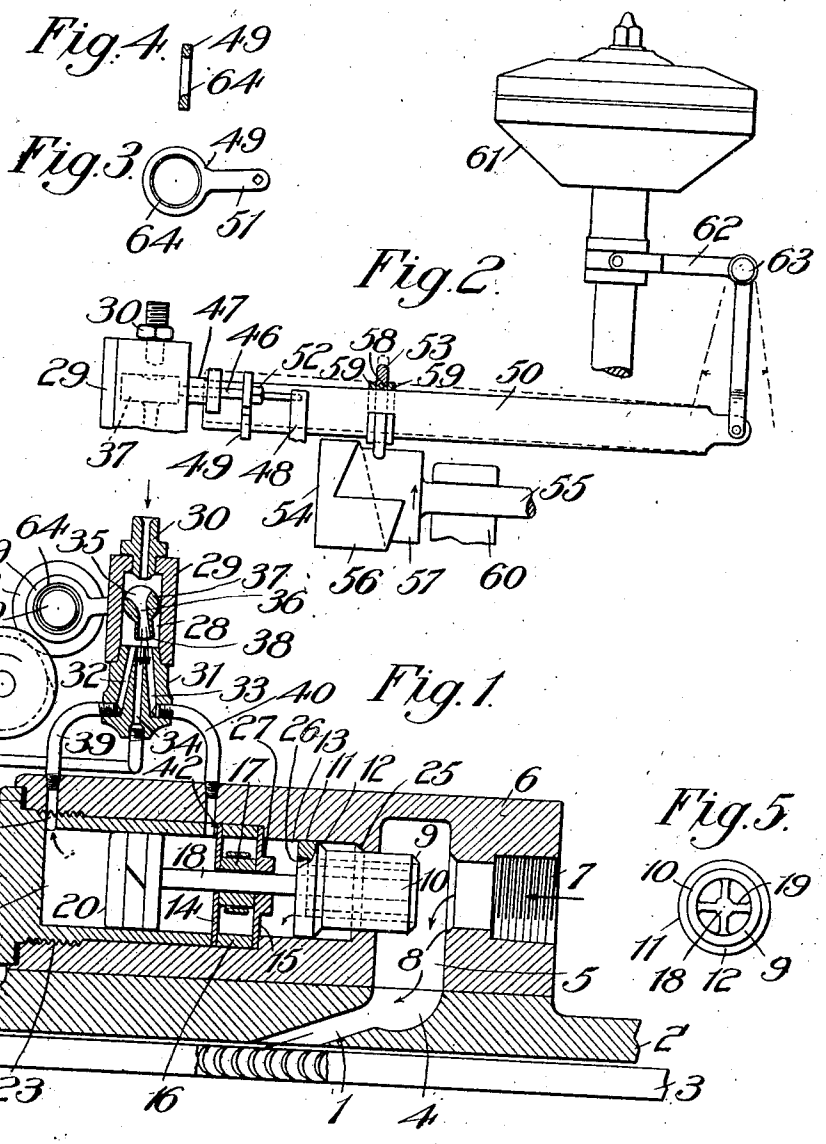
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J. WILKINSON.

TURBINE GOVERNING MECHANISM.

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TURBINE-GOVERNING MECHANISM.

No. 825,998. Specification of Letters Patent. Patented July 17, 1906.

Application filed July 10, 1905. Serial No. 269,047.

To all whom it may concern:

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Turbine-Governing Mechanism, of which the following is a specification.

My invention relates to controller mechanism for elastic-fluid turbines.

One feature of my present invention consists in improvements upon the fluid-pressure-controller means illustrated and claimed in Letters Patent No. 766,921, issued to me August 9, 1904. In that patent I provide a governor-shifted rotating cam which oscillates a reciprocatory controller-nozzle having a substantially circular jet end.

According to my invention I provide an improved cam-controller mechanism especially adapted to operate a rotary guide-nozzle, such as is claimed in a pending application. I also improve the design of the controller-nozzle and casing by providing the former with an oblong jet end which delivers an oblong stream of fluid into conduits for the controller fluid, which are preferably formed as passages in a block connected to the casing. The effectiveness of the controller-nozzle is increased by the novel arrangement of the controller-fluid conduits on each side of the exhaust or ejector port. The nozzle is designed so that it will discharge a jet of fluid into the exhaust port or passage throughout its travel, thereby producing a good ejector action at all times, which tends to lower the pressure in both controller-casing and the conduit not acted upon by the jet.

A further object of my present invention is to provide a novel valve for controlling the admission of motor fluid to a nozzle or engine port. This valve is illustrated as hollow and cylindrical in form, with one head disposed in a dash-pot chamber to which the supply-pressure has access through the valve and also around it when open. The valve is adapted to close against the stream of fluid flowing through the inlet-port under its control. As the hollow valve is moved by its motor against this stream the fluid flows through the valve and banks up pressure behind it in the dash-pot chamber, where its pressure acts against the enlarged end of the valve disposed in that chamber to assist in closing the valve and to hold it firmly against its seats when closed. When the valve is seated, the pressure behind it acts to close the valve tightly against the two beveled valve-seats, one in the dash-pot chamber and the other around the inlet-port. The valve will be substantially balanced when open, but sufficiently unbalanced when seated to prevent automatic opening or leakage of pressure between it and its seat. The valve dash-pots itself at each end of its stroke, thereby avoiding hammering its seats or cylinder-head. This valve construction has many practical advantages which render it valuable, and it will therefore be understood that the foregoing description and the claims based thereon are not limited to the details of its construction, but are rather intended to include such modifications of the valve mechanism as seek to obtain the benefits of its operation without departing from the spirit of my invention.

Referring to the accompanying drawings, illustrative of my invention and forming a part of this specification, Figure 1 is a vertical sectional view through a nozzled portion of a turbine and a controller-chamber, showing the valve in side elevation and the operating mechanism for the controller-nozzle in end elevation. Fig. 2 is a side view of the operating mechanism for the controller-nozzle and illustrates the governor's adjustment thereof. Figs. 3 and 4 are detail views of the loose ring which transmits the movements of the controller-bar to the controller-nozzle. Fig. 5 is an end view of the nozzle-valve. Fig. 6 is a diagrammatic view illustrating the relative conformation of the supply and jet ends of the controller-nozzle and inlet ends of controller-passages.

Similar reference-numerals refer to similar parts throughout the drawings.

The improved valve and its controller mechanism are applicable to various types of motors. In the drawings they are used to control the admission of fluid-pressure to a nozzle-passage 1 of an elastic-fluid turbine, of which only a supply-head 2 and bucket-wheel 3 are shown for the sake of illustration. A bowl 4 for the nozzle is formed in the head and communicates with a motor-fluid-supply passage 5, preferably formed in a detachable block 6, secured to the head and forming a

valve and motor casing. Motor fluid enters passage 5 through a port 7 in an end of the block disposed at right angles to passage 5 and provided with a beveled face 8 at its inner end, which constitutes a seat for the beveled head 9 of the nozzle-valve 10.

The valve 10 is in the form of a hollow cylindrical shell formed with an enlarged head 11 and a beveled face 12, which are disposed in what I term the "dash-pot" chamber 13. This chamber forms an inner reduced extension of the valve-motor chamber which enters the block at its end opposite port 7. A packing-compartment formed by the circular plates 14 and 15 and an interposed spacer-ring 16 separates the dash-pot chamber from the motor-chamber and is provided with packing 17, surrounding the piston-stem 18, which is connected at one end to spiders 19, connected to or integral with the valve 10, and at its other end to a piston 20. The piston is disposed within a cylinder 21, formed by a cylindrical shell closed at its outer end by an integral head 22 and provided with external threads, by means of which it is adapted to be screwed into the motor-chamber in the block. For this purpose the chamber is threaded at 23 and is also channeled around its outer end to receive packing 24, interposed between the head 22 of the cylinder and the block to prevent any leakage around the shell.

The body portion of the valve 10 passes freely through an opening in the dash-pot chamber opposite to the fluid-admission port 7, its head-block 9 being adapted to engage the beveled seat 8 and cut off communication between port 7 and passage 5. As the fluid-pressure will flow freely through the hollow valve after it is seated and will establish itself in the dash-pot chamber behind the head 11 of the valve, it is necessary to provide means to prevent the leakage of this pressure around valve 10 when closed into passage 5. This I do by providing a seat 25, so arranged that the beveled face 12 of the head 11 will engage and seat firmly against it as the valve seats at 8. This arrangement will have the double advantage of stopping leakage from chamber 13 and providing a dash-pot for the valve as it moves to seat itself.

It will be noted that head 11 of the valve fits closely in chamber 13 without being a tight fit. As the valve moves to close, the fluid between the faces 25 and 12 will become compressed, since the valve will move faster than it can leak out of the chamber past the valve 10 or escape around head 11 and will therefore act as a dash-pot to check or retard the valve's movement as it seats itself.

To dash-pot the valve as it moves in opposite direction, I provide its head 11 with a recess 26, which passes over a circular projection 27, carried by the packing-plate 15. A short chamber will be formed between the projection 27 and the sides of the chamber 13, into which the annular shouldered end of the head 11 enters, the parts fitting closely enough to act as a dash-pot to retard the valve's movement at the end of its opening travel. The valve is substantially balanced when open, as the pressure has access to all sides of it. When closed, however, it is unbalanced, as pressure will act against the head 11, while the faces 9 and 12 of the valve are firmly seated and are therefore not exposed to the pressure. This insures the valve being held firmly to its seat. As the valve is moved to its closed position against the stream of fluid, the power required to effect this is lessened by the fact that the fluid tends to rush through the valve and bank up behind it in the chamber 13.

The fluid-pressure-controller mechanism for the valve comprises a controller-chamber 28, formed in a casing 29, into one end of which is inserted a stationary nozzle 30 and into the other end of which a block 31 is secured and provided with three passages 32, 33, and 34, leading therethrough. Fluid under pressure flows in a jet through the stationary nozzles 30 into the chamber 28, where it enters the circular admission end 35 of a guide-nozzle 36, formed in a rotatable carrier 37, journaled in the sides of the casing. The discharge or jet end 38 of the guide-nozzle is oblong in shape, the nozzle-passage gradually changing from the circular shape at its admission end to a narrow oblong shape at its jet end, as illustrated in Fig. 6. The admission ends of the passages 32, 33, and 34 are disposed as closely together as possible, knife-edge partitions dividing the middle passage 34 from the passages on either side. Pipes 39 and 40 connect with the ends of the passages 32 and 33 and with ports 41 and 42, leading through the block 6 and motor-cylinder casing at opposite ends thereof. The middle passage 34 connects with a pipe 43, which leads to a small nozzle-passage 44, formed in the head and discharging fluid-pressure against the bucket-wheel 3. A coupling 45 may be used to make a tight joint between the pipe 43 and the admission end of the nozzle-passage 44. This intermediate passage 34 constitutes what I term the "exhaust" or "ejector" passage, while the passages 32 and 33 are passages for the valve-controlling fluid-pressure. In all of its operating positions the guide nozzle will be discharging fluid-pressure into the exhaust-passage 34 and will be discharging more or less into the passage 32 or 33. The ejector action of the fluid discharged into the passage 34 will act to lower the pressure or create a partial vacuum in the end of the cylinder, to which the passage 32 or 33, which is not exposed to the injector action of the jet, leads. As illustrated in Fig. 1, the jet is creating high pressure in passage 33 and the

right end of the cylinder and is exhausting the pressure through passage 32 from the left end of the cylinder.

The operating mechanism for the guide-nozzle, which is similar in operation to that described and claimed in a pending application, Serial No. 288,779, comprises a stem 46, connected to the nozzle-carrier and leading through a packing-gland 47 in the side of the casing 29. This gland may be made removable, so that the carrier may be inserted therethrough, or one side of the casing 29 may be detachable. Near its outer end the stem 46 is squared, beyond which point it is reduced and rounded to where it enters a bearing 48, suitably supported on the turbine-frame or otherwise. A ring 49, loosely mounted on the controller-bar 50, is provided with an arm 51, having a squared opening therein which slips over the reduced end of the stem 46 and on the squared portion thereof, where it is held by a nut 52, threaded onto the reduced portion of the stem. This ring will therefore be rigidly connected to the carrier-stem, and any oscillatory movements of the ring will be imparted to the carrier to move the guide-nozzle over the controller-passage. The controller-bar 50 has a wheel 53 rotatably mounted thereon between suitable guides and adapted to ride on a cam 54, driven by a stem 55 in any suitable manner from the turbine-shaft or from a separate motor. This cam is formed like the cam shown and described in my Letters Patent No. 766,921 and provided with an enlarged portion 56 of equal diameter throughout, which is of spiral conformation relatively to the reduced portion 57 of the cam, which is also of uniform diameter. The wheel 53 may be rotatably mounted on bar 50 in any desired manner. As shown, it rides on antifriction-balls 58 and is held against lateral displacement by the stops 59, formed by rings fixed to the bar or shoulders integral therewith. The wheel and bar are freely supported by the cam and ring 49, through which the bar 50 slips freely. As the cam is rotated in its bearing 60, the wheel may ride either entirely upon the surface 56 or the surface 57, or parts of the time on each, when it will be raised and lowered, as indicated in dotted lines, Fig. 2. The position of the wheel upon the cam is determined by a speed-governor 61, which rocks a bell-crank lever 62, pivoted on a fixed stud 63, through the arc indicated in dotted lines, Fig. 2. At its lower end this bell-crank lever 62 is loosely connected to the controller-bar 50 and acts to move the same and its wheel 53 to any desired operating-point relative to the cam 54. The endwise movements of the bar 50 are not transmitted to the ring 49, which fits loosely around the bar and has its inner engaging surface 64, Fig. 4, rounded, so as to prevent any binding of the ring and bar, due to angular variation of the latter as it is shifted by the governor.

In operation after the turbine or motor has been brought up to speed the wheel 53 will be shifted by the governor to the point where it will ride on the surface 56. As the load is brought on the speed of the governor will lower and the wheel will engage the spiral portion 57 in the cam and be shifted and lowered for intervals of varying length until under full load it rides entirely on surface 57. The shifting of the controller-bar acts to swing the guide-nozzle from its position over the passage 33, so that it will discharge pressure into the passage 32 and will eject the pressure from passage 33. This will unbalance the piston 20, causing it to move the valve to a closed position and cut the nozzle out of service. When the rod is lowered by the cam, the jet acts as shown in Fig. 1, where it will open the valve, the valve being shown intermediate its travel while opening.

In the drawings I have illustrated but one turbine nozzle and valve; but it will be understood that many of these may be used, and it will be obvious that the governing mechanism shown may control them all by simply providing connections to the pipes 39 and 40 and leading them through the several ends of the valve-motor cylinders.

The jet of controller fluid which enters the turbine through the nozzle 44 is about sufficient to operate it under a friction load. This pressure may be utilized in any other manner desired. The controlling mechanism shown may be used without a governor, in which event the controller-bar will be shifted manually. The speed of rotation of the cam 54 may be as slow as is consistent with an efficient governing operation.

Having thus described an illustrative embodiment of my invention, I desire to protect the same without limitation to details of construction.

What I claim is—

1. The combination, in a valve-controller mechanism, of a rotatable cam, an actuator-bar supported by said cam and oscillated thereby, a governing means for shifting said bar, a loose ring carried by said bar, a pivoted controller-nozzle operatively connected to said ring and adapted to be turned in its bearings by the oscillatory movements imparted to said ring by said bar, and a valve whose operation is controlled by the fluid-pressure flowing through said nozzle.

2. The combination, in a valve-controller mechanism, of a rotatable actuator, a bar engaging said actuator and oscillated thereby, a governor-controlled device connected to said bar for shifting it lengthwise, a loose ring mounted on said bar which slips freely therethrough when shifted by said governor, a fluid-pressure-controller casing comprising

a swinging nozzle, a stem for rocking said nozzle, and a lug or arm carried by said ring and operatively connected to said stem.

3. In a fluid-pressure-controller mechanism, a movable director-nozzle for a stream of fluid having a substantially circular admission end, and an oblong discharge end.

4. In a fluid-pressure-controller mechanism, a controller-chamber, a jet-orifice through which a stream of fluid-pressure enters said chamber, and a guide-nozzle for said stream having a substantially circular admission end and an oblong discharge end.

5. In a fluid-pressure-controller mechanism, a movable nozzle for discharging a jet of controller fluid into a conduit or conduits leading to valve-operating devices, said nozzle having a substantially circular admission end, and an oblong narrow discharge end, substantially as described.

6. In a fluid-pressure-controller mechanism, a controller-chamber, a jet-nozzle discharging a jet of fluid thereinto, a guide-nozzle formed with a substantially circular admission end disposed opposite to said jet-nozzle and having its discharge end oblong, conduits for the controller-fluid pressure, and a valve controlled by the pressure in said conduits.

7. In a fluid-pressure-controller mechanism, a fluid-controller chamber, a controller-nozzle therein, conduits leading from said chamber to a valve-operating mechanism, a conduit through which pressure is discharged from said controller-chamber which is interposed between said valve-controller conduits, and means to adjust said nozzle to deliver a jet of fluid into said discharge-conduit and into one or the other of said controller-conduits.

8. In a controller mechanism, a controller-chamber, a plurality of conduits leading therefrom, a controller-nozzle having an oblong elongated discharge-orifice which covers two or more ports at a time, and means to adjust said nozzle over said ports.

9. In a controller mechanism for turbine-valves, a pivoted jet-controller nozzle, controller-fluid conduits, a governor-controlled reciprocatory actuating means for said nozzle, and means to transform the reciprocatory movement into the rotary movement and apply it to swinging said nozzle in its bearings.

10. In an elastic-fluid turbine, a nozzle-passage therefor having a fluid-admission port, a valve movable toward said port to close it, a passage through said valve, a chamber behind the valve into which said fluid-pressure supply enters only through said passage in the valve and assists said valve in closing, and means to operate said valve.

11. In an elastic-fluid turbine, a nozzle-passage therefor having a fluid-admission port, a valve movable toward said port to close it, a passage through said valve, and a chamber in which one end of said valve fits as a piston and to which pressure has access only through said passage in the valve, said pressure acting on the valve when seated to unbalance it and hold it against its seat.

12. In an elastic-fluid turbine, a nozzle-passage, a supply-port therefor, a valve movable toward said port against the fluid flowing therethrough, means to maintain the initial supply-pressure behind said valve when seated over said port, and means to operate said valve.

13. In an elastic-fluid turbine, a nozzle passage, a pressure-supply port therefor, a valve movable against the pressure flowing through said port to close it, a passage through said valve, a chamber in which an end of said valve works and in which the stream of fluid banks up as valve is moved in opposition thereto, said pressure coöperating with actuating means to close said valve.

14. In an elastic-fluid turbine, a nozzle-passage, a fluid-admission port therefor, a differential hollow valve movable against the stream of pressure to close said ports, a dash-pot chamber within which the enlarged end of said valve is disposed, and operating devices connected to said valve.

15. In an elastic-fluid turbine, a nozzle-passage therefor, a fluid-admission port for said nozzle-passage, a valve movable across said nozzle-passage and adapted to seat against said port to close it, a chamber in which an enlarged head of said valve is disposed making a loose fit in said chamber, a recess in the rear head of said chamber into which a portion of said enlarged head enters with a dash-pot effect, and an operating-stem connected to said valve.

16. In an elastic-fluid turbine, a nozzle-supply passage, a fluid-admission port therefor, a valve having one end disposed in a pressure-equalizing chamber, an opening in said chamber through which said valve projects and seats against said admission-port, said port and opening being substantially oppositely disposed, a passage-way through said valve, by means of which the supply-pressure establishes itself in one end of said chamber behind the valve, a seat in said chamber which is engaged by the enlarged head of said valve, when the latter is in its closed position, to prevent the leakage of this pressure behind the valve into the nozzle-supply passage, and means to actuate said valve.

17. In a turbine, a nozzle-supply passage, a fluid-admission port, a compound valve having one head movable across said passage and adapted to close said port and the other head disposed in a dash-pot chamber, means to dash-pot the valve's movements in both directions, and means to operate the valve.

18. In a turbine, a nozzle-supply passage,

a fluid-admission port therefor, a valve having an enlarged head disposed in a chamber, an opening in said chamber through which the reduced portion of said valve passes to close said port, a limited leakage of pressure between said chamber and passage being provided for around said valve, a passage through said valve to maintain the high admission-pressure in said chamber behind the valve's enlarged head, a valve-seat in said chamber which is engaged by said enlarged head to prevent the leakage of pressure around said valve, when in its closed position, between said chamber and passage, and means to operate said valve.

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

JAMES WILKINSON.

Witnesses:
OWEN GOODWIN,
JAMES H. NOLAN.