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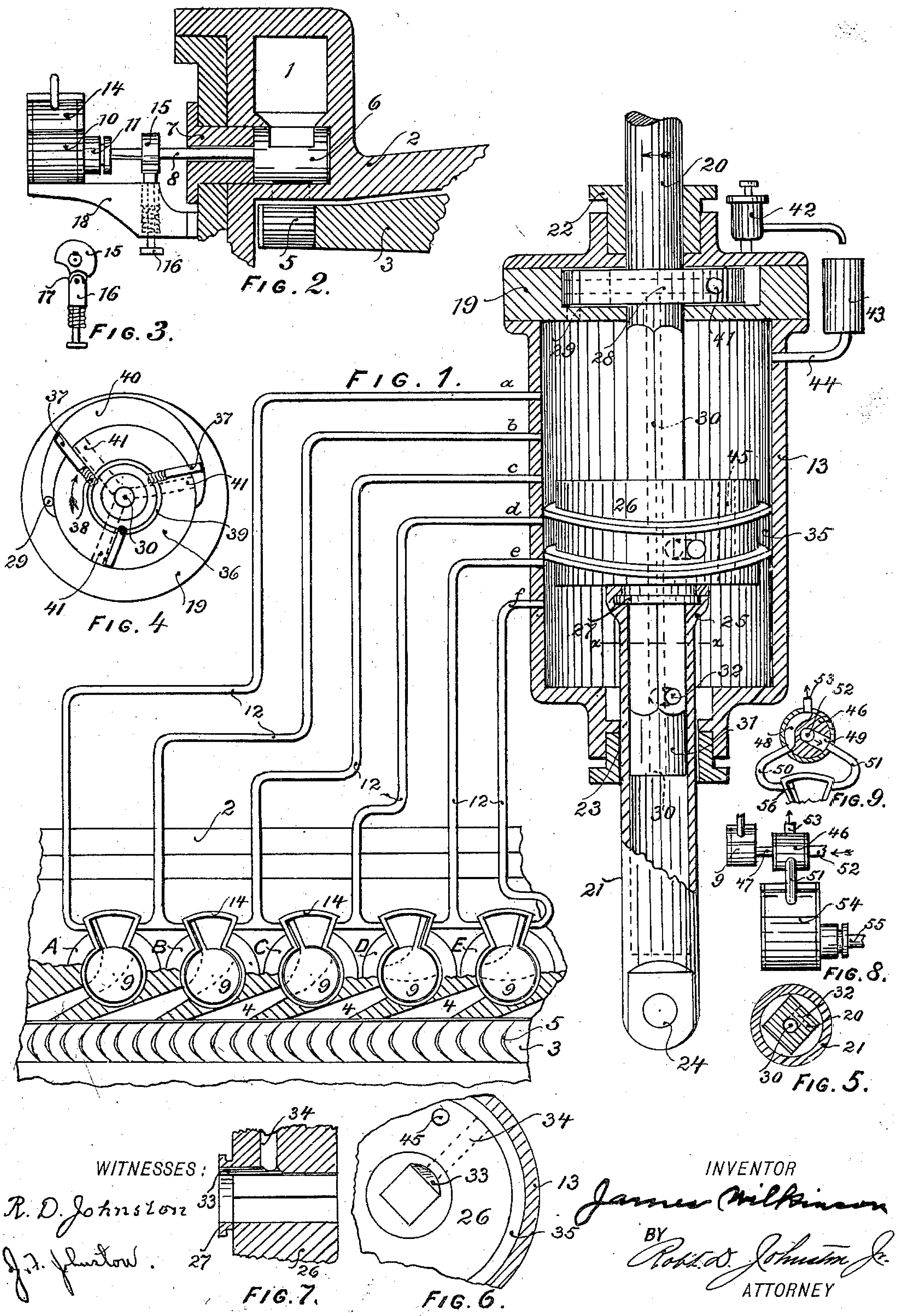
J. WILKINSON.

GOVERNING MECHANISM FOR TURBINES.

APPLICATION FILED JULY 14, 1903.

NO MODEL.



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No. 741,426. Patented October 13, 1903.

UNITED STATES PATENT OFFICE.

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GOVERNING MECHANISM FOR TURBINES.

SPECIFICATION forming part of Letters Patent No. 741,426, dated October 13, 1903.

Application filed July 14, 1903. Serial No. 165,495. (No model.)

To all whom it may concern:

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Governing Mechanism for Turbines, of which the following is a specification.

My invention relates to an improved governing mechanism for elastic-fluid turbines wherein governor-controlled hydraulic pressure is utilized to operate rotary valves which admit fluid-pressure to the turbine or to its wheel-compartments if it be of the compound type operating by stage expansion.

It is an object of my invention to provide apparatus which will maintain the operating liquid under the desired pressure and will admit it subject to a governor-controlled piston to one or more of a series of passages in pulsations or impulses to oscillate one or more of the turbine-valves, so that they admit pressure proportioned to slight variations in the load, while the other valves are maintained open or closed, according to the load.

My invention consists in the construction and arrangement of parts hereinafter described, and more particularly pointed out in the claims, reference being had to the accompanying drawings, forming a part hereof, and in which—

Figure 1 shows a sectional elevation of the hydraulic cylinder with its governor-controlled piston which admits pressure to a series of pipes leading to wing-valves controlling the admission of pressure to the turbine-nozzles. Fig. 2 is a vertical section, broken away, through the turbine parts shown in Fig. 1 with the rotary turbine-valve and its operating parts in elevation. Fig. 3 is a detail view of a spring-stop to hold the valve in either its open or closed position. Fig. 4 is a top plan view of the pumping device in the head of the cylinder seen with the cap removed. Fig. 5 is a section through x x of Fig. 1. Fig. 6 is a bottom view of a portion of the controller-piston, showing the pressure-conducting passages leading to the pressure-chamber around the piston. Fig. 7 is a transverse section through Fig. 6. Figs. 8 and 9 show the hydraulic wing-valve used to open a rotary fluid relay-valve which admits power to operate the turbine-valves.

The same reference characters refer to the same parts throughout the drawings.

A fluid-pressure passage 1 in the head 2 supplies the elastic fluid to a rotor-wheel 3 through a series of nozzles 4, which pass at an incline through said head. These nozzles, which deliver the fluid streams at an angle against a row of vanes or buckets 5, fixed to said wheel, are controlled by rotary valves 6, located in their throats. Circular seats are bored for these valves in the head and stuffing-glands 7, which surround the stems 8 of said valves, are inserted in and close the outer ends of the valve-seats. This construction and the arrangement of parts, as well as the nature of the valve action effected by the governor, are more fully set forth in an application filed by me on the 7th day of April, 1903, Serial No. 151,504, and form no particular part of this invention, which relates especially to a governing mechanism employing hydraulic pressure to operate the turbine-valves and regulate the admission of fluid-pressure thereto.

On the outer ends of the stems 8 are fixed wing-valves 9, mounted in casings 10, provided with stuffing boxes or glands 11 to prevent the leakage around the stems of liquid-pressure supplied to each casing by pipes 12, which communicate with the hydraulic cylinder 13. These pipes 12 are arranged to enter the cylinder at points equidistant and in alinement with each other and at their other ends they branch, so that each pipe leads to the opposite sides of adjacent casings 10. Except where the valves are arranged in separately-controlled groups, as shown in the drawings, the pipes controlling the end valves lead only to the outer sides of the valves' casings. The wing of the valve 9 moves in a segmentally-shaped extension 14 of the casing 10, into which the pipes 12 lead, and as pressure is admitted under governor control it moves the wing against one side or the other of 14, which represents open or closed positions for the rotary turbine-valve. A disk 15 is keyed to the stem 8 and provided with curved depressions in its periphery, which are engaged by a spring-controlled pin

16 when the valve is either open or closed with a view to holding it in the one position or the other until operated by the pressure. The casing 10 and spring-pin 16, whose bearing end may be rounded or have a friction-roller 17, as shown in Fig. 3, are both supported on a bracket 18, rigidly secured to the turbine-casing.

The hydraulic cylinder 13 is preferably filled with oil, though any other liquid may be used, and is provided at one end with a chambered head 19, through the center of which passes a shaft 20, that extends the entire length of the cylinder, telescoping at its inner end within a cylindrical hollow tube 21. This shaft is provided with a stuffing-box 22 and is rotated by the turbine or any other desirable source of power. The tube 21 enters the other end of the cylinder 13 through a suitably-packed opening 23, being provided at its outer end, which is closed, with an eye 24, to which a governor or devices controlled thereby are connected to move the tube back and forth in the cylinder, while its inner end has an internally-grooved offset or shoulder 25. A piston-valve 26 is connected to said tube by a flanged cylindrical extension 27, engaging said grooved offset in a manner to permit of the piston rotating freely while it shifts with the governor-actuated tube, which does not rotate. The shaft 20 is squared throughout its extent within the cylinder, and the piston 26, which is rotated thereby, has a square central opening, through which it passes. This shaft also operates a rotary pump of any desired construction, as 28, within the chamber in the head 19, which operates on the liquid supplied thereto from the cylinder through port 29 to force it under pressure through a passage 30, leading down through the shaft 20 to the tube below the cylindrical end 31 of said shaft, while a by-passage 32 opens through a flattened side of the shaft near its lower end. Between the squared portion of the shaft and the tube within which it telescopes there will be clearances or longitudinal passage-ways, with one of which the passage 32 communicates, as seen in Fig 5, and delivers liquid-pressure thereto, which passes up said passage-way to the piston. Here the lower part of one of the faces of the square central opening in line with said pressure-supplied passage-way is recessed, as shown at 33 in Figs. 6 and 7, to a point where a transverse passage 34 leads through the piston to its periphery. In this manner liquid-pressure will be supplied to this passage 34 regardless of the piston's position in the cylinder, and by this means I always maintain the liquid at the desired operating pressure in a circumferential chamber 35, disposed around the piston and into which this passage 34 leads. This pressure-chamber 35 is formed by two annular flanges or rings disposed to form conical helices around the piston and fit pressure-tight within the cylinder, which chamber will therefore be in the shape of a helix, since the flanges are equidistant throughout. The width of the chamber between flanges is slightly less than the distance between the pipes 12, and the pitch of the helix is such that the piston will actively control but one of the wing-valves 9 at a time. Pressure is supplied to operate the valves by the rotary pump 28, (shown in Fig. 4,) comprising the head 36, with radial recesses, in which are seated sliding vanes 37, normally pressed outwardly by springs 38 against the walls of the pump-chamber. An equalizing-groove 39 communicates with these several recesses. One side of the chamber is recessed, as shown at 40, and has the supply-opening 29 from the cylinder entering and supplying liquid to one end of the recess. A series of radial passages 41, leading through the head from in front of the vanes in the direction of rotation, enter the passage 30, and as the liquid is compressed by the movement of the vanes within the narrowing recess it passes down said passage and up through the passage-way within the tube 21 and through 34 to the pressure-chamber 35.

A relief-valve 42, set to open at any desired hydraulic pressure in the pump-chamber—say fifteen pounds—discharges into a vessel 43, from which the liquid is conducted back into the cylinder by pipe 44. This maintains the liquid within the cylinder under atmospheric pressure, and the pressure is equalized throughout the cylinder by a by-pass 45 through the piston-head.

The operation of my governing device is as follows: The piston 26 will be continually rotating, so that the liquid-pressure in the helical chamber 35 will be intermittently admitted to two of the pipes 12, which for convenience will be referred to as *a*, *b*, *c*, *d*, *e*, and *f*, while the valves will be distinguished by the letters A, B, C, D, and E. This action of the piston will be true except when it is at either extreme of its movement, as would be the case when all the load is off the turbine. Then the piston would be revolving at the top of the cylinder and admitting a constant valve-closing pressure through pipe *a*. As the load is thrown on the governor, acting through tube 21, draws the piston downwardly until the helical chamber admits impulses of pressure to pipe *b*, which would vary in duration according to the relative position of the piston's pressure-chamber and said pipe. The width of chamber 35 being slightly less than the distance between openings to the pipes *a b*, &c., it follows that when pressure is admitted to *b* the pipe *a* will be open to the atmospheric pressure in the cylinder, and therefore the wing-valve controlled by said pipes will be moved to its open position. The reverse is true when pressure is admitted to pipe *a*. As the piston descends it leaves all the valves above the one it is oscillating open, and as it ascends it leaves all below closed. Hence, treating the several pipes as points of regulation, it will be seen that the governor will move the piston to a point which will leave a number of the valves open roughly proportioned to the load and will oscillate the valve nearest the point of regulation to admit fluid-pressure to the turbine proportioned to variations in load intermediate the points of regulation. As shown in Fig. 1, the piston is admitting pressure to pipe *d*, through which it is conducted to valves C and D, where it throws the former valve to its open position, while it closes the latter. As the piston rotates from right to left the pressure from chamber 35 will be admitted for a time to pipe *e*, when the pressure in *d* will be relieved. This will open valve D, but will not affect valve E, which was already closed. Hence valve D is the one being oscillated, and as the piston moves slightly up and down under a practically constant load this valve will admit impulses of fluid-pressure varying in duration, but of equal volume and velocity, since the rotary valve 6 is opened fully each time. It is evident from the apparatus that these valves can have no intermediate stationary operating positions, for when not pulsating they are either open or closed and when pulsating pressure will always be on one side or the other to move the wing-valve to its open or closed position.

The modification of my invention shown in Figs. 8 and 9 illustrates the application of a fluid relay-power used to operate the turbine-valves under the control of a four-way valve 46, operated by the governor-controlled wing-valve 9. This valve 46 is rotated by the stem 47 of said valve 9 and through ports 48 and 49 alternately opens pipes 50 and 51 to the source of relayed power through pipe 52 and the return-pipe 53. These pipes 50 and 51 lead to either side of a wing-valve casing 54, similar to 10, and direct the pressure to throw the wing-valve 56, which opens the rotary turbine-valve by its stem 55.

One piston and cylinder may be used to control all the turbine-valves, or the valves may be separately grouped and have controller devices for each group. If the turbine operates by stage expansion, the pipes 12 may be used to operate a row of valves across the several stages.

Though I have shown a fluid relay-power controlled by the governor-valves, any other character of relay-power may be substituted and utilized to throw the turbine-valves.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a governing mechanism for turbines, nozzles admitting elastic fluid to the turbine, and hydraulic-pressure-operated means for pulsating the flow of said fluid.

2. In a governing mechanism for turbines, elastic-fluid-supply passages, and hydraulic-pressure-oscillated valves therefor.

3. In a governing mechanism for turbines, elastic-fluid-supply passages, hydraulic-pressure-actuated valves therefor, and governor-controlled means for oscillating said valves.

4. In a governing mechanism for turbines, elastic-fluid-supply passages, and rotary hydraulic-pressure-operated valves therein.

5. In a governing mechanism for turbines, elastic-fluid-supply passages, rotary valves therefor having stems, and hydraulic-pressure-operated wing-valves fixed on said stems.

6. In a governing mechanism for turbines, a governor device, a source of hydraulic pressure, and a supply-valve adapted to be operated by said pressure under the control of the governor device to admit pulsations of elastic fluid to the turbine.

7. In a governing mechanism for turbines, a set of supply-valves adapted to be operated by hydraulic pressure, passages for said pressure leading to said valves, and a governor device to admit the hydraulic pressure to said passages.

8. In a governing mechanism for turbines, supply-valves adapted to be operated by hydraulic pressure, passages for said pressure leading to said valves, and a governor-actuated controller device admitting pressure to one or more of said passages to pulsate part of said valves while the rest are left open or closed according to the load.

9. In a governing mechanism for turbines, a set of supply-valves, a source of pressure, and a rotating governor-controller device communicating with said source of pressure and directing it through passages to operate said valves.

10. In a governing mechanism for turbines, a plurality of pressure-operated supply-valves, pressure-conducting passages leading to said valves, and a governor-controlled movable pressure-chamber supplying pressure to said valves.

11. In a governing mechanism for turbines, a plurality of pressure-operated supply-valves, a series of pressure-conducting passages leading to said valves, a governor-controlled rotating piston, a helical pressure-chamber rotating with said piston and communicating with a source of pressure and said passages.

12. In a governing mechanism for turbines, governor-controlled valves operated by hydraulic pressure, turbine-supply valves, and valves operated by said governor-valves to admit a relay-pressure to operate said supply-valves.

13. In a governing mechanism for turbines, a series of supply-valves, hydraulic-pressure-actuated valves operating said supply-valves, a liquid-cylinder and a plurality of liquid-conducting passages leading therefrom to said pressure-actuated valves, in combination with a piston carrying a pressure-chamber around its periphery in the form of a conical helix, a shaft rotating said piston and governor-controlled means for shifting it, and

means to supply said chamber with liquid under pressure.

14. In a governing mechanism for turbines, pressure-operated supply-valves, passages for said pressure leading to said valves, and a controller device constructed and actuated to alternately open said passages to a high and a low pressure to oscillate the valves.

15. In a governing mechanism for turbines, pressure-operated supply-valves, passages for said pressure leading to said valves, and a controller device constructed and actuated to alternately open each of two adjacent passages to a source of valve-actuating pressure.

16. In an elastic-fluid turbine having pressure-operated supply-valves, a controller device having a pressure-chamber in the form of a conical helix.

17. In an elastic-fluid turbine, a pressure-actuated supply-valve, an operating-stem for said valve, a disk movable with said stem and having suitably-disposed depressions in its periphery, and a spring-controlled pin engaging the depressions of said disk and adapted to hold the valve in either its open or closed position.

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

JAMES WILKINSON.

Witnesses:

J. F. JOHNSTON,

H. M. HORTON.