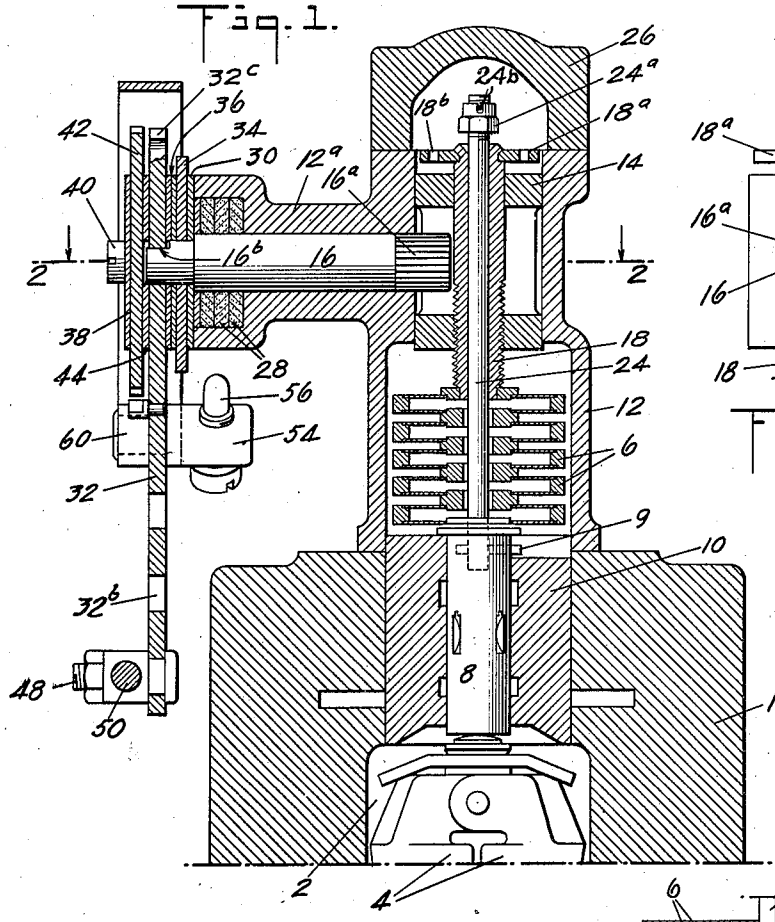
March 12, 1940. W. T. TABB 2,193,701

CONTROL MEANS

Filed Feb. 25, 1937 2 Sheets-Sheet 1

Fig. 1.



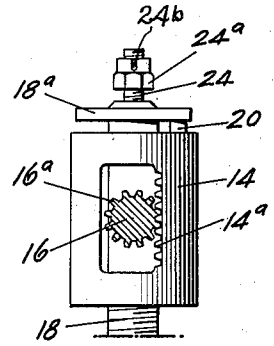


Fig. 3.

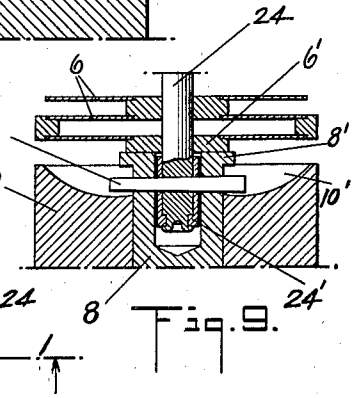


Fig. 9.

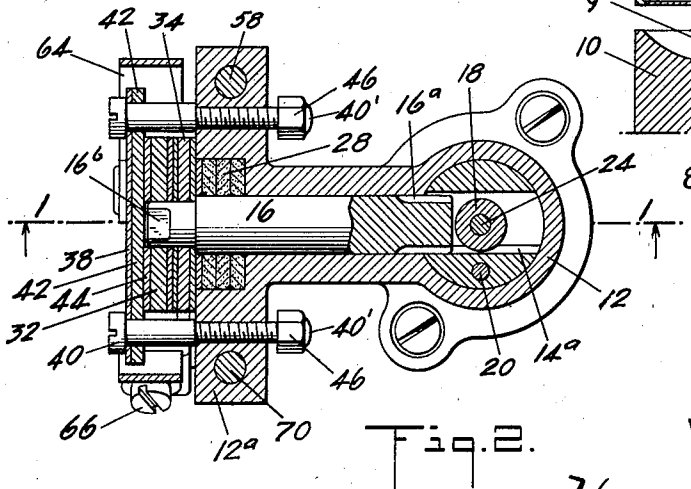


Fig. 2.

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CONTROL MEANS

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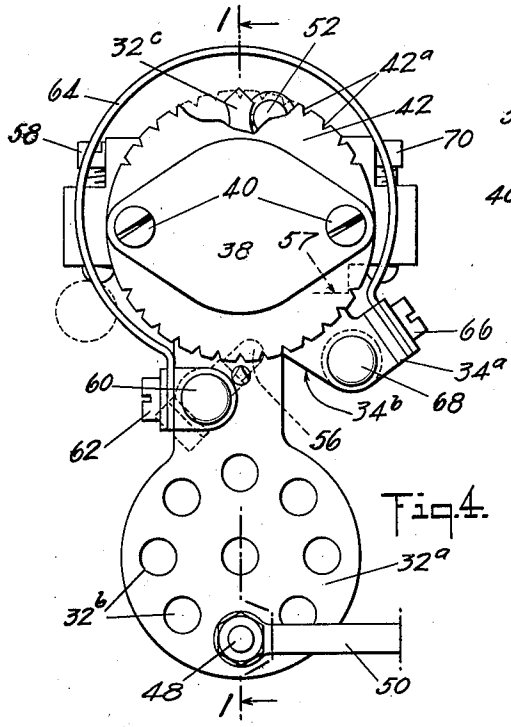


Fig. 4.

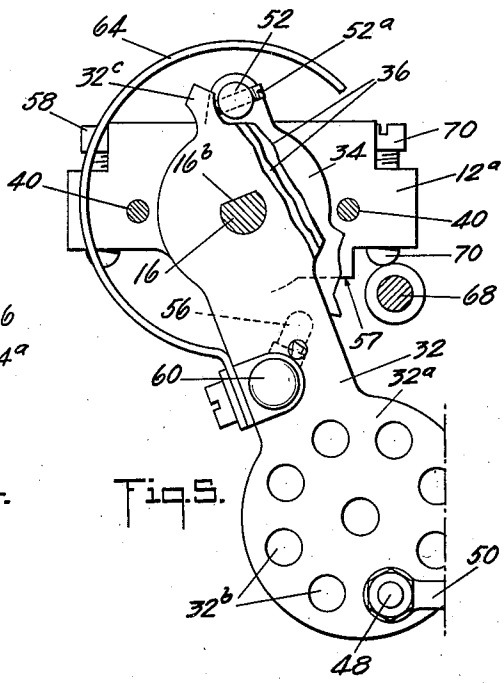


Fig. 5.

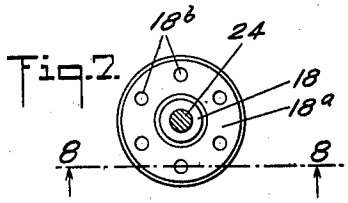


Fig. 2.

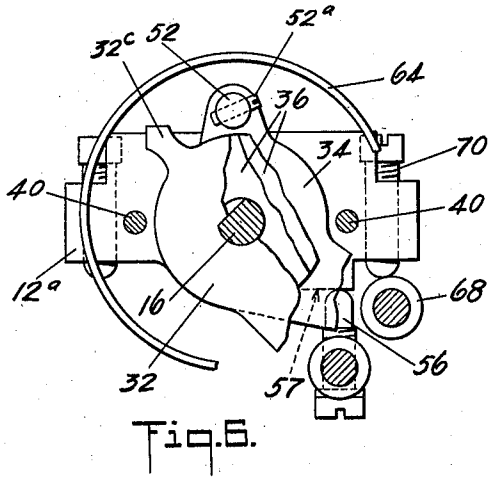


Fig. 6.

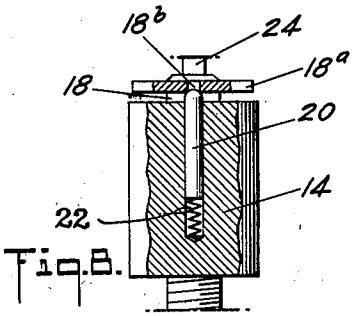


Fig. 8.

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Patented Mar. 12, 1940

2,193,701

UNITED STATES PATENT OFFICE

2,193,701

CONTROL MEANS

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Application February 25, 1937, Serial No. 127,747

31 Claims. (Cl. 137—140)

This invention relates to control means for governed devices and more particularly to means for controlling a fuel injection pump for internal combustion engines, and it is an object of this invention to provide a simple and effective means for controlling such pump which will permit of rapid and effective adjustment of the means for controlling the supply of fuel to the engine so as to adjust the engine speed throughout the speed range of the engine. It is also an object of this invention to provide such a controlling means which will, by a continuous movement of a controller handle, be effective to reduce the engine speed and to stop the engine and it is a further object of this invention to provide a controlling means of such construction that the controller handle will be automatically returned to a position for idling operation of the engine if released when in the position for stopping the engine and means which will give a definite indication to the operator when the controller handle in its movement towards engine stopping position reaches the idling position. It is a further object of this invention to provide an adjustable braking means for the controlled handle so that the handle will remain in position corresponding to any controlled speed of the engine, the braking effect being arranged to be partially relieved during a part of the movement of the controller handle. It is also an object of this invention to provide means within a housing for setting the upper limit of the engine speed; means outside the housing whereby the upper limit of the engine speed may be set and sealed at a lower speed; means for adjusting the idling speed of the engine; and means for stopping the engine.

In the drawings—

Fig. 1 is a partial central vertical sectional view of a fuel pump provided with a control means in accordance with this invention, the section being taken as on line 1—1 of Figs. 2 and 4;

Fig. 2 is a horizontal sectional view taken as on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view in elevation showing the relation of the rack on the spring adjusting member and the pinion on the operating shaft therefor;

Fig. 4 is a view in elevation of the control mechanism as seen looking from the left in Fig. 1, the operating arm being shown in a running position;

Fig. 5 is a view similar to Fig. 4 with the operating arm shown in the idling position and parts broken away to show other parts more clearly;

Fig. 6 is a partial view similar to Fig. 4 with the operating arm moved to its position for stopping the engine;

Fig. 7 is a plan view of a means for retaining the governor in adjusted position;

Fig. 8 is a vertical sectional view taken as on line 8—8 of Fig. 7; and

Fig. 9 is a fragmentary sectional view showing a slightly modified construction.

In the drawings the invention is shown applied to a fuel pump in which a plurality of pump cylinders (not shown) are arranged in a circle in a casing 1 and in a centrally arranged bore 2 is a centrifugal unit 4 which cooperates with a spring 6 in the control of a valve 8 slidably mounted in a valve bushing 10 in the upper portion of the bore 2. The valve 8 and bushing 10 are provided with ports and passages which cooperate with ports and passages in the casing 1 in the control of the supply of fuel to the engine cylinders but as the particular arrangement of these ports and passages is not part of the invention herein disclosed they are not shown in detail.

A housing 12 secured to the casing 1 is formed with a chamber to receive the spring 6 and the upper portion of the chamber opens into a cylindrical bore in which a sleeve 14 is slidably mounted. The housing 12 is also provided with a laterally projecting arm 12^a in which is mounted a shaft 16 having its inner end provided with gear teeth 16^a positioned to mesh with the teeth of a rack 14^a formed on the sleeve 14. Threaded into the sleeve 14 is a second sleeve 18 which is attached to the upper end of the spring 6 and which has attached to its upper end a disc 18^a. The disc 18^a is provided with a plurality of openings 18^b which cooperate with a plunger 20 slidably mounted in a recess in the sleeve 14 in preventing relative rotation of the sleeves 14 and 18, the plunger 20 being pressed into engagement in an opening 18^b by a spring 22. Slidably mounted in the sleeve 18 is a valve stem 24 secured at its lower end to the valve 8 by a pin 9 and threaded at its upper end to receive a nut 24^a which serves as an abutment for engagement by the sleeve 18 under certain conditions of operation of the device and also as a means for maintaining a minimum pressure on the spring 6 to prevent accidental displacement of the disks forming the spring. A cotter pin or sealing wire 24^b secures the nut in position. A cap 26 secured to the housing 12 encloses the upper parts of the sleeve 18 and the valve stem 24.

In the modified construction shown in Fig. 9 the upper end of the valve 8 is flanged as at 8' to form a seat for the spring disk collar 6' and to

limit the downward movement of the valve 8 in the valve seat 10. The upper end of the valve 8 is also recessed to receive the end of the rod 24 which has a collar or sleeve 24' riveted thereto. The rod 24 and sleeve 24' are secured to the valve 8 by a pin 9 passing through openings in the valve 8, sleeve 24' and rod 24 and positioned in a slot 10' in the valve seat 10. The pin 9 prevents relative rotation of the valve 8 and its seat 10. The sleeve 24' being secured to the rod 24 permits of the spring 6 being placed under stress by a nut on the upper end of the rod 24 to prevent accidental displacement of the disks of the spring 6 during assembly or removal of the spring and valve.

The opening in the arm 12a for the shaft 16 is enlarged at its outer end to receive a packing 28 and the outer end of the arm is finished to form a seat for a friction disk 30 which is mounted on the reduced outer end of the shaft 16. The outer end of the shaft 16 is cut away to form a flat surface 16b so as to prevent rotation, with respect to the shaft 16, of an operating or control arm 32 provided with an opening fitting the reduced and cut away end of the shaft 16. Also mounted on the reduced end of the shaft 16 is a rocker 34 which bears against the outer face of the friction plate 30 and is separated from the control arm 32 by the disks 36 of suitable non-frictional material. The control arm 32 is held in position on the shaft 16 and caused to press against the disks 36 by a spring plate 38 secured to the arm 12a by screws 40. Interposed between the spring plate 38 and the control arm 32 is a retainer plate 42 which is engaged by the screws 40 and a friction disk 44 which is provided with a central opening to receive the end of the shaft 16, the shaft 16 being rotatable with respect to the disk 44. The spring plate 38 is dished or curved when free so that the degree of pressure exerted thereby may be adjusted by operating the screws 40 but preferably the screws 40 are of such a length that the spring plate 40 exerts the desired pressure on the disks, control arm and rocker when the unthreaded portions of the screws engage the arm 12a. Nuts 46 secured on the screws by "heading" the ends thereof, as at 40', prevent unauthorized removal of the screws.

The control arm 32 is substantially disk-shaped where it fits the shaft 16 and is formed with a substantially circular portion 32a at the free end thereof, the portion 32a being provided with a plurality of openings 32b to receive a pin 48 to which one end of a rod or link 50 is pivotally connected, the link 50 serving as a means for the manual operation of the control arm 32. The disk portion of the arm 32 which fits the shaft 16 is provided with an extension 32c which is tapered at its end and which serves as a pointer cooperating with notches 42a on the retainer plate 42 in indicating the position of the control arm, the retainer plate being inscribed or marked in a suitable manner adjacent the notches. The extension 32c also cooperates with a pin 52 mounted in the rocker 34 in the operation of the rocker 34 under certain conditions. An adjustable stop 52a is provided in the pin 52 to adjust the relative positions held by the rocker 34 and the control arm 32 during the operation of the rocker by the extension 32c. Mounted in the arm 32 is a pin 54 in which is mounted an adjustable stop member 56 which cooperates with an abutment 57 formed on the arm 12a in limiting the movement of the control arm 32 in a counter-clockwise direction. The pin 54 cooperates with an adjustable stop member 58 mounted in the arm 12a in limiting the movement of the arm 32 in a clockwise direction. The pin 54 also serves to secure to the arm 32 a block 60 to which a screw 62 secures one end of a spring 64. The other end of the spring 64 is secured to a lip 34a on an extension 34b of the rocker 34 by a screw 66 and the spring, being biased to straighten, tends to shift the lower portion of the control arm 32 (as seen in Fig. 4) from the lower portion of the rocker 34. A pin 68 mounted in the extension 34b of the rocker is positioned to engage an adjustable stop member 70 mounted in the arm 12a and limit the counter-clockwise movement of the rocker 34.

In assembling the controlling mechanism for service, the nut 24a is first tightened to give a pressure of the spring 6 corresponding to a selected low speed of the centrifugal unit, a speed less than that at which the governor will be called upon to control. The nut 24a may then be sealed through a hole in the rod 24 by means of a cotter pin or wire 24b. The high speed nut 58 is then backed off and the control handle 32 swung clockwise until the post 54 engages the arm 12a. The sleeve 18 is then adjusted so that the spring pressure is that corresponding to the maximum permissible speed of the engine, that is, equal to the thrust of the centrifugal unit 4 at that engine speed. This setting of the sleeve 18 may be done by scale measurement since the thrust of the centrifugal unit at the desired speed is known. This setting of the top limit of speed does not disturb the setting of the nut 24a. The screw 56 is then set so that an extreme counter-clockwise position of the control arm 32 is determined at which the top of the sleeve 18 will lift the nut 24a, rod 24 and valve 8 to the position proper for stopping the engine. The screw 56, however, is preferably selected from an assortment of such screws of various lengths, so that it determines the correct counter-clockwise limit of the control arm for stopping when the screw is turned to the limit of its movement with its head against a lock-washer, since the screw 56 is not in any sense a customer's adjustment. The idling screw 70 is then adjusted so that the post 68 of the rocker 34 contacts the screw 70 when the spring pressure is that corresponding to the idling speed. In practice, to suit conditions, (particularly the probable range of idling speed adjustment desired, and the spring characteristic which effects the necessary range of movement of the control arm to cover the operating speed range of the engine) it may be found desirable to use rocker members 34 having various angular relations between the post 68 and the pin 52. All of the above adjustments may be set, of course, on the engine, or by rotation of the pump, or without the use of pressure measuring scale.

With the engine in operation, movement of the control arm 32 in a clockwise direction rotates the shaft 16 and operates the sleeves 14 and 18 downwardly to apply pressure to the spring 6 and shift the valve 8 to a position in which more fuel is supplied to the engine cylinders and the speed of the engine is increased until the centrifugal unit 4 and spring 6 position the valve to maintain a substantially uniform speed. As the extension 32c on control arm 32 engages the pin 52 on the rocker 34, the rocker moves with the arm 32 and the stress in spring 64 is unchanged so the spring 64 makes no change in the positions of the various parts. The engine speed will be increased throughout the clockwise movement of the arm 32 until further movement of the arm

32 in that direction is prevented by the stop 58. Movement of the arm 32 in a counter-clockwise direction operates the shaft 16 and sleeves 14 and 18 to lessen the pressure on the spring 6 and permit movement of the valve 8 to a position in which less fuel is supplied to the engine cylinders and the speed of the engine is reduced until the centrifugal unit 4 and spring 6 shift the valve to a position maintaining a substantially constant reduced speed for the engine. As the arm 32 is moved in a counter-clockwise direction the pin 52 is held against the extension 32c and the rocker 34 is caused to follow the movements of the control arm 32 by the spring 64 until further movement of the rocker is prevented by the engagement of the pin 68 with the stop 70. As the control arm 32 is in position for the idling operation of the engine when movement of the rocker is prevented by the stop 70 and as further movement of the arm 32 is opposed by increasing stress in the spring 64 the operator is given a positive indication when the arm 32 reaches the position for idling operation of the engine. Further movement of the control arm 32 in a counter-clockwise direction against the resistance of the spring 64 operates shaft 16 and sleeves 14 and 18 to engage sleeve 18 with the nut 24a on the valve stem 24 and shift the valve 8 to a position in which the supply of fuel to the engine cylinders is prevented and the engine is stopped. Upon stopping of the engine the release of the operating means for the control arm 32 by the operator permits the spring 64 to shift the control arm 32 in a clockwise direction causing the spring 6 to be placed under the required pressure to hold the valve 8 in position for the idling operation of the engine when the engine is again started.

During the movement of the handle counter-clockwise, when the idling position is reached the movement of the rocker 34 stops so that the braking action of the friction disk adjacent the arm 12a stops. The lesser friction of the disks intermediate the rocker 34 and the handle 32 thereafter replaces it. When the spring 64 returns the handle to the idling position from the stop position, the friction on the handle is that of the intermediate disks rather than of the disk adjacent the arm 12a, until the idling position is reached, but when the idling position is reached the greater friction of the disk against the arm 12a comes into play immediately, so that the handle 32 is held at the idling position and retains its setting at any position in a clockwise direction from the idling position. Under certain circumstances, the friction disk adjacent the spring plate may be replaced by a disk of non-friction material so that the friction on the control handle during the period of spring action will be less.

While the invention has been shown and described in connection with a fuel pump for internal combustion engines it is to be understood that the invention is not limited to such application but may be applied in other arrangements.

What is claimed is:

1. In a speed controller for internal combustion engines, a shaft by rotation of which the governed speed of the engine is selected, an operating arm by which said shaft is rotated, a rocker, a spring connecting said rocker and operating arm for moving said rocker with said arm and a stop limiting movement of said rocker to less than the movement of said arm, said spring being placed under increased stress by movement of said arm in the same direction after movement of said rocker is stopped.

2. In a speed controller for internal combustion engines, a shaft by rotation of which the governed speed of the engine is selected, an operating arm by which said shaft is rotated, a rocker, a spring connecting said rocker and operating arm for moving said rocker with said arm and a stop limiting movement of said rocker to less than the movement of said arm, said spring serving to return said arm when released after further movement of said arm following the engagement of said rocker with said stop.

3. In a speed controller, a speed responsive unit, a spring controlling the action of said unit, an adjustment member for said spring, friction means for maintaining said member in position when within a certain range of its movement, and spring means returning said member to a position within said range when moved to a position outside said range.

4. In a speed controller for internal combustion engines, a valve controlling the fuel supply of the engine, a spring for controlling the position of said valve, an adjustment member for said spring, said adjustment member having a range of positions including a range of governed speeds of the engine when unloaded, spring means for moving said member in the direction for increased engine speed to one of said governed speed positions from a position at one side of said one governed speed position, friction means for maintaining said member in said position when so moved, and adjustable means for selecting said position.

5. In a speed controller for internal combustion engines, a shaft by rotation of which the governed speed of the engine is selected, an operating arm by which said shaft is rotated, a plurality of friction means opposing movement of said shaft, one of said friction means being inoperative during a portion of the movement of said shaft, and spring means opposing movement of said shaft in one direction when said one friction means is inoperative.

6. In combination, a pivotally mounted control handle, means frictionally opposing movement of said handle in both directions during a portion of its movement and opposing movement of said handle to a less degree during the remainder of its movement and a spring opposing movement of said handle in one direction during the portion of movement of less frictional opposition, said spring returning said handle through the portion of the movement opposed by said spring.

7. In combination, a valve for controlling the supply of fuel to an internal combustion engine, controlling means for said valve comprising a shaft and operating means for said shaft, and a plurality of friction means opposing movement of said shaft between shaft positions for idling and full power of the engine, one of said friction means being inoperative between shaft positions for idling and stopping the engine.

8. In combination, a valve for controlling the supply of fuel to an internal combustion engine, controlling means for said valve comprising a shaft and operating means for said shaft, a plurality of friction means opposing movement of said shaft between shaft positions for idling and full power of the engine, one of said friction means being inoperative between shaft positions for idling and stopping the engine, and spring means opposing movement of said shaft between

shaft positions for idling and stopping the engine.

9. In combination, a valve for controlling the supply of fuel to an internal combustion engine, controlling means for said valve comprising a shaft and operating means for said shaft, friction means opposing movement of said shaft between shaft positions for idling and full power of the engine, and spring means opposing movement of said shaft between shaft positions for idling and stopping the engine, said spring means serving to return said shaft from the engine stopping position to the idling position.

10. In combination, a valve, speed responsive means for operating said valve, a spring opposing operation of said valve by said means, means for varying the position of said valve by varying the reaction of said spring, means for providing for an additional operation of said valve while holding constant the reaction of said spring and a second spring opposing operation of said valve by said last named means.

11. In combination, a valve, controlling means for said valve comprising a shaft, an operating arm fixed on said shaft, a rocker rotatable about said shaft, means on said arm engaging with said rocker to move said rocker with said arm in one direction and a spring connecting said rocker and arm for moving said rocker with said arm in the opposite direction.

12. In combination, a valve, controlling means for said valve comprising a shaft, an operating arm fixed on said shaft, a rocker rotatable about said shaft, means on said arm engaging with said rocker to move said rocker with said arm in one direction, a spring connecting said rocker and arm for moving said rocker with said arm in the opposite direction and a stop limiting movement of said rocker to less than the movement of said arm.

13. In combination, a valve, controlling means for said valve comprising a shaft, an operating arm fixed on said shaft, a rocker rotatable about said shaft, means on said arm engaging with said rocker to move said rocker with said arm in one direction, a spring connecting said rocker and arm for moving said rocker with said arm in the opposite direction and a stop limiting movement of said rocker to less than the movement of said arm, said spring being placed under increased stress by movement of said arm after movement of said rocker is stopped.

14. In combination, a valve, controlling means for said valve comprising a shaft, an operating arm fixed on said shaft, a rocker rotatable about said shaft, means on said arm engaging with said rocker to move said rocker with said arm in one direction, a spring connecting said rocker and arm for moving said rocker with said arm in the opposite direction and a stop limiting movement of said rocker to less than the movement of said arm, said spring being placed under increased stress by movement of said arm after movement of said rocker is stopped and serving to return said arm to its position when movement of said rocker is stopped.

15. In combination, a valve, controlling means for said valve comprising an operating arm, a rocker, means on said arm engaging with said rocker to move said rocker with said arm in one direction, a spring connecting said rocker and arm for moving said rocker with said arm in the opposite direction, friction means and a spring plate engaging said arm and rocker with said friction means.

16. In combination, a valve, a spring for operating said valve, a member engaging said spring, a shaft for operating said member to vary the pressure of said spring on said valve, means for operating said shaft and a stem secured to said valve, said shaft operating said member to engage said stem and operate said valve.

17. In combination, a valve, speed responsive means for operating said valve, a spring opposing operation of said valve by said speed responsive means, a member engaging said spring, a shaft for operating said member to vary the pressure of said spring on said valve, means for operating said shaft, a stem secured to said valve, said shaft operating said member to engage said stem and operate said valve, and a second spring opposing operation of said stem by said member.

18. In combination, a valve for controlling the supply of fuel to the engine cylinders, speed responsive means for operating said valve to control the engine speed, a spring opposing operation of said valve by said speed responsive means, means to vary the action of said spring on said valve to vary the engine speed, means to positively shift said valve to a position for stopping the engine and means yieldingly opposing movement of said valve to engine stopping position.

19. In combination, a valve for controlling the supply of fuel to the engine cylinders, speed responsive means for operating said valve to control the engine speed, a spring opposing operation of said valve by said speed responsive means, means to vary the action of said spring on said valve to vary the engine speed between idling and full speeds, means to positively shift said valve from a position for idling to a position for stopping the engine and means yieldingly opposing movement of said valve from the idling position to the engine stopping position.

20. In combination, a valve for controlling the supply of fuel to the engine cylinders, speed responsive means for operating said valve to control the engine speed, a spring opposing operation of said valve by said speed responsive means, means to vary the action of said spring on said valve to vary the engine speed between idling and full speeds, means to positively shift said valve from a position for idling to a position for stopping the engine and means yieldingly opposing movement of said valve from the idling position to the engine stopping position, said yielding means serving to return said valve from the engine stopping position to the idling position.

21. In combination, a valve for controlling the supply of fuel to an internal combustion engine, speed responsive means for operating said valve, a spring opposing operation of said valve by said speed responsive means, means for controlling the pressure of said spring comprising a shaft and an arm for operating said shaft, a stop for limiting movement of said arm in a direction to increase the pressure of the spring, means for adjusting the pressure of said spring with said arm in engagement with said stop and means for limiting the movement of said arm to less than its full movement.

22. In combination, a valve for controlling the supply of fuel to an internal combustion engine, a casing enclosing said valve, speed responsive means for operating said valve, a spring opposing operation of said valve by said speed responsive means, means for controlling the pressure of said spring comprising a shaft projecting from said casing and an arm outside said casing for operating said shaft, a stop engaging said

arm to limit its movement in a direction to increase the pressure of the spring, means within said casing for adjusting the pressure of said spring with said arm in engagement with said stop and adjustable means in said stop for adjusting the limit of movement of said arm.

23. In combination, a valve for controlling the supply of fuel to an internal combustion engine to control the engine speed, a casing enclosing said valve, speed responsive means for operating said valve, a spring opposing operation of said valve by said speed responsive means, means for controlling the pressure of said spring to vary the engine speed, comprising a shaft projecting from said casing and an arm outside said casing for operating said shaft, a stop engaging said arm to limit its movement in a direction to increase the speed of the engine, means within said casing for adjusting the pressure of said spring for the maximum governed speed of the engine with said arm in contact with said stop, and adjustable means in said stop for limiting movement of said arm to a position in which the spring pressure is less than sufficient to maintain maximum governed speed of the engine.

24. In combination, a valve having a stem, a speed responsive device for operating said valve, a spring opposing operation of said valve, a sleeve movable on said stem and engaging said spring, a shaft for operating said sleeve to adjust the pressure of said spring and means on said stem engaging said sleeve to hold said spring under an initial pressure, said sleeve being operable by said shaft to positively operate said valve.

25. In combination, a valve, a speed responsive device for operating said valve, a spring opposing operation of said valve, a sleeve engaging said spring, a shaft for operating said sleeve to adjust the pressure of said spring and a valve stem secured to said valve, said sleeve engaging said stem to operate said valve.

26. In combination, a valve, speed responsive means for operating said valve, a spring opposing operation of said valve, a sleeve engaging said spring, a second sleeve in which said first sleeve is mounted and a shaft having a rack and pinion connection with said second sleeve, said sleeves being relatively adjustable for adjusting the maximum pressure applied to said spring by operation of said handle.

27. In combination, a valve, speed responsive means for operating said valve, a spring opposing operation of said valve, a sleeve engaging said spring, a second sleeve in which said first sleeve is mounted, a shaft operatively connected to said second sleeve, a valve stem extending through said first sleeve and spring and secured to said valve, and means on said valve stem engaging said second sleeve to hold said spring under initial stress between said valve and said first sleeve.

28. In a speed controller, a valve, speed responsive means for operating said valve, spring means for controlling the operation of said valve by said speed responsive means, a member movable for adjusting the reaction of said spring means corresponding to a given position of said valve and so adjusting the controlled speed, a second member movable with respect to said first member, a second spring means holding said second member in fixed relation to said first member during a portion of the movement of said first member and a stop limiting movement of said second member with said first member in the direction for speed reduction.

29. In combination, a valve, speed responsive means for operating said valve, spring means for controlling the operation of said valve by said speed responsive means, a member movable for adjusting the reaction of said spring means corresponding to a given position of said valve, a second member movable with respect to said first member, a second spring means holding said second member in fixed relation to said first member during a portion of the movement of said first member, a stop limiting movement of said second member with said first member in one direction, further movement of said first member after movement of said second member is stopped positively operating said valve.

30. In combination, a valve, speed responsive means for operating said valve, spring means for controlling the operation of said speed responsive means, a member movable to vary the reaction of said spring means for any given position of said valve and yieldable stop means for said member arranged to oppose movement of said member in one direction beyond a predetermined point, said stop means comprising resilient means attached to said member, a fixed abutment and an abutment connected to said resilient means, said abutments being held engaged by said resilient means when said stop means opposes movement of said member and being separated by movement of said member in the opposite direction.

31. In combination, a valve, speed responsive means for operating said valve, spring means for controlling the operation of said speed responsive means, a member movable to vary the reaction of said spring means for any given position of said valve and yieldable stop means for said member arranged to oppose movement of said member in one direction beyond a predetermined point, said stop means comprising resilient means attached to said member, a fixed abutment and an abutment connected to said resilient means, said abutments being held engaged by said resilient means when said stop means opposes movement of said member, movement of said member when opposed by said stop means serving to positively move said valve and movement of said member in the opposite direction serving to separate said abutments.

WARNER T. TABB.