P. WAGNER.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAY 31, 1911.

1,049,784. Patented Jan. 7, 1913.

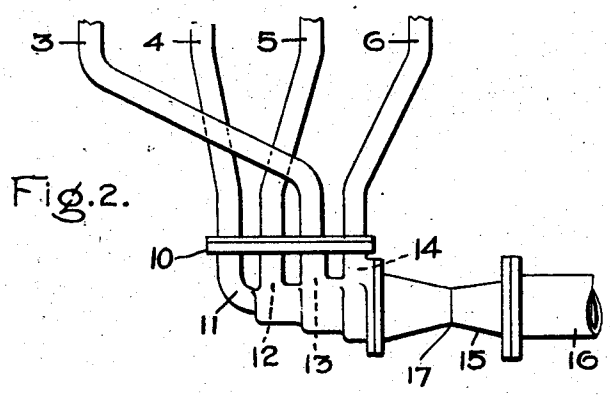


Fig.2.

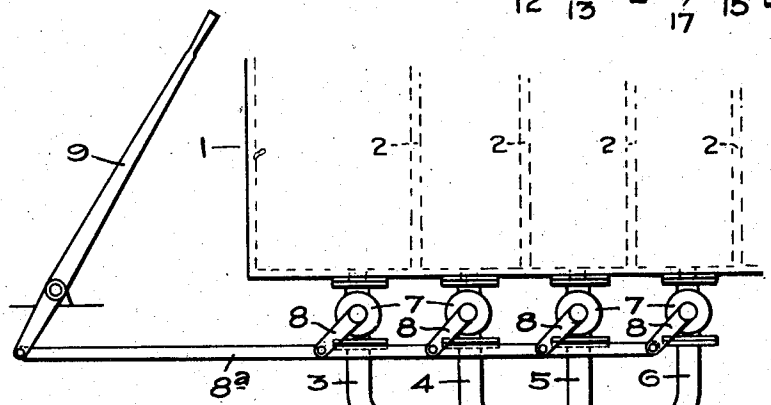


Fig.1.

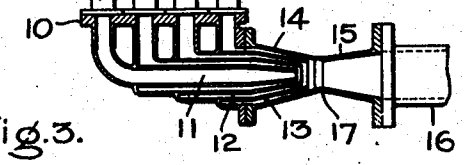


Fig.3.

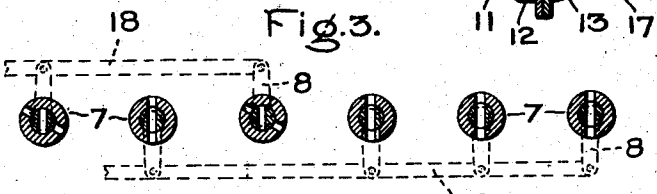
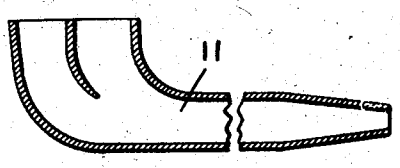


Fig.4.



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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

1,049,784. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed May 31, 1911. Serial No. 630,438.

To all whom it may concern:

Be it known that I, PAUL WAGNER, a subject of the King of Prussia, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Means for Draining Water from the Stages of Elastic-Fluid Turbines, of which the following is a specification.

In operating steam turbines, and particularly those used for marine propulsion, it is desirable and frequently a matter of necessity to drain the stages, or at least some of them, of the accumulated water therein. The idea of piping the stages to a common main and controlling each pipe separately by a non-return or check valve has been tried but without complete success because a certain pressure difference must exist between opposite sides of the valve to insure its opening. From this it follows that it is impossible when the turbine is idle to remove all the water from each stage because the force exerted by it is insufficient to raise the valve from its seat. In some cases even where the turbine is running the pressure difference is not enough to raise the valve. In other cases the valves rust or corrode and hence fail to work, and being concealed the failure to work is often not noticed.

My invention has for its object to avoid the objections above mentioned and also to provide a simple and reliable means for draining water from the various stages of a multistage turbine.

My improved apparatus has the advantage that it permits of draining even those stages having a pressure below that of atmosphere.

In carrying out my invention, all or as many stages as it is desired to drain are provided each with a drainage conduit or pipe connected to some low point therein. Each of these pipes discharges into a common discharge conduit through a nozzle-like structure. The nozzles for several of these pipes are so arranged that the medium passing out of one nozzle acts on another nozzle in a manner to create a suction or draft effect thereon and hence in said conduit or pipe and in the stage connected thereto. As an illustration of what I consider the best arrangement of parts, I assemble all of these nozzles in one structure, said nozzles being concentrically arranged and each receiving fluid from its connected stage of the turbine and discharging it into one and the same discharge conduit. In such an arangement an ejector effect is obtained so that I am able not only to extract water from those stages whose pressure is above atmosphere but also from those whose pressure is below. I may so arrange the nozzles and stage connecting pipes one to the other, that adjacent nozzles are connected to adjacent stages, or I may so arrange them that adjacent nozzles are connected to stages whose pressures are widely different. For example, the fluid from the first stage may act on that of the third or on both the second and third. The arrangement will depend largely upon the number of stages and upon the work extracted at each stage and the pressure distribution.

In the accompanying drawing, which is illustrative of my invention, Figure 1 is a sectional view of my improved water removing device connected to a turbine; Fig. 2 is a view in side elevation of a slight modification; Fig. 3 is a modification showing valve arrangements; and Fig. 4 is a detail view of a modified form of nozzle.

1 indicates the casing of a multistage turbine of any suitable construction. The stages are separated from each other by partitions 2 shown in dotted lines. Connected to each stage is a water drainage conduit. Four of these conduits are shown and numbered 3, 4, 5 and 6. The high pressure stage is connected to conduit 3, the second stage to conduit 4, and so on. Each conduit contains an oscillating or other valve 7 having an operating lever 8. The levers are united by a connecting rod 8^a for simultaneous operation. The rod is moved by a hand lever 9 located at any convenient point.

10 indicates a casting or other structure comprising a central nozzle 11 connected in this instance with the high pressure stage conduit 3. Surrounding this nozzle is a second nozzle 12, and around it a third nozzle 13, and around it is a fourth nozzle 14, all of said nozzles being concentrically arranged. The outer wall of nozzle 14 forms a part of the Venturi tube 15 which has the usual restricted throat and empties into the discharge conduit 16. Owing to the shapes of the nozzles and the Venturi tube, the velocities of the fluids passing therethrough are relatively high, and said velocities are gradu-

ally reduced after the fluid passes the throat 17 of said tube, *i. e.*, the point of greatest restriction. The discharge ends of these nozzles terminate at substantially the same point so that each one may, in so far as possible, be within the range of action of one or more other nozzles.

The water of condensation from a given stage that is connected to a conduit is accelerated according to the pressure of the particular stage in question. It flows out of the nozzle at the end of the conduit with such velocity that not only is the passage of water from stage to stage prevented but the action of said rapidly moving fluid assists the discharging operation of the associated nozzles connected to conduits leading to lower pressure stages by creating a suction effect of sufficient value to assist the movements of the fluid in all cases. In the case of the low pressure stages this action creates such a draft or suction as to raise the fluid from condenser to atmospheric pressure.

If the number of stages in the turbine is large, with a correspondingly large number of water discharging nozzles, the velocity of the inner nozzle jets may not be sufficient to draw off the water from the outer nozzles. In such cases the conduits leading from the turbine to the nozzles may be arranged as shown in Fig. 2. The nozzles 11, 12, 13 and 14 are concentrically arranged as before but the inner nozzle 11 is now connected to the second stage and the surrounding nozzle 12 to the third stage while the third nozzle 13 is connected to the first or high pressure stage. This arrangement will insure sufficient suction on the nozzles connected to the low pressure stages to draw off the water of condensation therefrom.

The valves 7 are ordinarily closed to avoid waste and are only opened when it is desired to discharge water of condensation. They should always be closed when the turbine is idle to prevent air from working into the condenser.

The arrangement of the valves 7 and operating mechanism may with advantage be such that the drainage of the high pressure stage or stages is effected independently of the low pressure stages, but to get the best effect the drainage of said low pressure stages should be accompanied by the drainage of at least one high pressure stage so as to get the benefit of the high velocity fluid therefrom. Such an arrangement is shown diagrammatically in Fig. 3. Six valves are shown, the first and third being connected to and operated by rod 18. The conduits controlled by these valves are connected to high pressure stages. The second, fourth, fifth and sixth valves are connected to and operated by the rod 19. The second valve controls the passage of water from a high pressure stage and the last three from low pressure stages. This arrangement is desirable for the reason that the same amount of water does not ordinarily collect in each of the stages, and if a stage having only a small amount of water is left open a loss of steam will result.

Where the turbine has a large number of stages, it is possible to connect more than one conduit to each stage as shown in Fig. 4.

I have shown the valves operated by hand but they may be opened and closed automatically.

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. A multistage turbine, in combination with means for removing water from its stages comprising drainage conduits connected to the stages, and discharging devices for the conduits so positioned and related one to the other that the fluid flowing through one device creates a suction effect in another and also in its connected conduit.

2. A multistage turbine, in combination with means for removing water from its stages comprising drainage conduits connected to the stages, and discharging nozzles connected to the conduits and shaped to impart velocity to the fluid drained from the stages, said nozzles being in juxtaposition so that the fluid having the higher velocity in escaping from its nozzle exerts a suction effect on another nozzle and the fluid flowing therethrough.

3. A multistage turbine, in combination with drainage conduits connected to the stages, nozzles which receive the fluid from the conduits and impart velocity thereto, the fluid flowing from one nozzle creating a suction effect on another nozzle, and valves in the said conduits.

4. A multistage turbine, in combination with drainage conduits connected to the stages, nozzles which receive the fluid from the conduits and impart velocity thereto, the fluid flowing from one nozzle creating a suction effect on another nozzle, and a conduit that is common to and receives the fluid from all of the nozzles.

5. A multistage turbine, in combination with drainage conduits connected to the stages, valves for the conduits, nozzles which receive the fluid from the conduits, said nozzles being concentrically arranged and discharging at substantially the same point, and a conduit that receives the fluid from all of said nozzles.

6. A multistage turbine, in combination

with drainage conduits connected to its stages, valves for the conduits, nozzles which receive the fluid from the conduits, said nozzles being concentrically arranged and discharging at substantially the same point, and a Venturi tube coöperating with the nozzles that receive the fluid from all of the nozzles and which first increases and then decreases the velocity of the fluid issuing from the nozzles.

7. In combination, a plurality of nozzles surrounding each other and concentrically arranged, said nozzles discharging on the same side and at substantially the same point, a Venturi tube one end of which incloses the discharge ends of the nozzles, said tube coöperating with the nozzles to produce a suction effect on one or more of them, and conduits connected to said nozzles and which receive fluid under different pressures.

8. A multistage turbine, in combination with a plurality of juxtaposed nozzles, drainage conduits connecting stages of different pressures of the turbine with the nozzles, said conduits and nozzles being so arranged that the fluid issuing from a nozzle connected to a high pressure stage acts to create a suction on a nozzle connected to a stage of lower pressure, valves controlling the conduits, and a conduit that receives the fluid discharged by all of the nozzles.

9. A multistage turbine, in combination with a conduit that receives water of condensation from the turbine, and means receiving said water from different stages of the turbine whose pressures are dissimilar and discharging it into the conduit, said means being so arranged that the fluid flowing from one stage creates a suction effect on the fluid flowing from a stage of lower pressure.

In witness whereof, I have hereunto set my hand this 13th day of May, 1911.

PAUL WAGNER.

Witnesses:
GUSTH UBERLÉE,
GUSTAV HULBROCK.