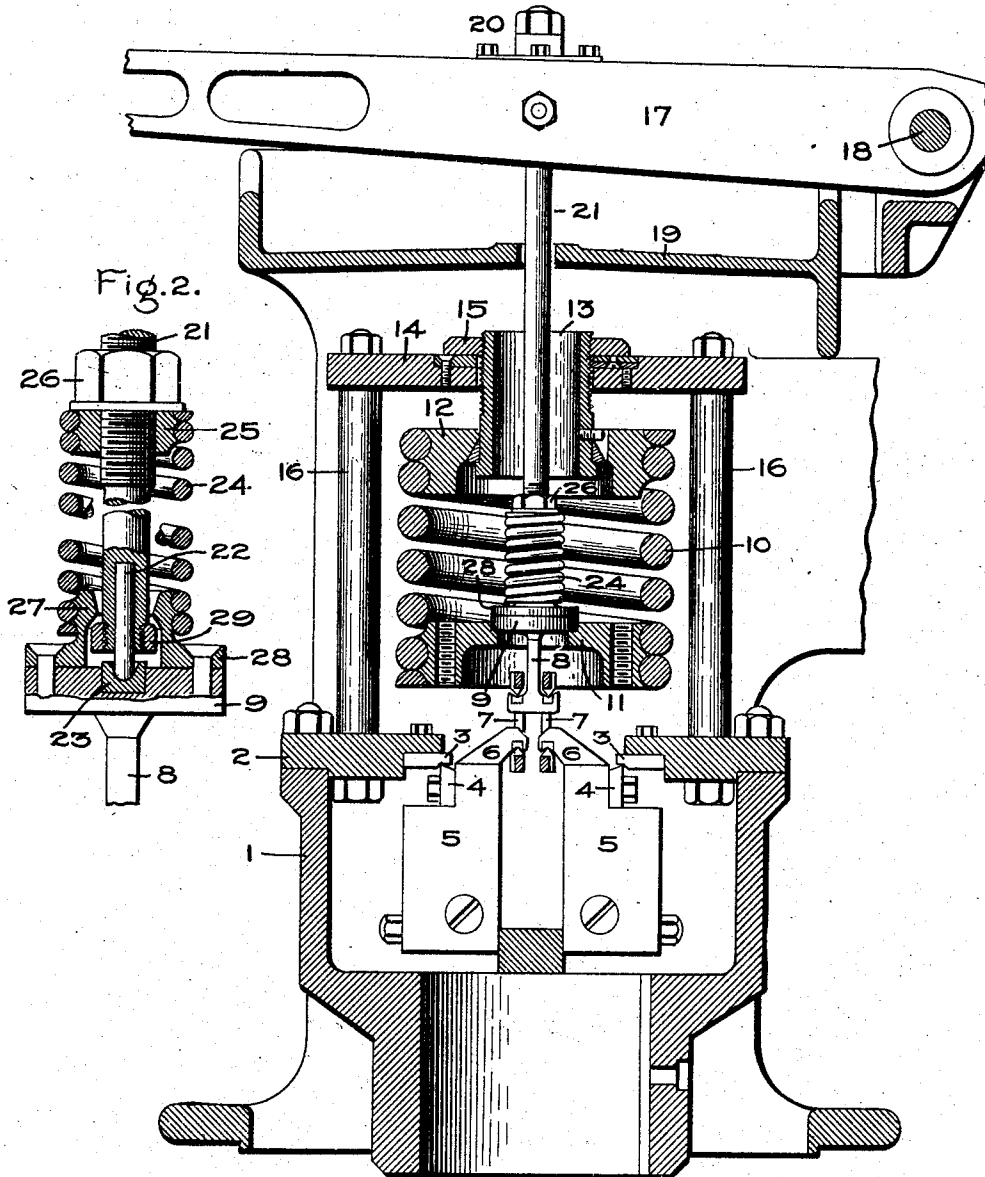


F. W. BENTLEY.
TURBINE GOVERNOR.
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974,113.

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Fig. 1.



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UNITED STATES PATENT OFFICE.

FREDERICK W. BENTLEY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TURBINE-GOVERNOR.

974,113.

Specification of Letters Patent.

Patented Nov. 1, 1910.

Application filed February 27, 1909. Serial No. 480,312.

To all whom it may concern:

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

This invention relates to elastic fluid turbines, and its object is to improve the construction of certain portions of the centrifugal governors used to regulate the admission of steam to the turbine. In general, these governors comprise a pair of weights suitably pivoted and adapted to swing outwardly under the action of centrifugal force when their support is rotated rapidly. The tendency of the weights to move outwardly is resisted by a strong helical spring, which may act either by compression or tension. The movement of the weights is transmitted by a pull rod to a lever which is connected with the throttle valve in the steam main, or to the pilot valve of a relay valve-actuating mechanism. The attachment of said rod to the spring is by means of a universal joint in order to permit a free play of said rod and prevent it from hampering in any way the action of the weights and spring. The present invention has especial reference to this joint, and consists in a construction in which the freedom of movement is secured by rounding the end of the rod, which end is stepped in a suitable socket, so that said rod is able to rock freely in said socket or step. An auxiliary spring urges said end down upon said step and forms the motion transmitting connection between the weights and the rod, while permitting an unobstructed swaying of the rod in any direction laterally.

In the accompanying drawing which is illustrative of one embodiment of my invention, Figure 1 is a vertical section of a governor, and Fig. 2 is a vertical section of the joint, on an enlarged scale.

The support 1 is keyed to the upper end of the turbine shaft so as to revolve with it. At the upper end of the support is an annular plate 2 which supports the hardened bearings 3 for the knife edges 4 on the weights 5. These knife edges form the pivots on which the weights turn as they swing out or in within the confines of the support 1. The upper inwardly extending

ends 6 of the weights are provided with hardened bearings which receive the knife edges on the links 7 that depend from the T-shaped hanger 8. At the upper end of said hanger is a head 9 which is supported by the governor spring, preferably a strong helical spring 10 having at one end a head 11 which is provided with external screw-threads adapted to receive the convolutions of the spring. Inasmuch as the parts 9 and 11 move together they may for certain purposes be considered as forming the movable abutment. The head 11 has a central hole to permit the hanger 8 to pass down through it, and the head 9 of said hanger is supported on the portion of the head 11 around the edge of said hole. The other end of the spring is also provided with an annular head or stationary abutment 12 suspended on the flange of a tube 13 which extends up through a platform 14 and is vertically adjustable therein by means of a nut 15 meshing with screw-threads on the exterior of said tube. The platform is supported by columns 16 rising from the top of the casing 1, and preferably standing on the plate 2.

The governor lever 17 is fulcrumed at 18 on the stationary housing or frame 19 which rises from the top of the turbine casing. At 20 is a universal joint by means of which the rod 21 is connected with said lever. The joint is constructed to permit the rod to rotate with the casing 1, the weights and the spring, but as the specific construction of this joint forms no part of the present invention, I have not illustrated it in detail. The governor rod depends through the tube 13 and passes axially through the spring. Its lower end is rounded and stepped in a hardened rounded socket in the hanger and preferably in a block 23 inserted in the head 9 of the hanger. This rounded end can be made integral with the rod but I prefer to form it by inserting a hardened pin 22 in the end of the rod and rounding the end of said pin. This pin or member is under compression, due to the action of the spring 24. In order to keep these parts together, the helical spring 24 encircles the rod, and is attached thereto at its upper end and to the head 9 at its lower end.

Referring more particularly to Fig. 2, it will be seen that the rod has a screw-threaded portion to receive the collar 25 and a lock nut 26. The periphery of the collar is

screw-threaded to receive the convolutions of the spring 24, whose lower end enters the screw threads on the outside of a neck 27 rising from a plate 28 which is riveted to the head 9 of the hanger. This plate is annular and is concentric with the rod and its pin and socket, which are housed within the neck 27. The spring 24 is under tension so that it tends to force the pin down into the socket, and yet it permits a perfect freedom of swaying movement of the rod, which rocks on the end of the pin. The pull of the weights is transmitted through the spring 24 to the rod and thence to the governor lever.

On the lower end of the rod 21 is a nut 29 located within the neck 27 and separated therefrom at all points by a space large enough to permit the parts to move freely and without striking. It is to be observed, however, that the diameter of the nut is greater than that of the bore of the neck. This acts as a safety device in case the spring 24 breaks. The depth of the socket in part 23 is greater than the clearance between the nut and the internal shoulder of the neck so that the pin 22 cannot by any chance jump out of its socket. Further, if the spring 24 breaks there will still be a mechanical connection between the moving weights and the lever 17 through the head 9, nut 29 and rod 21. There will be a small amount of lost motion in this connection, due to the clearance space above referred to, but under the conditions specified this can be disregarded. The main thing is to protect or prevent the turbine from running away, and the construction satisfies this requirement. Since the depth of the space between the under side of the nut and the top of the socketed block 23 and its support is less than the length of the thread on the rod, the nut cannot work entirely off and thus interrupt the connection between the speed governor and the mechanism controlled thereby. The joint 22, 23 can be used without this safety device if so desired and the conditions warrant it.

By means of this pin and socket joint, the wear is reduced to a minimum, and the durability of the governor is greatly increased.

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 centrifugal governor, the combination of weights, spring means opposing the action of the weights as they are revolved, a fixed abutment attached to one end

of the spring means, a movable abutment attached to the other end, a connection between the movable abutment and the weights, a governor rod, a pin located between one end of the rod and the movable abutment, and a spring which holds the pin in contact with said abutment.

2. In a centrifugal governor, the combination of weights, a spring opposing the outward movements of the weights as they are revolved, a fixed abutment attached to one end of the spring, a movable abutment attached to the other end of the spring, a connection between the movable abutment and the weights, a governor rod, a means that engages one end of the rod, a socket in the movable abutment in which the said means rests, and a spring independent of the first named spring which holds the means in engagement with the rod and the socket.

3. In a centrifugal governor, the combination with the weights and the hanger from which they are suspended, of the governor rod, and a universal joint between said rod and said hanger including a pin and a socket in which one end of said pin is stepped.

4. In a centrifugal governor, the combination with the weights and the hanger from which they are suspended, of the governor rod, and a universal joint between said rod and said hanger comprising a pin, a socket in which said pin is stepped, and means for retaining said pin in said socket with freedom of lateral movement.

5. In a centrifugal governor, the combination with the weights and the hanger from which they are suspended, of the governor rod, and a universal joint between said rod and said hanger comprising a pin, a socket in which said pin is stepped, and resilient means for urging said pin toward said socket.

6. In a centrifugal governor, the combination with the weights and the hanger from which they are suspended, of the governor rod, and a universal joint between said rod and said hanger, comprising a pin, a socket in which said pin is stepped, and a spring attached at one end to said rod and at the other end to said hanger.

7. In a centrifugal governor, the combination of weights, a spring opposing their movements, fixed and stationary abutments attached to the spring, a connection between the weights and the movable abutment, a governor rod, a means located between one end of the rod and the movable abutment, a spring maintaining this means under compression, and a safety device which transmits motion from the movable abutment to the rod when the second spring is injured.

8. In a centrifugal governor, the combination of weights, a spring opposing their

movements, fixed and movable abutments attached to the spring, a connection between the weights and the movable abutment, a governor rod, a member located between one
5 end of the rod and the movable abutment, a spring that normally holds said member under compression, a means carried by the said end of the rod that is normally inactive, and
10 a device normally free of said means but which engages it when the second spring is injured.

9. In a centrifugal governor, the combination of weights, a spring opposing the action of the weights as they are revolved, a
15 fixed abutment to which one end of the spring is attached, a movable abutment attached to the other end of the spring, a connection between the movable abutment and the weights, a governor rod having a rounded
20 end, and means connecting the rod to the movable abutment comprising a socket carried by the abutment which receives said rounded end and a spring attached at one
25 end to the movable abutment and at the other end to the rod.

10. In a centrifugal governor, the combination of pivoted weights, an axially arranged spring which opposes the action of the weights as they are revolved, a fixed
30 abutment to which one end of the spring is

attached, a movable abutment attached to the other end of the spring, a connection between the movable abutment and the weights, an axially extending governor rod having a hemispherical end, and means connecting
35 the rod to the movable abutment comprising a socket carried by the abutment which receives said hemispherical end, and a spring surrounding the end of the rod and attached at one end to the movable abutment
40 and at the other end to the rod, which spring tends to hold the end of the rod in the socket while permitting a pivotal movement of said rod relative to the movable abutment.

11. In a governor, the combination of centrifugally acting weights, a member moved by said weights, a governor rod, and a universal joint between the end of the rod and
45 said member, comprising a rounded projection on one of said parts, a socket on the other which receives said projection, and a spring attached at one end to the rod and at the other end to said member.

In witness whereof, I have hereunto set
55 my hand this 25th day of February, 1909.

FREDERICK W. BENTLEY.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD,