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(54) **FLOATING POWER PLANT FOR EXTRACTING ENERGY FROM FLOWING WATER**

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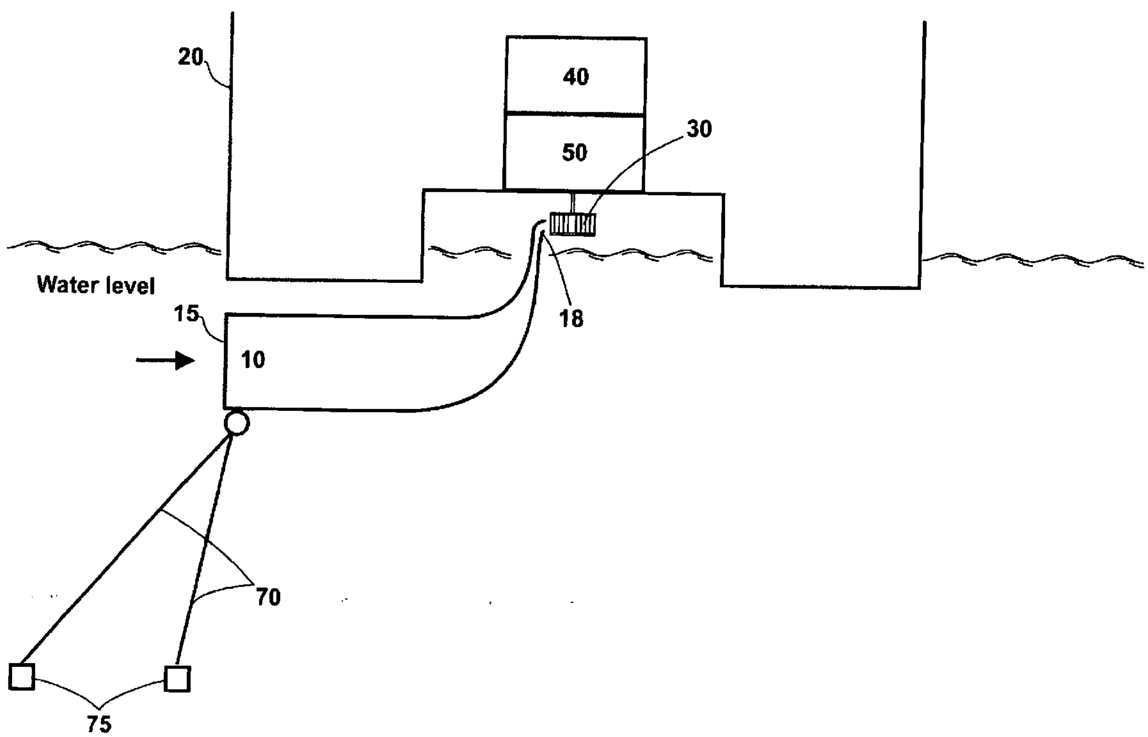
(57) **ABSTRACT**

A floating power plant for converting energy from ocean tides and free flowing rivers, without the need for a dam or barrage. The power plant includes a floating platform which houses a hydro-turbine above the water surface; and transfer-conduits which transfer the water and drive the turbine. The power plant include adjustable moorings and stabilizing ducts to allow for the alignment of the conduit inlets with the current.



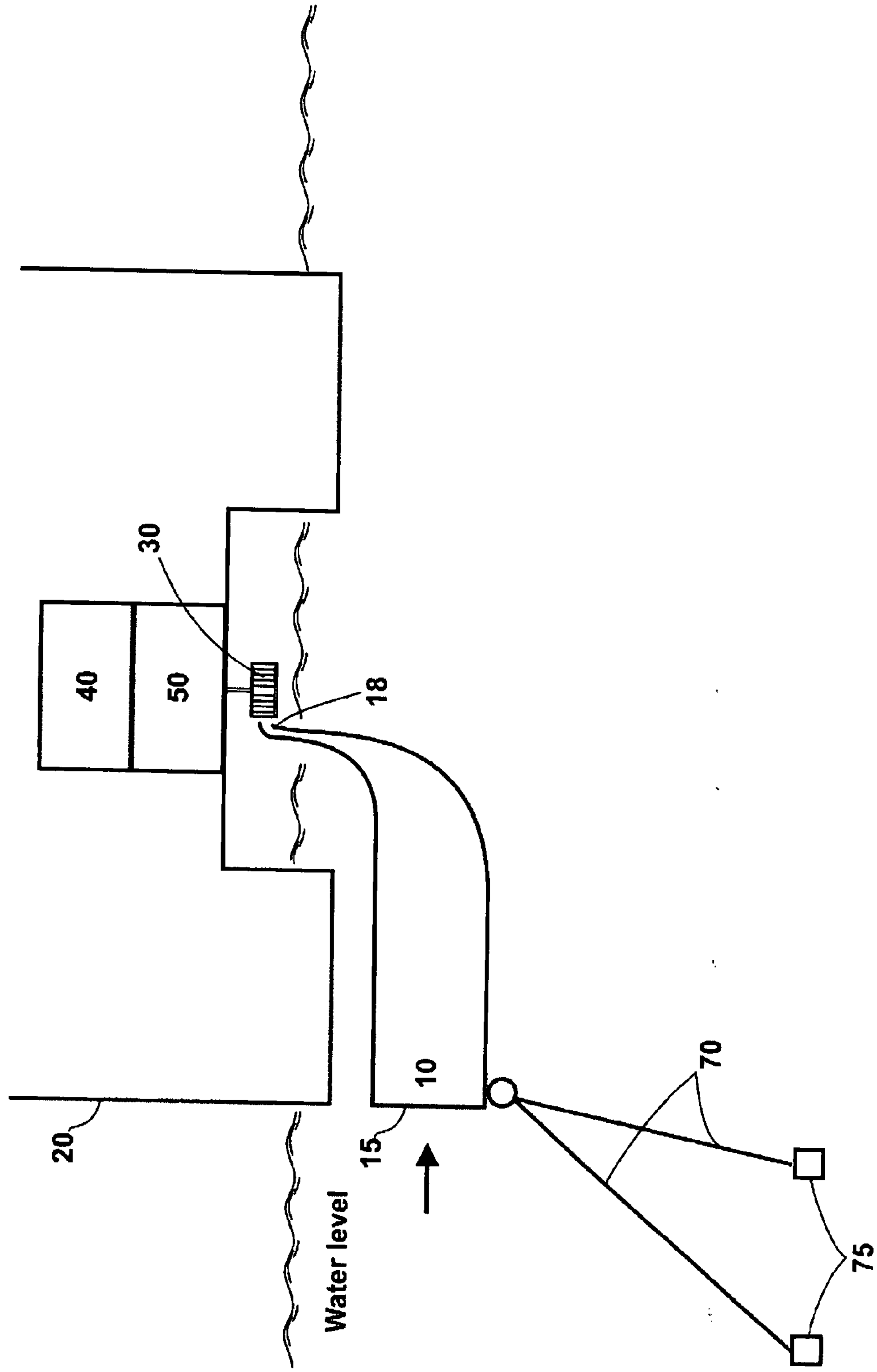


Figure 1

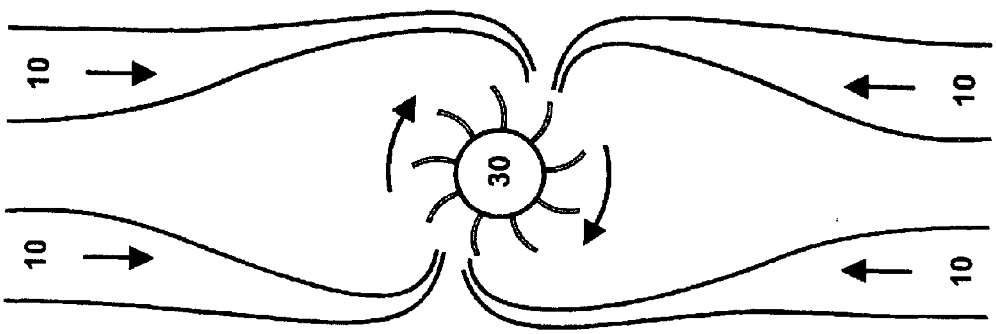


Figure 2

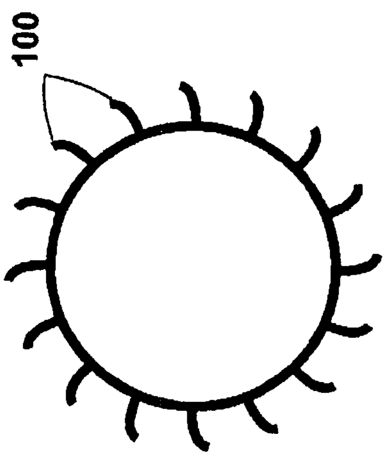


Figure 3a

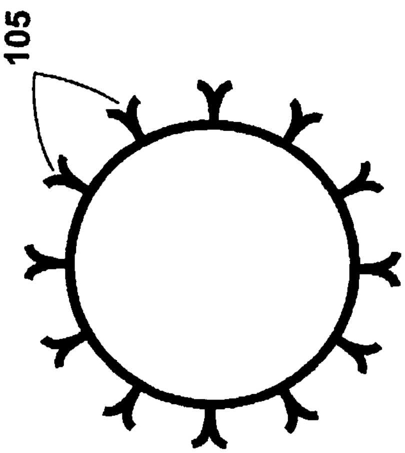


Figure 3b

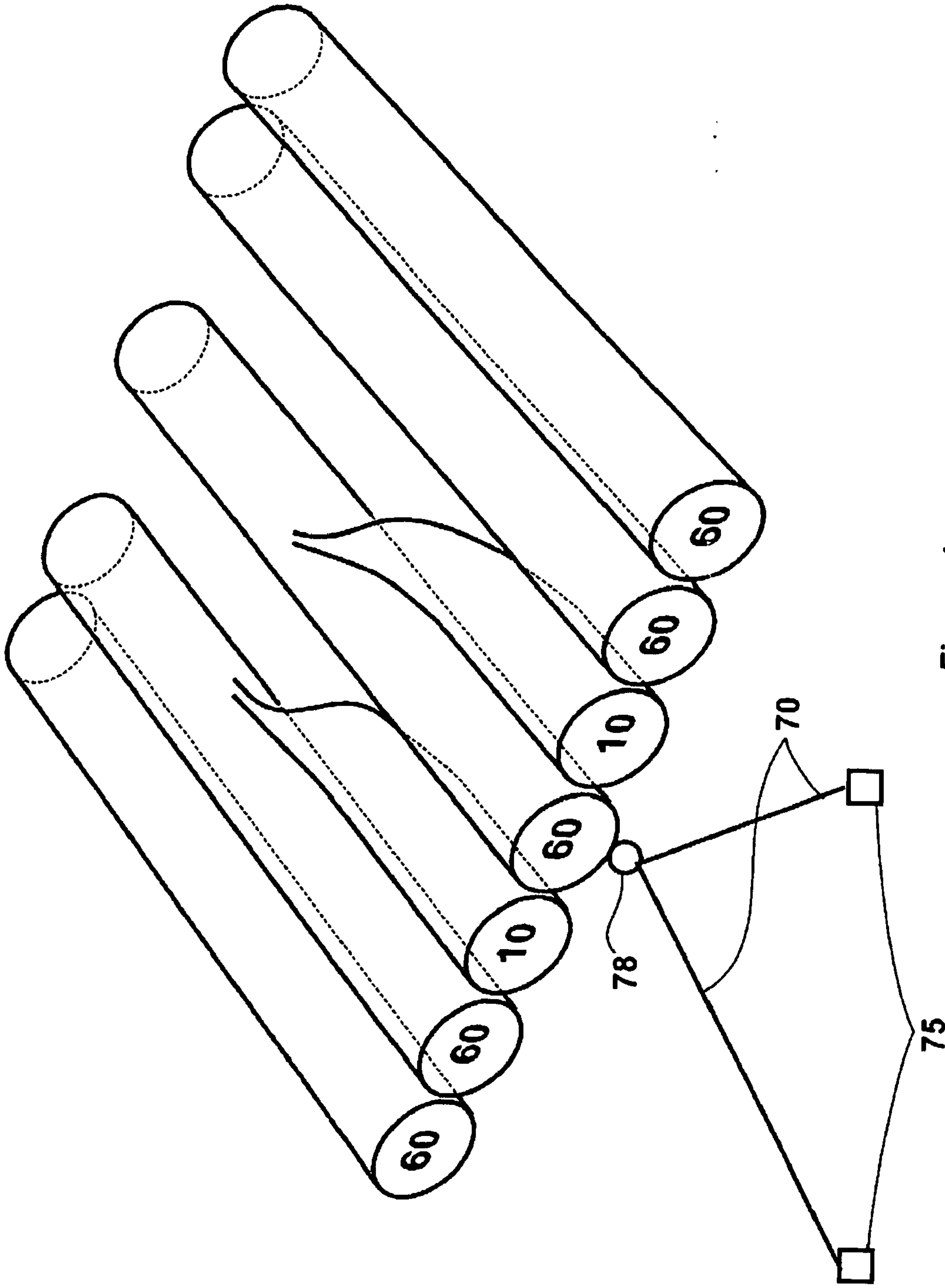


Figure 4

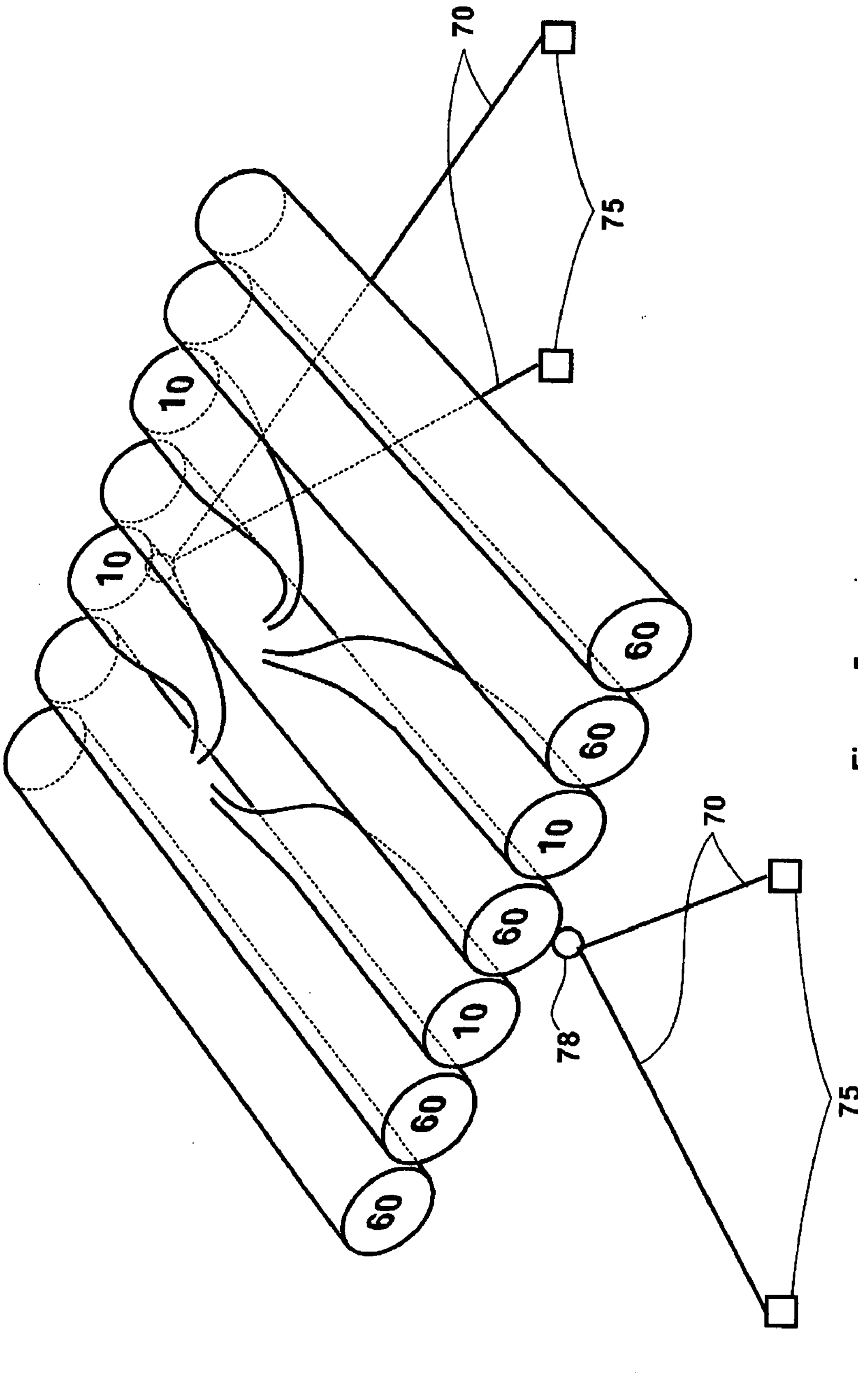


Figure 5

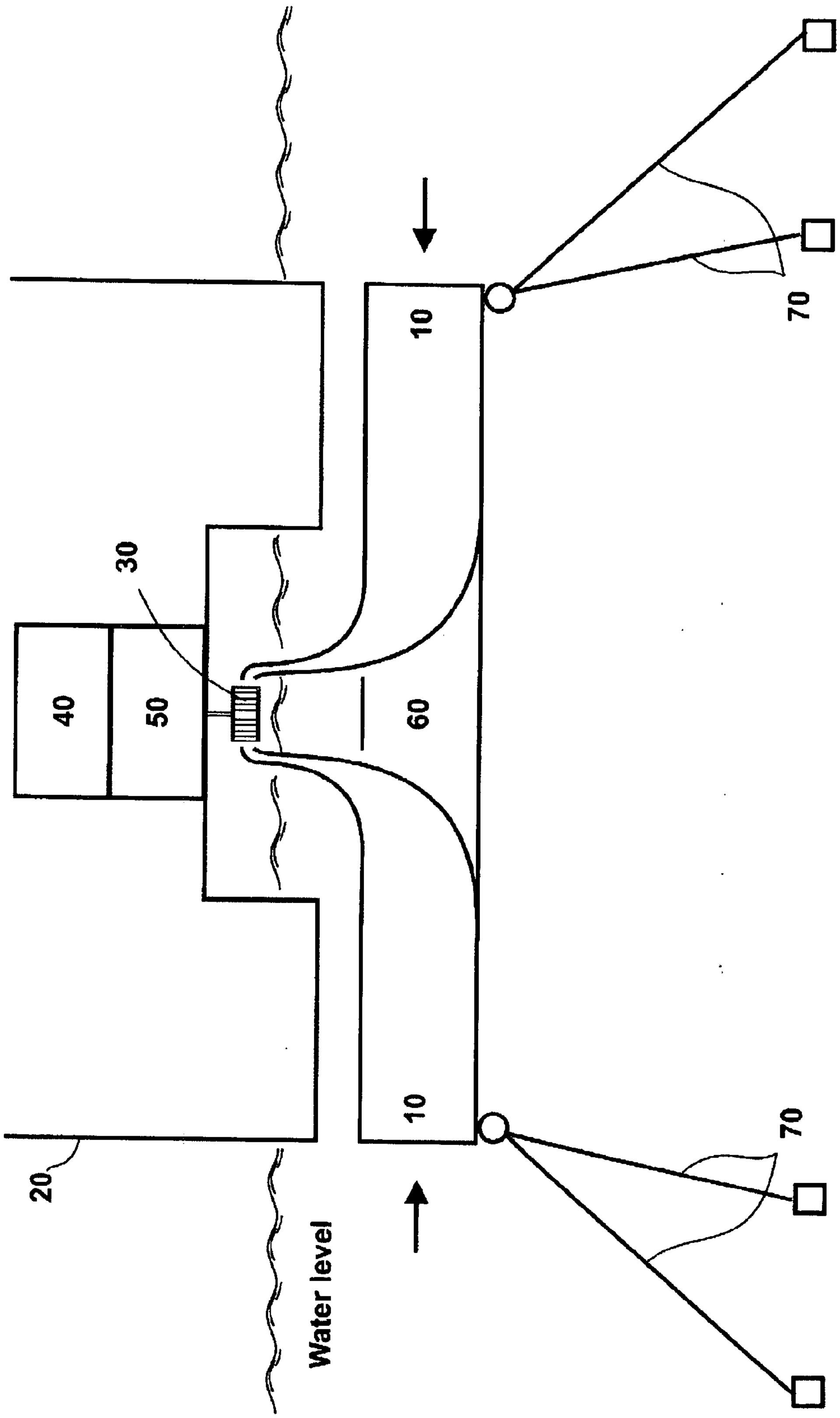


Figure 6

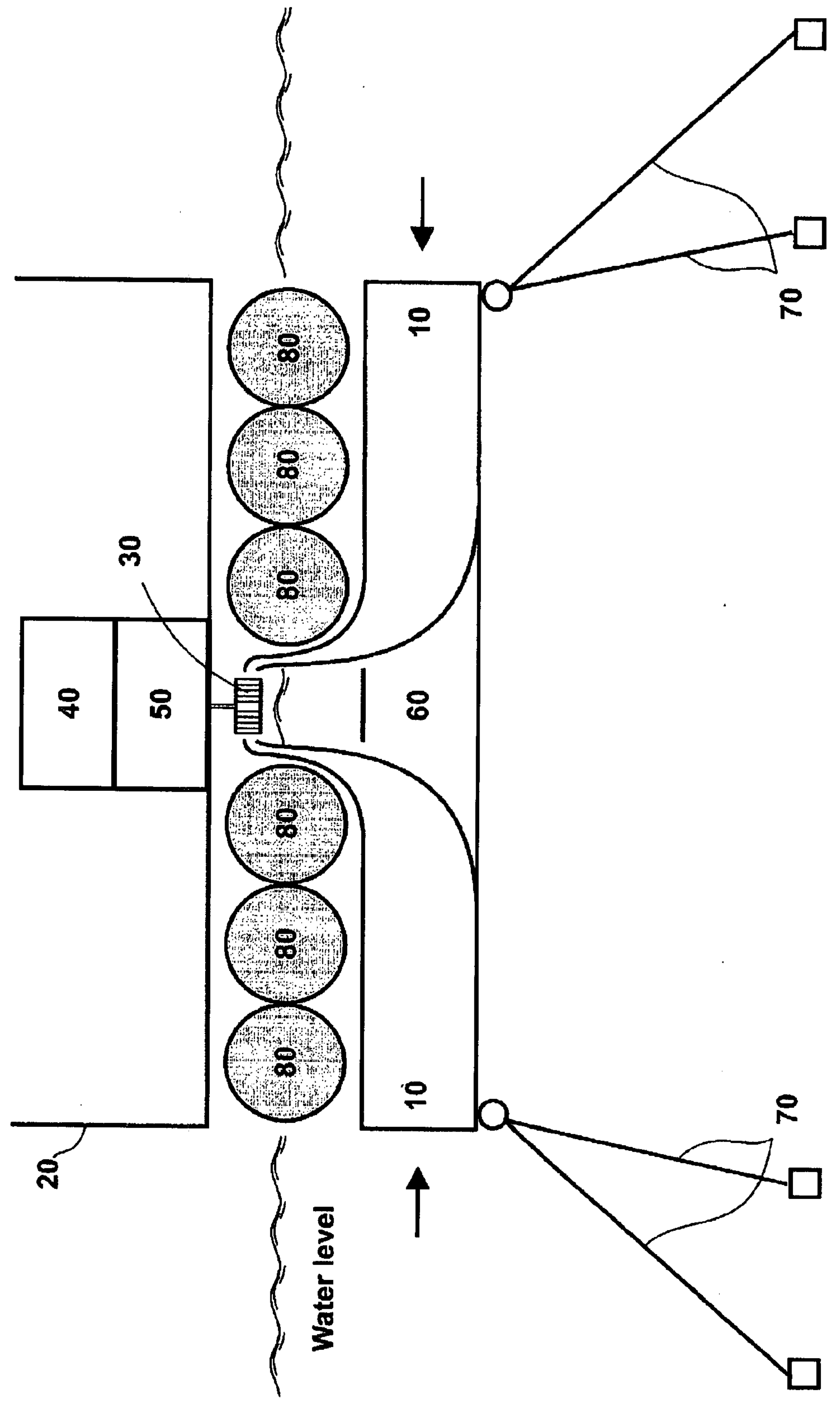


Figure 7

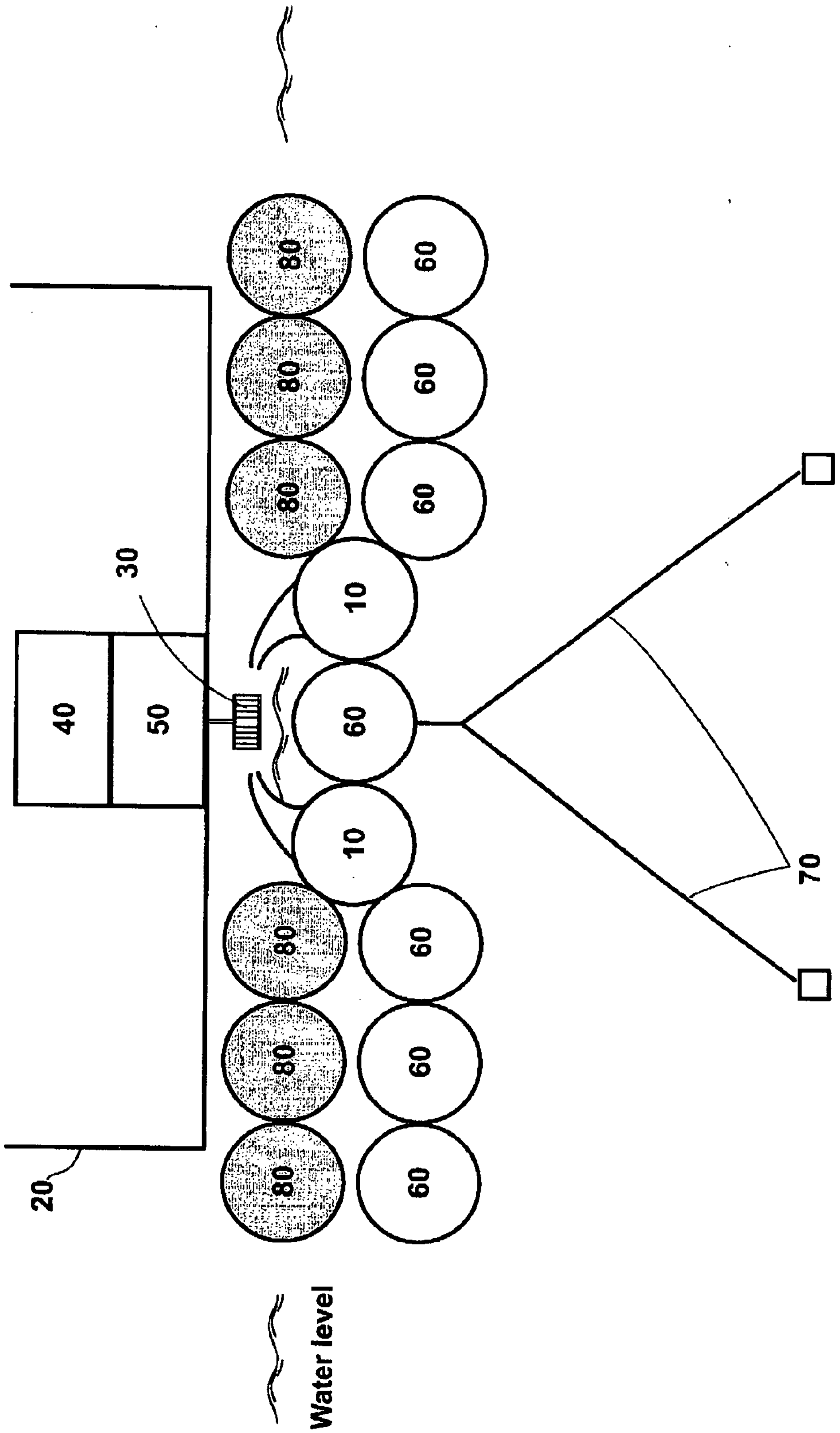


Figure 8

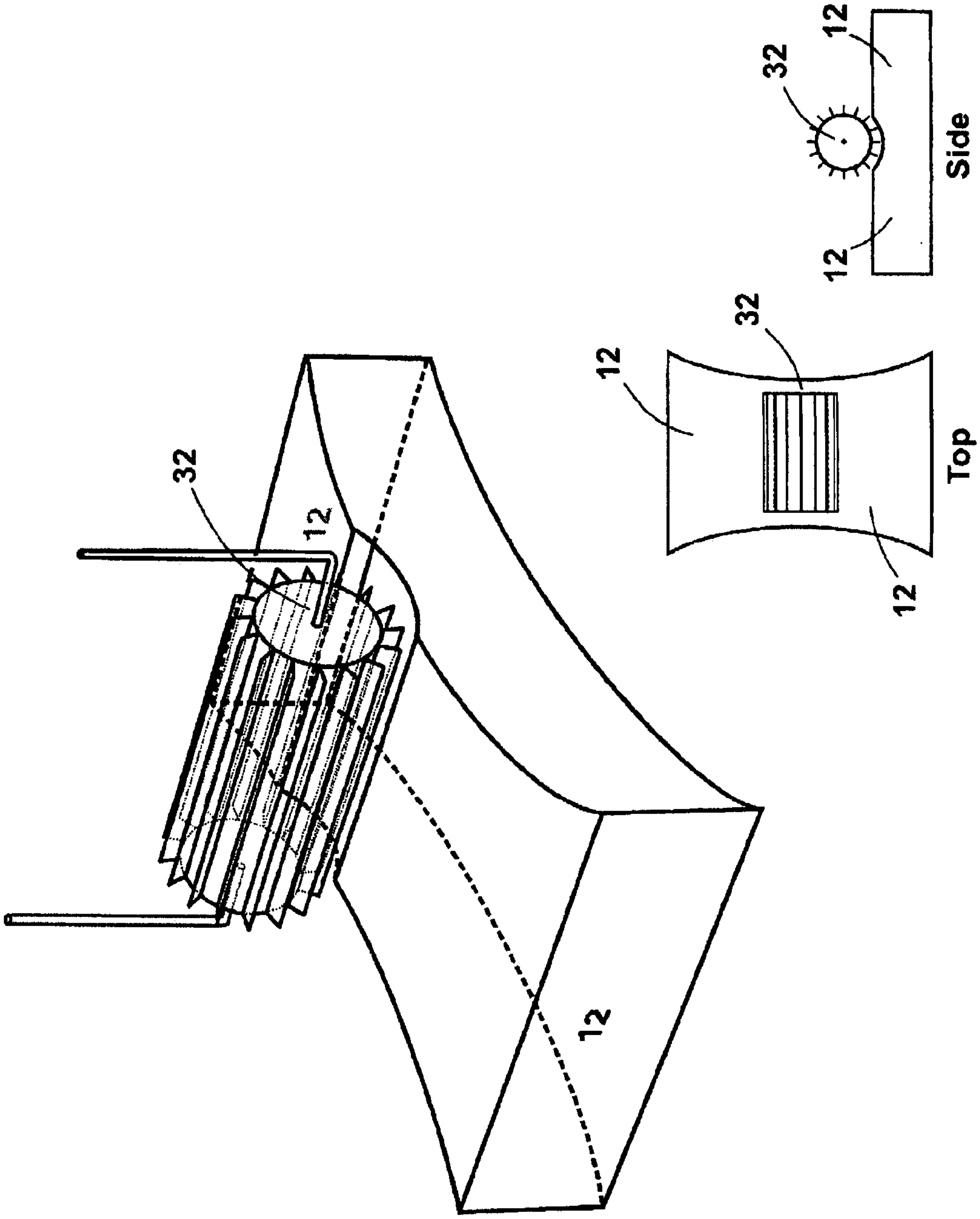


Figure 9

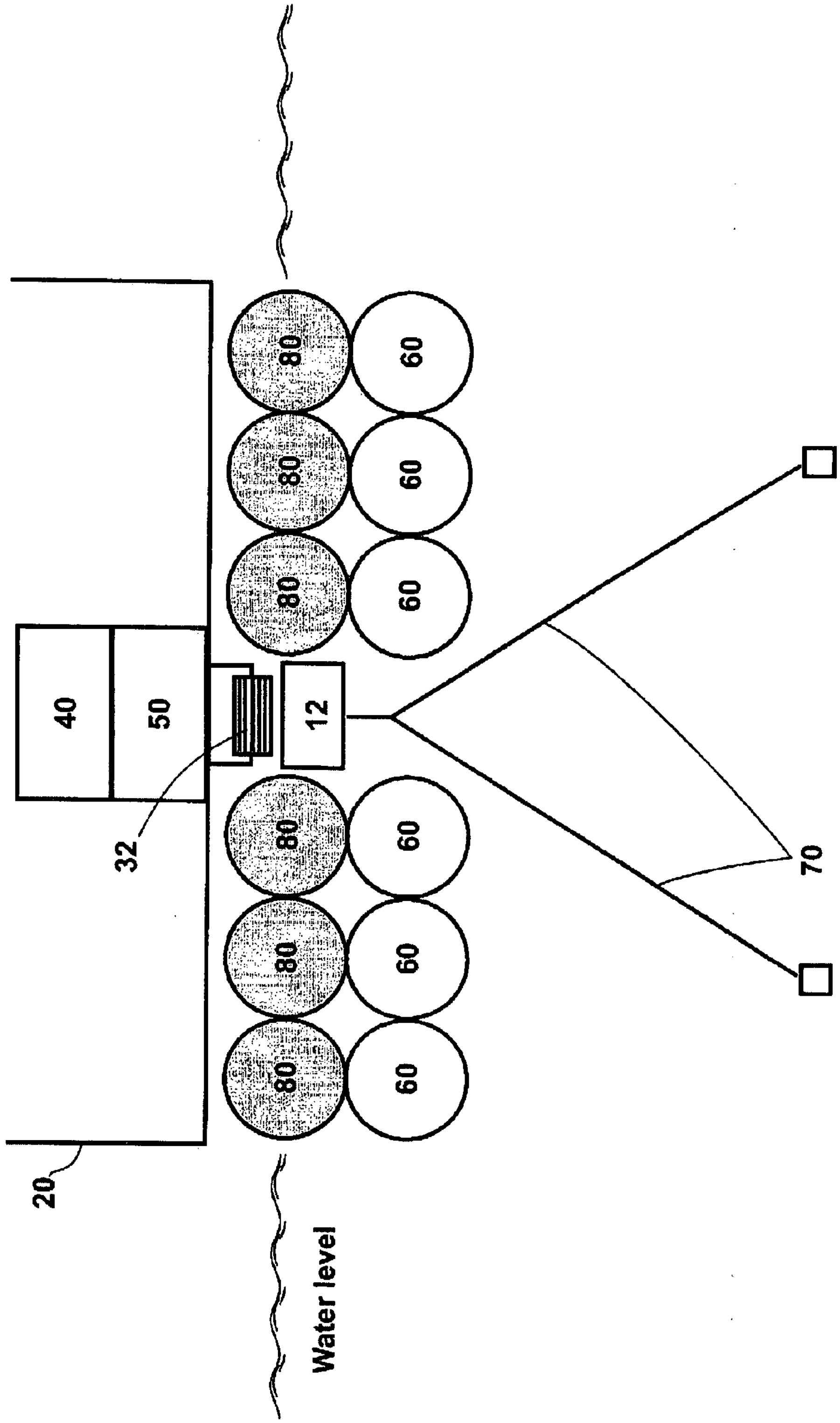


Figure 10

FLOATING POWER PLANT FOR EXTRACTING ENERGY FROM FLOWING WATER

CLAIM FOR PRIORITY

[0001] This application is based upon Provisional Patent Application Ser. No. 60/804,888 of the same title, filed Jun. 15, 2006. The priority of Provisional Application Ser. No. 60/804,888 is hereby claimed and the disclosure thereof incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates generally to hydro-power plants for generating electricity from flowing water. More specifically, the plants of the invention are adapted to capture energy from low head water sources, such as tidal streams and free flowing rivers, without the need for a dam or impoundment.

BACKGROUND OF THE INVENTION

[0003] Hydro-power plants generate electricity by utilizing the kinetic energy in moving water to drive a turbine. Conventionally, hydro-power plants have included four key components: (1) a dam impounding a large body of water, which stores a great amount of potential energy; (2) a penstock, in which the potential energy of the impounded water converts into kinetic energy as the water flows toward a turbine; (3) a turbine which captures the kinetic energy and converts it into mechanical energy; and (4) a generator which converts the mechanical energy into electrical energy. Hence, in conventional hydro-power operations, the dormant kinetic energy, or water head, determines the economics of producing electricity at hydro-power plants.

[0004] In free flowing stream sites, the kinetic energy (velocity of stream) determines the economics of producing electricity. The kinetic energy in ocean tides and free flowing rivers is both free and inexhaustible. Yet, the cost of producing electricity from such streams is, at present, prohibitively high. First, kinetic energy in such streams is widely diffused over a large body of water. Existing water turbines, such as those used in conventional hydro-power plants, cannot capture the diffused kinetic energy in such streams. Turbines which are specifically designed for free flowing streams, while technologically feasible, are inherently unviable from an economic standpoint. For example, turbines which have been designed for free flowing streams typically place the electrical generator under water which entails extreme inconvenience and high costs associated with installation, operation, and maintenance.

[0005] Methods for extracting energy from free-flowing water or "low-head" energy sources are known in the art. However, many of these systems are designed to capture the energy from oscillatory water movement from waves rather than the displacement motion of currents. For example, U.S. Pat. Nos. 4,773,221 and 4,277,690 both to Noren are directed to a float system for generating electricity whereby passing waves vertically oscillate a tube, such that the water moving in the tube rotates a turbine. The floats of the '690 and '221 patents also contain a movable piston that is disposed within the tube such that the piston moves relative to the tube in response to the water oscillation. The moving piston drives an energy converter (i.e. a turbine) within the float, for converting the piston movements to useful energy.

[0006] U.S. Pat. No. 5,770,893 to Youlton is directed towards a float system containing a vertical tube assembly of different lengths. The tube assembly of the '893 patent is filled with water at a relative height to the oscillating float, and subsequently affects the air column in each tube. A turbine is provided for harnessing power from fluctuations in the air column caused by the changing water level in the tube. United States Patent Application No. 2005/0167988 to Wood describes an apparatus for generating electricity by compressing air in a vertical tube and, in turn, allowing the compressed air to flow through an air turbine to convert the energy of compression to mechanical energy and subsequently to electrical energy. However, the above systems which utilize the ocean waves to generate electricity are not efficient from an economic standpoint.

[0007] United States Patent Application No. 2003/0059292 to Baker is directed towards an energy converting apparatus that is capable of converting water current energy into usable energy. The apparatus in the '292 patent application is submerged in a body of water and includes at least one turbine, at least one exit port, and at least one intake system, where the intake system is a penstock which accelerates the water towards a turbine.

[0008] U.S. Pat. No. 6,568,181 to Hassard et al. describes an apparatus for extracting power from a fluid flow, whereby a submerged concrete constriction channel causes water to accelerate, and the water is transferred by a conduit into a fluid driven engine.

[0009] Several methods for converting tidal energy into usable energy are described by the Electric Power Research Institute's TISEC project which is described in detail at http://epri.com/oceanenergy/streamenergy.html, the entirety of which is incorporated herein by reference.

[0010] While the methods described in the study by the Electric Power Research Institute enable the production of electricity without the need for a dam, there are significant technological and economical obstacles to the commercial viability of such devices.

[0011] The technological obstacles are the physical limitations associated with operating turbines in a free flowing stream. According to the Betz' law, no turbine can convert more than 59% (16/27) of the kinetic energy in a laterally flowing fluid into mechanical energy. Further, a turbine operating submerged in water (i.e., an in-stream turbine) has an additional limitation on its efficiency. When rotors of the turbine rotate fast in water, cavitations occur on or near the rotor blades; the cavitations would not only disrupt the water-flow, they would also cause damages to the rotor. To avoid the cavitations problem, the in-stream turbine must not rotate any faster when the velocity of water-flow exceeds a certain preset level, the so-called rated-speed. That is, the in-stream turbines are subject to two limitations, the Betz' law and the cavitations problem.

[0012] The firms reviewed in the study by the Electric Power Research Institute have developed their own in-stream turbine technologies, and some of them have tested their custom-made turbines. All of these in-stream turbines share a common characteristic: the higher the water velocity, the lower the turbine efficiency. The Marine Current Turbines, for example, claims that its proprietary turbine has the efficiency rate of approximately 40% at its rated-speed of about 3 m/s; their turbine efficiency would be only 5% at the water-flow velocity of 6 m/s (i.e., 0.4/8). The Gorlov Turbine (GCK), for another example, says that the efficiency rate of its helical turbine is 33% at its rated-speed of 3 m/s; their turbine efficiency would be roughly 4% at the water-flow velocity of 6 m/s (i.e., 0.33/8). In contrast, the present invention places the turbine in the air above the water surface: the turbine revolves free of the limitations associated with the Betz' law and the cavitations problem.

[0013] The economical obstacle in generating power from free flowing streams is the high installation and maintenance costs associated with placing turbines without the benefit of a dam. The firms reviewed in the study by the Electric Power Research Institute have proposed to build underwater structures, which would necessitate a high installation cost and would cause ecological damages. Most firms in the study have also proposed to place both the turbine and generator underwater, which would entail a high maintenance cost. In contrast, the present invention collects energy from free flowing streams while floating on the surface of the water with minimal submerged components.

[0014] The present invention includes a floating platform having at least one turbine coupled thereto, where the water is transferred to the turbine by conduits which are at least partially submerged. As compared to the systems described in the art, the design of the present invention is advantageous in several respects including: (1) the ability to capture the kinetic energy in free flowing streams free of the limitations associated with the Betz' law and the cavitations problem; (2) minimization of the installation and maintenance costs due to above water positioning; (3) the ability to minimize the ecological disruption; and (4) the ability to use commercially available turbines.

SUMMARY OF THE INVENTION

[0015] According to one aspect of the present invention there is provided a floating power station for extracting energy from a flowing stream of a body of water, where the floating plant includes: (a) a float platform adapted to float on the body of water, where the platform includes a deck; (b) at least one hydro-turbine which is mounted to the float platform; and (c) at least one transfer conduit which is mounted to the platform, where the conduit has an inlet portal submerged in water and an outlet jet portion placed above the water surface. In a preferred embodiment, the conduit is mounted to the platform and is adapted to receive a portion of the flowing stream below the surface of the body of water in its inlet portal, and transfers the stream in the conduit, such that the stream issues from the outlet jet portion of the conduit above the surface of the body of water and is incident upon an impulse-type hydro-turbine. The spent jet is thereafter returned to the body of water. The above described embodiment may also be adapted to accommodate cross-flow turbines consistent with the claimed subject matter.

[0016] The power plants of the invention enable the economical and convenient production of energy from a renewable source.

[0017] Still further features and advantages of the invention are apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The invention is described in detail below with reference to the following drawings:

[0019] FIG. **1** is a schematic diagram illustrating a hydro-power plant of the invention which includes a transfer conduit and an impulse turbine;

[0020] FIG. **2** is a schematic diagram depicting a top plan view of an impulse turbine which is being impinged upon by the jets from four conduits;

[0021] FIG. **3***a* is a schematic side sectional view of a uni-directional cross-flow turbine, and FIG. **3***b* is a side view of a bidirectional cross-flow turbine;

[0022] FIG. **4**. is a schematic perspective view of an aligned array of stabilizing ducts and two transfer conduits interposed therein;

[0023] FIG. **5** is a schematic perspective view of an aligned array of stabilizing ducts, and four conduits, whereby two matched pairs of the conduits are positioned substantially 180° from each other;

[0024] FIG. **6** is a schematic diagram illustrating a floating hydro-power plant having multiple conduits, stabilizing ducts, an impulse turbine, and which is secured by a pair of catenary moorings;

[0025] FIG. **7** is a schematic diagram illustrating a floating hydro-power plant which has a plurality of air-tanks mounted to the floating platform;

[0026] FIG. **8** is a frontal schematic diagram illustrating a hydro-power plant with two transfer conduits;

[0027] FIG. **9** is a schematic diagram illustrating a bidirectional cross-flow turbine and a rectangular conduit; and

[0028] FIG. **10** is a frontal schematic diagram illustrating a floating hydro-power plant having a rectangular conduit positioned to impinge a cross-flow turbine.

DETAILED DESCRIPTION OF THE INVENTION

[0029] The invention is described in detail below with reference to numerous embodiments for purposes of exemplification and illustration only. Modifications to particular embodiments within the spirit and scope of the present invention, set forth in the appended claims, will be readily apparent to those of skill in the art.

[0030] The hydro-power stations of the present invention include a floating platform with a hydro-turbine mounted thereto, and at least one conduit to transfer the water and drive the turbine. FIG. **1** illustrates the general operation of the present invention, where a transfer conduit **10** has an inlet portal **15** which is oriented in the direction of incoming flow and is submerged in water, and an outlet **18** which extends above the surface of the water to the impulse turbine **30**. The turbine is attached underneath the platform **20**, where the floor of the platform has an open space, such that the turbine is suspended in the air above water. Water enters into the inlet portal **15** of conduit **10**; it flows in the conduit; it comes out of the outlet **18**, or nozzle, of the conduit as a jet of water. The conduit in FIG. **1** is cornucopia shaped. In the configuration shown in FIG. **1**, the generator **40** and hydraulic system **50** sit on the top of turbine **30**. Also shown is a two point catenary mooring **70** connected to anchors **75**, where a cable, two anchors, and a mooring ring, are configured such that the cable connects the two anchors and the float platform via the mooring ring. Preferably the mooring ring is an O-ring.

[0031] The transfer conduits used in the invention are elongated, stream-lined conduits. The present invention includes transfer-conduits that perform the combined roles of dam and penstock of conventional hydro-power plants. The inlet portal of the conduit has a cross-section that is larger than the cross-section of the outlet, which acts to change the water velocity from a speed of V_1 at the inlet portal to a speed of V_2 at the outlet jet. In other embodiments, the conduits may be untapered, that is, of generally uniform cross section over their lengths. In still other cases, the ducts may be non-enclosed ducts, that is, have a U-shaped cross-section.

[0032] Note, the velocity at the outlet will be smaller than the velocity of the stream in the body of water, independent of the geometry of the conduit. For example, consider a curved tube with an inlet area A_1 and an outlet area A_2, where the tube is bent into an "S" shape. The centerline of the tube at the entrance is located at a depth "d" below the surface of the water, and the centerline of the tube at the exit is located at a height "h" above the surface. For this example, it is assumed that the depth "d" is large compared to the length scale $\sqrt{A_1}$ of the entrance and similarly the height is large compared to the length scale $\sqrt{A_2}$ of the exit. The water is assumed incompressible and inviscid. The fluid moving through the tube constitutes a streamtube. The far upstream area of the streamtube is A_0 (which is not necessarily identical to the entrance area of the tube A_1) and the velocity far upstream is V_0. For instance, if the tube were towed at a speed U in water at rest, then $V_0=U$.

[0033] Consider a streamline originating far upstream of the entrance and exiting at A_2. Bernoulli's equation yields:

$$p_0 + \frac{1}{2}\rho V_0^2 + \rho g z_0 = p_2 + \frac{1}{2}\rho V_2^2 + \rho g z_2$$

where z is the vertical position. The static pressure high upstream is hydrostatic,

$$p_0 = p_a + \rho g d$$

where p_a is the atmospheric pressure in the air (assumed constant). At the exit $p_2=p_a$ because the fluid is incompressible. Substituting into Bernoulli's equation:

$$p_a + \rho g d + \frac{1}{2}\rho V_0^2 + \rho g z_0 = p_a + \frac{1}{2}\rho V_2^2 + \rho g z_2$$

Now, $z_2-z_0=d+h$, and thus,

[0034]

$$V_2^2 = V_0^2 - 2gh$$

Thus, it can be seen that the outlet velocity, V_2, will be lower than the stream velocity, V_0, given the above assumptions.

[0035] Further, given the conservation of mass

$$A_0 V_0 = A_2 V_2$$

And thus,

[0036]

$$A_0 = A_2\sqrt{1 - \left(\frac{2gh}{V_0^2}\right)}$$

[0037] In a preferred embodiment, the outlet of the transfer-conduit will be positioned close to the water surface. The role of the transfer-conduit is to direct water to the turbine which rotates in the air above the water surface free of the limitations related to the Betz' law and the cavitations problem. The benefits of the transfer conduit will be greater, when the velocity of the stream is very high.

[0038] It is contemplated in the inventive power plants that more than one transfer conduit may be positioned to drive a turbine. For example, an assembly of transfer conduits may be positioned to drive one impulse turbine. Additionally, multiple conduits may be used on the floating platform to drive more than one turbine. For tidal currents it may be advantageous to employ at least two transfer conduits which are substantially 180° offset from one another, such that the conduits utilize the energy of the water from both the ebb and flow of the tide.

[0039] For example, FIG. **2** shows a schematic (viewed from above) of four transfer-conduits **10**, two aligned for each direction of tidal water flow and positioned to impinge a single impulse turbine **30** in the center. This illustrates that with the aid of the back-to-back placement of the transfer-conduits, the single impulse turbine can become bi-directional without any modification to the turbine.

[0040] The shape and position of the transfer-conduit depends on the type of turbine used. The conduits for an impulse turbine may have a cornucopia-like shape, such that the narrow outlet end is positioned above water, while the larger inlet end is submerged; the conduit may have a longitudinal axis that is curved or S-shaped. This design directs the water flowing through the tubes above the surrounding water level, so that the turbine, pumps, motor, and generator are located above water for ease of maintenance and servicing. Additionally, the lack of significant submerged components means the platform can more easily be moved as required. The specific size, shape, proportions, and positioning of the conduit are not particularly limited and may be varied to improve the efficiency of the power plant depending on the location of power plant, type of turbine used, current flow, and other factors.

[0041] The power plants may utilize commercially available hydro turbines. Impulse turbines, such as the Pelton turbine and Turgo turbine, are suspended in air; these turbines capture the kinetic energy in a jet of water impinging upon the runners of turbines. Cross-flow turbines, which rotate around a horizontal axis and are generally suspended in the air, may also be used in the power plants of the invention. Reaction turbines, such as the Francis turbine, Kaplan turbine, and Tyson turbine, in contrast, are fully submerged in water to prevent cavitations; these turbines capture the kinetic energy in water as water flows past the turbine blades. Conventional hydro-power plants with a relatively lower water head use reaction turbines, whereas hydro-power plants with a relatively higher water head use impulse turbines. Because a higher water head represents a greater amount of dormant kinetic energy, hydro-power plants that can use impulse turbines would have a lower cost of electricity, ceteris paribus.

[0042] When used to harness energy from tidal flows, the present invention can make impulse turbines bi-directional without any modification of the turbine, by positioning the conduits back to back such that water is transferred to the turbine when the tidal current is both incoming and when it reverses flow. For these applications, impulse or bi-directional cross-flow turbines are preferred. For example, either the Pelton turbine or Turgo turbine can become bi-directional with the aid of the back-to-back placement of transfer-conduits. FIGS. **3***a* and **3***b* show side sectional views of two cross-flow turbines. The cross-flow turbine (also known as the Michell or Ossberger turbine) is similar to a water wheel. FIG. **3***a* shows the blades **100** on a typical, uni-directional cross flow turbine. FIG. **3***b* illustrates that with a simple modification of the blades **105**, the cross-flow turbine can become bi-directional.

[0043] The amount of energy that can be extracted from currents with hydro-turbines is less than kinetic energy in water. The inefficiencies of turbine, gearing and generator reduce the maximum extractable amount. The amount of kinetic energy in ocean tides further depends on the constantly varying flow velocities of water over various tide cycles, such as (1) two flood tides and two ebb tides during one lunar day, (2) two spring tides and two neap tides during one lunar month, etc.

[0044] The hydro-power plant of the present invention also includes a floating platform to which turbines, generators, conduits and hydraulic systems are mounted. When an impulse, or cross-flow, turbine is mounted to a platform, the turbine is to be suspended in the air above water. Two alternative ways to mount a turbine to a floating platform are available. First, the platform has an open draw under its floor such that a turbine can be mounted to the platform, suspended in the air between the platform floor and water below. Second, the platform may have large air-tanks under its floor, and a turbine is mounted to the platform between the air-tanks, suspended in the air between the platform floor and water below. The turbine and transfer conduits are positioned on the platform such that the water jet from the outlet of the transfer conduit impinges on the turbines above the water level, and the water subsequently falls back into the stream below. This is readily apparent from, for example, FIG. **1**.

[0045] The platform can be made to float either by the pressure of water displaced by the hull of the platform, or by the buoyancy provided by air-tanks which may be attached under the platform. The advantage of using air-tanks is that the platform floor is above the water level so that simple scuppers, rather than a mechanical pump, can drain water off the platform.

[0046] In a preferred configuration of the invention, the floating power plant includes a group of stabilizing ducts attached under the platform, where each of the ducts are of a uniform dimension along its length, and substantially parallel to the transfer conduits. The transfer-conduits may be imbedded between, or among, the parallel ducts such that the inlets of parallel ducts and transfer-conduits are all oriented to the same direction, and that all the inlets are symmetrical across the flow. The function of parallel ducts is analogous to that of wind vanes. The parallel ducts, utilizing the velocity of water flowing through the ducts, would stabilize the whole floating plant structure, and the transfer-conduits in particular, against yawing, pitching, and rolling motions caused by waves and winds. The parallel ducts would also provide a structural support to the transfer-conduits. The stabilizing ducts should be aligned to be substantially parallel to the conduits, though it is recognized that the transfer-conduits may be curved, particularly near the outlet jet.

[0047] The present invention may also include a catenary mooring system with tether and anchors, which would provide an automatic yawing mechanism. When a stream pushes the floating plant until the tether becomes taut, the catenary mooring system, working together with the parallel ducts, would automatically align the inlets of parallel ducts and transfer-conduits to the flow of stream. FIGS. **4** and **5** show schematics of parallel ducts **60** used in conjunction with conduits **10** and a mooring system **70**. In the drawings, each of the parallel ducts **60** is of a cylindrical pipe; transfer-conduits **10** are imbedded between the parallel ducts **60** such that the inlet of the parallel ducts and transfer-conduits tubes are all oriented to the same direction; the inlets are symmetric across the flow. FIG. **4** also shows a two-point catenary mooring **70** securing the system to anchors **75** with a mooring ring **78** which is disposed about the mooring line. The use of a mooring ring enables a multi-point tethering system, where the anchor points do not necessarily need to be perpendicular to the water flow. That is, the lengths of the cable on the two sides of the mooring ring may be automatically adjusted to align the floating plant with the water flow. FIG. **5** illustrates a bi-directional configuration having conduits **10** which are positioned in opposite directions from each other, and a pair of two-point catenary moorings **70**; this configuration is capable of utilizing current flowing in either direction.

[0048] The present invention may also optionally include a hydraulic system that connects a turbine with a standard electrical generator to produce electricity. The electrical generator may be positioned near the turbine on the floating platform, an adjacent floating platform, or may be located on shore. Ocean tides flow at varying speed over lunar day and lunar month cycles. The hydraulic system permits an infinite gear ratio so that the electrical generator can be run at a constant revolutions per minute (rpm) regardless of the rpm of the turbine; mechanical gearing systems, in comparison, have a limited capacity to adapt to the varying speed of ocean tides.

[0049] Specific embodiments of the invention are further described in reference to additional figures. The various features of the embodiments may be used with the various configurations described herein. FIGS. **6** and **7** illustrate one embodiment of the present invention which includes at least two transfer-conduits **10** which are positioned at about 180° from each other, for operation in tidal flows. The transfer-conduits **10** are placed next to the parallel ducts **60**; an impulse turbine **30** is suspended in the open space under the platform **20**; the platform houses a generator **40**, a hydraulic pump and motor system **50** placed between the turbine **30** and generator **40**; the whole floating plant is tethered to the anchors via a pair of two-point catenary moorings **70**. FIG. **7** shows a similar configuration, with a plurality of air-tanks **80** that are mounted to the float platform.

[0050] FIG. **8** illustrates another embodiment where the transfer-conduits, **10**, are configured to impinge on an impulse turbine, **30**. FIG. **8** also illustrates various ways of configuring the air-tanks, **80**, stabilizing ducts, **60**, and transfer-conduits, **10**. In this embodiment, the floating plant is depicted with a generator, **40**, and a hydraulic system, **50**, on the platform.

[0051] FIG. **9** illustrates a perspective, top, and side view of a rectangular transfer-conduit **12**, for use with a modified, bi-directional cross-flow turbine **32**. When the present invention is equipped with a cross-flow turbine, the shape of the conduit may be an elongated rectangular duct, where two conduits are substantially connected to form a single passage with the exception of an opening at the top, in the middle, as shown in FIG. **9**.

[0052] FIG. **10** shows a view of an embodiment the present invention which includes a cross-flow turbine. A rectangular transfer-conduit **12** is placed between the parallel ducts **60**; a cross-flow turbine **32** is suspended in the air above the surface of the body of water, and under the flat bottom of platform **20**. The platform also has air-tanks **80** mounted thereto. The platform houses a generator **40**, and a hydraulic pump and motor system, **50**, placed between the turbine **32** and generator **40**; the whole floating plant is tethered to the anchors via a catenary mooring **70**.

[0053] The present invention enables the production of electricity from free flowing streams at costs competitive with other sources of electricity. The inventive power plants are superior to prior devices in many respects including: (1) they require no construction work of building underwater structure; (2) they use commercially available turbines; (3) it keeps no electrical components, or moving mechanical parts, under water; (4) they are modular so that they can be produced, both in number and size, on a flexible scale; (5) they can be easily moved for deployment; and (6) the platforms offer a convenient access for maintenance and servicing.

[0054] While the invention has been illustrated in connection with several examples, modifications to these examples within the spirit and scope of the invention will be readily apparent to those of skill in the art. In view of the foregoing discussion, relevant knowledge in the art and references discussed above in connection with the Background and Detailed Description, the disclosures of which are all incorporated herein by reference, further description is deemed unnecessary.

What is claimed is:

1. A floating power plant for extracting energy from a flowing stream of a body of water such as a river or ocean tidal flow, the floating power plant comprising:

(a) a float platform adapted to float on the body of water, the float platform including a deck;

(b) at least one impulse, on cross-flow, hydro-turbine mounted to the float platform; and

(c) at least one conduit mounted to the float platform, said conduit having a submersible inlet portal and an outlet jet portion;

wherein the conduit is mounted to the float platform so as to be adapted to receive a portion of the flowing stream below the surface of the body of water in its inlet portal and transfer the stream within the conduit such that the stream issues from the outlet jet portion of the conduit above the surface of the body of water and is incident upon the hydro-turbine of the floating power plant, the spent jet thereafter being returned to the body of water.

2. The floating power plant according to claim **1**, wherein the internal cross-section of the transfer-conduit progressively decreases or increases along a direction of flow over the conduit's length.

3. The floating power plant according to claim **1**, wherein the transfer-conduit has a longitudinal axis that is curved.

4. The floating power plant according to claim **1**, wherein the transfer-conduit has a longitudinal axis that has an S-curve.

5. The floating power plant according to claim **1**, having a plurality of transfer-conduits with cross-sections that progressively decrease or increase along a direction of flow over their respective lengths.

6. The floating power plant according to claim **1**, wherein the transfer-conduits are further characterized in that their outlet jet portions are disposed above their inlet portals and laterally offset with respect thereto.

7. The floating power plant according to claim **6**, wherein the plurality of transfer-conduits includes pairs of substantially identical transfer-conduits which are offset from one another by 180° such that the floating power station is operable on a reversible stream such as a tidal flow without changing its position.

8. The floating power plant according to claim **1**, further comprising an electricity generator mounted to the platform and coupled to the hydro-turbine.

9. The floating power plant according to claim **1**, further comprising hydraulic power transfer means coupled to the hydro-turbine, and connected to an electricity generator.

10. The floating power plant according to claim **9**, wherein the hydraulic transfer means include a hydraulic pump coupled to the hydro-turbine and a hydraulic motor hydraulically coupled to the hydraulic pump and connected to an electricity generator.

11. The floating power plant according to claim **1**, further comprising means for adjustably mooring the floating power plant such that the inlet portal of the transfer-conduit may be aligned with the direction of flow of the stream.

12. The floating power plant according to claim **11**, wherein the means for adjustably mooring the floating power plant includes a two-point mooring.

13. The floating power plant according to claim **12**, wherein the two-point mooring is a catenary mooring which comprises a cable, two anchors, and a mooring ring, such that the cable connects the two anchors and the float platform via the mooring ring.

14. The floating power plant according to claim **11**, wherein the means for adjustably mooring the floating power plant include a plurality of catenary moorings.

15. The floating power plant according to claim **1**, wherein the floating power plant further comprises a plurality of submersible stabilizing ducts mounted to the float platform substantially parallel to the transfer-conduit.

16. The floating power plant according to claim **15**, wherein the stabilizing ducts have a substantially uniform dimension along their length.

17. The floating power plant according to claim **1**, wherein the float platform has a plurality of air tanks mounted to the deck, which are disposed such that the turbine compartment is defined between air tanks.

18. The floating power plant according to claim **1**, comprising a plurality of hydro-turbines mounted in the turbine compartment.

19. The floating power plant according to claim **1**, further comprising a plurality of electricity generators and hydraulic systems mounted to the platform.

20. The floating power plant according to claim **6**, wherein there are provided at least two transfer-conduits having outlet jets impinging on the hydro-turbine.

21. The floating power plant according to claim **7**, wherein there are provided at least four transfer-conduits having outlet jets impinging upon the hydro-turbine.

22. A floating power plant for extracting energy from a reversible tidal stream which flows in a first direction and a second direction substantially opposite the first direction, the floating power plant comprising:

(a) a float platform adapted to float on the body of water, the float platform defining a turbine compartment which is open above the surface of the body of water;

(b) at least one impulse, on cross-flow, hydro-turbine mounted to the float platform in the compartment above the open draw;

(c) a first transfer-conduit mounted on the float platform having a first inlet portal adapted to receive a portion of the tidal stream flowing therein at velocity V_1, and wherein the stream is delivered to the impulse turbine at velocity V_3;

(d) a second transfer-conduit mounted on the float platform having a second inlet portal which is substantially 180° offset from said first inlet portal, the second inlet portal being adapted to receive a portion of the tidal stream flowing therein at velocity V_2, and wherein the stream is delivered to the impulse turbine at V_4;

(e) a third transfer-conduit substantially identical to and substantially parallel with said first transfer-conduit and a fourth transfer-conduit substantially parallel with and substantially identical to said second transfer-conduit; and

(f) means for adjustably mooring the floating platform such that the inlet portals of the transfer-conduits are aligned with the first and second directions of the tidal stream.

23. The floating power plant according to claim **22**, comprising a plurality of hydro-turbines.

24. The floating power plant according to claim **22**, further comprising an electricity generator mounted on the floating platform and coupled to the hydro-turbine.

25. A floating power plant for extracting energy from a flowing stream or a reversible tidal stream which flows in a first direction and a second direction substantially opposite the first direction, the floating power plant comprising:

(a) a float platform;

(b) at least one hydro-turbine mounted to the float platform, wherein the hydro-turbine is selected from impulse turbines having a vertical, or horizontal, axis of rotation, and cross-flow turbines having a horizontal axis of rotation;

(c) a first transfer-conduit mounted on the float platform having a first inlet portal adapted to receive a portion of the stream flowing therein at velocity V_1, and wherein the stream is delivered to the hydro-turbine at velocity V_3;

(d) a second transfer-conduit mounted on the floating platform having a second inlet portal which is substantially 180° offset from said first inlet portal, the second inlet portal being adapted to receive a portion of the tidal stream flowing therein at velocity V_2, and wherein the stream is delivered to the hydro-turbine at velocity V_4; and

(e) means for adjustably mooring the floating platform to align the inlet portals of the transfer-conduits with the first and second directions of the stream.

26. The floating power plant according to claim **25**, wherein the transfer-conduits are each configured to deliver a stream to a cross-flow turbine which rotates about a horizontal axis.

27. The floating power plant according to claim **26**, wherein the cross-flow turbine is bi-directional.

28. The floating power plant according to claim **27**, wherein the first and second transfer-conduits are partially conjoined.

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