No. 806,692. PATENTED DEC. 5, 1905.

G. MEYERSBERG.

GOVERNING MECHANISM FOR ELASTIC FLUID TURBINES.

APPLICATION FILED MAY 10, 1905.

2 SHEETS—SHEET 1.

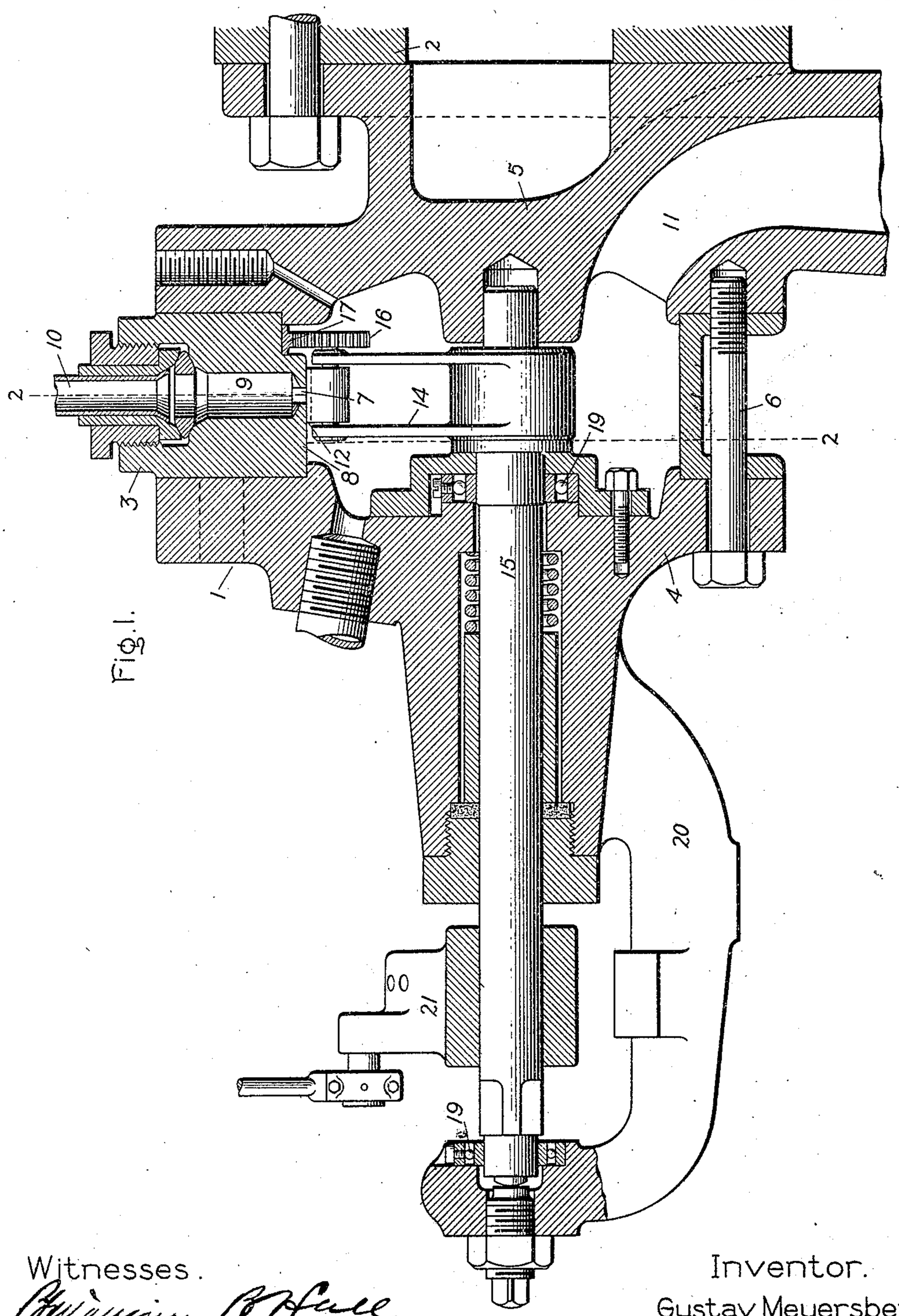

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

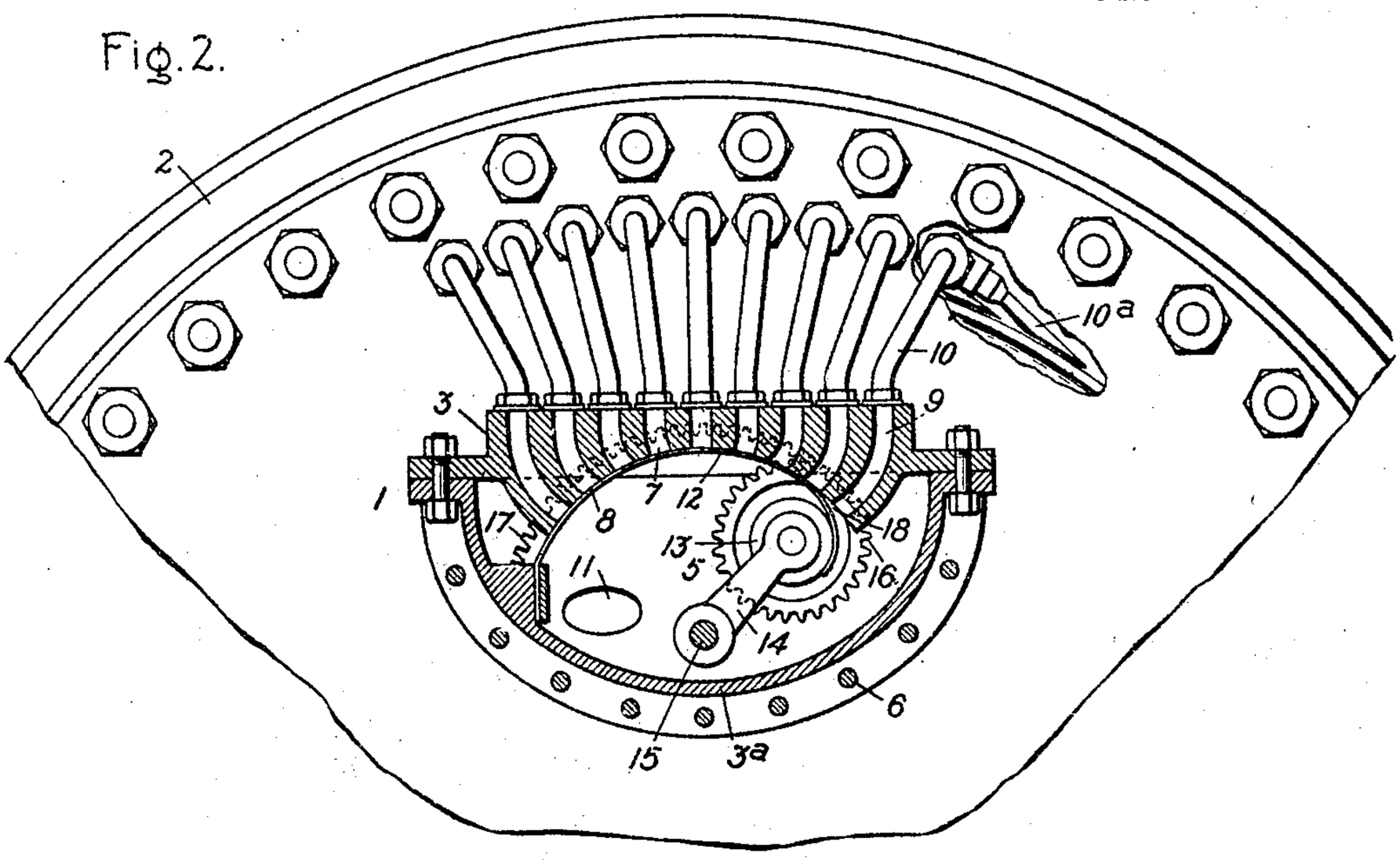


Fig. 3.

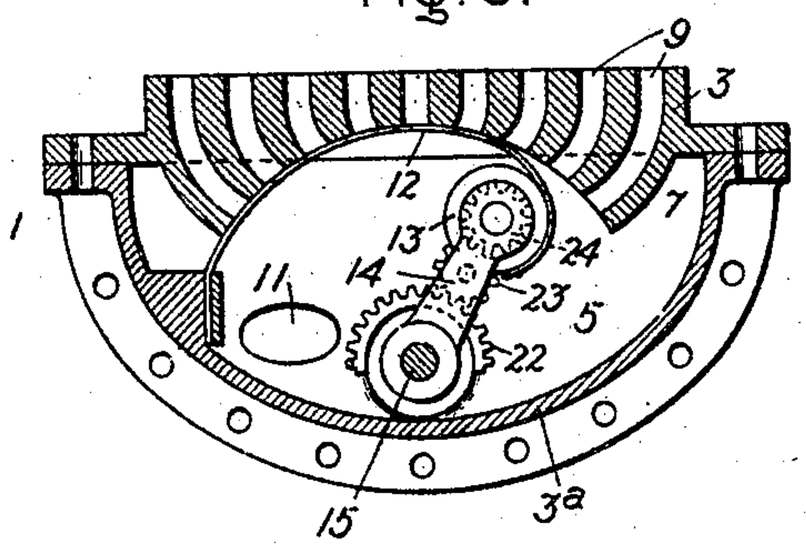


Fig. 4.

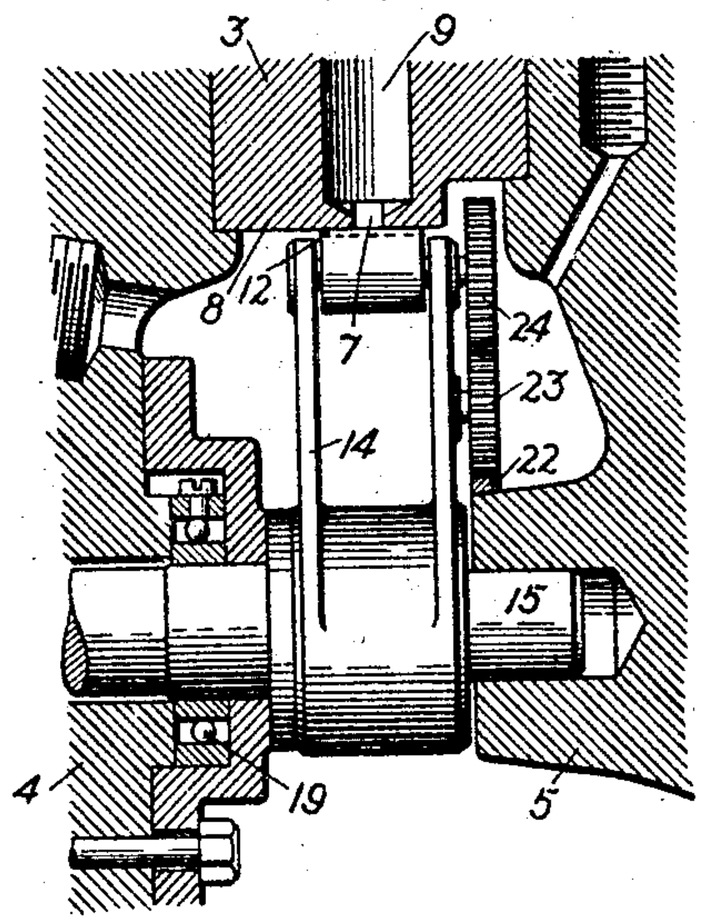
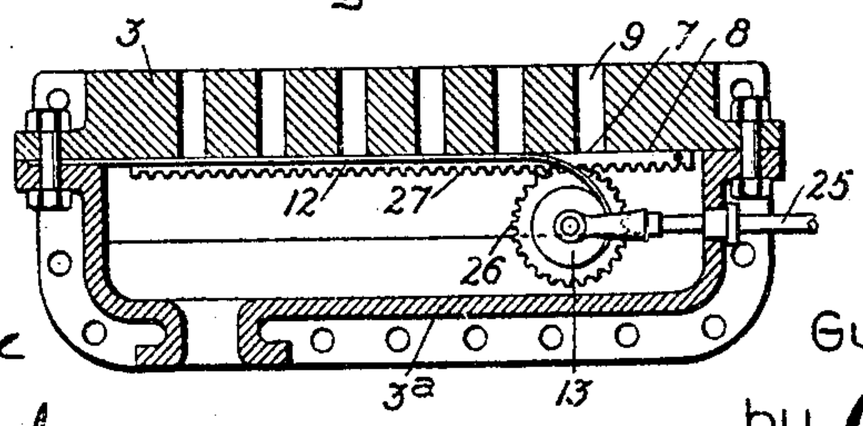


Fig. 5.



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UNITED STATES PATENT OFFICE.

GUSTAV MEYERSBERG, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR ELASTIC-FLUID TURBINES.

No. 806,692. Specification of Letters Patent. Patented Dec. 5, 1905.

Application filed May 10, 1905. Serial No. 259,723.

To all whom it may concern:

Be it known that I, GUSTAV MEYERSBERG, a subject of the Emperor of Austria-Hungary, residing at Berlin, Germany, have invented certain new and useful Improvements in Governing Mechanisms for Elastic-Fluid Turbines, of which the following is a specification.

My invention relates to certain improvements in governing mechanisms for elastic-fluid turbines, and relates more particularly to mechanisms of that type shown in the pending application for Letters Patent, Serial No. 198,687, filed March 17, 1904.

It has for one of its objects to improve the operation and also to improve the construction and arrangement of the parts set forth in said application, so as to diminish the overall dimension of the apparatus.

A further object is to simplify and shorten the fluid-conveying conduits leading from the valve mechanism to the nozzles or fluid discharging devices of the turbine.

The construction shown in application above referred to is preferably employed in connection with relatively small size machines, and for the larger sizes it is not so readily adapted, for the reason that the disk which carries the valve or flexible band becomes objectionably large and heavy, and consequently necessitates larger and stronger parts to support and to operate it. I do not mean by this to say that the prior construction cannot be employed for machines of large sizes, as it can be so used, if desired; but the present construction is preferable in such cases. Furthermore, where a large number of conduits are employed to supply a group of closely-associated nozzles they are (in the former construction) arranged more or less completely around the periphery of the valve-casing. This necessitates specially long pipes or conduits extending from the side of the valve-casing opposite to the nozzles. These conduits besides being long are required to be bent into proper shape in order to make the desired connection, which is an expensive operation. The present invention can also be employed with relatively small machines, if desired. To overcome these objections, I provide a valve-casing in which the ports communicating with the nozzle or groups of nozzles or nozzle-sections are arranged in a wall of relatively small curvature or one of large radius. The ports preferably closely associated are located on one side of the casing as distinguished from extending entirely around it. By reason of this construction the conduits leading from the ports to the nozzles may be made comparatively short and free from objectionable bends. The valve for covering or uncovering the ports comprises a flexible band, preferably of metal, that is anchored at one end and at its free end is connected with a carrier, the latter being arranged to wind or unwind the valve as the demand for steam or other elastic fluid is increased or decreased. The carrier is made relatively small in diameter and is so mounted that it has a rotary or oscillatory motion about its axis, and in addition a bodily movement to and fro in response to speed changes. The carrier may have a greater or less movement than three hundred and sixty degrees about its axis, as desired. The carrier is mounted in such a manner that it is free to move to and fro under the action of a device responsive to load or speed changes. The same device which causes the carrier to move bodily to and fro also causes it to wind and unwind flexible valves, and thus open or close the ports leading to the nozzles or nozzle-sections. As illustrative of the way in which the carrier may be moved to and fro, I have shown it mounted on a pivoted arm, the latter being suitably connected with the load or speed-responsive device driven directly or indirectly by the turbine-shaft. The carrier is provided with a gear or equivalent arrangement so that as the arm is moved about its axis a rotary or oscillatory motion, as the case may be, is imparted thereto for winding or unwinding the valve. The arrangement of parts is preferably such that the angular movement of the carrier is greater than the angular movement of the arm; but the invention is not limited to this relation. In some instances I may make the surface of the casing containing the ports flat, in which case the movement of the carrier to and fro will be in a straight line instead of in the arc of a circle. Stated generally, when the motion of the actuator is about an axis, the ported surface of the valve-casing will be curved, and when it is in a straight line all parts of the ported surface will lie in the same plane. I have shown the valve arranged to work on a concave surface; but it can be arranged to work on a convex surface, if desired.

In the accompanying drawings, which illus-

trate one embodiment of my invention, Figure 1 is a longitudinal section of the governing mechanism. Fig. 2 is a section on line 2 2 of Fig. 1, drawn on an enlarged scale, showing the valve and one form of means for actuating it. Fig. 3 is a similar section showing a modified form of valve-actuating means. Fig. 4 is a detail of parts of the modified construction, and Fig. 5 shows a further modification of the governing mechanism.

Referring to the drawings, 1 represents a valve-casing which is bolted or otherwise secured to the wheel-casing or shell of the turbine, (indicated at 2.) The casing preferably comprises a plate 3, a cover 3^a, which is bolted thereto, and heads 4 and 5, secured on opposite sides of the plate and cover by means of bolts 6. The plate is provided with one or more rows of ports 7 in inner wall 8, which may be straight, concave, or cylindrical. The curvature of the wall is preferably such that all the ports in any given case may be grouped at one side of the axis, so that the height of the casing can be reduced to a minimum. The curved wall 8 is carefully machined, as it forms a seat for the valve. Connected with each of the ports is a passage 9, that in turn connects with a conduit 10, leading to a nozzle or fluid-discharging device of the turbine, (indicated at 10^a.) Each conduit extends in a straight line between the valve-casing and its respective nozzle. Suitable steam-tight connections are provided between the conduits and the valve-casing and nozzles. Formed or otherwise provided in one head of the casing is a supply-conduit 11, which receives motive fluid from a suitable source and supplies it to the valve-casing. Located within the casing is a valve 12, which preferably takes the form of a flexible band. It may be made of steel or any other suitable metal having resiliency and capable of standing high temperature without being destroyed. The valve is adapted to be actuated in such a manner as to successively cover and close the ports or inlet ends of the fluid-conveying conduits leading to the nozzles or to successively uncover and open them. For this purpose the valve is secured at one end, Fig. 2, to a suitable part of the casing, such as the cover, and the other end is attached to a carrier or drum 13, which is adapted to move in a curvilinear path concentric with the center of curvature of the wall 8. Simultaneously with this movement of the drum the latter is adapted to be rotated, so that as it passes over the curved wall it unrolls or rolls the band so as to cover or uncover the valve-ports. The drum is mounted at the outer end on a crank-arm or lever 14, which is rigidly supported on a rock-shaft 15. This shaft may be automatically actuated, as by means of an automatic governor, or manually actuated, as by means of a lever or hand-wheel. Any suitable means may be employed to rotate the drum, some positively-driven means being preferable. According to the desired form of actuating means a gear or pinion 16 is arranged on the arm 14 to oscillate therewith. The gear is keyed to the journal of the drum and meshes with an internal toothed segmental rack 17, fixed to a stationary part of the casing adjacent the outer end of the arm and parallel to the path of movement thereof. The gear and rack thus constitute a power or motion transmitting connection which converts the oscillating movement of the arm into rotary movement of the drum, or, in other words, the rocking of the shaft 15 simultaneously moves the drum over the valve-ports and rotates it to wind or unwind the valve. From this it will be seen that the parts which compose the valve-actuating mechanism are small and light compared with the former construction, so that the entire structure occupies less space. The periphery of the drum should be separated from the curved wall 8 by a clearance somewhat greater than the thickness of the valve, so as to relieve the pressure on the portion of the valve adjacent the drum. On referring to Fig. 2 it will be seen that the pressures on opposite sides of the valve at point 18 are balanced, owing to the fact that steam has access to both sides. If the drum held the valve in close contact with its seat at this point, it is evident that a condition of unbalanced pressures would exist, and hence the work of raising or winding the valve would be much greater than in the construction shown. Reducing the work required of the governor to move the rock-shaft 15 obviously increases the effectiveness of the governing mechanism as a whole. The rock-shaft extends through the head 4 of the casing and is supported adjacent its ends in ball-bearings 19, one of which is arranged within the casing and the other on a supporting-arm 20, extending laterally from the head 4. Any suitable packing may be provided around the shaft where it passes through the head to prevent escape of motive fluid from the casing. On the shaft is provided a crank 21, which is intended to be connected with a device responsive to variations in the speed of the turbine. Thus with changes in speed the shaft will be rocked to a greater or less extent in one direction or the other, and thereby actuate the valve through the intervening parts, so that the valve-ports are successively opened or closed to vary the fluid-supply and compensate for the changes in load.

The operation of the governing mechanism is as follows: Assuming the parts to be in the position shown in Fig. 2, (which may correspond substantially to a position of no load,) and a load is suddenly thrown on the turbine, the speed-responsive device is immediately affected and motion is imparted to the shaft 15, which causes the arm to move about its pivot in the direction indicated by the arrow. This movement of the arm causes the drum to be rotated in a clockwise direction by virtue of

the gear and rack, so that the band or valve is wound on the drum and a larger number of ports uncovered. This opens the supply of motive fluid to a larger number of nozzles in substantial accordance with the demand for motive fluid, so that the speed is maintained substantially constant. Should the load decrease, the shaft 15 is rocked in the opposite direction, thereby causing the valve to be unwound through the intermediate mechanism, so as to cut out of operation a greater or less number of the valve-ports and nozzles or nozzle-sections, depending upon the change in speed due to the fluctuation in load. Cutting a nozzle into or out of service increases or decreases the number of active wheel-buckets.

Referring to Fig. 4, the means for actuating the drum comprises an externally-toothed segmental rack 22, which is located on a suitable part of the casing adjacent to the shaft 15. Carried by the crank-arm is a pinion 23, meshing with said rack and in turn meshing with a gear 24, keyed to the journal of the drum. The operation of this modified form is substantially the same as that already described and further description is therefore unnecessary.

In the construction shown in Fig. 5 the ported wall 8 is straight and the carrier is arranged to move parallel thereto. The carrier is rotatably mounted on a connecting-rod 25, which is connected with the speed-responsive device in any suitable manner. The rectilinear movement of the carrier due to the rod is translated into simultaneous rotary motion by means of the gear 26 and the rack 27, so that the valve is caused to wind or unwind to cover or uncover the ports in accordance with the variations in the demand for motive fluid.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a governing mechanism for turbines, the combination of a wall provided with a plurality of fluid-discharging ports, a rotatable carrier arranged to move along the wall, and a flexible band which is actuated by said carrier to cover or uncover the ports.

2. In a governing mechanism for turbines, the combination of a wall provided with one or more fluid-discharging openings or ports, a valve or flexible band arranged to cover or uncover the ports, a carrier on which the band is adapted to wind or unwind, and a means for moving the carrier over the wall and simultaneously winding or unwinding the valve to cause it to cover or uncover the ports.

3. In a governing mechanism for turbines, the combination of a wall provided with a plurality of independent fluid-discharging ports, a flexible valve arranged to cover or uncover the ports, a drum or carrier to which the valve is attached, and a means which simultaneously moves the drum about its axis and moves it bodily over the wall in a direction parallel thereto for progressively winding or unwinding the valve to cover or uncover the ports.

4. In a governing mechanism for turbines, the combination of a curved stationary wall provided with a plurality of independent fluid-discharging ports, a valve or flexible band arranged to cover or uncover the ports, a carrier for the valve which moves over the wall in a path concentric therewith, and a means for moving the drum about its axis simultaneously with its bodily movement over the wall for winding or unwinding the valve to successively open or close the ports.

5. In a governing mechanism for turbines, the combination of a curved wall provided with independent fluid-discharging ports, a valve or flexible band fixed at one end adjacent the wall, a carrier attached to the other end of the valve, and a common actuating means for simultaneously moving the carrier bodily and moving it about its axis for winding or unwinding the valve to successively open or close the ports.

6. In a governing mechanism for turbines, the combination of a wall provided with a plurality of independent fluid-discharging ports, a valve or flexible band for covering or uncovering the ports, a carrier for the valve, a support for the carrier, and a means on the support which imparts movement of the carrier about its axis during a to-and-fro movement of the support to permit the valve to cover or uncover the ports.

7. In a governing mechanism for turbines, the combination of a curved wall provided with a plurality of independent fluid-discharging openings, a valve or flexible band which is adapted to cover or uncover the openings, an oscillating member which carries the valve, and a means also carried by said member which winds or unwinds the valve simultaneously with the oscillation thereof for uncovering or covering the openings.

8. In a governing mechanism for turbines, the combination of a curved wall provided with a plurality of independent fluid-discharging openings, a valve or flexible band which is adapted to cover or uncover the openings, an oscillating member, and a means actuated by the member for moving the valve to successively cover or uncover the ports.

9. A governing mechanism for turbines comprising a curved wall provided with a plurality of independent openings which discharge motive fluid to the nozzles of the turbine, a flexible band or valve arranged to cover or uncover the said openings, in combination

with a means for actuating the valve which comprises an oscillating and rotating member on which the valve winds or unwinds.

10. A governing mechanism for turbines comprising a curved wall provided with a plurality of independent openings which discharge motive fluid to the nozzles of the turbine, a flexible band or valve arranged to cover or uncover the said openings, in combination with a means for actuating the valve which comprises an oscillating drum to which the valve is attached, and a power-transmitting device which rotates the drum for actuating the valve to successively open or close the openings.

11. A governing mechanism for turbines comprising a curved wall provided with a plurality of independent openings which discharge motive fluid to the nozzles of the turbine, a flexible band or valve arranged to cover or uncover the said openings, in combination with a mechanism for actuating the valve comprising a carrier to which the valve is attached, means for moving the carrier parallel to the wall, and means for simultaneously rotating the carrier to cause the valve to wind or unwind for successively opening or closing the openings.

12. A governing mechanism for turbines comprising a curved wall provided with a plurality of independent openings which discharge motive fluid to the nozzles of the turbine, a flexible band or valve arranged to cover or uncover the said openings, in combination with a mechanism for actuating the valve comprising an oscillating arm, a drum mounted thereon to which the band is attached, and a gearing which rotates the drum during oscillation of the arm for winding or unwinding the valve to successively open or close the openings.

13. A governing mechanism for turbines comprising a curved wall provided with a plurality of independent openings which discharge motive fluid to the nozzles of the turbine, a flexible band or valve arranged to cover or uncover the said openings, in combination with a mechanism for actuating the valve comprising an oscillating arm, a drum mounted thereon to which the band is attached, a gear connected with the drum, and a rack arranged with respect to the gear to cause it to rotate the drum during oscillation of the arm for moving the valve to successively open or close the openings.

14. A governing mechanism for turbines comprising a curved wall provided with a plurality of independent openings which discharge motive fluid to the nozzles of the turbine, a flexible band or valve arranged to cover or uncover the said openings, in combination with a mechanism for actuating the valve comprising an oscillating arm, a drum mounted thereon to which the band is attached, a gear connected with the drum and carried by the arm, and a stationary rack arranged parallel to the path of movement of the arm and meshing with the gear for causing rotation of the drum during oscillation of the arm so as to move the valve for successively opening or closing the openings.

15. The combination of a plurality of fluid-discharging devices or nozzles, a curved wall arranged adjacent and concentric to the said devices which is provided with a plurality of independent fluid-discharging openings or ports, conduits between the ports and the devices, a valve or flexible band for controlling said ports, and a means for actuating the valve to successively cover or uncover the ports.

16. In a governing mechanism for elastic-fluid turbines, the combination of a casing having a curved ported wall, a flexible valve adapted to cover and uncover the ports as the demand for vapor energy changes, and a carrier for the valve, the diameter of which is less than the radius of curvature of the wall.

In witness whereof I have hereunto set my hand this 18th day of April, 1905.

GUSTAV MEYERSBERG.

Witnesses:
JULIUS RUMLAND,
CARL RICKEBEN.