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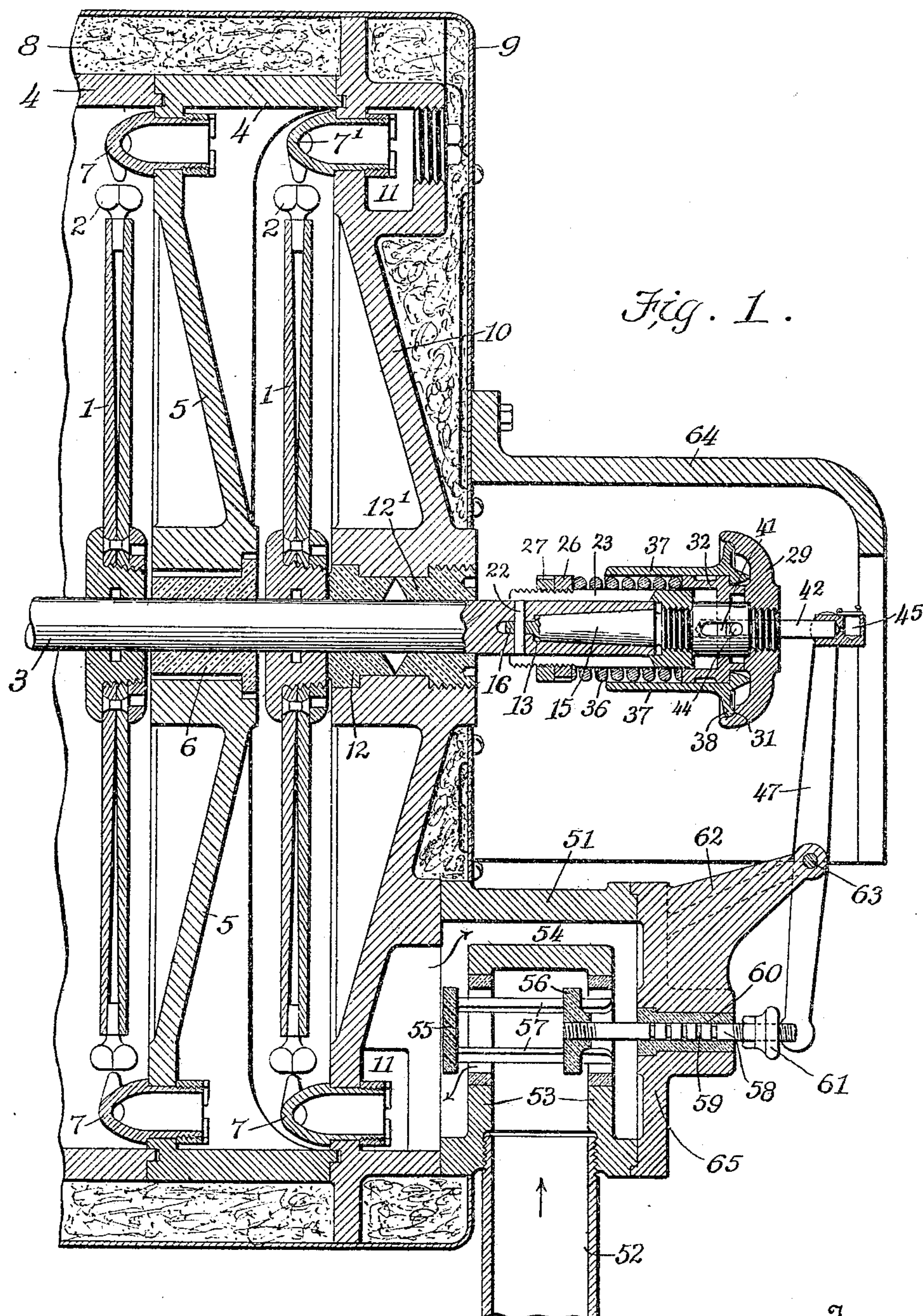
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C. V. KERR.

HIGH SPEED GOVERNOR FOR STEAM TURBINES.

APPLICATION FILED JAN. 14, 1905.

2 SHEETS--SHEET 1.



Witnesses
Ernest Puleford
John H. Ketch

Inventor
by Charles V. Kerr,
W. E. Schornborn
Attorney

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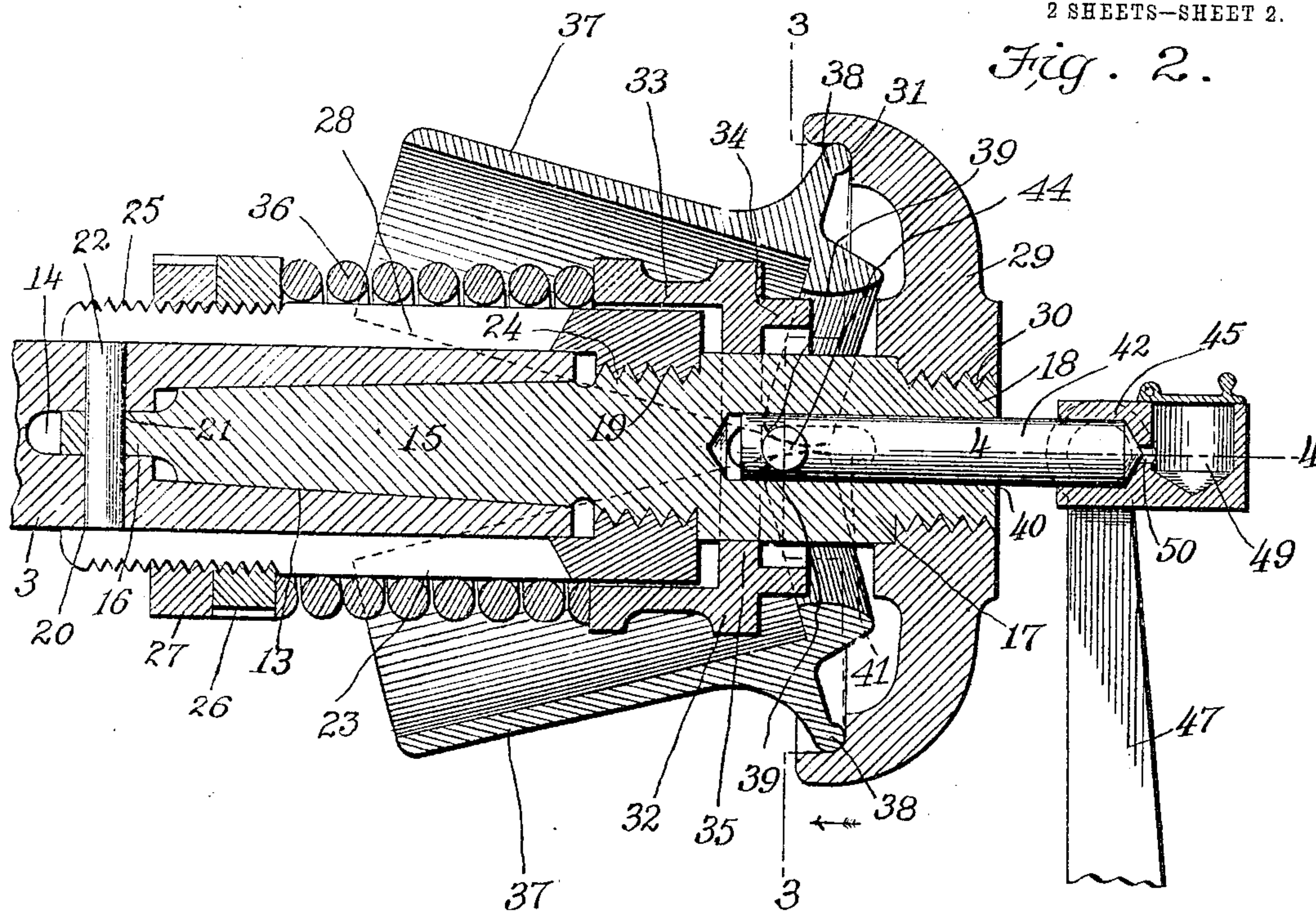


Fig. 3.

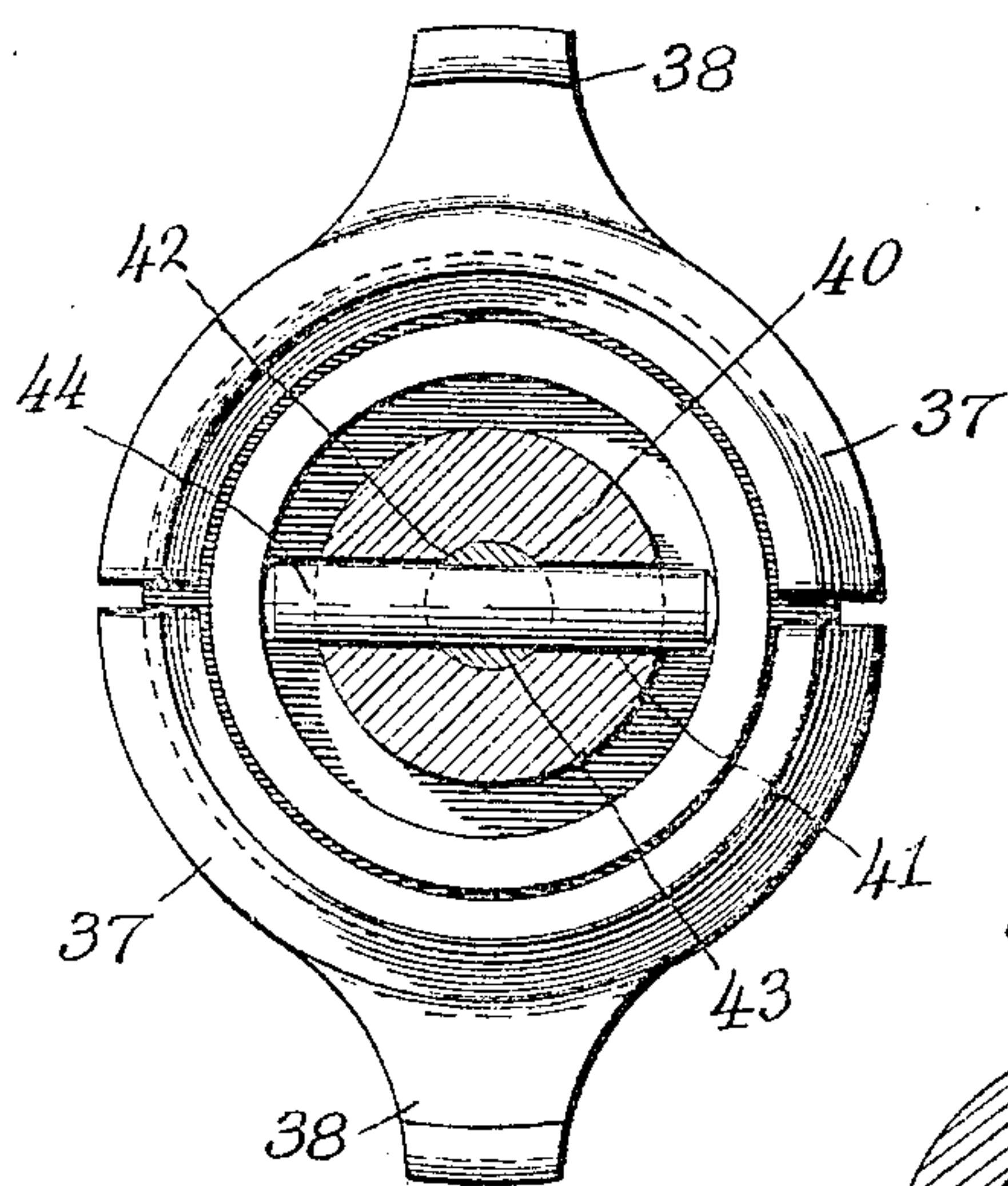


Fig. 4.

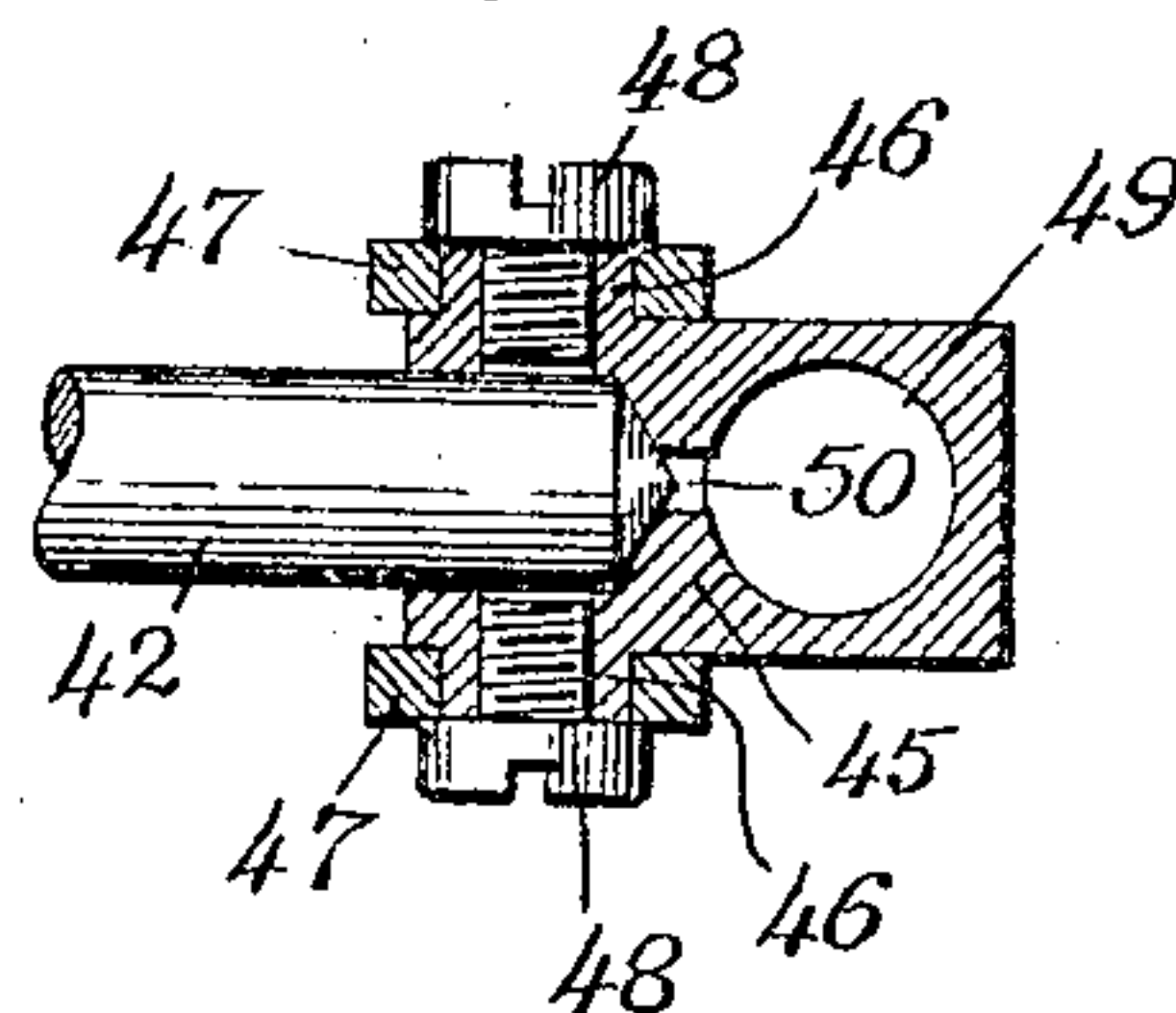
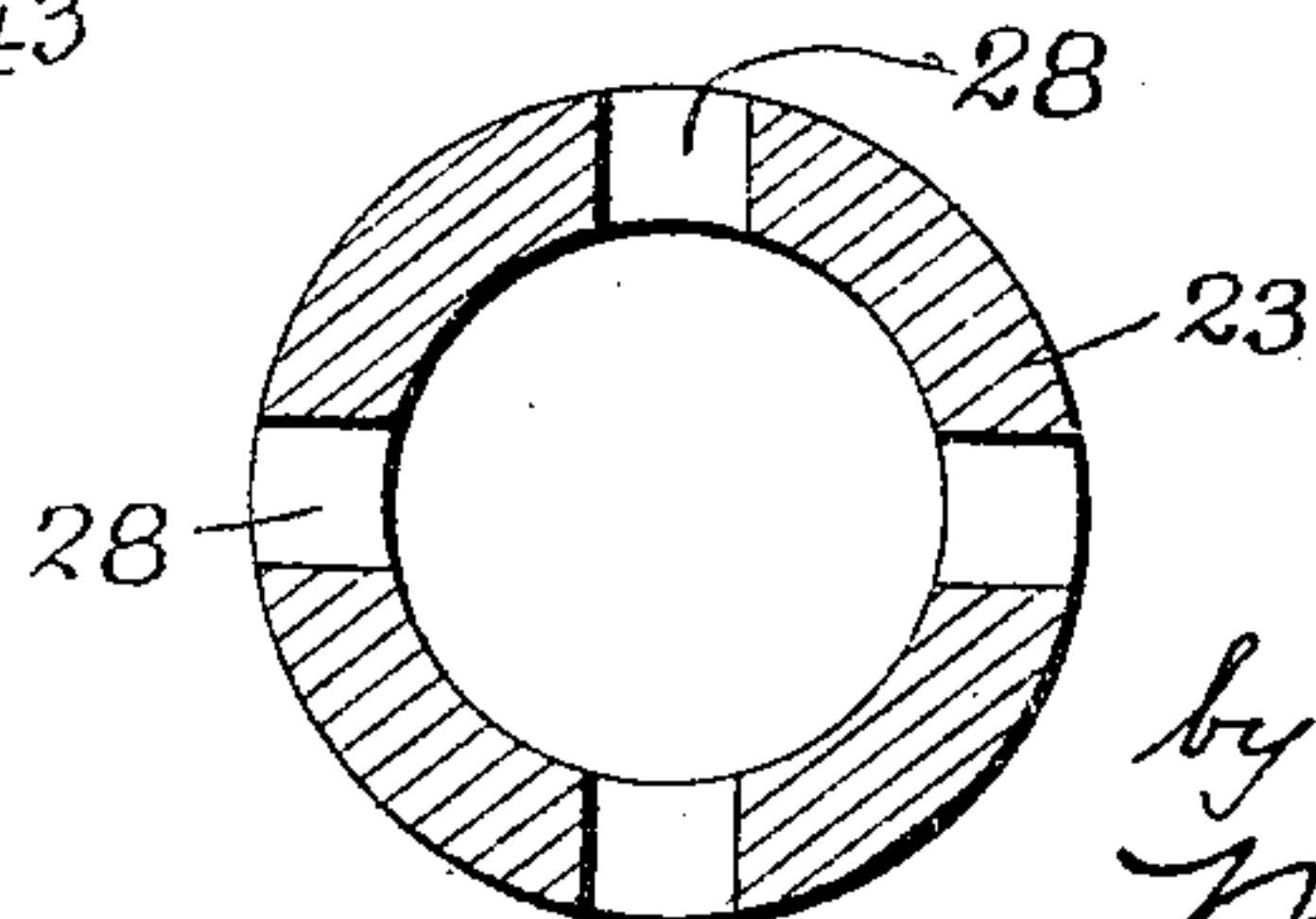


Fig. 5.



Witnesses
Ernest Puleford.
John H. Kalk.

Inventor
by Charles V. Kerr,
W. E. Schoenborn
Attorney

UNITED STATES PATENT OFFICE.

CHARLES V. KERR, OF WELLSVILLE, NEW YORK, ASSIGNOR TO KERR
TURBINE COMPANY, OF WELLSVILLE, NEW YORK, A CORPORA-
TION OF NEW YORK.

HIGH-SPEED GOVERNOR FOR STEAM-TURBINES.

No. 801,322.

Specification of Letters Patent.

Patented Oct. 10, 1905.

Application filed January 14, 1905. Serial No. 240,977.

To all whom it may concern:

Be it known that I, CHARLES V. KERR, a citizen of the United States, residing at Wellsville, in the county of Allegany and State of New York, have invented certain new and useful Improvements in High-Speed Governors for Steam-Turbines, of which the following is a specification.

My invention relates to automatic governing mechanism for engines, and more especially to those intended for use with elastic-fluid turbines, as shown, for example, in my application filed October 10, 1904, Serial No. 227,804.

The objects of my invention are, first, to construct an automatic governor for elastic-fluid turbines in which the running parts are in perfect balance; second, to pivot and arrange the bearings of the centrifugal weights forming a part of the governor so as to secure great durability of the mechanism and at the same time freedom from sticking while in operation; third, to construct and arrange the parts of the governing mechanism and its means for attaching to the turbine-casing so that the turbine may be readily assembled or dismantled by stripping the parts over the shaft and the governor may be slipped off the shaft without the necessity of separating or dismantling the same; fourth, to construct the motive-fluid or steam end casting of the turbine, the governor mechanism and its inclosing casing so that the motive-fluid connections may be made at either side or at the bottom of the end casting; fifth, other evident advantages of construction and relation of parts comprising the mechanism whereby a governor is provided which will maintain the speed of a motor constant within certain predetermined limits and over a wide range of the load.

The invention consists of features of construction and relation of elements, which will be hereinafter more particularly described, and pointed out in the appended claims.

In the accompanying two sheets of drawings, in which similar reference characters indicate the same parts in the several views, Figure 1 is a sectional view of my improved governor with only a portion of the turbine to show the arrangement of securing the same to the motive-fluid end of the casing. Fig. 2 is an enlarged sectional view of the gov-

ernor mechanism, showing the end of the turbine-shaft and means of securing the governor to the same. Fig. 3 is a transverse sectional view on line 3 3 of Fig. 2 with the governor-weights in the position as indicated in Fig. 1. Fig. 4 is a sectional view on line 4 4 of Fig. 2. Fig. 5 is a transverse sectional view about the middle of its length of the sleeve surrounding the outer end of the rotary shaft.

Referring to Fig. 1 of the drawings, 1 1 represent the wheels, and 2 2 are the buckets on the periphery of the wheels of a turbine.

3 is a rotary shaft passing centrally through the engine-casing, to which the several wheels 1 1 are suitably secured.

4 4 are separable sections of the engine-casing, which are fitted to each other by tongue-and-groove joints.

5 indicates one of the partitions which separates one wheel-chamber from the next.

6 is any suitable bushing or packing gland about the shaft and seated in the central shaft-opening of the partition 5.

7 7' are nozzles which inject the motive fluid against the buckets 2 on wheels 1.

8 is the usual lagging covering the engine-casing and which is protected by a sheet-metal housing 9. 10 is a casting containing the motive-fluid chest 11, which is connected with the first set of nozzles 7'.

12 and 12' are suitable bushings or packing-glands interposed between the central shaft-opening in the end casting 10 and the shaft 3 in order to form a fluid-tight packing and a bearing for the rotary shaft.

The features so far described form no part of my present invention, as they may be readily changed or modified in many ways or any other existing forms of motive-fluid turbines could be substituted therefor.

The section of the rotary shaft 3, which extends out through the end casting 10, is provided at its end with a central or axial socket 13, preferably tapering or smaller at its bottom. (See Fig. 2.)

14 is an extension or reduced portion of the socket 13, the function of which will be hereinafter more clearly described.

15 is a rod or plug of the same shape and carrying diameter as the socket 13 and which is adapted to be inserted and fitted in said socket 13. The said plug 15 is provided at one end with a reduced end 16, which fits in

the smaller or inner portion 14 of the socket 13. The other end of plug or rod 15 is provided with an enlargement 17, which is provided with an end threaded section 18 and a
5 separated threaded section 19, adjacent to the end of the shaft 3.

20 is a diametrical opening in the shaft 3 at a point corresponding to the middle section of the reduced extension 14 of the pocket 13.

10 21 is an opening in the reduced end 16, corresponding to the opening 20 in the shaft.

22 is a retaining-pin which may be tapered, if so desired. Said pin passes into the openings 20 and 21 and engages the reduced end
15 16, thereby firmly holding the rod or plug in the socket 13 of the shaft 3 and at the same time causing it to rotate therewith when the turbine is in operation.

Encircling the outer end of the shaft 3 is a
20 sleeve 23, which engages at its outer end by internal screw-threads 24 the threaded section 19 of the plug or rod 15. The other or inner end of the sleeve 23 is provided with a threaded end section 25, which is engaged by an
25 adjustable screw-collar 26 and a lock-nut 27, the function of which will be hereinafter described.

28 indicates radial longitudinal slots in the sleeve 23 for the purpose of permitting the
30 insertion and withdrawal of the retaining or locking pin 22 in the openings 20 and 21 of the shaft 3 and plug end 16, respectively. (See Figs. 2 and 5.)

29 is a cup-shaped piece which is provided
35 with suitable internal threads 30, which engage the threaded end section 18 of the plug or rod 15.

31 is a circular flange or shoulder on the inner side and near the outer edge of the
40 cup 29.

32 is a collar which is slipped over the outer end or enlargement 17 of the plug 15. Said collar 32 is provided with an inner annular flange 33 and a similar outer flange 34, which
45 form a large and a small cup-shaped section with a common annular portion 35, which is slidably supported on said enlargement 17.

Surrounding the outer periphery of the sleeve 23 and interposed between the screw-
50 collar 26 and the inner end of the collar 32 is a coil-spring 36, the function of which will be hereinafter described.

37 37 are centrifugal weights which are semicircular in transverse section and provided at one end with an extension 38, which
55 engages the circular flange or shoulder 31 of the cup 29 and outer curved edges 39, which bear against the outer side of the flange 33 on the opposite sides of the collar 32.

40 is a hole bored centrally and axially in the enlargement 17 and the outer section 18 of the plug 15. (See Figs. 2 and 3.)

41 is a radial slot in the enlargement 17 and extending almost its entire length.

65 42 is a spindle loosely inserted in said hole

40. Near the inner end of the spindle is provided a circular opening 43, through which and the slot 41 is passed a pin 44, with its ends bearing against the outer side of the annular portion 35 and inner side of the outer
70 flange 34 of collar 32.

From the foregoing description of the construction and arrangement of the parts comprising the governor it will be seen that when the shaft 3 is rotated all the parts so far described as being attached to the end of the shaft and the plug or rod 15 will be made to rotate therewith. 75

The outer end of the spindle 42 bears in a suitable governor-pivot 45, which consists of
80 a properly-shaped casting having two side lugs 46 46, which are engaged by openings in the ends of the governor-levers 47 47, said levers being held in position on said lugs by any suitable means—as, for example, screws
85 48 48, as shown.

49 is an oil or grease cup having a suitable cover and provided with a duct 50, leading to the end of the spindle 42 in the bearing of the pivot 45. 90

Attached by any suitable means (not shown) to the lower end of the motive-fluid end casting 10 and communicating with the fluid-chest 11 therein is a governor-valve casing 51, which is provided with the usual motive-fluid inlet
95 52. Within the valve-casing 51 is provided an inner chamber 53, which is surrounded by passages 54, which communicate with the main supply-passages of the motive fluid to the turbine. A governor-valve consisting of
100 two head-sections 55 and 56, which are connected by separated strips 57, is adapted to move in suitable seats attached to an opening in the walls of the inner chamber 53.

58 is a valve-stem, one end of which is connected to the head 56 of the valve and is provided with water-grooves 59 at the section which passes through a bronze bushing 60, thereby forming a suitable packing and at the same time preventing the valve-stem from
110 sticking in reciprocating through the governor-valve-casing cover 65.

61 is a spindle-button provided with internal threads and which is adjustable by engaging a corresponding threaded section on the
115 outer end of the valve-stem 58.

62 is a bracket cast integral with governor-valve-casing cover 65, which supports the governor-levers 47 47 by the pivot pin or pins 63. 120

64 is a hood attached by bolts or other suitable expedient to the fluid end casting 10 to shield the end of the rotary shaft and governor mechanism.

The manner of assembling the various parts
125 of the governor is effected by arranging on the plug or rod 15 the sleeve 23, screw-collar 26, lock-nut 27, spring 36, collar 32, centrifugal weights 37, spindle 42, and the cup-shaped piece 29. After the above-enumerated parts
130

have been properly arranged and adjusted on the plug or rod 15 the tapered end of the rod is inserted in the like corresponding central or axial socket 13, having its tapered end 16 passing into the reduced section 14 of the socket 13. The sleeve 23 is then turned on the end of the shaft 3 until one of its slots 28 correspond to the diametrical opening 20 in the shaft, which permits the retaining-pin 22 to be inserted into the openings 20 and 21 of the shaft 3 and reduced end 16 of the plug or rod 15. After the insertion of the retaining-pin 22 the sleeve 23, which is fitted to freely turn on the shaft, may be partly turned to cover the opening 20, and when the screw-collar 26 and lock-nut 27 are screwed up to engage the threads on the split or slotted end of the sleeve 23 the same is made to bind tightly against the shaft, and thereby firmly and securely hold the plug or rod 15 and the rotary parts of the governing mechanism to the end of the shaft 3.

The balanced governor-valve and valve-casing 51 are constructed so that by means of the passage 54 the motive fluid is made to entirely surround the sections composing the throttle-valve, and thereby causing a pressure to be exerted through the valve-stem 58 against the lower end of the governor lever or levers 47. This exerted pressure which, as will be readily seen, is equivalent to the differences of the exposed areas of the valve-section 56 or the cross-sectional area of the valve-stem 58, tends to normally hold by means of the pivoted governor-levers 47 47 the governor-pivot 45 against the outer end of the rotary spindle 42, which is fixed to the rotating governor mechanism on the turbine-shaft.

When it is desired to inspect or repair the inner parts of the turbine, all that is necessary after hood 64 has been taken off is to remove the pivot-pin 63 of the governor-levers 47 47 and the retaining-pin 22, when the plug or rod 15 may be removed and the rotary elements comprising the governor may be readily slipped off the end of the shaft without disturbing the operative relations of any other section of the governor mechanism, the throttle-valve, or its casing. After the rotary elements of the governor are slipped off the end of the shaft the motive-fluid end casting 10, having the valve-casing 51 and balanced governor-valve attached thereto, may be easily stripped off the end of the shaft, which may be followed by the other separable sections 4 of the turbine-casing and bucket-wheels 1 1 of the rotary element.

The operation of my invention is as follows: Assuming the parts to be arranged and adjusted in the position, as indicated in Fig. 1, the action of the motive fluid in passing from any suitable source into supply-pipe 52, through the governor-valve casing 51 and valve into the fluid-chest 11 and by means of the injector-nozzle 7 7' is made to impinge against the

buckets 2 on the periphery of the wheels 1 1, thereby rapidly revolving the shaft 3. This rotary motion is transmitted to the governor-weights 37 37, which by the action of centrifugal force are made to assume a position as indicated in Fig. 2. The governor-weights in being thrown out in this position cause their extensions 38 38, which are provided with a rounded or roller-bearing surface to react against the flange or shoulder 31 of the fixed cup-shaped piece 29. Owing to the confinement of the extensions 38 the inner or knife-edge portions 39 39 of the weights 37 37 press the collar 32 against the compressible coil-spring 36. The spindle 42 being loosely inserted in the hole 40 at the end of the plug or rod 15, and there being a force constantly exerted to the left against the outer end of the spindle 42, due to the unbalanced governor-valve, as previously described, the pin 44 is pressed, by means of its valve-stem 58 and governor-levers 47 47, against the outer side of the annular portion 35 of the collar 32. Thus it will be seen that the inner end of the spindle 42 will be made to assume different positions depending on the variable automatic adjustment of the collar 32, which is effected by the angular position of the governor-weights 37 37, or the rotary motion of the turbine-shaft. The different longitudinal positions of the spindle 42 in turn oscillate on their pivot-pin 63, the governor-levers 47 47, whose lower ends bear against the adjustable button 61, shift the governor-valve, which correspondingly regulates the motive fluid to the rotary elements of the turbine, and thereby preserving a constant and efficient speed of the turbine whether working under a maximum or minimum load.

The strength of the spring 36, which controls the action of the centrifugal weights 37 37, can be easily adjusted by means of the screw-collar 26 and lock-nut 27, and the position of the governor-valve with respect to its seats and operative relation of the rotary elements of the governor may be quickly regulated without interruption by simply turning the button 61.

From the foregoing description of the structural features, mode of assembling the different parts, and manner of operation it will be readily seen I have devised a turbine-governor in which all the parts are in perfect balance, free from sticking while in operation, and at the same time enable the governor to be readily assembled or disconnected from the turbine without the necessity of disturbing its assembled relations.

Various changes may be made in the specific construction of the governor and its mode of attaching to the turbine-shaft or connections with the governor-valve, and while I have shown my preferred form I do not care to limit myself to these specific arrangements, as they could be modified in many

ways without departing from the spirit of my invention and accomplish the same results.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of the shaft, a removable rod or plug adapted to be seated and secured in the socket, centrifugal weights supported on said removable rod or plug, a movable collar or abutment, a spring reacting against the movable collar or abutment, means for transmitting the movement of the centrifugal weights to the movable collar or abutment, a governor-valve, and means for transmitting the movement of the movable collar or abutment to the governor-valve.

2. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of the shaft, a removable rod or plug adapted to be seated and secured in the socket, an abutment secured to the outer end of the removable rod or plug, a movable collar or abutment surrounding the rotary shaft, a spring reacting against the movable collar or abutment, centrifugal weights acting against the abutment secured to the outer end of the rod or plug and the movable collar or abutment, a governor-valve, and means for transmitting the movement of the movable collar or abutment to the governor-valve.

3. A governor for turbines or the like, comprising a fixed rotary shaft, a socket in the outer end of the shaft, a removable rod or plug adapted to be seated and secured in the socket, and a centrifugally-actuated controller attached to and removable with the outer end of the rod or plug.

4. A governor for turbines or the like, comprising a fixed rotary shaft, a socket in the outer end of the shaft, a removable rod or plug adapted to be seated and secured in the socket, a centrifugally-actuated controller attached to and removable with the outer end of the rod or plug, a governor-valve, and means for connecting the governor-valve with the centrifugally-actuated controller.

5. A governor for turbines or the like, comprising a fixed rotary shaft, a removable rod or plug, means for securing the rod or plug to the end of the rotary shaft, a centrifugally-actuated controller attached to and removable with the outer end of the rod without separating its operative parts, a governor-valve, and means for loosely and detachably connecting the controller with the governor-valve.

6. A governor for turbines or the like, comprising a fixed rotary shaft, a centrifugally-actuated controller, an opposing spring concentric with the shaft for said controller, means for integrally carrying the controller and spring, and a detachable connection between the shaft and said controller and spring-carrying means, whereby the latter may be

removed away from the end of the shaft without dismantling the controller or spring or disturbing the shaft.

7. A governor for turbines or the like comprising a fixed rotary shaft, a socket in the outer end of the shaft, a centrifugally-actuated controller, means for carrying the controller inserted in the socket, and a pin for detachably connecting the shaft and the controller-carrying means, the removal of said pin permitting the separation of said shaft and controller-carrying means and its removal away from the end of the shaft.

8. A governor for turbines or the like, comprising a rotary shaft, a centrifugally-actuated controller, means for carrying the controller, a pin for detachably connecting the shaft and the controller-carrying means, a sleeve surrounding the shaft and provided with an opening registering with said pin, and means for securing said sleeve on the shaft with the opening out of register with the pin, whereby the pin is prevented from removal by the inner walls of the sleeve.

9. A governor for turbines or the like, comprising a rotary shaft, a centrifugally-actuated pivoted controller, a fulcrum member on which the controller is pivoted, a detachable connection between the fulcrum member and the shaft, a yielding collar or abutment operated by the movement of the controller, a governor-valve, and means connecting the yielding abutment and the governor-valve.

10. A governor for turbines or the like, comprising a rotary shaft, a collar or abutment, means to press the collar or abutment outward, a centrifugally-actuated controller adapted to press the collar or abutment inward, and a governor-valve having a loose and detachable connection with the collar or abutment, said valve being operated upon by the motive fluid to press the abutment inward.

11. A governor for turbines or the like, comprising a rotary shaft, a spring-pressed collar or abutment thereon, a centrifugally-actuated controller tending by its rotation to move the abutment against the tension of its spring, and a governor-valve having a loose and detachable connection with the spring-pressed collar or abutment and also tending to move it against the tension of its spring.

12. A governor for turbines or the like, comprising a fixed rotary shaft, a socket in the outer end of the shaft, a plug entering said socket, a centrifugally-actuated controller mounted on said plug, and means for detachably connecting the shaft and plug whereby the centrifugally-actuated controller may be removed from the end of the fixed shaft without disturbing the operative relation of said controller on the plug.

13. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of said shaft, a plug entering said socket, a centrifugally-actuated controller mounted

on said plug, and a pin detachably connecting said shaft and plug.

14. A governor for turbines or the like, comprising a rotary shaft, a socket in the end of said shaft, a plug seated in said socket, a pin detachably connecting the shaft and plug, a fulcrum member mounted on the outer end of the plug, an adjustable sleeve surrounding the plug and having an opening registering with said pin, means for adjustably securing the sleeve on said shaft, a collar or abutment mounted on the plug between the sleeve and fulcrum member, an expansion-spring tending to press the collar or abutment outward, centrifugal weights fulcrumed on the fulcrum member and engaging the spring-pressed collar or abutment, a governor-valve, and connections between the governor-valve and the spring-pressed collar or abutment.

15. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of said shaft, a plug detachably seated in said socket, a fulcrum member mounted on the outer end of said plug, a spring-pressed collar or abutment loosely mounted on said plug, centrifugal weights having portions engaging with the fulcrum member and the spring-pressed collar or abutment and confined therebetween by the action of the spring, a governor-valve and connections between the spring-pressed collar or abutment and the governor-valve for controlling the supply of motive fluid.

16. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of said shaft, a plug detachably seated in said socket, a spring-pressed collar or abutment on said plug, a centrifugally-actuated controller mounted on said plug and acting against the spring-pressed collar or abutment, a socket in the outer end of said plug, a spindle loosely seated in the socket and having a pin-and-slot connection with the plug, the pin being extended beyond the surface of the plug and engaged with the spring-pressed collar or abutment, a governor-valve, a governor-lever having a bearing for said spindle at one end and connected with the governor-valve at the other end, the motive fluid cooperating with the centrifugally-actuated controller to oppose the spring-pressed collar or abutment.

17. A governor for turbines or the like comprising a rotary shaft, a centrifugally-actuated controller detachably mounted on said shaft, a yielding abutment operated by the controller, a governor-valve, and a detachable and loose connection between the governor-valve and the yielding abutment to permit ready separation of the parts.

18. A governor for turbines or the like comprising a rotary shaft, a centrifugally-actuated controller detachably mounted on said shaft, a yielding abutment operated by the controller, a governor-valve, and a governor-lever having a detachable and loose connection with

both the governor-valve and the yielding abutment.

19. A governor for turbines or the like comprising a rotary shaft, a centrifugally-actuated controller detachably mounted on said shaft, a yielding abutment operated by the controller, a spindle engaging the abutment loosely, a governor-valve, and a governor-lever having a detachable and loose connection with both the governor-valve and said spindle.

20. A governor for turbines or the like comprising a rotary shaft, a socket in the end of said shaft, a plug detachably mounted in said socket, a yielding abutment mounted on said plug, centrifugal weights pivotally mounted on said plug and adapted to engage and operate the yielding abutment, a bore in the outer end of said plug, a spindle seated in said bore and having a pin loosely engaging said yielding abutment, a governor-valve, and a detachable governor-lever having a loose engagement with the governor-valve at one end and having a bearing at its other end loosely receiving said spindle.

21. A governor for turbines or the like comprising a rotary shaft, a socket in the end of said shaft, a plug detachably seated in said socket, a split sleeve surrounding said shaft and plug, a screw-threaded collar and lock-nut for locking the sleeve on the shaft, a fulcrum member mounted on said plug, an abutment mounted on said plug, a spiral spring confined between said screw-threaded collar and said abutment, centrifugal weights pivoted on the fulcrum member and having projections engaging the abutment, and connections adapted to control the motive fluid by the operation of the centrifugal weights.

22. A governor for turbines or the like comprising a rotary shaft, a socket in the end of said shaft, a plug seated in the socket and extending beyond the end of the shaft, a detachable pin passing through the shaft and the inner end of the plug, a sleeve surrounding the shaft and plug said sleeve being provided with one or more slots at its inner end through which the pin may pass, an abutment mounted on the plug, a screw-threaded collar and lock-nut for locking the sleeve to the shaft, a coiled expansion-spring confined between the collar and the abutment, centrifugal weights mounted on the plug and engaging the abutment to communicate their motion thereto, a governor-valve, and means for controlling said valve by the movement of said centrifugal weights.

23. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of the shaft, a removable rod or plug adapted to be seated and secured in the socket, centrifugal weights supported on said removable rod or plug, a movable collar or abutment, a spring reacting against the movable collar or abutment, means for transmitting the movement of the centrifugal weights at two substantially diametric opposite points of the

movable collar or abutment, a governor-valve, and means for transmitting the movement of the movable collar or abutment to the governor-valve.

- 5 24. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end of the shaft, a removable rod or plug adapted to be seated and secured in the socket, an abutment secured to the outer end of the removable
10 rod or plug, a movable collar or abutment surrounding the rotary shaft, a spring reacting against the movable collar or abutment, centrifugal weights acting at one point against the abutment secured to the outer end of the
15 rod or plug and at two substantially diametric opposite points of the movable collar or abutment, a governor-valve, and means for transmitting the movement of the movable collar or abutment to the governor-valve.
- 20 25. A governor for turbines or the like, comprising a rotary shaft, a socket in the outer end

of the shaft, a removable rod or plug adapted to be seated and secured in the socket, an abutment secured to the outer end of the removable rod or plug, a movable collar or abutment surrounding the rotary shaft, a spring concentric with the shaft and reacting against the movable collar or abutment, centrifugal weights acting at one point against the abutment secured to the outer end of the rod or
25 plug and at two substantially diametric opposite points of the movable collar or abutment, a governor-valve, and means for transmitting the movement of the movable collar or abutment to the governor-valve. 30

In testimony whereof I affix my signature in presence of two witnesses. 35

CHARLES V. KERR.

Witnesses:

WM. D. APPLEBEE,
E. A. RATHBUN.