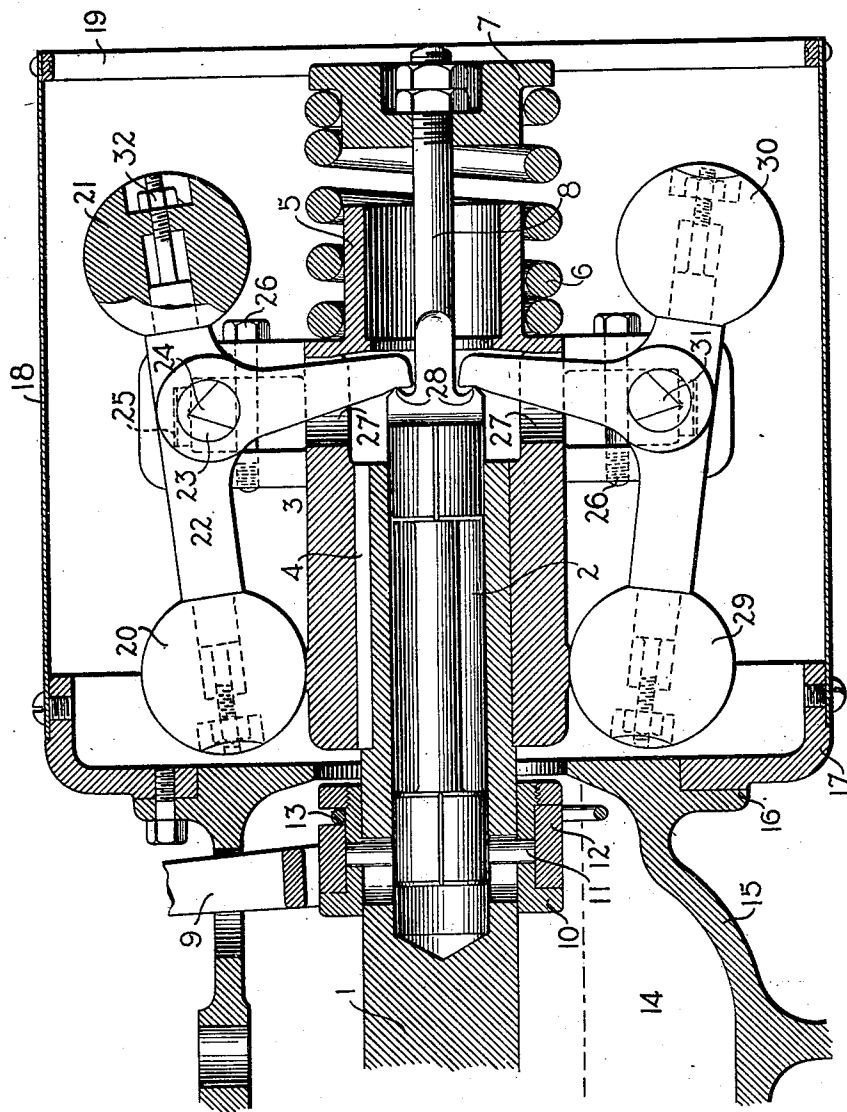


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O. JUNGREN.
AUTOMATIC GOVERNOR.
APPLICATION FILED APR. 29, 1903.

NO MODEL.



Witnesses.

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UNITED STATES PATENT OFFICE.

OSCAR JUNGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

AUTOMATIC GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 742,874, dated November 3, 1903.

Application filed April 29, 1903. Serial No. 154,890. (No model.)

To all whom it may concern:

Be it known that I, OSCAR JUNGREN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Automatic Governors, of which the following is a specification.

Automatic governors of the fly-ball type as ordinarily constructed are provided with weights located at the free ends of arms or supports. The tendency of the weights to move outwardly under centrifugal action is opposed by a spring or springs of suitable character. It is recognized by designers of governors that the load on or work required of a governor to move the controlling-valve or other regulating device should represent only a very small per cent. of the capacity of the governor to do useful work. In other words, the governor should have a large amount of "stored energy," so to speak, and give up only a very small amount of it in actuating the regulating means. The features above referred to have heretofore required that massive weights or the equivalent lighter weights mounted on long arms be provided with one or more powerful opposing springs; but I have discovered a way whereby a powerful and sensitive governor of the fly-ball type can be constructed with heavy centrifugally-acting weights and a relatively small and short opposing spring.

In carrying out my invention I provide a number of weights arranged in pairs, each pair being connected by a lever which is pivotally secured to a shaft or other rotating support. I may make the weights of each pair similar and place one of the weights nearer the pivot than the other, or I may make one weight heavier than the other and locate the pivot centrally. The pivot for each pair of weights extends at right angles to the axis of rotation of the shaft or head. Hence the outward movement of the heavier weights or weights exerting the greater leverage is opposed by the lighter weights or weights exerting a less leverage. Since certain of the weights are located in a manner to work against and overpower the others, it is only necessary to provide a means—such as a spring, for example—for opposing the

difference between the two forces. Obviously as the outwardly-moving weights get farther and farther away, considering the axis of the revolving shaft or support as a base-line, the force or effect is correspondingly increased, while that of the inwardly-moving weights is correspondingly decreased. This arrangement renders the governor particularly sensitive to speed changes. Hence the regulating means will be promptly adjusted to meet the new conditions. Connected to the weight-carrying levers in any desirable manner is a suitable mechanism for actuating a controlling device—such as a valve, for example. My invention is not to be construed, however, as being limited to using a valve, for any other form of regulating mechanism can be attached thereto.

In the accompanying drawing I have illustrated a longitudinal section of one of my improved governors.

1 represents the shaft or other revolving element, the outer end of which is bored centrally, as at 2, to receive the means for transmitting motion from the weights to the regulating device. Keyed or otherwise secured to the shaft is a support of suitable construction. In the present instance it comprises a bracket 3, having as many pairs of looped arms as there are pairs of weights. In the present instance two pairs of weights are shown. Hence two arms are formed on the bracket. The bracket is provided with an elongated hub, and a key 4 is provided to prevent independent rotation of the parts. The left-hand end of the hub also acts as a support for the weights when the parts are in a position of rest, as shown in the drawing. The bracket is provided with a cylindrical extension 5, which may with advantage be formed integral therewith. This sleeve acts as a means for preventing the compression-spring 6 from moving laterally. It also forms part of a fixed abutment for said spring. The outer end of the spring engages with a shouldered disk 7, that forms a movable abutment and which is connected, by means of a guide-rod 8, with a regulating device or lever 9. The end of the rod is provided with an adjusting-nut, whereby the tension of the spring can be adjusted. Motion between the rod

and the lever is transmitted by means of a sliding collar 10, that surrounds the shaft and is connected to the rod by a pin 11. The collar is surrounded by a ring or band 12, that is attached to the forked end of the regulating device or lever 9. In the right-hand side of the ring or band a groove is turned for receiving the oil-ring 13. The lower portion of this ring extends into an oil-chamber 14, formed in the bearing 15. In this manner the collar and attaching means are constantly lubricated. The bearing is provided with a shouldered flange 16, to which the ring 17 is attached, the latter acting as a support for the cylindrical casing 18, that surrounds and protects the moving parts of the governor. The right-hand end of the casing is provided with a strengthening-ring 19.

The centrifugally and differentially acting weights are arranged in pairs on the same side of the axis of the shaft or rotating element. The weight 20 moves outward away from the axis of the shaft, due to centrifugal force, while the weight 21 moves inward toward the axis of the shaft. The tendency of both these weights is to fly outwardly under centrifugal force; but owing to the fact that the leverage exerted by the weight 20 is greater than that exerted by the weight 21 the former overpowers the latter. Obviously the greater the distance between the center of the weight 20 and the axis of the shaft the greater will be its effect. Conversely, the nearer the center of the weight 21 is to the axis of the shaft the less will be its effect. The weights are connected by a lever 22, which can with advantage be made T-shaped. The lever is provided with a cylindrical opening to receive the fulcrum or pivot 23, which extends at right angles to the axis of rotation of the shaft. The outer ends of the pivot are provided with hardened knife-edges 24, which engage with hardened seats 25. (Shown in dotted lines.) These seats are located in the outer ends of the looped or slotted arms of the bracket. It is to be noted that each arm of the bracket is solid, with an opening for receiving the pivot for the weights. By reason of this construction there is no danger of the supports giving way under centrifugal strain and permitting the weights to be detached. The pivots are prevented from moving inwardly from their position by the bolts 26. The bracket is provided with openings 27 to receive the inwardly-projecting ends of the T-shaped levers 22. The inner end of each lever engages with a knife-edge 28, that is formed on or attached to the guide-rod 8. Situated on the opposite side of the axis of the shaft or rotating member is a pair of similar weights arranged in the manner above described. Hence further description of them is unnecessary.

In order to obtain the proper balance between the weights and the spring, it is necessary to provide means for adjusting each

one separately. The spring, as previously stated, is adjusted by changing the position of the abutment on the connecting-rod by rotating the adjusting-nut. The levers 22 are screw-threaded at the ends where they pass through the weights, and adjusting-nuts 32 are provided therefor. By this arrangement the weights can be similarly or dissimilarly adjusted toward and away from the pivot. Hence the resultant force exerted by each pair of weights can be easily and accurately adjusted. By the arrangement specified the characteristic of the spring and that of the weight can be made to bear the proper relation.

In the drawing I have shown two pairs of weights, each pair being disposed on opposite sides of the axis of the driving-shaft; but it is evident that my invention is not limited as to the number of pairs of weights which are employed.

I have shown the weights 20 and 21 and 29 and 30 of the same size, with the pivots 23 and 31 arranged nearer the weights 21 and 30 than to the weights 20 and 29, so that the weights 20 and 29 will be able to overpower the weights 21 and 30; but it is evident that this arrangement can be altered, if desired, the essential feature being to have the parts so related that when the shaft is rotated one weight of each pair will move outwardly away from the center of rotation and the other weight will move inwardly. As the weights 20 and 29 move outwardly the force exerted thereby is continually increasing, while the force of the weights 21 and 30 as they move toward the center is decreasing. This means that the compression-spring 6 is called upon to take care of the resultant forces between the weights of the several pairs. This arrangement of parts is extremely important, since it enables me to materially reduce the size of the spring. In the present instance the spring has about one-third the length that would be necessary if the weights 21 and 30 were omitted, it being assumed that the governor was intended to have the same power. When I say that the spring 6 can be made about one-third the length ordinarily employed for a governor of the same power, I do not mean to be understood as limiting myself to this or any other length of spring.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a governor, the combination of a shaft or revolving support, centrifugally and differentially acting weights arranged in pairs, supporting devices therefor extending paral-

1. In a governor, the combination of a shaft or revolving support, and a means opposing the resultant action of each pair of weights.

2. In a governor, the combination of a shaft or revolving support, centrifugally and differentially acting weights arranged in pairs on the same side of the shaft or support, a means opposing the resultant action of each pair of weights, and a regulating device which is connected to the weights.

3. In a governor, the combination of a shaft or revolving support, centrifugally-acting weights carried thereby and arranged in pairs, a pivot for each pair of weights extending across the axis of rotation of the shaft or support, and a regulating device which is responsive to the resultant action of the weights.

4. In a governor, the combination of a shaft or revolving support, centrifugally-acting weights arranged in pairs, one weight of each pair moving away from the axis of the shaft or support and the other toward it, a pivotal suspension for each pair of weights, and a means which opposes the resultant action of the weights.

5. In a governor, the combination of a shaft or revolving support, centrifugally and differentially acting weights arranged in pairs on the same side of the shaft or support, a lever for connecting the weights, a bracket mounted on the shaft or support, a pivot for the lever situated between the weights and supported by the bracket, and a spring opposing the resultant force of the weights.

6. In a governor, the combination of a shaft or revolving element, differentially-acting weights arranged in pairs and mounted on opposite sides of the axis of rotation, a lever for supporting each pair of weights, a pivot for the lever situated between the weights so that one in each pair can overpower the other, a spring opposing the combined resultant forces of the weights, a regulating device, and a connection between the weights and the said device.

7. In a governor, the combination of a shaft or revolving element, centrifugally and differentially acting weights mounted thereon and arranged in pairs on opposite sides of the axis, T-shaped levers to which each pair of weights is attached, a movable abutment, and means for connecting the levers to the abutment.

8. In a governor, the combination of a shaft or revolving element, centrifugally and differentially acting weights mounted thereon and arranged in pairs on the same side of the shaft-axis, a lever for each pair of weights, a pivot for each lever extending at right angles to said axis, a movable abutment, a spring opposing the resultant action of all of the weights, a regulating device or lever, and means for connecting the weight-carrying levers with the abutment and regulating device or lever.

9. In a governor, the combination of a shaft or revolving element, a bracket having radial arms, each of said arms having an opening, centrifugally and differentially acting weights connected in pairs, the pairs being located on opposite sides of the shaft-axis, weight-carrying levers which pass between the arms, pivots for securing them in place that enter the openings in the arms, and a movable abutment opposing the differential action of the weights.

10. In a governor, the combination of a shaft or rotating element, centrifugally and differentially acting weights arranged in pairs and located on opposite sides of the axis of the shaft, a pivot for the weights extending transversely to said axis, and means for relatively adjusting the weights in each pair.

11. In a governor, the combination of a shaft or rotating element, centrifugally and differentially acting weights arranged in pairs and located on opposite sides of the axis of the shaft, a pivot for the weights extending transversely to said axis, means for relatively adjusting the weights in each pair, a means opposing the resultant forces of the weights, and a device for adjusting said means.

12. In a governor, the combination of a shaft or rotating element, centrifugally and differentially acting weights arranged in pairs and located on opposite sides of the axis of the shaft, a movable abutment, and connecting means which transfer the resultant forces of the weights to the abutment.

In witness whereof I have hereunto set my hand this 28th day of April, 1903.

OSCAR JUNGREN.

Witnesses:

ALEX. F. MACDONALD,
HELEN ORFORD.