F. OESTERLEN.

HYDRAULIC TURBINE.

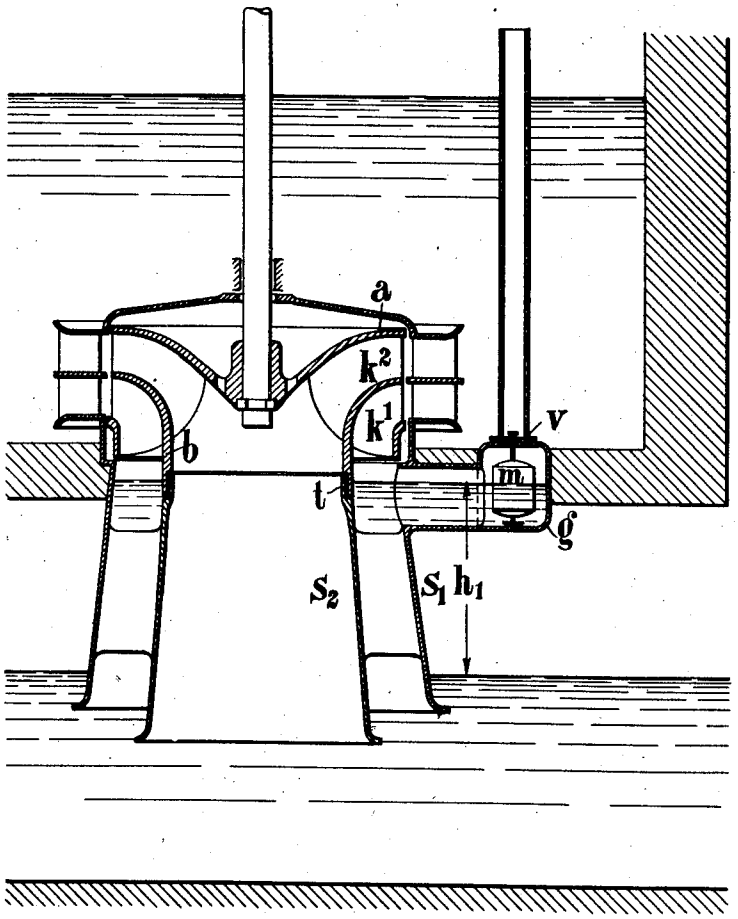
APPLICATION FILED JUNE 28, 1912.

1,047,134.

Patented Dec. 10, 1912

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

L. H. Grote

M. E. Ellis

INVENTOR

FRITZ OESTERLEN

BY Howson and Howson

his Attorneys

F. OESTERLEN.

HYDRAULIC TURBINE.

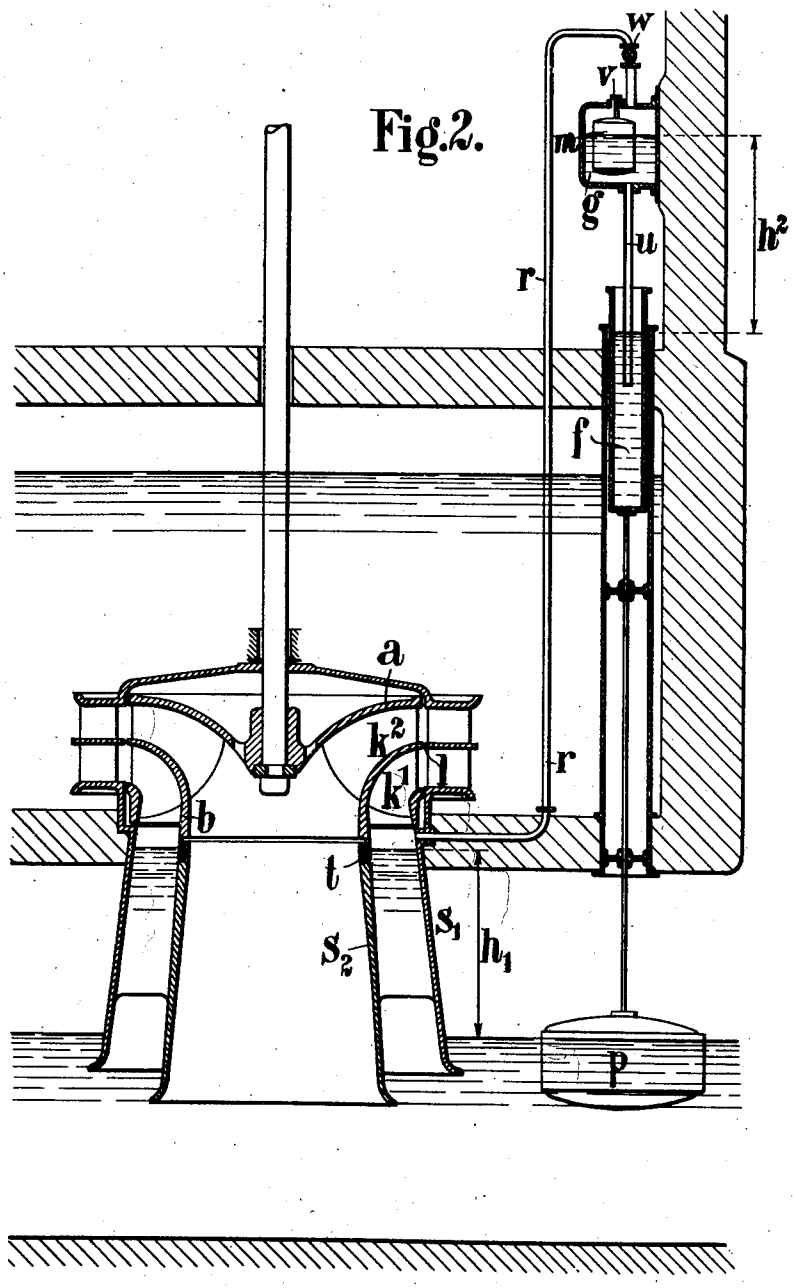
APPLICATION FILED JUNE 28, 1912.

1,047,134.

Patented Dec. 10, 1912.

2 SHEETS—SHEET 2.

Fig.2.



WITNESSES

L. H. Grote

W. E. Klein

INVENTOR

FRITZ OESTERLEN

BY Howson and Howson

his Attorneys

UNITED STATES PATENT OFFICE.

FRITZ OESTERLEN, OF HEIDENHEIM, BRENZ, GERMANY.

HYDRAULIC TURBINE.

1,047,134. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed June 28, 1912. Serial No. 706,485.

To all whom it may concern:

Be it known that I, FRITZ OESTERLEN, a subject of the Emperor of Germany, and residing at Heidenheim, Brenz, Germany, have invented a certain new and useful Improvement in Hydraulic Turbines, of which the following is a specification.

My invention relates to hydraulic turbines and particularly to multiple vane wheel turbines, the object of my invention being to so improve the construction thereof as to increase their efficiency when some only of the vane wheels are working.

The invention is here described with relation to a double vane wheel turbine of the Francis type, viz., in which the flow is from the outside inward. Turbines of this type as hitherto constructed, have the disadvantage that when both vane wheels discharge into a common suction or drag pipe the latter has much too large a capacity for the discharge from one vane wheel alone, should the flow to the other be cut off; while furthermore the vane wheel from which the flow is cut off revolves in back water, with the result that the efficiency of the turbine is materially decreased. Consequently even though by providing a plurality of concentric suction pipes into which the several vane wheels of a multiple wheel turbine severally discharge, it is possible to overcome the objection that the suction pipe has too great a capacity when only certain of the vane wheels are working, the second and more serious difficulty still remains, viz. that the non-working vane wheel revolves in the stagnant back water. In order to relieve this difficulty, and to prevent the non-working vane wheel from acting as a brake through its rotation in the back water, and likewise to prevent the suction of air at atmospheric pressure from the suction tube of the non-working vane wheel into the tube of the working wheel through the joint between the working vane wheel and its suction tube thus lessening the vacuum in the latter, the present invention contemplates an arrangement whereby air is admitted to the suction tube of the non-working vane wheel in such quantity and so regulated that in this suction tube the column of back water is lowered below the blades of the non-working vane wheel while at the same time it is maintained at a height sufficient to cover the joint between the suction tube and the working vane wheel.

The regulation of the air inlet can be accomplished in a very simple manner by an air inlet valve carried or controlled by a suitably arranged float valve. In turbines of the character here considered, such a float valve would have to be arranged in a very small space, and consequently the present invention contemplates as another feature thereof, the arrangement of the float valve mechanism in the machine room above the turbine or in an equally convenient and accessible place, from which the float valve may be controlled.

In the accompanying more or less diagrammatic drawings, Figures 1 and 2 are vertical sections through two turbine installations in which the invention is embodied in different forms.

In the form shown in Fig. 1, the rotor a of the double vane wheeled turbine, possesses an inner vane wheel k^2 and an outer vane wheel k^1. The usual suction pipe s^1 receives the discharge from the latter, while the inner vane wheel k^2 discharges into a special suction pipe s^2 concentric with the pipe s^1. The inner suction pipe s^2 and the partition wall b meet at the overlap joint t. A chamber g opens from the suction pipe s^1 of the outer vane wheel k^1 at the desired height for the float valve. In this normally air tight chamber is arranged a float m which carries an air inlet valve v. The float m holds the valve v shut when the water stands at the desired height in the chamber. Should the water rise, the float lifts the valve v and admits air until the water has descended again to the proper height.

In the second exemplary installation shown in Fig. 2, a pipe r opening at its lower end to the suction tube s^1 at the desired height, places the same in communication with a normally air tight chamber g located in a room above the turbine. In this chamber g a float m is arranged, which controls the air valve v. A vertical tube u extending downward from the chamber g opens at its lower end into a water filled vessel f. By reason of the fact that chamber g is air tight and its partial vacuum corresponds to the vacuum in the suction tube s^1, in view of their connection through tube r, water is sucked from f into g to a height h^2 corresponding to the vacuum column h^1 in the suction tube. The chamber f is filled with water to such extent that when the water in the suction pipe s^1 is at the desired

height, the fluid in the chamber g is at a height which insures the closure of the valve v by the float m. Should the partial vacuum in s^1 be increased, so that the level of the water therein rises, similarly the partial vacuum in g is increased and fluid from f rises through the pipe u thus raising the float m and admitting air through the valve v. The vacuum is thus lowered and the water level sinks in the suction pipe s^1 as well as in chamber g, whereupon the float m again closes the valve v.

Instead of being filled with water, the chambers g and f may be filled with any desired fluid *e. g.* oil or mercury. In this case the height of the vacuum column h^2 would vary according to the specific gravity of the liquid employed and would be greater or less than h^1.

The vacuum column h^1 varies with the rise or fall of the level of the tail race. Consequently in the arrangement of the chamber g in the machine room above the turbine as in Fig. 2, it is necessary to vary the height of the level of the fluid in the vessel f with the rise or fall of the tail race. This can be done in any suitable way, *e. g.* by the running off or in of fluid in the vessel f, or by manually raising or lowering the vessel. A simple automatic regulation for this is accomplished however by mounting the vessel f on a rod carried by the float p in the tail race, so that the vessel is raised or lowered by the float f. Where a liquid other than water is used in the chamber g and vessel f, means must be provided between the float and the vessel f to insure a proper variation of the height of the liquid in the latter. The valve w closes the tube r absolutely when both vane wheels are working. Instead of the outer suction pipe s^1, obviously the inner pipe s^2 may be subjected in this manner to the regulation of its vacuum, in which case the outer vane wheel k^1 would be driven and the inner vane wheel k^2 be cut off from the water.

The height of the vacuum column h^1 (h^2) is naturally regulatable at will and varies under different conditions. Practically the level of the water in suction pipe s^1 will always reach and cover the joint t.

Instead of only two vane wheels, obviously three or more can be employed of which one or more may be shut off and regulated in the manner stated.

I claim as my invention:—

1. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, in combination with means for admitting air to the suction tube of at least one of said vane wheels whereby the stagnant vacuum water column standing therein when the flow is cut off from its vane wheel, may be partially lowered to a position in which it is out of contact with the non-working vanes, substantially as described.

2. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, in combination with means for admitting air to the suction tube of at least one of said vane wheels, said means being automatically controlled to admit sufficient air to lower the stagnant vacuum water column standing in said tube when the flow is cut off therefrom, to a point below the vanes of said non-working vane wheel while maintaining it at a height sufficient to cover the joint between said tube and the adjacent working vane ring discharging at full vacuum into the adjacent suction tube, substantially as described.

3. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, in combination with float-valve controlled means for admitting air to the suction tube of at least one of said vane wheels whereby the stagnant vacuum water column standing therein when the flow is cut off from its vane wheel, may be partially lowered to a position in which it is out of contact with the non-working vanes, substantially as described.

4. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, in combination with float-valve controlled means for admitting air to the suction tube of at least one of said vane wheels whereby the stagnant vacuum water column standing therein when the flow is cut off from its vane wheel, may be partially lowered to a position in which it is out of contact with the non-working vanes, said float-valve mechanism being arranged at a point vertically remote from the turbine, together with an air tube connecting said float valve chamber with the suction tube, for the purpose described.

5. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, an air tube leading from one of said suction tubes to a normally air tight float chamber, a fluid container below said float chamber, a tube extending from said float chamber to said fluid chamber and terminating below the fluid level in the latter, whereby a vacuum column is created in said tube and float chamber corresponding to the vacuum in said suction discharge tube, in combination with an air inlet valve for said float chamber and an operative connection between the same and the float, for the purpose described.

6. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, an air

tube leading from one of said suction tubes to a normally air tight float chamber, a vertically movable container below said float chamber, a tube extending from said float chamber to said fluid chamber and terminating below the fluid level in the latter, whereby a vacuum column is created in said tube and float chamber corresponding to the vacuum in said suction discharge tube, in combination with an air inlet valve for said float chamber and an operative connection between the same and the float, for the purpose described.

7. A multiple turbine of the type described having an independent suction discharge tube for each vane wheel, an air tube leading from one of said suction tubes to a normally air tight float chamber, a fluid container below said float chamber, a tube extending from said float chamber to said fluid chamber and terminating below the fluid level in the latter, whereby a vacuum column is created in said tube and float chamber corresponding to the vacuum in said suction discharge tube, in combination with an air inlet valve for said float chamber and an operative connection between the same and the float, together with a float in the tail race and a supporting connection between said float and the fluid container whereby the vertical position of the latter is automatically varied by the float with the rise or fall of the tail race, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

FRITZ OESTERLEN.

Witnesses:
PAULINE MÜLLER,
FRIDA KLAIBER.