A stream energy extraction device including endless ropes running around sheaves, there being connected, along at least one rope, submerged sail- or vane-like elements. Flowing water causes the sail- or vane-like elements to be moved through the water, whereby at least a portion of the stream energy of the water is transmitted to the rope. A channel encloses at least a portion of the rope that is traveling in an upstream direction.
STREAM ENERGY EXTRACTION DEVICE

BACKGROUND INFORMATION

[0001] 1. Field of the Invention
This invention relates to a stream energy extraction device. More particularly, it relates to a stream energy extraction device for extracting energy from flowing water. More particularly yet, the invention relates to a system that uses sail-like elements to capture flow energy.

[0002] 2. Description of the Prior Art
The prior art in the field of stream energy extraction devices includes ropes running around at least two sheaves, there being sail- or vane-like elements connected along the rope. By a rope is meant, in this connection, any form of elongated flexible element such as a fiber rope, wire or chain. Along one portion of its longitudinal extent, the rope extends at one angle relative to the direction of flow, and in another portion of its longitudinal extent, at a different angle relative to the direction of flow.

[0003] The operation of stream energy extraction devices working according to this principle is conditional on the rope having to be moved, in a portion of its longitudinal extent, in a direction in which one component of the moving direction is up-stream. It is usual for the sail- or vane-like elements to be brought, during this part of the movement, to take a position in which the flow resistance in the water is substantially reduced.

[0004] The GB document 2131490 deals with a device of this kind, in which vanes are folded in to reduce the viscous forces acting on the vanes along the return path.

[0005] Even if the sail- or vane-like elements are brought, during the upstream movement, to take such a position, the rope and elements are subjected, during the upstream movement, to viscous forces which cause the power output of the stream energy extraction device to be reduced to a considerable extent.

[0006] The invention has for its object to remedy or reduce at least one of the drawbacks of the prior art.

BRIEF SUMMARY OF THE INVENTION

[0007] The object is achieved according to the invention through the features which are specified in the description below and in the claims that follow.

[0008] A stream energy extraction device in accordance with the invention includes at least one endless rope that runs in an endless path about the sheaves. Sail- or vane-like elements are connected along at least one endless rope and are submerged in flowing water. These elements are also referred to hereinafter as vanes, for purposes of simplicity, but it is understood, that the construction of the vanes is not limited by this word, but rather, encompasses any suitable construction of a foil or sail device for capturing stream energy. The flowing water has a stream energy that causes the sail- or vane-like elements to move through the water, whereby at least a portion of the stream energy in the water is transmitted to the rope. The stream energy impinging on the vanes forces the rope to run, whereby, because of the endless path of the rope at least a component of the moving direction of the rope is upstream. In the stream energy extraction device according to the invention, at least a portion of the component of the rope that is traveling in the up-stream portion of the path is enclosed in a channel.

[0009] The channel may be completely or partially closed, so as to form a shielding against the flowing water. Furthermore, the channel may be provided with covers or closing mechanisms which are arranged to reduce or stop water from flowing in the direction of flow of the surrounding water, i.e., in the downstream direction of flow. For example, possibly guide vanes or pipes may be provided, which cause the water in the channel to flow in the same direction as the travel direction of the rope.

[0010] The water flow in the channel may be an upstream flow, or at least, if flowing in the downstream direction, have a lower downstream speed, relative to the speed of the surrounding water flow.

[0011] It is the most advantageous for the flow rate and direction in the channel to be approximately equal to the moving speed and direction of the rope. A pump may supply the channel with water, whereby the flow rate and direction of flow in the channel is controlled by means of the pump.

[0012] Advantageously, the pump is driven by the water flow at the channel.

[0013] The invention contributes to the output power from a stream energy extraction device of this kind being increased to a considerable extent. The invention thereby provides for practical utilization of flowing water for energy production, also in regions with insignificant head and a relatively slow flow of water.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 shows schematically a stream energy extraction device according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] FIG. 1 illustrates schematically a preferred embodiment of a stream energy extraction device 1 according to the invention. This illustration is an example only of a preferred embodiment and is not intended to limit the invention to this particular embodiment. The stream energy extraction device 1 comprises a rope 2 that runs about a plurality of sheaves 4, 4’ and 4”, and a number of sail-like elements or vanes 6 that are connected to the rope 2. The vanes 6 are spaced apart, as illustrated.

[0016] A pump or generator 8 is connected to the sheave 4 by means of a driving element 10, so as to extract energy from the stream energy extraction device 1.

[0017] The general direction of flow of the water is indicated by the arrows 12 and the moving direction of the rope 2 is indicated by an arrow 14.

[0018] Between the sheave 4 and the sheave 4” the rope 2 is moved in one direction relative to the direction of flow 12. In a manner known per se, the vanes 6 assume a favorable relative position relative to the direction of flow 12 to pick up stream energy from the water.

[0019] By means of control organs, not shown, the vanes 6 change direction at the sheave 4, assuming a second favorable relative position relative to the direction of flow 12.

[0020] Between the sheaves 4” and 4, the rope 2 is moved in an upstream direction. The vanes 6 here assume a position in which they present the least resistance to the water flow or are braked to the least extent possible by the water flow.

[0021] A closed channel 16 encloses the rope 2 and the vanes 6 at least along a portion of the space between the sheaves 4” and 4.
In this preferred exemplary embodiment, a pump, indicated by paddle wheels 18 in FIG. 1, is provided to pump water in an upstream direction through the channel 16. The pump 18 is driven by the flowing water along the channel 16 and may be constituted by a mechanical or flow-technical device according to the prior art known per se.

The channel 16 is provided with an inflow conductor pipe 20 and an out-flow conductor pipe 22 which are both arranged to contribute to an improved flow in the channel 16. The upstream flow of water in the channel 16 in the upstream path of the rope 2 and the vanes 6 attached thereto substantially eliminates energy losses that would normally result from upstream travel of the rope 2 and the vanes 6 through a downstream flow.

A stream energy extraction device for use in water having a downstream flow; the stream energy extraction device comprising:

- a plurality of sheaves;
- at least one endless rope that runs in an endless path about the plurality of sheaves, the endless path including a downstream path and an upstream path;
- a plurality of vanes that are connected to the at least one endless rope; and
- a channel having an inflow and an outflow, so as to create a flow in the channel that has a channel flow strength that is diminished relative to a downstream flow strength in the channel, wherein the channel is disposed so as to enclose a portion of the at least one endless rope and the vanes that are traveling through the upstream path and to exclude a portion of the endless rope and the vanes that are traveling through the downstream path;

wherein the downstream flow impinges on the vanes and forces the at least one endless rope to run about the sheaves; and

wherein the channel flow strength in the channel reduces energy losses resulting from travel of the at least one endless rope and the vanes through the upstream path.

1. The stream energy extraction device of claim 1, further comprising a pump;
2. The stream energy extraction device of claim 1, further comprising a pump;
3. The stream energy extraction device of claim 2, wherein the pump is drivable by means of water flow at the channel.
4. The stream energy extraction device of claim 1, wherein the inflow of the channel is an inflow conductor pipe.
5. The stream energy extraction device of claim 1, wherein the outflow of the channel is an outflow conductor pipe.
6. The stream energy extraction device of claim 1, further comprising power generation apparatus that is coupled to one of said plurality of sheaves, so as to generate power from flow energy captured by the vanes from said downstream flow.

7. The stream energy extraction device of claim 2, wherein the pump pumps water in an upstream direction through the channel, so as to create an upstream flow in the channel.

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