Simple Free-Energy Devices

There is nothing magic about free-energy and by "free-energy" I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 27: Power From Buoyancy

Buoyancy
While we are aware of buoyancy being used to convert wave power into electricity, we seem to neglect the idea of using the very powerful buoyancy forces as a direct tool at locations away from the sea. This is definitely a mistake because serious levels of power can be generated from such a system. One such system is:

The "Hidro" Self-Powered Generator of James Kwok.
This design demonstrates yet again, the practical nature of drawing large quantities of energy from the local environment. Commercial versions are offered in three standard sizes: 50 kilowatt, 250 kilowatt and 1 megawatt. This generator which James has designed can be seen at the Panacea-bocaf.org web site at http://panacea-bocaf.org/hidrofreeenergysystem.htm and on James' own web site at http://www.jameskwok.com/tech/hidro.html both of which have video clips explaining how the design works. The method is based on different pressures at different depths of water, gravity, and on the buoyancy of air-filled containers. The system does not rely on wind, weather, sunlight, fuel of any type, and it can operate all the time, day or night, without causing any kind of pollution or hazard. This particular design calls for a water-filled structure of some height, a source of compressed air and a pulley system, and without wishing to be in any way critical, it seems rather more complicated than it needs to be. If, unlike James, you have not done the mathematics for the system, you would assume that the amount of power generated by a system like this would be less than the amount of power needed to make it operate. However, that is definitely very far from reality as considerable excess power is gained through the natural forces of the local environment which make the system operate. Part of the patent application which James made is shown here:

US 2010/0307149 A1	**Date: 9th Dec. 2010**	**Inventor: James Kwok**

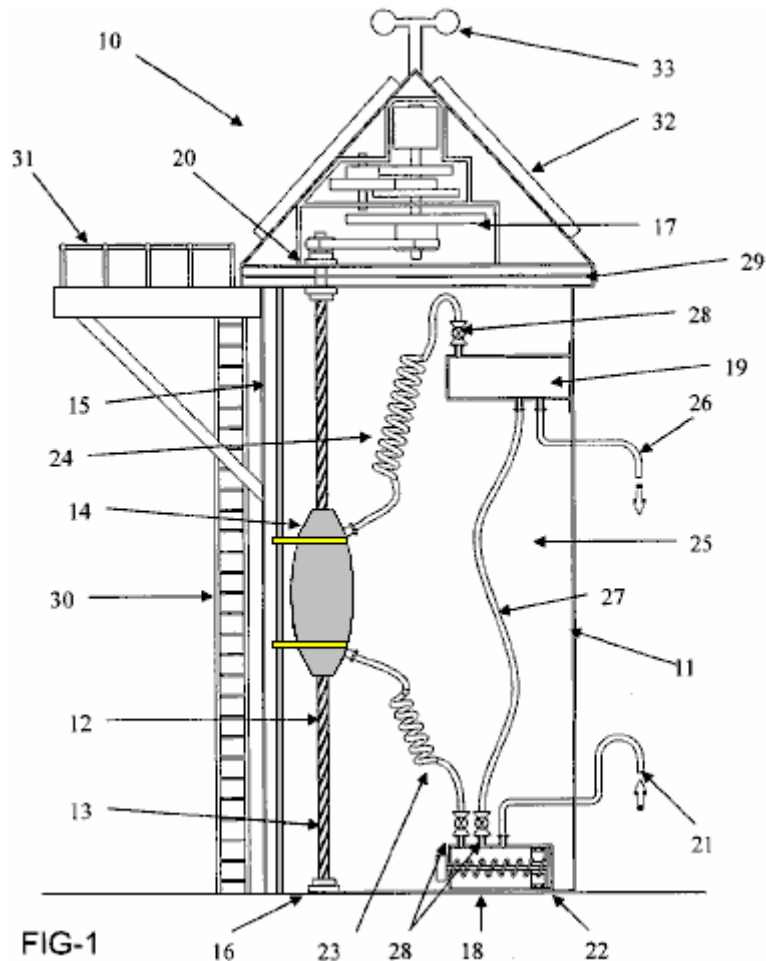**HYDRODYNAMIC ENERGY GENERATION SYSTEM**

FIG-1

Fig.1 is a cross-sectional view of an embodiment of the energy generation system of the present invention. Here, the energy generation system **10** comprises a vessel **11** in the form of a water tank and a shaft **12** which can rotate about it's longitudinal axis. The shaft **12** is provided with a helical screw groove **13** and is connected at it's lower end to a bearing **16** which allows it to rotate freely about its longitudinal axis.

The upper end of the shaft is connected to a generator **17** which is a flywheel system. The rotational energy of shaft **12** may be transferred to the generator through a ratchet-cog system **20**. A buoyant inflatable capsule **14** is provided along with its guiding mechanism **15** which is in the form of a wire or pole to assist in the smooth vertical movement of buoy **14**.

There is a first air reservoir **18** located in a lower portion of the vessel **11** and a second air reservoir **19** located in an upper portion of the vessel **11**. The first reservoir **18** draws air from the atmosphere, in through air intake port **21**. Once the pressure in the first reservoir has reached a predetermined value, a piston **22** is actuated, forcing air through hose **23** into the buoyant capsule **14**, which, when inflated, begins to move upwards through water tank **11**, as the buoy **14** has become less dense than the fluid **25** (such as fresh water or saltwater) in tank **11**. This in turn causes rotation of shaft **12**, and activation of the power generator **17**, thereby generating power.

When buoy **14** reaches the upper limit of its travel, the air in the buoy may be forced to flow through a second hose **24** and into the second air reservoir **19**. When air is removed from the buoy it moves downwards through vessel **11** under gravity and with the assistance of ballast (not shown). The downward movement of buoy **14,** causes rotation of the shaft **12**, which drives the generator **17**, thereby generating power.

Air stored in the second reservoir **19** may be vented to the atmosphere through a vent **26** if the pressure in the second reservoir **19** becomes too high. Alternatively, air may flow from the second reservoir **19** into the first reservoir **18** through a third hose **27** so that less air must be drawn into the first reservoir **18**

when buoy **14** reaches the lower limit of its travel and must once again be inflated with air from the first reservoir **18**.

The hoses **23**, **24** and **27** are provided with non-return valves **28** to ensure that air will flow in only one direction through the system **10**. Vessel **11** may be provided with ventilation **29** as required and it may also be provided with access stairs **30** and an access platform **31** so that maintenance may be carried out as required. The system may also be provided with a solar energy collection device **32** to generate at least a portion of the energy required to drive piston **22** and the non-return valves **28**. Energy produced by the solar energy collection device **32** may also be used to power a light or beacon **33** to indicate the location of the system **10**.
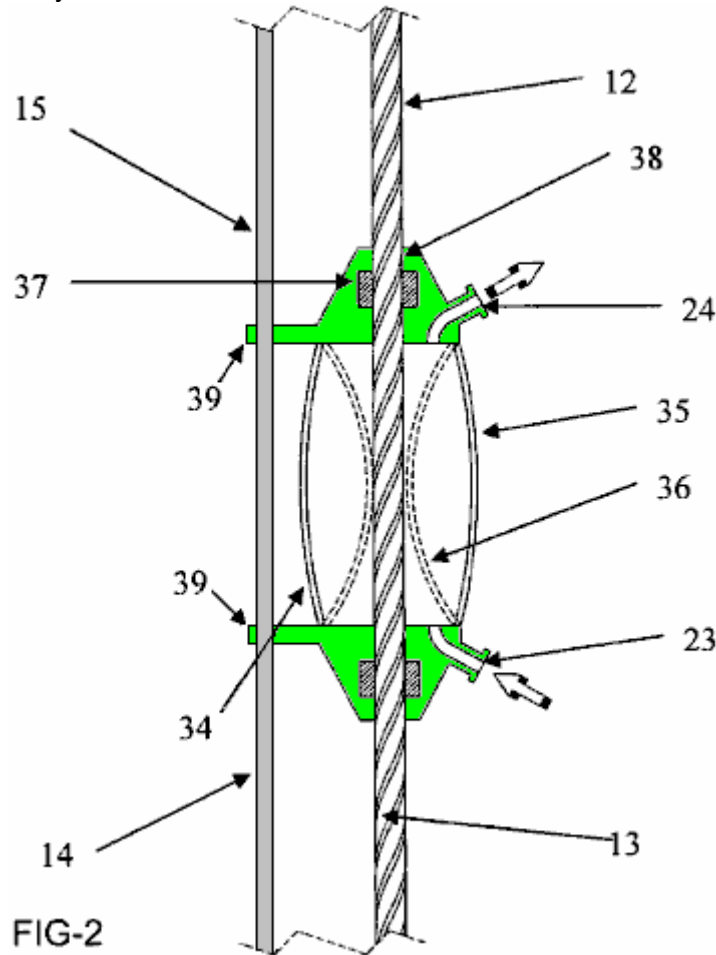

FIG-2

Fig.2 shows one arrangement for buoy **14** comprising an inflatable capsule **34**. This figure illustrates the shape of the walls of the inflatable capsule **34** when inflated **35** and when deflated **36**. Air passes into capsule **34** through hose **23** and exits from the capsule through hose **24**.

The buoy **14** also has a sleeve **37** attached to it. This sleeve has projections which engage with the helical groove **13** of shaft **12**, thereby causing rotation of the shaft when the buoy moves relative to shaft **12**. Sleeve **37** is provided with ballast **38**, such as stainless steel weights that assist in the downward movement of the buoy when it is deflated.

Buoy **14** is attached to a guide pole **15** and the buoy has a pair of arms **39** which slide on the guiding pole **15** and assist in the smooth vertical movement of the buoy.
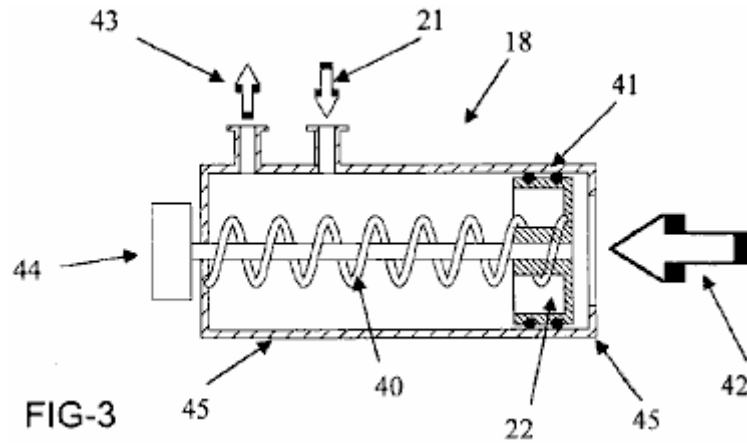
FIG-3

Fig.3 shows one version of the first air reservoir **18**. Air is drawn into reservoir **18** through air intake **21**. The reservoir includes a piston **22** associated with a spring **40**, the piston **22** being provided with seals **41** to prevent leakage of air.

When pressure, such as hydrostatic pressure, is applied in the direction of arrow **42**, the piston moves to the left of the reservoir **18** compressing spring **40** and forcing air out through outlet **43**. A motor **44** is provided to reverse the movement of the piston **22**. Reservoir **18** may be fixed to the floor of the vessel.
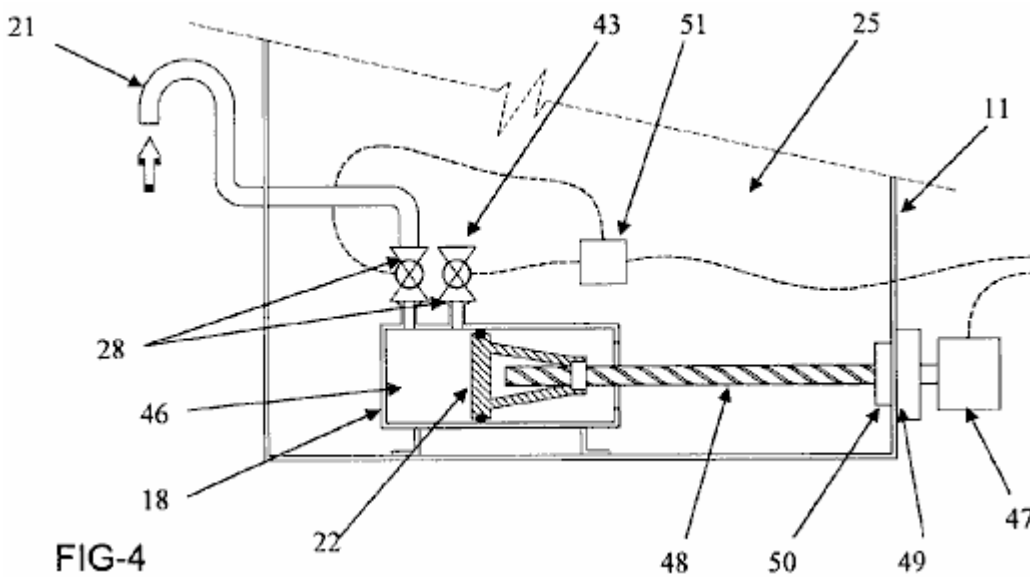
FIG-4

An alternative construction of the first air reservoir **18** is shown in **Fig.4**. In this embodiment, reservoir **18** is housed within a vessel **11** containing a fluid **25**. Air enters reservoir **18** through air intake **21** and is held in a chamber **46**. The reservoir has a piston **22** and the movement of the piston **22** towards the left of the reservoir **18** forces air in the chamber **46** out through air outlet **43**.

Piston **22** is driven by motor **47** which rotates the helically-grooved shaft **48**. The motor is linked to the shaft by a ratchet and cog mechanism **49**, which is provided with a spring loaded seal **50** on the inner surface of vessel **11**. An actuator **51,** may be used to control the opening and closing of non-return valves **28** as well as the actuation of motor **47**.

Fig.5 illustrates a cross-sectional view of an energy generation system according to one of the embodiments of the present invention:
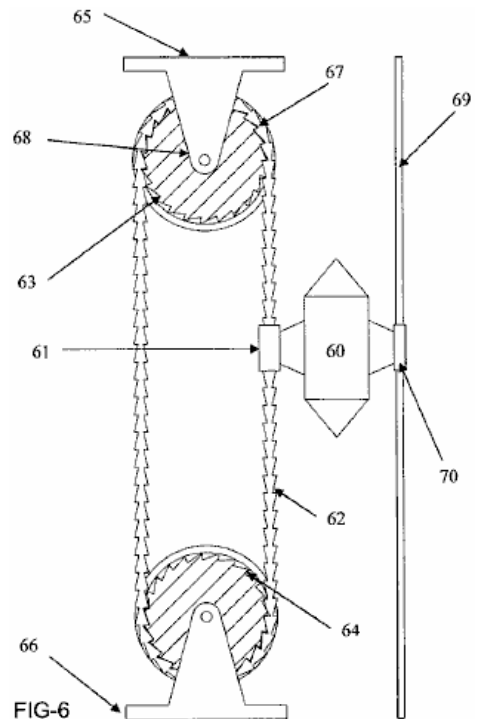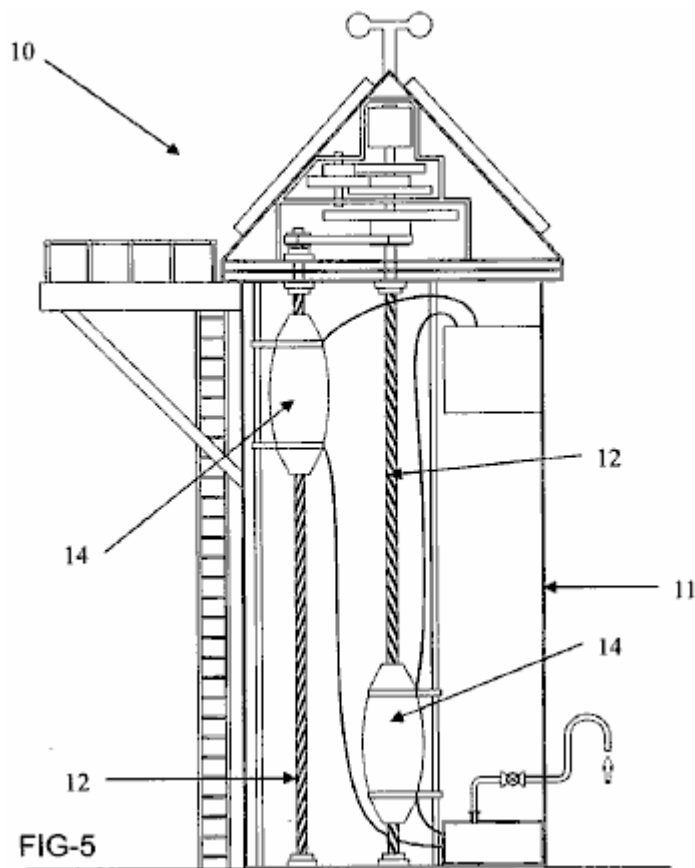
FIG-5

FIG-6

Fig.5 shows an embodiment where which a pair of buoys **14** are present. Each buoy is associated with its own shaft **12** and may move up and down inside vessel **11** independent of one another.

In **Fig.6**, an alternative embodiment of the present invention is illustrated, where the buoy **60** has a connecting method **61** in the form of a cylindrical sleeve through which a guide chain **62** passes. Chain **62** is provided in an endless loop and is located on an upper tracking device **63** and a lower tracking device **64**, both of which are pulleys. The upper pulley **63** may be fixed to an upper wall (not shown) of a vessel (not shown) via a bracket **65**, while the lower pulley **64** may be fixed to a lower wall (not shown) of a vessel (not shown) via a bracket **66**.

The connection mechanism **61** contains ratchets which engage with the links of the chain **62** when buoy **60** moves downwards. Thus, as buoy **60** moves downwards, chain **62** also moves, thereby causing both the upper and lower pulleys to rotate in a clockwise direction. The upper and lower **64** pulleys have a series of indentations **67** corresponding to the shape of the links of the chain **62**. In this way, the chain **62** sits in the indentations **67** and grips the tracking device (**63**, **64**), thereby ensuring that the tracking device (**63**, **64**) rotates.
In the embodiment of the invention illustrated in **Fig.6**, a work shaft **68** is associated with the upper pulley **63** such that rotation of the upper pulley results in rotation of the work shaft **68**. The work shaft **68** is located substantially perpendicular to the direction of travel of the buoy **60**. The work shaft drives a generator to produce power.
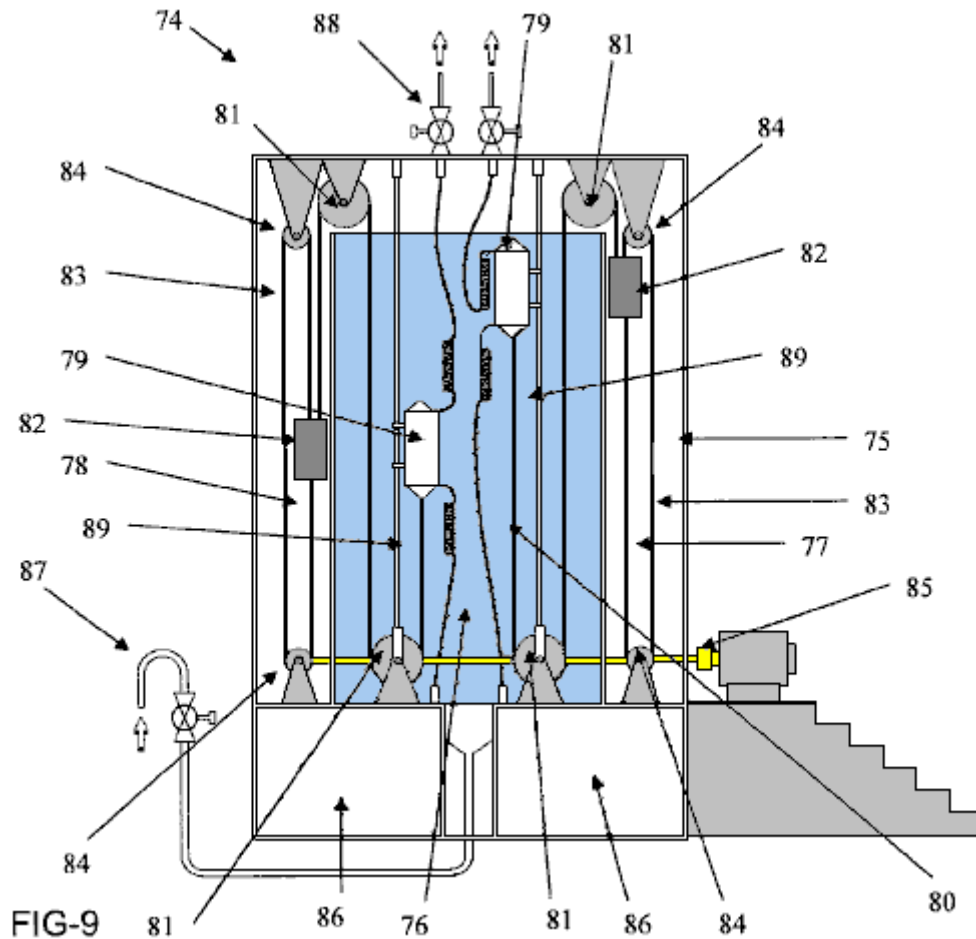
FIG-9

Fig.9 shows an alternative embodiment of this energy generation system **74**. The system is comprised of a vessel **75** having a fluid-filled "wet" compartment **76** and one or more "dry" compartments (in this case, a pair of dry compartments **77**, **78**) with no liquid in them. These dry compartments may be fabricated from any suitable material, such as, concrete, steel, fibreglass, plastic or any combination of materials.

The system also has a pair of buoys **79** each with a deflatable bladder-like construction. The buoys have guide rails **89** which ensure that the buoys move smoothly up and down inside the vessel **75**.

In this embodiment of the invention, air reservoirs **86** are located in the base of the vessel **75**. Air enters the reservoirs **86** through inlet **87**, while air exiting from the buoy **79** is vented through valves **88**. The vented air may either be expelled to the atmosphere or recycled to the reservoirs **86**.

Each of the buoys is designed to be connected to one end of a chain or rope **80**. A weight **82** is connected to the other end of the chain or rope **80**. The chain or rope **80** has a series of pulleys **81** such that when the buoy is inflated and filled with air, the buoyancy is greater than the weight **82** and so the buoy rises in the vessel.

When the buoy **79** is deflated, weight **82** is heavier than the buoyancy and so the buoy sinks in vessel **75**. In the embodiment illustrated here, the weights **82** are located in the dry compartments **77,78**. There are several reasons for this, including that, by locating the weights **82** in the dry compartments **77,78**, the velocity of the weights **82** in the downward direction is increased, and therefore an increase in the energy produced by the system **74** is experienced.

The weights **82** are associated with second ropes or chains **83**, such that vertical movement of the weights **82** results in the rotation of the second ropes or chains **83** around a pair of sprockets **84**. Rotational energy generated by the rotation of the second ropes or chains **83** is transferred to a power generation device **85** (such as a turbine or the like) in order to generate power (e.g. electrical power)

In spite of its mechanical complexity, the Hidro design is offered as a commercial generator with tens of kilowatts of excess power, indicating that buoyancy is a significant method of generating power, based on the fact that water is hundreds of times heavier than air. Due to its weight, movement in water is slow but can be very powerful. The helical groove method of converting the vertical movement of the floats into rotational power is used because of this as it has a very high ratio between shaft turns and movement along the shaft. This can be understood when you consider the fact that a complete revolution of the shaft is caused by the float moving up just one step to the next thread position directly above. The turns ratio for the complete float movement is determined by the angle of the groove cut into the drive shaft.

One other thing which needs to be considered for such a project is the weight of the overall structure when filled with water. The overall weight is liable to be many tons and so the footing underneath the generator needs to be very robust. Also, while compressed air is mentioned, giving the impression of cylinders of compressed air or gas, For continuous operation one would expect an air pump to be used. Whether or not an air pump is used, the diameter of the air hoses needs to be considered. Most people think that a gas can flow along a pipe or tube very easily. That is not the case. If you want to get a feel for the constriction caused by a pipe, then take a one metre length of 6 mm diameter plastic tube and try blowing through it. No significant amount of air will pass through the tube even if you blow very hard. The web site http://www.engineeringtoolbox.com/natural-gas-pipe-sizing-d_826.html shows this table:

Capacity of Pipe (MBH ≈ CFH)							
Pipe Size (inches)		Pipe Length (feet)					
Nominal	Inside diameter	10	20	40	80	150	300
1/2	0.622	120	85	60	42	31	22
3/4	0.824	272	192	136	96	70	50
1	1.049	547	387	273	193	141	100
1 1/4	1.380	1200	849	600	424	310	219
1 1/2	1.610	1860	1316	930	658	480	340
2	2.067	3759	2658	1880	1330	971	686
2 1/2	2.469	6169	4362	3084	2189	1593	1126
3	3.068	11225	7938	5613	3969	2898	2049
4	4.026	23479	16602	11740	8301	6062	4287
5	5.047	42945	30367	21473	15183	11088	7841
6	6.065	69671	49265	34836	24632	17989	12720
8	7.981	141832	100290	70916	50145	36621	25895

Notice the major difference in carrying capacity of any of these pipes with just the change from a 10-foot (3 metre) length to a modest 20-foot (6 Metre) length, and those lengths are the sort of lengths needed for many applications. Also, look at the figures for, say, the 0.5 inch (nominal) diameter pipe. With just a 10-foot length, it would take a full two minutes to pump just one cubic foot of air through it. It follows then, that pipes of considerably larger diameter are needed for a project like the 'Hidro'.

It is possible to construct a much more simple version of the 'Hidro', perhaps like this:

A Simple Buoyancy Power Generator
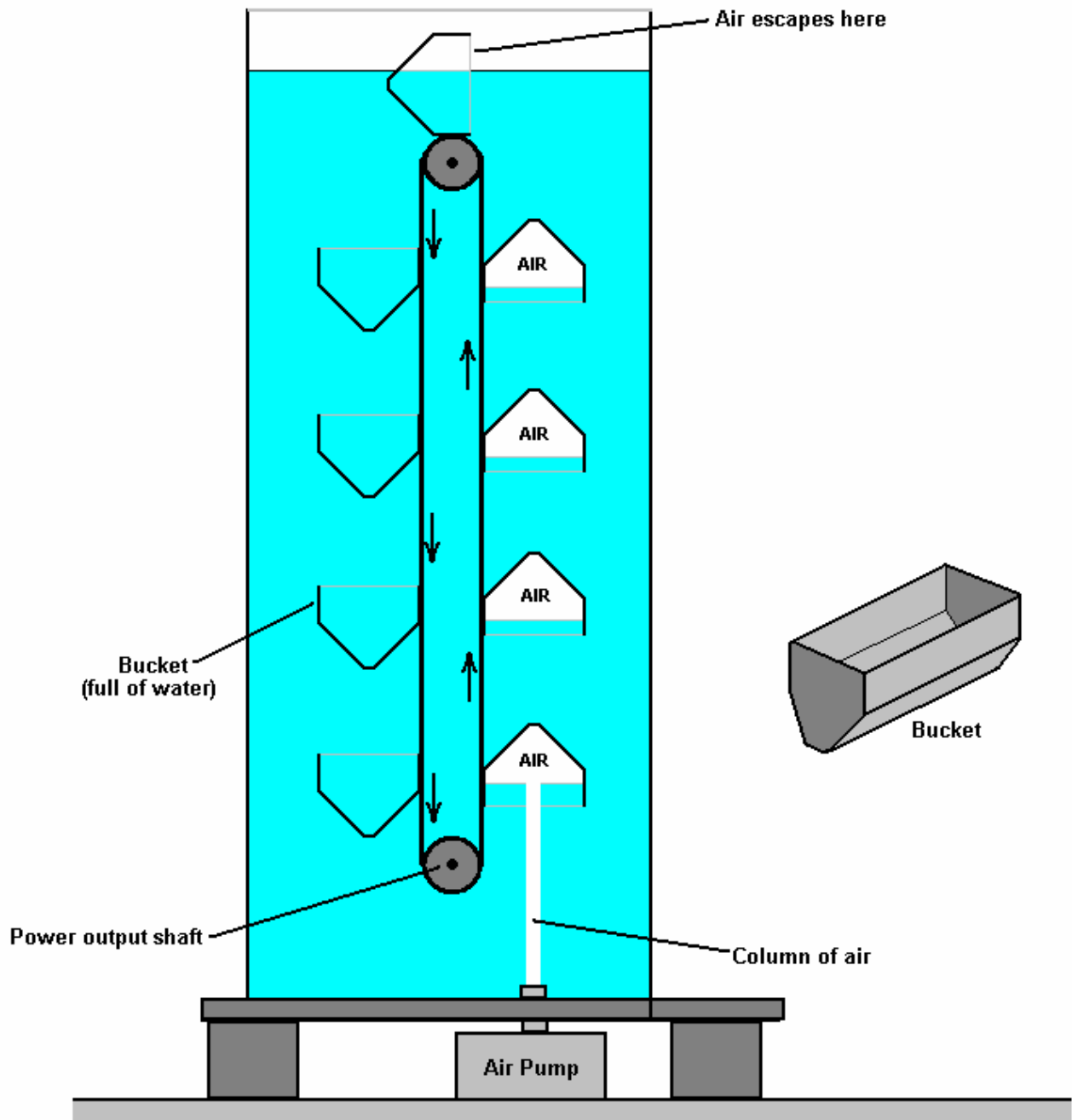
A simple hydraulic, buoyancy-powered generator can be constructed, with two or more horizontal, rotating shafts submerged in water in such a way that they are effectively positioned one above the other. Each shaft has one, and preferably two or more sprocket wheels mounted on it. Each of these sprocket wheels engages with a continuous chain loop which also engages with the sprocket wheel which is positioned vertically above it. These vertical chain loops form a belt-style support for a series of identical buckets. On one side of the vertical belt the buckets have their open face upwards and on the other side the bucket openings are facing downwards. An air pump is positioned directly underneath the set of buckets which have the bucket openings facing downwards. The air pump generates an upward-moving stream of air which collects in the rising buckets, displacing the water filling the bucket. This results in a powerful upward thrust caused by the buoyancy of that bucket, and the thrust causes the bucket to move upwards, rotating both horizontal shafts and bringing another water-filled bucket into position above the air pump. A gearing system transfers the rotation torque thus produced, to a generator which produces electricity for general purpose uses.

This is a generator whose input shaft is rotated through buoyancy caused by air-filled containers submerged in a tank of water or some other suitable heavy liquid. Continuous, powerful rotation of the generator shaft is produced through the use of one or more conventional, commercially available air

pumps.   An air pump is used to fill a series of containers which are open at one end and which are attached to what is effectively a belt arrangement created by two strong chain-link loops which mesh with sprocket wheels mounted on two shafts, either, or both of which can be utilised for the extraction of useful power, preferably for driving an electricity generator but not necessarily limited to that function as any powerful torque has many useful applications.

Objectives are to provide a power generation system which is very simple in form and which can be understood, operated and maintained by people with minimal training. Also, a system which uses components which are already readily available, thus avoiding significant manufacturing costs, and one which operates without the need for any kind of complex mechanism or high-precision equipment and which can operate with a wide range of commercially available products.
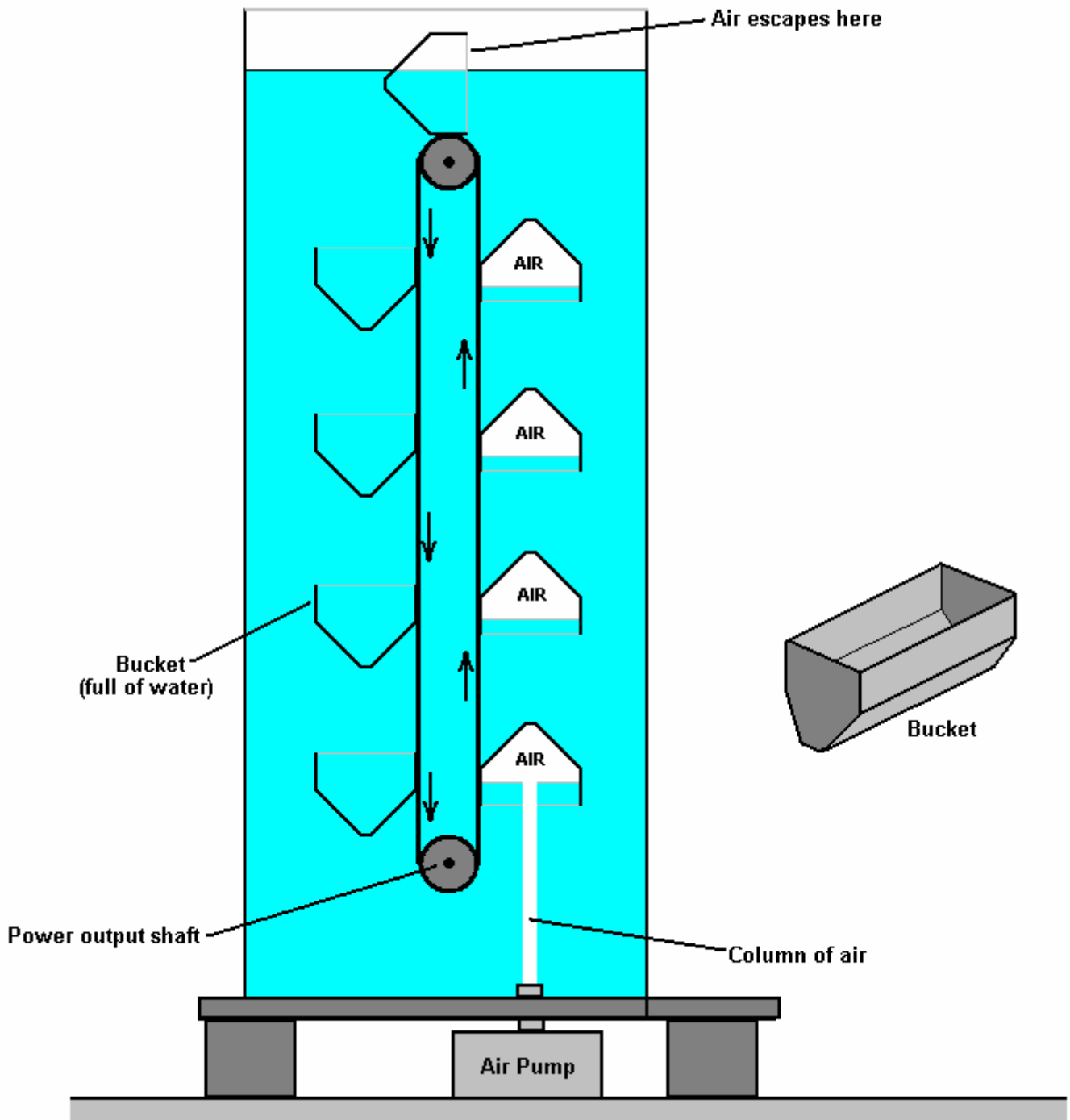

Fig.1, is a simplified partial schematic cross-sectional view showing the main components of the generator as seen from one end.
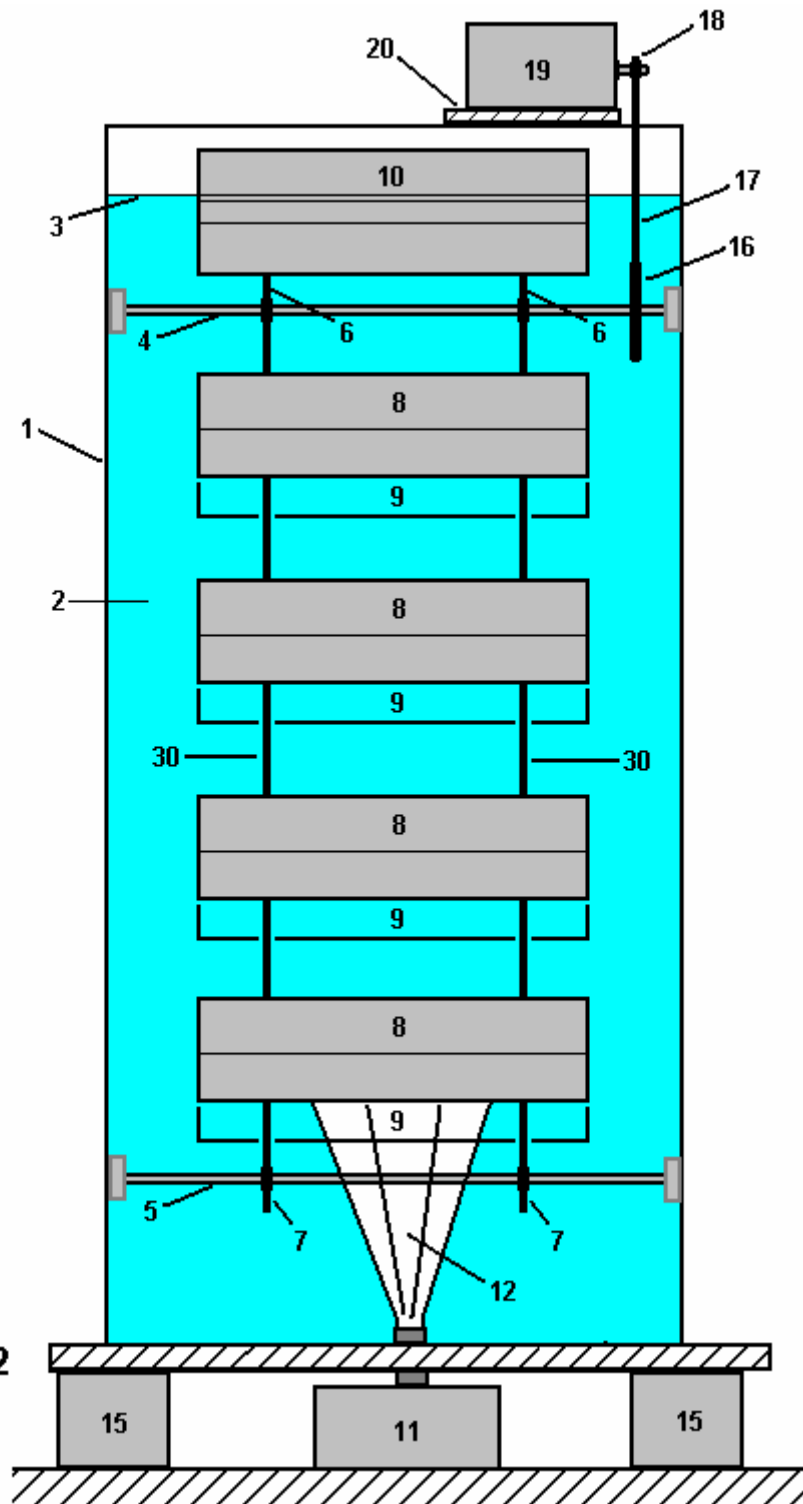
Fig.2, is a cross-sectional conceptual schematic view showing the front view of the generator in its most simple form.
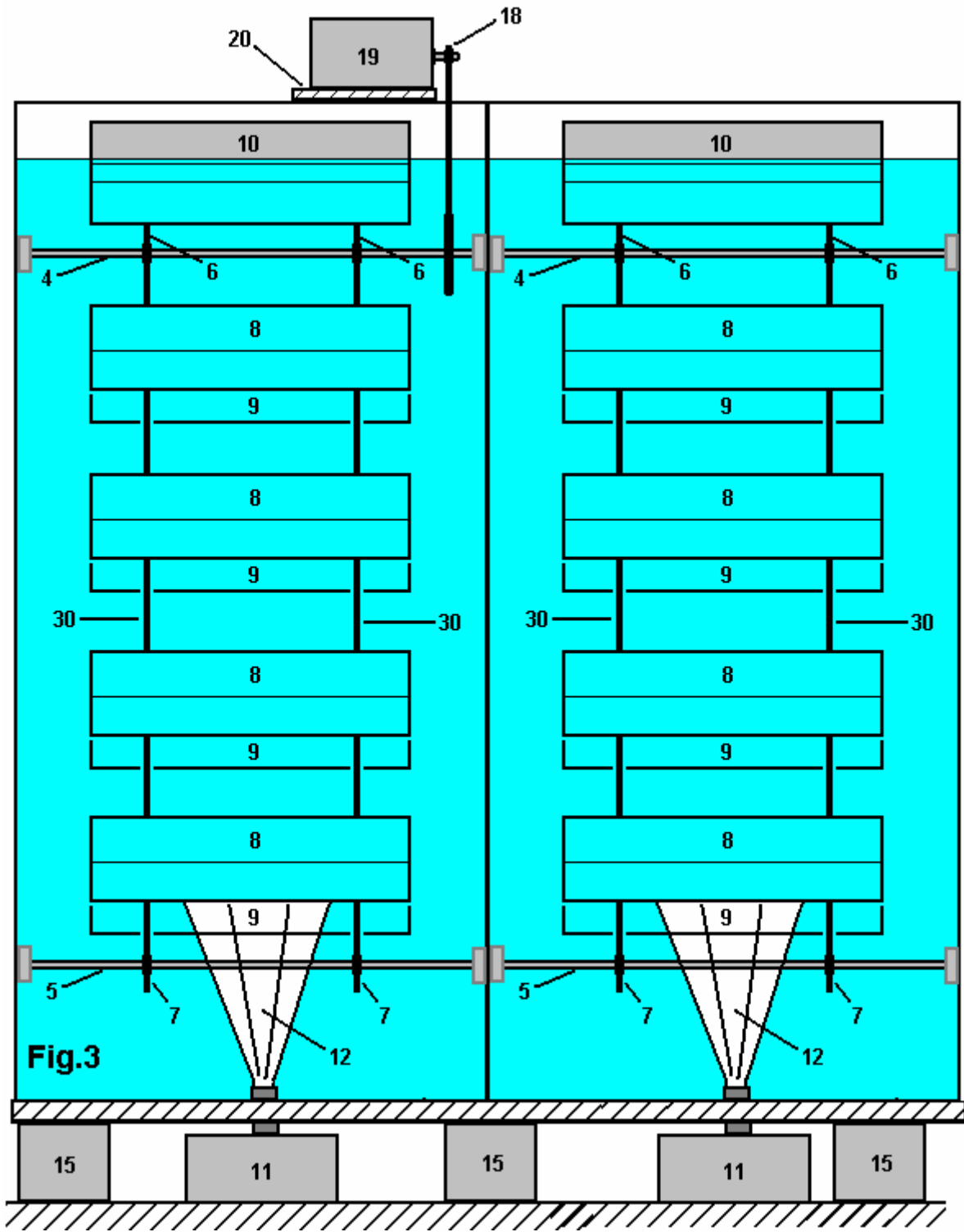
Fig.3, is a cross-sectional conceptual schematic view showing the front view of the generator where more than one set of buckets is used.
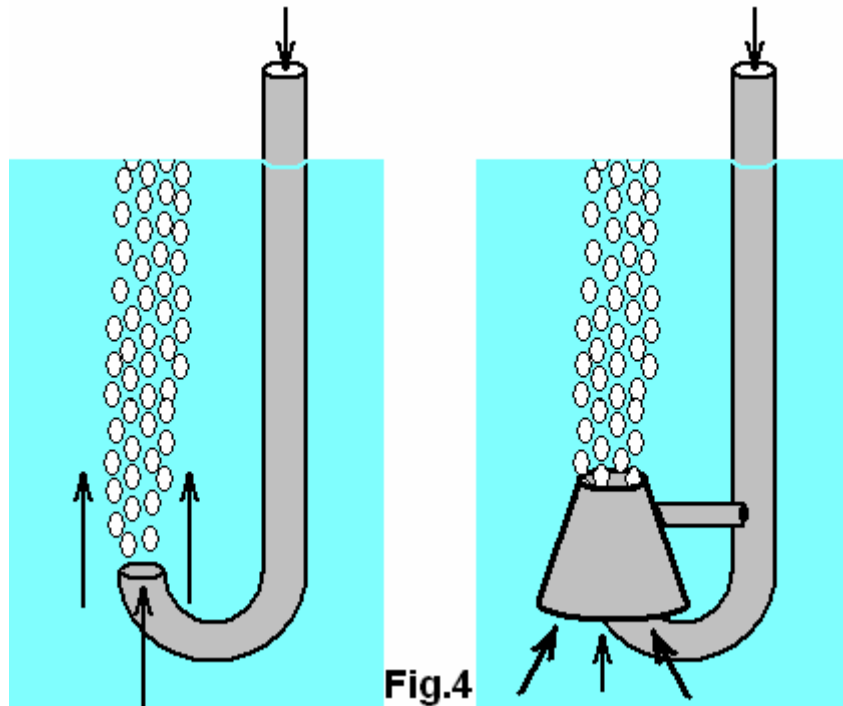
Fig.4, is a perspective conceptual view showing arrangements for a simplified air-feed system which operates from above the tank.

Fig.1, illustrates the overall concept of the generator in its most simple form where lightweight rigid buckets are used to capture the rising air from the air pump. In this Figure, a water tank **1**, holds water or other suitable liquid **2**. The surface of the liquid **3**, is indicated to illustrate the fact that a bucket **10**, which is in the process of turning over at the top of its orbital motion, is positioned so that one edge of the bucket is clear of the surface of the water, which allows the air which was trapped inside the bucket to escape into the atmosphere and the water fill the entire bucket causing only a very minor turbulence when doing so. This is a desirable, but not essential feature as the air trapped in any bucket will escape upwards as soon as the bucket starts its downward movement, positioning its open end upwards, although this causes unnecessary turbulence inside the tank. One possible bucket shape is shown in perspective view, but many different bucket shapes may be used, including flexible membrane types or alternatively, hinged-plate types which have very much reduced resistance to moving through the water when in their collapsed state during their downward movement.

The buckets **8, 9** and **10**, are attached to two strong chains **30**, which mesh with the upper sprocket wheel **6**, mounted on the upper axle **4**, and the lower sprocket wheel **7**, which is mounted on the lower axle **5**. Although it is not visible in **Fig.1**, there are two upper sprocket wheels **6**, two lower sprocket wheels **7**, and two chain loops **30,** although these can be seen in **Fig.2**.

The tank is supported on a robust plate **14**, which itself is supported by a series of pillars **15** which rest on a secure footing **16**, providing operating space underneath the tank for the installation and maintenance of the air pumping equipment. As fresh water weighs 1000 Kg per cubic metre, the weight of the operational generator system is substantial and so this must be allowed for when assessing the footing needed to support the tank and it's contents. While a thin-wall tank is shown in **Fig.1**, many different forms of tank may be utilised, including earth bank and plastic membrane styles, or resurfaced abandoned well shafts. The tank of **Fig.1** presumes that the lower axle **5** is taken out through the wall of tank **1**, using an arrangement similar to that used for the drive shafts which power the screws of ships and other power vessels.   While an arrangement of that type provides a drive shaft which is conveniently close to the ground, the much more simple arrangement shown in **Fig.2** where the output power is taken off using the very simple chain and sprocket wheel method utilised for the bucket supports (chain **30,** and sprocket wheels **6** and **7**). In general, the more simple and straightforward any design is, the better it works in practice and the lower any maintenance costs become.

Referring again to **Fig.1**, when activated, air pump **11** produces a stream of air **12**, which flows rapidly upwards. This stream of air **12**, once established, does not have to push against the head of water as

immediately above the nozzle of the pump is a rapidly rising column of air, sustained both by the exit velocity from pump **11** and the natural upward movement caused by the relative weights of water and air (as water is several hundred times heavier than air). This column of air would normally flow straight upwards in calm water, but should it be found that turbulence in the water tends to push the rising air away from its vertical path, baffles can be placed around the pump and positioned so that the air stream is forced to stay within the same section of water taken up by the rising buckets.

The rising air enters the lowest of the rising buckets and collects in it, forcing the water out of the open bottom of the bucket. If the rising bucket is not completely filled with air before the next bucket moves between it and the air pump, the trapped air will expand as the bucket rises and the water pressure reduces due to the lesser depth. Any one bucket with a substantial amount of air in it will create a very significant upward force due to buoyancy, air being about one thousand times lighter than water.

Each bucket on the rising side adds to that upward force and consequently, the chains **30** need considerable strength. The weight of the buckets on each side of the chain match and so the main advantage of light buckets is to lower the inertial mass of the moving parts. Movement through the water is relatively slow but this is offset by gearing between the output drive shaft and the generator's input shaft. The power of the system can be increased by adding more buckets in the vertical chain, increasing the water depth accordingly. Other ways of increasing the power include increasing the volume inside each bucket and/or increasing the flow rate produced by the air pump or pumps used. Another simple method is shown in **Fig.3** and discussed below. An alternative to air pumps is to use tanks of a compressed, non-polluting gas, possibly air.

The buckets shown in the various Figures are rigid, very simple shapes, possibly made by a plastic moulding process in order to be cheap, strong, lightweight and permanently water-resistant. There are, of course, many possible variations on this including using rigid hinged plates sealed with a strong flexible membrane, allowing the buckets to fold and become streamlined on their downward path, and opening as soon as they turn to start their upward movement. There are many mechanisms which can provide this movement, but it is a matter of opinion as to whether or not the extreme simplicity of rigid buckets is worth sacrificing

Fig.2 shows a schematic layout of the generator when seen from the side. The same numbers apply to the components already seen in **Fig.1**. The arrangement seen in **Fig.2** is the most simple, basic, single bucket set. The near-side rising buckets **8** obscure the view of the far-side falling buckets **9** and only the lowest part of the falling buckets **9** can be seen in this view. **Fig.1** shows buckets which are some two and a half times longer than they are wide, but this, of course, is just one option among literally thousands of possible proportions. The size and shape of buckets is related to the performance and number of air pumps being used for any one set of buckets and that choice depends on what is available locally at a reasonable price. It would not be unusual for two or three air pumps to be used side by side along the length of the bucket **8** although **Fig.2** only shows a single pump.

Fig.2 also shows a simple method for power take off where a large diameter sprocket wheel **16** is mounted on the upper axle **4**, and driving a much smaller diameter sprocket wheel **18** which is mounted on the drive shaft of the electricity generator **19** which is mounted on plate **20** which is attached securely to the top of tank **1**.

Fig.3 shows one of the possible arrangements for increasing the system power without increasing the depth of water used. Here, the axles **4** and **5** extend far enough to allow another set of buckets to drive them, increasing the torque very substantially. While **Fig.3** shows one extra set of buckets, there is, of course, no reason why there should not be three or more sets of buckets side by side. It should be noted however, that the partitions shown between the bucket sets are not there just to reduce the water swirling but are needed to support the bearings which are essential for the extended axles, since without those, the diameter of the bars used for the axles would have to increase very markedly to avoid unwanted flexing along their length. While the second set of buckets has been shown aligned exactly with the first set, there is an advantage in offsetting them relative to each other so that the output torque is more even with buckets emptying and filling at different points in the bucket cycle.

Fig.4. shows a method for further simplification, where the air is pumped from above the water surface. It is a matter of concern to most people, that the pressure of the head of water above the air pump is a

major obstacle to overcome and will be a continuous opposing force during operation of the generator. If air is being injected from underneath the tank, then initially, that pressure head has to be overcome. However, once the air flow is established, a vertical cigar-shaped area of water vortex is established by the rising air stream. This three-dimensional annular vortex negates the water head in the small area immediately above the air nozzle, and almost sucks the air out of the pump, after the initial introduction of the air has been accomplished.

There is another way of achieving this desirable effect without ever having to pump against the total head of water, and that is to use a mobile air pipe as shown in **Fig.4**. Initially, the air pump is started and lowered a short distance into the water. The opposing head of water is not large and the water vortex can be established quite easily. The pipe is then lowered very slowly, so as to maintain the vortex at a progressively lower depth, where, in spite of the increased head of water, the pump does not have to overcome that head. When the pipe outlet reaches the operational depth, it is then rotated to bring it under the set of rising buckets. The major advantage of this arrangement is that the tank is as simple as possible, with no possibility of leaking, and so abandoned wells can be modified to become energy generators. Alternatively, an earth bank can be erected to form an above-ground tank, possibly sealed with a plastic membrane. This method also avoids needing to support the weight of tank and water above a work-area where the air pump or compressed-air cylinders are located and maintained. The creation of the water vortex can be assisted by the addition of a cowl around the pipe exit as shown in this figure, but that is an optional feature.

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