

SELF-CONTAINED HYDROELECTRIC GENERATOR

FIELD OF THE INVENTION

The present invention generally relates to a system and a method for generating hydroelectric power. More particularly, it relates to a system and a method of lifting water from a water source from a relatively lower position to a relatively raised position by siphon pump and channeling the water from the relatively raised position down to drive a turbine driven generator.

BACKGROUND OF THE INVENTION

Energy is plentiful in winds, sunlight, waves and tidal changes. However, these natural sources of energy vary erratically with seasons and weather conditions. In particular, solar energy is not available at night. A direct conversion of such sources of energy into power of useful form based on such systems are impractical, because the requirement for storage and modulation makes the conversion inefficient and costly. By means of the hydro-turbine, this invention introduces a constant, uncomplicated and reliable way to convert energy of flowing water into power of useful steady form. Such power is can be used to run or activate machinery, such as the drilling of a well or powering household appliances.

Hydroelectric energy is a safer and a more cost-effective form of energy. Hydroelectric power generally involves the use of kinetic energy of falling water to drive turbines which in turn drive generators for generation of electricity. While conventional hydroelectric power generation has typically depended on the availability of running water, many prior art systems have attempted to employ a substantially closed water system to generate hydroelectric power.

An automatic siphon pump system for raising a body fluid, is disclosed in US Patent 2,855,860. The system consists generally of a number of cascading water tanks and a plurality of siphon pipes. Each siphon pipe generally consists of an inlet tube, a horizontal pipe section and a lower leg pipe section. The inlet tube of the first siphon pipe has a lower end submerged in a fluid source and an upper end which extends through the first water tank. The inlet tube is in fluid connection with the horizontal pipe extending horizontally above the water tank. The lower level leg pipe has an upper end connected to the end of the horizontal pipe and a lower end connected to a vacuum source. The vacuum source is used to initiate the flow of water through the siphon pipe. In addition, a quantity of air is injected into the siphon pipe so that more water flows into the siphon tube than flows out of

the siphon tube. The extra volume of water in the siphon tube is diverted to and captured in the first tank. Similar siphon pipes are used to raise water to successively higher water tanks. At each level, the extra volume of water in the siphon pipe is captured in the water tanks. Pre-designated fluid levels are maintained in each of the water tanks.

Another prior art system, disclosed in US Patent 6,420,794 discloses a hydropower conversion system for circulation of water between a delivering reservoir and a receiving reservoir through hydro-turbines, pumps, and back-up reservoir. Water in the delivering reservoir is maintained at a constant functioning level by adjusting valve linked with valve control mechanism to adjust the opening and closing of passages conducting water flowing from the back-up reservoir into the delivering reservoir. Outlets allow excess water to flow out of the back-up reservoir back down to the receiving reservoir. The pumps are driven by a natural energy source such as wind or solar power.

The first prior art system includes complex valves and air to promote or sustain siphoning and siphoning flow rates. The second prior art requires pumping of the water to the delivering reservoir to maintain the constant flow of water through the hydro-turbine. To overcome the shortcomings of the prior art devices, a new and improved water lifting system based on siphoning which does not require the use of air is desired.

Accordingly, it is an object of the present invention to provide a compact and improved apparatus for lifting water or other fluids based on siphons.

It is another object of the invention to provide a method and system for lifting water which further employs the raised water to generate highly efficient, clean and low cost hydroelectric energy. The invention is self-contained, simple in installation, with limited moving parts which are arranged to be accessible by users at ground level.

SUMMARY OF THE INVENTION

In accordance with these and other objects, the present invention provides, in an embodiment, a new and improved apparatus and method for lifting fluid such as water from a first relatively lower position to a second relatively raised position. More particularly, the method of lifting a fluid from a relatively first lower position to a second relatively raised position involves the step of moving fluid in a generally upward direction from a lower reservoir to an upper tank. The fluid from the fluid

source is initially pumped upwardly to the upper tank at a higher rate that the fluid exits from the upper tank to drive a turbine. The pump is switched off once the upper tank is filled and siphon action is initiated.

The method of lifting water relies on the end of one or more siphon conduits to be in fluid connection with the lower reservoir and discharging the fluid from the lower reservoir into the upper tank via the siphon conduits. The fluid entering the inlet opening of the source siphon conduits may be filtered to ensure there is no clogging. The fluid level in the lower reservoir may be monitored by sensors and replenishes when the level drops to a critical level. The siphon conduits are arranged to discharge fluid into the upper tank from a level higher than the roof of the upper tank so that the upper tank may be completely filled.

The present apparatus for lifting water from a relatively lower position to a second relatively raised position includes a lower reservoir and an upper tank and one or more siphon conduits.

The apparatus may include a means for commencing the siphoning flow through the one or more siphon conduits. A standard fluid transfer pump such as a piston pump may be used to pump fluid from the lower reservoir to the upper tank to initiate fluid flow through the one or more siphon conduits.

A discharge conduit extending from the bottom conical end of the upper tank allows the fluid in the tank to be discharged by gravity. A one-way flow valve may be provided in the discharge conduit to control the rate of fluid flows from the upper tank, where at steady state the valve is fully opened, and the flow rate is constant. The discharge conduit directs the fluid discharge to drive a water turbine.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a hydroelectric generator in accordance with a preferred embodiment of the present invention.

FIG. 2a and FIG. 2b are the respective side view and back view of the hydroelectric generator of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1**, **2a** and **2b**, a preferred embodiment of a new and improved hydroelectric generator in accordance with the principles of the present invention is generally designated as **100**. Hydroelectric generator **100** includes four siphon conduits **12** and a power generation unit **30**. Water is lifted through conduits **12** from lower reservoir **16** to an upper tank **50**. The water is then channeled via a discharge conduit **15** from the raised position of upper tank **50** down to power generation unit **30** which produces electrical power. Power generation unit **30** is arranged above lower reservoir **16** so that the water discharged by power generation unit **30** naturally flows back into lower reservoir **16**.

Upper tank **50** may be in one-way fluid communication with lower reservoir **16** such that water can only flow in the direction from lower reservoir **16** to tank **50**.

In accordance to the preferred embodiment of the invention, upper tank **50** is airtight and is a cylindrical conical tank of capacity 1,000 m³, diameter 2 meters and elevated 10 meters above lower reservoir **16** and preferably constructed in steel. Upper tank **50** having alternative shapes, such as for example circular vessels, or alternative height, width and length dimensions may be used without departing from the spirit of the invention.

Support structure **25** is used to support upper tank **50** at its elevated position. Support structures **25** may be constructed from steel, however, support structures constructed from other materials, such as for example wood or engineering polymers, are also considered to be within the scope of the invention.

In the present embodiment, four siphon conduits **12** are used to siphon water from lower reservoir **16** to upper tank **50**. Siphon conduits **12** are arranged to discharge water into tank **50** through the tank roof and from a height higher than the roof to enable complete filling of tank **50**. Water may be sourced from wells, rivers or bodies of water at the convenience of the user. The water is preferably filtered before it is filled into lower reservoir **16** to prevent clogging. The capacity of lower reservoir **16** is larger than the capacity of upper tank **50**, preferably at least 2 times to 3 times the capacity of upper tank **50**.

The diameter of the siphon conduits **12** is about 1 inch such that the total volume of water siphoned by conduits **12** is equal to the total volume of water flowing out of discharge conduit **15**. Siphon

conduits **12** are preferably constructed from a non-corrosive metal, such as for example stainless steel, however other materials apparent to one skilled in the art, such as polyvinyl chloride (PVC) pipe or other engineering polymer tubing, may be used without departing from the spirit of the invention.

In a preferred embodiment, the lowest most section of siphon conduits **12** are connected to a fluid pump **20**. Fluid pump **20** may be battery or solar powered and pumps water from reservoir **16** into each of the conduits **12** to initiate the flow of water through siphon conduit **12**. Valves **2** are provided to allow shutting off the connection of pump **20** to the conduits **12** when necessary. During the initialization process, valves **2** are set to an open state and the pump **20** is operated to pump water from reservoir **16** to tank **50**. Discharge conduit **15** is closed. The rate of water pumped into tank **50** is arranged to be higher than the rate of water discharged through discharge conduit **15** and tank **50** is gradually filled with water. Overflow conduit **13** is in fluid connection with upper tank **50** and extends downwardly from the tank's roof to an open end for fluid to exit the tank out through the open end of conduit **13**. An on/off valve **3** is provided to set conduit **13** to an open or closed state. During the initialization stage, overflow conduit **13** is in the open state. As water gradually fills tank **50**, air in the tank is pressurised and escapes through overflow conduit **13**.

When tank **50** is filled with water, excess water escapes through overflow conduit **13**. At this moment, valve **3** of overflow conduit **13** and valves **2** are closed, pump **20** is shut off and the valve for discharge conduit **15** is open simultaneously. Water discharges from upper tank **50** through discharge conduit **15**, a decrease in pressure is created in upper tank **50** thereby drawing water from lower reservoir **16** through siphon conduits **12**. Steady state flow is achieved at this point.

In the event external factors, such as for example the infiltration of gases into siphon conduit **12** or discharge conduit **15**, should interrupt the siphonic flow, the relevant valves are opened and fluid pump **20** may be operated to reestablish a stable siphonic flow.

While a fluid pump is used in the preferred embodiments of the present invention, other mechanisms for initiating or maintaining siphonic flow apparent to one skilled the art are also considered to be within the scope of the invention.

Prior to operation of hydroelectric generator **100**, lower reservoir **16** is filled with water to a pre-determined starting fill level. Once water has reached the designated fill level, fluid pump **20** is

started to initiate the flow of water through siphon conduit **12**. Once a steady state flow is achieved, the fluid pump is turned off.

During steady state operation of hydroelectric generator **100**, water is siphoned via siphon conduits **12** from lower reservoir **16** into upper tank **50**. The water flowing into upper tank **50** is directed downward to power generation unit **30** via the discharge conduit **15**. Power generation unit **30** includes a water turbine and a generator as is known to one skilled in the art. The flowing water turns the turbine which in turn drives the generator which produces electricity. To smoothen the power delivered to the generation unit **30**, variable gears and flywheel may be included in power generation unit **30**. For the present embodiment, water lifted to approximately 10 meters and is discharged through discharged conduit **15** for generation of electricity. The prototype with 1,000 m³ of water capacity in upper tank 12 is able to generate 5KW of electricity.

While the invention has been described with specific embodiments, other alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to include all such alternatives, modifications and variations set forth within the spirit and scope of the appended claims.