No. 778,248. PATENTED DEC. 27, 1904.

O. JUNGGREN.

CENTRIFUGAL GOVERNOR.

APPLICATION FILED JAN. 2, 1904.

Fig. 1.

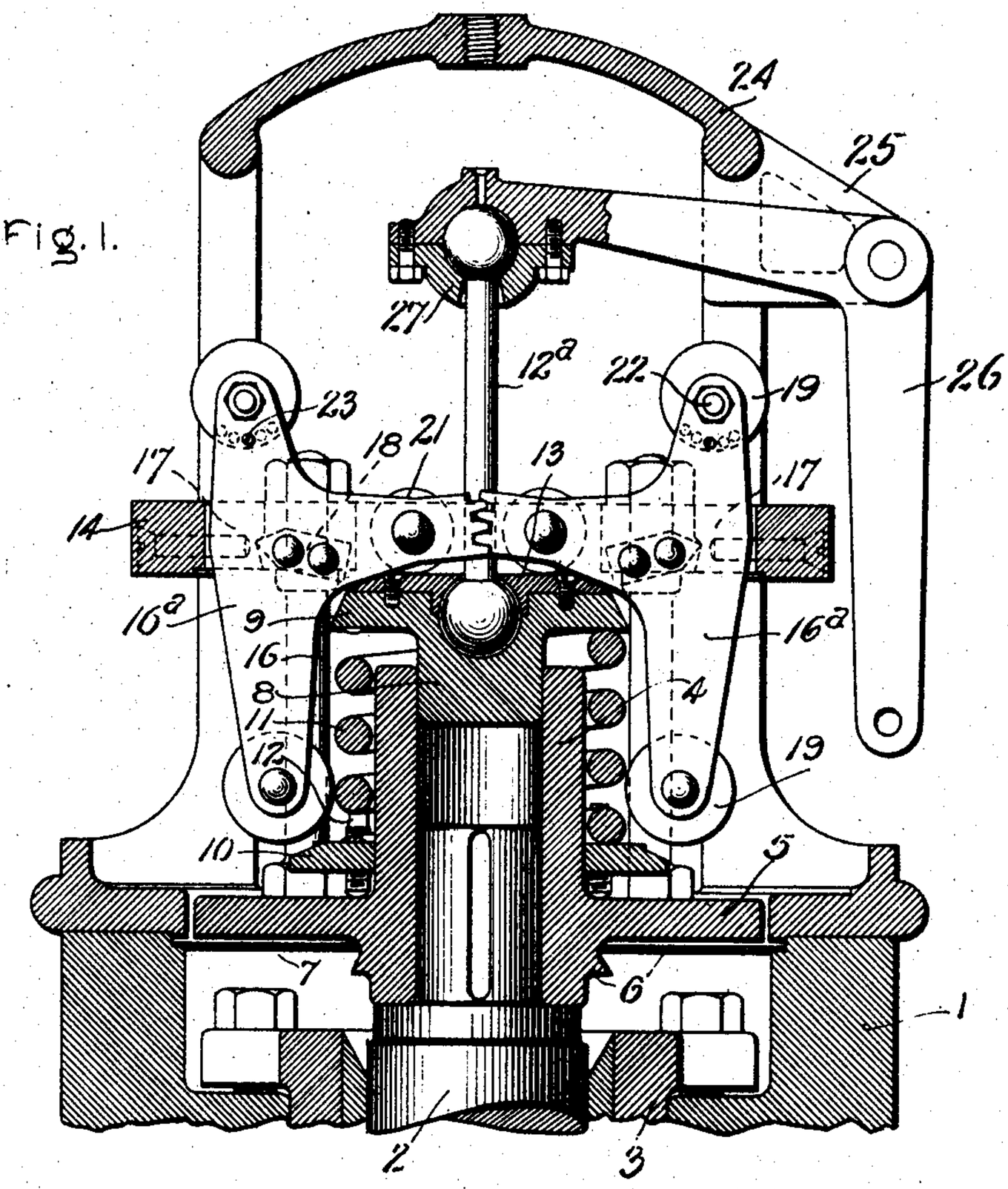
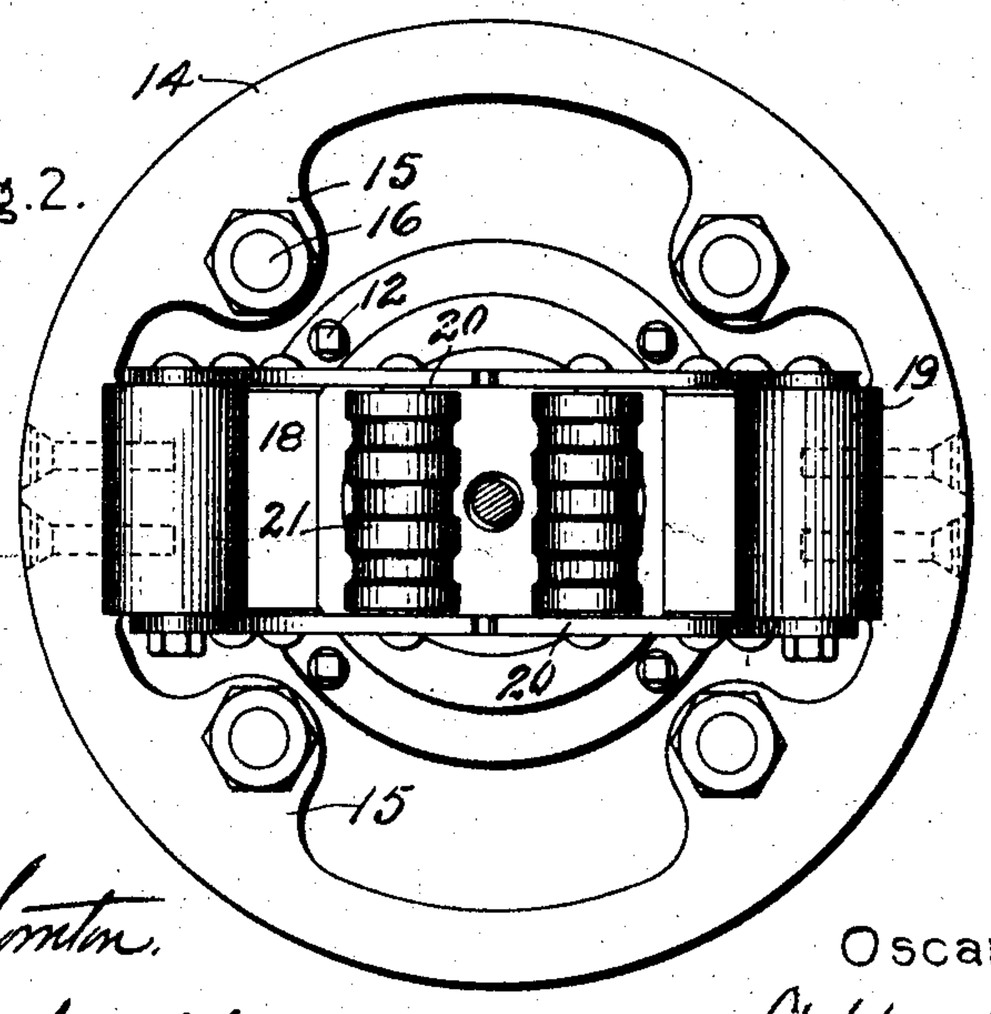


Fig. 2.



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No. 778,248. Patented December 27, 1904.

UNITED STATES PATENT OFFICE.

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

CENTRIFUGAL GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 778,248, dated December 27, 1904.

Application filed January 2, 1904. Serial No. 187,416.

To all whom it may concern:

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

The present invention has for its object to improve the construction of centrifugal governors, and more especially those designed for high-speed machines—such as elastic-fluid turbines, for example.

The improvements are directed to the construction and arrangement of parts whereby a simple and reliable governor is provided especially adapted for high-speed service and one having little or no vibration or internal friction.

For a consideration of what I believe to be novel and my invention attention is directed to the specification and claims appended thereto.

In the accompanying drawings, which illustrate one embodiment of my invention, Figure 1 is a vertical section of a governor as applied to the shaft of a vertical turbine, and Fig. 2 is a plan view of the weights and their support.

1 represents a part of the casing of a dynamo or turbine, and mounted therein in a vertical position is a shaft 2, which rotates the weights. Surrounding the shaft and attached to the casing is a bearing 3. The upper end of the shaft is reduced in size and between the parts of the shaft having different diameters is a shoulder. Keyed to the end of the shaft and resting on the shoulder is a head or support having a sleeve-like hub 4 and a disk or flange 5. On the lower end of the support is an oil-thrower 6, which prevents oil from the bearing from working upward around the flange. Between the flange and the bearing is a thin disk 7, which also assists in preventing lubricant from working upward. The upper end of the hub of the support extends somewhat above the end of the shaft and may form a guide for the central projection 8 of the spring-pressed abutment 9. Surrounding the hub and resting on an adjustable plate 10 for varying the degree of its compression is a coiled spring 11. The spring should be made with care and balanced as accurately as possible. The plate is supported by a number of adjusting-screws 12, which are so situated that they can be moved by means of a wrench from a point above the plate. The upper end of the spring engages the abutment 9, which has a central projection on the under side and an outwardly-extending flange. The upper side of the abutment is cupped out to receive the lower end of a dumb-bell link 12^a, which is held in place by the attaching-plate 13. The spherical bearing-surfaces surrounding the end of the link are carefully fitted thereto, so as not to bind or to have any appreciable amount of lost motion.

The link is bored centrally to permit lubricant to flow through it into the spherical joint at its lower end. In the present illustration of the invention a slip-joint is provided between the abutment and the link and a second slip-joint between the upper end of the link and the lever carried by the dome, but under some conditions one of these joints can be omitted and an ordinary pivot-joint employed.

Mounted above the flange on the support and parallel thereto is a frame 14 for supporting the weights. This frame may with advantage be made in the form of a ring with internal projections 15 to receive the upper ends of the standards 16. I regard the feature of the ring-like frame which incloses the weight-arms and also the standards for supporting it as an important feature of the invention, since by their use an exceedingly strong construction is provided with a minimum amount of metal. The lower ends of the standards are tapped into the flange 5, and locating them inside of the ring permits the use of a ring of maximum size, giving plenty of room for the weight-arms with a minimum diameter of the flange. Each of the standards is provided with a shoulder on which the ring rests, and also with a screw-thread to receive a retaining-nut. Removing the ring permits the weights to be taken off.

Situated on opposite sides of the shaft are weight-arms 16^a, each arm being provided with two weights which act differentially. The arrangement of weights and arms is

broadly claimed in my United States Patent No. 742,874, dated November 3, 1903. While this arrangement of weights is very desirable, I do not wish to be understood as limiting the present invention thereto, since other forms of weights and arms can be employed and many of the advantages of the present invention be retained.

At diametrically opposite points the ring is provided with hardened blocks 17 (shown in dotted lines) to receive the hardened knife-edges 18 on the weight-arms. The blocks are retained in place by screws. The weights 19 may weigh equal or different amounts, depending on their location with respect to the point of pivot—*i. e.*, the knife-edge. They are connected together by flat T-shaped plates, and the knife-edge is riveted or bolted thereto. In order to cause corresponding movements of the weights, or, in other words, to synchronize them, the portions of the weight-arms 20 adjacent to each other are provided with meshing gear-teeth, the pitch-lines for which are struck from the centers of motion of the arms. Carried by and connecting the arms 20 of each pair of weights is a roller 21, that may be corrugated to reduce the friction between it and the spring-pressed abutment with which it engages. It is desirable to make either one or both of the weights on each arm adjustable, and to accomplish this the supporting-pin 22 passes through the mass eccentrically with respect to its center of gravity. Near the edge the weight is provided with a number of holes that are adapted to be swung into alinement with a pin 23 carried by the arm. As the position of the weight is changed about its supporting-pin its effective action will be varied. The relative position of the several parts of the governor is also an important feature of the invention. The spring is arranged at the end of the shaft, between the same and the fulcrum of the weights, thereby enabling the over-all dimensions of the governor to be reduced to a minimum, without, however, sacrificing its effectiveness in operation.

Surrounding the weights and their rotating support is a stationary dome 24, that has an enlarged base which is secured to the casing 1 or other fixed support. The opposite sides of the dome are cut away to permit inspection and adjustment of the moving parts. The upper end of the dome is rounded and in the center is a screw-threaded opening to receive an oil-cup or an eyebolt when it is desired to remove the dome from the machine to which it is attached. On one side of the dome is formed a bracket 25, and pivotally mounted thereon is a lever 26 for transmitting motion from the weights to a suitable governing device. In the present illustration the lever is of the bell-crank type and one arm extends parallel with the side of the dome, while the other arm extends to the axis of the wheel and is connected by the link 12^a to the abutment 9. The upper end of the link has a ball attached thereto by a screw-threaded joint or equivalent device and is secured to the end of the lever by a cup 27. Just over the ball and in line with the opening in the dome is an oil-hole whereby the ball may be lubricated, for it is to be understood that the ball rotates, while the lever can only move up and down.

As the speed of the shaft increases the lower pair of weights move outwardly against the action of the spring and the upper weights, which causes the link 12^a to pull the end of the lever 26 downward. A decrease in speed causes the reverse action to take place.

The invention has been described in connection with a vertical-shaft machine; but obviously it can be used with a shaft occupying a different position.

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 comprising centrifugally-acting weights and an opposing means, the combination of a dome which incloses the weights, and the lever which extends from a point within to a point without the dome and is moved by the resultant force of the weights and opposing means.

2. In a governor comprising a shaft and centrifugally-acting weights, in combination with a flanged support carried by the shaft, a detachable frame extending parallel to the flange for supporting the weights, means attached to the flange for supporting the frame, an abutment acting on the weights, and a spring which engages the abutment.

3. In a governor comprising a shaft and centrifugally-acting weights, in combination with a flanged support carried by the shaft, a movable abutment opposing the weights, a frame which encircles and supports the weight-arms, and standards carried by the flanged support which support the frame.

4. In a governor comprising a shaft and centrifugally-acting weights, in combination with a flanged support carried by the shaft, a movable abutment opposing the weights and covering the end of the support, a link pivotally attached to the abutment and in line with the axis of the shaft, a stationary frame surrounding the weights, and a lever which is carried by the frame and is pivotally attached to the link at a point in line with the shaft-axis.

5. A governor comprising a shaft, centrifugally-acting weights, and a means opposing the weights, in combination with a flanged

support carried by the shaft, a separable frame which carries the weights, and supports that are attached to the flange of the support and carry the frame.

6. A governor comprising a shaft, centrifugally-acting weights, and a means opposing the weights, in combination with a frame to which the weights are pivotally attached, a support carried by the shaft, and a number of independent and concentrically-arranged standards which extend parallel with the axis of the shaft and support the frame.

7. A governor comprising a shaft, centrifugally-acting weights, and a means opposing the weights, in combination with a support, a lever pivoted thereto, and a link, the axis of which coincides with the axis of the shaft, for connecting the lever with the weights and their opposing means.

8. In a governor, the combination of a shaft, weights movable under changes in shaft speed, an abutment positively rotated by the shaft which opposes the action of the weights, a lever, a link independent of the weights and in line with the shaft-axis which is connected with the abutment and the lever, and a slip-joint between the link and the abutment.

9. In a governor, the combination of a shaft, weights movable under changes in shaft speed, an abutment which opposes the action of the weights, a frame located outside of the weight-carrying arms, a support rotating with the shaft, independent standards concentrically arranged about the shaft-axis which are carried by the support and are attached to the support, a spring which acts on the abutment and is concentrically mounted with respect to the shaft-axis, and means for adjusting the tension of the spring.

10. In a shaft-governor, the combination of a lever with a weight adjustably attached to the lever at a point eccentric to the center of its mass.

11. In a shaft-governor, the combination of a lever, a weight adjustably attached to the lever at a point eccentric to the center of its mass, and means for varying the position of the weight around its point of support.

12. In a shaft-governor, the combination of weight-carrying levers situated on opposite sides of the shaft-axis, centrifugal and differentially-acting weights carried by the levers, a connection between the weight and levers for causing corresponding and synchronous movements, and a means opposing the action of the weights.

13. In a shaft-governor, the combination of pairs of levers situated on opposite sides of the shaft-axis, with gear-teeth for each lever, the teeth of opposing levers meshing.

14. In a shaft-governor, the combination of pairs of levers situated on opposite sides of the shaft-axis, with gear-teeth for each lever, the teeth of opposing levers meshing, weights carried by the levers, a movable abutment opposing the weights, and means carried by the levers which engage the abutment.

15. In a governor comprising a shaft, centrifugally-acting weights, and a spring opposing the weights, a casing through which the shaft extends, a dome mounted on the casing, and a lever carried by the dome which is connected at a point within the same to the weights and their opposing means and is actuated by their resultant force.

16. In a governor, the combination of a rotating shaft, centrifugally and differentially acting elements, and a means for opposing their action which occupies a position at the end of the shaft and lies within the length of the elements.

17. In a governor, the combination of a rotating shaft, centrifugally and differentially acting elements, and a spring for opposing their action which is located at the end of the shaft and is supported between it and the common plane of the fulcrums of the elements.

18. In a shaft-governor, the combination of a lever, a weight carried thereby which is movable on an axis eccentric to the center of its mass, and means for adjusting the weight to change the position of its center of gravity relative to the fulcrum of the lever.

19. In a shaft-governor, the combination of pairs of levers situated on opposite sides of the shaft-axis, with gear-teeth for each lever whose pitch-circles are struck from the respective fulcrums of the levers, the teeth of one lever meshing with those of the other.

20. In a shaft-governor, a centrifugally-acting element, comprising plates, and weights located between them.

21. In a shaft-governor, a centrifugally-acting element, comprising plates, and weights secured between them, one of which is adjustable.

22. In a shaft-governor, a centrifugally-acting element, comprising plates, weights secured between the same at their ends, and of which one is adjustable, and a fulcrum intermediate the weights.

23. In a shaft-governor, a pair of centrifugally-acting elements, each comprising T-shaped plates, weights secured between them at the outer ends of the opposite arms, and a connection between the center arms of the plates of both elements.

In witness whereof I have hereunto set my hand this 30th day of December, 1903.

OSCAR JUNGGREN.

Witnesses:
BENJAMIN B. HULL,
MARGARET E. WOOLLEY.