No. 788,004. PATENTED APR. 25, 1905.

J. WILKINSON.

CONTROLLER MECHANISM FOR MARINE TURBINES.

APPLICATION FILED AUG. 18, 1904.

3 SHEETS—SHEET 1.

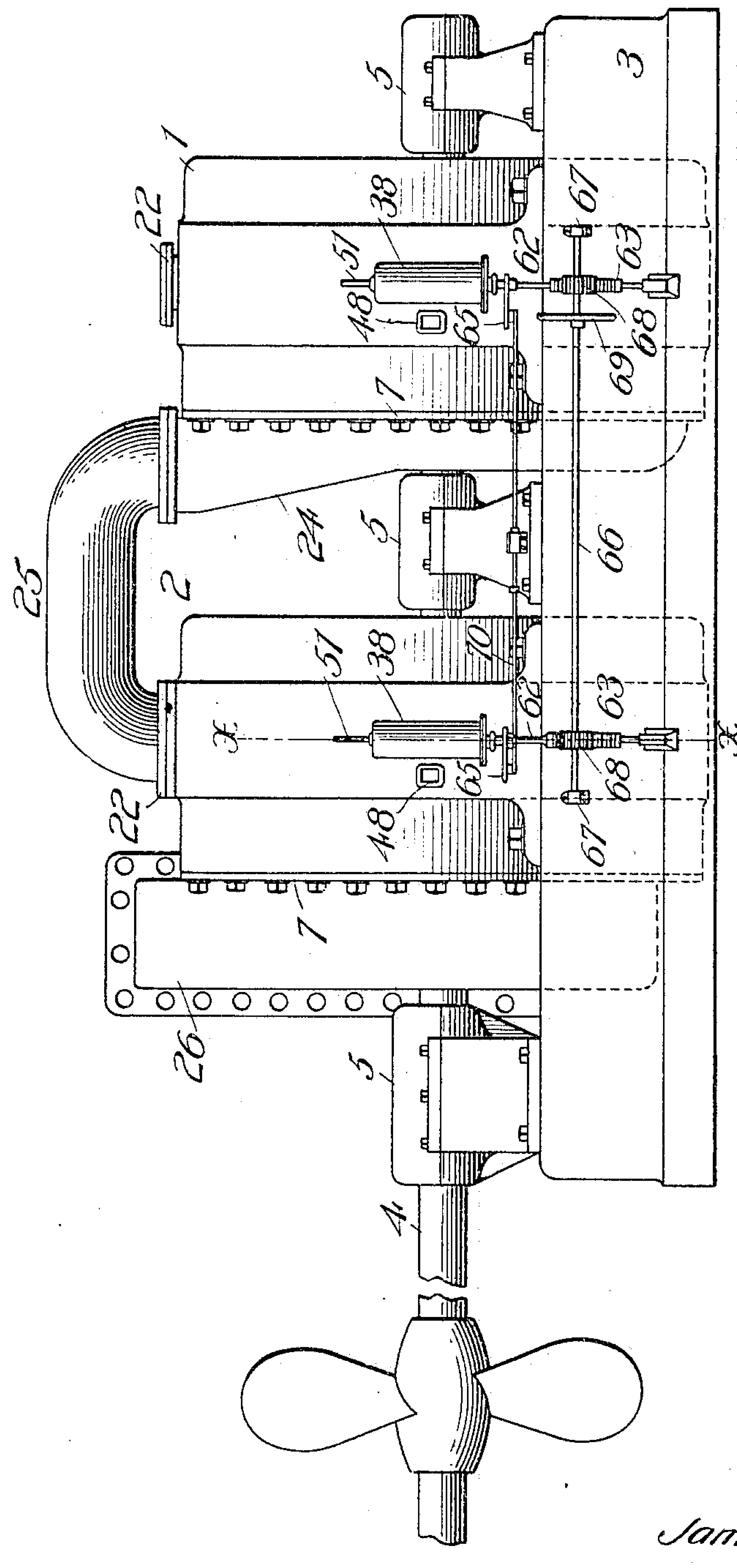

Fig. 1.

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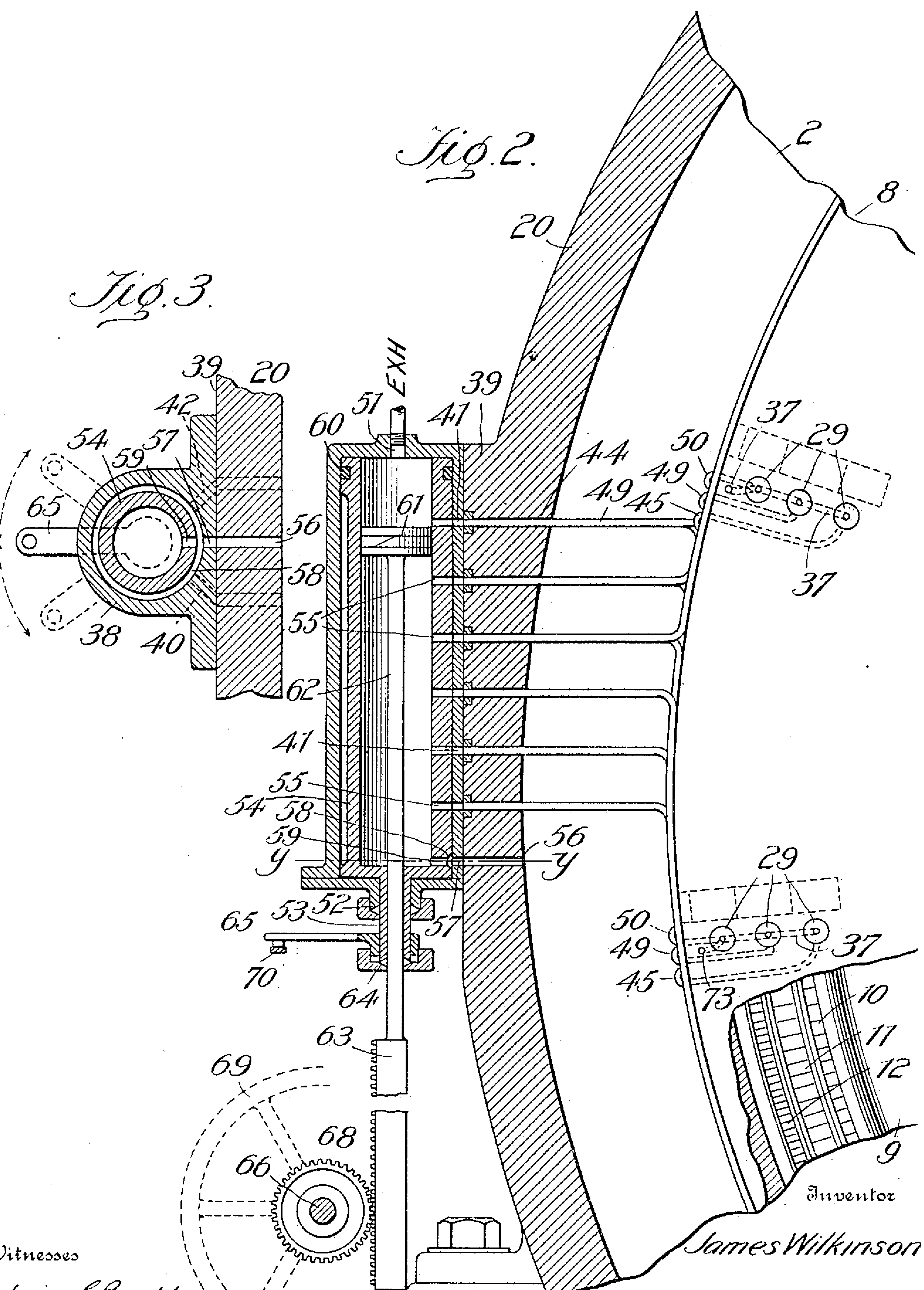

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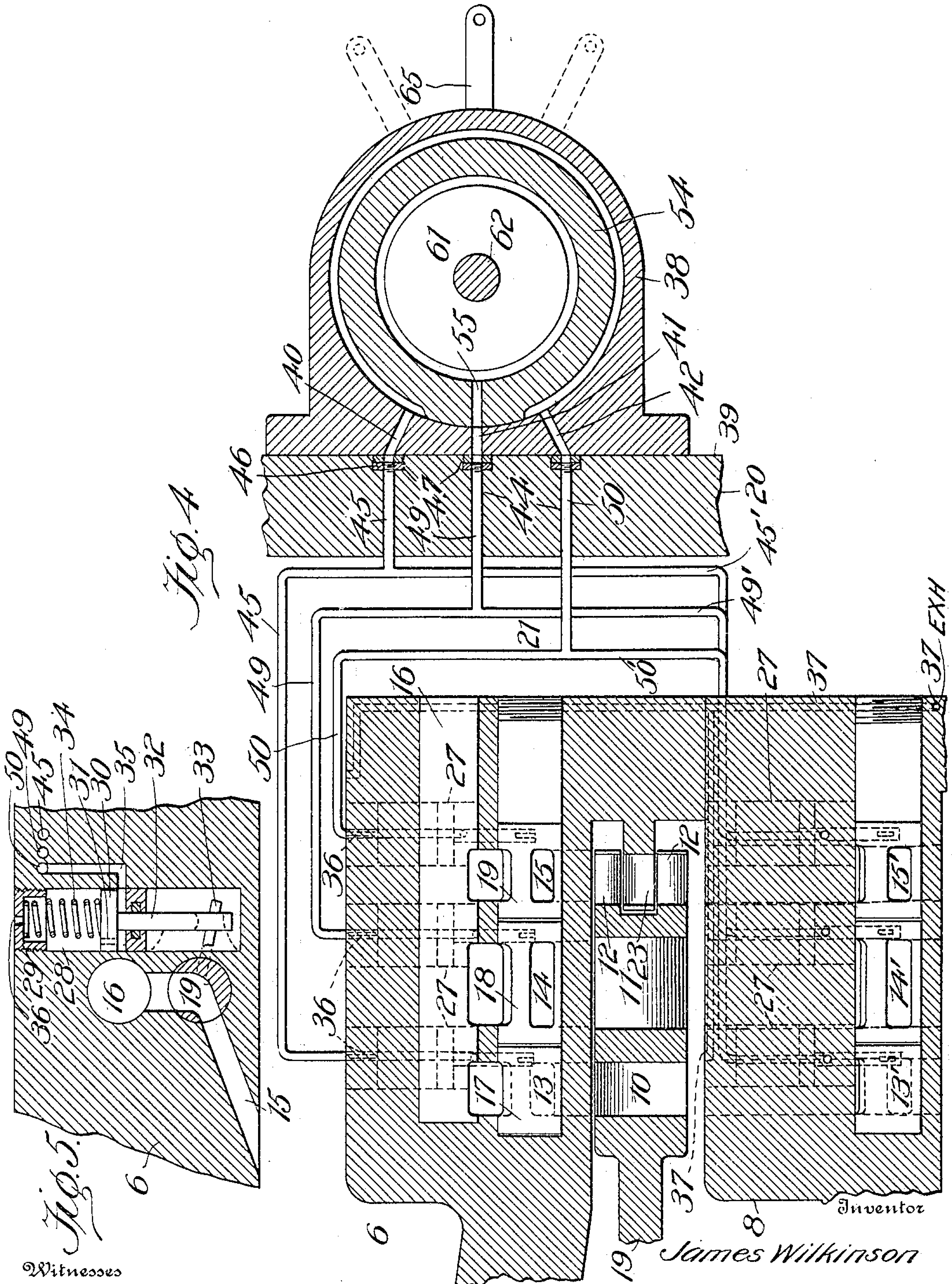

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UNITED STATES PATENT OFFICE.

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

CONTROLLER MECHANISM FOR MARINE TURBINES.

SPECIFICATION forming part of Letters Patent No. 788,004, dated April 25, 1905.

Application filed August 18, 1904. Serial No. 221,260.

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 Marine Turbines, of which the following is a specification.

My invention relates to an improvement in mechanism for controlling the supply of motor fluid to an elastic-fluid turbine.

My controller mechanism is particularly adapted for use in connection with turbines having a plurality of admission-nozzles which act against a compound bucket-wheel to drive the turbine at different speeds or in different directions or according to my present construction to drive it at two speeds in one direction and to reverse it.

It is an obvious advantage where independent valves are utilized to control the flow of motor fluid through the several nozzle-passages or groups of passages producing these different driving effects that a single controller mechanism should be capable of regulating the admission of motor fluid to the turbine whether it be operating at full or fractional speeds or reversing. To this end I have adapted the controller mechanism, shown and more fully described in a pending application, to control a plurality of independent fluid-actuated supply and, if desired, stage valves for a turbine of any of the types above referred to. Conduits for conducting fluid-pressure to control the operation of these valves are preferably divided into groups, one to control the valves of each group of similarly-acting nozzles, and an adjustable valve-seat is provided with a plurality of ports which register with any desired group of conduits. This seat exposes the other groups of conduits to a pressure which causes the valves under their control to close, while a valve on the seat operates to expose the ports therein and the conduits with which they register to different pressures to cause the valves under their control to open or close to vary the volume of fluid-pressure admitted to the active working passages.

My invention further comprises improvements in means for moving in unison the controller mechanisms for a plurality of turbine units serially coupled up.

My invention further comprises the details of construction and arrangement of parts hereinafter more fully described, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of my improved multiple marine turbine. Fig. 2 is an enlarged sectional view broken away along *x x*, Fig. 1. Fig. 3 is a cross-sectional view along the line *y y*, Fig. 2. Fig. 4 is an enlarged detail sectional view of the controller mechanism, illustrating the pipe connections to the valve-motors in the supply-head and diaphragms. Fig. 5 is a detail view of a valve-motor in the supply-head.

In the drawings I have illustrated my invention embodied in a compound two-speed and reversible marine turbine, comprising the turbines 1 and 2, mounted upon a common bed-plate 3 and acting to drive a propeller-shaft 4, for which I provide bearings 5, one at each end of the bed-plate and one between the turbines. The two turbines are similar in construction and operation to the turbine shown and described in my Letters Patent No. 752,496. Each comprises a supply-head 6 and exhaust-head 7, between which are interposed diaphragm-partitions 8, which divide the interior of the turbine into compartments or stages, within each of which a wheel 9 rotates having three sets of peripherally-disposed buckets 10, 11, and 12. Three sets of nozzles 13, 14, and 15 lead from transverse fluid-supply passages 16 in the supply-head and under the control of rotary fluid-actuated valves 17, 18, and 19 discharge motor fluid against the buckets in the first stage. A shell 20 surrounds the inner casing of the turbine, leaving an annular chamber 21 between it and the casing. Fluid-pressure is supplied through a port 22 in the side of shell 20 to this chamber, into which the passages 16 open. Nozzles 13′, 14′, and 15′ lead through the several diaphragms to the exhaust, being disposed in alinement with the corresponding sets of nozzles 13, 14, and 15 in the supply-head and constituting working passages for the motor fluid. The successive nozzles 14 14′ coöperate with the interposed rows of buckets 11 and constitute the intermediate full-speed forward-driving working passages. Nozzles 13 13′ coöperate with buckets 10 and form reversely-disposed working passages which act to drive the turbines at full speed in an opposite direction to the intermediate passages. The outer nozzles 15 15′ coöperate with double rows of buckets 12, together with the interposed stationary rows of intermediates 23, and constitute half or cruising speed forward-driving working passages. These several working passages are similar in construction and operation to the corresponding working passages of my Patent No. 752,496 aforesaid, and therefore require no further detailed description here and constitute no material part of my present invention, which relates principally to the mechanism for controlling the flow of the motor fluid through said passages.

It being my intention to operate the turbines in series, I provide the exhaust-chamber 24 of turbine 1 with a port communicating with a conduit 25, leading to the supply-port 22 of turbine 2 to supply motor fluid to chamber 21 between its shell and casing. The exhaust-head 7 of this turbine discharges the motor fluid into the main exhaust or condenser 26.

Each valve 17, 18, and 19 is operated by a fluid-motor 27, seated in the supply-heads and diaphragms adjacent to the valves they control and each comprising a cylinder 28, closed at its top by a plug 29, and a piston 30, having a very small leakage-opening 31, and a stem 32, which leads through the inner end of the cylinder and enters a recess, where it connects with a crank 33, secured to a valve. A spring 34 above the piston tends to move the latter to its valve-open position, while a passage 35 enters the lower end of the cylinder to admit the controller fluid-pressure below the piston to close the valve. Atmospheric pressure is admitted to the cylinders through passages 36, leading through plugs 29 for the supply-valve motors, and conduits 37 may lead from the supply or exhaust head to each stage-valve motor to admit a low pressure thereto. The fluid-pressure controller mechanism for each turbine comprises a casing 38, rigidly secured to a seat 39, formed on the side of shells 20. This casing is provided with three rows of openings 40, 41, and 42, which lead through its bottom portion and register with openings 44, leading through the shell. A group of pipes 45 connect with the passages leading to the several motor-cylinders for valves 17, controlling the inner row of reversing working passages, and extend through the openings 44 in the shell, which register with ports 40 in the casing. Each pipe 45 may control a single valve-motor or a group around the supply-head or by suitable branch pipes 45′ may control a plurality of stage-valves, operating them in groups with each supply-valve. The pipe 45 is threaded at one end, which is inserted through one of the openings 44, and is engaged by a threaded nut 46, which seats in a recess 47 in seat 39. This recess is threaded at its open end, into which a screw-plug is inserted having an opening registering with a port 40. I provide a suitable hand-hole 48 in the side of each shell, by means of which these pipes may be connected up. A similar set of pipes 49 communicate with the ports 41 in the casing and with the motors controlling the valves 19 for the intermediate full-speed working passages, and pipes 50 register with ports 42 and communicate with the motors for operating the valves of the outer or half-speed working passages. Each of the pipes 49 and 50 may have branch pipes 49′ and 50′ leading to stage-valves. The interior of the controller-casing 38 forms a cylinder open at one end to the atmosphere through port 51 and having at its other end a suitably-packed aperture 52, through which passes the tubular spindle 53, formed integral with a multiported valve-shell 54, seated in the casing and provided with a single row of ports 55, leading through a thickened web portion which rests upon the bottom of the casing. This shell is reduced between its end portions to form a chamber between it and the casing, which extends from the web portion around the shell. As will be seen more clearly in Fig. 4, pressure is admitted to this chamber through a passage 56, leading through seat 39 and registering with a port 57, which admits pressure to a groove 58 through the web portion of the shell. The pressure will therefore, as seen in Fig. 3, have access to the chamber between the casing and the shell, and it will also have access to the interior of the shell through a port 59. The opposite end of the shell is open, so that it is exposed to the atmosphere through port 51, suitable packing 60 being used around the end of the shell to prevent the escape of the pressure within the casing through this port. A controller-piston 61 moves pressure-tight in this shell, being operated by a rod 62, leading through the tubular spindle 53 and connected at its outer end to a rack 63. A suitable packing-gland 64 will prevent the escape of pressure around the rod. A crank 65 is rigidly connected to the spindle and is used to rotate the valve-shell to move its row of ports 55 into alinement with either row of ports 40, 41, or 42. The web of the valve-shell, through which ports 55 pass, is of such a width that when it occupies a position over one of the rows of ports through the casing the other two rows will be exposed to the high pressure in the chamber between the shell and casing. It follows, therefore, that two of the groups of pipes 45, 49, and 50 will always be in communication with the high pressure in the controller-casing, which will accordingly actuate the motors under their control to maintain two of the groups of working passages always closed. The other groups, being controlled by pipes in communication with the interior of the valve-shell, will be opened or closed according to the position of the piston therein. The high pressure exists in one end of the valve-shell and the atmosphere in the other, so that as the piston exposes the pipes to the high or low pressure the motors controlled thereby will close or open to operate the valves under their control. Thus, as seen in Fig. 2, the valve-shell is moved to a position where it controls the forward-driving working passages through pipes 49, the high pressure behind the piston entering all but the last pipe 49, so that all but the valves controlled by this pipe in the whole turbine are closed. The volume of pressure admitted to the active working passages is controlled by moving the piston 61 to uncover more or less ports 55 and expose them to the atmosphere. As an operating means for the piston I use a pinion-shaft 66, mounted in bearings 67 upon the bed-plate 3 and provided with two pinions 68, which mesh with the racks 63 on the piston-rods 62 of turbines 1 and 2. A hand-wheel 69 may be used to operate the rod. The cranks 65 for operating the valve-shells are connected together by a rod 70. In this manner each of the turbines has a similar controller mechanism adapted to be moved at the same time by a common operating mechanism.

These turbines may have any desired number of stages, and where large powers are required I may couple up three or more upon the same shaft in the manner shown in my Letters Patent.

Since the governing mechanism is independent in its operation from the detailed character of the turbine, it is evident that the construction shown in the drawings may be simplified to control a turbine having but two independent groups of working passages. Such turbines have been described in my Letters Patent Nos. 761,866 and 752,610, in which case the intermediate rows of ports 41 and pipes 49 would be dispensed with, the construction and operation of the controller devices being otherwise unchanged.

These and other modifications in the application of my controller mechanism, as well as in the details of its construction, may be made without departing from the spirit of my invention.

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

1. In a controller mechanism for a multiple-nozzle turbine, fluid-pressure-operated means to throw the nozzles into or out of service, conduits for the controller fluid-pressure, an adjustable valve having ports which communicate with part of said conduits at a time, while the others are exposed to a pressure which throws the nozzles under their control out of service, and a controller device to open or close the ports of said valve and the conduits communicating therewith to control the admission of fluid-pressure thereto.

2. In combination with a multiple-nozzle turbine, means to open and close the turbine-nozzles, a plurality of passages for conducting fluid-actuating pressure to said means, and means to regulate the supply of motor fluid to the turbine by controlling the pressure in said passages, said means comprising an adjustable valve having a plurality of ports adapted to register with different passages in different operating positions, and a controller device movable over said valve to control the admission of pressure to its ports.

3. In an elastic-fluid turbine having a plurality of fluid-actuated valves, a controller mechanism comprising a plurality of conduits for valve-actuating fluid opening into a controller-chamber, a valve therein to open a part of said conduits to the admission of fluid-pressure, and a controller device within said chamber to control the admission of pressure to said other conduits.

4. In a turbine, a plurality of motor-fluid valves, and fluid-pressure-controller means to actuate said valves comprising fluid-conduits, a movable casing, a controller-chamber therein having a port or ports which register with a part of said conduits, and a controller device in said chamber to expose said ports to a high or low pressure.

5. In a turbine, a plurality of nozzles which discharge motor fluid against a bucket-bearing element with different driving effects, fluid-actuated valves to control said nozzles, conduits for the fluid-pressure which controls the operation of said valves, a multiported valve to control the admission of pressure to said conduits in groups, and a slide-valve acting between two pressures and operating to successively admit one or the other of them to the conduits of a group.

6. A controller mechanism for a multiple-valve turbine comprising a movable chamber exposed to a valve-controlling pressure, and a plurality of passages a part of which are adapted to communicate with said chamber and conduct fluid-pressure to control the operation of the turbine-valves.

7. A controller mechanism for a multiple-valve turbine comprising a movable element provided with a controller-chamber therein adapted to communicate a high or low pressure to a plurality of passages in groups, said passages being adapted to conduct fluid-pressure to control the operation of turbine-valves, and

a slide-valve in said chamber to open its ports to a high or low pressure.

8. In a controller mechanism for a multiple-valve turbine, a casing, an adjustable valve-seat therein having a plurality of ports, a plurality of passages entering said casing, a different group of said passages registering with the ports in said valve-seat in its different operating positions, and a slide-valve movable over said seat to control the admission of fluid-pressure to a group of said passages to control the operation of turbine-valves.

9. In a controller mechanism for a reversing-turbine, a forward-driving nozzle and fluid-pressure-controlled valve therefor, a reversing-nozzle and fluid-pressure-controlled valve therefor, said nozzles discharging motor fluid with opposite driving effects against a bucket-bearing element, and means to control the operation of said valves comprising fluid-pressure passages, a movable pressure-controller chamber which registers with one of said passages, and means in said chamber to admit or exhaust pressure from said passages.

10. In a controller mechanism for a multiple-valve turbine, a controller-casing, a plurality of conduits leading therefrom and communicating with valve-motors, a controller-chamber in a movable element in said casing adapted to control the operation of said valves in groups, and means in said chamber to control the operation of the several valves of a group.

11. In a controller mechanism for a turbine, a casing exposed to a constant pressure, a controller-chamber in said casing exposed to high and low pressures, conduits for valve-controlling pressures entering said casing and communicating with said chamber, and means in said chamber to expose said passages to the high or exhaust pressure therein.

12. In a controller mechanism for a turbine, a casing exposed to high pressure, a plurality of ports leading therethrough and communicating with passages for conducting valve-controlling fluid-pressure to means which operate to vary the fluid-pressure supply to the turbine, a movable controller pressure-chamber in said casing acting as a valve to open a part of said ports to the pressure in said casing which holds said valve to its seat, and means to admit the pressure of said chamber to the passages not exposed to the pressure in said casing.

13. In a controller mechanism for a turbine, a multiported casing, a multiported valve-shell whose ports are adapted to register with different groups of ports in said casing, and a piston-valve movable in said shell and operating to expose the ports thereof to a high or low pressure, and means to control the operation of turbine-valves by passages communicating with the ports in said casing and with motors for actuating said valves.

14. In a reversing-turbine, forward-driving nozzles, reversing-nozzles, fluid-actuated means to cut said nozzles out of service, conduits to conduct the controller fluid-pressure to said means, a controller-casing having two sets of ports, one communicating with the conduits for the forward-driving nozzles, and the other set with the conduits for the reversing-nozzles, ports admitting a high and an exhaust pressure to said casing, a valve therein which opens one group of conduits to a pressure which cuts the nozzles under their control out of service, and a controller device therein which admits said high or exhaust pressure to the other conduits.

15. In a turbine, a plurality of groups of nozzles which act to drive the turbine forward at full and fractional speeds and to reverse it, fluid-pressure-actuated valves to control said nozzles, conduits for the valve-actuating fluid-pressure, a multiported valve to control the admission of fluid-pressure to the conduit or conduits leading to the valve or valves controlling the nozzles which admit motor fluid to produce one of said driving effects, while admitting fluid-pressure to the other of said conduits to cause the valves under their control to close, and a slide-valve acting to control the admission of pressure to the active nozzle or nozzles by opening the ports of said controller-valve.

16. In a turbine, a fluid-pressure-controller mechanism for varying the supply of motor fluid, comprising a casing communicating at one end with a high pressure, a cylindrical shell therein having a port at one end to admit said high pressure thereinto and exposed at its other end to an exhaust-pressure, a plurality of ports in said shell, a plurality of conduits for conducting fluid-pressure to means for varying the fluid-supply, means to move said shell so that its ports register with certain of said conduits, a piston in said shell which controls the admission of said pressures to said conduits, and means to actuate said piston.

17. In a controller mechanism for a turbine, a casing supplied with high pressure, a multiported valve-seat therein, a valve-shell mounted on said seat and having a set of ports, a port admitting low pressure to said shell, means to move the ports in said shell into register with part of the ports in said seat, means to open the ports in said shell successively to said low pressure, said shell acting as a valve to admit the high pressure in said casing to the ports in said seat not exposed to said low pressure, and means to connect the ports in said seat with fluid-pressure-controlled means to vary the fluid-pressure supply to the turbine.

18. In a controller mechanism for a turbine, a controller-casing, a longitudinally-shouldered valve-shell therein, a row of ports in said shouldered portion, a circular multiport-

ed seat for said shell, a controller-piston in said shell, means to admit a high pressure to said shell and to said casing around said shell whereby the shouldered portion thereof is held against said seat, means to admit atmospheric pressure to said shell, means to move the ports in said shell into register with a set of the ports in its seat, and means to connect the ports in said seat with fluid-pressure-controlled means to vary the fluid-pressure supply to the turbine.

19. In a turbine, groups of working passages at different distances from the shaft center, means to cut said working passages out of service, and a fluid-pressure-controller mechanism for controlling the admission of motor fluid to said groups of passages independently comprising a controller-valve and an adjustable seat therefor.

20. In a turbine, groups of working passages at different distances from the shaft center, means to cut said working passages out of service comprising supply and stage valves, fluid-pressure-controller means for said valves comprising motors to actuate said valves, conduits connected up to the supply and stage valves of each group and a controller-chamber, and a controller-valve and an adjustable seat therefor in said chamber to control the operation of the valves of each group of working passages independently.

21. In a fluid-pressure-controller mechanism for a turbine, fluid-actuated means to vary the flow of fluid through the turbine, conduits to conduct the actuating fluid to said means, a movable pressure-controller chamber for controlling the admission of pressure to said conduits in groups, and a piston in said chamber for controlling the admission of a high or exhaust pressure to part of said conduits, an actuating-stem for said piston, a rack connected thereto, and gear means for shifting said piston.

22. In a controller mechanism for a set of turbines which are coupled up in series, fluid-pressure-controller mechanism for varying the admission of motor fluid to said turbines comprising pressure-controller chambers exposed to high and exhaust pressures, controller devices in said chambers, operating-stems for said devices, toothed racks carried by said stems, and a common controller-rod carrying a plurality of gear-wheels which mesh with said racks, and by means of which said devices may be moved simultaneously.

23. In a controller mechanism for a set of turbines, groups of working passages in each turbine disposed at different distances from the shaft center, means to cut said working passages out of service, a fluid-pressure-controller mechanism for each turbine adapted to control the admission of motor fluid to the groups of passages thereof independently, each mechanism comprising a controller-valve and an adjustable seat therefor, means to adjust the said seats of both mechanisms, and means to actuate said adjusting means simultaneously.

24. In a controller mechanism for a set of turbines, groups of working passages in each turbine disposed at different distances from the shaft center, means to cut said working passages out of service, a fluid-pressure-controller mechanism for each turbine adapted to control the admission of motor fluid to the groups of passages thereof independently, each mechanism comprising a controller-valve and an adjustable seat therefor, means to adjust the said seats simultaneously, and means to simultaneously effect a corresponding movement of said controller-valves.

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

JAMES WILKINSON.

Witnesses:

W. E. SMITH,

H. M. HARTON.