

Search history

Search 1: FT=(francis and turbine and hydraulic and runner) (Results 432)

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Search 4: FT=(francis and turbine and hydraulic and runner and blade*) and PD=1999:2014 (Results 103)

1) Family number: 29586289 (US5997242A)

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HYDRAULIC TURBINE

Abstract: Source: US5997242A An **hydraulic turbine** includes a rotatable **turbine runner**. The **turbine runner** has a circumferential inlet for receiving a fluid and an axial outlet for discharging the fluid. The **turbine runner** also includes a conical-shaped hub rotatable about a central axis, the hub having a diameter that decreases in size from the inlet to the outlet, the conical-shaped hub including a base having a circumference adjacent the inlet and a surface sloping inwardly toward the central axis, the surface including a concave section facing the inlet when viewed in the meridional cross-section. The **turbine runner** also includes at least two helical **turbine blades** connected to the conical-shaped hub, each **turbine blade** having a leading edge adjacent to the inlet, a trailing edge adjacent to the outlet, a **blade** running length therebetween having a pitch, each **turbine blade** further including an outer edge, wherein each **turbine blade** winds at least halfway around the conical-shaped hub. The **turbine runner** also includes a shroud surface surrounding the rotatable hub, the shroud surface being defined by the outer edges of the **turbine blades**, the shroud surface and the hub defining a flow channel for the fluid between the inlet and the outlet. The circumferential inlet completely surrounds the base of the hub and is adapted for receiving a fluid flow around the circumference of the inlet that is uniform in quantity, direction and pressure, the fluid flow including a component perpendicular to the central axis when viewed in the meridional cross-section. The hub surface and the shroud surface are both non-parallel to the central axis at the inlet and parallel to the central axis at the outlet for changing the direction of the fluid passing through the **turbine runner**. The fluid is discharged from the **turbine runner** outlet in a direction that is substantially parallel to the central axis.

Probable Assignee: ALDEN RESEARCH LABORATORY INC**Earliest Publication Date:** 19980611

2) Family number: 31393709 (US2004250537A)

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MACHINE AND SYSTEM FOR POWER GENERATION THROUGH MOVEMENT OF WATER

Abstract: Source: US2004250537A A machine and system for power generation through movement of water having an array of power generating cells electrically interconnected, where the array is configured in an interchangeable modular fashion and the cells are positioned to receive kinetic energy from the movement of water to generate electricity through the movement of an electrical **turbine** within each cell. The individual **turbines** and cells may generate relatively small amounts of electricity and use polymer magnetics in the impellers and windings in the **turbine** to withstand ocean environments and are stacked on electrically conductive trays for ease of installation and replacement.

Probable Assignee: HYDRO GREEN ENERGY LLC**Earliest Publication Date:** 20041216

3) Family number: 31482926 (US2005013691A)

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FRANCIS TURBINE

Abstract: Source: US2005013691A A **Francis turbine** with a improved shape of **blades** to reduce the secondary flow around the **blades** and improve the **hydraulic** efficiency is provided. A **Francis turbine** comprises a rotating shaft, a crown, a plurality of **blades** and a band. The band is coaxially coupled with the crown by the **blades** and the rotating shaft, the crown, the **blades**, and the band as a whole are driven by water and rotate toward a **turbine** direction during a **turbine** operation. On a leading edge of at least one of the **blades**, a local maximum point exists between the crown and the band. The leading edge leans toward the **turbine** direction from the band connecting point, where the band and the leading edge are connected. And, a circumferential distance in the rotating direction between the band connecting point and the leading edge is the largest at the local maximum point.

Probable Assignee: TOSHIBA KK**Earliest Publication Date:** 20041217

4) Family number: 23128824 (US2002070560A)

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DUAL TYPE MULTIPLE STAGE, **HYDRAULIC TURBINE** POWER GENERATOR INCLUDING REACTION TYPE **TURBINE** WITH ADJUSTABLE **BLADES**

Abstract: Source: US2002070560A A **hydraulic turbine** power generator mounted on a single shaft wherein the **hydraulic turbine** means includes a plurality of reaction type **turbine** stages arranged to be in combination, rotatably responsive to the **hydraulic** fluid coupled to the **turbines**. One of the **turbine** stages having axial **turbine runner** means mounted to the single shaft and having a plurality of adjustable **blades** for permitting the pitch of the **blades** to be adjusted for controlling the effective operative fluid head to cause the shaft to rotate at a preselected speed and including means for adjusting the pitch of the adjustable **blades**. The **turbine** stages can be a **Francis** type **turbine** and a Kaplan type **turbine**. The **hydraulic turbine** power generator can be oriented in an upward direction to cause the fluid flow to travel upwardly through the **turbine** stages and function as a two phase **turbine** expander resulting in the separation of the liquid phase from the gas/vapor stage.

Probable Assignee: EBARA INT CORP

Earliest Publication Date: 20020613

5) Family number: 28621232 (US5879130A)

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AERATION THROUGH RUNNER

Abstract: Source: US5879130A A **turbine**, adaptable to enhance the levels of dissolved gas such as oxygen in water flowing therethrough, includes a rotating shaft and a **runner** secured to the shaft. The **runner** includes a crown, a band and a plurality of spaced apart **runner blades**. Each **blade** has a water directing surface defined by a pressure side, an oppositely facing suction side, a leading edge and a spaced apart trailing edge. At least one of the **blades** further has a first gas admission passage extending from a first gas admission aperture formed in the crown to a second gas admission aperture formed in the band. The **runner** further includes an interconnection passage and a gas discharge aperture formed in the band for discharging an oxygen containing gas from the band.

Probable Assignee: VOITH SIEMENS HYDRO POWER GENERATION INC

Earliest Publication Date: 19990309

6) Family number: 34512197 (US2007140852A)

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FRANCIS PUMP-TURBINE

Abstract: Source: US2007140852A A **Francis** pump-**turbine** includes a **runner** provided with **runner blades** arranged around in a circumferential direction of a main shaft of the **runner**, each of the **runner blades** being supported by a band at a bottom side thereof in a **blade** height direction and supported by a crown at a head side in the **blade** height direction, in which the **runner blade** is formed, at a trailing edge thereof, with a curved portion expanding to the main shaft when the **turbine** is in operation, the curved portion has a maximum point with respect to a straight line connecting a crown-side trailing edge connecting end at which the trailing edge and the crown are connected and a band-side trailing edge connecting end at which the trailing edge and the band are connected, and an angle formed by a straight line connecting the maximum point and the crown-side trailing edge connecting end and a straight line connecting the maximum point and the band-side trailing edge connecting end is set to be within a range of alpha less than or equal to 150 degrees.

Probable Assignee: TOSHIBA KK

Earliest Publication Date: 20070418

7) Family number: 53662664 (US2014294590A)

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COMPACT BLADE FOR RUNNER OF FRANCIS TURBINE AND METHOD FOR CONFIGURING RUNNER

Abstract: Source: US2014294590A A **blade** for a **runner** of a **Francis turbine** having a throat diameter (Dth), the **blade** including: a maximum thickness of no less than 0.03 Dth and a leading edge having a maximum lean angle of no less than 45 degrees, wherein the lean angle is defined by a vertical line and the leading edge.

Probable Assignee: ANDRITZ HYDRO LTD

Earliest Publication Date: 20130502

8) Family number: 55666339 (US2014023500A)

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VERTICAL AXIS WIND AND HYDRAULIC TURBINE WITH FLOW CONTROL

Abstract: Source: US2014023500A A vertical axis wind and **hydraulic turbine** with flow control including a regular hexagonal structure of radius R, parallelepiped-shaped, inside which a rotor rotates with three or more vanes on a vertical axis which is located in the center of the hexagon as seen from above, wherein the vanes when rotating generate a circle of radius Rt, further including six articulated deflector vanes that grab and concentrate the flow of air or liquid entering the rotor vanes, from the wind or liquid current entry side to the **turbine** and diffuse the flow of air or liquid exiting from the rotor vanes, from the side opposite to the wind or liquid entry side to the **turbine**.

Probable Assignee: RUBIO ANA ELISA

Earliest Publication Date: 20140123

9) Family number: 52405945 (US2014246859A)

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HYDROMOTIVE MACHINE

Abstract: Source: US2014246859A Hydromotive machines, e.g. hydroturbines and pumps with integral low head loss shut off valves are described. Arrays of such hydroturbines facilitate power generation within the limited space available at pre-existing gated water control structures. An adjustable pitch hydroturbine **runner** particularly suited for use with the integral loss shut-off valve provides higher power output and higher specific speed than prior art hydroturbines at low head hydroelectric projects. Arrays of pumps in accordance with the present invention provide high discharge capacity in a limited space, with each individual pump within the array having an integral low head loss valve for shut off and backflow prevention.

Probable Assignee: OBERMEYER HENRY K

Earliest Publication Date: 20121122

FLUID MACHINE

Abstract: Source: US2012063889A A fluid machine of an embodiment includes a sealing portion formed of an annular minute gap between a **runner** band of a **runner** configuring a rotating portion and a sealing liner which is a stationary portion and arranged in opposition to the **runner** band. A groove having a quadrangular cross-sectional shape is formed circumferentially on a surface of the sealing liner configuring the sealing portion. In a cross section perpendicular to a groove forming direction of the groove, an angle θ , formed between a side WU of the groove on the most upstream side with respect to the flowing direction of the leakage flow and a side W0 of the groove which is on an extended line of the surface of the sealing liner, is determined to be 15 degrees or more and 40 degrees or less.

Probable Assignee: TOSHIBA KK

Earliest Publication Date: 20120315

FRANCIS-TYPE RUNNER FOR A TURBINE, AND ENERGY CONVERSION PLANT COMPRISING SUCH A RUNNER

Abstract: Source: US2015285207A This **Francis**-type **runner** for a **turbine** includes a crown, a band and **blades** the number of which is not a prime number. These **blades** are made as one piece and extend between the crown and the band, and between a leading edge and a trailing edge each trailing edge has its concave face facing upstream over its entire length. In addition, first **blades** are uniformly distributed about a central axis of the **runner** in a number equal to a divisor of the total number of **blades**. Each of these first **blades** has a point of attachment of its trailing edge to the crown that is lowered by comparison with the point of attachment of the trailing edge to the crown of second **blades**, which are likewise part of the **runner**. Moreover, the ratio between, on the one hand, the radius of a circle centered on the central axis of the **runner**, perpendicular to this axis and passing through the point of attachment of the trailing edge of a first **blade** to the crown and, on the other hand, the radius of a circle centered on the central axis of the **runner** perpendicular to this axis and passing through the point of attachment of the trailing edge of the same **blade** to the band is less 0.15.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20140620

HYDRAULIC TURBINE WITH INCREASED POWER CAPACITIES

Abstract: Source: US2004115047A A **hydraulic turbine** with increased power capacities for new or existing hydroelectric installations. The **turbine** has a larger axial **runner** wheel and a reshaped **runner** ring peripherally extending around the **runner** wheel. A draft tube with a larger elbow section extends on a downstream side of the **runner** ring. A water supply port extends around a rotation axis of the **runner** wheel on an upstream side of the **runner** ring, and is adapted to produce a centripetal water flow swirling around the rotation axis of the **runner** wheel. A turning passageway extends between the water supply port and the **runner** ring, and is adapted to guide and redirect the centripetal water flow in a substantially axial direction of the **runner** wheel. An axial distributor extends between the turning passageway and the **runner** ring.

Probable Assignee: ALSTOM SA

Earliest Publication Date: 20030411

HYDRAULIC MACHINE

Abstract: Source: US2010086394A A **hydraulic** machine having a hydro **turbine runner** which has a crown at a center and a band along an outer periphery, and is formed around the axis of rotation, long **blades** which are arranged along the circumferential direction of the axis of rotation, and whose center-side ends are supported by the crown, and periphery-side ends are supported by the band, and short **blades** which are arranged between the long **blades**, and whose center-side ends are supported by the crown, periphery-side ends are supported by the band, and rear edges are curved in a rotation direction of the hydro **turbine runner** in **turbine** operation, on a plane of projection perpendicular to the axis of rotation.

Probable Assignee: TOSHIBA KK

Earliest Publication Date: 20100408

METHOD FOR MANUFACTURING A ROTATING PART OF A HYDRAULIC MACHINE, ROTATING PART MANUFACTURED ACCORDING TO THIS METHOD, HYDRAULIC MACHINE AND ENERGY CONVERSION INSTALLATION

Abstract: Source: US2016084216A A method is disclosed for manufacturing a rotating part which belongs to a **hydraulic** machine of an installation for converting **hydraulic** energy into electrical or mechanical energy. This rotating part includes **blades** distributed about an axis of rotation of the rotating part and extending from a leading edge to a trailing edge. This method can include manufacturing, in steel, a first part of each **blade**, which defines the leading edge thereof, manufacturing a second part of the **blade** in a material other than steel and attaching this to the first part of the **blade** so as to form a trailing edge.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20141128

LIQUID CONTROL JET DURING PART LOAD OPERATION IN A HYDRAULIC TURBINE

Abstract: Source: US2011188991A A **hydraulic turbine** including: a passageway permitting liquid to pass through the **turbine**; a draft tube defining a portion of the passageway through which liquid normally flows in a vortex flow path during optimal **turbine** operating conditions; a rotatable **runner** mounted upstream of the draft tube and rotating about a central axis passing through the **runner** and extending into the draft tube; at least one nozzle head device positioned relative to the central axis of the **runner** and adjacent to an upper portion of the draft tube, the at least one nozzle head device has at least one nozzle from which a corresponding control jet of high velocity liquid is injected axially downstream of the **runner** and into liquid flowing into the upper portion of the draft tube during part load **turbine** operation, so as to mitigate breakdown of the vortex flow path.

Probable Assignee: ANDRITZ TECHNOLOGY AND ASSET MANAGEMENT GMBH

Earliest Publication Date: 20071209

16) Family number: 23202972 (US6038494A)

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CONTROL SYSTEM FOR ENHANCING FISH SURVIVABILITY IN A HYDROELECTRIC POWER GENERATION INSTALLATION

Abstract: Source: US6038494A A system for controlling a hydroelectric power production facility includes sensors for detecting the presence of fish adjacent to the facility. A controller linked to the sensors controls the orientation of control surfaces associated with a **turbine**/generator set to enhance the survivability of fish entrained into the facility when fish are detected to be present. The system may be adapted to control fish bypass and spillway structures within the facility to further enhance the survivability of fish populations. The system balances fish survivability with other parameters related to the operation of the facility, optimizing power production levels once estimates of fish survivability meet targets or optimum levels. The system may be adapted to coordinate control of several facilities along a water system to permit implementation of an overall water, fish and power management plan.

Probable Assignee: TENNESSEE VALLEY AUTHORITY

Earliest Publication Date: 19981121

17) Family number: 30468943 (US2005214115A)

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HYDRAULIC MACHINE ROTOR

Abstract: Source: US2005214115A Rotor **blades** of a **hydraulic** machine rotor are shaped such that the inlet edge and outlet edge of two adjacent rotor **blades** have varying profiles in different sections.

Probable Assignee: VA TECH HYDRO GMBH

Earliest Publication Date: 20040205

18) Family number: 52204010 (US2014050587A)

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POWER-CONVERSION INSTALLATION INCLUDING A **HYDRAULIC MACHINE PROVIDED WITH A **RUNNER****

Abstract: Source: US2014050587A The invention relates to a **Francis runner** (200) for a **hydraulic** machine, comprising: a wheel (1), which is rotationally symmetrical about an axis of rotation (Z) of the **runner** (200); a crown (12); and a plurality of inwardly curved vanes (21), each of which has a peripheral edge (212). The peripheral edge (212) of at least one of the vanes is curved, the concavity thereof facing to ward the outside of the **runner** (200). The maximum value of the distance measured between any point on the peripheral edge (202) and a straight line passing through a first connection point between the peripheral edge (212) and the wheel (1), and through a second connection point between the peripheral edge (212) and the crown (12), is at an intermediate point on the peripheral edge (212). The radius (Rn) from the intermediate point (N) is strictly smaller than the radius (Ra) from the first connection point (A). The radius (Rn) from the intermediate point (N) is strictly smaller than the radius (Rc) from the second connection point (C).

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20121026

19) Family number: 33474862 (US2006228215A)

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STRESS RELIEF GROOVES FOR **FRANCIS TURBINE RUNNER BLADES**

Abstract: Source: US2006228215A There is disclosed a **runner** for a **Francis**-type **hydraulic turbine** where each **runner blade** has an outlet edge with two stress relieving grooves cut through the **blade** from the outlet edge adjacent the crown and the band. The grooves each present an opening across the outlet edge and the grooves each extend a predetermined distance from the outlet edge into the **blade**.

Probable Assignee: GENERAL ELECTRIC CANADA

Earliest Publication Date: 20061007

20) Family number: 56020890 (US2014079532A)

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HYDRAULIC MACHINE AND METHOD OF OPERATING SAME

Abstract: Source: US2014079532A In one embodiment, a **hydraulic** machine includes a **runner** including a plurality of **blades** arranged in a ring shape, a crown connected to the **blades** from an upper side and having a lower end surface at a position surrounded by the **blades**, and a band connected to the **blades** from a lower side, the **runner** being configured to convert energy of pressured water into rotational energy. The machine further includes a main shaft configured to transmit the rotational energy of the **runner** to a generator, and a draft pipe located downstream of the **runner**, and configured so that the water used to drive the **runner** flows into the draft pipe. The machine further includes a columnar member disposed on a rotation axis of the main shaft below the crown, and having a diameter smaller than a diameter of the lower end surface of the crown.

Probable Assignee: TOSHIBA KK

Earliest Publication Date: 20140320

21) Family number: 30401581 (US2006018754A)

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FRANCIS WHEEL AND HYDRAULIC MACHINE COMPRISING ONE SUCH WHEEL

Abstract: Source: US2006018754A The invention relates to a Francis runner comprising a crown, a band and blades (2) which extend between the crown and the band. The value of the angle (β_{24}) between the linear speed (U , D_{224}) of a blade (2) and the median (25 , Δ_{214}) of said blade (2) at the trailing edge (22) has, in the vicinity of the point (224) at which the blade (2) is attached to the band, has a value included between 20 and 25 degrees. In this way, the machine has a satisfactory efficiency while the equivalent power under high load can be high.

Probable Assignee: ALSTOM SA

Earliest Publication Date: 20040319

22) Family number: 30476702 (US2006051210A)

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FRANCIS TURBINE

Abstract: Source: US2006051210A The invention relates to a Francis turbine and a hydraulic turbine comprising one such Francis turbine. The inventive Francis turbine comprises a ceiling, a belt and blades (2) which extend between the ceiling and the belt and which define liquid flow channels therebetween. The ratio (e/L) of the maximum thickness (e) of each blade (2) to the average developed length (L) of the average fibre (23) thereof is between 0.1 and 0.2. According to the invention, over essentially the entire height of the leading edge (21), said average fibre (23) is oriented along a straight line (Δ_{23}) which forms an angle (α) greater than 90 degrees in relation to the linear feed speed (U) of the leading edge (21) of the blade (2).

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20040409

23) Family number: 10133183 (US6135716A)

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RUNNER FOR FRANCIS-TYPE HYDRAULIC TURBINE

Abstract: Source: US6135716A PCT No. PCT/NO97/00194 Sec. 371 Date Jan. 8, 1999 Sec. 102(e) Date Jan. 8, 1999 PCT Filed Jul. 28, 1997 PCT Pub. No. WO98/05863 PCT Pub. Date Feb. 12, 1998 Disclosed is a runner for a Francis-type hydraulic turbine, comprising a ring, a hub, and a number of blades all having a curved shape and being attached to the ring and hub. Each blade has an inlet edge and an outlet edge. The blades are characterized in that, in the direction of turbine rotation, the junction point of each blade inlet edge at the ring is located forwardly of the inlet edge attachment point for that blade at the hub, and the junction point of each blade outlet edge at the hub is located forwardly of the outlet edge attachment point for that blade at the ring.

Probable Assignee: GE ENERGY NORWAY AS

Earliest Publication Date: 19980203

24) Family number: 30010553 (US6113348A)

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IMPULSE TURBINE

Abstract: Source: US6113348A An impulse turbine comprises at least one runner keyed to a drive shaft in association with a distributor unit which has, for each runner, a circular outlet for the supply of fluid from the distributor unit to the blades of a respective runner. Each outlet is arranged coaxially inside the respective runner and the distributor unit is shaped in a manner such as to define a substantially circular path for the fluid and to cause the fluid to emerge from the distributor unit through the at least one outlet predominantly tangentially relative to the outlet.

Probable Assignee: BAROZZI PIETRO

Earliest Publication Date: 19991204

25) Family number: 33514127 (US2008088135A)

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ELECTRIC POWER GENERATING SYSTEM USING RING-SHAPED GENERATORS

Abstract: Source: US2008088135A Electric power generating system using ring-shaped generators essentially formed by turbines and generators, and optionally converging-diverging nozzles. The turbines may be of any type, such as axial turbines, open center turbines, reel-shaped turbines, cycloidal turbines, etc, optionally with a circular cog wheel, impellers, or the like. Further, the turbines may have curved and/or articulated blades, or the like. The generators can have permanent magnets or variable reluctance, unsealed and optionally independent. The exciter can be made of a ring of magnets (or areas alternately having high and low magnetic permeability) around the blades, and the armature (winding magnets or magnets having a high-permeability core) forms an arc or ring fitted in the housing or the nozzle and/or the stationary inner cylinder or ring (or braced ring system) in the case of open-centered turbines.

Probable Assignee: NOVO VIDAL MARIA ELENA

Earliest Publication Date: 20061019

26) Family number: 43488142 (US2010303615A)

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HYDRAULIC MACHINE, AN ENERGY CONVERSION INSTALLATION INCLUDING SUCH A MACHINE, AND A METHOD OF ADJUSTING SUCH A MACHINE

Abstract: Source: US2010303615A This hydraulic machine has a wheel (2) mounted to move in rotation relative to a stationary structure (9) and about a stationary axis, said wheel being designed to pass a forced flow of water therethrough. At least one leak limiter device (100) for limiting water leaks is disposed between the wheel (2) and the stationary structure (9), said device defining operating clearance (J) between the wheel and the stationary structure. Said leak limiter device (100) has at least one deformable and/or movable member (103) that is deformable and/or movable in a radial direction (F_1) relative to the axis of rotation of the wheel, while the wheel is rotating.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20090703

(27) Family number: 57931641 (US2016076508A)

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ROTATING PART OF A **HYDRAULIC** MACHINE, **HYDRAULIC** MACHINE PROVIDED WITH SUCH A ROTATING PART AND INSTALLATION FOR CONVERTING ENERGY COMPRISING SUCH A MACHINE

Abstract: Source: US2016076508A When traversed by a flow of water, a **hydraulic** machine rotating part rotates around an axis of rotation. It includes **runners** which are distributed around the axis of rotation and each extend between a leading edge and a trailing edge. Each **runner** can include a first part which defines its leading edge and a second part which is attached to the first part and defines the trailing edge at least in part. The second part can be elastically deformable or displaceable in a reversible manner with respect to the first part, under the action of the flow of water, the second part defining, when the machine operates, the direction of the flow of water downstream of the **runner**.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20141128

(28) Family number: 33034175 (US2006115357A)

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RUNNER FOR **FRANCIS** TYPE **HYDRAULIC** TURBINE

Abstract: Source: US2006115357A There is disclosed a **runner** for a **Francis**-type **hydraulic turbine** where each **runner blade** has a outlet edge comprising a deflected edge portion. The deflected edge portion is located adjacent to the junction or attachment point of the outlet edge to the band of the **runner** to define a stress reducing tip extension portion of the **blade** adjacent the band. This tip extension portion reduces stress concentration adjacent where the outlet edge joins the **runner** band.

Probable Assignee: GENERAL ELECTRIC CANADA

Earliest Publication Date: 20060530

(29) Family number: 43636027 (US2011008150A)

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WHEEL FOR A **HYDRAULIC** MACHINE, A **HYDRAULIC** MACHINE INCLUDING SUCH A WHEEL, AND AN ENERGY CONVERSION INSTALLATION EQUIPPED WITH SUCH A **HYDRAULIC** MACHINE

Abstract: Source: US2011008150A The invention relates to a wheel (R) of the **Francis** type that comprises a ring (1) with revolution symmetry about the rotation axis (Z) of the wheel (R), and curved **blades** (21, 22) connected to the ring (1) and each having an outer peripheral edge (212, 222) and an inner central edge (211, 221). The connection points (B₂₁, B₂₂) between the ring (1) and the inner central edges (211, 221) of the **blades** (21, 22) are located on a same circle (C₁₀) centred on the axis (Z). The connection points (A₂₁, A₂₂) between the ring (1) and the outer peripheral edges (212, 222) of the **blades** (21, 22) are located on at least two distinct circles (C₂₁, C₂₂) (D₂₁, D₂₂) centred on the axis (Z).

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20090820

(30) Family number: 30459401 (US2004066043A)

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HYDROGEN PRODUCTION FROM HYDRO POWER

Abstract: Source: US2004066043A A **turbine** installation configured for large scale hydrogen production includes a foundation structure separating an upper elevation headwater from a lower elevation tailwater. The foundation structure defines a water passageway extending therethrough between an inlet adjacent the headwater and an outlet adjacent the tailwater. A **runner** is supported for rotation by the foundation and disposed in the water passageway intermediate the inlet and the outlet so that water flowing through the passageway as a result of head differential causes rotation of the **runner**. A generator is supported by the foundation and connected to the **runner** by a rotary shaft for generating electrical power as the **runner** rotates. An electrolyzer is electrically coupled to the generator for receiving the electrical power and producing hydrogen. A control system is capable of sensing the remaining hydrogen storage capacity and performing an economic comparison analysis to determine whether operating the **turbine** to produce additional hydrogen or to supply a utility grid with power provides the highest economic return.

Probable Assignee: VOITH SIEMENS HYDRO POWER GENERATION GMBH AND CO KG

Earliest Publication Date: 20040408

(31) Family number: 31457098 (US2005008475A)

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HYDRAULIC TURBINE WITH ENHANCED DISSOLVED OXYGEN

Abstract: Source: US2005008475A A **hydraulic turbine** is adapted to introduce oxygen into a water flowing through a water passageway of a **turbine**. The **turbine** has a circumferential chamber formed between a rotating band and a stationary discharge ring. The chamber has a gas admission aperture for receiving an oxygen containing gas into the chamber. A downstream end portion of the band has a plurality of spaced apart vanes providing chamber outlet passageways between the vanes and through the band. The vanes are configured to rotate with the band and to draw the oxygen containing gas and water from the chamber through the outlet passageways in the band and into the water passageway.

Probable Assignee: GENERAL ELECTRIC CANADA INC

Earliest Publication Date: 20050109

(32) Family number: 28132871 (US2001007634A)

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HOLLOW **BLADE** FOR **HYDRAULIC** TURBINE OR PUMP

Abstract: Source: US2001007634A A **runner** for a **hydraulic turbine** or pump includes a hub and a plurality of **blades** extending from the hub at spaced intervals therearound. Each **blade** includes an inner edge secured to the hub and a distal outer edge, a leading edge and an opposed trailing edge, and a curved suction surface and an opposed curved pressure surface. At least one of the **blades** is fabricated from a curved pressure-side member and a curved suction-side member secured together. The pressure-side member includes at least a substantial portion of the curved pressure surface and an opposed first inner surface. The suction-side member includes at least a substantial portion of the curved suction surface and an opposed second inner surface. The first and second inner surfaces face each other, and at least a portion of the first inner surface is spaced from at least a portion of the second inner surface to form a cavity within the **blade**. A method of making the hollow **blade** is also disclosed.

Probable Assignee: VOITH HYDRO INC

Earliest Publication Date: 20001205

33) Family number: 56266220 (US2014308119A)

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HYDRAULIC MACHINERY

Abstract: Source: US2014308119A A **hydraulic** machinery 1 comprises: vanes 10 that are circumferentially arranged side by side; and rotatable guide vanes 20 that are arranged inside the respective stay vanes. An outlet end-point 11 of each stay vane is in contact with a common reference circle. Each guide vane includes a pressure side **blade** surface 21 and a negative-pressure side **blade** surface 22, and has a camber line connecting centers of inscribed circles 24 that are in contact with both the **blade** surfaces 21, 22. When each guide vane takes a maximum opening degree, a central point O of a maximum inscribed circle 24m is located on an outlet side of the guide vane, relative to an intersection point 32 at which a line as the shortest distance, which is drawn between the outlet end-point and the negative-pressure side **blade** surface 22, and the camber line 25 intersect with each other.

Probable Assignee: TOSHIBA KK

Earliest Publication Date: 20140424

34) Family number: 30316608 (US2004037698A)

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HYDRAULIC TURBINE AND EXIT STAY APPARATUS THEREFOR

Abstract: Source: US2004037698A The invention is an Exit Stay Apparatus for **Francis** and propeller **hydraulic turbines**. The purpose of the invention is to eliminate the loss of **turbine** efficiency and strong pulsations in draft tube caused by the axial circular vortex in all **turbine** operating regimes other than optimum without a noticeable decrease in maximum efficiency. It can be incorporated not only into newly fabricated **hydraulic turbines**, but also retrofitted into existing **turbines**. The Exit Stay Apparatus has a crown and exit stay vanes secured to the crown. When installed in the **turbine**, the exit stay crown is located immediately after the **runner** crown, which is truncated at the bottom by a plane perpendicular to the central axis of the **turbine**. The exit stay crown together with the truncated **runner** crown forms water passages after the **runner blade** crown profile exit. The exit stay vanes are arranged in a circular array around the **turbine** axis, located after the **runner blades**, and attached at the periphery either to the draft tube cone or to an exit stay flange secured to the **turbine** discharge ring and to the draft tube cone.

Probable Assignee: GOKHMAN ALEXANDER

Earliest Publication Date: 20040226

35) Family number: 44516016 (US2011206518A)

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FRANCIS-TYPE RUNNER FOR A HYDRAULIC MACHINE, HYDRAULIC MACHINE INCLUDING SUCH A RUNNER, AND METHOD FOR ASSEMBLING SUCH A RUNNER

Abstract: Source: US2011206518A The present invention relates to a **Francis runner** for a **hydraulic** machine that comprises a belt with a rotational symmetry about a central axis of the **runner**, a ceiling with a rotational symmetry about the axis, and a plurality of **blades** (21, 22) extending between the ceiling and the belt. The **runner** also includes at least two elements (41, 42, 43, 61, 62, 63) partially defining at least the belt and/or the ceiling while at least one edge (231, 232, 241, 242) of a **blade** (21, 22) is inserted between the two elements defining the belt and/or the ceiling.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20100311

36) Family number: 46623549 (US2011293400A)

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INSTALLATION FOR CONVERTING HYDRAULIC ENERGY, AND A METHOD OF CONTROLLING SUCH AN INSTALLATION

Abstract: Source: US2011293400A The invention relates to a unit comprising a **hydraulic turbine** (1), a duct (5) leading a forced flow of water to the **turbine**, a duct (8) discharging the outgoing flow from the **turbine** and vanes (20) for guiding the flow through the discharge duct. Each guide vane (20) is able to rotate about an axis (x22) secant to the wall (84) of the discharge duct. Means (30) are provided for controlling the angular position of the vane (20) about its axis of rotation (x22). Each guide vane (20) can also be retracted into the wall (84) of the discharge duct (8), and means (21) are provided for adjusting the extent to which they are withdrawn into the wall.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20100820

37) Family number: 31423277 (US2004265117A)

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HYDRAULIC TURBINE DRAFT TUBE WITH ENHANCED DISSOLVED OXYGEN

Abstract: Source: US2004265117A A **hydraulic turbine** has a gas distribution manifold mounted to an inside wall of a draft tube downstream from a **turbine runner**. The gas distribution manifold extends at least substantially around the first inside wall of the draft tube. The gas distribution manifold has a plurality of gas outlet ports for discharging oxygen into the water as the oxygen containing gas passes there around. An oxygen containing gas supply extends along a person access passageway and through the wall of the draft tube into the gas distribution manifold adjacent a man hole door.

Probable Assignee: GENERAL ELECTRIC CANADA INC

Earliest Publication Date: 20041225

38) Family number: 54309660 (US2014186157A)

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HYDROELECTRIC POWER GENERATION SYSTEM

Abstract: Source: US2014186157A A hydroelectric power generation system has: a first water storage tank with a high-pressure water injection port on the bottom face; a **runner** which is stored in a condition of floating in the first water storage tank; and multiple transmission members that contact the outer periphery surface of the **runner** and transmit the rotational force of the **runner** to the principal axis of rotation in the generator unit. The **runner** has an introduction pipe that rises upward from an opening at the center of a bottom face to introduce high-pressure water; first guide pipes that extend radially from around the introduction pipe; and first injection nozzles provided at the tips of the first guide pipes, wherein the reactive force of the high-pressure water injected is utilized to turn the **runner**.

Probable Assignee: MURAI KIYOTOSHI

Earliest Publication Date: 20130605

39) Family number: 43487840 (US2010272555A)

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HYDRAULIC MACHINE, AN ENERGY CONVERSION INSTALLATION INCLUDING SUCH A MACHINE, AND THE USE OF A HYDROSTATIC LABYRINTH-BEARING IN SUCH A MACHINE

Abstract: Source: US2010272555A This **hydraulic** machine (1) has a wheel (2) mounted to move in rotation relative to a stationary structure (9) and about a stationary axis of rotation (X2), the wheel (2) being designed to pass a forced flow (E) of water therethrough. A hydrostatic bearing (100), provided between firstly an element (111) constrained to rotate with the wheel (2) and, secondly a portion (91) of the stationary structure (9), is disposed between a first zone (Z1) of the machine, which zone is in fluid communication with the forced flow (E) and in which zone, during operation, a pressure prevails that is similar to the pressure of the forced flow, and a second zone (Z2) of the machine that is isolated from the forced flow by said bearing.

Probable Assignee: ALSTOM SA

Earliest Publication Date: 20090703

40) Family number: 31391551 (US2005019153A)

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IMPULSE **TURBINE, PARTICULARLY OF THE REVERSIBLE TYPE**

Abstract: Source: US2005019153A An impulse **turbine**, particularly of the reversible type, comprises at least a **runner** fast on a shaft in order to be rotatable about an axis of rotation. Each **runner** is provided with at least a hollow working member adapted to receive a fluid fed according to a direction substantially transverse with respect to said axis of rotation, from an inlet portion to a discharge portion of the hollow working member, so that thrust forces are generated whose resultant tends to drive the **runner** into rotation as a result of the passage of the fluid in the hollow working member. The distance between the straight line of action of the resultant of the thrust forces on each hollow working member and the axis of rotation of the **runner** is smaller than the distance between the inlet portion of each hollow working member and the axis of rotation of the **runner**.

Probable Assignee: PIETRO BAROZZI

Earliest Publication Date: 20041213

41) Family number: 32394003 (US2005249594A)

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****RUNNER** **BLADE** FOR LOW SPECIFIC SPEED **FRANCIS** **TURBINE****

Abstract: Source: US2005249594A The present invention relates to design of new **runner** to suit an existing **Francis turbine** water path. It is designed to meet performance at reduced head hence suitable for higher unit discharge and unit speed than originally designed. The **blade** of **runner** comprises a set of nine profiles covering crown to skirt and the profiles have distinct geometrical parameters. Computational fluid dynamic (CFD) based studies exhibit that the **runner** has better performance features for existing water path; both in terms of efficiency of pressure distribution for a range of unit discharge $q_{11} = 170-240$ litres/second and unit speed $n_{11} = 56-72$ rpm; or alternatively for specific speed range $ns, m = 83-98$.

Probable Assignee: BHARAT HEAVY ELECTRICALS LTD

Earliest Publication Date: 20051110

42) Family number: 32383291 (US2005242451A)

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HYDRAULIC **TURBINE DRAFT TUBE DEFLECTOR WITH ENHANCED DISSOLVED OXYGEN**

Abstract: Source: US2005242451A A deflector for use in a **hydraulic turbine** is adapted to be mounted relative to a vertically extending wall of the draft tube. The deflector has an upstream plate and a downstream plate. The upstream plate is positioned to extend downwardly and outwardly from the wall of the draft tube and the downstream plate is positioned to extend downwardly and inwardly from the upstream plate. The downstream plate has at least one elongated air communication port extending therethrough and adjacent the upstream plate. An air supply inlet portion extends from the wall of the draft tube into the deflector above the elongated air communication port permitting an oxygen containing gas to flow from the air supply inlet portion downwardly through the deflector, out the elongated air communication port and into the water flowing past the downstream plate so as to enhance the dissolved oxygen content of the water.

Probable Assignee: GENERAL ELECTRIC CANADA

Earliest Publication Date: 20051030

43) Family number: 30352871 (US2005087933A)

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SEAL FOR USE BETWEEN TWO MOBILE PARTS OF A **HYDRAULIC MACHINE**

Abstract: Source: US2005087933A Arrangement for sealing a gap between first and second parts of a **hydraulic** machine. The arrangement includes at least one sealing element mounted with respect to the first and second parts. A first hydrostatic bearing is formed between a first surface of the at least one sealing element and the first part. A second hydrostatic bearing is formed between a second surface of the at least one sealing element and the second part. At least one first bearing element is arranged on at least one of the surface of the first part and the first surface. At least one second bearing element is arranged on at least one of the surface of the first part and the first surface. At least one supply line is structured and arranged to supply a **hydraulic** bearing medium. The **hydraulic** bearing medium is fed via the at least one supply line to the at least one first bearing element, and thereafter is fed via **hydraulic** resistance to the at least one second bearing element. This Abstract is not intended to define the invention disclosed in the specification, nor intended to limit the scope of the invention in any way.

Probable Assignee: PHILIPP GITTNER DIPL ING DR TE

Earliest Publication Date: 20040304

44) Family number: 20750035 (US2003099544A)

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RADIAL WATER TURBINE

Abstract: Source: US2003099544A Radial-type **hydraulic turbine** comprising a **turbine** housing (1) with a **runner** (10) and with a water inlet to a water duct (6) having a decreasing flow cross-sectional area around the circumference for supplying water to the **runner** (10), as well as an axial water outlet (22) from the **turbine** housing (1). The **turbine** housing (1) comprises two substantially planar, parallel plate parts (2, 4) as delimitations in axial direction, whereby the plate parts (2, 4) are oriented to be normal to the **turbine** axis (10A). The opening (8) for water flow from the water duct (6) to the **runner** (10) has a smaller axial dimension than the spacing between the plate parts (2, 4). Between the plate parts (2, 4) there is provided an outer plate wall (3) formed by bending of an elongate, rectangular piece of sheet material, as a radial delimitation of the water duct (6) outwardly and with an at least approximate spiral shape as seen in the plane of the plate parts.

Probable Assignee: SMALL TURBINE PARTNER AS

Earliest Publication Date: 20010903

45) Family number: 31991403 (WO06007622A1)

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TURBINE

Abstract: Disclosed is a **turbine**, particularly to be operated with liquid impinging media which impinge a rotor (1) via an inlet pipe (11) and an axial conducting device. According to the invention, the inlet pipe (11) that is disposed inside the rotor and the rotor (1) are positioned so as to be movable relative to each other in an axial direction.

Probable Assignee: MOESTL ANDREAS PETER

Earliest Publication Date: 20050725

46) Family number: 57981410 (US2014363280A)

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METHOD OF REFURBISHING AN ENERGY CONVERSION FACILITY AND REFURBISHED ENERGY COVERSION FACILITY

Abstract: Source: US2014363280A This method can be used for refurbishing a facility for converting **hydraulic** energy into electrical or mechanical energy, and vice versa. The facility includes a **Francis** type pump-**turbine**. The pump-**turbine** includes a **runner** movable about an axis, a pre-distributor, including stay vanes defining between each pair of two adjacent stay vanes a first water passage channel and a distributor, including guide vanes arranged downstream of the stay vanes in the direction of water flow feeding the pump-**turbine** operating in **turbine** mode. The guide vanes define between each pair of two adjacent guide vanes a second water passage channel. This method includes steps of reducing the height, taken parallel to the axis of rotation of the **runner**, of the first water passage channels and reducing the height, taken parallel to the axis of rotation of the **runner**, of the second water passage channels.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20141210

47) Family number: 42432188 (US2009087305A)

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EXIT STAY APPARATUS WITH INTERMEDIATE FLANGE

Abstract: Source: US2009087305A The invention is an Exit Stay Apparatus with Intermediate Flange for **Francis** and propeller **hydraulic turbines**. The purpose of the invention is to improve the effectiveness of known Exit Stay Apparatus (U.S. Pat. No. 6,918,744, July 2005, for **Hydraulic Turbine** and Exit Stay Apparatus therefor) in eliminating the axial central vortex and, therefore, in increasing the efficiency and decreasing the flow pressure pulsations in draft tube cone at off optimum operating regimes. The new Exit Stay Apparatus has an intermediate flange between exit stay crown and periphery and two sets of exit stay vanes: crown exit stay vanes secured to the exit stay crown and the intermediate flange and peripheral exit stay vanes secured to the intermediate flange and following to the periphery. When installed in the **turbine** the peripheral exit stay vanes are secured at the periphery. There are more crown exit stay vanes than the peripheral exit stay vanes and their profiles are longer than the profiles of the peripheral exit stay vanes. The Exit Stay Apparatus with Intermediate Flange is expected to have the same peak efficiency as known Exit Stay Apparatus.

Probable Assignee: GOKHMAN ALEXANDER

Earliest Publication Date: 20090402

48) Family number: 57465875 (US2016010618A)

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HYDRAULIC TURBINE, AND POWER CONVERSION FACILITY INCLUDING SUCH A TURBINE

Abstract: Source: US2016010618A Said **hydraulic turbine** includes a wheel which is made to rotate about a rotational axis (X2) by a main water stream (F1) going from a penstock to a suction tube along a flow path that passes through the wheel. Said **turbine** also includes first means that are placed outside the flow path of the main water stream (F1) and enable the mixing of a secondary water stream (F2), taken from the flow path and located upstream from the wheel, and an oxygen-containing gas (A2). Said **turbine** also includes second means for injection, downstream from the wheel of the **turbine**, a water/gas mixture (F3) produced in the first means.

Probable Assignee: GE RENEWABLE TECHNOLOGIES

Earliest Publication Date: 20140925

49) Family number: 43507222 (US2009179426A)

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REDUCED PRESSURE DIFFERENTIAL HYDROELECTRIC **TURBINE** SYSTEM

Abstract: Source: US2009179426A This invention involves a hydroelectric **turbine** system that is capable of producing electricity while sustaining a majority of the fluid flow or **hydraulic** pressure within the pipe line or pipe network driving the system. The system's objective is to shave as little pressure as possible from an enclosed pipe system that requires pressure to operate and function properly. More particularly, this invention relates to a hydroelectric **turbine** generator system wherein the system is specially designed and configured with an unique impeller and fluted **turbine** housing that enable a generator device to produce a particular amount of electric current and voltage, while yet minimizing flow restriction and pressure loss to the fluid pressure driving the system. Application of this technology includes all fluid flow or fluid transfer systems that require sustained pressure to move fluids like water or other materials from one location or point to another, through pipes, pipe systems or networks, regardless of distance or pipe size diameters. This invention, for example will be ideally suited for powering electronic control or monitoring systems in landscapes, parks, roadway easements, golf courses or public water transfer systems or other remote sites that may require power. Utilization of this invention provides an ecological and reliable energy production source, usually on a small scale, in remote locations where incorporating other forms of power supply may be less practical, impractical or impossible.

Probable Assignee: TECHSTREAM CONTROL SYSTEMS INC

Earliest Publication Date: 20090716

50) Family number: 11640513 (US5823740A)

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DISSOLVED GAS AUGMENTATION WITH MIXING CHAMBERS

Abstract: Source: US5823740A A shrouded **turbine** for enhancing the levels of dissolved gas such as oxygen in water flowing therethrough. The **turbine** comprises a rotatably mounted **runner**, a stationary discharge ring and a band seal. The **runner** includes a crown, a band, and a plurality of **blades** extending between the crown and the band. The discharge ring is concentric with the band and spaced therefrom to permit relative rotation of the band and discharge ring. The band seal is disposed near an upstream edge of the band between the discharge ring and the band to limit water leakage into a band mixing chamber formed therebetween. The seal and the chamber are configured such that the band mixing chamber remains substantially flooded during **turbine** operation. A gas admission aperture allows gas to be injected into the mixing chamber. The mixing chamber is configured to promote mixing of the gas with the water leaking into the chamber during **turbine** operation. An additional mixing chamber may be provided above the crown.

Probable Assignee: VOITH HYDRO INC

Earliest Publication Date: 19981020

51) Family number: 56716943 (WO14090885A1)

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FRANCIS-TYPE **TURBINE**-PUMP AND ENERGY CONVERSION PLANT COMPRISING SUCH A **TURBINE**-PUMP

Abstract: This **Francis**-type **turbine**-pump comprises a **runner** (2) rotating about a vertical axis (X2), this **runner** itself comprising a **runner** crown (202), a **runner** band (204), **blades** (206) which extend between the **runner** crown and the **runner** band and which between them define water flow ducts (10). Vanes (12) are each arranged in a flow duct, each vane being overall parallel to the direction in which the water (E') flows along the duct and overall perpendicular to the **blades** (206) defining this duct. Each **blade** (206) extends between a first edge (208), that forms a leading edge when the **turbine**-pump is operating in pump mode and a trailing edge when it is operating in **turbine** mode, and a second edge (210), that forms a trailing edge when the **turbine** is operating in pump mode and a leading edge when it is operating in **turbine** mode. Each vane (12) extends, from the first edge (208) and toward the second edge (210), over a length (L12) measured parallel to the direction in which the water (E') flows through the corresponding duct (10), that represents less than 80 percent of the distance (D204) between a point (P1) of attachment of the first edge (208) to the **runner** band (204) and a point (Q1) of attachment of the second edge (210) to the **runner** band, measured parallel to the direction in which the water (E') flows along the duct.

Probable Assignee: ALSTOM SA

Earliest Publication Date: 20140613

52) Family number: 57051919 (JP2014141903A)

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HYDRAULIC TURBINE OR **RUNNER** OF PUMP **HYDRAULIC TURBINE**, AND ITS MANUFACTURING METHOD

Abstract: Source: JP2014141903A PROBLEM TO BE SOLVED: To easily perform position adjustment between constituents within a manufacturing tolerance and an assembling tolerance without impairing the soundness of welding, in a pump **hydraulic turbine** which is assembled by welding.SOLUTION: According to an embodiment, stubs (4a, 4c) constituting a **runner blade** end which includes a root R of a **runner blade** (4) are integrally formed at least at one of a crown (2) and a band (3). A **runner blade** part (4b) except for the **runner blade** end of the **runner blade** is formed separately from the crown and the band, and the **runner blade** part is welded to the stubs. As the stubs and the **runner blade** part which are welded to each other, there are employed stubs and a **runner blade** part in which a thickness of either of the stub and the **runner blade** part is formed thicker than a thickness of the other end, and which have open tips at the other end face.

Probable Assignee: TOSHIBA CORP

Earliest Publication Date: 20140723

53) Family number: 44993683 (US2010260596A)

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HYDRAULIC BULB **TURBINE** WITH MIXED-FLOW PROPELLER **RUNNER**

Abstract: Source: US2010260596A The invention is a Bulb **turbine** with mixed-flow propeller **runner** instead of axial flow propeller **runner**. The main area of application for the invention are the large tidal power plants (Fundy Bay, Severn Lake, etc.) with barrages where the propeller **runners** are working together with DC generators located in the bulbs. The theoretical fluid mechanical and energy output analyses show that the application of Bulb **turbine** with mixed-flow propeller and (Q11)_{opt}=2.830 m³/sec would increase the energy output of the Fundy Bay tidal power plant with 200 units up to 4.5 million megawatt-hours per year in comparison with commercially available Bulb **turbines** with axial flow propellers and (Q11)_{opt}=2.200 m³/sec without additional cost for the plant construction and its equipment. Also, the **runner** rotation of Bulb **turbines** with mixed-flow propellers [(N11)_{opt}=110.0 rpm, N_{opt}=50.807 rpm] is 0.667 times slower than of commercially available Bulb **turbines** [(N11)_{opt}=165.0 rpm, N_{opt}=76.211 rpm] what makes these **turbines** fish friendlier than the commercially available Bulb **turbines** with axial flow propellers.

Probable Assignee: GOKHMAN ALEXANDER

Earliest Publication Date: 20101014

54) Family number: 31720997 (CA2436670A)

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HYDRAULIC TURBINE WITH INTERBLADE VORTEX SUPPRESSOR

Abstract: Source: CA2436670A An improved **Francis**-type **turbine runner**. To extend operating range to partial load, inter **blade** fins partially extend into the flow paths between the **runner blades**. The inter **blade** fins correspond in shape and pattern with the shape and pattern of that portion of the **runner blades** with which the fins coextend along the flow paths between **blades**. The fins are recessed rearwardly of the flow dividing edges of the **runner blades** in the flow paths between the **runner blades** and reduce occurrence of inter **blade** vortices during partial or low load operating conditions. The shape of the interblade fins is further improved by tilting or sloping the tip of the interblade fin towards the suction surface of the adjacent **blade**. This creates a small convergence in the flow path between the fin and the suction surface of the **blade**.

Probable Assignee: GEN ELECTRIC CANADA

Earliest Publication Date: 20050207

55) Family number: 43506636 (US2009178462A)

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METHOD FOR CREATING A LOW FLUID PRESSURE DIFFERENTIAL ELECTRICAL GENERATING SYSTEM

Abstract: Source: US2009178462A This invention involves a method of creating a hydroelectric **turbine** system that is capable of producing electricity while sustaining a majority of the fluid flow or **hydraulic** pressure within the pipe line or pipe network driving the system. The system's objective is to shave as little pressure as possible from an enclosed pipe system that requires pressure to operate and function properly. More particularly, this invention relates to a hydroelectric **turbine** generator system wherein the system is specially designed and configured with an unique impeller and fluted **turbine** housing that enable a generator device to produce a particular amount of electric current and voltage, while yet minimizing flow restriction and pressure loss to the fluid pressure driving the system. Application of this technology includes all fluid flow or fluid transfer systems that require sustained pressure to move fluids like water or other materials from one location or point to another, through pipes, pipe systems or networks, regardless of distance or pipe size diameters. This invention, for example will be ideally suited for powering electronic control or monitoring systems in landscapes, parks, roadway easements, golf courses or public water transfer systems or other remote sites that may require power. Utilization of this invention provides an ecological and reliable energy production source, usually on a small scale, in remote locations where incorporating other forms of power supply may be less practical, impractical or impossible.

Probable Assignee: TECHSTREAM CONTROL SYSTEMS INC

Earliest Publication Date: 20090716

56) Family number: 11478808 (US5601411A)

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STAINLESS STEEL TYPE 13CR5NI HAVING HIGH TOUGHNESS, AND USAGE THE SAME

Abstract: Source: US5601411A High toughness stainless steel type 13Cr5Ni containing C: 0.008-0.03 percent (by weight, all of the following elements), Si: max. 1 percent, Mn: max. 2 percent, Cr: 10.0-14.0 percent, Ni: 4.0-7.0 percent, and Mo: 0.2-2.0 percent, in which (Cr/Ni) ratio is in a range of 2.0-3.0 or (C/Mo) ratio is in a range of 0.015-0.1, as a structural material for fluid machinery, austenitic stainless steel containing C: 0.10-0.30 percent (by weight, all of the following elements), Si: max. 1 percent, Mn: max. 2 percent, Cr: 16.00-23.00 percent, Ni: 1.00-8.00 percent, and Co: 2.00-9.00 percent, and Ni+Co: 6.00-12.00 percent as a weld padding layer forming material, and fluid machinery using the same.

Probable Assignee: HITACHI LTD

Earliest Publication Date: 19960109

57) Family number: 31782867 (CA2438429C)

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METHOD OF RE-BUILDING FRANCIS TURBINE RUNNERS

Abstract: Source: CA2438429C A **hydraulic turbine** power house or installation has a rotatably mounted **runner** having a crown, a band and a plurality of original **runner blades** extending between the crown and the band. A method of retrofitting the **runner** with improved performance comprises the steps of removing the **runner** from the **turbine** power house or installation, removing the original **runner blades** from the crown, machining the surface of the crown to smooth the surface adjacent the removed original **runner blades**, affixing new **runner blades** with improved characteristics to the crown, securing the band to the **runner blades** to complete the assembly of the retrofitted **runner**, and re-installing the retrofitted **runner** in the **turbine** power house or installation.

Probable Assignee: GEN ELECTRIC CANADA

Earliest Publication Date: 20050222

58) Family number: 12197183 (WO9943954A1)

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RING GATE CONTROL SYSTEM FOR FRANCIS TURBINE

Abstract: A control system for a ring gate (134) disposed in a **hydraulic turbine** installation in which water flows through a water passageway from an upstream reservoir past a **turbine runner** (126). The ring gate surrounds the **runner** and is mounted for longitudinal movement between an open position in which the water flow is unencumbered and a closed position in which the water flow is shut off. The control system includes a set of actuators (146), a set of operating rods, and an electrical control circuit. The actuators are installed above the ring gate and distributed around its circumference. Each operating rod is connected to the ring gate and an associated actuator. The electrical control circuit controls and synchronizes the actuators and thereby controls the movement of the ring gate. A **turbine** installation including the ring gate control system is provided along with a method for controlling the movement of the ring gate. A method of utilizing the actuators as a jacking system to lift the head cover and thereby ease maintenance is also disclosed.

Probable Assignee: VOITH HYDRO INC

Earliest Publication Date: 19990902

59) Family number: 57434272 (WO14147026A1)

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FRANCIS-TYPE RUNNER FOR A HYDRAULIC MACHINE, HYDRAULIC MACHINE EQUIPPED WITH SUCH A RUNNER AND ENERGY CONVERSION PLANT COMPRISING SUCH A HYDRAULIC MACHINE

Abstract: This **Francis**-type **runner** (R) for a **hydraulic** machine comprises a **runner** crown (2) and a **runner** skirt (1) with symmetry of revolution about an axis (X2) of rotation of the **runner** (R) and **blades** (12). Each **blade** (12) extends between a first edge (13) and a second edge (14). The ratio between, on the one hand, the radius (R1) of a circle centred on axis (X2) of rotation of the **runner** (R) at right angles to this axis and passing through a point (C) of attachment of the first edge (13) of the **blade** (12) to the **runner** crown (2) and, on the other hand, the radius (R2) of a circle centred on the axis (X2) of rotation of the **runner** (R) at right angles to this axis and passing through a point of attachment (A) of the first edge (13) of the same **blade** (12) to the **runner** skirt (1) is strictly greater than 1 and less than or equal to 1.1.

Probable Assignee: ALSTOM SA

Earliest Publication Date: 20140919

60) Family number: 50832236 (US2012076648A)

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INSTREAM HYDRO POWER GENERATOR

Abstract: Source: US2012076648A A **turbine** apparatus is immersed in an ambient stream of a flowing fluid, such as water, so as to encapture a portion of the flowing fluid and extract power therefrom, before returning it back into the ambient stream, which may be a tidal flow of ocean water, or a relative flow of water behind a boat. The apparatus includes a converging intake duct with an inlet opening that faces forward into the ambient stream flow, a spiral volute casing that redirects the fluid into a spiral flow, a rotor arranged coaxially on the spiral axis, and an exhaust duct that diverges and curves from an exhaust inlet coaxial with the spiral axis to an exhaust outlet that opens rearwardly into the ambient flow. The rotor has a peripheral rotor inlet around the circumference of a first stage thereof and an axial rotor outlet at one axial end thereof, and is arranged with its rotor axis coinciding with the spiral axis oriented transverse to the ambient stream flow. The rotor redirects the fluid from the spiral tangential and radial direction at the rotor inlet to the axial direction at the rotor outlet, while extracting power therefrom. Fluid flow channels are designed to achieve smooth acceleration, redirection, power transfer, and deceleration of the fluid preferably without turbulence and cavitation, and preferably using streamlines to develop the surface contours of complex channel components.

Probable Assignee: MCBRIDE GEORGE F

Earliest Publication Date: 20120329

61) Family number: 51756651 (US2012210944A)

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HYDRO-ELECTRIC GENERATION METHOD AND SYSTEM WITH SALTWATER FLUME FOR AQUACULTURE

Abstract: Source: US2012210944A Embodiments that generate electrical power via hydro-electric systems that employ man-made flumes configured to support saltwater aquaculture are disclosed. Various embodiments pump water, such as saltwater or freshwater, into supply a man-made flume. The embodiments may generally employ a **blade** assembly to harness wind power and drive a mechanical pump that transfers the water into the man-made flume. The flumes in different embodiments may contain different forms of aquaculture, such as shrimp, fish, and crabs. As water flows through the flume, the continual fresh supply may continually aerate the water in the flume to support the aquatic life. Water exiting the flume may impact a **turbine** that is coupled to a generator to generate electrical power.

Probable Assignee: GODINICH STEPHEN LEE

Earliest Publication Date: 20120823

62) Family number: 57785720 (EP3285128A1)

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WASSERKRAFTWERK-ECHTZEITUEBERWACHUNGSSYSTEM UND VERFAHREN HYDROELECTRIC POWER PLANT REAL-TIME MONITORING SYSTEM AND METHOD

Abstract: Source: EP3285128A1 A hydroelectric power plant real-time monitoring system comprising a real-time data acquisition system (11) connected to dedicated sensors positioned in a hydroelectric power plant (2) and configured to acquire in real-time real-time measured power plant data comprising simulation inputs (111). The monitoring system also comprises a real-time simulation system (12) and a real-time diagnostic system (13), whereby the simulation system is configured to receive the measured simulation inputs (111) to simulate in real-time a transient behavior of the hydroelectric power plant based on the measured simulation inputs and to provide in real-time real-time simulated power plant data related to the transient behavior of the hydroelectric power plant and comprising at least one real-time simulated monitored quantity (123) corresponding to a simulated quantity of a non-measured power plant quantity or of a non-measurable power plant quantity. The real-time diagnostic system (13) compares the simulated monitored quantity (123) with a predetermined threshold to trigger, when said real-time simulated monitored quantity (123) exceeds said predetermined threshold, an alarm identifying a power plant transient behavior problem and/or computes at least one output related to said real-time simulated monitored quantity (123) and compares said output with a predetermined threshold to trigger, when said output exceeds said predetermined threshold, an alarm identifying a power plant transient behavior problem.

Probable Assignee: POWER VISION ENGINEERING SARL

(63) Family number: 29320647 (US2003066934A)

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METHOD OF UTILIZATION A FLOW ENERGY AND POWER INSTALLATION FOR IT

Abstract: Source: US2003066934A The author suggests a new method and a new inexpensive, large **blade**-rope type wind rotor, that will be suspended at high altitude and produce huge quantities of energy. The air installation embodiment includes (Fig. 25): propeller 220, wing 226, rope transmission 229, electric generator 12 located at ground. Water rotors can utilize energy of ocean and sea streams. The invention contains 11 projects: 6 for air, 1 for a river, 3 for the sea and ocean, and 1 for ships. They have a power capacity of up to 60 MgW (air), up to 200 MgW (water) for one unit. The suggested installations have the following advantages: 1. Huge power production capacity-up to 5000-10000 times more than conventional ground-based rotor designs. 2. The rotor operates at high altitude of 1-14 kilometers, where wind has high speed and high stability (permanent flows). 3. The installation is much less expensive compared to conventional currently-employed windmills, partly because no tower is necessary to fix the rotor in space. 4. Wind energy is free -environmentally friendly.

Probable Assignee: BOLONKIN ALEXANDER ALEXANDROVI**Earliest Publication Date:** 20030410**(64) Family number: 50557127** (WO12017150A1)

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FRANCIS TURBINE RUNNER WITH NON-PERIODIC ANGULAR DISTRIBUTION OF VANES

Abstract: This **Francis turbine runner** comprises a crown, a band, and several vanes (26i) distributed about an axis of rotation (X2) of the **runner**. The vanes (26i) are not symmetric with respect to the axis of rotation (X2) and have a distribution about this axis (X2) which is not periodic and even.

Probable Assignee: ALSTOM SA**Earliest Publication Date:** 20120127**(65) Family number: 42774361** (EP2012005A2)

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HYDRAULIC TURBINE

Abstract: Source: EP2012005A2 An impulse **turbine** comprises at least one **runner** (10; 110; 210) provided with a plurality of **blades** (14; 14a; 114; 214) and adapted to rotate about an axis of rotation (A) as a result of the delivery of a pressurized fluid to the **blades** (14; 14a; 114; 214) through fluid delivery means which include at least a nozzle (20; 120; 220) facing an active surface (22; 22a, 22b; 122; 222) of the **blades**. Each nozzle (20; 120; 220) includes an outflow portion (20a; 120; 220a) lying substantially in a general plane of the **runner** (10; 110; 210) and extending in an inner zone of the **runner** between the **blades** (14; 14a; 114; 214) and the axis of rotation (A). The outflow portion (20a; 120; 220a) of the nozzles (20; 120; 220) is directed towards the outside of the **runner** (10; 110; 210) along a direction parallel to and spaced from the radial direction of the **runner**, and each **blade** (14; 14a; 114; 214) of the **runner** (10; 110; 210) define an arched path extending transversely to the plane of the **runner** (10; 110; 210).

Probable Assignee: BAROZZI PIETRO**Earliest Publication Date:** 20090103**(66) Family number: 30468153** (WO04030430A1)

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HYDRAULIC MACHINE ROTOR

Abstract: The **blades** (2) of a **hydraulic** machine rotor (1) are formed in such a way that it is possible to obtain greater efficiency and enable the **hydraulic** machine to be operated even in partial load ranges without incurring any significant limitations. The aim of the invention is to obtain a **hydraulic** machine exhibiting good cavitation behavior and to produce and mount a rotor (1) in a manner which is as simple as possible without any limitations, using very small clearances and processing machines. In order to achieve said objectives, the rotor **blades** (2) of the inventive rotor (1) are divided such that part (2a) of the rotor **blades** (2) can detached from the rotor (1).

Probable Assignee: VA TECH HYDRO GMBH**Earliest Publication Date:** 20040415**(67) Family number: 55121616** (IN00757MU2012A)

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MICRO HYDRO TURBINE SYSTEM

Abstract: Source: IN00757MU2012A The present invention relates to a **turbine** system for the generation of power from a low head micro hydro site. Particularly, the invention provides a micro hydro **turbine** comprising a **turbine** unit, a suction unit and a generation unit for the generation of electricity from a low head and a low discharge **hydraulic** force. The said **turbine** is cost effective, possesses longer life and significantly helps in increasing the output of power as compared to the conventional **turbines**.

Probable Assignee: SAHAJE AMOGH**Earliest Publication Date:** 20131108**(68) Family number: 52672527** (US2015014995A)

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MARINE POWER GENERATING SYSTEM AND MARINE POWER GENERATING METHOD

Abstract: Source: US2015014995A [Problem] To provide a marine power generation system which is engineered to be able carry out power generation stably and highly efficiently, using the large source of energy even in ocean currents having insufficient speeds to create a water current, similar to a water discharge from a dam, which is ideal for hydroelectricity. [Solution] As an example of a water intake structure (10), a sea surface floatation object, floats on the sea by buoyancy, and has an aperture part (12) through which seawater is taken therein. A water guide pipe (20) is underwater, which secures a space underwater. One end of the water guide pipe (20) is connected to the sea surface floatation object (10), and the seawater which is taken in from the sea surface floatation object which is the water intake structure (10), is introduced downward under the sea surface. Power generators (30) that generate power from either the falling motion of the seawater or water pressure are in the water guide pipe (20), and carry out power generation. A submersible body (40) is in the water, and an accumulation space (41) is provided that takes in the seawater which is discharged from another end of the water guide pipe (20). The seawater that is taken into the accumulation space (41) in the submersible body (40) is discharged outward from the submersible body (40) by a discharge part (50).

Probable Assignee: NISHIOKA TOSHIHISA

Earliest Publication Date: 20121219

69) Family number: 30536378 (EP0930432A2)

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ROTOR **BLADE FORM FOR **FRANCIS** WATER **TURBINE****

Abstract: The paddle wheel for a **hydraulic** flow machine, especially a water **turbine**, has a wheel base (1.1), a wheel crown (1.2) and a number of paddles (1.3), each of which has an entry edge (1.3.1) and an outlet edge (1.3.2). Each outlet edge (1.3.2) has deflection at point (C) near the wheel base (1.1) to run (1.3.3) on the base (1.1) to meet a point (B) which is opposite to, and downstream from, the point (A) where the outlet edge (1.3.2) would meet the wheel base without any deflection. The deflection line between points (B,C) is straight, concave or convex.

Probable Assignee: VOITH SIEMENS HYDRO POWER GENE

Earliest Publication Date: 19990721

70) Family number: 57579881 (WO14166663A1)

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DEVICE AND METHOD FOR REDUCING PRESSURE FLUCTUATIONS IN THE SUCTION PIPE OF A WATER **TURBINE OR WATER PUMP OR WATER PUMP **TURBINE****

Abstract: A device and a method for reducing pressure fluctuations in the suction pipe of a water **turbine** or water pump or water pump **turbine** having an impeller (10) that has a plurality of rotor **blades** and a hub (11), having a housing that has a guide apparatus for regulating the flow of water through said impeller, and having a suction pipe (14) for guiding the water flowing through the impeller, wherein, in an operating state that deviates from the optimal operating range, at least one displacer (15, 25) is situated in the region of the suction pipe (14) and extends in an axial extension of the impeller (10), and wherein the at least one displacer (15, 25) is completely removed from the flow region in the optimal operation range.

Probable Assignee: VOITH PATENT GMBH

Earliest Publication Date: 20141016