Nov. 25, 1952 J. H. HOLLOWAY 2,619,075

GOVERNOR HAVING SPRING LOAD AND MEANS FOR ADJUSTABLY CONTROLLING SPRING SCALE

Filed Feb. 8, 1945 2 SHEETS—SHEET 1

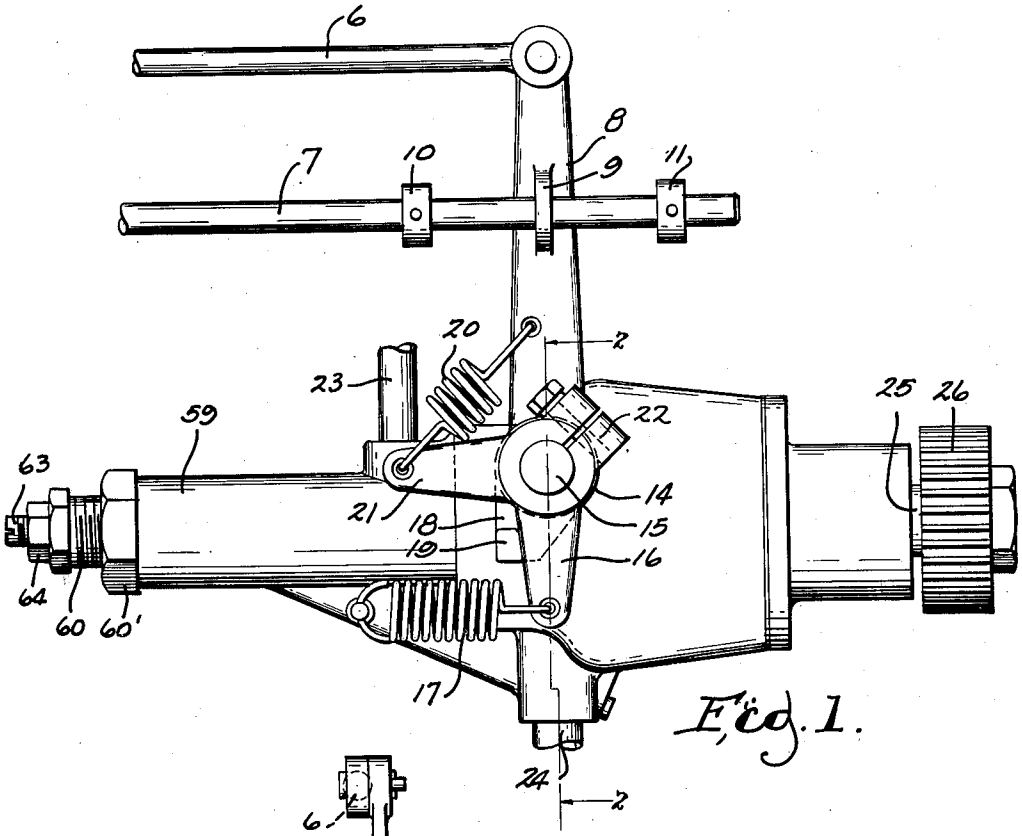

Fig. 1.

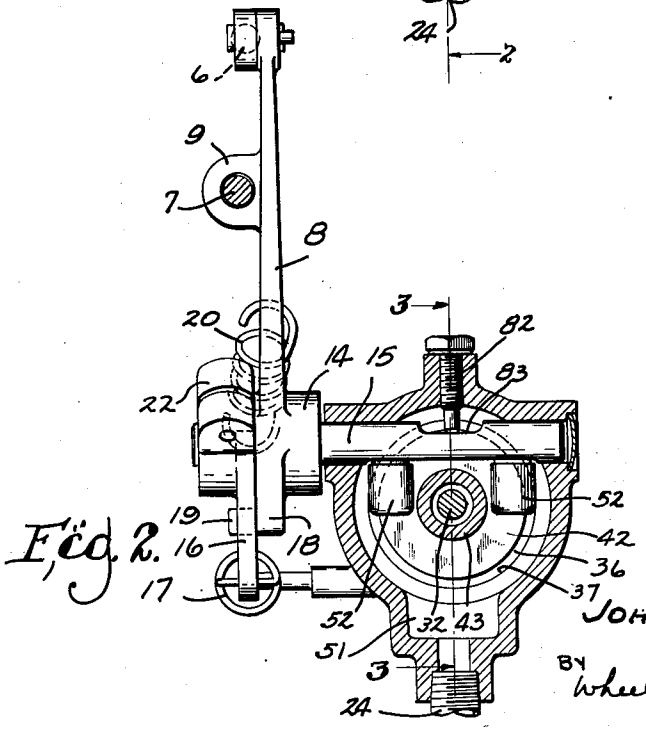

Fig. 2.

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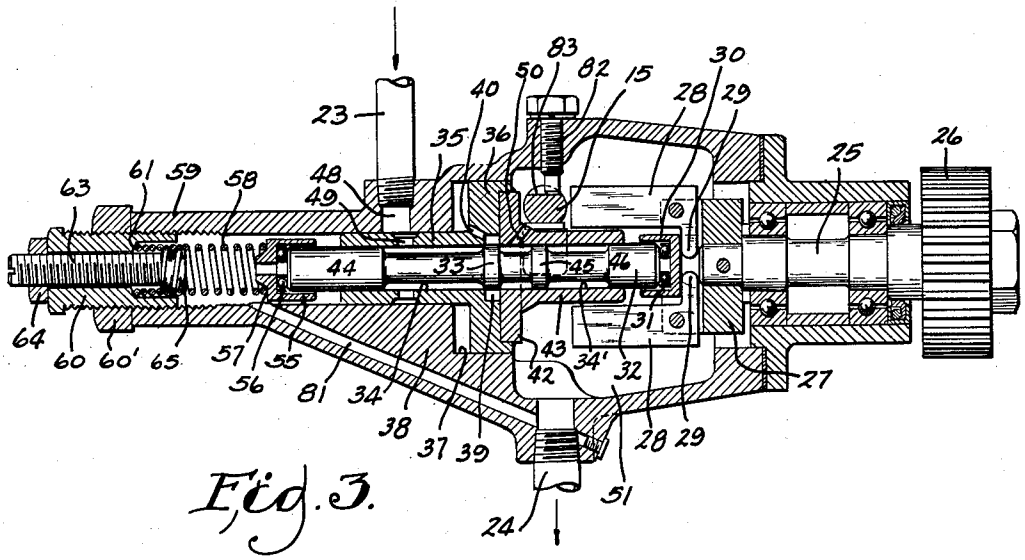

Fig. 3.

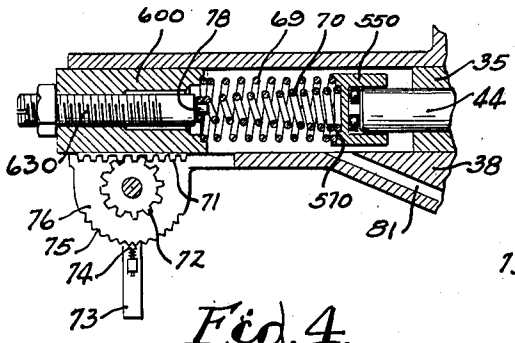

Fig. 4.

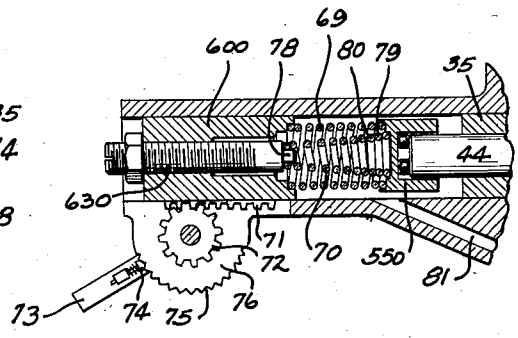

Fig. 5.

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GOVERNOR HAVING SPRING LOAD AND MEANS FOR ADJUSTABLY CONTROLLING SPRING SCALE

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Application February 8, 1945, Serial No. 576,823

20 Claims. (Cl. 121—42)

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This invention relates to improvements in governor mechanisms.

The present application is a companion to my application of the same title, Serial No. 439,091, filed April 15, 1942, patented April 17, 1945, No. 2,373,684.

It is a primary object of the invention to improve governor mechanisms of the type shown in the above identified companion application by making such mechanisms more compact, more economically manufactured and more readily controlled.

Specifically, my objects are the provision in a governor mechanism of simplified means for controlling adjustably the scale of spring operation to prevent hunt; to provide novel and improved means by which the spring may be controlled not only as to its scale of response but also as to its pressure whereby the speed to which the governor is set may be subject to instant manual adjustment; to provide a novel and improved piston structure to facilitate manufacture; and to provide novel and improved external controls for the regulating or supplementing of governor operation on the throttle responsive thereto.

Other objects will be apparent to those skilled in the art upon analysis of the following disclosure of my invention.

In the drawings:

Fig. 1 is a side elevational view of a governor structure embodying my invention.

Fig. 2 is a view taken in cross section on the line 2—2 of Fig. 1.

Fig. 3 is a view taken in longitudinal section through the governor in the axial plane indicated at 3—3 in Fig. 2.

Fig. 4 is a fragmentary detail view similar in section to Fig. 3 and showing a modified embodiment of my invention.

Fig. 5 is a view similar to Fig. 4 showing the parts in a different position of adjustment.

Like parts are designated by the same reference characters throughout the several views.

In general, the governor as herein disclosed corresponds to that disclosed in the corresponding application above identified.

The link 6 is a speed control link being connected, for example, to the throttle valve of a carburetor. The link 7 is a manually operable link for modifying or overcoming governor action momentarily when some departure from a set speed is required. To this end the lever 8 to which the link 6 is connected is provided with an apertured boss 9 through which the link 7 is reciprocable, the link 7 being provided with

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adjustable collars at 10 and 11, whereby, at each end of a predetermined range of relative movement, one or the other of the collars 10 or 11 may be engaged with boss 9 to transmit movement from the manually operable link 7 to the speed control link 6.

The lever 8 has a central hub portion 14 loosely mounted on the rock shaft 15, which provides a fulcrum for the lever. The bell crank 16 clamped to the rock shaft is subject to the bias of a tension spring 17 which tends to oscillate the bell crank clockwise as viewed in Fig. 1. Lever 8 has an extension 18 below its hub 14 and such extension has a lug 19 laterally engaged by the downwardly depending arm of bell crank 16. Such engagement is yieldably maintained by a tension spring 20 connected between the horizontally extending arm 21 of the bell crank and the upwardly extending portion of lever 8. The tension of spring 20 is such that the lever 8 and bell crank 16 will normally move as a unit with each other and with shaft 15 to which the bell crank is clamped at 22. However, by manipulating link 7 to the right, as viewed in Fig. 1, the collar 10 may be engaged with the boss 9 to oscillate lever 8 clockwise independently of bell crank 16, the relative movement between the bell crank and lever being opposed by the bias of spring 20. If the link 7 is manipulated to the left, as viewed in Fig. 1, sufficiently to engage the collar 11 with boss 9, the resulting movement of lever 8 counterclockwise will force the bell crank 16 and shaft 15 likewise to oscillate in a counterclockwise direction.

The speed controlling connection of link 6 will be such that a movement of the link 6 to the right and a corresponding oscillation of lever 8, as viewed in Fig. 1, will result in retarding the speed of the prime mover controlled by link 6, while the movement of link 6 to the left and a corresponding counterclockwise oscillation of the lever 8 will accelerate the prime mover controlled by link 6.

As in the device disclosed in my companion application aforesaid, it is contemplated that the governor include a servomotor operated by a liquid supply under pressure through the liquid supply pipe 23, used liquid being returned through the discharge pipe 24. Usually these pipes will connect to a pump driven by the prime mover which is controlled as to its speed by the governor and manually controlled link herein disclosed.

The governor shaft 25 (Figure 3) derives its motion through a gear or the like at 26. Fixed to the shaft is a block 27 to which the governor

weights 28 are pivoted for movement in a plane diametrically respecting the shaft 25. Such weights have arms at 28 acting through the cup-shaped member 30 and thrust bearing 31 upon the stem 32 of the servomotor valve 33. This valve is closely fitted in a bore 34 in the tubular stem 35 of piston 36. The piston 36, in turn, is closely fitted into the cylinder 37 which comprises a bore in the casing 38. The annular passage 39 in piston 36 communicates by means of ducts 40 with the cylinder 37. The valve 33 corresponds substantially exactly in width with channel 39 and normally registers therewith. The channel 39 may conveniently be formed as a counterbore in the face of the piston 36 subsequently closed by the disk 42 which may be welded to the piston and provided with a tubular stem portion 43 constituting an extension of the piston. The stem portion 43 is in axial alignment with the stem portion 35 and has a corresponding bore 34'. The valve stem 32 has bearing portions 44, 45 and 46 guided in the respective bores 34, 34' of piston stems 35, 43.

The pressure pipe 23 communicates through a casing orifice 48 and an orifice 49 in piston stem 35 with bore 34 at a point between the bearing surface 44 and the valve 33. Upon any relative displacement resulting in relative movement of valve 33 to the right with respect to the piston 36, as viewed in Fig. 3, oil under pressure will pass from pipe 23 into the channel 39 and thence through ducts 40 to the cylinder 37, resulting in an increased pressure on piston 36 in a direction to move the piston to the right until its channel 39 is again registered with valve 33.

Any relative displacement of valve 33 which results in its relative movement to the left respect piston 36, as viewed in Fig. 3, will result in allowing oil to escape from cylinder 37 through ducts 40 to that portion of bore 34' lying between the valve 33 and the bearing member 45 from which the ducts 50 open outwardly into the casing chamber 51 from which leads the discharge pipe 24. The relief of pressure against the face of piston 36 which lies at the left in Fig. 3 will allow the piston to move to the left until the channel 39 of the piston is again registered with valve 33 to cut off the escape of oil from the cylinder.

The closure disk 42, welded or otherwise secured to the face of the piston which lies at the right in Fig. 3, serves as a bearing to receive the thrust of fingers 52 (Fig. 2) projecting downwardly from the rock shaft 15. Thus, the bias of tension spring 17 exerted on the bell crank 16 is exerted through the rock shaft 15 and fingers 52 upon the piston in a direction to urge it to the left as viewed in Fig. 3. Such bias is opposed to the pressure of oil communicated through the pressure supply line 23 to the cylinder 37 from time to time as already described.

The valve 33 is also subject to bias and it is important that the bias acting on valve 33 should be adjustable not only in degree but also with respect to the scale of the spring which furnishes such bias.

The end of bearing portion 44 on the valve stem 32 is enclosed within a cup-shaped member 55 spaced by anti-friction bearing means 56 from the end of member 44 and provided at 57 with a seat for the compression spring 58. A tubular extension 59 of the governor casing 38 houses the spring 58 and supports the means for its control and adjustment. Screw threaded into the end of the tubular extension 59 is the tubular plug 60 which may be locked in position by a lock nut 60'. The spring 58 is seated in a cavity 61 in the tubular plug 60. Slidably adjustable through the plug 60 is a screw 63 which is adjusted to desired position by nut 64. Screw 63 carries a head portion 65 having helical threads adapted to engage successive coils of spring 58. By rotating the screw 63 within the tubular plug 60, the threaded head 65 may be made to engage a selected coil or coils of spring 58, and the screw is then drawn by nut 64 to pull the engaged coils into cavity 61 whereby they are immobilized. This provides means whereby the scale of spring 58 may be adjusted so that within the range of speeds for which the pressure of spring 58 is set by the tubular plug 60 the governor will not vibrate or hunt.

A modified arrangement for preventing hunt while affording additional freedom of control of the speed setting is illustrated in Figs. 4 and 5.

In this construction the thrust bearing cap 550 is so formed at 570 as to provide a dual spring seat for the helical spring 69 and the conical spring 70 respectively. The helical spring seats directly upon the slide 600 which is used in lieu of the tubular plug 60 (Fig. 3). Fastened to this slide are rack teeth 71 engaged by a pinion 72 manually rotatable by means of a lever 73. A friction detent pawl 74 carried by the lever 73 yieldably engages in the notches 75 of a segment 76 mounted on the casing whereby to hold the lever releasably in any position to which it may be manually adjusted for moving the slide 600 inwardly or outwardly in the tubular extension 59.

The conical spring 70 is provided at its smaller end with a pin 78 provided for seating it on the end of the adjusting set screw 630 which, with its lock nut 64, is used in lieu of set screw 63 of Fig. 3.

A helical spiral spring, such as the conical spring 70, is inherently of such nature that as compression thereon is increased (the flexibility of its larger diameter coils begin in excess of the flexibility of its coils of smaller diameter) the larger coils will progressively engage each other and thus cease to function resiliently. This automatically changes the scale of such a spring, as is shown in Fig. 5, where the coils 79 and 80 are out of action due to mutual contact.

It will be observed that, by reason of the construction described, the change of scale is produced automatically as the compression of the two springs 69 and 70 is varied by moving the slide 600 inwardly and outwardly through the operation of the lever 73. However, the precise point in the movement of the slide at which a given change of scale is produced may be varied by adjusting the screw 630.

In all embodiments of the invention it is preferred to provide a drain duct 81 leading from the outer end of the tubular casing extension 59 to the discharge outlet at 24 so that any of the pressure oil which may leak past the bearing member 44 will be carried off and not allowed to accumulate.

In operation, the governer will be set for a predetermined speed of operation of the prime mover controlled thereby. In the construction shown in Figs. 1 to 3, the setting must be made with a wrench and is intended to remain comparatively constant. In the construction shown in Figs. 4 and 5, the setting may be made manually and with the greatest facility by simply adjusting the lever 73.

The drawing shows the governor weights in their idle or inoperative position to which they are adjusted by the compression of spring 58 in Fig. 3 and the compression of springs 69 and 70 in Fig. 4. When the governor weights are centrifugally thrown outwardly upon reaching a speed sufficient to overcome the compression of the respective springs aforesaid, the valve 33 will be moved to the left whereby fluid pressure will be exhausted from the face of the piston 36 and the piston will likewise be moved to the left under the tension of the external spring 17, acting through the bell crank 16, rock shaft 15 and the fingers 52. The initial position of the rock shaft is determined by the set screw 82 acting on the flat 83 of the rock shaft but wholly at one side of the center line to leave the shaft free to oscillate in a clockwise direction from a position in which it is viewed in Fig. 3.

The resulting clockwise oscillation of the rock shaft 15 is communicated through lug 19 to lever 8, thereby causing the speed control link 6 to move to the right in a decelerating direction, as viewed in Fig. 1. If the speed falls below the predetermined value for which the springs 58 or 69, 70 are adjusted, the centripetal movement of the weights 28 will allow the bias springs acting on the valve stem to move the valve 33 to the right, thereby admitting pressure fluid to the face of piston 36 and causing such piston to move likewise to the right, until its channel 39 is again registered with the valve 33. Such movement is effected against the bias of external spring 17 and is communicated through the rock shaft 15, bell crank 16 and tension spring 20 to the lever 8 which is thereupon moved counterclockwise to reciprocate the speed control link 6 to the left in an accelerating direction, as viewed in Fig. 1.

In both constructions means is provided for changing the scale of the springs 58 or 69, 70 to avoid any possible hunting at the speeds for which the governor is set to respond.

It is also a feature of the device that for emergency purposes it is always possible to take the regulation of the speed control member 6 away from the governor by means of the manually operable link 7. When this link is moved to the right sufficiently to engage collar 10 with the boss 9 to its continued movement, if there were a positive connection between the lever 8 and the rock shaft 15, would require the exercise of considerable force to move the piston 36 against the oil pressure supply through the pipe 23. Accordingly, lost motion is provided through the spring 20 which permits the lever 8 to move independently of the bell crank 16, lug 19 moving away from the bell crank as the spring 20 yields. Thus, manual control is effected without disturbing the setting of the governor.

In the opposite direction of movement, where acceleration is desired, the link 7 is moved to the left until the collar 11 engages the boss 9. This movement is communicated through lever 8 directly to the speed control link 6. While the bell crank 16 is constrained to oscillate with the lever against the bias of spring 17, the governor setting remains unaffected, since the fingers 52 simply move away from the face of the piston, leaving the piston in the position predetermined by the governor weights.

I claim:

1. In a governor which comprises a servomotor having a valve, a piston and speed responsive means for moving the valve, the combination with such vale, of a spring acting thereon in opposition to said speed responsive means and provided with means for varying the scale of such spring as distinguished from its pressure, said scale varying means comprising a screw threaded to a coil of the spring and means for adjusting the screw axially of the spring for mutually contacting successive coils engaged by the screw whereby to immobilize them.

2. In a governor which comprises a servomotor having a valve, a piston and speed responsive means for moving the valve, the combination with such valve, of a spring acting thereon in opposition to said speed responsive means and provided with means for varying the scale of such spring as distinguished from its pressure, said scale varying means comprising a spring seat member provided with a cavity with a wall to which the coils of the spring are substantially fitted, a rod slidable in said member and having a threaded portion engaged with a coil adjacent said wall whereby the rotation of said rod will engage successive coils of the spring for the immobilization thereof respecting said wall.

3. In a governor of the type having a servomotor provided with a piston, a valve, and speed responsive means for moving the valve to control the position of the piston, the combination with such a valve, of spring means biasing the valve in opposition to said speed responsive means, and means providing two separate adjustments for said spring means, one of said adjustments comprising means for regulating its bias, and the other of said adjustments comprising primarily means for adjusting its scale, both of said adjustments being effective upon the same end of said spring means.

4. The device of claim 3, in which the spring means comprises inner and outer springs of different characteristics and the means providing two separate adjustments includes a pair of spring seat elements respectively providing seats for the respective springs, one of said elements being adjustable with respect to the other for controlling relative scale and shifting the relative bias to which the respective springs are subject, the other element being provided with means for its adjustment for bodily moving both of said elements concurrently for variation in the bias exerted collectively by said springs.

5. In a device of the character described, the combination with a part requiring bias and a stationary part providing a guideway which said part requiring bias is movable, inner and outer springs of different characteristics seated against the part requiring bias, separate seating elements against which the other ends of the respective springs are seated, means mounted on said stationary part for adjusting one of said elements with respect to the stationary part, and means mounted on said one element for adjusting the other of said elements with respect to said one element, the adjustment of said one element effecting adjustment of the bias of both of the springs concurrently, and the adjustment of the other element effecting adjustment of the bias of only one of said springs, whereby to effect a relative transfer of load as between said springs and to adjust the scale of the bias which is the combined effect of said springs.

6. The device of claim 5, in which the spring seated against the scale adjusting element is of

conical form and the other spring is of helical form.

7. In a device of the character described, the combination with a part requiring bias and a stationary part with respect to which the first part is movable, inner and outer springs of different characteristics seated against the part requiring bias, separate seating elements against which the other ends of the respective springs are seated, means for adjusting one of said elements with respect to the stationary part, and means for adjusting the other of said elements with respect to said one element, the adjustment of said one element effecting adjustment of the bias of both of the springs concurrently, and the adjustment of the other element effecting adjustment of the bias of only one of said springs, whereby to effect a relative transfer of load as between said springs and to adjust the scale of the bias which is the combined effect of said springs, one of said springs outside of the other being of helical form, said other spring being of conical form, the element against which the helical spring seats comprising a manually operable reciprocable member, and the element providing a seat for the conical spring comprising a screw threaded in said member for independent adjustment therein in the direction of its reciprocation.

8. In a governor, the combination with means movable responsive to speed variation, of a rock shaft provided with fingers normally engaged with said means for the oscillation of the rock shaft in accordance with the movement of said means, a bell crank on the rock shaft provided with a spring biasing it in a direction to maintain said fingers in operative contact with said means, a lever pivoted coaxially with the rock shaft and having a lug engaged by the bell crank in the direction in which the bell crank is biased by the spring, and a second spring connected between the bell crank and the lever and subjecting the lever to bias in an opposite direction whereby to maintain its lug normally engaged with the bell crank, together with speed controlling means connected to the lever.

9. The combination set forth in claim 8, in further combination with a manually operable control member for operating the speed control means independently of the governor, said control member having lost motion connections whereby said manually operable control member is normally inoperative throughout the range of response of the speed control member to the governor, the said springs permitting the speed control member to be operated by the manually operable member regardless of the governor when the lost motion connections are effective.

10. The device of claim 8, in which the lever is provided with an apertured boss, and a manually operable link extending through the aperture of the boss and provided with collars normally spaced from the boss and engageable therewith only after a predetermined motion of said link, the said springs being adapted to permit said link to operate the speed control member regardless of the governor when either of the respective collars engages the boss.

11. In a governor, the combination with a governor shaft and centrifugally responsive means mounted thereon, of a servomotor cylinder substantially coaxial with the shaft, a servomotor piston reciprocable in the cylinder and provided with a bleed duct and an annular cavity to which said duct affords communication from the face of the piston, bearing sleeves connected with the piston, a valve normally registered with the cavity and movable in both directions therefrom and provided with bearing means guided in said sleeves, means for supplying a liquid under pressure at one side of the valve and means for exhausting liquid from the other side thereof, whereby displacement of the valve respecting the annular cavity will admit or release oil from the piston face through the bearing means, means for transmitting to said valve pressure developed by said centrifugally responsive means, spring means substantially coaxial with the valve acting on the valve in opposition to pressure developed by said centrifugally responsive means, means for adjusting the bias of the spring means, means separate from said adjusting means for adjusting the scale of response of the spring means whereby to preclude hunting in the range through which said governor is set to operate by adjustment of pressure on the spring means, and means at the opposite side of the piston from the cylinder for transmitting motion from the piston for speed control purposes.

12. The governor described in claim 11, in which such motion transmitting means includes a rock shaft having fingers in operative engagement with the piston and oscillatory away therefrom, a bell crank on the rock shaft, a spring biasing the bell crank in a direction to oscillate the rock shaft and fingers into engagement with the piston, a lever mounted substantially coaxially with the rock shaft and provided with a lug engaged by the bell crank in the oscillation of the bell crank responsive to its bias, a spring connecting the bell crank with the lever and subjecting the lever to bias in a direction to hold its lug in engagement with the bell crank and a speed control link operatively connected with the lever.

13. The governor described in claim 11, in which such motion transmitting means includes a rock shaft having fingers in operative engagement with the piston and oscillatory away therefrom, a bell crank on the rock shaft, a spring biasing the bell crank in a direction to oscillate the rock shaft and fingers into engagement with the piston, a lever mounted substantially coaxially with the rock shaft and provided with a lug engaged by the bell crank in the oscillation of the bell crank responsive to its bias, a spring connecting the bell crank with the lever and subjecting the lever to bias in a direction to hold its lug in engagement with the bell crank and a speed control link operatively connected with the lever, together with manually operable lost motion connections for the operation of said link independently of said piston, the said springs and the lug affording connection between the bell crank and lever accommodating the movement of said link and lever independently of the piston.

14. In a governor of the type having a servomotor provided with a piston, a valve and speed responsive means for moving the valve to control the position of the piston, the combination with such a valve and a fixed support, of spring means biasing the valve in opposition to said speed responsive means, a tubular member axially adjustable respecting said support and comprising a spring seat, and an adjusting screw threaded within said tubular member and adjustable independently thereof and comprising means for adjusting the scale of response of said spring means, said tubular member comprising

means for regulating the bias of said spring means upon said valve.

15. The combination set forth in claim 14 in which the spring means comprises a helical compression spring engaging said seat and said valve.

16. The combination with a servomotor comprising a cylinder, a piston and a piston-controlling valve, of a casing connected with the cylinder and projecting axially therefrom, a tubular spring seat member adjustable axially in the casing, spring means acting upon said valve and comprising a compression spring confined between the valve and the spring seat member, and an adjusting screw threaded to said member and adjustable axially thereof independently of said member, said screw comprising means for adjusting the scale of said spring means and said member comprising means for adjusting the bias thereof.

17. The combination set forth in claim 16 in which said scale adjusting means constitutes a threaded head selectively adjustable for engagement with different convolutions of said compression spring.

18. The combination set forth in claim 16 in which said scale adjusting means constitutes a separate spring seat, said spring means including a supplemental conical spring engaging the spring seat of said screw and bearing upon said valve.

19. In a governor the combination with a governor shaft and centrifugally responsive means mounted thereon, of a servomotor comprising a valve operative in one direction by said means, and a cylinder controlled by said valve, compression spring means engaging said valve and acting thereon in opposition to said centrifugally responsive means, an adjustable seat for said spring means for varying the bias thereof, and means adjustable independently of said seat for varying the scale of said spring means, said scale adjusting means comprising means for forcing successive spring coils into mutual contact, whereby to immobilize them.

20. In a governor the combination with a governor shaft and centrifugally responsive means mounted thereon, of a shaft movable in response to the thrust of said centrifugally responsive means, spring means engaging the last mentioned shaft and acting thereon in opposition to said centrifugally responsive means, an adjustable seat for said spring means for varying the bias thereof, and means for urging successive coils of said spring into mutual contact, whereby to immobilize them to vary the scale of said spring means.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
978,026	Joenichen	Dec. 6, 1910
1,023,490	Beck et al.	Apr. 16, 1912
1,055,834	Tibbetts	Mar. 11, 1913
1,241,441	Pilcher	Sept. 25, 1917
1,488,107	Flanders	Mar. 25, 1924
1,604,545	Bragg	Oct. 26, 1926
1,627,761	Woolson	May 10, 1927
1,830,636	Bragg	Nov. 3, 1931
1,934,691	Baker	Nov. 14, 1933
2,002,315	Furgason	May 21, 1935
2,007,423	Davis	July 9, 1935
2,197,743	Crafts	Apr. 16, 1940
2,215,406	Paxman	Sept. 17, 1940
2,248,447	Wood	July 8, 1941
2,256,715	Kirschner	Sept. 23, 1941
2,259,693	Hogeman	Oct. 21, 1941
2,264,874	Day	Dec. 2, 1941
2,324,514	Kalin	July 20, 1943
2,338,761	Draper	Jan. 11, 1944
2,365,471	Ingres	Dec. 19, 1944
2,373,684	Holloway	Apr. 17, 1945
2,380,963	Greenman	Aug. 7, 1945

FOREIGN PATENTS

Number	Country	Date
39,400	France	Aug. 11, 1931
	(Second addition to No. 695,060)	
160,847	Switzerland	June 16, 1933