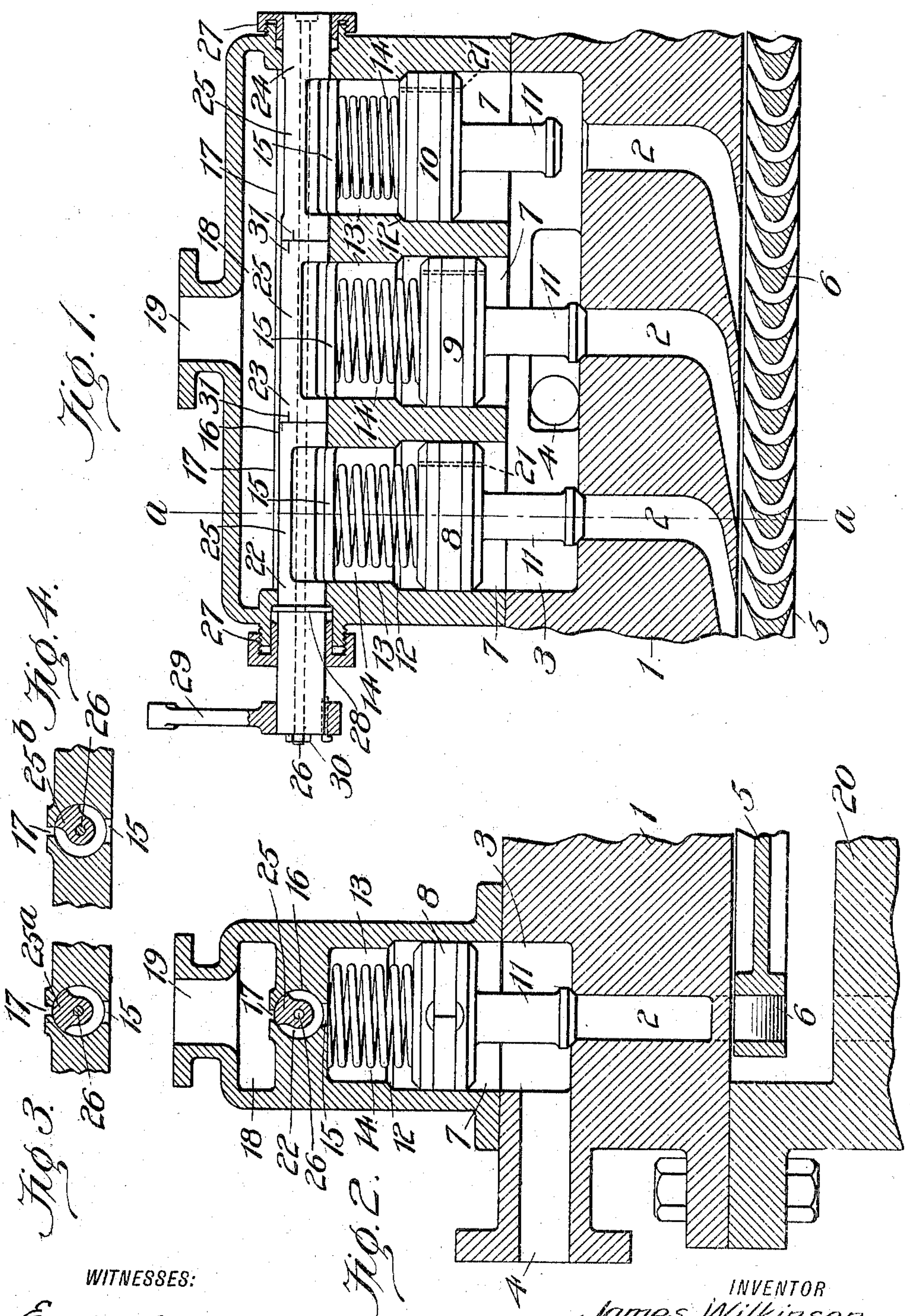
No. 811,982. PATENTED FEB. 6, 1906.

J. WILKINSON.

CONTROLLER MECHANISM FOR TURBINES.

APPLICATION FILED JAN. 25, 1905.



WITNESSES:

Edwin L. Bradford

P. H. Burck

INVENTOR

James Wilkinson

BY

Robt. S. Johnston Jr.

ATTORNEY

UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF BIRMINGHAM, ALABAMA, ASSIGNOR TO WILKINSON TURBINE COMPANY, A CORPORATION OF ALABAMA.

CONTROLLER MECHANISM FOR TURBINES.

No. 811,982. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed January 25, 1905. Serial No. 242,621.

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 new and useful Improvements in Controller Mechanism for Turbines, of which the following is a specification.

My invention relates to controller mechanism for elastic-fluid turbines, having as its object to provide means whereby a set of valves controlling separate nozzle-passages can be adjustably connected together or to a common actuator and adapted to open or close the nozzle-passages which they control in any desired manner.

The highest efficiency in the control of multiple-nozzle turbines is derived from governing means which fully open and close the several nozzles in a successive manner as the load varies, regulating the supply by controlling one or at most a small percentage of the nozzles.

It is the purpose of my invention to produce this regulation by the use of a plurality of rotary valves which are moved simultaneously by a governing device and adapted, according to their conformation or adjustment, to produce any desired control over the flow of motor fluid through the nozzles.

In its broadest sense my invention contemplates the use of these valves to directly open and close the turbine-nozzles, in which case they may be operated by a governor, or the governor may move the valves by a relay power, or they may be moved by hand. In its preferred form, however, these valves will control by fluid-pressure the operation of nozzle-valves, being therefore secondary or controller valves. Heretofore such secondary valves have regulated the operation of the nozzle-valves by controlling their actuating fluid, which necessitated the provision of valved supply as well as exhaust passages for the valve-motors. It is my purpose to simplify this construction by utilizing the secondary valves to control only the exhaust of fluid-pressure from the valve-motors to effect the operation of the valves, it being only necessary to valve an exhaust-port to carry this into effect.

My invention comprises the contruction and arrangement of parts hereinafter more fully described, and illustrated in the accompanying sheet of drawings, wherein is shown in its simplest form an embodiment of my controller mechanism for a group of three fluid-actuated nozzle-valves.

Figure 1 is a longitudinal sectional view through a controller-casing for a set of nozzle-valves, shown in elevation, the controller-valves being similar in construction and shown adjusted to produce a successive operation of the nozzle-valves. Fig. 2 is a sectional view taken along the line *a a* of Fig. 1. Figs. 3 and 4 are partial sectional views of controller-valves corresponding to the sectional view shown in Fig. 2 and illustrating valves of different conformation in different positions relative to the exhaust-port which they control.

Similar reference-numerals refer to similar parts throughout.

In the drawings I have shown only sufficient turbine construction to illustrate an embodiment of my invention, it being understood that the same is applicable to any type of turbine utilizing a plurality of independently-controlled nozzle passages or sections to discharge motor fluid against a bucket element or rotor-wheel. Thus in the drawings I show in partial section a supply-head 1 for a turbine of the impact axial-flow type provided with a set of three nozzles 2, leading from a valve-chest 3, which is supplied through a port 4 with motor-fluid pressure from any suitable source. These nozzles discharge the fluid at an acute angle against a bucket-wheel 5, having buckets 6 secured to its periphery. A controller-casing is superimposed above the valve-chest and provided with three chambers 7, forming cylinders for the actuating-pistons 8 9 10 for the reciprocating nozzle-valves 11. These valves are operated by said pistons and seat against the beveled inlet ends of the nozzles 2, acting, without intermediate operating positions, to open or close the same. The pistons are also beveled and engage tapering seats 12, above which are formed recesses 13 for the reception of coiled springs 14, which tend to close the valves 11. At their upper ends these recesses 13 open through ports 15 into an elongated circular valve-seat 16, which opens above through a narrow slot 17 into an exhaust-chamber 18, provided with a port 19 and preferably formed in the controller-casing. In Fig. 2 I show a diaphragm 20, bolted to head 1 and serving to divide the turbine into stages.

When pressure is admitted to the valve-chest, it tends to open the nozzle-valves and to enter the cylinders above the valves through small passages 21 in the pistons. The pressure will maintain them open so long as there is a free exhaust of the pressure above the pistons, which prevents the balancing of the valves by the accumulation of high pressure above the pistons. As soon as the combined power of the spring and pressure above a valve exceeds the pressure below the valve the latter is closed. Springs of considerable power will be used not only for the purpose of holding the valves firmly to their seats, but also to increase the readiness with which the valves respond to the controller-pressure, for the stronger the spring the less pressure required above the valve to close it.

I provide valve means to control the exhaust of pressure from above the pistons, utilizing three elongated rotary valves 22 23 24, disposed end to end within the seat 16 and provided with cylindrical end portions between which the valves are reduced to form segmental portions 25. These valves may be adjustably connected to each other, but are preferably mounted upon a bolt 26. When in position, the end valves project through stuffing-boxes 27 beyond the casing. The circular ends of the valves seat substantially pressure-tight with their seat and prevent the exhaust of pressure from any cylinder whose controller-valve covers a portion of the slot 17, opposite the reduced part of the valve through which the cylinder is exhausted, as shown in Figs. 2 and 3. The valve 22 is collared at 28 and has a governor or hand-actuated crank 29, connected to its outer end. A nut 30 on the bolt 26 locks the valves in any desired position thereon; but this may be effected by set-screws or otherwise.

The controller-valves when in their closed position are unbalanced by the pressure above the nozzle-valve pistons and held against their seats with sufficient force to prevent leakage. When open, however, the valves are balanced. In Fig. 1, where the several controller-valves are of similar conformation, I have shown them arranged so as to produce a successive action of the nozzle-valves. This arrangement is indicated by the notches 31, which when they register indicate that the valves will open and close the exhaust from their respective cylinders at the same time. It will be noted that the valves are set with their notches at relatively increasing distances apart. A similar successive action of the valves may be obtained by varying the construction of the controller portions of the valve, as indicated by 25^a and 25^b in Figs. 3 and 4, for where the peripheral width of the controller portions are different they can act with the same effect as where the controller portions are similar, but adjusted in advance of each other. If desired, valves in this latter case can be also adjusted on the bolt 26 or they may be mounted rigidly thereon. The advantages of adjustability, however, are of importance, since they enable the relative arrangement of the valves to be slightly altered until they act to regulate in any desired successive manner. Thus if the valves be set in the position shown in Fig. 1 and after an extended test it is found that they regulate within a four-per-cent. speed variation under a given travel of the governor-actuated crank 29 the set of valves may be withdrawn from the circular valve-seat and adjusted so that the successive opening of their nozzle-valves is secured within a smaller range of travel of the crank, and thus the valves may be made to regulate within a two-per-cent. speed variation. The narrowness of the controller portion 25 of the valves prevents them becoming too much unbalanced to be easily controlled, it being considered advisable to hold them firmly to their seat to prevent the wear which results from leakage of pressure between the valve and its seat. Since the several controller-valves are operated together, they are being continually exercised, though the regulation is done by but one. This preserves the valves and their seat and prevents sticking or unequal wear.

The passages through the pistons are very small and the total amount of leakage therethrough will not be large nor the efficiency of the turbine materially effected thereby, in view of the fact that this pressure may be utilized either in a low-pressure stage or to serve some useful purpose in connection with the turbine, such as superheating.

The set of these valves shown is merely illustrative, it being understood that my invention is applicable to any desired number of valves which may be arranged in one or more groups, each of which will be controlled by a separate set of independently-adjustable valves. The controller-valves may be set to operate two or more nozzle-valves simultaneously or on any desired order. It is therefore the purpose of my invention to protect, broadly, the use of a set of independent secondary valves which control the operation of nozzle-valves by acting to cut off communication between them and exhaust-pressure, also a set of rotary valves adjustably connected to a common actuator and acting either to directly control the admission of motor fluid to nozzles or to control through the instrumentality of a relay power, such as fluid-pressure, the operation of valves which act to open and close the turbine-nozzle.

The mechanism shown is applicable for

stage-valves as well as supply-valves, and the secondary valves may be used to control nozzle-valves of any desired type.

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

1. In an elastic-fluid turbine, a number of valves controlling the flow of motor fluid through nozzle-passages, fluid-pressure motors to operate said valves, and secondary valves interposed between said motors and an exhaust-pressure, which cause said turbine-valves to be opened or closed by cutting their motors into or out of communication with said exhaust.

2. In a turbine, a number of nozzle-passages, fluid-pressure-controlled valves therefor, and secondary valves controlling exhaust-ports only for the valve-actuating fluid to cause the nozzle-valves to open or close in any desired manner.

3. In a turbine, a number of nozzle-passages, valves therefor, fluid-motors to actuate said valves, a port through which pressure is exhausted from each motor, and governor-controlled valves for said ports which control said nozzle-valves by regulating the exhaust from their motors.

4. In a turbine, a number of nozzle-passages, a rotor against which fluid is discharged by said passages, a number of valves for said passages, fluid-motors to actuate said valves comprising cylinders open at one end to high pressure and at the other to an exhaust, means to cause said high pressure to establish itself in the exhaust end of said cylinder, and a number of controller-valves which regulate the exhaust of pressure from said cylinders.

5. In a turbine, a number of nozzle-passages through which motor fluid is directed against a rotatable element, a number of rotary valves controlling the flow of motor fluid through said passages, and means to move said valves together, said valves being adapted to successively open or close said passages.

6. In a multiple-nozzle turbine, nozzle-passages, a set of rotary valves controlling the flow of fluid through said passages, means to move said valves simultaneously, and means to adjust said valves to produce any desired successive opening or closing of said passages.

7. In an elastic-fluid turbine, a number of nozzle-passages adapted to discharge motor fluid against a rotatable element, a set of rotary valves adjustably connected together and adapted to be moved simultaneously by hand or governor to effect any desired successive opening or closing of said passages.

8. In an elastic-fluid turbine, a number of nozzle-passages adapted to discharge motor fluid against a rotatable element, fluid-actuated valves for said passages, and a set of rotary controller-valves for controlling, by exhaust-pressure means, the operation of said nozzle-valves.

9. In an elastic-fluid turbine, a number of nozzle-passages adapted to discharge motor fluid against a rotatable element, fluid-actuated valves for said passages, controller means for said valves comprising a group of rotary valves, adapted to be simultaneously moved by a common actuator, which control by fluid-pressure means the operation of said nozzle-passage valves.

10. In an elastic-fluid turbine, a number of motor-fluid induction-passages, valves therefor, fluid-motors to operate said valves, a port for the exhaust of fluid-pressure from said motors, and a number of governor-controlled rotary valves acting to control said nozzle-valves by regulating the exhaust of fluid-pressure from their respective motors.

11. In an elastic-fluid turbine, a number of motor-fluid induction-passages, valves therefor, fluid-motors to operate said valves, ports for the exhaust of fluid-pressure from said motors which enter a common valve-chamber, and a governor-actuated valve means to successively open said ports.

12. In an elastic-fluid turbine, a number of motor-fluid induction-passages, valves therefor, fluid-motors to operate said valves, ports for the exhaust of fluid-pressure from said motors, and a multiported valve device adapted to successively open or close said ports, thereby controlling the operation of said first-mentioned valves.

13. In an elastic-fluid turbine, fluid-induction passages, fluid-pressure-controlled valves therefor, and a controller means comprising a multiported valve device and a number of conduits for valve-controlling fluid-pressure, the ports in said valve device and the conduits with which they are adapted to register being so arranged relatively as to produce a successive registering of said ports with said conduits, as said device is moved.

14. In an elastic-fluid turbine, fluid-induction passages, fluid-pressure-controlled valves therefor, a number of conduits for valve-controlling fluid-pressure, and a compound valve device for said conduits which has adjustable parts to effect a successive opening or closing of said conduits.

15. In an elastic-fluid turbine, fluid-induction passages, fluid-pressure-controlled valves therefor, a number of conduits for valve-controlling fluid-pressure, a compound valve device therefor having adjustable controller portions which may be set to open or close said conduits in any desired successive order.

16. In an elastic-fluid turbine, a motor-fluid-supply passage, a number of nozzle-passages leading therefrom and discharging against a rotatable element, a controller mechanism comprising a number of cylinders which communicate at one end with said

supply-passage, and at the other with an exhaust-passage, valves for said nozzles, pistons for operating said valves which move in said cylinders a multiple-valve device for successively opening communication between said cylinders and exhaust, and governor means to actuate said device.

17. In an elastic-fluid turbine, the combination with a number of nozzles, and piston-actuated valves therefor, of a fluid-pressure controller mechanism comprising a casing formed with cylinders for said pistons and with an exhaust-passage, ports leading from said cylinders to said exhaust-passage, a common valve-seat intersecting said exhaust-ports, a set of secondary valves disposed in said seat end to end, and means to actuate said latter valves.

18. In combination with a multiple-nozzle turbine having fluid-pressure-actuated nozzle-valves, a controller-casing comprising ports leading from the valve-actuating devices and communicating with an exhaust, a valve-chamber intersecting said exhaust-ports, a rotary valve-controller means in said chamber, which is removable through a side opening in said casing.

19. In combination with a multiple-nozzle turbine having fluid-pressure-actuated nozzle-valves, a controller-casing comprising ports leading from the valve-actuating devices and communicating with an exhaust, a valve-chamber intersecting said exhaust-ports, a number of rotary valves disposed end to end in said chamber, means to actuate said valves, and means to adjust them to open and close said exhaust-ports successively.

20. In an elastic-fluid turbine, a number of induction-nozzles, piston-actuated valves for said nozzles, cylinders for said pistons exposed below to the motor-fluid pressure and above to an exhaust through valve-controlled ports, means to provide for the slow admission of high pressure above said pistons, springs tending to seat said valves, a number of controller-valves for the exhaust of said cylinders, and a common actuator for said controller-valves which moves them simultaneously.

21. In an elastic-fluid turbine, a motor-fluid-supply chamber, a plurality of induction-passages leading from said chamber and adapted to discharge the fluid against a rotatable element, a controller-casing provided with a number of cylinders, pistons therein exposed below to the pressure in said supply-chamber, means to permit a restricted flow of said high pressure above said pistons, valves operated by said pistons for controlling the flow of fluid through said passages, springs tending to close said valves, and a number of secondary valves which control the operation of pistons by regulating the exhaust of pressure from the cylinders above them.

22. In an elastic-fluid turbine, a number of fluid-induction passages and piston-actuated valves therefor, in combination with a controller mechanism comprising an exhaust-passage, a number of ports communicating therewith and with the cylinders for said pistons, a number of similar valves for opening and closing said exhaust-ports, means to adjust the position of said latter valves relatively to each other, and governor-controlled means to actuate them.

23. In a controller-casing for a number of nozzle-valves, motors for actuating said valves, exhaust-passages leading from said motors through the controller-casing to an exhaust-pressure, a number of rotary valves adjustably connected to each other, a seat for said valves leading through said casing and intersecting said passages, and means to operate said valves.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAMES WILKINSON.

Witnesses:
A. R. Forsyth,
Nomie Welsh.