

July 14, 1936.

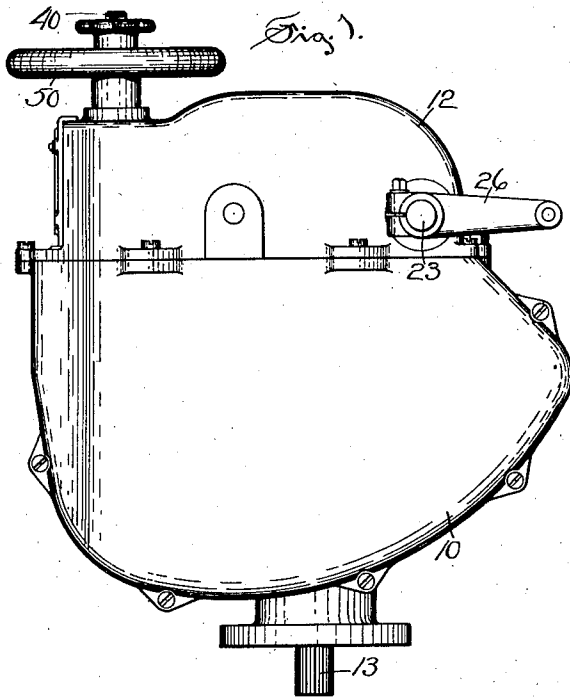
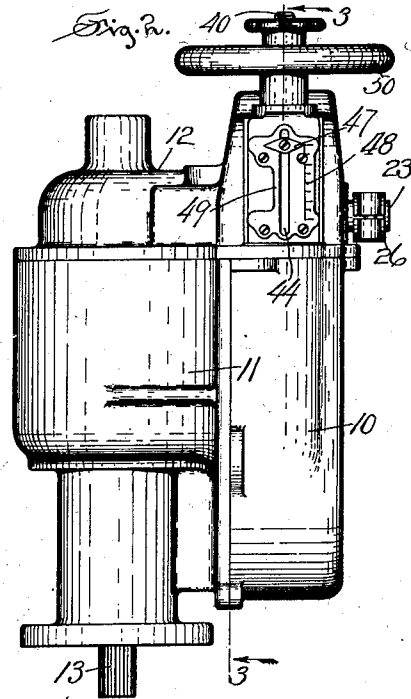
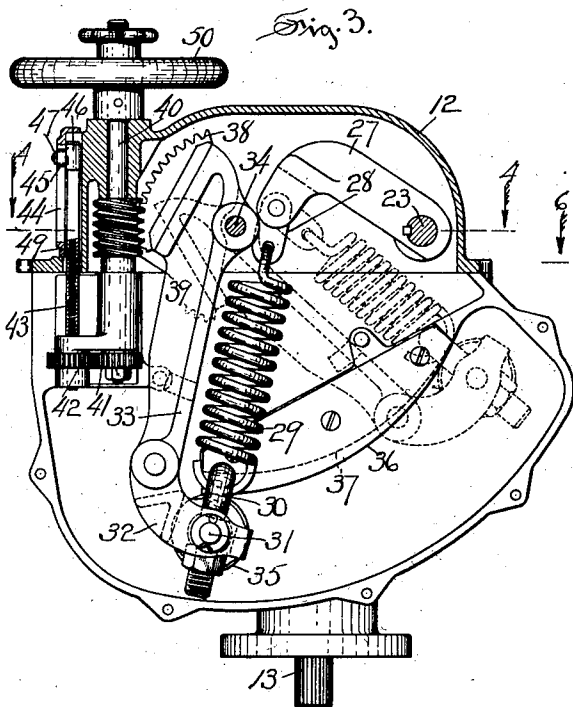
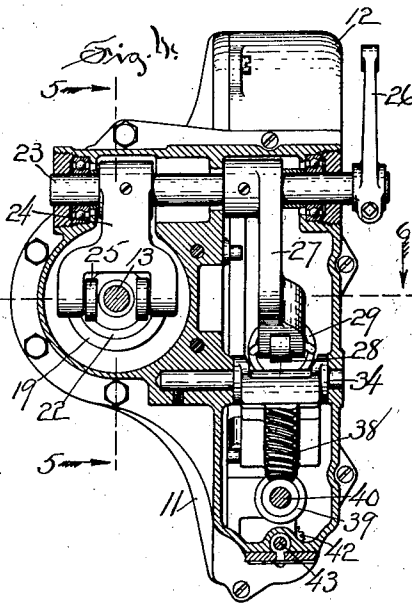
J. M. CRAFTS

2,047,577

GOVERNOR

Filed March 7, 1934

2 Sheets-Sheet 1



INVENTOR.
Irving M. Crafts,
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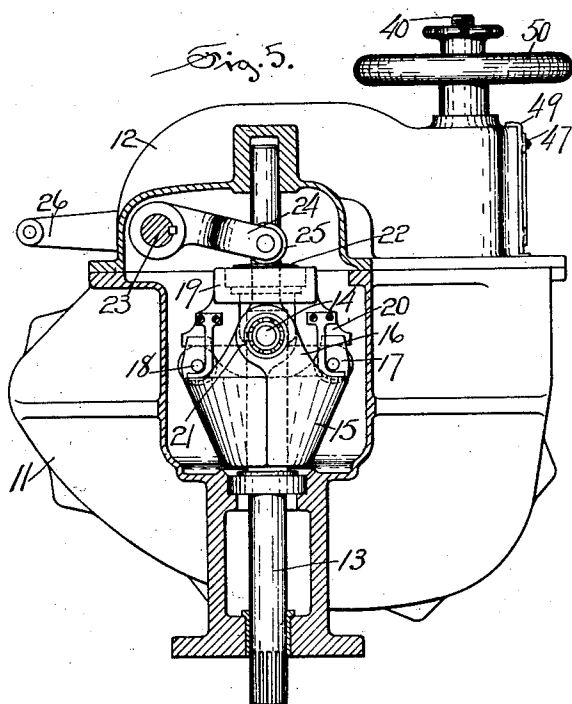
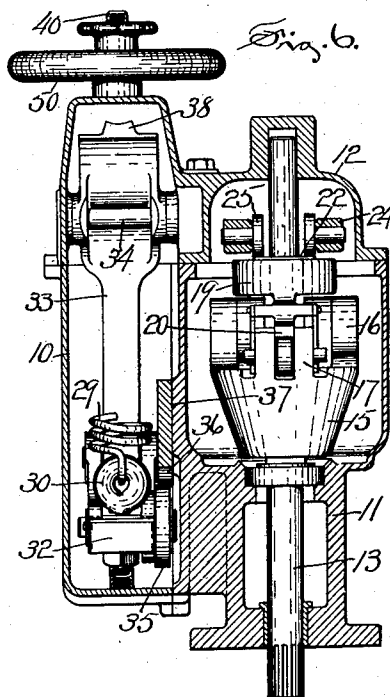
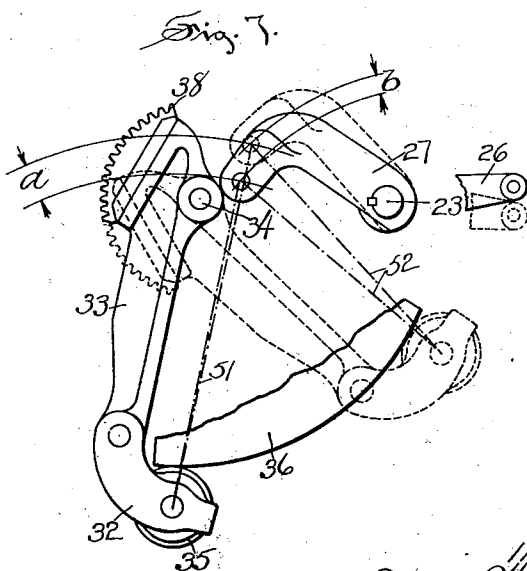
I. M. CRAFTS

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GOVERNOR

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2 Sheets-Sheet 2



INVENTOR.
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UNITED STATES PATENT OFFICE

2,047,577

GOVERNOR

Irving M. Crafts, Portland, Conn., assignor to
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Application March 7, 1934, Serial No. 714,392

10 Claims. (Cl. 264—3)

My invention relates to the class of devices which are employed for the purpose of regulating speed of machinery, and particularly that of engines or motors, and an object of my invention, among others, is the production of a governor that shall be particularly efficient in its operation as well as embodying simplicity in its construction; and a particular object of the invention is to provide a governor in which, by the use of a single governor spring, different speeds within wide range and at substantially uniform rates may be obtained.

One form of a governor embodying my invention and in the construction and use of which the objects herein set out, as well as others, may be attained is illustrated in the accompanying drawings, in which—

Figure 1 is a view in elevation of my improved governor.

Figure 2 is a similar view observed from a point located at right angles to the point of view of Fig. 1.

Figure 3 is a view in section on a plane denoted by the dotted line 3—3 of Fig. 2.

Figure 4 is a view in section on a plane denoted by the dotted line 4—4 of Fig. 3.

Figure 5 is a view in section on a plane denoted by the dotted line 5—5 of Fig. 4.

Figure 6 is a view in section on a plane denoted by the dotted line 6—6 of Fig. 4.

Figure 7 is a diagrammatic view illustrating the construction and operation of the device.

In the accompanying drawings the numeral 10 denotes a section of the case of my improved governor, 11 another section which is secured to the side of the first section and 12 a cap section which is secured to the top of the sections 10 and 11 in any suitable manner. A governor shaft 13 is rotatably mounted in the case, projecting at one end therefrom, which projecting end is adapted to be secured to the mechanism to be regulated in a manner common to structures of this type. A weight supporting pin 14 extends through said shaft and fly weights 15 are pivotally mounted on said pin as by means of knuckles 16 projecting from the upper ends of said weights and through which said pin extends. Ears 17 also project from the upper ends of said fly weights to receive floating ring supporting pins 18 upon which a floating ring 19 is mounted and supported as by means of lugs 20 which extend downwardly from the under surface of the ring on opposite sides thereof and rest upon bearings between the ears 17. The lugs 20 at their adjacent ends are formed with bearing points 21 which are adapted to touch the sides of a squared part of the shaft 13 forming bearing faces for said lugs. The gap between the lugs flares outwardly from the bearing point into the opening in the

ring 19 that contains a ball bearing 22. The bearings or pins 18 just referred to are in fact trunnions of rollers which press against the lugs 20.

A throttle actuating shaft 23 is mounted in the case with an arm 24 extending therefrom having a forked end straddling the shaft 13 and with rounded bearings 25 on the inner faces of the forked end resting in contact with the ball bearing 22 located within the floating ring 19. This effects rocking movement of the shaft 23 as the weights are operated by centrifugal force caused by rotation of the shaft 13 in a manner which will be readily understood by those skilled in the art. A throttle actuating arm 26 projects from the shaft 23 for connection with and operation of a throttle in a manner common to structures of this class. The construction of the fly weights and their operation with parts appurtenant thereto is fully set forth and described in my co-pending application of Serial Number 558,071, filed August 19, 1931 and reference is hereby made to said application for such further understanding of the specific structure of said parts as may be required.

In prior devices of this class a spring has commonly been employed to resist outward movement of the fly weights and thereby determine the amount of centrifugal force to be generated by said fly weights before the operation of the throttle to check the speed of the engine, and this has prevented operation of prior governors for the control of different rates of speed without the use of springs each adaptable to each particular speed. My improved governor, illustrated and described herein, enables a single spring to be employed in a manner to determine the amount of resistance to be overcome by the fly weights before action thereof to control any particular speed.

With this arrangement a spring supporting arm 27 is secured to the shaft 23 within the cap 12, and as shown in Figs. 3 and 4 of the drawings, a link 28 connecting said arm with one end of a governor spring 29 preferably of helical form, the opposite end of said spring being held by a screw eye 30 projecting through an enlarged portion of a stud 31 secured to the pivoted foot 32 of a spring tensioning lever 33 mounted on a pivot 34 secured in the side parts of the cap section 12 of the case, and as shown in Fig. 6 of the drawings.

A roller 35 is mounted on the stud 31 for rolling contact with a regulating cam 36 secured to the face of a boss 37 on the outer side of the case section 11 of the case, the section 10 of said case, in fact, being in the nature of a cover for mechanism secured to the outer side of said case section 11.

It is customary, in the operation of governors of this type, to tension the governor spring so that the fly weights 15 will attain a certain speed of rotation before they develop centrifugal force enough to stretch the spring, or overcome its tension, such tension determining the maximum speed of the engine which will be permitted by the fly weights before said fly weights act upon the throttle, for just as soon as the spring begins to stretch rotation of the shaft 23 under the action of the fly weights is impeded thereby operating to move the throttle and control the engine speed in a manner that will be readily understood. This problem is a simple matter, so far as a single speed is concerned.

When, however, a different speed, say a lesser speed, is sought it will be evident that the governor spring under the same conditions as to tension, will not be tensioned at the lesser speed by the centrifugal force of the fly weights and the throttle lever will not therefore be operated to move the throttle when the desired speed of rotation is attained. It therefore becomes necessary to reduce the tension of the spring so that such tension will be overcome when the desired lesser speed is reached, and I accomplish this purpose by use of the regulating cam 36 hereinbefore mentioned which is so formed that the necessary tension of the spring 29 for any desired rate of speed may be obtained by locating the roller 35 at certain points on the cam which will produce such desired rate of speed.

In order to enable the roller to be thus located I have provided a tensioning mechanism which comprises a rack 38 in the form of the segment of a worm wheel on the upper end of the lever 33, which rack meshes with a tensioning worm 39 on a tensioning shaft 40 mounted in bearings in the cap 12 and in a projection from the outer face of the section 11 of the case, and as shown in Fig. 3 of the drawings. The lower end of the shaft 40 bears a pinion 41 meshing with a pinion 42 on an adjusting arbor 43 mounted for longitudinal movement in another projection from the outer face of the section 11 of the case. The pinion 42 has a screw threaded hole to which the arbor 43 is fitted and this pinion is located between two projections from the case, as shown in Fig. 3, to hold it against lengthwise movement. Said arbor extends upwardly into a recess in the outer side of the cap 12, said recess having a slot 44 to receive a lug 45 projecting from a head 46 at the upper end of the arbor.

The lug 45 has an index point 47 cooperating with graduations 48 appearing on the face of a plate 49 in which the slot 44 is formed. These graduations will denote different speeds which will be acquired by the engine when the pointer designates such speeds by location at such graduations. The shaft 40 has a hand wheel 50 secured to its upper end for the purpose of operating the shaft to adjust the tension of the spring 29 in a manner which it is believed will be readily understood without further explanation herein.

The cam 36 is so formed that the ratio between the force exerted by the spring and the centrifugal force developed by the fly weights required for any desired speed within the range of the governor is determined and fixed and the position of the index point 47, as denoted by the graduations 48, will denote any of such rates of speed.

The spring 29 having been tensioned to effect operation of the governor to regulate a predeter-

mined speed, when the engine is started the speed will continue to increase until such speed is reached at which time the fly weights 15 will come into operation, the speed of rotation having developed force enough in the fly weights to counteract the tension of the spring thereby tending to move the throttle towards its closed position whenever the speed shall be exceeded. As an example, if the spring be tensioned so that the fly weights will govern the speed for 1000 R. P. M. the centrifugal force developed by the fly weights will at this speed overcome the tension of the spring whenever this speed is exceeded thereby tending to maintain the speed at slightly in excess of 1000 R. P. M. If the load upon the engine is suddenly decreased the fly weights immediately act against the tension of the spring to close the throttle thereby tending to maintain the rotation at some predetermined speed but slightly in excess of 1000 R. P. M. If the tension of the spring alone were relied upon in varying the speed from that above described, say, to a lesser extent, the amount of stretch of the spring would not be in the same proportion as the variation in the speed and, moreover, the degree of movement of the throttle would be lessened whereas such degree of movement should be maintained.

By the use of my improved mechanism illustrated and described herein I am enabled by the use of a single spring to keep any variation in speed caused by variation in load upon the engine substantially in the same proportions, when compared with the rate of rotation, for all different rates within the range of the governor. This is illustrated in Fig. 7 of the drawings wherein the lever 33 at the left hand position will tension the spring for a speed of, say, 1000 R. P. M., the arm 27 which governs the position of the throttle at this speed being at a point indicated by the lower line *a*. A release of load upon the engine, however, will stretch the spring to an extent determined by the amount of load released, the upper line *a* denoting the amount of movement to fully close the throttle as required, the fly weights operating to keep the throttle in such position between the upper and lower lines *a* as the conditions of the load may demand to maintain the speed between 1000 R. P. M. and the predetermined excess of speed hereinbefore mentioned. In practice the variation in speed may be held to within 3% of the speed for which the spring is tensioned at any speed within the range of the device.

If the lever 33 be moved to the position shown in dotted lines at the right in Fig. 7 the spring will be tensioned for a rate of speed less than 1000 R. P. M. The centrifugal force developed by the fly weights for such speed is now much less than that developed for the rate of 1000 R. P. M. with a result that the spring will be stretched, as conditions require, from the lower line *b* to the upper line *b* to close the throttle, it being noted that while the stretch of the spring is less than in the first instance, the movement of the throttle will be the same. This is permitted by the change in the angular position of the spring which although being stretched to a lesser extent permits the throttle to be moved to the same extent as before, this change in angular position being taken care of by the compensating cam 36 which also effects the required lessening of the tension of the spring.

In the foregoing explanation relating to the 75

stretch of the spring 29 for different rates of speed the angular position of the spring for the higher rate of speed is indicated by the dot and dash lines 51 in the movement of the arm 27 from fully open throttle position to fully closed throttle position, while the angular position of the spring for the lower speed is indicated by the dot and dash lines 52 to move the arm 27 from fully opened to fully closed throttle positions.

In accordance with the provisions of the patent statutes I have described the principles of operation of my invention together with the device which I now consider to represent the best embodiment thereof; but I desire to have it understood that the device shown is only illustrative, and that the invention may be carried out by other means and applied to uses other than those above set out.

I claim:

1. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with said throttle actuating shaft to oppose centrifugal force of said fly weights, means operatively connected with the other end of said spring for changing its angular position, a spring tension regulating cam over which said means is movable to vary the tension of the spring and means associated with said angularly adjusting means for the spring for positively holding the latter from movement in either direction laterally of the axis of said spring.

2. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring supporting arm secured to said shaft, a spring attached at one end to said arm, a lever for attachment of the other end of said spring thereto, a regulating cam over which the spring attached end of the lever is movable for varying the tension of the spring, and means associated with said lever for positively holding it from lateral movement in either direction.

3. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring operatively connected at one end with said shaft to oppose centrifugal force of said fly weights, a pivotally mounted tensioning lever operatively connected with the other end of said spring, means associated with said lever for determining its position and for preventing lateral movement thereof in either direction, and a regulating cam adjacent the spring attached end of said lever and over which said lever end is movable to vary the tension of the spring and to oppose the force exerted thereby.

4. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal force of said fly weights, a pivoted member to which the other end of the spring is attached, a fixed cam adjacent the pivoted member for engagement by the movable end of the pivoted member, and means for moving the pivoted member over the cam for varying the tension of the spring.

5. A governor including a shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal

force of said fly weights, a lever to which the other end of the spring is attached, a cam member over which the free end of the lever is movable and said lever being formed of pivotally connected sections whereby tension of the spring is varied by movement of the lever end over the cam member.

6. A governor including a shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal force of said fly weights, a lever to which the other end of the spring is attached, a cam member over which the free end of the lever is movable and said lever being formed of pivotally connected sections whereby tension of the spring is varied by movement of the lever end over the cam member, and means operatively connected with the lever for adjusting the position thereof relative to the cam member and positively holding the lever from lateral movement in either direction.

7. A governor including a shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal force of said fly weights, a lever to which the other end of the spring is attached, a cam member over which the free end of the lever is movable and said lever being formed of pivotally connected sections whereby tension of the spring is varied by movement of the lever end over the cam member, and means operatively connected with the lever for adjusting the position thereof relative to the cam member and positively holding the lever from lateral movement in either direction, including a worm gear on the lever and a manually operable worm engageable with the gear.

8. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal force of said fly weights, a lever having a pivoted foot at one end, the other end of the spring being attached to the foot and a cam member over which the foot is movable whereby tension of the spring is varied by movement of the lever and foot over the cam member.

9. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal force of said fly weights, a lever having a pivoted foot at one end, the other end of the spring being attached to the foot and a cam member over which the foot is movable whereby tension of the spring is varied by movement of the lever and foot over the cam member.

10. A governor including a governor shaft, fly weights borne by said shaft, a throttle actuating shaft operatively connected with said fly weights, a spring having one end operatively connected with the throttle operating shaft to oppose centrifugal force of said fly weights, a lever having the other end of the spring connected to its free end and a cam adjacent the free end of the lever and over which said end is movable for varying the tension of the spring and effective leverage of said lever.