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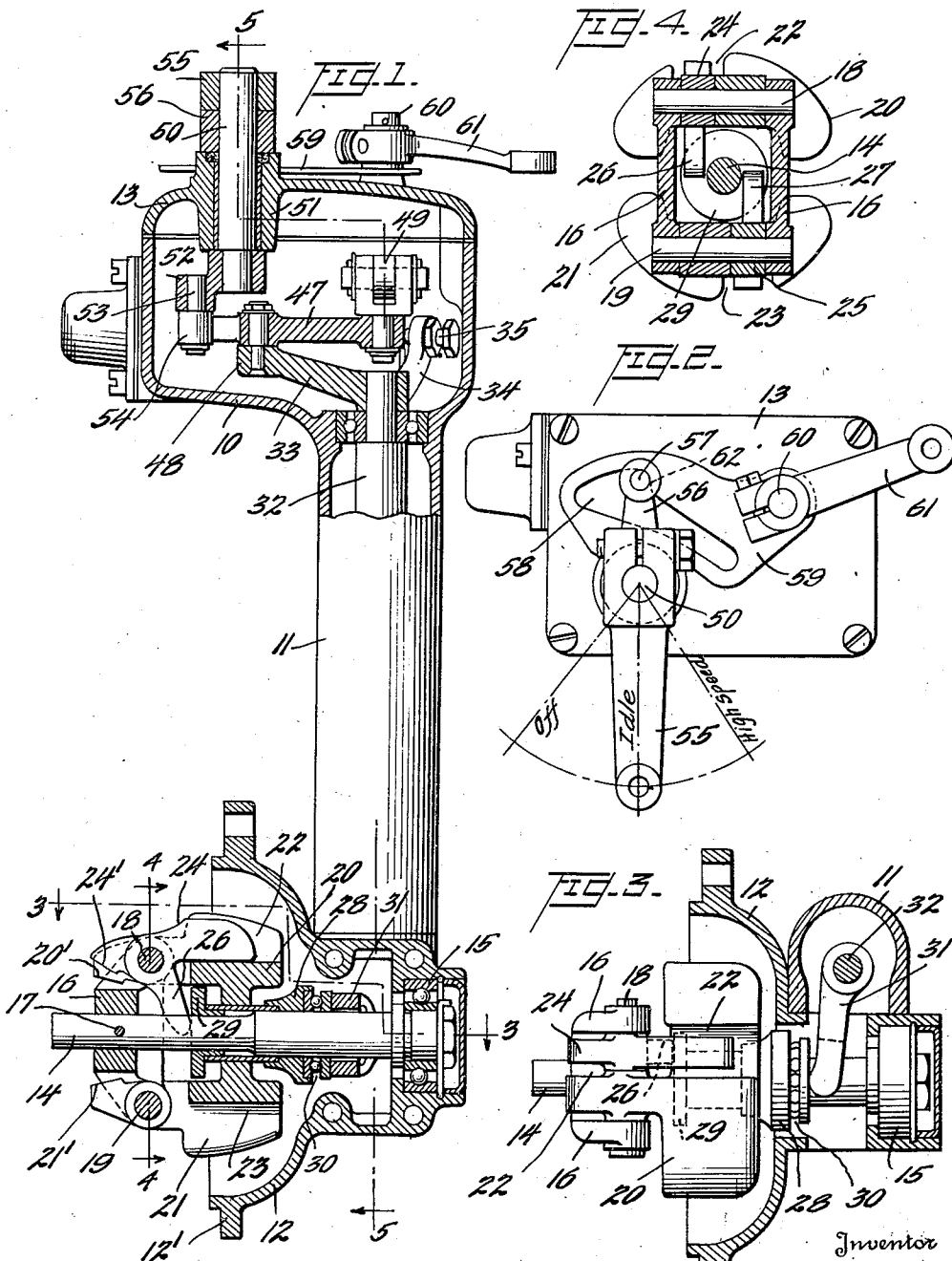
H. G. ADLER ET AL

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CENTRIFUGAL GOVERNOR

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2 Sheets-Sheet 1



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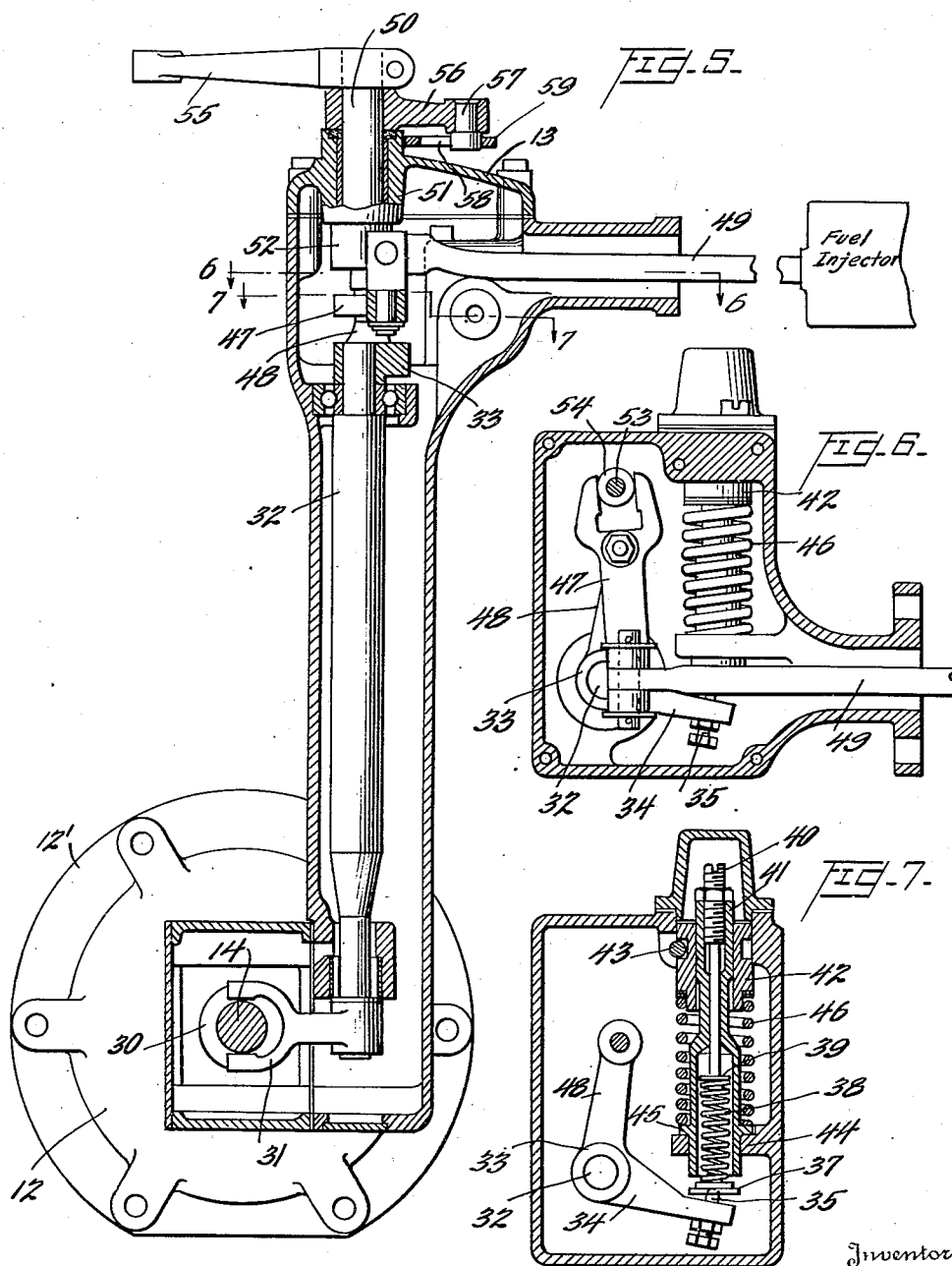
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CENTRIFUGAL GOVERNOR

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This invention relates to centrifugal governors, particularly for internal combustion engines, and more especially to governors intended for use in connection with Diesel engines for vehicles and other uses. However, certain features of the present invention are applicable to centrifugal governors for use with other types of engines, as will be understood from the following specification.

As is well understood, internal combustion engines of the Diesel type do not employ carburetted fuel but the fuel, in liquid form, is sprayed into the cylinders, usually by means of a pump or injector. It is a characteristic of such injectors that, when the fuel feed is set for maintaining the engine at idling speed, conditions do not remain stable, but, on the other hand, the engine tends either to increase its speed, or to stall. Therefore, when a governor is employed in connection with a Diesel engine, it is desirable to effect governing not only at the desired maximum speed but also at the desired idling speed of the engine, while permitting manual control of speeds between idling speed and the predetermined maximum speed. In this way, when it is desired to run the engine at idling speed, the fuel feed may be set at such a value as would ordinarily tend to run the engine at a speed slightly above the predetermined idling speed, but the engine will be prevented from running above the desired idling speed by reason of the governing effect provided at such speed.

Accordingly, it is the principal object of the present invention to provide a centrifugal governor capable of effecting governing at idling speed and also at a predetermined maximum speed, while permitting manual control of the engine at all intermediate speeds.

A further object of the present invention is the provision, in a centrifugal governor of the character described, of means for adjusting the idling speed at will, whether the engine is running or not, and to this end it is another object of this invention to provide adjusting means which will be readily accessible at all times.

As is well known, in order to shut down a Diesel engine it is necessary to shut off entirely the flow of fuel to the engine. Accordingly it is a further object of the present invention to provide means whereby the fuel control means may be entirely closed, irrespective of the condition of the governor, by a manual operation.

Another object is the provision of means whereby the fuel control means may be manually operated within the limits of the two governed

speeds, such manual operation, in one phase or condition of the mechanism, being confined to such limits, while in another phase or condition of the mechanism, the fuel control means is moved to full closed position and is secured in such position.

Another object of the invention is to provide a governor which will automatically close off the fuel when the engine is being driven by an external source of power at speeds in excess of the preset idle speed.

In addition, it is a general object of the present invention to provide a centrifugal governor of the character described, which is of a simple, economical and rugged construction.

Other and further objects, features and advantages of the present invention will be apparent to one skilled in the art from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a vertical sectional view of a governor constructed in accordance with the present invention;

Figure 2 is a plan view of the mechanism shown in the upper portion of Figure 1;

Figure 3 is a section on line 3—3 of Figure 1;

Figure 4 is a section on line 4—4 of Figure 1;

Figure 5 is a vertical section on line 5—5 of Figure 1;

Figure 6 is a horizontal section on line 6—6 of Figure 5; and

Figure 7 is a horizontal section on line 7—7 of Figure 5.

In order to facilitate an understanding of the invention, reference is made to the embodiment thereof shown in the accompanying drawings and detailed descriptive language is employed. It will nevertheless be understood that no limitation of the invention is thereby intended and that various changes and alterations are contemplated such as would ordinarily occur to one skilled in the art to which the invention relates.

Referring to Figure 1, it will be seen that the governor of the present invention is housed in a casing comprising, generally, a spring box 10, a tubular portion 11, and what for convenience may be called a flanged portion 12. Preferably the flanged portion 12 is cast separately, and is adapted to be bolted or otherwise suitably secured to the lower end of the tubular portion 11, for convenience in manufacturing, while the main body of the spring box 10 may be made integral with the tubular portion 11. The spring box 10 is provided with a removable cover 13, which may

be secured in place by bolts or other suitable means.

The governor mechanism comprises, generally, a rotating assembly which is partially housed in the flanged portion 12 of the casing, fuel feed controlling mechanism housed in the spring box 10, and a shaft connecting the rotating assembly with the fuel feed controlling mechanism, such shaft extending through the tubular portion 11 of the casing.

The rotating assembly, as best seen in Figures 1, 3 and 4, comprises a short shaft 14, the outer end of which is adapted to be secured to and driven by any suitable rotating shaft or other part of the engine to which the governor is applied, the flange 12' being bolted to the adjacent wall of the driving member housing. The shaft 14 is journaled in an anti-friction bearing 15 and carries a cross-head 16 which may be secured thereon in any suitable fashion, as by means of a pin 17. The respective ends of the cross-head 16 are bifurcated, the respective arms of each bifurcated end of the cross-head being apertured to receive pivot pins 18, 19.

A relatively heavy centrifugal member or fly weight 20 is pivoted on the pin 18 and a similar member 21 is pivoted on the pin 19. The members 20 and 21 are formed, as best seen in Figures 3 and 4, to provide axially extending recesses 22 and 23, respectively, in the outer surfaces thereof, such recesses being provided for the reception of relatively light centrifugal members or fly weights 24 and 25. The latter are also pivoted on the pins 18 and 19, respectively, and like the heavy members 20 and 21, are adapted to swing outwardly around the pivots 18 and 19 when the shaft 14 is rotated. The heavy members 20 and 21 are formed, at their upper ends, with a surface 20', 21', respectively (Figure 1), adapted to abut the carrier 16 after the said members have swung outwardly to a certain limited extent. The light members 24 and 25 are similarly formed, as seen at 24' (Figure 1), but it will be noted that the lighter members are permitted a greater extent of movement about their respective pivot pins than that permitted to the heavy members. As best seen in Figures 1 and 4, the lighter centrifugal members 24 and 25 are provided with inwardly extending cam lugs 26, 27.

The shaft 14 carries a riser sleeve 28, at the outer end of which is provided an annular flange 29 for engagement with the cam lugs 26 and 27. The inner end of the sleeve 28 is provided with an anti-friction thrust bearing 30, the inner race or ring of which is adapted to engage the yoke 31. The latter is secured on the end of the shaft 32, which extends upwardly through the tubular portion 11 of the casing and is suitably journaled therein.

A bell crank lever 33 is secured on the upper end of shaft 32, and is adapted to oscillate as the shaft 32 is turned by the action of the fly weights upon the riser sleeve 28 and yoke 31. One arm 34 of the bell crank lever 33 is provided with an adjusting screw 35 which is adapted to engage the spring plate 37, which latter carries a helical spring 38. The adjusting screw 35 provides means for coordinating the spring position with the weight position. The opposite end of the spring 38 abuts against a flange 39 formed on the end of an adjusting screw 40, the latter being threaded into the outer end of a spring guide 41. The latter is slidably mounted in a sleeve 42 which in turn is secured in a suitable

boss formed in the wall of the spring box 10, as by means of the pin 43. The spring box 10 is also formed with an inwardly extending bracket 44 for engaging and supporting the spring guide 41 by means of the annular flange 45 formed thereon adjacent its lower end. It will be noted that the lower portion of the spring guide 41 is of a diameter exceeding the internal diameter of the sleeve 42, the upward movement of the guide 41 within the sleeve 42 being thus limited in extent. A second helical spring 46 surrounds the spring guide 41 and is confined between the lower end of the sleeve 42 and the flange 45.

From the foregoing description it will be apparent that after the spring 38 has been compressed sufficiently to permit the spring plate 37 to engage the lower end of the guide 41, any further movement of the bell crank 33 will be resisted by the spring 46. As pointed out hereinafter, the spring 38 serves to provide the proper resistance for the initial outward movements of the centrifugal members, while the spring 46 provides the necessary resistance for the additional outward movement of the lighter centrifugal members 24 and 25 at high speeds.

By manipulating the adjusting screw 35, the springs and weights may be exactly coordinated. That is, the distance between the spring plate 37 and guide 41 may be adjusted so that the spring plate 37 will engage the lower end of guide 41 at the same instant when the low speed weights 20 and 21 reach their limit of outward movement. Thus it will be seen that the low speed weights will not be resisted by the high speed spring, while the low speed spring will not continue to be active after the high speed weights come into operation. This is a very important factor in the proper functioning of the governor.

A bifurcated lever 47 is pivoted at the distal end of the other arm 48 of the bell crank lever 33, the end of the lever 47 farthest from the pivot point being connected, by suitable universal means, to a fuel control rod 49. The latter extends to and controls the fuel feed means, which in the present instance is illustrated conventionally in Figure 5 as a fuel injector for a Diesel engine. The details of the injector or other fuel feed means form no part of the present invention and will not be described herein, but it will be understood that the flow of fuel to the cylinders is controlled in accordance with the movements of the rod 49.

A short spindle 50 is journaled in the boss 51 formed in the cover plate 13 and carries at its lower end a short crank 52. The latter is provided with a downwardly extending pin 53 on which is journaled a roller 54, the latter being adapted for insertion between the bifurcations of the lever 47, providing a movable fulcrum therefor. An arm 55 is secured upon the upper end of the spindle 50, and is adapted for connection to the accelerator pedal or other manual control means employed in connection with the engine. A short arm 56 is secured on the spindle 50 beneath the arm 55, and is provided at its end with a downwardly extending pin 57. The latter extends within a slot 58 formed in the plate 59 (Figure 2), secured on a spindle 60 which, like the spindle 50, is journaled in a boss formed in the cover plate 13. An arm 61, secured on the upper end of the spindle 60, is adapted to be connected, through any suitable means, to an instrumentality on the control panel of the engine or vehicle (not shown). It will be seen that the plate 59 may be oscillated

by moving the arm 61. When the plate 59 is in the position illustrated in Figure 2, it will be obvious that due to the configuration of the slot 58, the arm 55 can be oscillated only between the "idle" position and the "high speed" position as indicated in that figure. If, now, the arm 61 and plate 59 are rotated clockwise, the pin 57 will first be disengaged from the shoulder 62 of the slot 58, and as the clockwise rotation of the plate 59 continues, the pin 57 will be engaged by the lower edge of the slot 58, and will be cammed in a clockwise direction, moving the arm 55 to the "off" position as indicated in Figure 2. Thereafter, the arm 55 cannot be moved until the arm 61 is rotated in the counter-clockwise direction. It will be understood, of course, that every movement of the arm 55 involves a corresponding movement of the crank 52, thus oscillating the lever 47 about its pivotal connection with the bell crank arm 48, and producing a corresponding movement of the fuel control rod 49. Thus, the movement of the arm 55 to the "off" position results in moving the fuel control rod 49 so as to shut off completely the flow of fuel to the engine and thus stop the engine.

From the foregoing description it is believed that the operation of the governor will be readily apparent. Assuming that the engine is running, and that the arm 55 has been set at the "idle" position, governing of the idling speed must be affected by the combined action of the heavy centrifugal members 20 and 21 and the light centrifugal members 24 and 25. By reason of the fact that the latter lie in recesses formed in the outer surfaces of the former, the lighter members are caused to move outwardly with the heavier members, and any outward movement of the heavier members therefore causes the cam lugs 26 and 27 to engage the flange 29 and move the sleeve 23 toward the right in Figure 5, thus rotating the shaft 32 and bell crank lever 33. This movement is of course resisted by the spring 38, which is initially tensioned so as to cause governing to take place at the desired idling speed. The rotation of the bell crank lever 33 causes a corresponding movement of the lever 47 about the fulcrum 54, thus moving the fuel control rod 49 to affect the necessary control of the fuel feed means.

When it is desired to operate the engine above idling speed, the arm 55 is moved counter-clockwise (Figure 2), thus moving the fulcrum 54 and causing the lever 47 to rotate about its pivotal connection with the bell crank arm 48, which results in a movement of the fuel control rod 49 to increase the amount of fuel fed to the engine, thus increasing the speed of the latter. This increase of speed does not immediately bring the high speed governing means into play, but causes the heavy centrifugal members 20 and 21 to swing outwardly until the surfaces 20' and 21' engage the carrier 16. The engine is now free to increase in speed without interference from the governor, up to the predetermined governed speed, at which time the lighter centrifugal members 24 and 25 will take control by forcing the riser sleeve 28 farther to the right, against the tension of spring 46. This movement causes the bell crank lever 33 to rotate farther in the clockwise direction, producing a clockwise movement of the lever 47 about the fulcrum 54, thus moving the fuel control rod 49 to the left and cutting down the amount of fuel fed to the engine.

During all of the time when the engine is

operating, the arm 61 and plate 59 will occupy the position illustrated in Figure 2. When it is desired to shut down the engine, the arm 61 and plate 59 are rotated in the clockwise direction, which movement, as pointed out above, results in rotating the arm 55 to the "off" position, shutting down the engine.

It will thus be seen that we have provided a governor suitable for governing the engine at a predetermined idling speed and also at a predetermined maximum speed, while permitting manual speed control between these two predetermined speeds. A particularly important feature of the governor lies in the fact that the governed idling speed may be adjusted, by increasing or decreasing the tension on the spring 38 through the medium of the adjusting screw 40, while the engine is running. Another important advantage lies in the fact that by reason of the linkage between the manual control means, the governor, and the fuel control rod, the latter may be manually moved from full closed to full open position regardless of the position of the governor, provided the maximum governed speed has not been reached or exceeded. This is important in order to permit the engine to develop its full horse power under heavy loads at or below governed speed.

The control linkage is so designed and proportioned that the governor mechanism has sufficient travel to completely shut off the fuel with the lever 55 set at the idle position, as shown in Figure 2. Thus, when the vehicle is coasting down grade at any speed above the preset idle speed, fuel injection will cease and the engine will act as a brake. This feature prevents fuel waste as well as provides braking effect. It is also of major importance for gear shifting.

The governor of the present invention is of simple and rugged construction, and is relatively economical to manufacture.

We are aware that there have been previous attempts to perfect a two-speed governor for Diesel engines, one such governor being described in United States Patent No. 1,928,476, granted September 25, 1933, to Ottmar Baur et al. However, the governor of the present invention possesses many advantages over that described in the above mentioned patent, including the advantages particularly pointed out in the foregoing specification.

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

1. In a centrifugal governor, a rotatable member, a plurality of centrifugal members movably mounted on said rotatable member and comprising opposed relatively heavy members and opposed relatively light members, said centrifugal members being adapted to move outwardly when said rotatable member is rotated, means limiting the outward movement of said relatively heavy members, said relatively light members being mounted for outward movement with said heavy members and additional outward movement relative to said heavy members, spring means for resisting the outward movement of said heavy members and the initial movement of said light members, additional spring means for resisting the additional outward movement of said light members, means acting between said centrifugal members and said spring means and comprising a lever rotatable in accordance with the movements of said centrifugal members, control means, and means connecting said control

means and said lever, said connecting means comprising a second lever pivoted on said first lever and connected to said control means, and manually operable means providing a movable fulcrum for said second lever.

2. In a centrifugal governor, a rotatable member, centrifugal members carried by said rotatable member and adapted to move outwardly upon rotation of said rotatable member, spring means including a pair of springs arranged for sequential action for resisting outward movement of said centrifugal members, means acting between said centrifugal members and said spring means and comprising a lever rotatable in accordance with the movements of said centrifugal members, the initial movement of said lever being resisted only by said first-acting spring and additional movement of said lever being resisted only by said second-acting spring, control means, and means connecting said control means and said lever, said connecting means comprising a second lever pivoted on said first lever and connected to said control means, and manually operable means providing a movable fulcrum for said second lever.

3. In a centrifugal governor, a rotatable member, centrifugal members carried by said rotatable member and adapted to move outwardly upon rotation of said rotatable member, spring means including a plurality of springs for resisting outward movement of said centrifugal members, means acting between said centrifugal members and said spring means and comprising a lever rotatable in accordance with the movements of said centrifugal members, the initial movement of said lever being resisted only by one of said springs and additional movement of said lever being resisted only by another of said springs, control means, and means connecting said control means and said lever, said connecting means comprising a second lever pivoted on said first lever and connected to said control means, and manually operable means providing a movable fulcrum for said second lever, said last means comprising an arm mounted on a fixed pivot and having a fulcrum portion engaging said second lever.

4. In a centrifugal governor, a rotatable member, centrifugal members carried by said rotatable member and adapted to move outwardly upon rotation of said rotatable member, spring means including a plurality of springs for resisting outward movement of said centrifugal members, means acting between said centrifugal members and said spring means and comprising a bell crank lever rotatable in accordance with the movements of said centrifugal members and having one arm in engagement with said spring means, the initial movement of said lever being resisted only by one of said springs and additional movement of said lever being resisted only by another of said springs, control means, and means connecting said control means and said bell crank lever, said connecting means comprising a second lever pivoted on the other arm of said bell crank lever and connected to said control means, and manually operable means providing a movable fulcrum for said second lever.

5. In a centrifugal governor, a rotatable member, a plurality of centrifugal members movably mounted on said rotatable member and comprising opposed relatively heavy members and opposed relatively light members, said centrifugal members being pivoted for oscillatory movement about axes transverse to the axis of said rotatable member, each said light member being

mounted on a pivot common to one of said heavy members, means limiting the outward movement of said relatively heavy members, said relatively light members being mounted for outward movement with said heavy members and additional outward movement relative to said heavy members, spring means for resisting the outward movement of said heavy members and the initial movement of said light members, additional spring means for resisting the additional outward movement of said light members, means acting between said centrifugal members and said spring means and comprising a lever rotatable in accordance with the movements of said centrifugal members, control means, and means connecting said control means and said lever, said connecting means comprising a second lever pivoted on said first lever and connected to said control means, and manually operable means providing a movable fulcrum for said second lever.

6. The combination defined in claim 5, each said light centrifugal member lying outwardly of a portion of its associated heavy member, whereby its initial movement corresponds to that of said heavy member; and said means acting between said centrifugal members and said spring means comprising cams carried by said light members.

7. In a centrifugal governor having provision for governing at a low speed and at a higher speed, with manual control of intermediate speeds, a manually operable arm movable between full closed and full open positions, control means, means connecting said arm and said control means, and a manually operable member for limiting the movements of said arm to movements between low speed position and full open position and for moving said arm to full closed position.

8. A device according to claim 1, said manually operable means comprising an arm movable between full closed and full open positions, and a manually operable member for limiting the movements of said arm to movements between low speed position and full open position and for moving said arm to full closed position.

9. In a centrifugal governor having provision for governing at a low speed and at a higher speed, with manual control of intermediate speeds, a rotatable member, centrifugal members mounted on said rotatable member, control means, means connecting said control means and said centrifugal members and comprising a member movable in accordance with the movements of said centrifugal members, manually operable means for actuating said control means irrespective of the position of said last named member, and a manually operable member for moving said first manually operable means to running position and for confining the movements of said first manually operable means between predetermined limits.

10. In a centrifugal governor having provision for governing at a low speed and at a higher speed, with manual control of intermediate speeds, a rotatable member, centrifugal members mounted on said rotatable member, control means, means connecting said control means and said centrifugal members and comprising a member movable in accordance with the movements of said centrifugal members, manually operable means for actuating said control means irrespective of the position of said last named member,

and a manually operable member for confining the movements of said first manually operable means between predetermined limits and for moving said first manually operable means to full closed position.

11. In a device according to claim 2, means carried by said first lever and acting between said lever and said first-acting spring, said means being adjustable so as to alter the position of said lever and said centrifugal members relative to said spring.

12. In a centrifugal governor, a rotatable member, centrifugal members carried by said rotatable member and adapted to move outwardly upon rotation of said rotatable member, spring means including a pair of springs arranged for

5 sequential action for resisting outward movement of said centrifugal members, means acting between said centrifugal members and said spring means and comprising a lever rotatable in accordance with the movements of said centrifugal members, the initial movement of said lever being resisted only by said first-acting spring and additional movement of said lever being resisted only by said second-acting spring, control means, 10 means connecting said control means and said lever, and means acting between said lever and said first-acting spring, said last means being adjustable so as to alter the position of said lever relative to said spring.

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