No. 845,058. PATENTED FEB. 26, 1907.

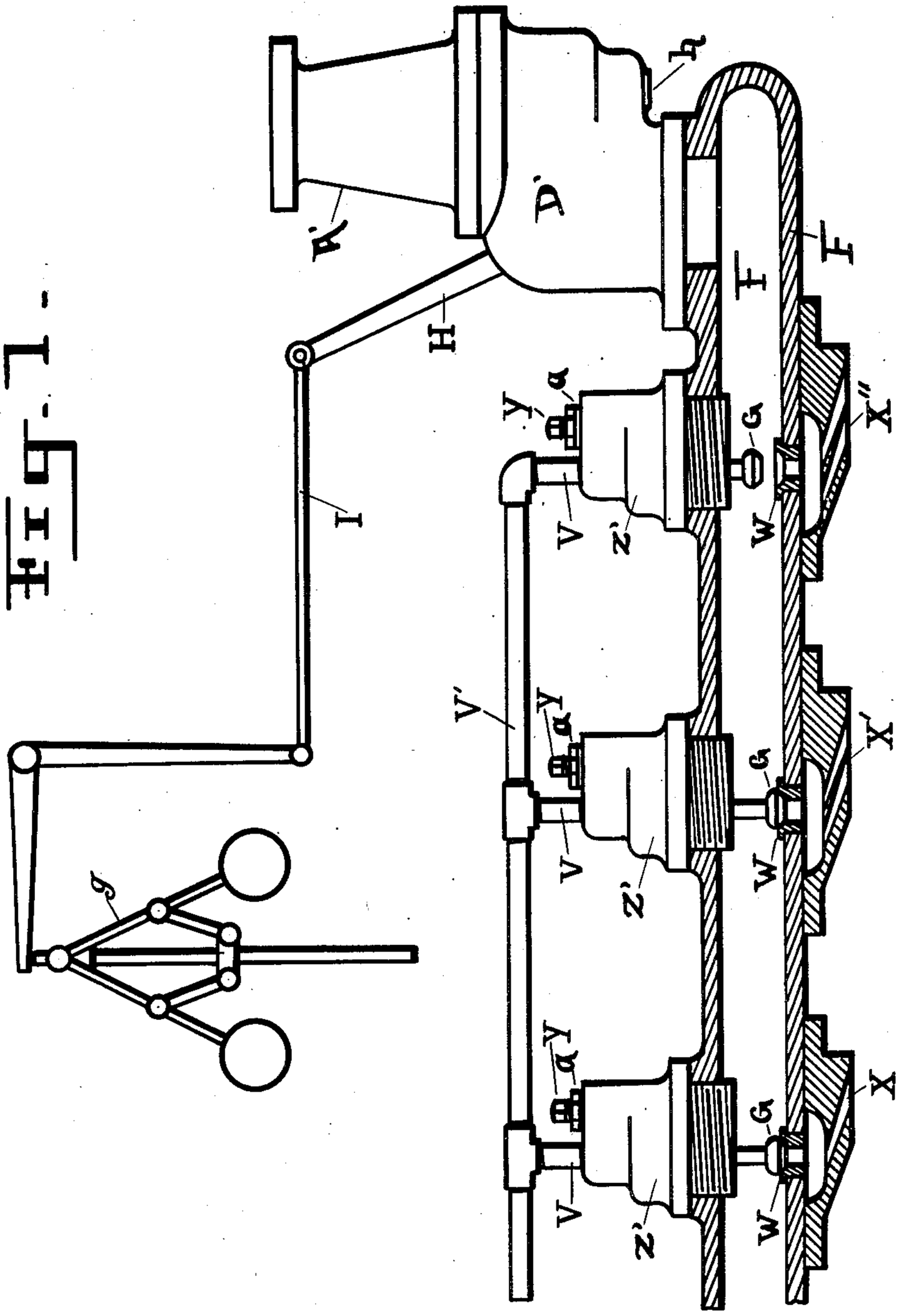
C. W. DAKE.

GOVERNING MEANS FOR TURBINES.

APPLICATION FILED DEC. 20, 1905.

2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:

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2 SHEETS—SHEET 2.

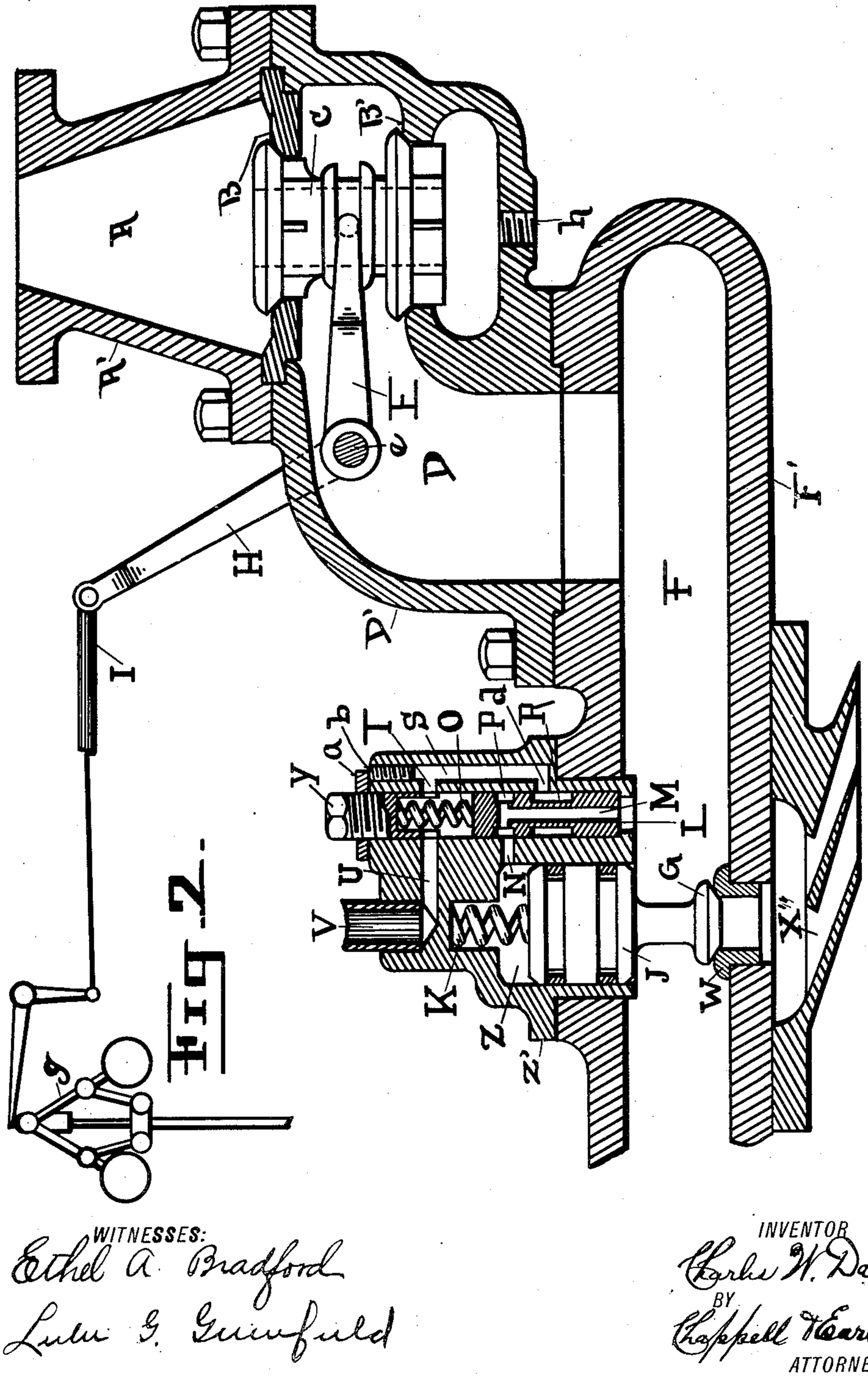

FIG. 2.

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GOVERNING MEANS FOR TURBINES.

No. 845,058. Specification of Letters Patent. Patented Feb. 26, 1907.

Application filed December 20, 1905. Serial No. 292,668.

To all whom it may concern:

Be it known that I, CHARLES W. DAKE, a citizen of the United States, residing at the city of Grand Rapids, county of Kent, State of Michigan, have invented certain new and useful Improvements in Governing Means for Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to governing means particularly adapted for governing and controlling the supply of fluid to elastic-fluid turbines.

The objects of this invention are, first, to provide an improved automatic means for supplying fluid to elastic-fluid turbines; second, to provide a construction of valves in series which will be controlled automatically in proportion to the varying pressure whereby the steam-supply will be controlled by opening and closing the different valves of the series of sets of nozzles, and, third, to provide an improved means of regulating the pressure at which the nozzles of such a series will open.

Further objects relating to details of construction will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification.

The invention is clearly defined and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a detail view of my improved elastic-fluid-turbine governing means, the supply-chamber being in section to show the relations of the various valves thereto; and Fig. 2 is an enlarged detail sectional view of the main throttling-valve and one of the automatic nozzle-valves.

In the drawings similar letters of reference refer to similar parts throughout the several views.

Referring to the lettered parts of the drawings, the main-valve casing A′ has a passage A leading therethrough. B B′ are the valve seats. The double valve C fits within th double-valve seats B and B′. The chamber or passage F is connected by the passage D to the source of supply.

A rock-shaft E is provided with a forked arm E for controlling the throttling-val

An external arm H on the rock-shaft is connected by the connecting-rod I to a suitable governor *g*. To the casing F′, forming the passage F, is secured seats W for the nozzle-closing valves G, there being in this instance three sets of nozzles X X′ X″, respectively. The valve G is connected to a piston J, fitting within a cylinder Z, which is secured to the opposite side of the casing F, the same being secured thereto by a suitable flange *z*′. A spring K serves to hold the piston J normally downwardly with yielding pressure, thus holding the nozzle-valve G normally closed. A port N leads into the bottom of the cylinder Z. By the side of the cylinder Z and parallel with it is a cylindrical valve L, which has a central aperture M therethrough and is connected to an annular port P toward the upper end thereof by suitable perforations. A broad annular port R is a little beneath. A spring L holds the valve normally downward, and the tension on this valve is adjusted by means of the screw Y, which is retained by a locking-nut *a*. A passage S is formed up in the valve-casing substantially parallel to the main valve and opens into a port T, near the top of the same, which connects by a passage U to the exhaust-pipe V. Connecting with the lower annular port R of the valve is a passage *d*, leading to the passage S, just referred to. A port N connects the inner end of the cylinder Z with the upper part of the valve L.

All of the regulating-valves are precisely similar, and as many are employed as there are different sets of nozzles which it is desired to control, the springs O of each valve being set at a predetermined tension to be opened by the elastic fluid at varying pressures. The tension of each spring O is controlled by the screw Y.

As shown in the drawings, all of the parts are at rest, with none of the parts under pressure.

In operation, the elastic fluid being admitted to the turbine in the ordinary way, the turbine being at rest, the throttling-valve C would be opened. The fluid would then enter by the passage D into the chamber F, and when sufficient pressure was admitted it would by coming in contact with the secondary valve L overcome the tension of the spring O and force the piston-valve L into its cylinder until the port R around the valve would register with the port N of the

cylinder Z. The port R being broad, it would of course embrace also the port *d*, which has communication with the ports S T U to the passage V, which has communication with the atmosphere or with a condenser or with a pressure which is at all times lower than the pressure which is in the chamber F. The ports mentioned thus being in communication, any pressure that was within the cylinder Z would pass out through the set of ports or passages and the pressure of the fluid in the chamber F would force against the piston J in the cylinder Z, and there being no pressure back of the piston J the tension of the spring K would be overcome by the fluid-pressure against the said opposite side of the piston J. The area of the piston J being also greater than the area of the valve G, the piston would be forced back into the cylinder Z and the valve G opened. The elastic fluid would then be admitted to the nozzles and pass therefrom to the turbine-wheel. The wheel would then revolve until the speed became so great that the governor, having connection with the throttling-valve C by means of the levers E H and rod I, would operate and partially close and would not allow so much fluid to flow to the chamber F. The pressure in the chamber F would then of course become less. The tension of the spring O of the secondary valve then being greater than the pressure of the fluid against the opposite end of the valve L, the valve L would be forced down by the spring O until the port P in the valve L would register with the port N of the cylinder Z, connecting the same with the passage M through the valve, when the fluid from the chamber F would flow into the bottom of the cylinder Z. The area of the piston being equal on both sides, when the valve G is opened the tension of the spring K would be free to force the piston J forward, and thus close the valve G. There being a plurality of nozzle-sections and automatic controlling-valves connecting to the chamber F set at different pressure for controlling the same, if the speed still continues too great the throttling-valve B would be further closed, the pressure in the chamber F further reduced, and others of the automatic nozzle-valves be closed in exactly the same way, they being set with stronger spring-pressure on their auxiliary valves, and they would of course be operated in the section accordingly, depending upon the supply of steam admitted by the governor.

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

1. In a governing means for turbine-engines, the combination of the engine-casing with a suitable passage F leading to the nozzle-valve; a throttle-valve; a governor connected to said throttle-valve; a series of nozzle-valves consisting respectively of the valve G, the piston J connected to the stem thereof, the cylinder Z within which said piston reciprocates; a spring for holding said valve normally in the closed position; a piston-valve for controlling the cylinder of the nozzle having a longitudinal port M opening laterally to an annular port P, toward its upper end and having a broad annular port R around the same toward the lower end; a spring O for holding said valve normally downward against a suitable shoulder; an adjusting-screw Y with suitable lock-nut *a* for adjusting the tension of said spring; a passage S with a port *d* to connect with the broad annular port R and a port T to connect to the upper part of the chamber of the valve M; a passage U and V exhausting from the upper end of said valve-chamber; a port N leading from the bottom of the cylinder Z to connect with the annular port P of the valve L, whereby the fluctuations of pressure in the chamber F will actuate the valve for the control of the piston of the nozzle-valve, as specified.

2. In a governing means for controlling turbine-engines, the combination of the engine-casing with a suitable passage F leading to a nozzle-valve; a throttle-valve for controlling the supply to the said passage with a suitable governor therefor; a nozzle-valve with a piston arranged in a suitable cylinder for actuating the same; a piston-valve by the side of said piston of said nozzle-valve, arranged to be actuated by the pressure from the supply-chamber; valve-ports in said piston-valve for controlling the supply to and from the cylinder which controls the nozzle-valve; a spring for holding the nozzle-valve normally closed, whereby the variations of pressure in the supply-chamber will control the opening and closing of the nozzle-valve, as specified.

3. In a governing means for turbine-engines, the combination of the engine-casing with a suitable passage F leading to the nozzle-valves; a throttle-valve; a governor connected to said throttle-valve; a series of nozzle-valves consisting respectively of the valve G, the piston J connected to the stem thereof, the cylinder Z within which said piston reciprocates; a spring for holding said valve normally in the closed position; a piston-valve for controlling the cylinder of the nozzle, having a longitudinal port M opening laterally to an annular port P, toward its upper end and having a broad annular port R around the same toward the lower end; a spring O for holding said valve normally downward against a suitable shoulder; a passage S with a port *d* to connect with the broad annular port R and a port T to connect to the upper part of the chamber of the valve M; a passage U and V exhausting from the upper end of said valve-chamber; a port N leading from the bottom of the cylinder Z to

connect with the annular port P of the valve L, whereby the fluctuations of pressure in the chamber F will actuate the valve for the control of the piston of the nozzle-valve, as specified.

4. In a governing means for controlling turbine-engines, the combination of a suitable casing with a suitable passage F leading to a series of nozzle-valves; a throttle-valve for controlling the supply to the said passage, with a suitable governor therefor; a suitable piston arranged in a cylinder for actuating the said nozzle-valves; a piston-valve by the side of each of said pistons for controlling the passage of fluid to control the cylinder of each of said nozzle-valves, arranged to be actuated by the pressure from the supply-chamber; and adjustable springs for holding said piston-valves yieldingly in position, whereby they will be actuated at different pressures whereby the nozzle-valves will be controlled by the variations of the pressure in the chamber F and will be opened and closed successively, as specified.

5. In a governing means for turbine-engines, the combination of the engine-casing with a suitable passage F leading to the nozzle-valves; a throttle-valve; a series of nozzle-valves consisting respectively of the valve G, the piston J connected to the stem thereof, the cylinder Z within which said piston reciprocates; a spring for holding said valve normally in the closed position; a piston-valve for controlling the cylinder of the nozzle having a longitudinal port M opening laterally to an annular port P, toward its upper end and having a broad annular port R around the same toward the lower end; a spring O for holding said valve normally downward against a suitable shoulder; an adjustable screw Y with suitable lock-nut *a* for adjusting the tension of said spring; a passage S with a port *d* to connect with the broad annular port R and a port T to connect to the upper part of the chamber of the valve M; a passage U and V exhausting from the upper end of said valve-chamber; a port N leading from the bottom of the cylinder Z to connect with the annular port P of the valve L, whereby the fluctuations of pressure in the chamber F will actuate the valve for the control of the piston of the nozzle-valve, as specified.

6. In a governing means for controlling turbine-engines, the combination of the engine-casing with a suitable passage F leading to a nozzle-valve; a throttle-valve for controlling the supply to the said passage; a nozzle-valve with a piston arranged in a suitable cylinder for actuating the same; a piston-valve by the side of said piston of said nozzle-valve, arranged to be actuated by the pressure from the supply-chamber; valve-ports in said piston-valve for controlling the supply to and from the cylinder which controls the nozzle-valve; a spring for holding the nozzle-valve normally closed, whereby the variations of pressure in the supply-chamber will control the opening and closing of the nozzle-valve, as specified.

7. In a governing means for controlling turbine-engines, the combination of the engine-casing with a suitable passage F leading to the nozzle-valves; a throttle-valve; a series of nozzle-valves consisting respectively of the valve G, the piston J connected to the stem thereof, the cylinder Z within which said piston reciprocates; a spring for holding said valve normally in the closed position; a piston-valve for controlling the cylinder of the nozzle, having a longitudinal port M opening laterally to an annular port P, toward its upper end and having a broad annular port R around the same toward the lower end; a spring O for holding said valve normally downward against a suitable shoulder; a passage S with a port *d* to connect with the broad annular port R and a port T to connect to the upper part of the chamber of the valve M; a passage U and V exhausting from the upper end of said valve-chamber; a port N leading from the bottom of the cylinder Z to connect with the annular port P of the valve L, whereby the fluctuations of pressure in the chamber F will actuate the valve for the control of the piston of the nozzle-valve, as specified.

8. In a governing means for controlling turbine-engines, the combination of a suitable casing with a suitable passage F leading to a series of nozzle-valves; a throttle-valve for controlling the supply to the said passage; a suitable piston arranged in a cylinder for actuating the said nozzle-valves; a piston-valve by the side of each of said pistons for controlling the passage of fluid to control the cylinder of each of said nozzle-valves, arranged to be actuated by the pressure from the supply-chamber; and adjustable springs for holding said piston-valves yieldingly in position, whereby they will be actuated at different pressures whereby the nozzle-valves will be controlled by the variations of the pressure in the chamber F and will be opened and closed successively as specified.

9. In a controlling means for turbine-engines, the combination of a nozzle-valve; a chamber surrounding the same; a piston in a suitable cylinder, the inner end of said cylinder connecting to said chamber, said piston being connected to said nozzle-valve for controlling the same; a piston-valve controlled by the pressure of the elastic fluid, with ports arranged to connect to the said valve-piston cylinder to admit and exhaust the elastic fluid therefrom; an adjustable spring to regulate the resistance of said piston-valve; and a spring for holding said nozzle-valve normally closed.

10. In a controlling means for turbine-en-

gines, the combination of a nozzle-valve; a chamber surrounding the same; a piston in a suitable cylinder, said piston being connected to said nozzle-valve for controlling the same; a piston-valve controlled by the pressure of the elastic fluid in the chamber surrounding the nozzle-valve, with ports arranged to connect to said valve-piston cylinder to admit and exhaust the elastic fluid therefrom; and a spring for holding said nozzle-valve normally closed.

11. In a controlling means for turbine-engines, the combination of a nozzle-valve; a chamber surrounding the same; a piston in a suitable cylinder connected to said nozzle-valve for controlling the same; a piston-valve controlled by the pressure of the elastic fluid in the chamber surrounding the nozzle-valve, with ports arranged to connect to the said valve-piston cylinder to admit and exhaust the elastic fluid therefrom; and a spring for holding said nozzle-valve normally closed, coacting as specified.

12. In a controlling means for turbine-engines, the combination of a nozzle-valve; a chamber surrounding the same; a piston in a suitable cylinder connected to said nozzle-valve for controlling the same; and a piston-valve controlled by the pressure of the elastic fluid in the chamber surrounding the nozzle-valve, with ports arranged to connect to the said valve-piston cylinder to admit and exhaust the elastic fluid therefrom, coacting as specified.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

CHARLES W. DAKE. [L. S.]

Witnesses:
ADELAIDE I. ADAMS,
LULU G. GREENFIELD.