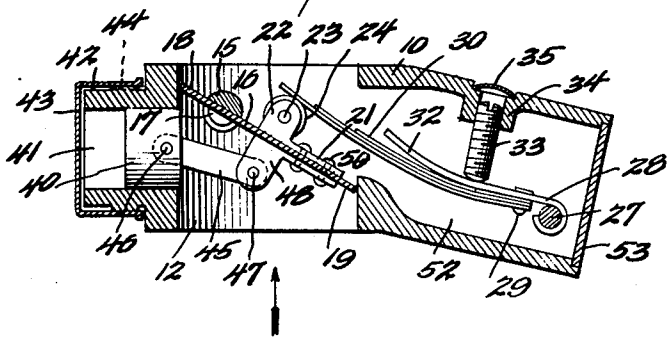
Sept. 26, 1933. A. A. BULL 1,927,973

GOVERNOR

Filed Aug. 16, 1930

FIG. 1.



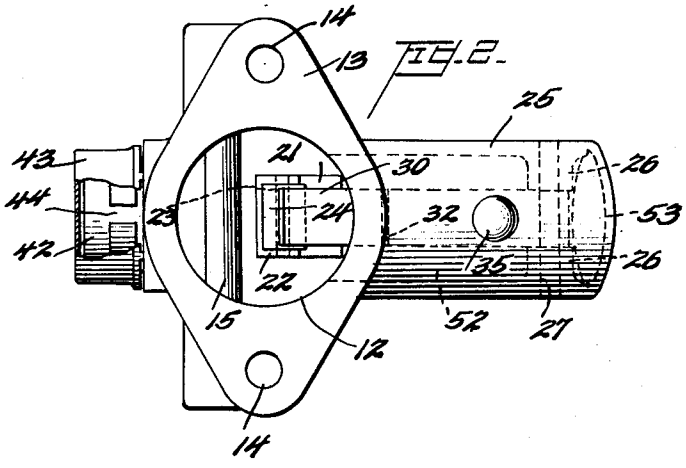


FIG. 2.

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GOVERNOR

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Application August 16, 1930. Serial No. 475,817

17 Claims. (Cl. 137—153)

This invention relates to governors and more particularly to governors of the suction type for use with internal combustion engines.

It is a general object of the present invention to provide a novel and improved form of governor for internal combustion engines.

An important feature of the invention resides in providing a governor having an unbalanced throttle valve, with a flat spring acting on the valve and having means for varying its effective length as the valve moves between open and closed positions.

Another important feature of the invention resides in mounting on the governor valve a roller for cooperation with a spring which biases the valve toward open position and wherein the point of contact between the roller and the spring varies as the valve moves.

Another feature of the invention resides in the arrangement of a valve, a backing plate and a spring wherein the spring cooperates with both the backing plate and the valve in such a manner that the effective length of the spring is so adjusted by movement of the valve that the spring effort balances the closing effort of the valve at a predetermined engine speed for all positions of the valve.

Another feature of the invention resides in novel means for adjusting the spring and backing plate for fixing the governing speed of the device.

A further feature of the invention resides in the use of auxiliary, valve-closing means functioning only during full and nearly full open positions of the valve, together with the other features of the invention already set forth.

Other and further objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and following specification wherein is disclosed a single exemplary embodiment of the invention with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawing:

Figure 1 is a vertical, central section through a governor constructed according to the present invention taken at right angles to the axis of the governor plate; and

Figure 2 is a plan view of the governor showing certain parts broken away.

This invention relates particularly to that type of governor wherein an unbalanced valve is arranged in the induction pipe of an internal combustion engine between the carburetor and the intake manifold and preferably between the manual throttle valve and the intake manifold. In other words, the governing valve is downstream from the manual throttle valve.

The unbalanced throttle valve is normally actuated toward a closed position by the velocity of the fuel gases flowing toward the intake manifold and impinging on the larger portion of the unbalanced valve. It is already known to provide spring means for opposing this closing action in such a manner that the spring effort is equal to the closing effort at a predetermined engine speed and at all positions of the valve whereby accurate governing at all engine loads is achieved. In accordance with the present invention simple and improved means are made use of for opposing the closing effort and by this arrangement the size of the governor is materially reduced and its construction is simplified so that its cost is less.

Referring now to the drawing, there is shown at 10 a casing or housing for the governing mechanism preferably composed of a single piece, die casting of some light metal provided with a passage 12 therethrough which is adapted to register with the induction pipe passage in the engine. Conveniently, the casing is provided with upper and lower flanges 13 which are arranged to fit between the carburetor flange and the induction pipe flange and to receive through the openings 14 bolts which secure the three parts together with the opening 12 in proper alignment.

Passing transversely through the opening 12 and materially offset from the center thereof is the rotatable spindle 15 for the unbalanced throttle plate 16 which takes the form of a butterfly valve secured at 17 to the spindle with a small portion 18 at one side of the spindle which opens toward the engine and with a large portion 19 at the opposite side of the spindle which opens toward the carburetor. It should be remembered that this type of governor is adapted for use where the gases flow upwardly as indicated by the arrow so that the tendency of the fuel gases impinging on the under surface of the larger portion 19 of the valve is to move it toward the closed position illustrated in Figure 1 wherein the edges of the valve engage the walls of the passage 12. The valve preferably closes at a considerable angle to the horizontal, as shown.

On the downstream or upper side of the portion 19 is mounted a punched metal bracket 21 provided with the upturned ears 22 supporting the spindle 23 of a roller 24, which roller is thus

mounted with its axis parallel to the spindle 15 but spaced therefrom a considerable distance.

A tubular extension 25 is formed integral with the housing of the governor and near its outer end has a pair of inturned bosses 26 supporting a pin or spindle 27 upon which is pivoted a metal backing plate or cam 28 by having its end bent around the spindle as shown. Riveted or otherwise secured to the plate near the pivot as at 29 is the end of a flat leaf spring 30. This spring may be a single leaf or may consist of a plurality of laminæ. If laminated, each of the laminæ may be of the same length or they may be of varying lengths for a purpose to be later described.

The free end of the spring extends toward and over the valve and bears on the roller to put an initial bias on the valve even in its open position. As the valve is moved from open to closed position, the roller moves toward the end of the spring. The plate 28 extends along over the spring and is curved as shown at 32 so that as the valve is moved from open to closed position the heel of the spring is caused to contact progressively with the backing plate or cam to reduce its effective length and increase the effort exerted by the spring on the valve against closing. By carefully proportioning the spring strength, the curvature of the backing plate and the change of position of the roller on the spring as the valve moves its position, it is possible to cause the effort exerted by the spring on the valve to exactly balance the closing effort of the valve at some particular speed of the engine and to maintain this balance for all positions of the valve in order that accurate governing may be effected. Various lengths of spring laminæ may assist in the above adjustments.

In order that the governing speed of the device may be adjusted, the backing plate is adjustably positioned by means of a screw 33 bearing on its concave surface and being mounted in a boss 34 in the casing. It is conveniently covered by a sealing device 35 such, for instance, as a Welsh plug to prevent tampering after the governor has once been adjusted.

In order that the governor may not be subject to overrunning or "stealing" at light engine loads, it is equipped with means for augmenting the closing effort on the valve plate at and near full open positions only. Such means takes the form of a device more fully shown and described in my co-pending application Serial No. 369,589, stabilizer for suction governor, filed June 8, 1929. Briefly, it comprises a piston 40 mounted for reciprocation in a cylinder 41 formed integral with the governor housing and on the upstream side of the governing valve. The inner face of the piston is subject to the reduced pressure within the induction pipe and the outer face has restricted communication with the atmosphere through passages 42 between the cap 43 which closes the end of the cylinder and the outer walls of the cylinder which are grooved as at 44. The restricted communication with atmosphere causes the piston to have a dash pot action to prevent fluttering with four cylinder engines of large bore, but the primary function of the piston is to assist in closing the valve from its wide open position when the gas velocities are low as at light loads on the engine. Under such conditions, the governor throttle will open wide if the manual throttle is partially closed without the piston in use, and the opening of the manual valve might cause racing because low velocity of the gas would not close the governor valve. However, with the piston in use its inner face will be subject to the suction on the downstream side of the manual throttle to thus assist in closing the main governing valve. As soon as the governing valve begins to approach closed position, however, the pressure beneath it will rise substantially to atmospheric and the small piston will have no more effect in closing the governor valve.

The piston 40 can be connected to the valve plate in any desired manner but is conveniently attached by means of a link 45 pivoted on the piston pin 46, at one end, and at the other end on the pin 47 mounted on a bracket 48 on the upstream side of the large portion of the throttle valve and opposite the bracket 21 supporting a roller. Conveniently, the same fastening means 50 can be used for attaching these two brackets to the governor plate.

The chamber 52 which houses the spring, the backing plate and the adjusting screw is closed at the end by a cover 53 to prevent leakage of air which would dilute the fuel mixture.

An important feature of the arrangement just described is its extreme simplicity and the small number of simple parts as well as the ease of manufacturing these various parts. With the exception of the housing, substantially all of the parts can be stampings and the only real machining which is necessary is the boring of the cylinder 41 and the journals for the pivot 15. Thus the device can be made at low cost and can compete favorably with more complicated devices intended to produce similar results.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a governor for internal combustion engines, in combination, a governing valve adapted to be urged toward closed position by the fuel gases, a flat spring adapted to bias said valve toward open position, a rigid curved backing plate for said spring adapted to vary its effective length as the spring is flexed, and means varying the point of action between said spring and valve as the spring is flexed.

2. The combination with the induction pipe of an internal combustion engine, of a governor including an unbalanced throttle valve in said induction pipe normally actuated toward closed position by the velocity of fuel in said induction pipe, a leaf spring opposing movement of said unbalanced valve, means to change the effective length of said spring as the valve moves to balance the spring effort against the closing effort at a predetermined speed of the engine and at all positions of the valve, and means to augment said closing effort only at and near full open position of the throttle valve.

3. The combination with the induction pipe of an internal combustion engine, of a governor including an unbalanced throttle valve in said induction pipe normally actuated toward closed position by the velocity of fuel in said induction pipe, a leaf spring pivoted at one end, the opposite end of said spring cooperating with and opposing movement of said unbalanced valve, a curved backing plate positioned adjacent said spring to change the effective length thereof as the valve moves to balance the spring effort against closing effort at a predetermined speed of the engine and at all positions of the valve.

4. The combination with the induction pipe

of an internal combustion engine, of a governor including a throttle valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said induction pipe, a roller mounted on the valve and spring means extending through a wall of the induction pipe and bearing on said roller to oppose movement of the valve toward closed position.

5. The combination with the induction pipe of an internal combustion engine, of a governor including a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, a roller mounted directly above the downstream surface of said valve at a distance from said pivot and a leaf spring bearing directly on said roller to oppose said closing.

6. The combination with the induction pipe of an internal combustion engine, of a governor including a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, a roller mounted above one surface of said valve at a distance from said pivot, a flat spring bearing on said roller to oppose said closing and means to vary the effective length of said spring as the valve turns on its pivot.

7. The combination with the induction pipe of an internal combustion engine, of a governor including a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, a roller mounted to move with said valve, a flat spring bearing on said roller, said roller and spring being so related that the roller moves toward the free end of the spring as the valve moves toward closed position.

8. The combination with the induction pipe of an internal combustion engine, of a governor including a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, a curved backing plate supported remotely from the pivot of said valve, a flat spring having one end secured to said backing plate, extending adjacent the curved portion thereof and in operative relation to the valve to oppose its closing, the relationship of the parts being such that the spring progressively contacts with the backing plate as the valve closes to balance the spring effort against the closing effort at a predetermined speed of the engine and at all positions of the valve.

9. The combination with the induction pipe of an internal combustion engine, of a governor including a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, a curved backing plate supported remotely from the pivot of said valve, a flat spring having one end secured to said backing plate, extending adjacent the curved portion thereof and in operative relation to the valve to oppose its closing, the relationship of the parts being such that the spring progressively contacts with the backing plate as the valve closes to balance the spring effort against the closing effort at a predetermined speed of the engine and at all positions of the valve and means to adjust the position of the backing plate to fix the governing speed.

10. The combination with the induction pipe of an internal combustion engine, of a governor including a casing forming a portion of said induction pipe, a butterfly valve pivoted eccentrically in said induction pipe, a roller mounted on the downstream face of the larger portion of said valve, a curved backing plate having its end remote from the valve pivoted to an extension of said casing, a flat spring secured to the backing plate near the pivot and extending into engagement with said roller and means to adjust the position of the backing plate to adjust the initial tension of the spring.

11. The combination with the induction pipe of an internal combustion engine, of a governor including a casing forming a portion of said induction pipe, a butterfly valve pivoted eccentrically in said induction pipe, a roller mounted on the downstream face of the larger portion of said valve, a curved backing plate having its end remote from the valve pivoted to an extension of said casing, a flat spring secured to the backing plate near the pivot and extending into engagement with said roller and means subject to induction pipe pressure on the upstream side of said valve to augment the closing effort thereof at and near open position of the valve only.

12. The combination with the induction pipe of an internal combustion engine, of a governor including a casing forming a portion of said induction pipe, a butterfly valve pivoted eccentrically in said induction pipe, a roller mounted on the downstream face of the larger portion of said valve, a curved backing plate having its end remote from the valve pivoted to an extension of said casing, a flat spring secured to the backing plate near the pivot and extending into engagement with said roller, means to adjust the position of the backing plate to adjust the initial tension of the spring, a cylinder in the wall of said induction pipe upstream from the valve, a piston in the cylinder exposed to the differential of atmospheric and induction pipe pressures and a link connecting said piston to said valve.

13. The combination with the induction pipe of an internal combustion engine, of a governor including an unbalanced throttle valve plate in said induction pipe actuated toward closed position by the movement of fuel in said pipe, a spring having main and progressively shorter leaves opposing movement of said valve plate and means on the valve plate to change the effective length of the main leaf only of the spring as the valve moves, to balance spring effort against valve closing effort at a predetermined speed of the engine.

14. The combination with the induction pipe of an internal combustion engine, of a governor including an unbalanced throttle valve in said induction pipe actuated toward closed position by the movement of fuel in said pipe, a multi-leaved spring having main and shorter leaves opposing movement of said valve, means to vary the effective length of each leaf of the spring, and means to additionally vary the effective length of the main leaf only.

15. A governor of the type described adapted to be mounted in the induction pipe of an internal combustion engine, including in combination a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, a spring comprising a plurality of flat leaves of different lengths supported remotely from the pivot of said valve, a roller mounted to move with said valve and contacting the free end portion of the longest leaf of said spring, said roller and spring being so related that the roller moves

toward the free end of the spring as the valve moves toward closed position.

16. A governor of the type described adapted to be mounted in the induction pipe of an internal combustion engine, including in combination a butterfly valve pivoted eccentrically in said induction pipe and normally actuated toward closed position by the velocity of fuel in said pipe, and means balancing the closing forces acting on the valve at a predetermined speed of the engine comprising a spring consisting of a plurality of flat leaves of different lengths supported remotely from the pivot of said valve and a roller mounted to move with said valve and contacting the free end portion of the longest leaf of said spring.

17. The combination with the induction pipe of an internal combustion engine, of a governor including an unbalanced throttle valve plate in said induction pipe actuated toward closed position by the movement of fuel in said pipe, a spring comprising a plurality of flat leaves of different lengths opposing movement of said valve plate, and means movable with said plate to change the effective length of the main leaf only of the spring as the valve moves, to balance spring effort against valve closing effort at a predetermined speed of the engine.

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