequently set up due to the relative motion of the two valves resulting in a countertorque on the valve tending to hold it open. The offset of the governing valve under such conditions is ineffective to cause the valve to respond. To overcome this disadvantage I have provided the auxiliary spring which insures the instant starting of the governing valve toward its closing position under even slight changes in vacuum. Consequently, when the hand throttle is partially closed in advance of the governing throttle the latter will immediately respond by virtue of the force exerted by the auxiliary spring.

When the governing valve reaches its closed position, no force in the present instance is exerted by the auxiliary spring, but at this time the force in the same direction on the valve due to its slight offset or unbalance, will be at its maximum and will be sufficient to maintain the cam roller lightly in contact with the face of the cam. In other words, the angular force exerted on the valve due to its offset, when the valve is in its closed position, which force may not be any greater than three or four ounces, is substantially equal to the angular force exerted by the auxiliary spring on the valve when the latter is in its wide open position.

From the foregoing it will be seen that in the present preferred construction the combination of the auxiliary spring and the slight unbalance of the governing valve make it possible to establish substantially a constant torque on the valve to close it, and also to hold the roller lightly in contact with the cam so as to regulate the angular movement of the valve to the desired disproportionate movement as compared with the movement of the piston. By combining these two slight forces a very slight angular force exists at any time to create friction in the contact between the roller and cam.

I claim:

1. In a governor for an internal combustion engine, a governing valve pivoted to provide an unbalanced portion, a lever for turning said valve, a spring connected to the lever and effective in conjunction with said unbalanced portion to turn the valve toward closing position, a piston chamber and a piston therein subject to the differential between the vacuum in the intake passage and atmospheric pressure, a main spring acting on said piston, a cam device carried by the piston and movable in a path parallel thereto, and a roller on said lever and contacting with the cam.

2. In a governor for internal combustion engines, the combination of a governing valve, a vacuum operated piston, spring means opposing movement of the piston in one direction, a sliding cam carrier interposed between the piston and valve and slidable in a straight line path, a plate having a cam formed thereon, means for mounting said plate on the carrier and for adjusting the same relatively thereto, and means cooperating with the cam for controlling the rate of movement of the valve.

3. In a governor for internal combustion engines, the combination of a governor casing, a governing valve, a vacuum operated piston, spring means opposing movement of the piston in one direction, said piston having a piston rod slid-

able endwise in a straight line path, a bearing carried by said casing for guiding said rod in said path, a carrier fixed to said piston rod and having a cam, means carried by the casing for guiding said carrier, and means cooperating with the cam for controlling the rate of movement of the valve.

4. In a governor for internal combustion engines, the combination of a governor casing, a governing valve, a vacuum operated piston, spring means opposing movement of the piston in one direction, said piston having a piston rod slidable endwise in a straight line path, a bearing carried by said casing for guiding said rod in said path, a slide member fixed to said piston rod for movement therewith and having a cam, and means cooperating with the cam for controlling the rate of movement of the valve.

5. In a governor for internal combustion engines, the combination of a governor casing, a governing valve, a vacuum operated piston, spring means opposing movement of the piston in one direction, said piston having a piston rod slidable endwise in a straight line path, a bearing carried by said casing for guiding said rod in said path, a slide member fixed to said piston rod for movement therewith and having a cam, means carried by the casing for guiding said slide member, and means cooperating with the cam for controlling the rate of movement of the valve.

6. In a governor for internal combustion engines, the combination of a governor casing, a governing valve, a vacuum operated piston, spring means opposing movement of the piston in one direction, said piston having a piston rod slidable endwise in a straight line path, a bearing carried by said casing for guiding said rod in said path, a slide member fixed to said piston rod for movement therewith and having a cam, means for adjusting said cam relatively to the slide member, and means cooperating with the cam for controlling the rate of movement of the valve.

7. In a governor for an internal combustion engine having an intake conduit passage and adapted to maintain in operation partial vacuum therein, said governor comprising a casing having a passage, a pivoted governing valve in said passage, a piston chamber and a piston therein subject to vacuum in the passage, a spring acting against the piston, a templet operated by

the piston for moving the valve toward open position and effecting a modified movement of the valve as compared with the movement of the piston, and spring means acting independently of said templet for moving the valve toward closed position.

8. In a governor for an internal combustion engine having an intake conduit passage and adapted to maintain in operation partial vacuum therein, said governor comprising a casing having a passage, a pivoted governing valve in said passage, a piston chamber and a piston therein subject to vacuum in the passage, a spring acting against the piston, templet means operated by the piston for moving the valve toward open position, and means including a spring and an unbalanced portion of the valve acting independently of said templet means for moving the valve toward closed position, the action of said means being regulated by said templet means so as to modify the movement of the valve compared with the movement of the piston.

9. In a governor for an internal combustion engine having an intake conduit passage and adapted to maintain in operation partial vacuum therein, said governor comprising a casing having a passage, a governing valve in said passage pivoted to provide an unbalanced portion, a spring connected to the valve, said spring and unbalanced portion being operative to effect closing movement of the valve, and means including a device subject to the vacuum in said passage and free of positive connection with the valve for regulating the rate of closing movement of the valve throughout its range of operation.

10. In a governor for an internal combustion engine having an intake conduit passage and adapted to maintain in operation partial vacuum therein, said governor comprising a casing having a passage, a governing valve in said passage pivoted to provide an unbalanced portion, a spring connected to the valve, said spring and unbalanced portion being operative to effect closing movement of the valve, and means including a piston subject to the vacuum in said passage and a templet mechanism free in one direction of positive connection with the valve for regulating the closing movement of the valve throughout its range of operation.

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