No. 870,930. PATENTED NOV. 12, 1907.

W. L. CHURCH.

DAM.

APPLICATION FILED JULY 3, 1907.

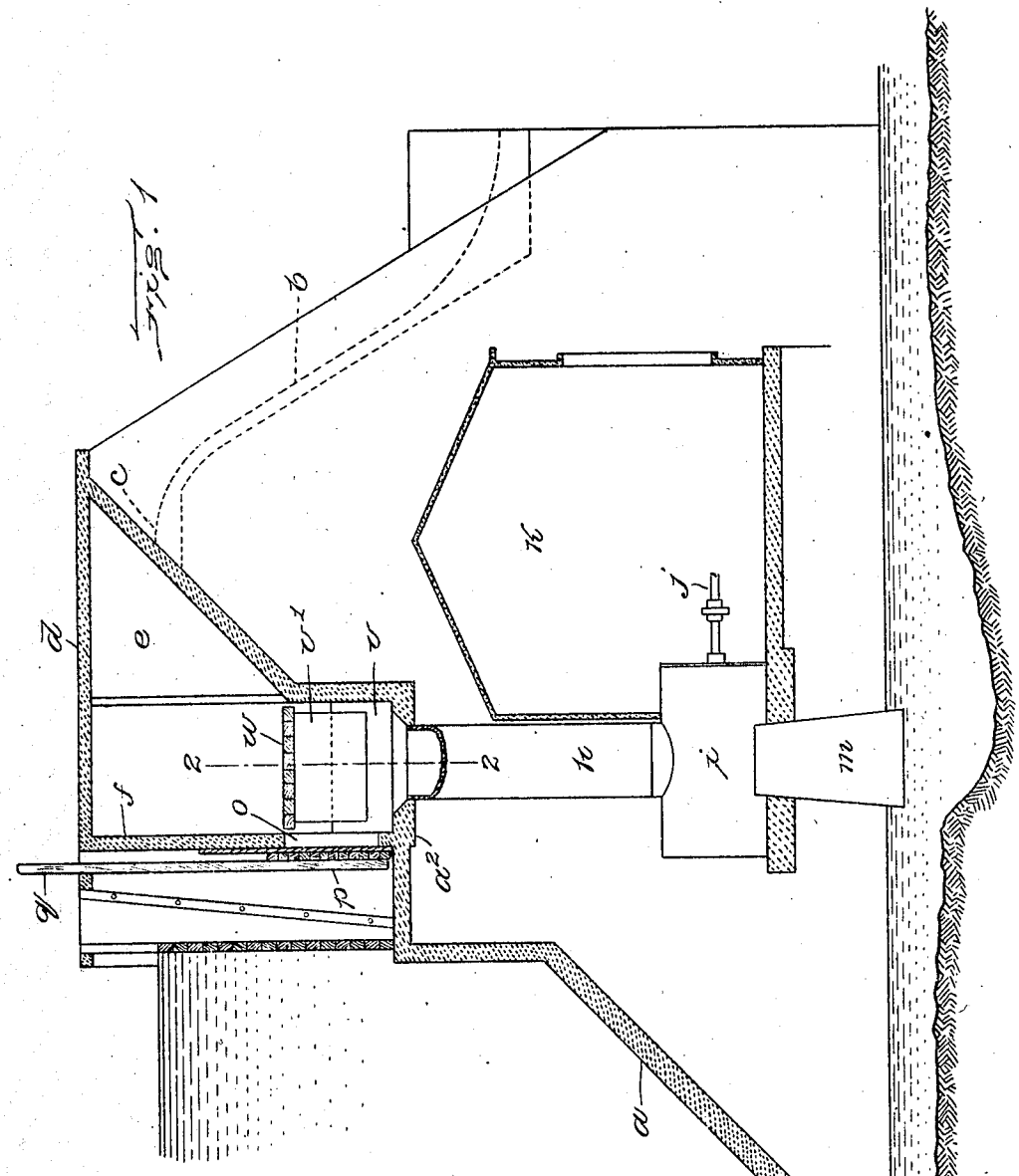

Fig. 1.

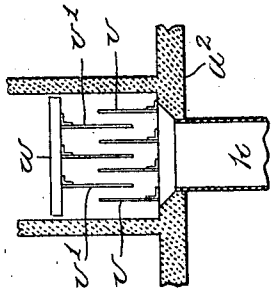

Fig. 2.

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UNITED STATES PATENT OFFICE.

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DAM.

No. 870,930. Specification of Letters Patent. Patented Nov. 12, 1907.

Application filed July 3, 1907. Serial No. 382,105.

To all whom it may concern:

Be it known that I, WILLIAM L. CHURCH, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Dams, of which the following is a specification.

This invention relates to turbine connections in a dam constructed to adjoin, overhang or cover a power station, which includes a wheel casing, containing a turbine or other form of wheel, adapted to be driven by a falling volume of water, the water being conducted to the wheel casing through a substantially vertical penstock, the receiving end of which is in communication with the body of water impounded by the dam.

It is well known that water passing from a state of rest into a substantially vertical conduit extending downwardly from near the surface of the water, acquires a gyratory motion in and immediately above the receiving end of the conduit, a whirlpool being thus formed which results in the entrainment of air with the water, the air being carried downwardly through the conduit, and displacing water which would otherwise act upon the wheel. The power derived from the weight of the water acting upon the wheel is therefore materially reduced by the presence of air in the stream, the air having no available weight, thereby reducing the weight of the volume of water above the wheel, and destroying by reëxpansion the vacuum in the draft tube below the wheel.

My invention has for its object to obviate this objection by preventing the entrance of air into a vertical penstock or conduit in any volume, so as to appreciably affect the force or power of the falling stream as above described.

The invention consists in the combination with a substantially vertical penstock or conduit extending downwardly from a body of water impounded by a dam to a wheel casing, of means for preventing the appreciable displacement of water passing downwardly through the conduit by air entering the same, this result being in part accomplished by preventing the gyration of the water at and above the receiving end of the penstock, and therefore the formation of a whirlpool, and the entrapping of air by the water entering the penstock, and in part by closing, so to speak, the end of the whirlpool should one be formed.

Of the accompanying drawings, forming a part of this specification,—Figure 1 represents a transverse section of a dam provided with a power station, which includes a vertical penstock, the dam being provided with means embodying my invention for preventing the formation of a whirlpool in the water entering the penstock, and for mechanically closing the suction end of the whirlpool if formed. Fig. 2 represents a section on line 2—2 of Fig. 1.

The same letters of reference indicate the same parts in all the figures.

I have illustrated my invention as applied to a dam composed of reinforced concrete, and including an inclined deck *a* and an apron or spillway *b*, said parts being oppositely inclined, and meeting to form a crest *c*, the latter being located between buttresses at the end portions of the dam, said buttresses being higher than the crest. In the drawings I have shown only one of the buttresses, and it will be understood that the buttress at the opposite end of the dam may be of the same construction as that here shown.

d represents the top of the buttress, which is preferably a horizontal platform of reinforced concrete, forming the top of a fore bay *e*, which is located at the upstream side of the deck. The downstream side of the fore bay is formed by the upper portion of the deck, while the front or upstream side of the fore bay is formed by a vertical wall *f*. The bottom of the fore bay is formed by a substantially horizontal portion a^2 of the deck, the latter being of angular form between its upper and lower portions, as shown in Fig. 1; to provide a horizontal fore bay bottom. Through the horizontal bottom a^2 extends a substantially vertical penstock *h*, which extends downwardly to a wheel casing *i*, located within the space over which the apron at the buttress portion of the dam projects. The casing *i* contains a water wheel, which may be of any suitable construction, and adapted to turn a shaft *j* which extends from the casing into a power chamber *k*. The tail water after passing the water wheel, escapes through a draft-tube *m*, and flows down stream through a suitable opening or openings in the downstream side of the dam. The upstream wall of the fore bay has a water inlet *o* in its lower portion to admit water to the fore bay and penstock, said opening being controlled by a vertically movable gate *p*, from which extends upwardly from the top *d* a suitable operating bar *q*.

In carrying out my invention I provide means for preventing the entrance with the water into the receiving end of the penstock, of bodies or globules of air in any measurable quantity Said means in part comprise a series of vertical blades or baffle plates *v* and *v'*, which are located in close proximity to the receiving end of the penstock, and extend above the same, the said blades being arranged to permit the free entrance of water from the fore bay into the penstock, and at the same time to prevent a gyratory motion of the water, and the formation of a whirlpool therein, the blades acting as baffle plates to prevent a horizontal or approximately horizontal circular movement of the water in the bottom portion of the fore bay and in the receiving end of the penstock. The blades or baffle plates are here shown as disposed in two series, one in-

cluding a plurality of fixed blades v, the lower edges of which are in close proximity to the receiving end of the penstock, and a plurality of movable blades v', affixed to and projecting downwardly from a float w, the blades v' al ernating with the blades v, as shown in Fig. 2. The invention also consists n part of the float w, which may be made of wood or other material of less specific gravity than water, and is therefore supported by the water in the fore bay, and adapted to rise and fall therewith.

It will be seen that while the water flows freely into the penstock between the blades v v', it is prevented by said blades from flowing horizontally, and thus forming a whirlpool, and sucking air in displacing bodies into the penstock. It will also be seen that even if the blades were absent, the float would of itself in part prevent the formation of the whirlpool, and further if a partial whirlpool should form, the float would prevent the downward suction of air, thereby cutting off the whirlpool from contact with the air.

It follows therefore that my invention consists of three parts, to wit; the float or floating platform, the hanging blades and the standing blades. Any one or two of these elements may be omitted and the invention remain substantially operative in its desired functions, although possibly in a lessened degree. The most complete operation would be secured by the presence of the platform and at least one set of the blades. The floating platform is a loose fit inside of the box forming the fore bay to the penstock. It is therefore prevented from rotating and at the same time is free to rise and fall as the level of the water surface may change.

Without departing from my invention, the platform may be fixed and mechanically supported in a position over the intake of the penstock, and at or beneath the lowest surface level of the water. But such a platform must be fixed at the lowest assumed level of the water and therefore becomes to that extent an obstruction when the water in the pond is standing at a higher level.

My invention is not limited to the described means for preventing the entrance of water-displacing bodies of air into a vertical penstock, as any other suitable means may be employed for this purpose without departing from the spirit of my invention.

I claim:

1. In combination, a substantially vertical penstock, and means for preventing the admission of water-displacing bodies of air with the water entering the penstock.

2. In combination, a substantially vertical penstock, and means for preventing the gyration of water at and above the receiving end of the penstock.

3. In combination, a substantially vertical penstock, and baffle plates arranged to prevent a gyratory movement of the water entering the penstock.

4. In combination, a substantially vertical penstock and a platform located above the receiving end of the penstock.

5. In combination, a substantially vertical penstock, a platform located above the receiving end of the penstock, and baffle plates affixed to and projecting downwardly from the platform.

6. In combination, a substantially vertical penstock and a floating platform located above the receiving end of the penstock, and baffle plates annexed to and projecting downwardly from the platform.

7. In combination, a substantially vertical penstock and a platform located above the receiving end of the penstock, and baffle plates attached to the penstock or forebay and extending across the intake of the penstock.

8. In combination, a substantially vertical penstock, a floating platform located above the receiving end of the penstock, baffle plates affixed to and projecting downwardly from the platform, and fixed baffle plates alternating with the plates on the platform.

In testimony whereof I have affixed my signature, in presence of two witnesses.

WILLIAM L. CHURCH.

Witnesses:
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