No. 846,538. PATENTED MAR. 12. 1907.

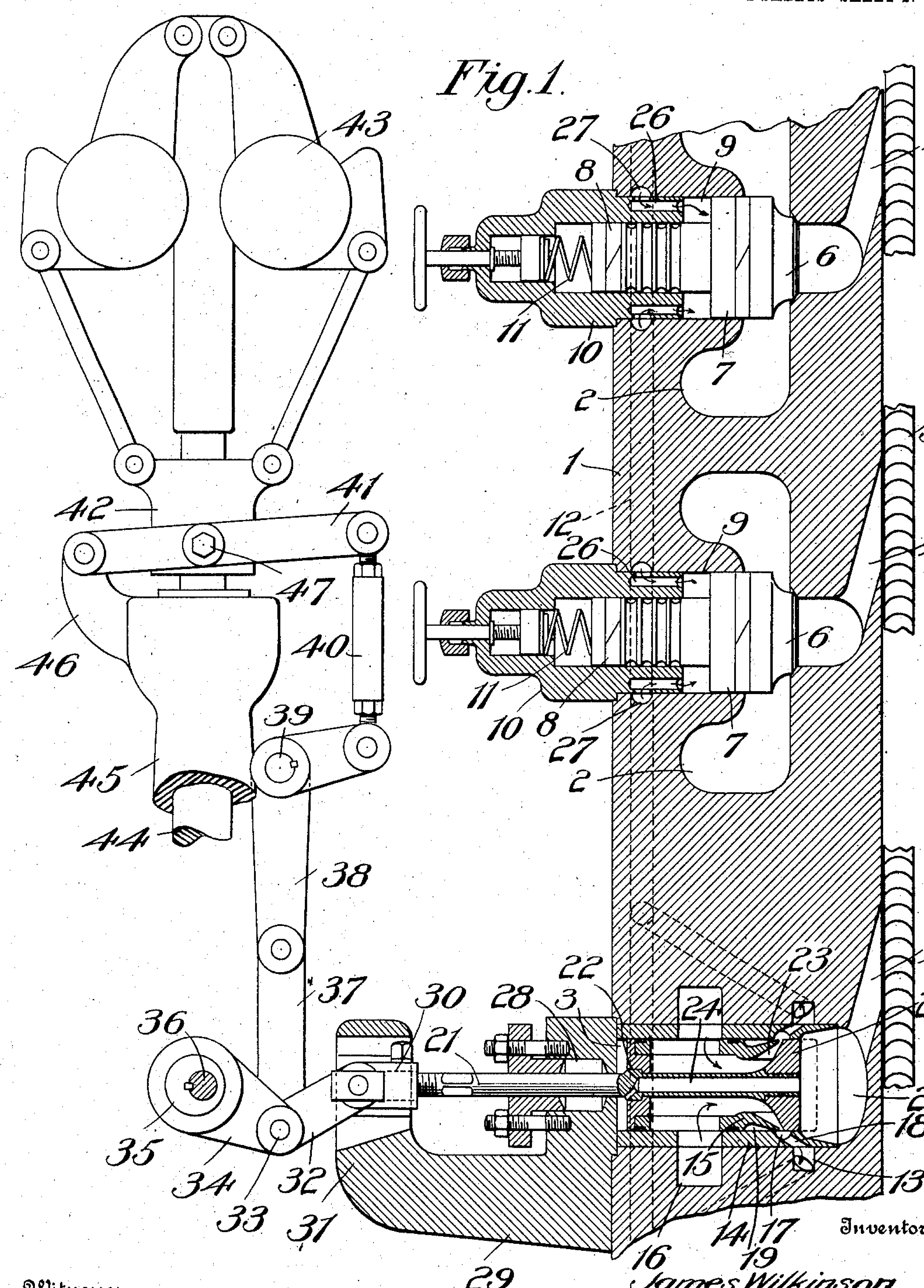
J. WILKINSON.

TURBINE GOVERNING MECHANISM.

APPLICATION FILED JULY 16, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Wm. H. Weicker

Edwin L. Bradford

Inventor

James Wilkinson

By

Robt. D. J. Shuster Jr.

Attorney

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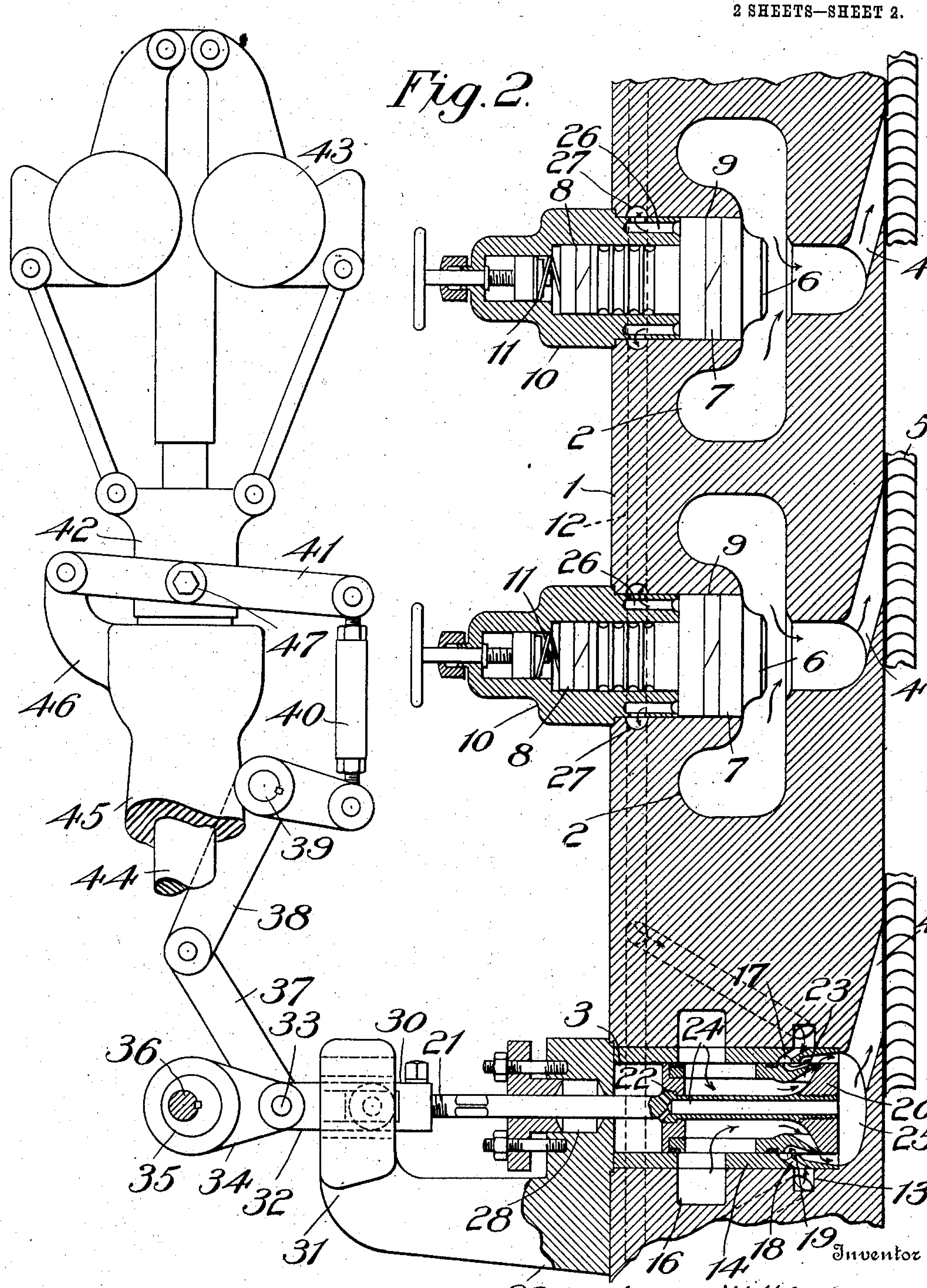
Fig. 2.



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James Wilkinson

By Robt. D. Johnston Jr.

Attorney

UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO WILKINSON TURBINE COMPANY, A CORPORATION OF ALABAMA.

TURBINE-GOVERNING MECHANISM.

No. 846,538. Specification of Letters Patent. Patented March 12, 1907.

Application filed July 16, 1906. Serial No. 326,466.

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 an improvement in governing mechanism for elastic-fluid turbines and is adapted to produce an intermittent governed cut-off of the supply of motor fluid after the fashion described in my pending application, Serial No. 136,229.

One purpose of my invention is to improve and perfect the governing mechanism described and claimed in a pending application, Serial No. 288,779, by substituting an eccentric for the cam motion and simplifying the arrangement of governor-shifted links or rigging, so as to reduce friction and lost motion and positively connect the various parts.

My invention also involves certain improvements in the design of the nozzle-controller element and its coöperating parts, the object of which is to improve the action of the jet.

The foregoing and other detailed improvements are illustrated in a preferred form in the accompanying drawings, in which—

Figure 1 shows the speed-governor and eccentric-valve rigging in elevation connected up to my improved controller-nozzle, shown in section in a turbine-supply head broken away to show the supply-nozzles and the valves therefor. Fig. 2 is a similar view with the several parts in their "valve-open" position for full-load conditions.

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

According to my proposed method of regulation I provide a controller mechanism which will hold the several nozzle-valves fully open under heavy load conditions, intermittently open for governed periods under lighter load conditions, and fully closed under certain conditions. To obtain this complete cycle of action with an eccentric necessitates the interposition of a governor-controlled means for the purpose of introducing a variable in the relative positioning of the controller device and its eccentric-actuator, thus enabling the latter to exert an effective control of the valve or nozzle throughout the complete cycle of its revolution. This governor action does not vary the length of the controller-nozzle's travel nor the period of its occurrence, but acts merely to vary the position of the nozzle at either extreme of its uniform stroke with relation to the ports or similar devices with which it coöperates in exerting its controlling function on the supply-valves for the turbine. Such a cycle of operation is requisite to produce the ideal pulsatory regulation of an impact-turbine.

I have shown my invention as applied to a turbine having a supply-head 1, provided with one or more valve-chambers 2 and a controller-chamber 3, which are supplied with motor fluid from any suitable source and are adapted to discharge the fluid through nozzles 4 against a bucket-wheel 5 in the turbine. A reciprocating valve 6 is disposed in each chamber 2 and connected to a piston 7 and guide 8, which work in a cylinder-chamber 9 in the head, closed by a chambered head-block 10, in which the guide works. A spring 11 tends to seat the valve against the pressure in the chamber 2, which acts against the piston with a tendency to open the valve. Controller-fluid pressure is supplied to the cylinders 9 above the valve-pistons by a common conduit 12, which leads from an annular channel 13, surrounding the lower end of a casing 14, seated pressure-tight in the controller-chamber 3. A governor-shifted reciprocatory jet-nozzle 15 moves pressure-tight within casing 14, both nozzle and casing having ports through which fluid-pressure flows from an annular supply-groove 16 around the controller-chamber, through the nozzle 15, and is discharged through an annular jet-orifice, provided near the lower end of said nozzle, in a laterally-flowing annular jet. An annular groove 17 in the casing 14 has ports 18, which open into the channel 13. The jet is adapted to act with injector or ejector effect, according to its position in said groove, and thereby to control the pressure in said groove and channel 13, and accordingly in the controller-conduit 12.

As thus far described, my invention corresponds substantially with the disclosure in my pending application, Serial No. 288,779. The controller-nozzle in my present invention has its flaring jet-passage inclined downwardly, so as to discharge a cone-shaped jet in the direction of the incline of the wall at the lower end of the casing 14. Also the groove 17 in the casing is disposed above the channel 13, so that the connecting-ports 18 lead in the direction of the flow of the jet. The jet-orifice stands flush with the cylindrical side body of the controller-nozzle, which is of uniform diameter throughout except for an annular groove 19 just above the jet-orifice, which groove is slightly greater in width than the length of the nozzle's oscillatory travel and gradually deepens until at its outer edge it curves up suddenly to the side wall of the nozzle. The purpose of this construction, as best seen in Fig. 2, is to provide for a free exhaust from the groove 17, due to the ejector action of the jet. The outer lip of the jet-orifice may have a slight clearance from the wall of the casing 14. To form the annular jet-orifice and adapt it to deliver the novel form of jet, the inner end of the controller-nozzle 15 flares outwardly from a point opposite the greatest depth of the groove 19 and tapers so that at its end it forms the thin annular outer edge of the jet-orifice. The inner edge of the orifice is formed by the periphery of a cone-shaped valve 20, which forms a closure for the inner end of the nozzle 15 and is provided with a threaded central opening by means of which it is screwed onto the nozzle-stem 21. The cone-shaped portion of the valve enters the nozzle and forms, with the flaring wall thereof, an annular inclined jet-orifice, which may be disposed at any angle other than at right angles to the axis of its travel, preferably so as to discharge the jet at an acute angle to such axis. The stem 21 is shouldered at 22, so as to engage the outer face of a head-plate, which closes the upper end of the chamber in the controller-nozzle. Thin spacing-partitions 23, integral with the nozzle-piece, engage the valve, so that when screwed against them both valve and head-plate 22 are held in position. The stem 21 is shown provided with a stop, against which the valve is adapted to be screwed to take any strain from the partitions 23. A passage 24 leads through this stem and permits the pressure to equalize itself above and below the nozzle for balancing purposes. The valve 20 has a cylindrical side face, which by engagement with a narrow annular portion between the inner edge of the groove 17 and the tapering inner end wall of the casing 14, which merges into the bowl 25, serves to valve off the jet fluid from the latter bowl and the nozzle-passage leading therefrom into the turbine. The width of this valving-face of the controller-nozzle corresponds with the length of the eccentric's stroke. Under certain conditions, therefore, as seen in Fig. 1, this will effectively valve off the jet fluid from the bowl 25 throughout the complete oscillatory travel of the jet-nozzle. As the valving end of the jet-nozzle is moved by the stroke of the eccentric into the bowl 25 the ejector effect of the jet, by means of the groove 19, takes full and instant effect to exhaust the controller fluid from above the valve-pistons and cause the valves 6 to open, as seen in Fig. 2.

To insure the controller fluid acting uniformly against the valve-pistons, I provide a plurality of ports 26 around the inner end of the blocks 10, which ports lead from the cylinder to a groove 27, surrounding the block and in communication with the controller-conduit 12. The nozzle-stem passes out through a gland 28 in the head-block 29, which closes the outer end of the chamber 3, and is connected to a cross-head 30, which slides in ways formed in an overhanging extension 31 of the block 29. An arm 32, swivelly connected to the cross-head, is pivoted by a stud 33 to an arm 34, which at its other end surrounds an eccentric 35 for oscillating the jet-nozzle. The eccentric is mounted on a shaft 36, driven, preferably, at a slow rate of speed by the turbine. A link 37, pivotally connected to the stud 33, is in turn swiveled to the longer arm of a bell-crank lever 38, mounted on a journal 39, and coupled up, by means of a short adjustable rod 40 and the pivoted arm 41, to the sliding collar 42 of a centrifugal speed-governor 43. The governor is driven by a shaft 44, which receives motion through speed-reducing transmission devices from the turbine-shaft, (not shown,) and moves in a bearing 45, which carries the standard 46, to which arm 41 is pivotally connected. The latter arm is also pivotally connected, by means of the journal-stud 47, to the governor-collar 42 and moves therewith to rock the bell-crank 38 and by means of link 37 to adjust the angular relation of the eccentric toggle-arms 32 and 34. The distance of the controller-nozzle from the eccentric increases as the governor causes the angle between the eccentric toggle-arms to vanish, thereby changing the position of the nozzle relative to the casing 14, in which the jet is being oscillated by the eccentric.

In operation as the governor speeds up under a friction-load the arm 41 is raised and the eccentric toggle-arms adjusted to draw the controller-nozzle outwardly, so that, as seen in Fig. 1, the jet throughout its oscillatory travel discharges into the groove 16, the valve 20 acting to valve the fluid off from the bowl 25. As load is thrown on the governor gradually decreases the angle between the eccentric toggle-arms until the valve 20 intermittently clears its seat and the jet during gradually-increasing portions of its oscillations discharges directly into the bowl 25, thereby alternately injecting and ejecting fluid-pressure to and from the valve-cylinders to open the valves 6 for gradually-increasing periods. At maximum load the jet throughout its travel continuously discharges into the bowl 25, acting, as seen in Fig. 2, to produce a continuous ejector action, which lowers the pressure above all the valve-pistons and causes the valves to stand open.

The parts of the governing-rigging are so proportioned as to produce a complete cycle of adjustment for the controller-nozzle responsive to a minimum travel of the governor-collar. The angular direction of flow of the jet has been found to relieve all side thrust of the controller-nozzle, which might cause it to lag or retard the action of the governor.

The combined governing apparatus performs its controlling functions without waste of fluid-pressure and in a positive and direct manner. It is adapted for use with any type of turbine having one or a greater number of supply-valves to be controlled. Also the governor-nozzle alone may be used as the supply for small-sized turbines. In place of a toggle the governor may transmit its motion by rocking an eccentric that is linked to the middle of the valve-toggle. Various other modifications may be made within the scope of my invention.

What I claim is—

1. In a controller mechanism for turbines, a controller-nozzle, an eccentric, toggle-arms for transmitting oscillatory motion from said eccentric to said controller-nozzle, speed-responsive means to vary the angle between said arms, and a valve controlled by fluid acted upon by said nozzle.

2. In a controller mechanism for turbines, a controller device acting upon a portion of the turbine-supply, a valve controlled by the fluid acted upon by said device, an operating-stem for said device, an eccentric, toggle-arms connecting said eccentric and stem, and a link pivotally connected to said arms and operatively connected to a speed-responsive device.

3. In a controller mechanism for turbines, fluid-controlled supply-valves, a conduit for the controller-fluid, a controller device which is adapted to admit fluid-pressure to and eject it from said conduit, and means to fluctuate the pressure in said conduit comprising an eccentric, and means to impart uniform movements therefrom to said device, in combination with a speed-responsive device and means controlled thereby to vary the length of the transmission means between said eccentric and device.

4. In a fluid-controller mechanism for valves, a speed-responsive controller device comprising an annular valve adjacent to a jet-orifice, a port coöperating with said jet-orifice, an annular seat for said valve, a supply-port for admitting fluid to said orifice, an exhaust-port which is closed by said valve as said orifice discharges fluid into said port, and means to oscillate said controller device, said jet being adapted to eject fluid from said port when said exhaust-port is open.

5. In a fluid-controller mechanism for valves, a controller-chamber, a controller device which fits therein as a valve, a port leading from the side of said chamber, a jet-orifice in said device, a groove on one side of said orifice and a valving-face terminating at said orifice on the other side thereof, means to supply fluid to said orifice, an exhaust for said fluid controlled by said valving-face, and one or more valves controlled by the action of the fluid in said port in the chamber.

6. A controller mechanism for a turbine comprising a controller-fluid chamber, a controller device therein provided with a jet-orifice and a valving portion, a fluid-pressure supply acted upon by said device in said chamber, a supply-valve controlled by the fluid in said chamber, said jet and valve coöperating to move and hold said supply-valve closed and said jet acting with an ejector effect to cause said supply-valve to move in the other direction, and a port through which fluid exhausts under the control of said device.

7. In combination with a fluid-motor having one or more fluid-pressure-controlled valves, a controller mechanism for said valves utilizing a reciprocatory valve and fluid-jet to control the pressure of the valve-controlling fluid.

8. In combination with a fluid-motor, one or more fluid-pressure-controlled valves, means to effect the operation of said valves responsive to a controller-fluid pressure, and means to produce fluctuations in said latter pressure which comprises a vibratory controller device utilizing a fluid-jet to produce pressure-waves, and a valve to produce a constant pressure.

9. In a motor, one or more fluid-pressure-controlled valves, a controller device therefor comprising a cylindrical body, a narrow peripheral jet-orifice in said body which is smooth but for a groove to one side of said orifice, a chamber in which said device seats pressure-tight, a supply-port at one end of said chamber, an enlarged exhaust-port at the other into which said chamber opens, and a valve-controlling fluid-conduit leading from a point adjacent to said exhaust-port.

10. In a motor, one or more fluid-pressure-controlled valves, a reciprocatory controller device for discharging a wide thin jet of fluid at an angle to the line of travel of said device and in the direction of the fluid's exhaust, an exhaust-opening for said fluid, and means coöperating with said jet for controlling the operation of said valve or valves.

11. In a turbine-controlling apparatus utilizing a fluid jet to produce a variable

valve-controlling fluid-pressure, a controller-nozzle device adapted to discharge a cone-shaped jet.

12. In a turbine-governing apparatus, a movable jet-nozzle adapted to discharge fluid at an acute angle to the axis of its travel, and means responsive to said jet which vary the fluid-supply to the turbine.

13. In a turbine-governing apparatus, a governor-shifted jet-nozzle adapted to discharge fluid in a thin laterally-flowing jet at an angle other than a right angle to its line of travel, said fluid flowing from all sides of said nozzle so as to balance it, and means responsive to said jet which vary the fluid-supply to the turbine.

14. In a turbine, a supply-valve, an annular operating-piston therefor, a cylinder, a controller-fluid conduit surrounding said cylinder and provided with a plurality of ports adapted to admit the fluid uniformly to said annular piston.

15. In a turbine, a supply-valve, a fluid-motor therefor comprising a cylinder, a chambered head therefor, an annular piston, a guide connected to said piston and adapted to enter the chamber in said head, a controller-fluid passage surrounding said head, and a ring of ports leading from said passage through the head into the annular piston-chamber.

16. In a turbine-controller mechanism, a plurality of valves having annular pistons and cylinders, and a common controller-fluid conduit which connects with a ring of pressure supply and exhaust ports entering each cylinder.

17. In a turbine-controller mechanism, a controller device comprising a jet-orifice and a valve, means to impart uniform oscillations to said device, said valve having an effective surface substantially equal in length to the oscillatory movements thereof, and a narrow seat for said valve interposing between a port to receive the impact effect of said jet and an exhaust-port for said jet fluid.

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

JAMES WILKINSON.

Witnesses:
HENRY B. CONGDON,
JOHN E. DEVRON.