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GOVERNOR

Original Filed March 31, 1919

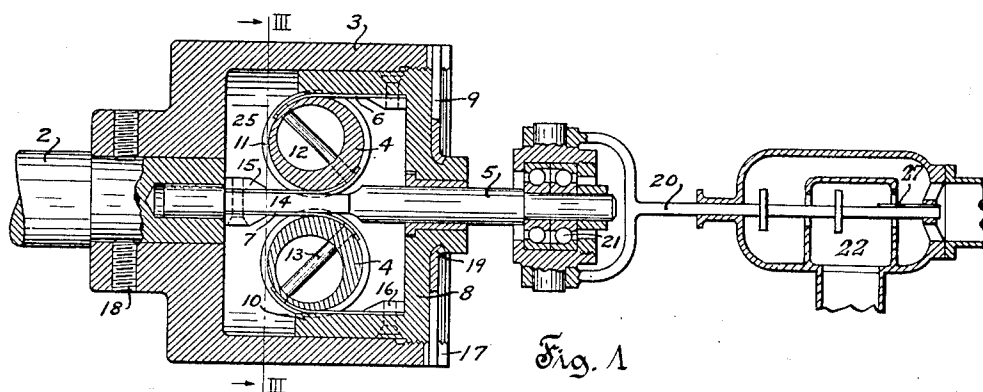


Fig. 1

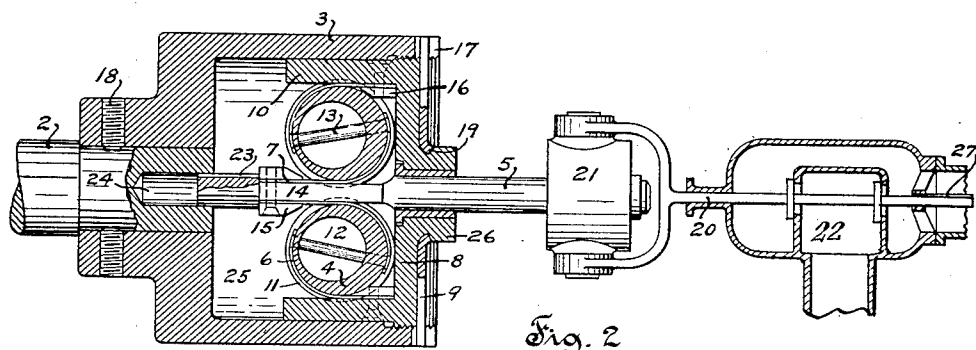


Fig. 2

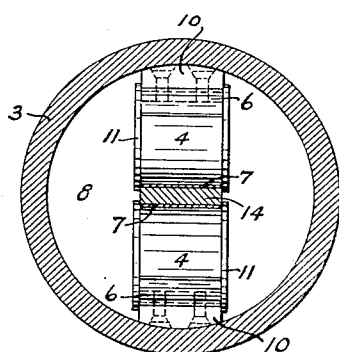


Fig. 3

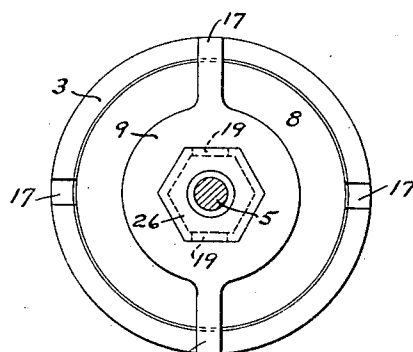


Fig. 4

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GOVERNOR.

Application filed March 31, 1919, Serial No. 287,060. Renewed March 30, 1922. Serial No. 548,191.

To all whom it may concern:

Be it known that HANS P. DAHLSTRAND, a citizen of the United States of America, residing at Wauwatosa, in the county of Milwaukee and State of Wisconsin, has invented a certain new and useful Improvement in Governors, of which the following is a specification.

This invention relates to improvements in the construction and operation of speed regulating devices or governors for controlling the speed of rotating bodies such as the rotors of energy translating machines. The speed governor forming the subject of the present invention is especially applicable for controlling the speed of prime movers such as steam turbines, hydraulic turbines, internal combustion engines, steam engines, and the like.

An object of the invention is to provide a speed regulator or governor which is simple and compact in construction and efficient in operation.

One of the more specific objects of the invention is to provide a centrifugal governor which is exceedingly sensitive to variations in speed and which is more reliable in operation than the governors of the prior art. This object is attained by eliminating friction losses between relatively moving coacting parts of the governor.

Another specific object is to provide a speed governor especially adapted for high speed operation.

A further specific object is to provide simple and efficient means for transmitting motion from the weights of a centrifugal governor to the mechanism controlled thereby.

Still another object is to provide a governing mechanism which may be readily assembled and disassembled for inspection or repairs.

These and other objects of the invention and the specific manner of attaining them will be apparent from the following description.

A clear conception of an embodiment of the invention may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views.

Fig. 1 is a transverse vertical section

through a speed governor of the centrifugal type, showing the position of the various elements when the governor is at rest.

Fig. 2 is a transverse vertical section through a speed governor of the centrifugal type, showing the position of the various elements when the governor is operating at maximum speed.

Fig. 3 is a transverse vertical section through the governor taken along the line III—III of Fig. 1 looking in the direction of the arrows.

Fig. 4 is an end view of the governor showing details of the casing or housing closure.

The governor comprises in general a cup-shaped casing or housing 3 forming a chamber 25, a closure plate or end head 8 for the housing, a motion transmitting element 5 extending through the chamber 25 and projecting beyond the end head 8, and a pair of cylindrical weights 4 located within the chamber 25 and on opposite sides of the element 5.

The housing is rigidly secured to an end of the shaft 2 by means of headless set screws 18, this shaft 2 being either the main shaft of an energy translating device or an auxiliary shaft rotatable by any suitable means. The housing 3 and shaft 2 are simultaneously rotatable and form a rotary support for the governor.

The end head 8 is screw threaded into the end of the housing 3 remote from the shaft 2 and has parallel guide members 10 coacting with diametrically opposite portions of the cylindrical inner surface of the chamber 25. The guide members 10 have parallel plane surfaces extending parallel to the common axis of the shaft 2 and housing 3. The end head 8 has a central hexagonal boss 26 which is undercut on diametrically opposite flats to form recesses and which has a central bore forming a bearing for the medial portion of the element 5. A locking plate 9 having two diametrically opposite radiating arms, has a central hexagonal opening fitting the boss 26, the plate 9 being secured to the hexagonal boss 26 by means of a pair of inwardly distorted tongues 19 which are driven into the recesses of the boss. The outer extremities of the radiating arms of the locking plate 9 coact with diametrically opposite transverse slots 17 formed in the housing 3, and

thereby prevent relative rotation of the head 8 and housing 3. The provision of the two diametrically opposite pairs of recesses 17, permits of adjustment of the end head 8 longitudinally of the housing 3 by quarter turns, while the hexagonal formation of the boss 26 still further reduces the increments of adjustment. The motion transmitting element 5 is mounted coaxial with the shaft 2 and housing 3, having its one end fitting a bore 24 in the end of the shaft 2, having its medial portion coacting with the central bore of the head 8, and having its opposite end associated with a ball bearing 21. The bore 24 of the shaft 2 is connected with the chamber 25 by means of a groove 23 formed in the end of the element 5 in order to eliminate unbalanced pressures upon the element. The ball bearing 21 is associated with an end of the valve stem 20 and permits relative rotation between the element 5 and stem 20, but does not permit relative longitudinal movement between these elements. The valve stem 20 has a controlling valve 22 associated therewith, the stem 20 and valve 22 being prevented from rotating by means of a spline 27 coacting with a groove in the valve casing. The valve 22 may be any form of valve acting either directly or indirectly to control the amount of energy for producing rotation of the main shaft 2.

The portion of the motion transmitting element 5 within the chamber 25 of the housing 3, is provided with a guide member 14 having parallel plane surfaces on opposite sides thereof which are parallel to and spaced from the plane inner surfaces of the guide members 10. The cylindrical weights 4 are located between adjacent plane surfaces of the guide members 10, 14 being secured to these guide members by means of flat springs 6, 7. The inner flat springs 7 are secured at corresponding ends to the guide member 14 by means of cleats 15 held in place by riveting or otherwise. The outer flat springs 6 are secured at corresponding ends to the guide members 10 by means of cleats 16 held in place by riveting or otherwise. The opposite ends of the flat springs 6, 7 coact with the cylindrical surfaces of the weights 4 and are secured to diametrically opposite portions of these weights by means of through rivets 13. The weights 4 are provided with side flanges 11 adapted to coact with the side surfaces of the springs 6, 7 and guiding members 10, 14 in order to prevent displacement of the weights relatively to these springs and guide members. The weights 4 are provided with through openings 12 located eccentrically relatively to the outer cylindrical surfaces of the weights thereby positioning the center of gravity of each weight to one side of the center of rotation thereof and nearer the axis of the governor when in the position

shown in Fig. 1 than when positioned as shown in Fig. 2. The center of gravity of each weight is movable in an arc about its center of rotation or a line extending parallel to its cylindrical surface and transverse to the axis of the shaft 2.

In order to assemble the governor, it is necessary to first assemble the weights 4, springs 6, 7, end head 8, and motion transmitting element 5. The housing 3 should then be secured to the end of the shaft 2 by means of the set screws 18. The element 5, weights 4 and guide members 10 may then be inserted within the chamber 25 of the housing 3 after which the end head 8 may be screwed into the housing 3 to the proper extent, that is, to the position shown in Fig. 1. The locking plate 9 is then slipped over the hexagonal boss 26 in a position such that the radiating arms of the plate 9 will fall at or near two of the slots 17. If these radiating arms do not exactly aline with the slots 17, the end head 8 may be turned sufficiently to cause registration of the arms and the adjacent slots 17, the motion thus required never exceeding 30°. After the radiating arms of the plate 9 have been inserted in the adjacent slots 17, the tongues 19 of the plate 9 should be driven into the adjacent recesses of the hexagonal boss 26. The governor is thus completely assembled and may be readily disassembled by merely bending back the radial arms of the locking plate 9 sufficiently to permit unscrewing and removal of the end head 8 and the associated parts from the housing 3.

During the normal operation of the governor, the shaft 2, housing 3, end head 8, element 5 and weights 4 are rotating simultaneously, the valve stem 20 and valve 22 being fixed against rotation by means of the spline 27. If the speed of rotation of the governor increases, centrifugal force acting upon the weights causes their centers of gravity to move outwardly away from the axis of the governor thereby causing the weights 4 to roll or rotate between the confining guide members 10, 14. The rotation of the weights 4 causes the adjacent flat springs 6, 7 to coact to a greater extent with the cylindrical outer surfaces of the weights, such increased coaction producing motion of translation of the element 5 along the governor axis, the translatory movement of the element 5 relative to the housing 3 being double that of the axis of a weight 4. During this translatory movement of the element 5 the weights 4 roll along the adjacent springs 6, 7, the limit of this motion being indicated by the position of the elements in Fig. 2. If the speed of rotation decreases, the centers of gravity of the weights 4 move inwardly towards the governor axis due to the initial tension in the flat springs 6, 7 which causes these springs to automatically

assume the position indicated in Fig. 1 upon abatement of the centrifugal force. The translatory movement of the element 5 is transmitted directly through the ball bearing 21 to the controlling valve 22.

It will be obvious that the rolling of the weights 4 along the springs 6, 7 induces very little friction tending to decrease the efficiency of the governor. The end and medial portion of the element 5 may if desired be provided with ball bearings in order to further eliminate friction. Such disclosure has been omitted in order to avoid unnecessarily complicating the disclosure and in view of the fact that ball bearings are a common expedient for reducing friction. By varying the mass of the weights 4, the eccentricity of the openings 12 in these weights, or the springs 6, 7, the rate of action of the governor may be readily altered to suit the required conditions of the operation. It will also be obvious that the entire mechanism may be readily assembled and disassembled for inspection and that the mechanism is extremely compact and simple.

It should be understood that it is not desired to limit the invention to the exact details of construction herein shown and described, for various modifications may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In a governor, a support having an axis, a weight revoluble about said axis and movable only in a direction parallel to said axis by centrifugal force developed in said weight, means for controlling the speed of revolution of said weight, and means for applying the motion of said weight to vary the position of said controlling means.

2. In a governor, a support having an axis, a weight revoluble about said axis and confined to rolling motion only parallel to said axis, said rolling motion being produced by centrifugal force developed in said weight, means for controlling the speed of revolution of said weight, and means for applying the rolling motion of said weight to vary the position of said controlling means.

3. In a governor, a support having an axis and a guide parallel to said axis, a weight revoluble about said axis and movable parallel to said guide by centrifugal force developed in said weight, means for controlling the speed of revolution of said weight, and means for applying the motion of said weight to vary the position of said controlling means.

4. In a governor, a support having an axis and a guide parallel to said axis, a weight revoluble about said axis and rollable along said guide and parallel to said axis by centrifugal force developed in said

weight, means for controlling the speed of revolution of said weight, and means for applying the rolling motion of said weight to vary the position of said controlling means.

5. In a governor, a support rotatable about an axis, a weight revoluble with said support and movable only in a direction parallel to said axis by centrifugal force developed in said weight, means for controlling the speed of revolution of said weight, and means for applying the motion of said weight to vary the position of said controlling means.

6. In a governor, a support rotatable about an axis, a revoluble weight confined to rolling motion only parallel to said axis, means for controlling the speed of revolution of said weight, and means for applying the rolling motion of said weight to vary the position of said controlling means.

7. In a governor, a support having an axis and a guide parallel to said axis, revoluble weights on opposite sides of said axis and movable parallel to said guide by centrifugal force developed in said weights, means for controlling the speed of revolution of said weights, and means for applying the motion of said weights along said guide to vary the position of said controlling means.

8. In a governor, a support having an axis and a guide parallel to said axis, revoluble weights on opposite sides of said axis and rollable parallel to said guide by centrifugal force developed in said weights, means for controlling the speed of revolution of said weights, and means for applying the rolling motion of said weights to vary the position of said controlling means.

9. In a governor, a rotary support having an axis and a guiding surface parallel to said axis, a cylindrical weight revoluble about said axis and rollable parallel to said guiding surface by centrifugal force developed in said weight, means for controlling the speed of revolution of said weight, and means coaxial with said support axis for applying the rolling motion of said weight to vary the position of said controlling means.

10. In a governor, a rotary support having an axis and a guide parallel to said axis, a weight revoluble about said axis and rollable parallel to said guide, a spring connecting said weight and said guide, a second spring associated with said weight, means for controlling the speed of revolution of said weight, and means coaxial with said support axis and associated with one of said springs for applying the rolling motion of said weight to vary the position of said controlling means.

11. In a governor, a support rotatable about an axis, and having a surface parallel

to said axis, a weight having rocker surfaces, a pair of springs secured directly to said weight for producing rocking of said weight upon said support surface, and means associated with at least one of said springs for controlling the rocking motion of said weight.

12. In a governor, a support rotatable about an axis and having a surface parallel to said axis, a weight having rocker surfaces, said weight being rockable upon said surfaces in a direction parallel to said axis by centrifugal force developed in said weight, and means for controlling the rocking movement of said weight.

13. In a governor, a support rotatable about an axis, a weight, a pair of springs connecting said weight and said support for producing rocking motion of said weight, said springs extending in part parallel to said support axis and said rocking motion producing translatable motion of a portion of one of said springs, means for controlling the speed of rotation of said support, and means for applying said translatable motion to vary the position of said controlling means.

14. In a governor, a support rotatable about an axis, said support having a surface parallel to said axis, a motion transmitting element having a surface parallel to said axis, a weight rollable between said surfaces, and means connecting said weight with said support and said element.

15. In a governor, a support rotatable about an axis, said support having a surface parallel to said axis, a motion transmitting element having a surface parallel to said axis, a weight rollable between said surfaces, and springs connecting said weight to said support and to said element respectively.

16. In a governor, a support rotatable about an axis, said support having surfaces parallel to said axis, a motion transmitting

element having surfaces parallel to said axis, weights on opposite sides of said element rollable on the said parallel surfaces of said support and of said element, and springs connecting said weights to their respective adjacent support and element.

17. In a governor, a support rotatable about an axis, a pair of weights simultaneously movable only in a direction parallel to said axis by centrifugal force developed in said weights, and means for urging said weights in a direction opposite to the direction of motion induced by centrifugal force.

18. In a governor, a support extending along and rotatable about an axis, guide ways adjustable along said axis and relatively to said support, weights connected to said guide ways, means for locking said guide ways to said support in different positions of adjustment, a motion transmitting element, and means connecting said weights and said element.

19. In a governor, a support extending along and rotatable about an axis, guide ways associated with said support and adjustable longitudinally of said axis, weights coacting with said guide ways, springs connecting said weights and said guide ways, a motion transmitting element movable relatively to said support, and springs connecting said element and said weights.

20. In a governor, a support having an axis, a weight revoluble about said axis and having an eccentric center of gravity, said weight being movable relatively to said support and during its revolution only in a direction parallel to said axis, means for controlling the speed of revolution of said weight, and means for applying the motion of said weight in a direction parallel to said axis to vary the position of said controlling means.

In testimony whereof, the signature of the inventor is affixed hereto.

HANS P. DAHLSTRAND.