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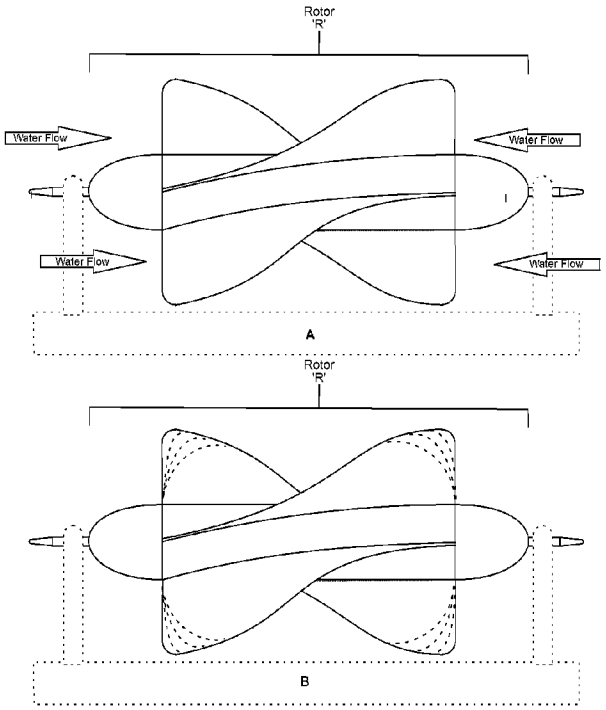
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(54) Titre : SYSTEMES D'ENERGIE ELECTRIQUE HYDROCINETIQUE SUBAQUATIQUE ET COMPOSANTES ET METHODES CONNEXES

(54) Title: SUBAQUEOUS HYDROKINETIC ELECTRIC ENERGY SYSTEMS AND RELATED COMPONENTS AND METHODS



(57) Abrégé/Abstract:
A subaqueous hydrokinetic electric energy system includes a stator including a first plurality of electricity-generating elements. The system also includes a rotor including a second plurality of electricity-generating elements. The rotor is disposed radially outward of an outer circumferential surface of the stator and is configured to rotate around the stator about an axis of rotation. The rotor is a cylindrical structure having a variable ovoid structure attached fore and aft and extending along a portion of an axial length of the stator. The system further includes at least two hydrodynamic bearing mechanisms configured to support the rotor relative to the stator during rotation of the rotor around the stator.

Subaqueous Hydrokinetic Electric Energy Systems and Related Components and Methods

Abstract

A subaqueous hydrokinetic electric energy system includes a stator including a first plurality of electricity-generating elements. The system also includes a rotor including a second plurality of electricity-generating elements. The rotor is disposed radially outward of an outer circumferential surface of the stator and is configured to rotate around the stator about an axis of rotation. The rotor is a cylindrical structure having a variable ovoid structure attached fore and aft and extending along a portion of an axial length of the stator. The system further includes at least two hydrodynamic bearing mechanisms configured to support the rotor relative to the stator during rotation of the rotor around the stator.

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SPECIFICATION

TECHNICAL FIELD

The present disclosure relates generally to subaqueous hydrokinetic electric energy systems, hydrokinetic electric turbines, and related components and methods.

INTRODUCTION

The section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described in any way.

A subaqueous hydrokinetic electric energy system may utilize a hydrokinetic electric ***turbine*** to generate electricity from the current in a moving body of water (e.g., a river, ocean current or controlled flow) or other fluid source. ***Tidal*** power, for example, exploits the movement of water caused by ***tidal*** currents, or the rise and fall in sea levels due to tides. As the waters rise and then fall, a flow, or fluid current, is generated. The one-directional flow, for example, from a river also creates a current that may be used to generate electricity. And, additional forms of differential pressure, such as, for example, that are created by dams, also can cause water to flow and create water speeds sufficient to enable the conversion of energy associated with the water's flow to other useful forms of energy.

Subaqueous hydrokinetic electric power, which relies on the natural movement of currents in a body of liquid (e.g., water), is classified as a renewable energy source. Unlike other renewable energy sources, such as wind and solar power, however, Subaqueous hydrokinetic electric power is reliably predictable. Water currents are a source of renewable power that is clean, reliable, and predictable years in advance, thereby facilitating integration with existing energy grids. Additionally, by virtue of the basic physical characteristics of water (including, e.g., seawater), namely, its density (which can be 832 times that of air) and its non-compressibility, this medium holds unique 'ultra-high-energy-density' potential in comparison to other renewable energy sources for generating renewable energy. This potential is amplified once the volume and flow rates present in many coastal locations and/or useable locations worldwide are factored in.

Subaqueous hydrokinetic electric power, therefore, may offer an efficient, long-term source of pollution-free electricity and

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other useful forms of energy that can help reduce the world's current reliance upon petroleum, natural gas, and coal. Reduced consumption of fossil fuel resources can in turn help to decrease the output of greenhouse gases into the world's atmosphere.

Electricity generation using subaqueous hydrokinetic electric turbines (which convert energy from fluid currents) is generally known. Such turbines can act like underwater windmills, and have a relatively low cost and ecological impact. In various hydrokinetic electric turbines, for example, fluid flow interacts with hydrofoil blades that rotate about an axis and that rotation is harnessed to thereby produce electricity or other forms of energy.

Subaqueous hydrokinetic electric energy systems, however, can pose various challenges relating to the stress and/or strain on the various components of the system resulting from the interaction of the relatively strong forces associated with fluid flow (e.g., moving currents which are often intermittent and turbulent or cavitation which can erode the trailing edge of hydrofoil blades and other components). Additional challenges also may arise with assembling such complex systems at an installation location.

It may, therefore, be desirable to provide subaqueous hydrokinetic electric energy systems having a robust configuration able to withstand the strong, intermittent, and turbulent forces associated with fluid flow. It also may be desirable to provide a subaqueous hydrokinetic electric energy system having a design which allows efficient assembly of the system on-site to reduce the expense of shipping the assembly from a manufacturing plant to the installation location, which in some cases may be relatively remote or difficult to access by normal large freight shipping. Other improvements to subaqueous hydrokinetic electric energy systems also are needed to improve long-term reliability, ease of manufacture, and to address problems inherent with operating in underwater environments.

SUMMARY

The present disclosure solves one or more of the above-mentioned problems and/or achieves one or more of the above-mentioned desirable features. Other features and/or advantages may become apparent from the description, which follows.

In accordance with various exemplary embodiments of the present disclosure, the subaqueous hydrokinetic electric energy system

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may include a rotor comprising a first plurality of electricity-generating elements. The system may also include a stator comprising a second plurality of electricity-generating elements. The rotor may be disposed radially outward of an outer circumferential surface of the stator and configured to rotate around the stator about an axis of rotation. The rotor may be a cylindrical structure extending along a portion of an axial length of the stator. The system may further include at least two hydrodynamic bearing mechanisms configured to support the rotor relative to the stator during rotation of the rotor around the stator.

In accordance with various additional exemplary embodiments of the present disclosure, a subaqueous hydrokinetic electric energy system may include a stator comprising a first plurality of electricity-generating elements. The system may also include a rotor comprising a second plurality of electricity-generating elements. The rotor may be disposed radially outward of an outer circumferential surface of the rotor and configured to rotate around the stator about an axis of rotation. The rotor may be a cylindrical structure in an axial direction of the rotor. The system may further include a plurality of hydrofoil blades extending radially outward with respect to the rotor and extending axially from end-to-end in a helical formation over the length of the cylinder along and being fastened to a surface of the rotor.

In accordance with various further exemplary embodiments of the present disclosure, a method of manufacturing a subaqueous hydrokinetic electric energy system may include assembling a plurality of rotors placed within the cylinder. The method may also include a plurality of small rotors forming an array of rotors around a radially inner circumferential surface of the assembled rotor.

Additional objects and advantages will be set forth in part in the description, which follows, and in part will be obvious from the description, or may be learned by practice of the present teachings. At least some of the objects and advantages of the present disclosure may be realized and attained by means of the elements and combinations particularly pointed out in the claims herein.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the present disclosure and claims, including equivalents. It should be understood that the present disclosure and claims, in their

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broadest sense, could be practiced without having one or more features of these exemplary aspects and embodiments.

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Subaqueous Hydrokinetic Electric Energy Systems and Related Components and Methods

CLAIMS

What is claimed is:

1. A subaqueous hydrokinetic electric generating system comprised of a cylinder mounted between and attached to domed shapes of the same diameter positioned fore and aft of the cylinder configured to rotate freely around a central axle.

2. The subaqueous hydrokinetic electric generating system of Claim 1, wherein the cylinder is comprised of a plurality of electricity-generating elements; a singular or plurality of rotors comprising a second plurality of electricity-generating elements, wherein the cylinder is disposed radially inward of an outer circumferential surface of the cylinder and configured to rotate around one or more stators about an axis of rotation, wherein the rotor is a cylindrical structure having a plurality of hydrofoil blades in an axial direction of the rotor; and extending radially outward with respect to the rotor, wherein all the hydrofoil blades extend outward radially from a base, the base extending axially along and being fastened to a surface of the rotor, such hydrofoil blades being parallel to each other and sweep at an angle in helical fashion sufficient to create resistance to a fluid flow from each extreme end of the cylinder causing the cylinder to rotate around the plurality of electricity-generating elements.

2. The subaqueous hydrokinetic electric energy system of Claim 1, wherein the first plurality of electricity-generating elements comprises coils, and wherein the second plurality of electricity-generating elements comprises magnets.

3. The subaqueous hydrokinetic electric energy system of Claim 1, wherein the rotor is configured to be rotated relative to the stator by a fluid flow moving in a direction of the axis of rotation.

4. The subaqueous hydrokinetic electric energy system of Claim 1, further comprising at least one electrical transmission conduit configured to transmit electricity from the electricity generating elements to a land-based electrical grid, wherein the stator comprises a passage for each conduit to run the conduit within the axle from the electricity generating elements to the land-based electrical grid.

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Subaqueous Hydrokinetic Electric Energy Systems

and Related Components and Methods

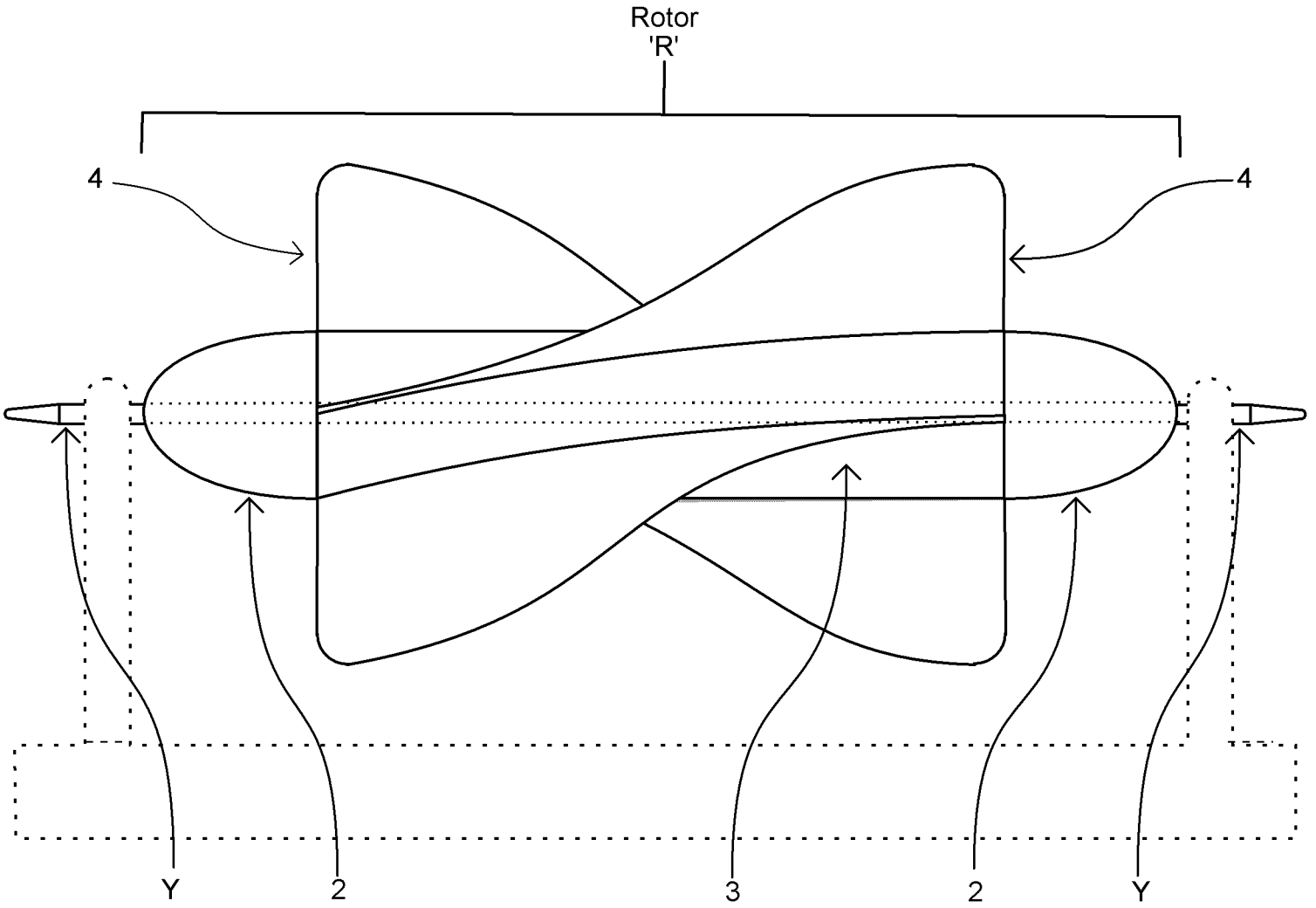


FIGURE 1

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Subaqueous Hydrokinetic Electric Energy Systems

and Related Components and Methods

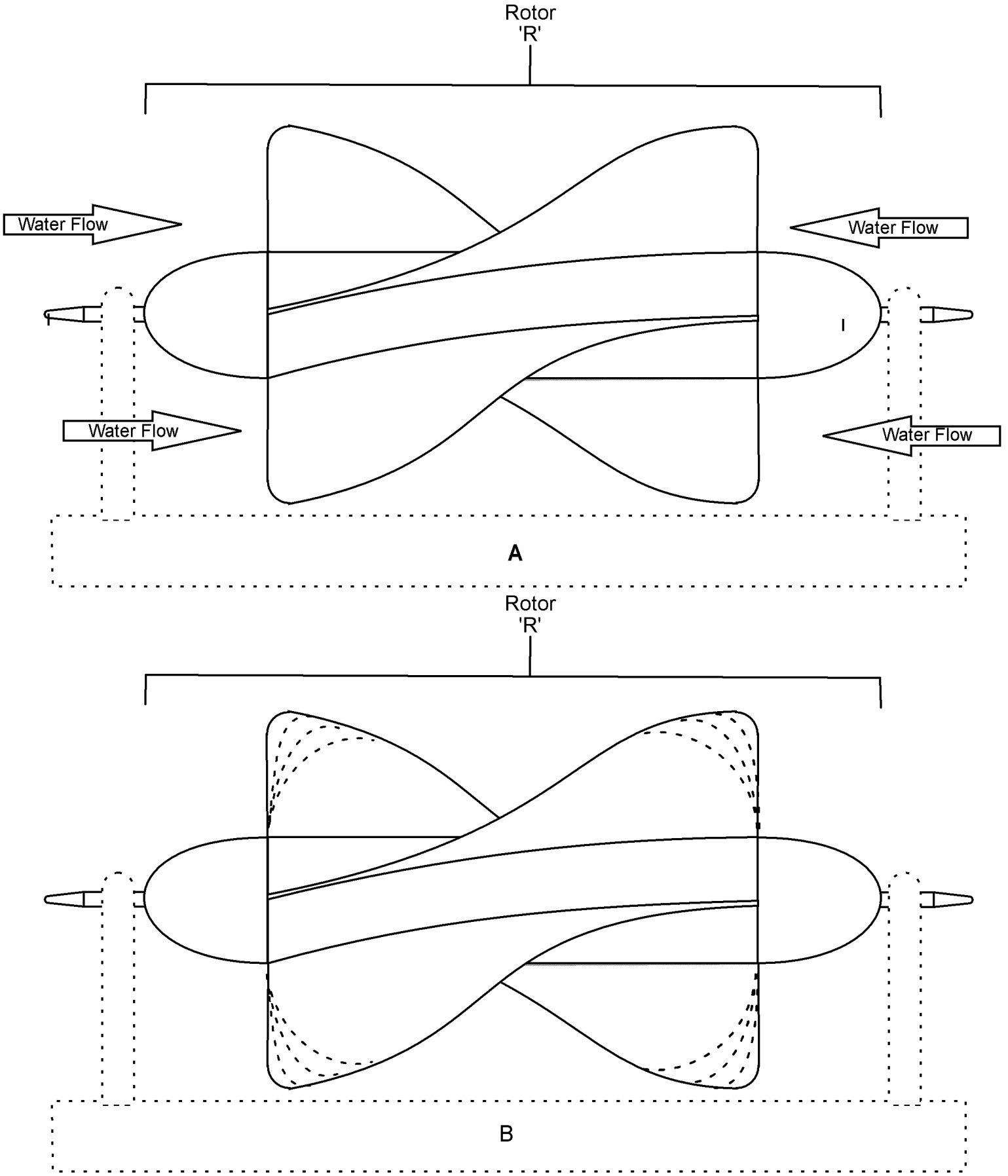


FIGURE 2

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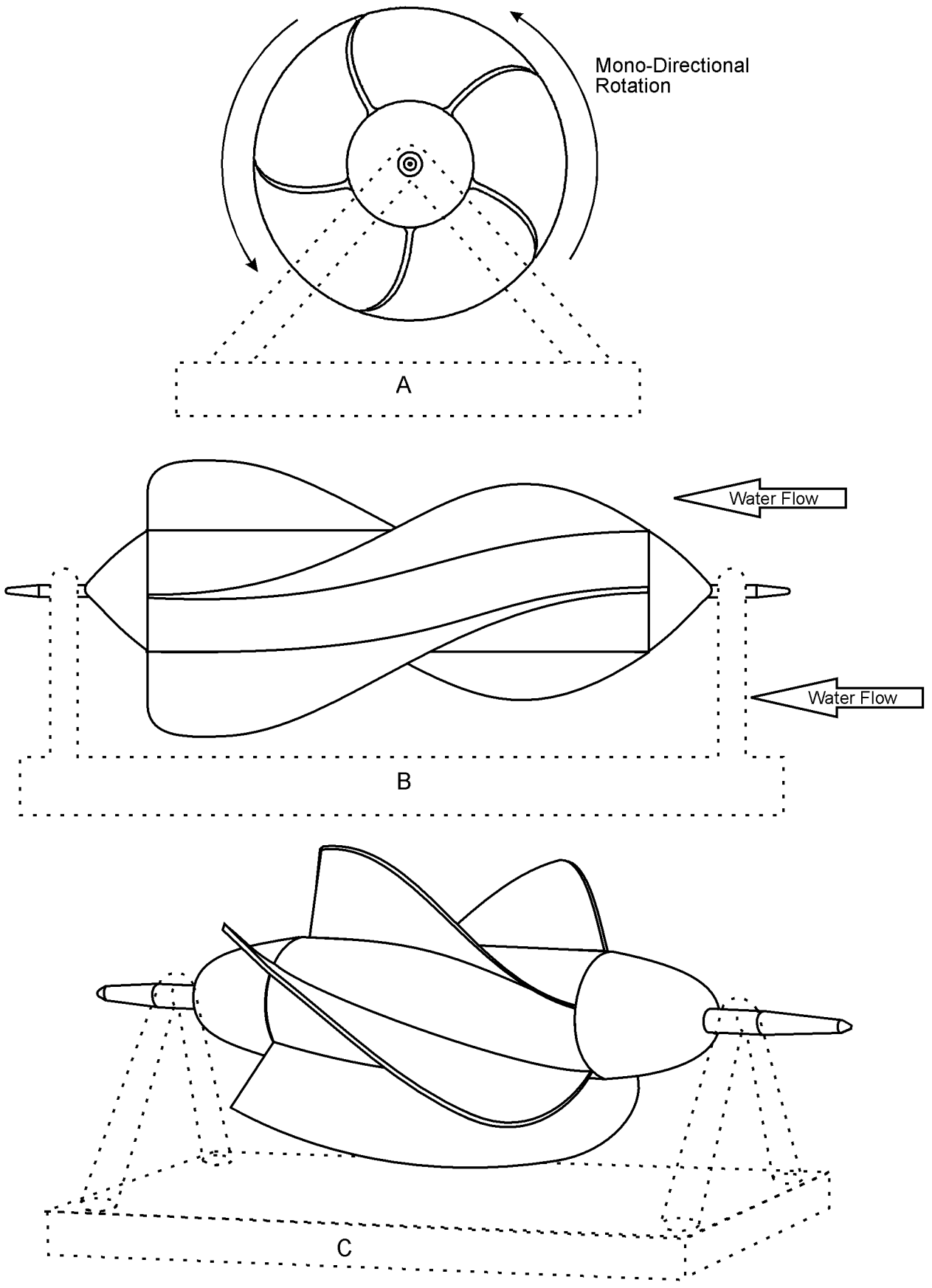


FIGURE 3

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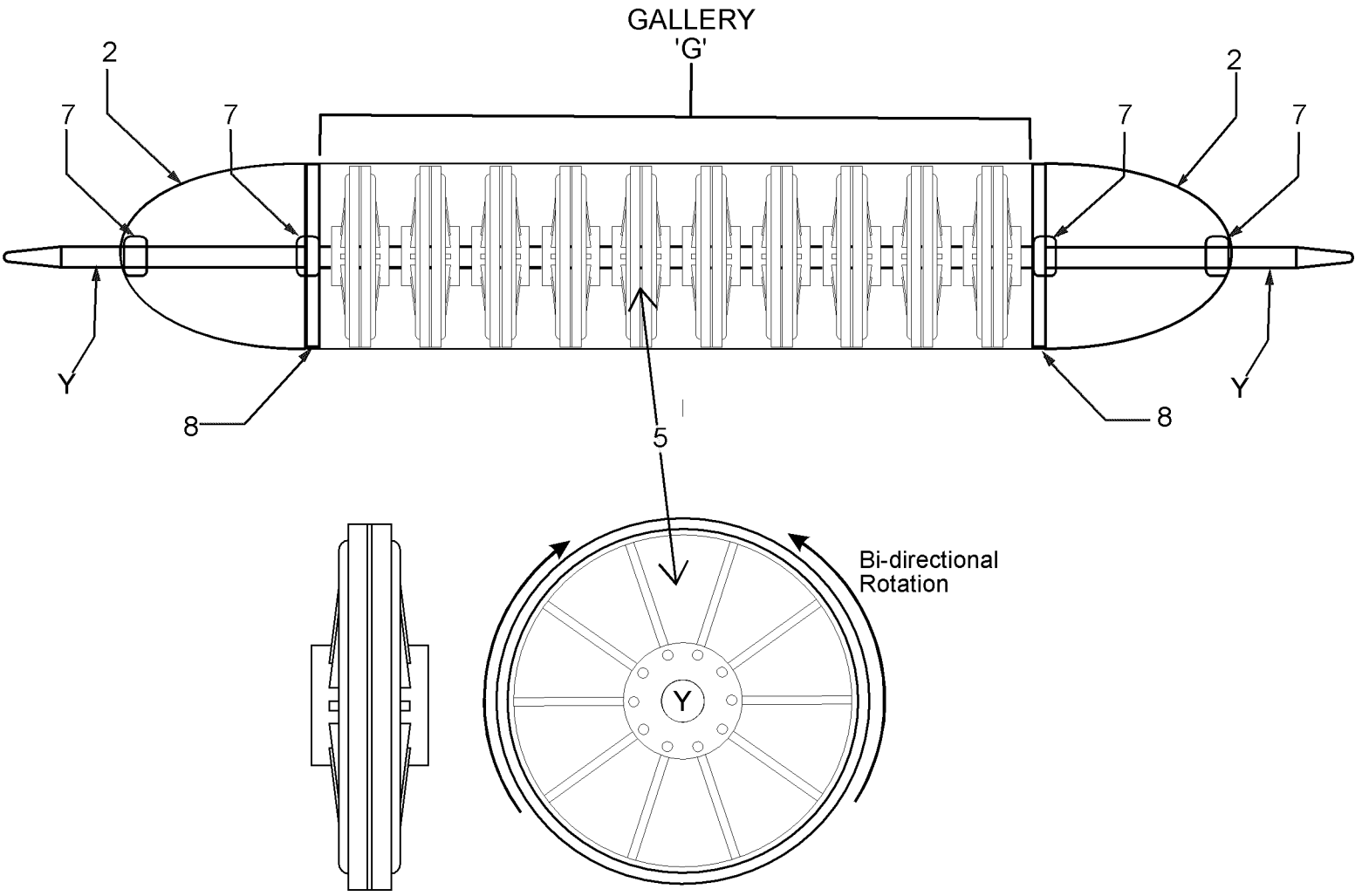


FIGURE 4

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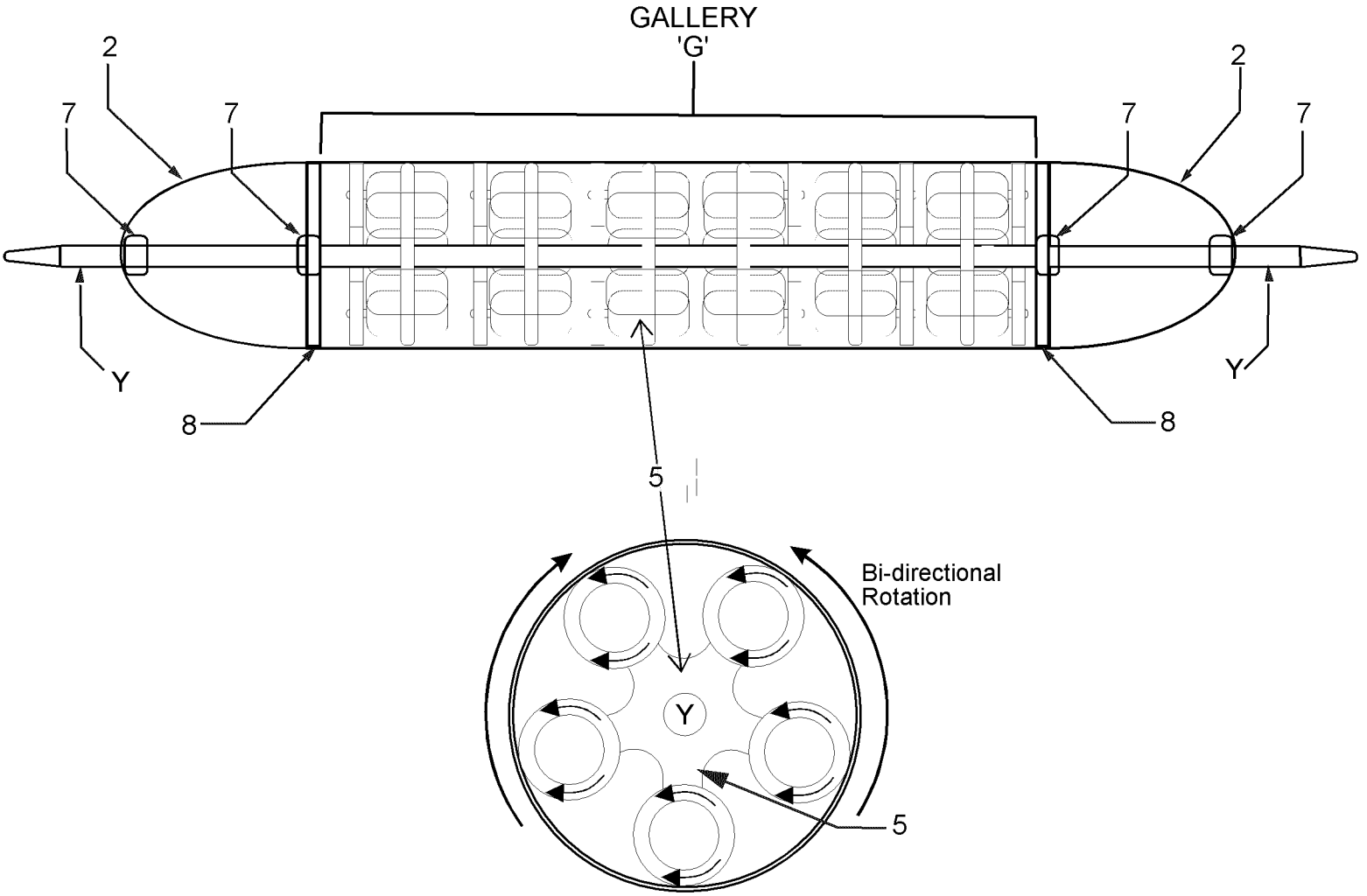


FIGURE 5

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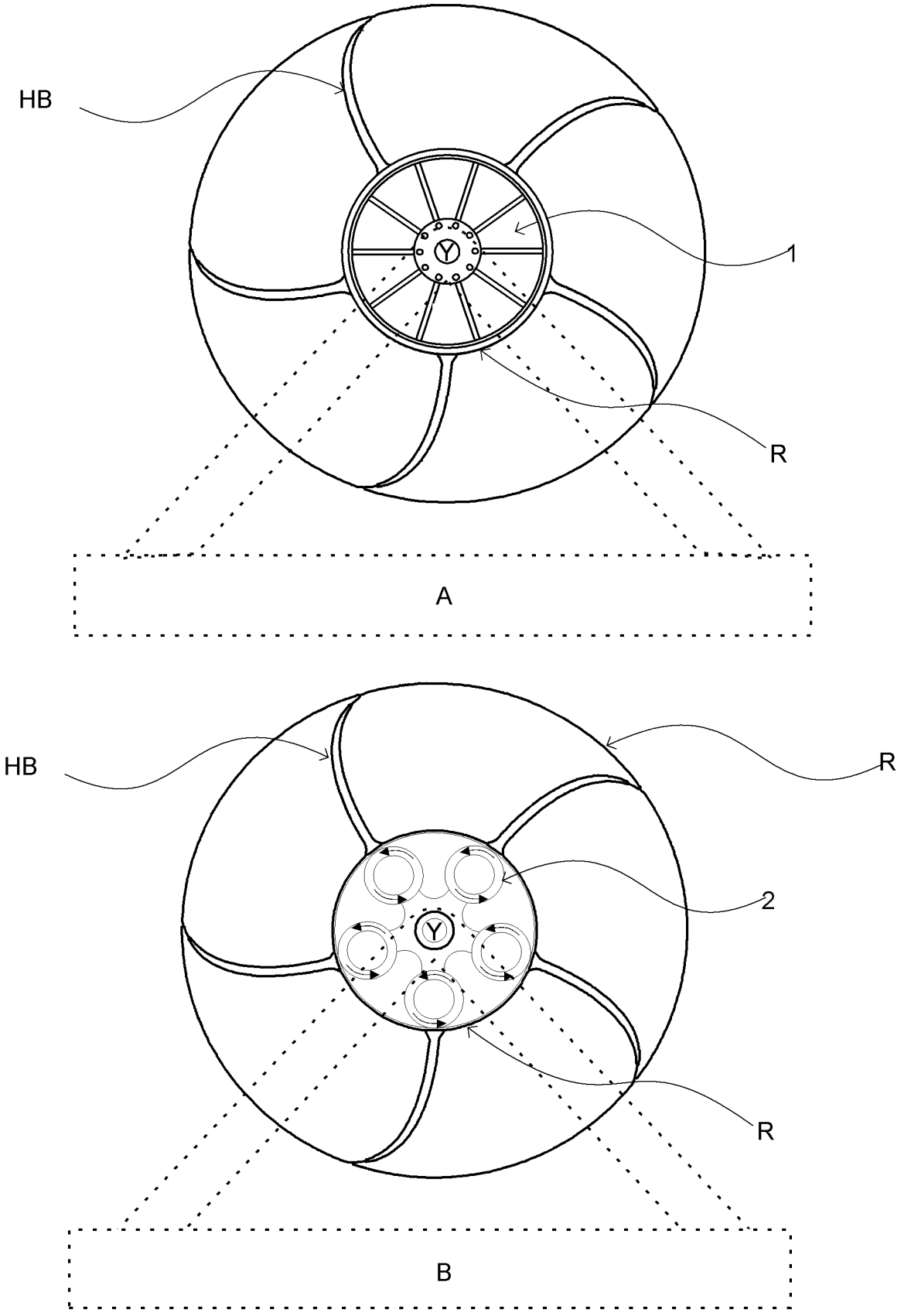
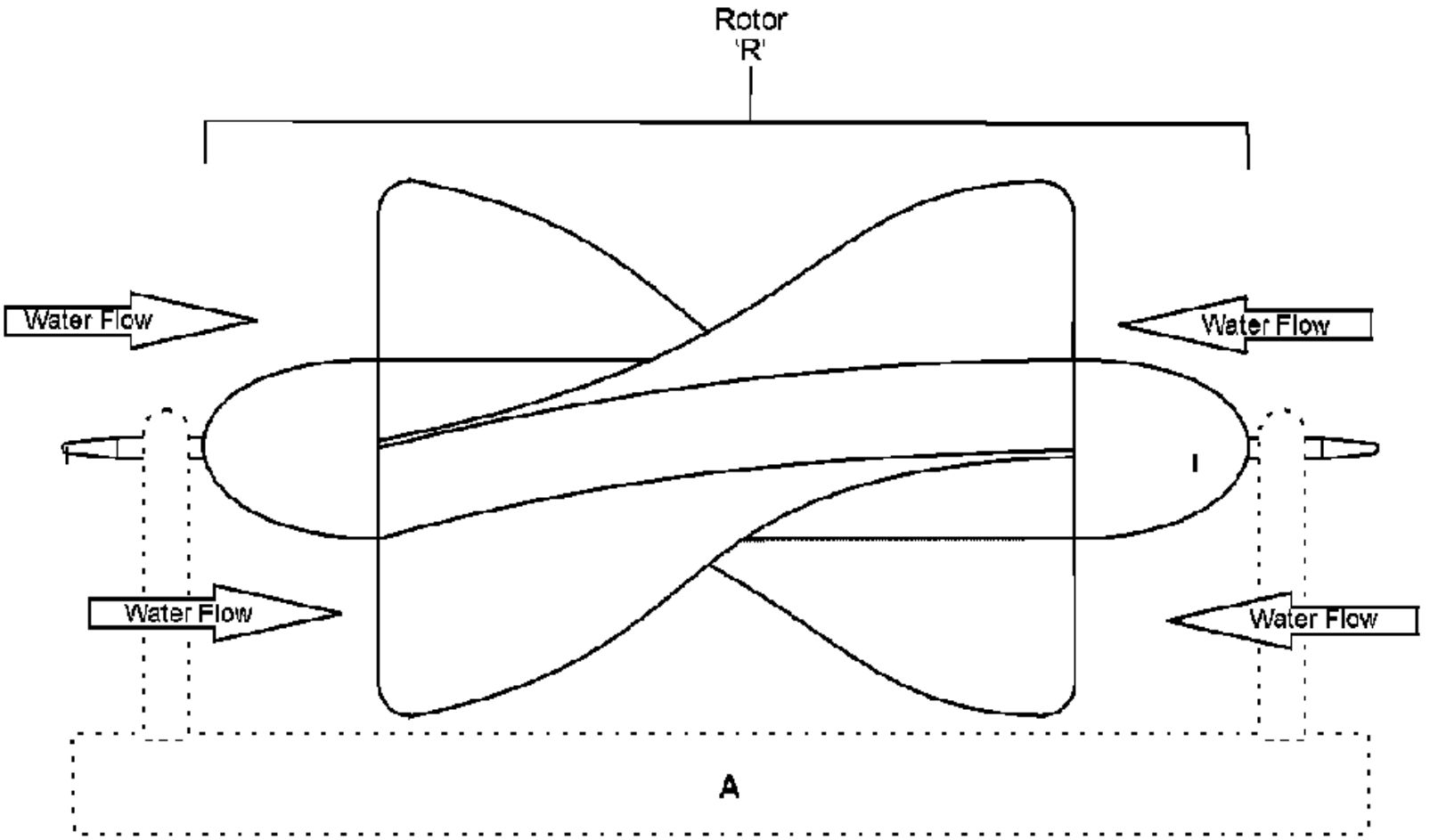
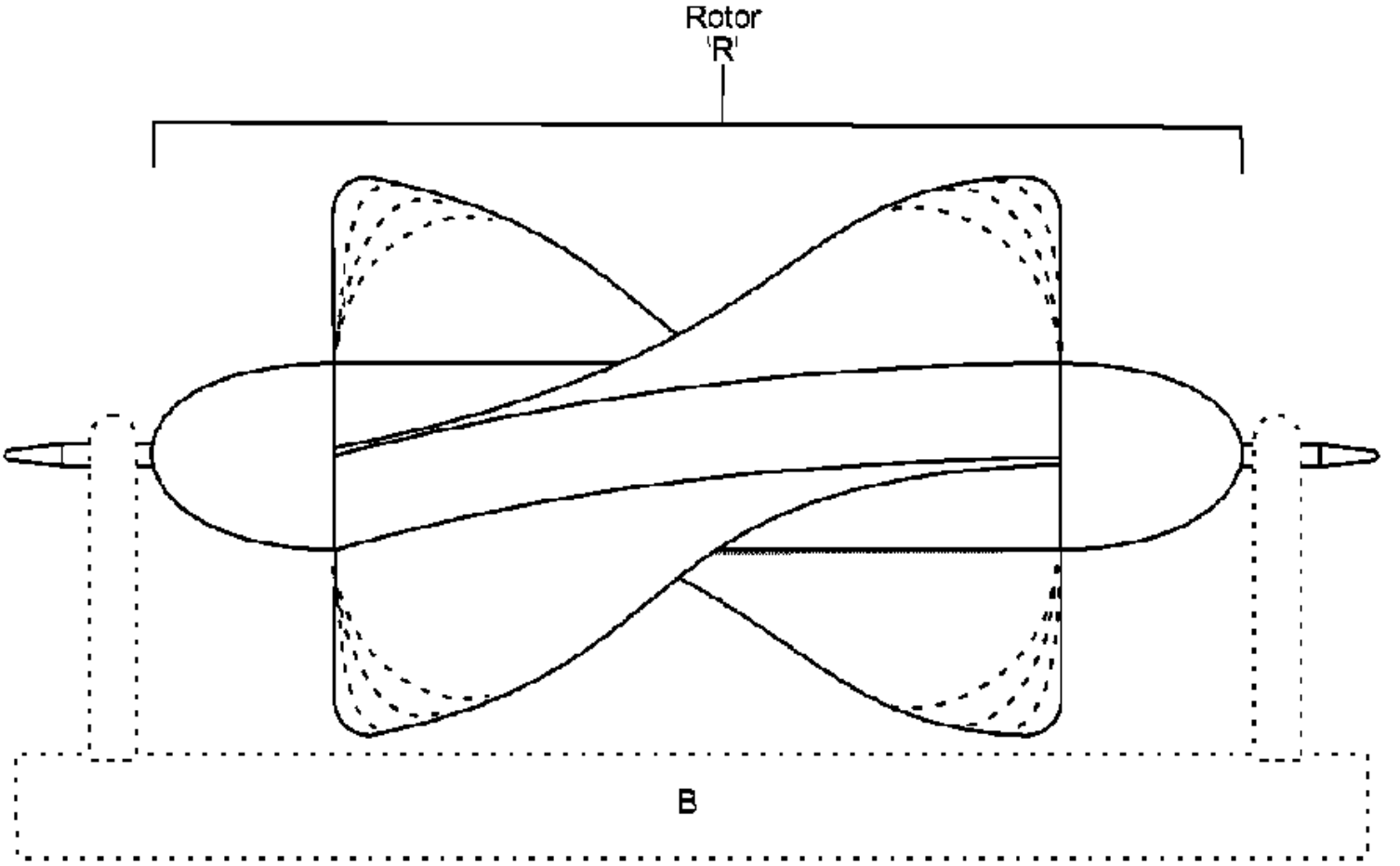


FIGURE 6

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Rotor
'R'
Water Flow
Water Flow
Water Flow
Water Flow
I
A


Rotor
'R'
B