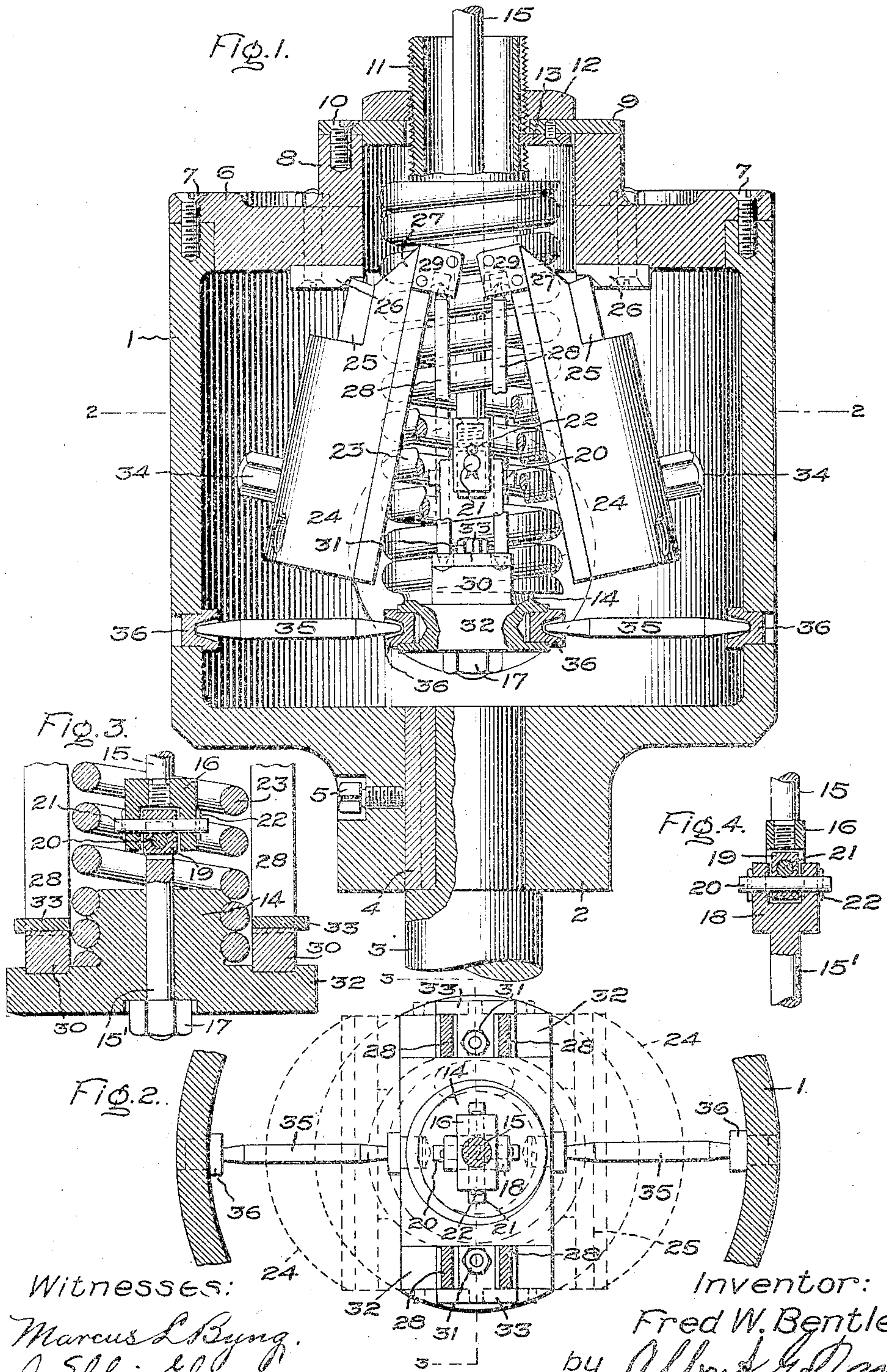


F. W. BENTLEY.  
CENTRIFUGAL GOVERNOR.  
APPLICATION FILED JULY 20, 1907.

957,861.

Patented May 17, 1910.



Witnesses:  
Marcus L. Byng,  
J. Ellis Allen

Inventor:  
Fred W. Bentley,  
by Albert G. Davis,  
Atty.



# UNITED STATES PATENT OFFICE.

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

## CENTRIFUGAL GOVERNOR.

957,861.

Specification of Letters Patent. Patented May 17, 1910.

Application filed July 20, 1907. Serial No. 324,759.

*To all whom it may concern:*

Be it known that I, FRED 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 Centrifugal Governors, of which the following is a specification.

This invention relates to automatic governors of the centrifugal type such as are used for governing engines actuated by steam or other elastic fluid.

The invention is an improvement upon the governor shown in U. S. Patent No. 778,249, December 27, 1904, and its object is to improve the construction and render it more compact and efficient than heretofore. The features of novelty are hereinafter set forth and particularly pointed out in the claims.

In the accompanying drawing, Figure 1 is a vertical sectional elevation of one embodiment of my invention; Fig. 2 is a sectional plan view on the line 2-2, Fig. 1; Fig. 3 is a sectional elevation of the lower portion of the spring and its abutment, taken on the line 3-3, Fig. 2; and Fig. 4 is a vertical section of the universal joint, taken at right angles to the showing in Fig. 3.

The working parts are carried by a suitable frame, preferably an inclosing casing or pot 1 which is preferably cylindrical, and has a central hub 2 on its bottom by means of which it is secured to the upper end of the shaft 3, preferably by a key 4 locked by a set-screw 5. The axis of the pot is coincident with that of the shaft so that it rotates concentrically therewith. A lid 6 is fastened on the pot by screws 7, and contains a central opening preferably surrounded by an upright circular flange 8 on which rests an annular plate 9 preferably rabbeted into the opening, and secured by one or more screws 10. The screw-threaded stem 11 of the upper spring-plug passes freely through the central aperture in the plate and is supported adjustably by the nut 12 which rests on said plate. A key 13 is fastened to the plate and engages a longitudinal groove in the stem to cause it to rotate with the pot, but does not interfere with its longitudinal adjustment.

The lower spring-plug 14 is suspended at the lower end of the connection-rod 15, by

means of which rod motion is communicated to other mechanism leading to the valves or devices which control the supply of motive fluid to the apparatus to be governed, such mechanism for example as the governor levers 31 and 58 shown in the above-mentioned patent. A universal joint is interposed between said rod and the plug in order to afford the latter perfect freedom to accommodate itself to any variations in the construction or action of the spring. I prefer to construct this joint as shown in Figs. 3 and 4.

The lower end of the rod is provided with a fork 16 which is preferably made separate from the rod and is drilled and tapped to receive the threaded end of the rod. A short rod 15' extends through the plug, with a retaining nut 17 on its lower end. Its upper end is provided with a fork 18 arranged at right angles to the fork 16. Between the arms of the two forks is a block 19. Pivot pins 20, 21 pass transversely through the forks and the block at right angles to each other though not in the same plane. Cotter-pins 22 retain the pivot pins in place: or if one pin has a notch to engage with the other pin, the cotter-pins are necessary only in said latter pin.

The spring-plugs are screw-threaded so that they can be readily attached to the ends of the helical tension spring 23, which encircles the rod 15. The regulation is adjusted by screwing the upper plug into or out of the spring, so as to vary the number of effective turns.

The governor weights 24 are two in number and are provided with knife-edge pivots 25 which bear against fulcrum plates 26 secured to the under side of the lid 6, adjacent to its central opening. At their upper ends, on each side, they have a hook 27 which engages the upper end of a strut 28, consisting of a straight flat bar having a knife-edge on each end. The hook 27 is preferably provided with a small bearing block of hardened steel, grooved to receive the knife-edge at the upper end of the strut. A plate 29 is fastened to the side of the hook and overlaps the end of the strut to retain it in place. The lower knife edge of the strut is stepped in a groove in a steel block 30 which is fastened by a screw 31 upon a lug 32 extending laterally from the lower spring-plug. Each block receives both the



struts on that side of the spring, and they are retained in the grooves by a T-shaped plate 33 fastened upon the block by the holding screw 31. The plates 29, 33 prevent the  
 5 struts from being thrown out of place laterally by centrifugal force when the governor is running.

When the governor is at rest, the tension of the spring lifts the hooks 27 and rocks  
 10 the weights inward until their inner faces abut against the opposite sides of the blocks 30. When running, the weights swing outward until, at maximum speed, the studs 34 strike the walls of the pot. These two posi-  
 15 tions measure the vertical range of movement of the rod 15, which in actual practice is about five-eighths of an inch. At normal speed the weights stand about in the position shown in Fig. 1.

Means are provided to counteract any tendency of the spring to move out of its central position in the plane of rotation of the weights under the stress of centrifugal force due to its own weight and that of the  
 20 parts carried on its lower end. I prefer for this purpose braces placed between the lower spring-plug and the walls of the pot. These braces are arranged radially, on a diameter at right angles to one passing between the  
 25 two struts on each side of the spring-plug; *i. e.*, in the same axial plane as that in which the weights swing, as shown in Fig. 2. The braces consist preferably of stout rods 35 having rounded ends which are received  
 30 loosely in sockets 36 formed or inserted in the sides of the spring-plug and the walls of the pot; said sockets being of sufficient depth and diameter to permit the necessary vertical play of the parts without danger of  
 35 disengaging the braces.

By locating the weights in the same zone of revolution as the spring, I get a structure which is very compact, being only half as high as a governor in which the weights  
 40 are placed below the spring. The parts are all inclosed in the pot so that if anything breaks it cannot fly out and endanger the attendants or adjoining apparatus. The parts can be made sufficiently large to be  
 45 strong and durable, without occupying an undue amount of space.

An important feature of the device is the omission of rubbing surfaces of any kind, thereby eliminating all lag in the operation  
 50 of the governor, and insuring a prompt and delicate response to changes in speed.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together  
 55 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  
 60 means.

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

1. A centrifugal governor which rotates about a given axis, comprising a frame, an axially arranged spring member that is at-  
 70 tached at one end to the frame, means extending between the frame and the unattached end of said member for preventing its lateral displacement, weights pivotally mounted on the frame and located in the  
 75 same zone of revolution as said spring member, and means connecting the weights and said member.

2. A centrifugal governor which rotates about a given axis, comprising a rotatable  
 80 shaft, a cylindrical casing fixed to the shaft, a tension spring located along said axis that is attached at one end to said casing, means for preventing the lateral displacement of the unattached end of the spring, weights  
 85 arranged within the casing and pivotally mounted thereon at each side of the spring in the same zone of revolution as said spring, and means connecting the weights and the  
 90 spring.

3. A centrifugal governor comprising a rotatable shaft, a casing fixed to the shaft, a tension spring having its upper end se-  
 95 cured to the casing, a spring-plug to which the lower end of the spring is attached, weights pivotally mounted on the casing and located in the zone of revolution of said spring, and connections between the weights and the plug.

4. A centrifugal governor, comprising a  
 100 tension spring, a spring-plug to which its lower end is attached, pivoted weights located in the zone of revolution of said spring, and struts between said weights and  
 105 plug.

5. A centrifugal governor, comprising a tension spring, a spring-plug attached to its lower end and having lateral lugs, pivoted weights located in the zone of revolution of  
 110 said spring and having hooks, and struts between said hooks and lugs.

6. A centrifugal governor, comprising a tension spring, a spring-plug attached to its lower end and having lateral lugs, grooved blocks on said lugs, pivoted weights located  
 115 in the zone of revolution of said spring and having hooks at their upper ends, and struts having knife-edge ends bearing against said hooks and blocks.

7. A centrifugal governor, comprising a  
 120 tension spring, a spring-plug attached to its lower end, and having lateral lugs, grooved blocks on said lugs, pivoted weights located in the zone of revolution of said spring and having hooks at their upper ends, struts  
 125 having knife-edge ends bearing against said hooks and blocks, and retaining plates for preventing said struts from being thrown out of place by centrifugal force.

8. A centrifugal governor, comprising a 130



frame, a tension spring, means for supporting the spring at one end on said frame, a plug attached to the other end of the spring, pivoted weights located in the zone of revolution of the spring and acting on the plug in opposition to said spring, and means for preventing lateral displacement of the plug and the attached end of the spring.

9. A centrifugal governor, comprising a tension spring, a spring-plug attached thereto, pivoted weights located in the zone of revolution of said spring and exerting a pressure on said plug in opposition to said spring, a frame carrying the parts, and braces between said plug and frame.

10. A centrifugal governor comprising a tension spring, a spring-plug attached thereto, pivoted weights located in the zone of revolution of said spring and exerting a pressure on said plug in opposition to said spring, a frame carrying the parts, braces between said plug and frame consisting of rods, and sockets loosely receiving the ends of the same.

11. A centrifugal governor, comprising a tension spring, a spring-plug attached thereto, pivoted weights located in the zone of revolution of said spring and exerting a pressure on said plug in opposition to said spring, a frame carrying the parts, and braces between said plug and frame in the same axial plane as that in which the weights swing.

12. A centrifugal governor which rotates about a given axis, comprising a rotatable shaft, a casing or frame fixed on the shaft, a tension spring having its axis coincident with the axis of rotation, weights pivoted on the frame or casing adjacent one end of the spring and arranged on opposite sides of the spring in the same zone of revolution as said spring, and connections between the weights and the other end of the spring.

13. A centrifugal governor, comprising a spring, weights located on opposite sides of the spring, knife-edge pivots for the weights arranged adjacent one end of the spring, and connections intermediate the weights and the other end of the spring, there being knife-edge pivots between said connections and the weights and the spring respectively.

14. A centrifugal governor which rotates about a given axis, comprising an axially

located spring, weights arranged on opposite sides of the spring and substantially parallel thereto; oppositely disposed knife-edge pivots at one end of each weight and adjacent one end of the spring, connections intermediate certain of the pivots and the other end of the spring, there being knife-edge pivots between said connections and the spring, a rod leading from the spring to the apparatus to be governed, and a universal joint between the spring and the rod.

15. In a centrifugal governor, the combination of a rotatable shaft, a cylindrical casing having a head at each end thereof, one of said heads being mounted on the end of the shaft, an axially arranged coil spring within the casing that is secured at one end to the other head of the cylinder, a plug attached to the other end of the spring, weights pivoted to the last-mentioned head and arranged around the outside of the spring, connections between the weights and said plug, a rod axially arranged within the spring and extending outwardly through that head to which one end of the spring is attached, and a connection between the inner end of the rod and said plug.

16. In a centrifugal governor, the combination of a rotatable shaft, a cylindrical casing having a head at each end thereof, one of said heads being mounted on the end of the shaft, an axially arranged helical spring within the casing that is adjustably secured at one end to the other head of the cylinder, weights arranged on opposite sides of the spring and pivoted to said head, a plug attached to the other end of the spring, connections between the weights and the plug, braces arranged between the plug and the wall of the casing to prevent lateral displacement of said plug, a rod axially arranged within the spring and extending outwardly through that head of the cylinder to which one end of the spring is attached, and a pivotal connection between the inner end of the rod and said plug.

In witness whereof, I have hereunto set my hand this 19th day of July, 1907.

FRED W. BENTLEY.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.