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Description

The invention relates to an energy conversion device for converting water energy into electric energy. The invention further relates to an energy conversion arrangement
5 having several energy conversion devices.

Various hydroelectric power plants are known from the state of the art.

DE 10 2006 006 260 A1 relates to a compact and easy-to-handle device for generating electrical energy. Such a device should be suitable for mobile operation on sailing boats, for transportable/quasi-stationary operation when camping or trekking and/or for
10 stationary operation in huts or in vacation resorts.

DE 10 2007 057 267 A1 relates to a device for the regenerative generation of electrical energy from wind energy over the open water of an ocean, sea or an inland water. The electrical energy generated is to be used in electrolysis plants for the production of hydrogen and oxygen and/or for a methanol or ammonia synthesis plant.

15 GB 2 001 396 A shows a device for converting tidal energy. Such a device is intended to generate electrical energy from the tidal movement of water.

US 2017/082086 A1 also relates to a device for generating electricity from a tidal or ocean current. Such a device should be easier to manufacture, install, operate and repair than conventional devices for generating electricity from a tidal or ocean current.

20 DE 20 2010 006 722 U1 shows funnel-shaped devices. Such devices are intended to increase the exit velocity during or after the exit of flows from the funnels.

US 2011/194927 A1 focuses on a small hydroelectric power plant intended to be used to generate electrical energy with an output of, for example, one hundred kilowatts from a stream or river in which the available hydraulic height is between one and eight meters.
25 Such a system is intended to make an economical and disturbance-free hydroelectric power plant accessible on a siphon basis.

JP S58 178881 A relates to a wave energy conversion device. Such a device is intended to convert wave energy into air energy and then into electrical energy.

US 2019/234369 A1 is aimed at a system for generating ocean current energy. Such a
30 system should not use underwater turbine generators, can be built at low cost and

requires low maintenance costs. Furthermore, such a system should have a low impact on fisheries and not generate magnetic field disturbances to marine life. To date, there have not been any hydroelectric power plants which can harness strong currents and/or high waves in order to generate electricity with little outlay. In particular, steep rock faces
5 by the sea, against which high waves strike, are not considered to be a suitable location for generating electricity.

The object which formed the basis of the present invention was to provide an energy conversion device for converting water energy into electric energy, which is no longer fraught with the disadvantages of the prior art. In particular, the object which formed the
10 basis of the invention was to provide an energy conversion device which guarantees a particularly efficient conversion of water energy. The object which preferably formed the basis of the invention was to provide an energy conversion device which is particularly suitable for extracting electric energy from strong currents and/or high waves. Alternatively or additionally, the object which formed the basis of the invention was to
15 provide an energy conversion device which is location-independent and/or which can be deployed at any installation site. In particular, the object which formed the basis of the invention was to provide an energy conversion device of any size. Another or additional object was to provide an energy conversion device which is easily feasible for anyone, in particular laymen, untrained users and private users. Furthermore, an object was in
20 particular to provide an energy conversion system which can be produced and/or which is to be operated in a particularly environmentally friendly manner.

Accordingly, an energy conversion device for converting water energy into electric energy is provided, which comprises at least one rotor and a flow housing. In particular, the energy conversion device is provided for converting water energy from waves into electric
25 energy. Alternatively or additionally, the energy conversion device can be provided for converting water energy of a flow, such as an ocean current, into electric energy. In contrast to conventional offshore wind power plants, the energy conversion device according to the invention makes it possible to extract energy constantly around the clock. Unlike wind which occasionally ceases or wind which blows too strongly for
30 conventional wind power plants, waves and water currents, in particular ocean currents, are constantly available regardless of the weather.

The at least one rotor has a rotor rotational axis, the alignment of which is fixed by a supporting frame. The rotor is preferably fixed to the supporting frame by a mechanical connection. The fixing of the rotor determines the alignment of the rotor rotational axis.

It is clear that the rotor can be rotated; the fixing of the rotor, for example to the supporting frame, supports the basic functionality of the rotor and does not adversely affect it. In order to fix the rotor to the supporting frame, known mechanical devices such as radial bearings, axial bearings and/or plain bearings can be provided. The at least one
5 rotor can comprise several rotor blades extending radially to the rotor rotational axis. The rotor is preferably adapted and arranged to harness power or electric energy as so-called "blue energy" from the inexhaustible energy source in the form of water in the sea or other moving bodies of water with the aid of the resistance principle. It is clear that the term rotor in the present disclosure comprises impellers and/or turbines and the like,
10 which are adapted and arranged to capture water energy and to transfer it into a rotational movement for conversion into electric energy, in particular by means of a generator.

The flow housing comprises a rotor mantle which surrounds the rotor radially to the rotor rotational axis. The rotor mantle preferably surrounds the rotor in its entirety. The
15 rotor mantle is preferably tubular. In particular, the rotor mantle completely surrounds the area spanned by the rotor blades of the rotor, preferably without contact. The flow housing is preferably adapted and arranged to guide the water moving in the flow housing in order to drive the rotor, in particular according to the resistance principle.

The flow housing further comprises a catching apparatus upstream of the rotor mantle, which is adapted and arranged to guide a movement of water to the rotor. The catching
20 apparatus is preferably stationary with respect to the rotor mantle. The rotor mantle and the catching apparatus can be formed in one piece. The catching apparatus can, for example, be funnel-like. With the aid of the rotor mantle and the catching apparatus, a forced flow through the rotor surface can be achieved. By guiding the movement of water
25 to the rotor, a particularly high yield of the energy conversion apparatus can be achieved.

In a further development of the invention, the catching apparatus extends like a channel, in particular in a cylindrical or cuboidal manner, from the rotor mantle. Alternatively or additionally, the catching apparatus has a round, in particular circular or elliptical, cross
30 section or angular, in particular polygonal, preferably square, cross section. The cross-sectional shape and/or channel extension of the catching apparatus is preferably adapted to the local conditions of the energy conversion device. In particular, the cross-sectional shape and/or channel extension can be adapted and arranged to guide and/or divert water from a prevailing direction of movement in order to align the rotor rotational axis. For example, the rotor rotational axis can be vertically aligned and the channel-like

catching apparatus can extend obliquely from the rotor mantle in order to guide a surface wave movement toward the rotor.

In energy conversion device according to the invention having a catching apparatus at least one, in particular funnel-shaped, preferably continual or stepped, cross-sectional tapering is arranged at the end of the catching apparatus facing the rotor mantle. A stepped cross-sectional tapering can be produced in a particularly simple and, therefore, inexpensive manner. A continual (step-free) cross-sectional tapering can be provided in order to produce a continual deflection of a flow. The cross-sectional tapering is preferably stationary with respect to the rotor mantle and/or the catching apparatus. The cross-sectional tapering has an inlet cross section and an outlet cross section. The inlet cross section and the outlet cross section preferably have the same cross-sectional shape. The inlet cross section is larger than the outlet cross section. A diagonal extension of the inlet cross section is preferably 1.1 to 10 times, in particular 1.5 to 5 times, preferably approximately 2 times as large as a diagonal extension of the outlet cross section. The cross-sectional tapering comprises, in particular, an inflow opening formed by the catching apparatus, which is larger than the cross-sectional area of the rotor mantle. The speed of the water and, optionally, of the air in the region of the rotor can be significantly increased by the cross-sectional tapering, compared to the speed in the surroundings of the energy conversion device, in particular by at least 20%, preferably by at least 40%, particularly preferably by at least 60%. By increasing the water, a particularly high yield can be achieved with the energy conversion unit according to the invention.

The catching apparatus of the energy conversion device according to the invention comprises at least one manifold. In particular, the manifold has an inner manifold wall and an outer manifold wall. The inner manifold wall is shorter than the outer manifold wall. In particular, the inner manifold wall is rounded or angular. Alternatively or additionally, the outer manifold wall has a rounded or angular progression. The manifold is preferably adapted and arranged to deflect a flow of water from a first direction of movement at the inlet of the manifold into a second direction of movement. The manifold preferably produces a deflection of the first direction of movement in the range of 30° to 180°, in particular in the range of 45° to 135°, preferably in the range of 70° to 110°, particularly preferably in the range of 90° ± 10°. For example, a substantially horizontal flow movement can be converted into a substantially vertical flow movement with the manifold. It can be preferred that the catching apparatus comprises an manifold and a cross-sectional tapering. In particular, a transition from the manifold to the cross-

sectional tapering can be continual. The manifold and the cross-sectional tapering preferably have the same, for example round, in particular oval or circular, or angular, in particular rectangular or polygonal, cross-sectional shape. The manifold and the cross-sectional tapering can be executed in a functional union, i.e., the catching apparatus can be formed by an manifold having an integrated cross-sectional tapering at least in sections. The cross-sectional tapering can be formed by inner and outer manifold walls aligned obliquely with one another. The manifold of the cross-sectional tapering is upstream with respect to the direction of movement of the water. The inner and the outer manifold walls can be aligned parallel to one another. With the aid of a catching apparatus which is equipped with an manifold and/or a cross-sectional tapering, an energy conversion device having a high yield and a particularly compact design can be achieved. The low material requirement during production, as well as low production and maintenance costs of the energy conversion device according to the invention additionally advantageously serve to protect resources. For example, it is possible to refrain from using rare metals.

According to the invention, the energy conversion device comprises a mounting, on which the supporting frame is movably held transversely, in particular orthogonally, and/or parallel to the direction of the rotor rotational axis. The rotor is fixed to the supporting frame. In particular, the mounting is a rail mounting. The supporting frame fixes the rotor and, therefore, the alignment of the rotor rotational axis. With the aid of the mounting, the supporting frame can be vertically movable, for example, in order to adapt the alignment of the rotor rotational axis to a prevailing water level, in particular tidal height. In this case, the orientation of the rotor rotational axis can remain constant and a preferably exclusively translational movability in the vertical direction and/or horizontal direction can be provided with the aid of the mounting. Such an energy conversion device can be deployed, for example, on rocks, in particular steep rock faces, and/or near the beach. In principle, it is conceivable to install or erect the energy conversion device according to the invention in any location, for example on land.

In another embodiment of an energy conversion device, which can be combined with the previous ones, the rotor can be displaced in the vertical direction and/or in the horizontal direction, preferably transversely, in particular orthogonally, or parallel to the rotor rotational axis, in particular between at least two rotor positions with parallel rotational axis alignments and/or relative to the supporting frame. The rotor can, for example, be displaced relative to the supporting frame in order to bring it, on the one hand, into an

operating position in contact with the water and, on the other hand, into a resting and/or service position outside the water. According to the invention the rotor is displaceable in order to guarantee an adaptation to the prevailing flow and/or the prevailing water level.

Alternatively or additionally, in one embodiment of an energy conversion device, the rotor is movable in a swiveling manner transversely to the rotor rotational axis, preferably about an in particular vertical swiveling axis and/or an in particular horizontal tilting axis. The rotor can be moved in a swiveling manner about several axes, for example about a swiveling axis and a tilting axis orthogonal thereto. The swiveling axis and/or the tilting axis are aligned transversely, preferably orthogonally, with respect to the rotor rotational axis. In particular, the rotor can be swiveled between at least two rotor orientations, in particular relative to the supporting frame, for example by approximately 45° or approximately 80°. In particular, the rotor can be rotated about the swiveling axis and/or about the tilting axis by at least 15°, in particular at least 45°, preferably at least 60°, and/or by not more than 360°, in particular not more than 180°, preferably not more than 120°. A rotor orientation can be determined on the basis of the angle alignment of the rotor rotational axis. For example, the rotor orientation can be pivoted about a substantially vertical swiveling axis, in order to be adaptable to prevailing flow conditions, for example on a beach. Alternatively or additionally, the rotor orientation can be pivoted about a substantially horizontal tilting axis, in order to be adaptable to a prevailing water level, for example a tidal height.

According to a preferred further development of the invention, the energy conversion device comprises an actuating device which is adapted and arranged to adjust the rotor position and/or the rotor orientation. In particular, the actuating device is mechanical, pneumatic, hydraulic and/or manual.

In a particularly preferred embodiment of an energy conversion device according to the invention, the rotor rotational axis is aligned in the horizontal direction. In particular, the alignment of the rotor rotational axis can be constantly aligned in the horizontal direction. The alignment of the rotor rotational axis can be fixed for a single determined horizontal direction. Alternatively, a movability of the rotor rotational axis with a constant horizontal alignment can be provided. For example, the rotor rotational axis can be movable in a translational manner with a constant horizontal alignment. Alternatively or additionally, the rotor rotational axis can be movable in a swiveling manner with a constant horizontal alignment, in particular about a vertical swiveling axis.

According to another particularly preferred embodiment of an energy conversion device, the rotor rotational axis is aligned in the vertical direction. In particular, the energy conversion device is adapted and arranged to convert water energy from a waterfall or waves on a steep shore. The alignment of the rotor rotational axis can be directed vertically upward for a waterfall. When used on a steep shore, the alignment of the rotor rotational axis can be directed vertically downward. In particular, the alignment of the rotor rotational axis can be constantly aligned in the vertical direction. The alignment of the rotor rotational axis can be fixed for a single determined vertical direction. Alternatively, a movability of the rotor rotational axis with a constant vertical alignment can be provided. For example, the rotor rotational axis can be movable in a translational manner with a constant vertical alignment.

In one embodiment of an energy conversion device, the flow housing can preferably comprise at least one sail which, at least in sections, forms a surface of the flow housing, in particular of the catching apparatus, preferably of an, in particular funnel-shaped, cross-sectional tapering and/or of the rotor mantle. In particular, the flow housing can be formed from one or more sails. Such an embodiment can be implemented in a particularly inexpensive manner.

A particular embodiment of an energy conversion device according to the invention comprises a float such as a boat, ship, barge, pontoon, a buoy, an oil drilling platform or the like, to which the supporting frame, to which the rotor is fixed, is fastened. In particular, the supporting frame fastened to the float can be executed like the supporting frame described above.

According to another particular embodiment of an energy conversion device, the supporting frame is provided, to which the rotor is fixed. The supporting frame is fastened to a foundation on the bottom, such as a seabed, a shore, a steep bank, a rock face or a rock bed. It is clear that this particular embodiment can be combined with the aforementioned embodiment which includes a mounting, in particular a rail mounting.

In a preferred embodiment of the energy conversion device, the supporting frame of the energy conversion device is fastened to a dam wall, such as a dam, a weir, a hydroelectric power plant or the like. The rotor is fixed to the supporting frame. The energy conversion device is suitable, for example, for equipping or retrofitting existing dam walls of any kind.

According to an embodiment of an energy conversion device, which can be combined with the previous ones, a plurality of rotors arranged behind one another, in particular having coaxial rotor rotational axes, in particular a single coaxial rotor rotational axis, is provided. Alternatively or additionally, the plurality of rotors arranged behind one
5 another can be connected to the same rotor shaft, in particular in order to drive the same generator(s) in order to generate electric energy. The plurality of rotors can be similar or different, for example have variously shaped rotor blades, different rotor blade numbers, different rotor diameters and the like. Several or all of the plurality of rotors can be housed in the same rotor mantle.

10 Additionally or alternatively, one embodiment of an energy conversion device, which can be combined with the previous ones, can comprise at least one retaining apparatus, arranged in particular behind the rotor. The retaining apparatus can be formed, for example, as an individual retaining flap or several retaining flaps. The retaining
15 apparatus, in particular the retaining flap, is adapted and arranged to allow a flow of water in a first direction through the flow housing, and to prevent a flow of water in a second direction opposite to the first direction. In this way, it can be guaranteed that water flow(s) towards the rotor exclusively in a single predetermined direction of movement.

The invention also relates to an energy conversion arrangement which comprises several
20 energy conversion devices. According to a preferred embodiment, the several energy conversion devices are arranged at least partially behind one another, in particular parallel to the rotational axis. Alternatively or additionally, the several energy conversion devices can be arranged at least partially above one another and/or next to one another, in particular parallel to the rotational axis. By using several energy conversion devices in
25 combination with one another, a high yield of electric energy from water energy can be extracted at suitable locations.

Further features and advantages of the invention are set out by the following description, in which embodiments of the invention are explained by way of example on the basis of schematic drawings, without restricting the invention, wherein:

30 Fig. 1 shows a schematic representation of an energy conversion device according to the invention having a vertical rotor rotational axis on a rock face;

- Fig. 2a shows a lateral view of an energy conversion device having a catching apparatus with a rectangular cross section;
- Fig. 2b shows a front view of the energy conversion device according to Fig. 2a;
- 5 Fig. 2c shows a top view of the energy conversion device according to Fig. 2a;
- Fig. 3a shows a lateral view of an energy conversion device having a catching apparatus with a round cross section;
- Fig. 3b shows a front view of the energy conversion device according to Fig. 3a;
- 10 Fig. 3c shows a top view of the energy conversion device according to Fig. 3a;
- Figs. 4 to 11 show various schematic representations of energy conversion devices according to the invention having different catching apparatuses;
- 15

For ease of reading, the same or similar reference numerals are used for the same or similar components in various embodiments in the following description of preferred embodiments of the invention.

- 20 The energy conversion device 1 is adapted and arranged according to the invention to convert water energy into electric energy. An energy conversion device 1 according to the invention comprises, as main components, a rotor 3 and a flow housing 5, in which the rotor 3 is housed. The rotor 3 has a rotor rotational axis D, the alignment of which is fixed with respect to, for example, the horizontal H and the vertical V. For this purpose,
- 25 the rotor 3 can be held, for example, by a supporting frame 7. The flow housing 5 is equipped with a rotor mantle 53 which surrounds the rotor 3 radially to the rotor rotational axis D.

Fig. 1 shows an energy conversion device 1 on a rock face 93. The rock face 93 extends substantially in the vertical direction V. On the rock face 93, a foundation 9 is provided, to which a supporting frame 7 of the energy conversion device 1 is anchored.

5 The rotor 3 is fixed, in the embodiment shown in Fig. 1, with a rotor rotational axis D oriented in the vertical direction V. The configuration of the rotor 3 is such that water moving in the vertical direction V upward through the rotor mantle 53 flows into it and drives it. In order to feed the waves 94 to the rotor 3 and to deflect the movement of the water into a substantially vertically upwardly directed direction of movement, the flow housing 5 is adapted and arranged upstream of the rotor mantle 53. To this end, the flow housing 5 is equipped with a catching apparatus 51. The catching apparatus 51 is composed of an manifold 57 and a funnel-shaped cross-sectional tapering 52. The catching apparatus 51, i.e., the manifold 57 and the cross-sectional tapering 52, as well as the rotor mantle 53 are fastened to the supporting frame 7 rigidly and in a stationary manner relative to one another. The flow housing 5 can, for example, be embodied like the one described below with respect to Figs. 2a to 2c. Downstream of the rotor mantle 53, a retaining apparatus, which is not shown in greater detail, for example a retaining flap, can be provided, which allows water to move upward in the vertical direction V through the flow housing 5 and which prevents water from flowing downward in the vertical direction V through the flow housing 5.

20 The supporting frame 7 is equipped with a rail mounting 8. Thanks to the rail mounting 8, the energy conversion device 1 can be moved in the vertical direction V. Depending on the currently prevailing tidal height, the position of the energy conversion device 1 and, in particular, the rotor position can be adjusted with the aid of the mounting 8 in order to optimally capture the energy of the waves 94, for example depending on the tidal height and/or the prevailing waves. In an exemplary embodiment, the rotor orientation, i.e., the alignment of the rotor rotational axis D, is constantly fixed in accordance with the vertical direction V. Alternatively, the energy conversion device can be swiveled about a first horizontal swiveling axis S and/or a second horizontal tilting axis (in the direction of the drawing plane) in order to be adjustable to a prevailing flow direction.

30 Figs. 2a to 2c show various views of the flow housing 5 of an energy conversion device 1. The rotor mantle 53 has a circular cross section. The manifold 57 of the catching apparatus 51 has a square cross section. The cross-sectional tapering 52 is funnel-shaped and has the same square cross section as the manifold 57 at the inlet and the same circular cross section as the rotor mantle 53 at the outlet. The rectangular cross section

of the manifold 57 is offset by approximately 60° on the outlet side (in the direction of the rotor 3) in relation to the rectangular cross section 54 of the manifold 57 on the inlet side (facing the waves 94). The manifold 57 produces a deflection of the direction of movement of the water starting from the horizontal direction H of the waves 94 into a substantially vertical, upwardly directed direction V by approximately 90° .

Figs. 3a to 3c show an alternative configuration of a flow housing 5 for an energy conversion device 1. The flow housing 5 shown in Figs. 3a to 3c differs substantially from the flow housing 5 described above with respect to Figs. 2a to 2c only in the continually circular cross section 55. In other respects, reference is made to the previous embodiments.

As shown in Figs. 2a to 3c, a swiveling axis S and a tilting axis K orthogonal thereto can be provided, relative to which the flow housing 5 can be moved in a swiveling manner. An actuating device, which is not shown in greater detail, which can be actuated, for example, mechanically, pneumatically, hydraulically or manually, can produce an alignment of the flow housing 5 with respect to the tilting and/or swiveling axis K, S.

Figs. 4 to 11 show a plurality of various configurations for flow housings 5 of various energy conversion devices 1 according to the invention. The ideal flow housing configuration can be selected depending on the local conditions. The selection of the flow housing configuration can also be made from an economic point of view, for example in terms of a simple and, therefore, inexpensive production and/or assembly. The cross-sectional shape is not shown in detail. It is clear that the flow housing 5 can be of various shapes, for example it can be shaped, at least in certain sections or completely, with a round, in particular circular or elliptical, cross section, or with, at least in certain sections or completely, an angular, in particular rectangular, particularly preferably square, or polygonal, cross section. The water inlet direction is identified with a thick, black arrow.

Fig. 4 shows an energy conversion device 1 having a catching apparatus 51 which has a larger cross-sectional width than the diagonal of the rotor mantle 53. The steplike transition between the catching apparatus 51 and the rotor mantle 53 forms a cross-sectional tapering 52 which produces a forced flow through the rotor 3 with an increased flow rate. This applies equally to the embodiment according to Fig. 5. The energy conversion devices 1 in Figs. 4 and 5 substantially only differ in that, in the embodiment according to Fig. 5, the rotor mantle 53 is arranged coaxially and centrally at the outlet of the catching apparatus 51 of the flow housing 5, whereas the rotor mantle 53 is

arranged axially parallel, but unsymmetrically offset at the outlet of the flow housing 5 shown in Fig. 4. In some embodiments, an alternative configuration having another water inlet direction is shown in accordance with a dashed arrow. In these alternative embodiments, the flow housing 5 also has a manifold 57.

5 The energy conversion devices 1, which are shown in Figs. 6 to 11, have flow housings 5 having various manifolds 57 and different cross-sectional constrictions 52. The manifolds 57 are each composed of an inner manifold wall 57i and an outer manifold wall 57a. In the case of the energy conversion devices 1 according to Figs. 8 and 10, both the inner manifold wall 57i and the outer manifold wall 57a are continually shaped in a
10 curved manner in an arc shape.

The cross-sectional tapering 52 of the energy conversion device 1 according to Fig. 8 is formed in a functional union by the manifold 57. In the case of the energy conversion device 1 according to Fig. 9 as well as those according to Fig. 10 and Fig. 11, a funnel-shaped cross-sectional tapering 52 is arranged between the manifold 57 and the rotor
15 mantle 53.

The energy conversion device 1 according to Fig. 7 has a straight inner manifold wall 57i and a continual outer manifold wall 57a running in the form of a quarter-circular arc. The energy conversion devices 1 according to Figs. 6 and 9 each have an outer manifold wall 57a which is shaped with angles. In the case of the energy conversion devices 1 of
20 Figs. 6 and 7, the cross-sectional tapering 52 is formed as previously described with respect to Fig. 4.

The manifold 57 according to Fig. 11 is formed in that the inner manifold wall 57i is shorter than the outer manifold wall 57a. The inner manifold wall 57i and the outer manifold wall 57a are substantially aligned parallel to one another. However, the
25 different lengths result in another alignment of the inlet cross section compared to the outlet cross section.

It is clear that, instead of the flow housing configurations described above with respect to Fig. 1, another flow housing configuration can be deployed, in particular one according to one of Figs. 4 to 11.

30 The features of the invention disclosed in the preceding description, the claims as well as the drawings can be essential, both individually and in any combination, for the realization of the invention in its various embodiments.

List of reference numerals

	1	Energy conversion device
	3	Rotor
	5	Flow housing
5	7	Supporting frame
	8	Rail mounting
	9	Foundation
	51	Catching apparatus
	52	Cross-sectional tapering
10	53	Rotor mantle
	54	Angular cross section
	55	Round cross section
	56	Retaining valve
	57	Manifold
15	57i	Inner manifold wall
	57a	Outer manifold wall
	58	Sail
	71	Float
	73	Dam wall
20	91	Waterfall
	93	Rock face
	94	Waves
	D	Rotational axis
25	H	Horizontal direction
	K	Tilting axis
	V	Vertical direction
	S	Swiveling axis

PATENTKRAV

1. Energikonverteringsindretning (1) til omdannelse af vandenergi til elektrisk energi, omfattende:

- 5 mindst én rotor (3) med en rotorrotationsakse (D), hvis justering er fastholdt, et strømningshus (5), som omfatter en rotorkappe (53), som omgiver rotoren (3) radialt i forhold til rotorrotationsaksen (D), hvor strømningshuset (5) omfatter en fangeindretning (51) opstrøms for rotorkappen (53), som er tilpasset og indrettet til at lede en bevægelse af vand til rotoren (3),
10 hvor mindst en tværsnitstilspidsning (52) er anbragt ved den ende af fangeindretningen (51), der vender mod rotorkappen (53), og hvor fangeindretningen (51) omfatter mindst én bukning (57), hvor bukningen er placeret opstrøms for tværsnitstilspidsningen i forhold til vandets bevægelsesretning,
15 yderligere omfattende en bæreramme (7), hvor justeringen af rotorrotationsaksen (D) er fastholdt af bærerammen (7), yderligere omfattende en montering, hvortil bærerammen (7), hvortil rotoren (3) er fastgjort, er bevægeligt holdt på tværs af og/eller parallelt med retningen af rotorrotationsaksen (D) for at tilpasse justeringen af rotorrotationsaksen til
20 en fremherskende vandstand.

2. Energikonverteringsindretning (1) ifølge krav 2, kendetegnet ved, at fangeindretningen (51) strækker sig kanalagtigt, især på en cylindrisk eller kubisk måde, fra rotorkappen (53).

25

3. Energikonverteringsindretning (1) ifølge krav 1 eller 2, kendetegnet ved, at fangeindretningen (51) har et rundt, især cirkulært eller elliptisk, tværsnit (55) eller kantet, især polygonalt, fortrinsvis kvadratisk, tværsnit (54).

30

4. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at tværsnitstilspidsningen (52) er en tragtformet, fortrinsvis kontinuerlig eller trinvis, tværsnitstilspidsning (52).

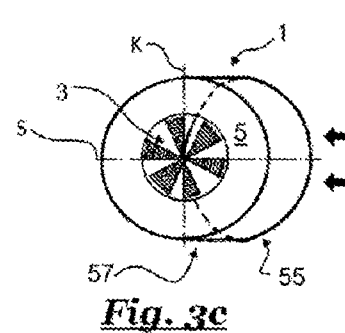
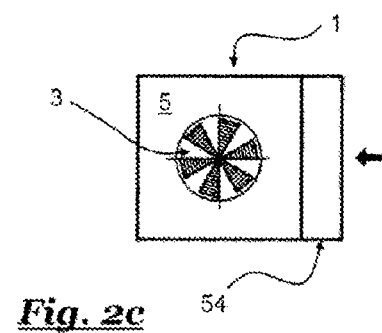
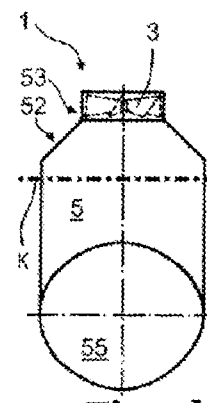
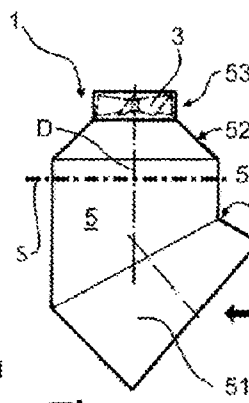
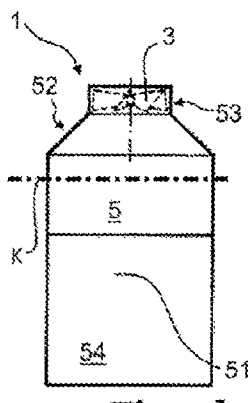
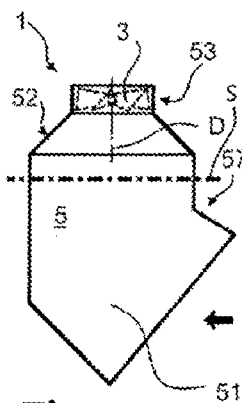
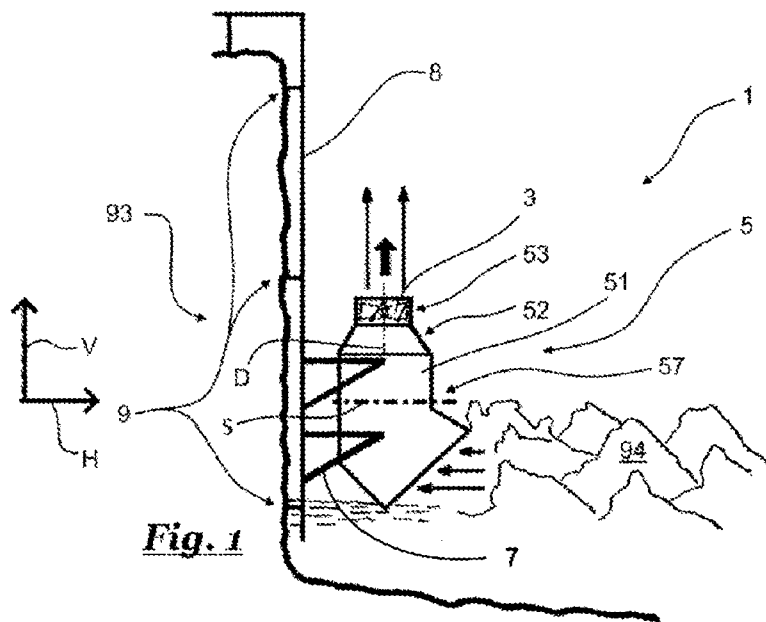
5. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at bukningen (57) har en indre bukning (57i) og en ydre buk-

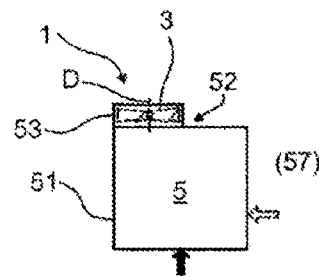
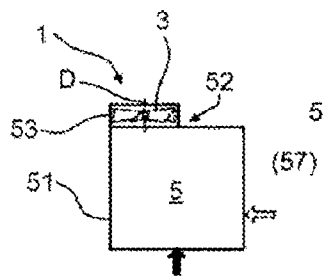
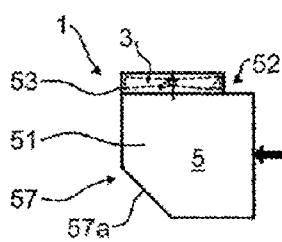
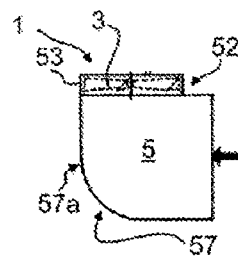
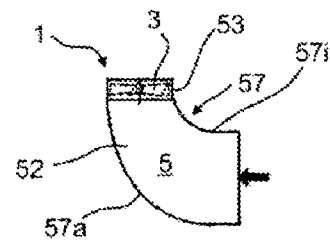
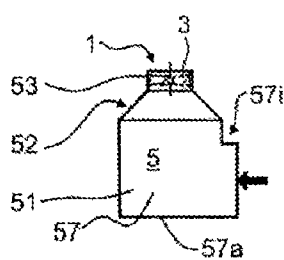
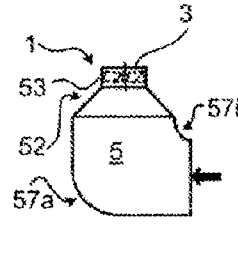
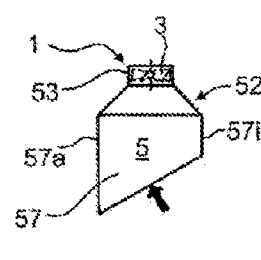
35

ningsvæg (57a), hvor den indre bukningsvæg (57i) er kortere end den ydre bukningsvæg (57a), hvor især den indre bukningsvæg (57i) har et afrundet eller kantet forløb, og/eller hvor især den ydre bukningsvæg (57a) har et afrundet eller kantet forløb.

- 5 6. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, hvor monteringen er en skinnemontering (8).
7. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, hvor bærerammen (7), hvortil rotoren (3) er fastholdt, holdes bevægeligt ortogonalt i forhold til retningen af rotorrotationsaksen (D).
- 10 8. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at rotoren (3) kan forskydes i vertikal retning (V) og/eller i horisontal retning (H), fortrinsvis på tværs af eller parallelt med rotorrotationsaksen (D), især mellem mindst to rotorpositioner med parallelle rotationsaksejusteringer og/eller i forhold til bærerammen (7).
- 15 9. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at rotoren (3) er drejeligt bevægelig på tværs af rotorrotationsaksen (D), fortrinsvis omkring en især vertikal drejeakse (S) og/eller en især horisontal vippeakse (K), især mellem mindst to rotororienteringer, især i forhold til bærerammen (7), f.eks. ca. 45° eller ca. 80°.
- 20 10. Energikonverteringsindretning (1) ifølge et hvilket som helst af kravene 8 eller 9, kendetegnet ved mindst én, især mekanisk, pneumatisk, hydraulisk og/eller manuel, justeringsindretning, som er tilpasset og indrettet til at justere rotorpositionen og/eller rotororienteringen.
- 25 11. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at rotorrotationsaksen (D) er justeret i horisontal retning (H), eller at rotorrotationsaksen er justeret i vertikal retning (V).
- 30 12. Energikonverteringsindretning (1) ifølge krav 11, kendetegnet ved, at energikonverteringsindretningen (1) er tilpasset og indrettet til at omdanne vandenergi fra et vandfald (91) eller bølger (94) på en klippevæg (93).
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13. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved, at strømningshuset (5) omfatter i det mindste et sejl (58), der i det mindste i sektioner danner en overflade af strømningshuset (5), især fangeindretningen (51), fortrinsvis af en, især tragtformet, tværsnitstilspidsning (52) og/eller af rotorkappen (53).
14. Energikonverteringsindretning (1) ifølge et hvilket som helst af kravene 2 til 13, som yderligere omfatter en flyder (71), hvortil bærerammen (7), hvortil rotoren (3) er fastholdt, er fastgjort.
15. Energikonverteringsindretning (1) ifølge et hvilket som helst af kravene 2 til 13, kendetegnet ved, at bærerammen (7), hvortil rotoren (3) er fastholdt, kan fastgøres til et fundament (9) i underlaget.
16. Energikonverteringsindretning (1) ifølge et hvilket som helst af kravene 2 til 13, kendetegnet ved, at bærerammen (7), hvortil rotoren (3) er fastholdt, kan fastgøres til en dæmningsvæg (73).
17. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved en flerhed af rotor (3), der er anbragt bag hinanden, især med koaksiale rotorrotationsakser (D) og/eller forbundet med den samme rotoraksel.
18. Energikonverteringsindretning (1) ifølge et hvilket som helst af de foregående krav, kendetegnet ved mindst én holdeindretning, der især er anbragt bag rotoren (3), såsom en holdeklap (56), der er tilpasset og indrettet til at tillade en strømning af vand i en første retning gennem strømningshuset (5), og til at forhindre en strøm af vand i en anden retning modsat den første retning.
19. Energikonverteringsarrangement, kendetegnet ved flere energiomdannelsesindretninger (1) ifølge et hvilket som helst af de foregående krav.
20. Energikonverteringsarrangement ifølge krav 19, kendetegnet ved, at de flere energiomdannelsesindretninger (1) er anbragt bag hinanden, især med parallelle rotationsakser, og/eller de flere energiomdannelsesindretninger (1) er anbragt over hinanden og/eller ved siden af hinanden, især med parallelle rotationsakser.



*Fig. 4**Fig. 5**Fig. 6**Fig. 7**Fig. 8**Fig. 9**Fig. 10**Fig. 11*