No. 775,107. PATENTED NOV. 15, 1904.

W. S. ELLIOTT.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAR. 2, 1904.

NO MODEL. 2 SHEETS—SHEET 1

Fig. 1.

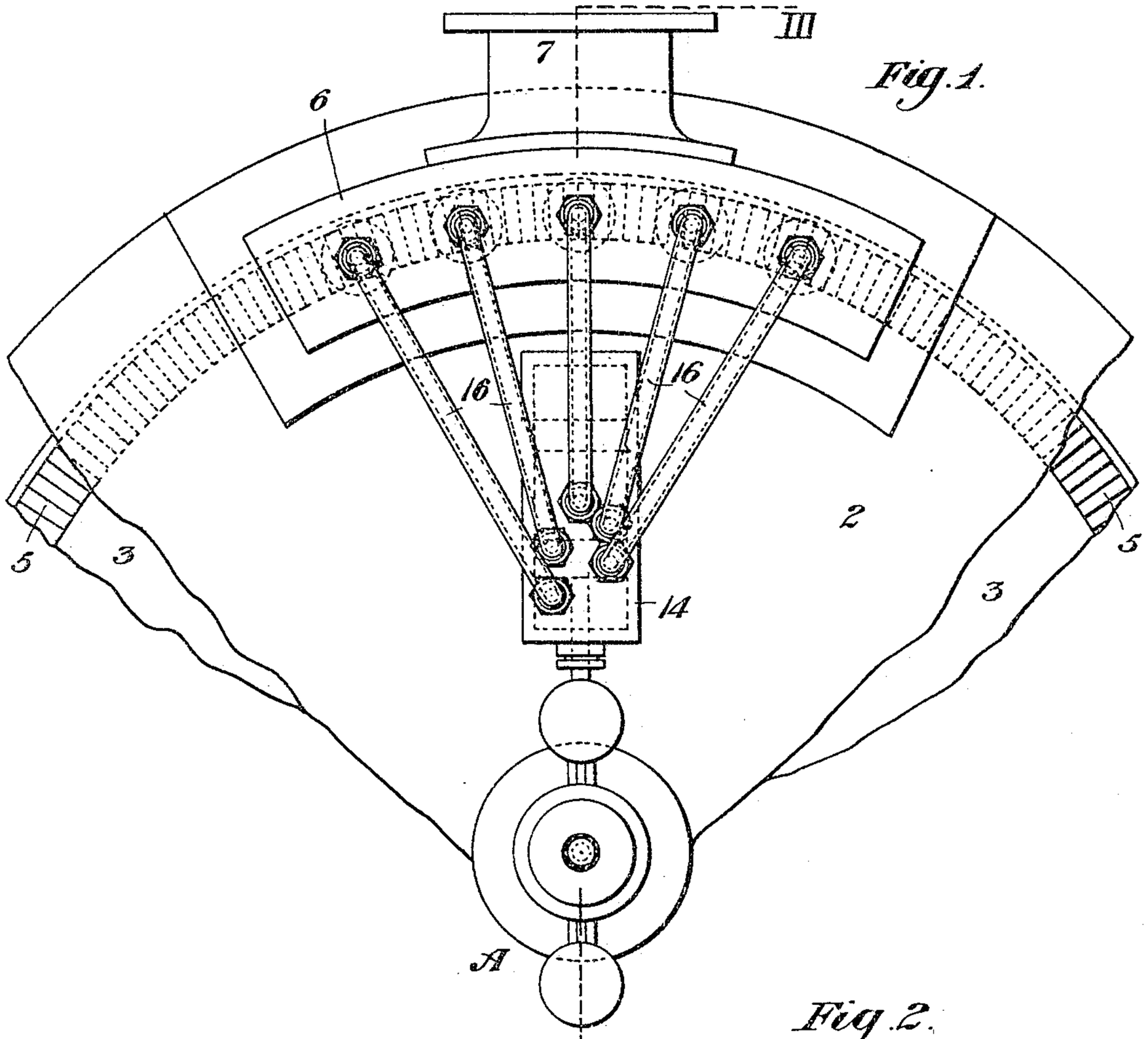
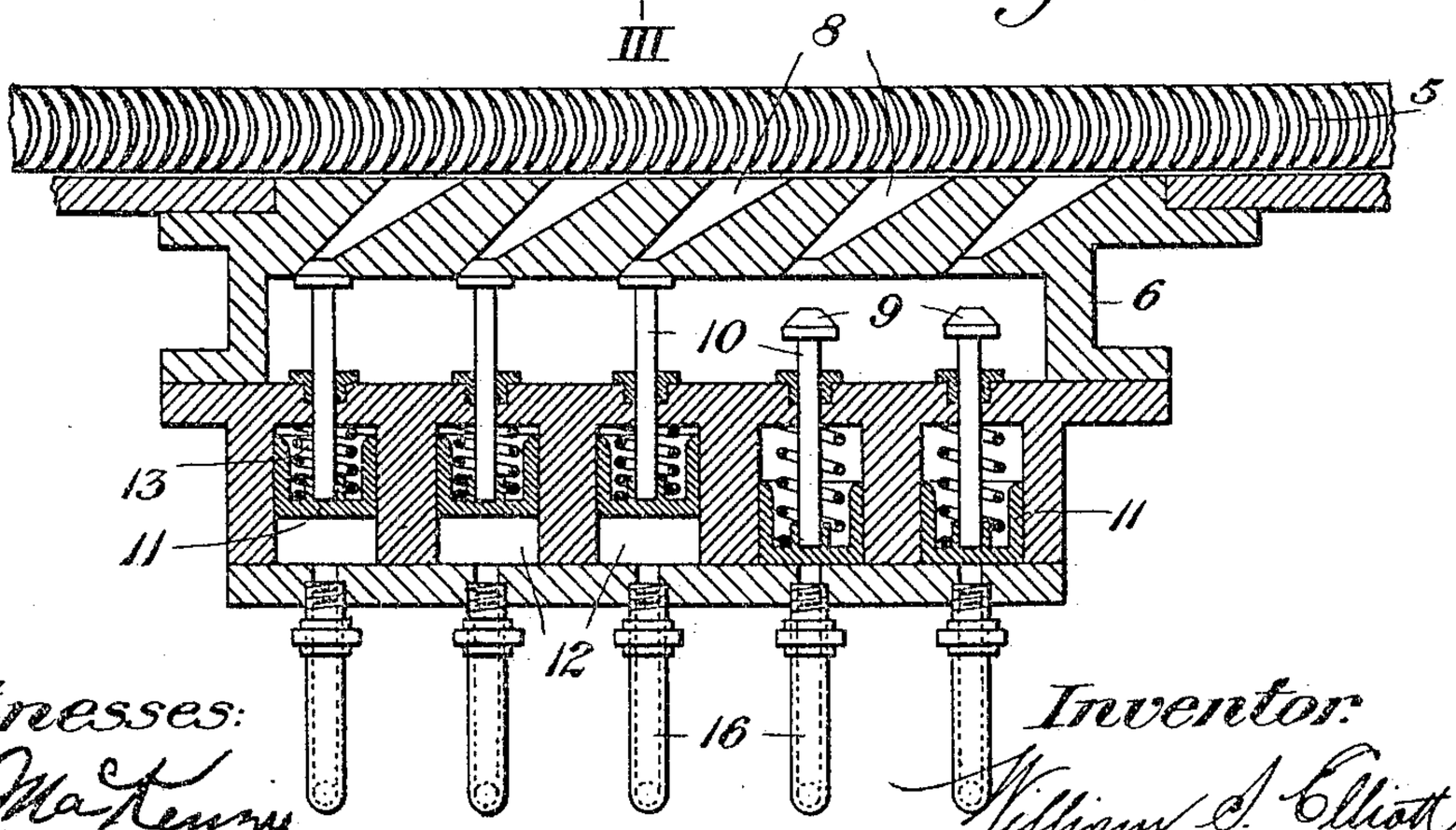


Fig. 2.



Witnesses:
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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

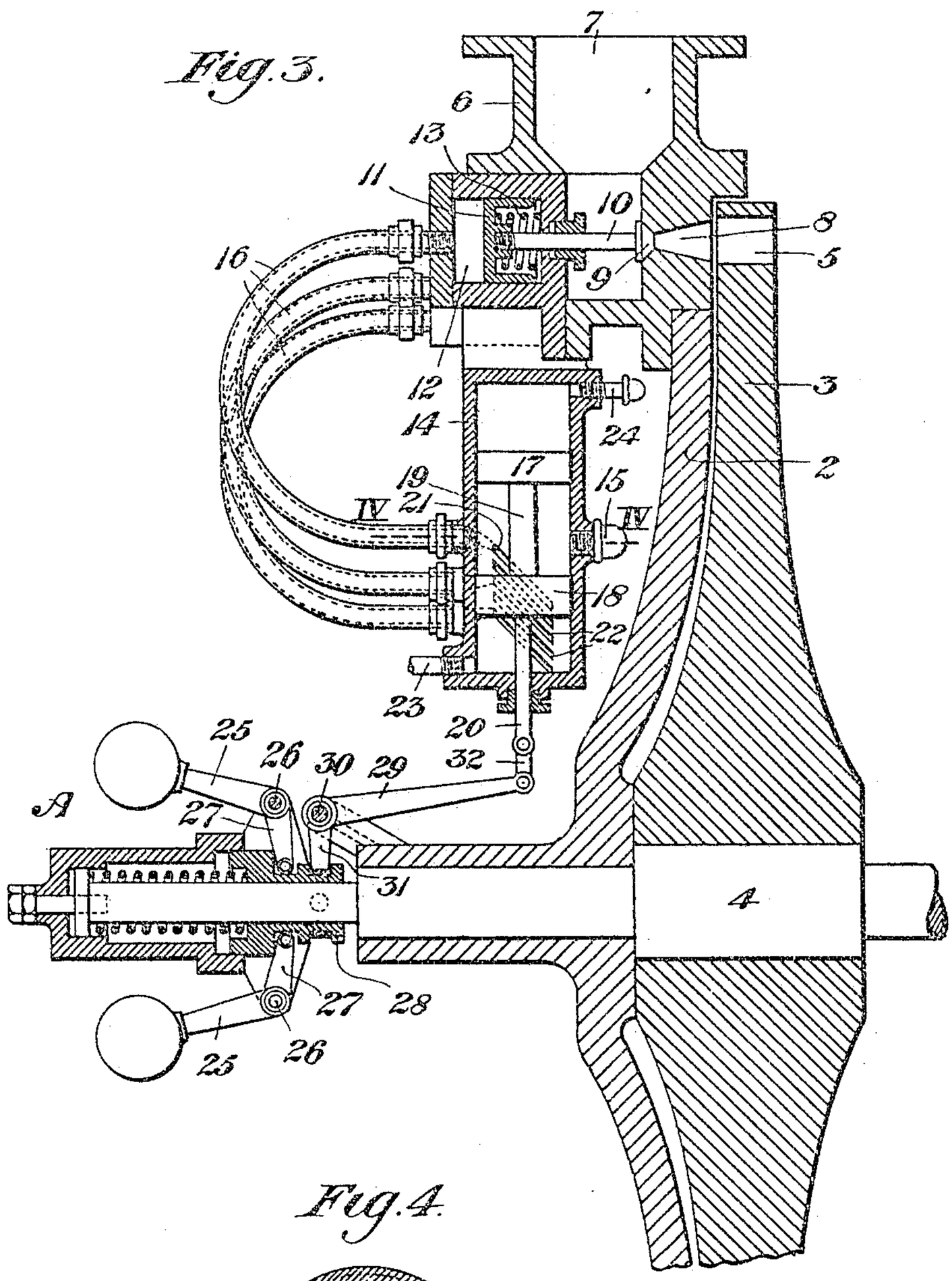
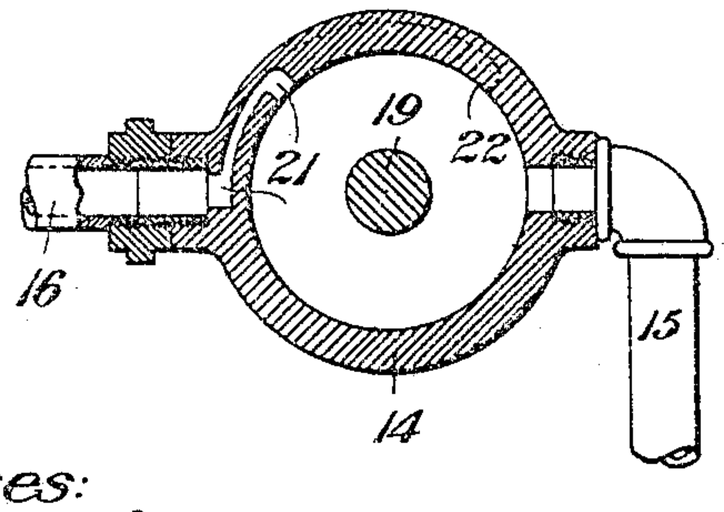


Fig. 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

WILLIAM S. ELLIOTT, OF PITTSBURG, PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

SPECIFICATION forming part of Letters Patent No. 775,107, dated November 15, 1904.

Application filed March 2, 1904. Serial No. 196,196. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. ELLIOTT, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification, reference being had therein to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a partial end view of an elastic-fluid turbine provided with my improved governing apparatus. Fig. 2 is a horizontal sectional view taken on the arc-line II II of Fig. 1. Fig. 3 is a vertical sectional view indicated by the line III III of Fig 1. Fig. 4. is a cross-section on the line IV IV of Fig. 3.

The object of my invention is to automatically govern the speed of an elastic-fluid turbine so as to maintain uniform speed under varying loads. For this purpose I employ a governor, preferably centrifugal, to the moving portion of which I connect valve-actuating mechanism adapted to control the supply and exhaust currents to and from nozzle-valve-actuating mechanism. These currents circulate through a cylinder within which is a balanced piston-valve adapted to be shifted by variations in the moving elements of the governor resulting from changes in its speed. The balanced valve controls the fluid-supply to a plurality of pistons connected with a series of valves controlling the supply of fluid leading to the nozzles, which in turn deliver the fluid against the vanes of the turbine.

The device is intended to regulate the supply of fluid to the turbine, dependent upon the variations in its load, and to maintain a resulting constant speed, the governor being connected directly with the valves which control the supply and exhaust to and from the nozzle-valve-operating pistons.

Referring now to the drawings, 2 is the shell or case of the turbine, surrounding the wheel 3, mounted on the usual shaft 4 and provided with the customary peripheral vanes 5.

6 is a fluid-inlet shell having a supply-passage 7 secured in the face of the case 2 and adapted to supply fluid through the various valve-controlled nozzles 8, leading to the vanes 5, each of said nozzles having seats provided with a valve 9, mounted on the inner end of stem 10, passing out through a stuffing-box in the front of the case. Each stem is provided with a piston 11 in cylinder 12, an interposed spring 13 being provided, surrounding the stem 10, adapted to bear outwardly against the piston, so as to unseat the valve when pressure is relieved from the piston.

Means are provided by which pressure is applied to or relieved from one or more of the pistons 11 as follows: Mounted in a suitable position is a cylinder 14, to the middle portion of which constant fluid-pressure is supplied by pipe 15, while pipes 16 connect each to the cylinders 12 and the interior of the cylinder 14 and are adapted to supply constant pressure against such of the pistons 11 to which said constant pressure is maintained. The pipes 16 connect with the interior of cylinder 14 at varying positions along the cylinder, being so located that each pipe may be successively supplied with pressure by means of the uncovering of its port. 17 and 18 are the pistons of the balanced valve, mounted on stem 19 in cylinder 14, pipe 15 supplying the fluid-pressure thereto and provided with an operating-stem 20, passing out through a stuffing-box in the end of the cylinder. The inner ends of pipes 16 communicate with the interior of cylinder 14 by ports 21, through which the pressure from pipe 15 is communicated to the pistons 11 when such inner ports 21 are uncovered, the piston 18 constituting a valve. Communicating with such inlet-ports 21, either by a diagonal groove or by any other suitable passage, are terminal ports 22, so located, in a different transverse plane beyond the plane of inlet-ports 21, that when the inlet-ports 21 are covered by the advancing piston-valve 18 the ports 22 or the other end of the groove will become uncovered. By this construction the exhaust from cylinder 12 is delivered behind the piston-valve.

Cylinder 14 is provided with an outlet-pipe 23, adapted to carry off the exhaust as it is discharged, a supplemental exhaust-pipe 24 being arranged beyond piston 17 to carry off leakage, whereby the piston-valve is balanced.

A is a governor provided with the usual

spring-retracted centrifugal balls, mounted on arms 25, pivoted at 26 and provided with lever-arms 27, engaging the reciprocating sleeve 28.

29 is a bell-crank lever pivoted at 30, having an arm 31 engaging sleeve 28 and adapted to be moved with it according to variations of the governor-balls and connected at the other end of the lever with the outer end of stem 20, preferably by an intervening link 32.

When the load of the engine increases, resulting in decreased speed and closing in of the balls of the governor, valve 18 is raised by lever 29, cutting off pressure through ports 21 from one or more of cylinders 12, allowing pistons 11 to be retracted by springs 13, thus unseating valves 9 and admitting an increased supply to the vanes. On the other hand, when the speed becomes too great the balls of the governor fly out, valve 18 is lowered by lever 29, opening one or more additional ports 21 and applying pressure to pistons 11 to close one or more additional valves 9, thus cutting off the supply to the nozzle and vanes, resulting in decreased speed. The speed is thus maintained constant and the equilibrium of the engine established.

It is evident that various designs or arrangements of valves and actuating mechanism may be used to control the admission of fluid to the turbine-vanes in combination with the regulating mechanism which I have shown and described, and I do not desire to be limited to the detailed construction herein set forth.

I claim—

1. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of cylinders provided with pistons connected with said valves, a supply-cylinder provided with a series of diagonal ports, connections between said supply-cylinder and the piston-cylinders, and means for controlling the supply.

2. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of cylinders provided with pistons connected with said valves, a supply-cylinder provided with a series of diagonal ports, connections between said supply-cylinder and the piston-cylinders, and means for controlling the supply governed by the speed in the engine.

3. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of cylinders provided with pistons connected with said valves, a supply-cylinder provided with a series of diagonal ports, connections between said supply-cylinder and the piston-cylinders, and means for controlling the supply actuated by the same elastic fluid which actuates the turbine.

4. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of cylinders provided with pistons connected with said valves, a supply-cylinder provided with a series of diagonal ports, connections between said supply-cylinder and the piston-cylinders, and means for controlling the supply consisting of a piston mounted in the supply-cylinder adapted to cover and uncover the diagonal ports, and governor mechanism connected with and controlling said piston.

5. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of pistons connected therewith, piston-chambers therefor, retracting-springs for the pistons, a pressure-supply-governing device adapted to control the circulation to and from the nozzle-valve piston-chamber, and a governor connected with the pressure-supply-governing device.

6. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of pistons connected therewith, a cylinder provided with a pressure-supply, connections between the piston-chambers and the pressure-supply cylinder, diagonal terminal ports therefor, a balanced valve mounted in the pressure-supply cylinder, and a governor connected with the balanced valve.

7. The combination with an elastic-fluid turbine, of a series of nozzle-valves adapted to admit fluid successively, a series of pistons connected therewith, a cylinder provided with a pressure-supply, connections between the piston-chamber and the pressure-supply cylinder, diagonally-disposed supply and exhaust ports connected therewith, a balanced valve adapted to cover said ports, and a governor connected with the balanced valve.

8. The combination with a series of nozzle-valve pistons and chambers therefor, of a cylinder provided with supply and exhaust ports communicating with the piston-chambers and having terminals located in different transverse planes, a balanced valve mounted in the cylinder adapted to cover and uncover said ports, and a governor connected with the balanced valve.

9. The combination with a series of nozzle-valve pistons and chambers therefor, of a cylinder provided with a constant pressure, supply and exhaust ports communicating with the piston-chamber and having terminals located in different transverse planes, a double-piston balanced valve embracing the supply-pressure inlet, one of said pistons being adapted to cover and uncover the supply and exhaust ports of the nozzle-pistons, and a governor connected with the balanced valve.

10. The combination with a series of nozzle-valve pistons and chambers therefor, of a cylinder provided with a constant pressure diagonally-disposed supply and exhaust ports communicating with the piston-chamber, a double-

piston balanced valve embracing the supply-pressure inlet, one of said pistons being adapted to cover and uncover the supply and exhaust ports of the nozzle-piston, and a governor connected with the balanced valve.

11. The combination with a series of nozzle-valve pistons and chambers therefor, of a cylinder provided with diagonally-disposed supply and exhaust ports communicating with the piston-chamber, a balanced valve mounted in the cylinder adapted to cover and uncover said ports provided with a stem projecting beyond the cylinder, a sliding sleeve, a lever connected with said sleeve and with the valve-stem, and centrifugal governor-weights connected with the sliding sleeve.

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

WILLIAM S. ELLIOTT.

Witnesses:

JAS. J. MCAFEE,

C. M. CLARKE.