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(71) Applicant(s)
ALSTOM Renewable Technologies

(72) Inventor(s)
Mazzouji, Farid;Traversaz, Monique

(74) Agent / Attorney
Watermark Patent and Trade Marks Attorneys, GPO Box 5093, Melbourne, VIC, 3001

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(71) Déposant *(pour tous les États désignés sauf US)* : **ALSTOM HYDRO FRANCE** [FR/FR]; 3 Avenue André Malraux, F-92300 Levallois Perret (FR).

(72) Inventeurs; et

(75) Inventeurs/Déposants *(pour US seulement)* : **MAZZOUJI, Farid** [FR/FR]; 35, route des Rivoires, F-38210 Vourey (FR). **TRAVERSAZ, Monique** [FR/FR]; 20, rue du Docteur Valois, F-38610 Gieres (FR).

(74) Mandataires : **MYON, Gérard** etc.; 62 Rue de Bonnel, F-69448 Lyon Cedex 03 (FR).

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[Suite sur la page suivante]

(54) **Title:** PELTON HYDRAULIC MACHINE INCLUDING MEANS FOR INJECTING A FLOW DRAWN FROM A MAIN FLOW

(54) **Titre :** MACHINE HYDRAULIQUE DE TYPE PELTON COMPRENANT DES MOYENS D'INJECTION D'UN ÉCOULEMENT PRÉLEVÉ D'UN ÉCOULEMENT PRINCIPAL

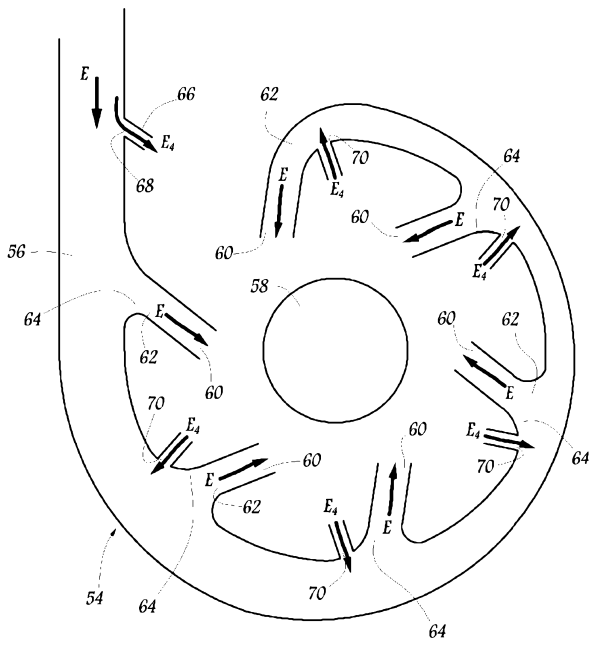

Fig.1

(57) **Abstract:** The invention relates to a Pelton machine through which a main flow (E) of water passes, including at least one Pelton turbine (54) manifold (56), with at least a turbulent zone or a reduced-pressure zone (64) being formed close to said manifold. The machine also includes means for injecting a flow (E_4) drawn from the main flow, and unaltered in relation to the main flow (E), into the turbulent or reduced-pressure zone (64) such as to alter the main flow (E) locally or increase the pressure in said zone (64).

(57) **Abrégé :** Cette machine de type Pelton traversée par un écoulement (E) principal d'eau, comprenant au moins un collecteur (56) d'une turbine Pelton (54), au voisinage duquel se forme au moins une zone tourbillonnaire ou une zone de pression réduite (64). Elle comprend des moyens d'injection d'un écoulement prélevé (E4) dudit écoulement principal, non modifié par rapport à l'écoulement principal (E), dans ladite zone (,64) tourbillonnaire ou de pression réduite de sorte à modifier localement l'écoulement principal (E) ou augmenter la pression dans cette zone (64).

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2008281601 05 Jul 2013

Pelton hydraulic machine including means for injecting a flow drawn from a main flow

The present invention relates to a Pelton type hydraulic machine of the type traversed by a main flow of water, comprising at least one manifold of a Pelton turbine, in the vicinity of which is formed at least one eddy zone or a reduced-pressure zone.

Such a hydraulic machine is used, for example, in a plant for producing hydroelectricity. The machine is installed in the path of the current or is supplied with water from a reservoir into which one or more water courses are discharged.

In these hydraulic machines, there are zones in which the main flow traversing the machine is disturbed and forms eddies or exhibits a reduced pressure, because of the configuration of the machine. Such zones disrupt the general performance of the hydraulic machine because they reduce the efficiency of action of the main flow in the hydraulic machine or cause problems of operation of the hydraulic machine.

Embodiments of the invention may make it possible to eradicate the eddy or reduced-pressure zones.

Accordingly, the invention relates to a Pelton type hydraulic machine of the aforementioned type, comprising means for injecting a flow tapped from the said main flow, not modified relative to the main flow, in the said eddy or reduced-pressure zone so as to locally modify the main flow or increase the pressure in this zone.

In a first aspect, a Pelton type hydraulic machine is disclosed. The hydraulic machine is traversed by a main flow of water and comprises at least one manifold of a Pelton turbine. At least one eddy zone or a

2008281601 05 Jul 2013

reduced-pressure zone is formed in the vicinity of the manifold. The hydraulic machine further comprises means for injecting a flow tapped from the main flow (not modified relative to the main flow) in the said eddy or reduced-pressure zone so as to locally modify the main flow or increase the pressure in this zone. The means for injecting a flow is located on the at least one manifold.

The injection of a flow tapped from the main flow into the eddy or reduced-pressure zones may make it possible to effectively make up for the lack of performance of the action of the main flow in these zones, which improves the performance and the behaviour of the hydraulic machine.

According to other embodiments of the hydraulic machine:

- the injection means may comprise at least one duct comprising an inlet tapping off a flow from the main flow upstream of the manifold and an outlet opening into the eddy or reduced-pressure zone,
- the injection means may comprise a valve placed in the path of the tapped flow, the said valve being able to be moved between an open position in which it allows the tapped flow to pass from the main flow and a closed position in which it prevents the passage of the tapped flow,
- the movement of the valve may be controlled by suitable control means,
- the eddy or reduced-pressure zone may be formed in the vicinity of the bifurcations of the manifold, the injection means being arranged to tap off the tapped flow from the main flow upstream of the said bifurcations and to inject the tapped flow in the vicinity of the said bifurcations.

2008281601 05 Jul 2013

Other aspects and advantages of embodiments of the invention will appear during the following description, given as an example and made with reference to the appended drawing in which:

- Fig. 1 is a schematic representation in section of a Pelton turbine according to an embodiment of the invention.

The embodiment of the invention described below applies to a hydraulic machine of the Pelton turbine type. Since this machine is known, it is not be described in detail in the present description. The invention may also apply to other types of hydraulic machines in which problems of the formation of eddy or reduced-pressure zones occur.

In the description, the terms "upstream" and "downstream" are defined with respect to the direction of flow of the main flow E traversing the hydraulic machine.

A Pelton turbine 54 according to an embodiment of the invention has been shown schematically in Fig. 1.

The Pelton turbine 54 comprises a manifold 56 rotating a rotor 58 by means of a main flow E flowing in the manifold 56 and injected towards the rotor 58 via injection zones 60. The manifold 56 surrounds the rotor 58 and the injection zones 60 protrude from the manifold 56 towards the rotor 58 via bifurcations 62, as shown in Fig. 6 and in a known manner.

Eddy zones 64 and reduced pressure zones are created in the vicinity of each bifurcation 62 which affects the performance of the Pelton turbine.

In order to alleviate this drawback, the manifold 56 comprises means for injecting a flow E_4, tapped off from

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2008281601 05 Jul 2013

the main flow E upstream of the bifurcation 62, into the zones 64 in the vicinity of the bifurcations 62. The injection means comprise for example one or more ducts 66 (partially shown) comprising an inlet opening 68 leading into the manifold 56 upstream of the bifurcations 62 and an outlet opening 70 leading to the vicinity of the bifurcations 62, for example upstream of the latter. The inlet opening 68 taps off the flow E_4 from the main flow E and the duct 66 conveys this tapped flow E_4 to the outlet opening 70 where the tapped flow E_4 is injected into the zones 64. The flow E_4 makes it possible to modify the main flow E in the zones 64 in order to homogenize the latter in the injection zones 60.

According to an embodiment that can be applied, the injection means comprise a valve (not shown) placed in the path of the tapped flow. The valve can be moved between an open position in which it allows the tapped flow to pass and a closed position in which it prevents the passage of the tapped flow. The valve is for example placed in the vicinity of each inlet opening of the injection means and makes it possible manually or automatically to control the injection of the tapped flow.

The movement of the valve is controlled by control means (not shown) which are mechanical or electric in a manner known per se. Therefore, during operating conditions of the hydraulic machine causing the formation of eddy or reduced-pressure or cavitation zones, an automatic system or an operator of the machine switches the valve(s) to the open position which makes it possible to inject the tapped flow in the said zones and to prevent the formation of these zones, as described above.

It should be noted that the tapped flow is not modified

2008281601 05 Jul 2013

relative to the main flow E, that is to say that the water does not sustain any operation to modify its composition during the tapped flow.

2008281601 05 Jul 2013

CLAIMS

1. A Pelton type hydraulic machine traversed by a main flow of water, comprising at least one manifold of a Pelton turbine, in the vicinity of which is formed at least one eddy zone or a reduced-pressure zone, the hydraulic machine further comprising means for injecting a flow tapped from said main flow, not modified relative to the main flow, in the said eddy or reduced-pressure zone so as to locally modify the main flow or increase the pressure in this zone, wherein the means for injecting a flow is located on the at least one manifold.

2. A hydraulic machine according to Claim 1, wherein the injection means comprise at least one duct comprising an inlet tapping off a flow from the main flow upstream of the manifold and an outlet opening into the eddy or reduced-pressure zone.

3. A hydraulic machine according to Claim 2, wherein the injection means comprise a valve placed in the path of the tapped flow, said valve being able to be moved between an open position in which it allows the tapped flow to pass from the main flow and a closed position in which it prevents the passage of the tapped flow.

4. A hydraulic machine according to Claim 3, wherein the movement of the valve is controlled by suitable control means.

5. A hydraulic machine according to any one of Claims 1 to 4, wherein the eddy or reduced-pressure zone is formed in the vicinity of bifurcations of said manifold, the injection means being arranged to tap off the tapped flow from the main flow upstream of said bifurcations and to inject the tapped flow in the vicinity of said bifurcations.

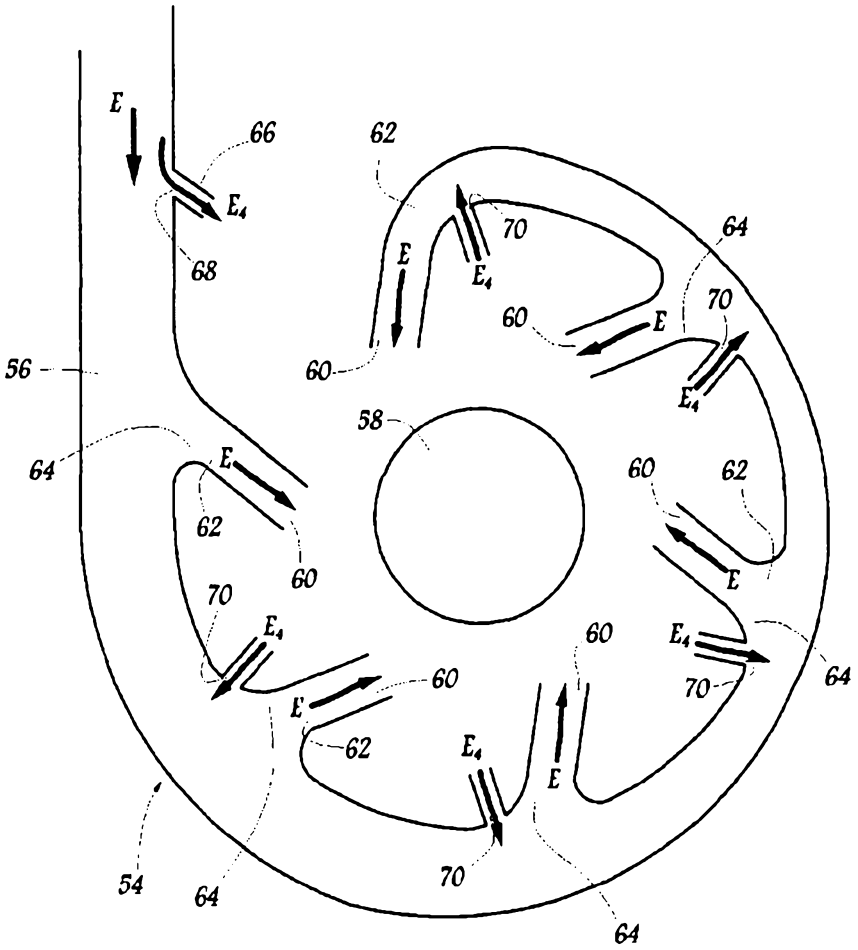
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Fig. 1