No. 811,987. PATENTED FEB. 6, 1906.

J. WILKINSON.

MARINE TURBINE.

APPLICATION FILED SEPT. 15, 1904.

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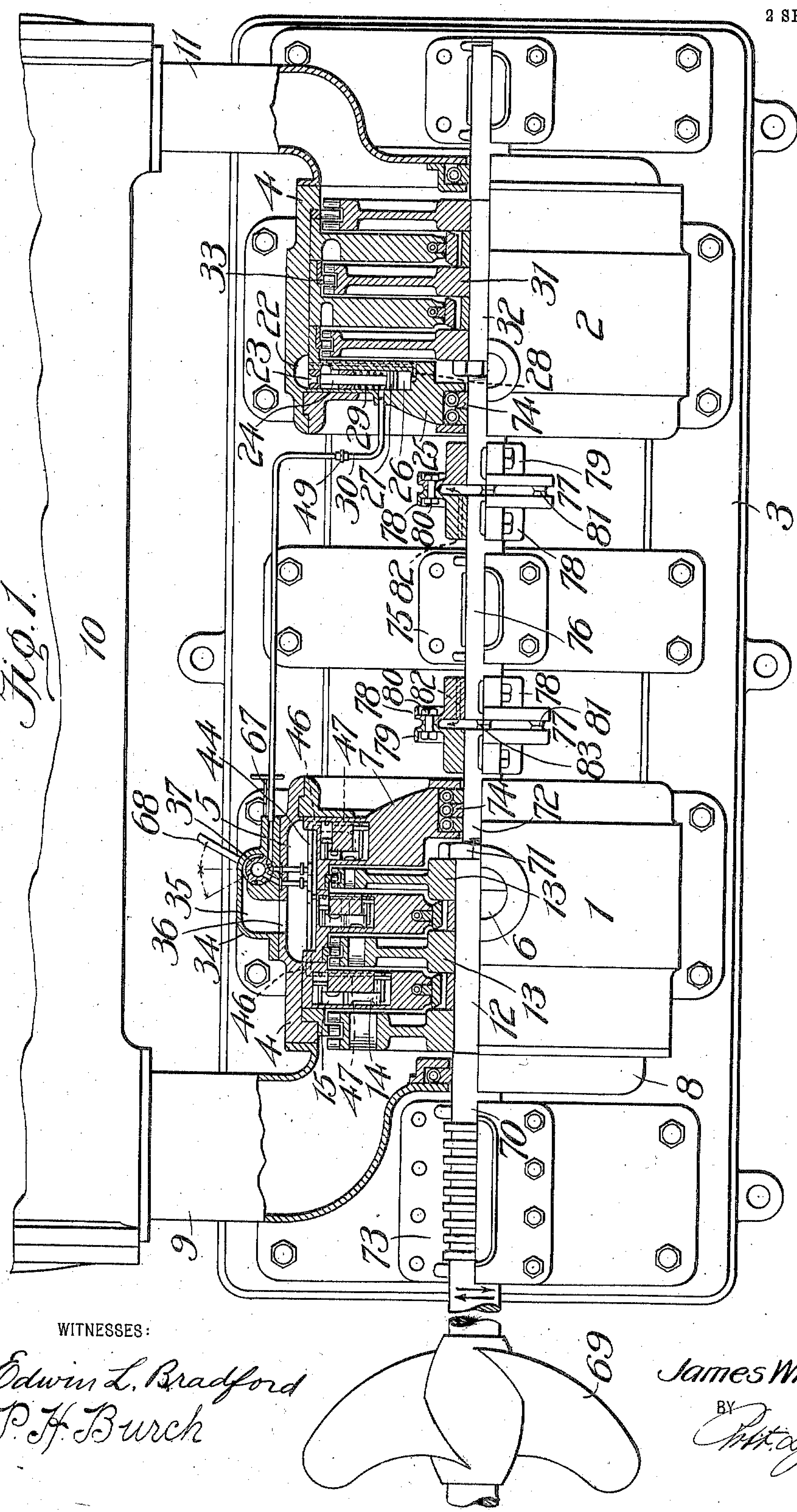

WITNESSES:

Edwin L. Bradford

P. H. Burch

INVENTOR

James Wilkinson

BY Robt. S. Johnston Jr.

ATTORNEY.

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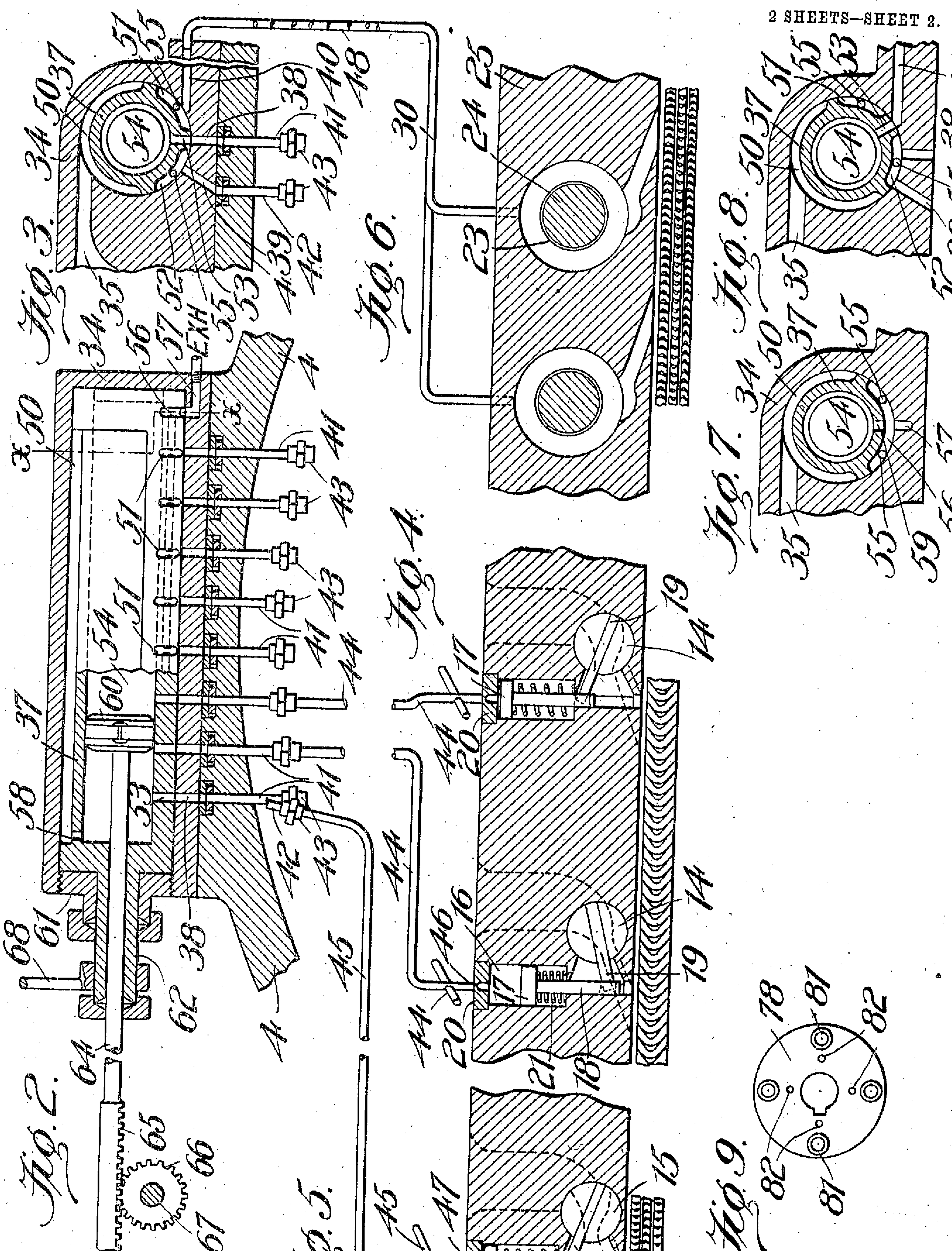

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ATTORNEY.

UNITED STATES PATENT OFFICE.

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

MARINE TURBINE.

No. 811,987. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed September 15, 1904. Serial No. 224,586.

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 Marine Turbines, of which the following is a specification.

My invention relates to elastic-fluid turbines and controller mechanism therefor.

I have shown and described in patents issued to me fluid-pressure-controller means for two-speed or reversing turbines wherein a controller-valve moves over a multiported seat through which a high or low pressure is conducted to fluid-actuated valves or their motors to open or close them.

It is an object of my invention to provide an improved controller-valve that will be held to its multiported seat in a manner to prevent any leakage of pressure around the same. To this end I expose the valve above to a high pressure and form one or more channels or recesses on its lower side to which atmosphere or low pressure is admitted, so that the valve is thus unbalanced to an extent that will cause it to be held very firmly to its seat. According to this construction I utilize high pressure to open the turbine-valves, which are closed by springs or other constant pressure acting against them or their motors when either is exposed to low pressure by the controller-valve.

It is a further object to improve the means for conducting the controller-fluid to the several valves or their motors, whether they be located within the same or different shells or turbines.

It is a further object to provide means to prevent the conduction of heat to the shaft bearing or bearings.

My invention, which I have illustrated as embodied in a compound marine turbine, comprises the details of construction and arrangement of parts hereinafter more fully described, and disclosed in the accompanying drawings, forming a part hereof, and in which—

Figure 1 is a top plan view of a compound turbine comprising a two-speed forward-driving and a single-speed reversing turbine adapted to drive a common shaft and shown partly in section to illustrate the arrangement of the working passages therein. Fig. 2 is a longitudinal vertical section through the controller-casing, showing the rotary shell partly in section. Fig. 3 is a transverse section through Fig. 2. Fig. 4 illustrates a section of a diaphragm with the valves and motors therein forming part of the full-speed working passages of the forward-driving turbine. Fig. 5 is a similar view of the half-speed working passages for the same turbine. Fig. 6 is a similar view of a nozzle-passage and valve in the reversing-turbine. Fig. 7 is a section through *x x*, Fig. 2, looking to the left. Fig. 8 corresponds to Fig. 3 and shows the valve-shell in position for controlling the reversing-turbine while cutting the other turbine out of service. Fig. 9 is an end view of one of the collars which forms a part of a ventilating-coupling for the shaft.

Similar reference-numerals refer to the same parts throughout.

The two-speed forward-driving turbine 1 and the reversing-turbine 2, which in their general construction and operation have been fully described in Letters Patent heretofore issued to me, are mounted upon a bed-plate 3 and provided with shells 4, which surround the inner casings formed by supply and exhaust heads and the interposed diaphragm-partitions, which subdivide the interior of the turbines into stages. The shell surrounding the turbine 1 is recessed to form an annular chamber 5, supplied with motor fluid through a port 6, which communicates with any suitable source of fluid-pressure. The supply-head 7 and the exhaust-head 8 are suitably held in place by the shell, the latter head communicating by a conduit 9 with a condenser 10, which communicates with the exhaust-head of the reversing-turbine 2 through a conduit 11. I provide two independent sets of working passages in the turbine 1, disposed at different distances from its shaft 12 and comprising supply-nozzle passages leading through the head 7 and stage-nozzle passages leading through the succeeding diaphragms. Bucket-wheels 13, provided with two peripheral sets of buckets coöperating with the inner and outer sets of nozzles, act to drive the shaft at full or cruising speed in the manner more fully and at length described in my Letters Patent Nos. 752,496 and 766,922. Motor-fluid pressure is admitted to the supply-nozzles through radially-disposed passages leading from the chamber 5 through the head 7 and shown in dotted lines, Fig. 1. I have provided independent valves to control the admission of motor fluid to the full and cruising speed working passages and also to control its flow through the several nozzle-passages in the diaphragms. The supply-valves are similar in construction and arrangement to the stage-valves, which are shown enlarged in Figs. 4 and 5, the valves 14 controlling the full-speed nozzle-passages and the valves 15 the cruising-speed nozzle-passages. Fluid-motors for operating these valves comprise cylinders 16, pistons 17, and stems 18, which actuate cranks 19, suitably connected to the valves. Plugs 20 close the ends of the cylinders, which communicate by conduits with a fluid-pressure-controller mechanism, hereinafter described. Springs 21 engage the pistons 17, tending to move them to close the valves under their control when the cylinders are exposed to a low pressure.

The reversing-turbine 2 is provided with a single working passage, to which the motor fluid is admitted from a supply-channel in its shell 4 through ports 23, under the control of reciprocating valves 24, radially disposed in chambers in the supply-head 25. Suitable partitions, preferably in the form of packing-rings, through which the valve-stems pass, divide these chambers into two parts, the outer constituting the admission end for the supply-nozzles and the inner parts constituting cylinders 26, within which move pistons 27, connected to or carried by the valve-stems. Passages 28 admit the high pressure from the supply-channel 22 to the inner end of each chamber 26, so that it normally tends to move the valves to close the ports 23 and cut off the supply to the turbine. Coiled springs 29, acting against this pressure, will open each valve 28 when its piston is balanced between equal pressures by the admission of high pressure through conduits 30, communicating with the controller mechanism and entering said cylinders at an intermediate point. The motor fluid when admitted to the supply-nozzles by valves 24 flows therethrough and through the succeeding stage-nozzles against interposed rows of buckets, two of which are mounted upon each wheel 31, disposed in several stages and mounted upon a shaft 32. Any desired number of admission-nozzle passages may be used and the bucket-wheels may be provided with one or more rows of buckets coöperating with said nozzle-passages. When double rows of buckets are used, which is my preferred construction, suitable intermediates 33 will be interposed between each double row, the same arrangement applying to the outer set of working passages of the turbine 1, where the slow speed developed by the motor fluid therein necessitates the interposition of intermediates between the rows of rotating buckets. The construction and arrangement of the working passages of the several turbines form the subject-matter of former patents and pending applications and not constituting an essential part of my present invention will not be further described in detail herein.

My controller mechanism comprises a casing 34, mounted on the shell 4 of turbine 1 and having a passage 35 therein communicating with the chamber 5 through an opening 36 and admitting the high pressure above a rotary valve-shell 37, seated in a circular seat, through which lead three sets of ports 38, 39, and 40, preferably arranged in parallel rows. The ports 38 and 39 respectively communicate with sets of pipes 41 and 42, which enter chamber 5 through openings in the shell and are provided with couplings 43 at their inner ends by means of which they may be connected to pipes 44 and 45. These latter pipes are disposed in the same or separate recesses formed by reducing or channeling the outer wall of the inner casing, as seen in Fig. 1, my purpose being to so place the pipes that they will not interfere with the removal of the shell 4 when they have been disconnected from pipes 41 and 42. The pipes 44 and 45 communicate, by means of suitable connections, with passages 46 and 47, respectively, leading through the supply-head and diaphragms and entering the cylinders 16 through plugs 20. The ports 40 communicate with a set of pipes 48, connected by couplings 49 with the conduits 30, which enter the cylinders 26 in the supply-head of the reversing-turbine. The valve-shell 37, which is in the form of a cylinder, is reduced between its ends to form a chamber 50, as seen in Figs. 2 and 3, which extends more than half-way around the shell, so that the high pressure admitted thereto by passage 35 will hold the shell firmly against the multiported portion of its seat. The lower portion of the shell is provided with two sets of short narrow grooves 51 and 52, transversely disposed in its outer surface and arranged in pairs opposite each other and on each side of a row of ports 53, leading from a controller-chamber 54 within the shell and adapted to register with one or the other of the sets of ports 38, 39, and 40. The grooves are of such a length and are so disposed that the sets of ports, not in register with ports 53, open, as may be seen by reference to Figs. 1, 3, and 8, into one or the other, or both, of these sets of grooves, which by interconnecting passages 55, communicate with an elongated groove 56, Fig. 7, near the end of the shell which is open to the atmosphere or a low pressure through a port 57. In this manner the valve-shell will not only be unbalanced by the admission of atmospheric pressure below it, but this pressure will be communicated to the motors of the valves for all but the set of active working passages which are in communication through ports 53 with the controller-chamber 54. Since the admission of a low pressure to a valve-motor will cause it to close its valve, it follows that all but one set of working passages will be cut out of service in each of the valve-shell's operating positions. The volume of motor fluid is varied to the active set of working passages by admitting a high pressure through port 58 to one end of chamber 54 and low pressure to the other end through a port 59, in communication with port 57, and providing a piston-valve 60, movable pressure-tight therein and adapted to admit the high or low pressure to any desired number or all of ports 53. These ports being in communication through a set of pipes with the motors controlling the valves for the active working passages, more or less of these valves will be opened according as the high or low pressure is admitted to their motors. The shell 37 is inserted into its seat through an opening at one end thereof, which is closed by a screw-plug 61, through which passes a hollow spindle 62, integral with the shell. The piston-valve 63 is inserted through an opening in one end of the shell and operated by a stem 64, provided with a rack 65, engaging a pinion 66, mounted on a stem 67. A crank 68 engages the spindle 62. By moving this crank to bring the shell-ports 53 into register with any set of ports, as 38, Fig. 3, the exhaust-pressure in the manner described is admitted to the motors of the valves in the reversing-turbine and in the outer working passages of turbine 1 to cut them out of service. By turning stem 67 the piston 63 will be moved to admit high pressure to the ports 53 in succession. This high pressure is communicated to the valve-motors of the inner full-speed working passages of turbine 1 and opens supply-nozzles to admit motor fluid proportioned to the load. This valve may be operated in any manner desired. This mechanism controls with equal facility the valves of both turbines and may be used to control a whole set of turbines by piping the controller-fluid pressure to them. When it is desired to disconnect pipes 41 and 42 from 44 and 45, the controller-casing is unbolted from the shell, and by using opening 36 as a hand-hole this may be readily effected.

I prefer to bore the chambers in head 25 of equal diameter and preferably form the seats for the valves by inserting in the open ends of the chambers plugs having fluid-admission openings 23, which are closed by the valves 24.

The construction and control of the turbines having been thus described, I will now refer to the manner in which they operate to drive the propeller 69, which is connected to shaft 12 of turbine 1. The several bucket-wheels 13 of this turbine are suitably secured thereon between a shoulder 70 and a circular nut 71, screwed onto a reduced threaded portion 72 of the shaft. The high pressure in the first stage has access around this nut and acting against a greater surface-area of the wheel and shaft toward the supply than toward the exhaust-head thus serves in the manner described in the pending application to assist the thrust-bearing 73 to counteract the push thrust of the propeller. A similar arrangement in turbine 2 assists in counteracting the pull thrust. Packing 74 for both shafts 12 and 32 is seated in a recess in heads 7 and 25. A bearing 75, disposed between the turbines, supports a short shaft 76, connected at opposite ends to shafts 12 and 32 by ventilated couplings 77. Each coupling comprises a collar 78, comprising a hub keyed to an end of shaft 76, and a similar collar 79, secured in like manner to the abutting end of shafts 12 and 32. The adjacent faces of these collars are provided with integral flanges connected by bolts 80 and spread slightly apart by circular abutting shoulders 81, surrounding the bolts. These collars serve to connect the several shafts together, so that they constitute practically a single shaft. The clearance between the flanged faces of the collars serves as a ventilating-passage, which communicates near its center with a plurality of air-passages 82, leading through the hubs of the collars 78, so that the coupling acts with a centrifugal effect to maintain as it rotates a circulation of air through passages 82 and between the flanges. This prevents the conduction of heat to the shaft 76 from shafts 12 and 32 and maintains the bearing 75 always cool. The several shafts need not come into direct contact with each other but to relieve the couplings of thrust strain I reduce the ends of the shaft to form the projections 83, which abut without conducting any appreciable amount of heat to the bearing. Though I have described a preferred form for this coupling, I desire to protect, broadly, the use of any similar or analogous means which may be substituted therefor to prevent the conduction of heat to a shaft-bearing for a motor.

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

1. In a fluid-controller means for a turbine, fluid-controlled means to open and close nozzle-passages, pipes communicating with said means and disposed within a reduced portion of the turbine-casing, a fluid-controller chamber, and conduits leading therefrom which are detachably connected to said pipes.

2. In a turbine having an inner casing and a removable outer casing, fluid-pressure controlled valves within the turbine, fluid-con-

ducting pipes seated in the same or different cut-away portions of the inner casing and adapted to admit a high or low pressure to said valves, a controller-valve controlling the admission or exhaust of pressure to other pipes which are coupled to the first-mentioned pipes.

3. In a turbine having an inner casing and a removable shell surrounding it, nozzle-passages, valves therefor, motors to actuate the valves, conduits leading to said motors through the casing, pipes communicating with said conduits and disposed in a reduced portion of said casing so as to be below or flush with its outer periphery, and a fluid-controller means carried by said shell and adapted to control the admission of fluid-pressure to said pipes.

4. The combination with a turbine having an inner casing and an outer shell, a recess in said casing, one or more pipes disposed therein, a controller-chamber, pipes leading therefrom through said shell, means to couple said latter pipes to the pipes in the casing, and means, controlled by the pressure in said pipes which regulate the operation of the turbine.

5. In a turbine, a supply-head for a wheel-compartment, a valve-chamber therein leading inwardly from its outer periphery, a valve-seat disposed in the outer end of said chamber and communicating with a motor-fluid-supply chamber, a valve in said valve-chamber, a nozzle-passage leading therefrom through said head, a fluid-motor for operating said valve comprising a cylinder formed by the inner end of said chamber, a piston therein for operating said valve, and means to communicate a controller-fluid pressure to said cylinder.

6. In a supply-head for a wheel-compartment, a chamber therein leading from its periphery inwardly, a partition therein, a valve having a stem passing through said partition and connected to a piston, a fluid-supply opening adapted to be closed by said valve, a nozzle-passage supplied with motor-fluid pressure when said opening is open, means tending to move said valve in one direction, and controller means exposing said piston to a pressure which will cause it to move in the opposite direction.

7. In a turbine, a supply-valve, a chamber for said valve leading radially into the valve-bearing portion, a supply-passage communicating with the outer end of said chamber, a circular valve-seat inserted in the outer end of said chamber, a nozzle-passage communicating with said chamber, a piston connected to said valve and movable in the inner end of said chamber as a cylinder, means to admit a high pressure against said piston to close said valve, and controller means to open said valve.

8. In a turbine, a plurality of supply-valves, a valve-bearing portion, radial chambers therein within which the valves are disposed and from which lead nozzle-passages, pistons for actuating said valves, a motor-fluid-supply chamber, valve-seats at the outer end of said chambers through which motor fluid enters from said supply-chamber, passages to expose said pistons to a high pressure tending to close said valves and a controller-fluid pressure tending to open them, and springs coöperating with said latter pressure to open the valves.

9. In a controller means for a turbine, a chamber to which high pressure is admitted, a multiported valve-seat, a valve thereon held to its seat by said chamber-pressure, means to unbalance said valve by admitting low or atmospheric pressure between it and its seat, and conduits leading from the ports in said seat to valve means which control the discharge of motor fluid against rotating buckets in the turbine.

10. In a controller means for a turbine, a chamber to which high and low pressures are admitted, a valve therein exposed to said pressures and unbalanced thereby, a seat to which said valve is firmly held by said pressures, passages leading to said chamber, said valve being adapted to admit said low pressure to said passages in groups, independent sets of nozzle-passages controlled by said groups of passages and adapted to be cut out of service when said low pressure is admitted to their respective groups of passages, and means to admit high pressure to one group of passages to open one or more of the nozzle-passages of a set.

11. In a turbine having a plurality of fluid-pressure-controlled valves, a controller mechanism comprising a plurality of conduits for the valve-controlling fluid which lead from a controller-chamber, a valve therein adapted to open a part of said conduits to the admission of a low pressure, and a controller device adapted to control the admission of high pressure to the other of said conduits.

12. In a turbine having a plurality of fluid-actuated valves, a controller mechanism therefor comprising a plurality of conduits for valve-actuating fluid opening into a controller-chamber, a multiported valve therein to control the admission of low pressure to said conduits in groups, and a slide-valve acting between high and low pressures and operating successively to admit one or the other of said pressures to the conduits of a group.

13. A controller mechanism for a multiple-valve turbine comprising a controller-chamber formed in a movable casing and exposed to high pressure, a plurality of passages which communicate with said chamber and conduct fluid-pressure therefrom to control the operation of a set of turbine-valves, a second set of independent turbine-valves, one or

more chambers in said casing in communication with a low or atmospheric pressure, and a plurality of passages which communicate said latter pressure to the latter set of turbine-valves.

14. In a controller mechanism for a turbine, a multiported casing, a multiported valve-shell with ports which are adapted to register with different groups of ports in said casing, one or more recesses in said shell which are exposed to a low or atmospheric pressure and which are adapted to communicate with the group or groups of ports in said casing which are not in register with the ports in said shell, a plurality of turbine-valves and means to control their operation comprising motors, passages connecting said motors with the ports in said casing, and means to cause said valves to close when their motors are exposed to a low pressure through said passages.

15. In a controller mechanism for a turbine, a chamber supplied with high pressure, a multiported valve-seat therein, a valve-shell mounted and movable on said seat and provided with a set of ports, means to admit high and low pressure to said shell, means to adjust said shell to move its ports into register with a set of ports in said seat, means to admit the high or low pressure in said shell to one or more of the ports therein, said shell acting as a valve to admit low pressure to the ports in said seat not in register with its ports, and means to connect the ports in said seat with fluid-pressure-controlled means to vary the fluid-pressure supply to the turbine.

16. In a turbine, groups of working passages at different distances from the shaft-center, means to cut said working passages out of service comprising valves, actuating-pistons therefor, cylinders for said pistons, spring means tending to move said valves to their closed position in nozzle-passages which they control, and means to admit a controller-fluid pressure to said chambers comprising a plurality of conduits and a controller-valve adapted to admit a low or atmospheric pressure to the motor-cylinders of the valves for one set of working passages, in combination with means to admit high or low pressure to the motor-cylinders of the other working passages.

17. In a controller mechanism for a turbine, a controller-pressure chamber, a multiported valve-seat therein, and a valve-shell adapted to control the admission of high or low pressure to the ports in said seat in groups, said shell comprising a plurality of ports to which a high or low pressure is admitted by a controller-valve, and a plurality of chambers exposed to a low or atmospheric pressure and adapted to communicate with the ports in the seat not in register with the ports in said shell, in combination with fluid-pressure-actuated means within the turbine to vary the flow of motor fluid.

18. In a set of turbines driving a common shaft, a bearing for said shaft between said turbines, and means, interposed between said bearing and the turbines, to prevent, by a forced circulation of air, the conduction of excessive heat to said bearing.

19. In a compound turbine, a plurality of separate shells, a shaft, one or more bucket-bearing elements in each shell which are connected to said shaft, a bearing for said shaft, between two of said shells, and ventilated couplings in said shaft to prevent the conduction of heat from the shells to said bearing.

20. In combination with a turbine, a shaft therefor, a bearing for said shaft, a coupling interposed between the turbine and bearing, and means to prevent the heat of the shaft portion in the turbine being transmitted through said coupling to said bearing.

21. In combination with a turbine, a shaft formed in two parts, one entering the turbine and driven thereby which becomes highly heated by the temperature of the motor fluid in the turbine, the other mounted in a bearing, and a coupling adapted to be cooled by the circulation of air, which connects said parts of the shaft together.

22. In combination with a turbine, a sectional shaft, a bearing in which one section of said shaft is supported, said other section being disposed within the turbine, and means to connect the shaft-sections together and leave an air-space between their adjacent ends, as and for the purposes described.

23. In combination with a turbine, a sectional shaft therefor, one section being subjected to the heat within the turbine, a bearing in which the other section is supported, flanged portions carried by the adjacent ends of said sections, means to connect said portions to couple the shaft-sections together, shoulders on the abutting faces of said flanged portions which set them apart to form an air-space between them.

24. In combination with a turbine, a sectional shaft therefor, a coupling connecting the sections of said shaft and disposed between the turbine and a bearing for the shaft, said coupling comprising collars rigidly connected to an end of each shaft and to each other, and air-passages formed in and between said collars and so arranged that the coupling acts, when rotated, with centrifugal effect to maintain a cooling circulation of air which prevents the conduction of heat through the coupling to said bearing.

25. A turbine, a sectional shaft therefor, a bearing for said shaft, and means to connect the sections of the shaft, which comprise two collars each having a hub portion keyed to an end of a shaft-section, bolt-holes leading

through circular shouldered portions of said collars, bolts which connect said collars, said shoulders being adapted to abut so as to leave a clearance between the collars, and air-passages leading through said hub portion of a collar, said shaft-sections being reduced when they abut.

26. The combination of a motor, a shaft driven thereby, a bearing for said shaft disposed without the motor, and means interposed between the motor and bearing to prevent the conduction of heat through said shaft from the motor to said bearing by inducing currents of air between parts of said shaft.

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

JAMES WILKINSON.

Witnesses:
JNO. H. WALLACE,
NOMIE WELSH.