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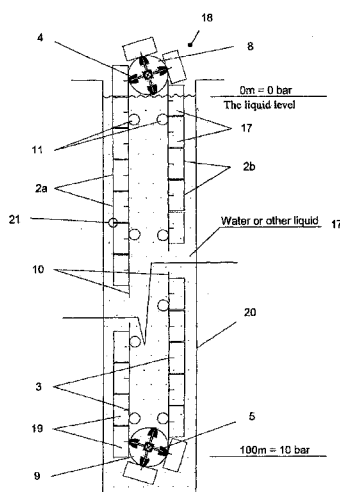
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(54) Title: LIQUID BUOYANCY ENGINE

Fig.1: Schematic layout of the new device 1



(57) Abstract: Liquid buoyancy engine uses buoyant force of water, hydrodynamic properties of water and working bodies (2) moving in water (17) for the drive of devices for the production of kinetic energy. The working bodies (2) are formed by external rigid jacket permeable to water (13), with openable cover (15) and openable bottom (16) and flexible internal jacket impermeable to water and gas (14). The working bodies (2) are fastened on the carrier (10) and move by means of the main rotary system (8) and (9) installed in the top section of the device (1) above water level (17) and in the bottom section in water (17). In the top section of the device (1) the compressed air (19) is evacuated from the internal jacket (14) and both the cover (15) and bottom (16) of the external rigid jacket (13) of the working body (2) open which, during the motion of the working body in water (17) in vertical downward direction, minimises extremely the hydrodynamic drag of the liquid acting on the working body (2).

Title: Liquid buoyancy engine

Technical Field

This invention relates to ecological equipment and the procedure for the use of the buoyant force of objects according to the Archimedes principle, hydrodynamic properties of water and bodies moving in it and the inertia force of a codirectionally flowing fluid for the drive of devices using kinetic energy or similar in a broader sense of the main claims of 1 to 6 listed below.

Background Art

Well-known devices and procedures for the generation of energy, in particular electric energy, use hydraulic power as one of the renewable resources, for instance from reservoirs, which are created by building a dam or from tidal power plants which use the difference of high tide and low tide levels or energy of waves. Additionally, the specific properties of other freely available substances, such as air, are used.

The devices and procedures for hydrostatic-pneumatic generation of power are common. Energy is obtained from hydrostatic pressure; for instance, in a water reservoir.

A "procedure and device for hydrostatic-pneumatic generation of power" (DE 30 05 767 A1) is recognised as when a volume of air is compressed by the action of hydrostatic pressure of water and then the compressed air is accumulated in an air chamber from which it drives a turbine generating power. Under the level of the bottom of the water reservoir, there is a transfer tank which can be filled with water from the water reservoir and while the water is discharged with simultaneous air exhaust, the transfer tank is closed airtight and filled with water from the water reservoir until air pressure rises to the value corresponding to the hydrostatic pressure. The compressed air is accumulated in the air chamber and expands in the turbine.

The "power generation by buoyancy in liquid" (DE 10 2005 053 444 A1), where the buoyant elements are driven through the rise of pressure in the lock system, is also well-known. Power in this case is obtained by means of cup seals and slide valves.

A device and the procedure for the use of the buoyant force of buoyant bodies for the drive of, in particular, a three-phase generator or similar device is also recognised (DE 10 2009 043 356 A1). The buoyant bodies are fastened on pivoted transport equipment with guide rollers and are filled with water and air in the upper and lower dead centre, respectively. In the

upper dead centre of the transport equipment, water flows under pressure in the highest pressure vessel. Consequently, the airtight and watertight diaphragm, which may move in the pressure vessel coaxially, moves in the direction of air exhaust and air is expelled from the pressure vessel by this motion. The expelled air or gas is led through another shaft or connecting duct from the highest pressure vessel. The air expelled from the upper pressure vessel is forced in the lower pressure vessel through connecting piping. When the valve opens, the water is expelled from the lower pressure vessel in the water shaft by pressure of air in coaxial motion of the diaphragm.

The disadvantage of these recognised procedures and devices is that power generation, for instance, by means of buoyant elements filled with air, is accompanied by a large loss of water in the lock system, and, furthermore, a large amount of energy is used for the transportation of the buoyant elements filled with air down in the water before the power is obtained thanks to buoyancy. Also, the need of water pressure for filling the buoyant elements, expelling the compressed gas from the vessel in the upper dead centre and expelling water in the lower dead centre is a source of an increase in power loss in such a device and thus a decrease in the efficiency of the entire system. The joint disadvantage of all hitherto known devices is an extraordinary resistance of closed objects in their motion in the fluid, particularly in the time when they carry out no work.

In consideration of these facts, the task of this invention was to create a new device and procedure for obtaining kinetic energy utilisable for the drive of other devices which would enable the optimal use of available eco-friendly energy resources.

This task has been resolved by the features of claims 1 to 6. The secondary patent claims specify advantageous versions of the invention.

Disclosure of the Invention

The invention is a Liquid Buoyancy Engine which, according to the main claims, uses the buoyant force of water (Archimedes principle), hydrodynamic properties of water and working bodies moving in it for the drive of devices for the production of kinetic energy.

Its advantage compared to hitherto solutions is that it brings a new system for development of power wherein working bodies are formed by an external rigid jacket permeable to water with an openable bottom and cover and a flexible internal jacket impermeable to water and air. The working bodies, i.e. primary elements of the device are fastened on carriers (of a pulling system, e.g. on chains) which move by means of the main rotary system (e.g. gear wheels) whose top section is above water level and bottom section is in the water. To decrease vibration, the carriers are guided by means of an auxiliary limiting system (e.g. auxiliary gear wheels) in the route of the carriers under the water level.

In the top section of the device, an extract air manifold is connected to a multiple-purpose valve of the working body. Here the compressed air suctioned from the internal jacket is again compressed and ready for its repeated transfer into the working bodies. At this, both the cover and bottom of the external rigid jacket of the working body are open. The opening of the body causes an extreme drop of hydrodynamic drag forces in its descending in water in vertical direction which is proportional to the reduction of the cross-section of the body. At the same time, it ensures immersion of the working body without the power demand necessary for filling its internal space with water.

In the bottom section of the device, the compressed air manifold is connected to the multiple-purpose valve of the working body. The air is forced through the multiple-purpose valve of the filling system into the internal jacket with a simultaneous closing of both the bottom and cover of the external jacket of the working body on which buoyant force begins to act according to the Archimedes principle. The force ensures the movement of the working body to water level and thus the generation of the kinetic energy which is taken from the device by means of a driving mechanism for further utilisation.

The working bodies are equipped with a system with the multiple-purpose valve which ensures extraction of air from the internal jacket in the top section of the device and its watertight locking along the entire travel of the working body to the bottom section of the device, from where, after filling with air, it ensures watertight closing of the internal jacket along the travel of the working body to the top section of the device.

The water, which was in the internal space of the external jacket of the lower working body, is forced back in the water shaft in expansion of the internal jacket with the use of the bottom and cover closing and permeability of walls of the external jacket of the working body. The amount of water which is expelled from the lower working body corresponds to the amount which filled the space of the working body entering the fluid in the top section of the device so that the total amount of water in the water shaft remains constant due to the fact that the working bodies are above water level in the highest part of the device.

The proposed design ensures minimum loss of water in the water shaft with the device which can be easily compensated by pumping or transportation. The water shaft intended for the device has a constant cross-section along its entire length. The water column height is preferably 100 m with regard to the state of the art.

At the same time, the motion of the working bodies also puts into codirectional motion the column of water in which the device is placed and the energy of inertia of this moving water provides additional support to the progression of efficiency of the whole system.

In addition, according to the auxiliary design of the invention, it is possible to further increase the efficiency of the whole working process by using the pressure of compressed air previously filled from the internal jacket of the working body in the top section of the device, in its evacuation by a vacuum pump and compressor connected in series, which can

substantially reduce the power needed for the new compression of air. Power output of the device can be also increased by increase of the speed of filling of the internal jacket of the working bodies through the rise of air pressure and volume in a unit of time, e.g. by increasing the number or size of the valves of the exhaust/filling system and adequately the number of the multiple-purpose valves of the working bodies.

The total power output of the device can also be increased by expanding the size of the device.

Brief description of Drawings

Figure 1 is a schematic layout of the new device (front view).

Figure 2 is a schematic layout of the new device (side view).

Figure 3 shows a detail of the main rotary system in the top and bottom sections of the device.

Figure 4 shows the working body in the working position.

Figure 5 shows the working body in preparation of an optimal position for passage through water (in evacuation of air).

Figure 6 shows the working body in filling of compressed air.

Figure 7 shows working bodies in motion in water toward the bottom of the device.

Best Mode for Carrying Out the Invention

Figure 1 is a schematic layout of the new device 1 (front view) with working bodies 2, in motion of the working body 2 from the bottom to the top of the device 1 in working position 2a and in motion of the working body 2 from the top to the bottom of the device 1 in optimal position for passage through water 2b with a minimum distance 21, main rotary system in the top section of the device 8 (above water level 17) and main rotary system in the bottom section of the device 9 (in water 17), with limiting system 11, exhaust system 4, filling system 5, multiple-purpose valves 3, water shaft 20 with marked water level 17 and presence of atmospheric air 18.

Figure 2 is a schematic layout of the new device 1 (side view) with working bodies 2 and their minimum distance 21, ensured by carriers 10, with main rotary system in the top section of the device 8 (above water level 17), and main rotary system in the bottom section of the device 9 (in water 17), driving shaft 12, exhaust system 4, extract air manifold 6, filling system 5, filling air manifold 7, water shaft 20 with marked water level 17 and presence of atmospheric air 18. The pressure of the compressed air. 19 in the filling air manifold 7 and

filling system 5 is sufficient to reliably overcome the pressure created by the water column 17 in the water shaft 20 with the device 1. The pressure of compressed air 19 (see Fig. 4 and 5) in the extract air manifold 6, exhaust system 4, varies from maximum pressure to vacuum so that the originally compressed air 19 is reliably exhausted from the internal jacket 14 and its volume is minimised inside the external jacket 13 of the working body 2. The filling air manifold 7 as well as the extract air manifold 6 are integral parts of the device 1.

Figure 3 shows a detail of an example of possible solution of the main rotary system in the top section of the device 8, exhaust system 4, driving mechanism 12, and of the main rotary system in the bottom section of the device 9, filling system 5 and carriers (pulling system) 10 of the working bodies 2.

Figure 4 shows the working body 2 in working position 2a (see Fig. 1), i.e. with the closed openable cover 15, closed openable bottom 16, multiple-purpose valve 3, compressed air 19 and the internal jacket 14 expanded to maximum volume enabled by the external jacket 13 of the working body 2.

Figure 5 shows the working body 2, in evacuation of compressed air 19 by the multiple-purpose valve 3 and change (decreasing) of the volume of the internal jacket 14, in preparation of an optimal position for passage through water 2b, in the position of opening of the cover 15 and bottom 16 of the working body 2, which ensures almost resistance-free filling of water 16 through the whole surface of the water permeable external jacket 13 of the working body 2.

Figure 6 shows the working body 2, in filling of compressed air 19 by the multiple-purpose valve 3 and in change (increasing) of the volume of the internal jacket 14, in preparation of working position 2a in the position of closing of the cover 15 and bottom 16 of the working body 2, by which water 17 is expelled through the whole surface with a minimum resistance of the water permeable external jacket 13 from the space of the working body 2.

Figure 7 shows working bodies 2 in position 2b (see Fig. 1) and their almost resistance-free motion to the bottom of the device 1 in water 17, ensured by optimisation of drag coefficient thanks to fully opened covers 15 and bottoms 16 and minimum volume of internal jackets 14 of working bodies 2, without compressed air 19 (see Fig. 1 and 5) ensured by the multiple-purpose valves 3 and minimum distance 21, of working bodies 2.

All features contained in the device description, in layouts and relating claims for protection can be either separately or in any combination be the nature of the patent.

Industrial Applicability

The device using a reduced drag coefficient of the body passing through water and, in particular the buoyancy energy of the working bodies filled with air (gas) in water and liquids, has a wide spectrum of applicability; it can serve as a direct drive of another device, for a drive of generators, turbines, or similar. The device is extraordinarily eco-friendly because with use of for instance natural water, it does not pollute it by any additives and has no negative effect on it.

This highly efficient device can be implemented, for example, by its installation in ground, with the use of stable boxes or with adaptation of suitable existing above-ground structures such as cooling towers or the like. Such a solution minimises the occupation of land and can also serve for the effective use of otherwise low-effective, environmentally or otherwise risky existing structures.

Further advantages and advantageous versions of the invention are stated in the example of invention implementation, in drawings and in the claims.

Item list

- 1 device
- 2 working body
- 2a working body in working position
- 2b working body in optimal position for passage through water towards the bottom of the device
- 3 multiple-purpose valve
- 4 exhaust system
- 5 filling system
- 6 extract air manifold
- 7 filling air manifold
- 8 main rotary system in the top section of the device
- 9 main rotary system in the bottom section of the device
- 10 carrier (pulling system)
- 11 auxiliary limiting system
- 12 driving mechanism
- 13 external jacket of the working body permeable to water
- 14 internal jacket of the working body impermeable to water and air
- 15 openable cover of the working body
- 16 openable bottom of the working body
- 17 water
- 18 atmospheric air
- 19 compressed air
- 20 water shaft
- 21 minimum distance of the working bodies

Claims

1. A device (1), which uses hydrodynamic properties of water and objects moving in it, in particular buoyant force of water for the generation of energy characterised in that working bodies (2) are carried by a carrier (10) through the main rotary system (8 and 9) between the bottom and top of the device (1), where, in the top section, the driving mechanism (12) is connected to the main rotary system (8) and compressed air (19) is evacuated from the internal jacket (14), cover (15) and bottom (16) is opened so that the working body (2) can open maximally and reduce its drag coefficient in passage through water (17) at the maximum; at the same time, in transfer of the working body (2) in the bottom section of the device (1) compressed air (19) is filled in its internal jacket (14), both the cover (15) and bottom (16) close, and the buoyant force acts fully onto the working body (2).
2. A device (1), according to claim 1, characterised in that the working body (2) is equipped with an external rigid jacket permeable to water (13), flexible internal jacket impermeable to water and air (14), openable cover (15), openable bottom (16) and with at least one multiple-purpose valve (3), which ensures filling and discharge of compressed air (19) and sealing of the internal jacket (14) so that the discharged or filled air (19) cannot get in or out spontaneously and that water cannot get in the internal jacket.
3. A device (1), according to claims 1 and 2, characterised in that the working bodies (2) are in the top section of the device (1) above water level (17) connected by at least one multiple-purpose valve (3) to the exhaust system (4) and to the manifold of air (6) evacuated from the internal jacket (14) of the working body (2).
4. A device (1), according to claims 1 and 2, characterised in that the working bodies (2) are in the bottom section of the device (1), under water level (17), connected by at least one multiple-purpose valve (3) to the filling system (5) and to the filling air manifold (7) to the internal jacket (14) of the working body (2).
5. A device (1), according to claims 1, 2 and 3, characterised in that the working bodies (2) are above water level (17) put in an optimal position for passage through water (2b) by opening the cover (15) and bottom (16), concurrently with discharge of air (19), while the working bodies are carried by the carrier (10) in water (17) at a minimum distance (21) so that an unwanted turbulence of water (17) is minimised in the water shaft (20) and that an extremely low drag coefficient of the working bodies (2) moving in water (17) is ensured.
6. A device (1), according to claims 1, 2 and 4, characterised in that the working bodies (2) their internal jacket (14) are in water (17) in the bottom section of the device (1) filled with compressed air (19) and put in working position (2a) by closing the cover (15) and bottom (16) which causes that the buoyant force of water begins to act on them and the working

bodies (2) are carried by the carrier (10) in a minimum distance (21) so that an unwanted turbulence of water (17) is minimised in the water shaft (20) in the motion toward the top section of the device (1).

7. A device (1), according to one of the previous claims, characterised in that the working bodies (2) are fastened to carriers (10) which move by means of the main rotary system (8 and 9) installed in the top section of the device (1) above water level (17) and in the bottom section of the device in water (17), in which in order to reduce vibration of the system the working bodies (2) are guided with the use of the auxiliary limiting system (11) in the route of the carriers (10) under level of water (17).

8. A device (1), according to one of the previous claims, characterised in that the working bodies (2) can be equipped with a higher number of multiple-purpose valves (3) and, sufficiently to this number, the extract air manifold (6) and filling air manifold (7) must be connected by means of relevant number of exhaust systems (4) and filling systems (5).

9. A device (1), according to one of the previous claims, characterised in that compressed air (19) is evacuated from the internal jacket (14) of the working body (2) for subsequent reuse.

10. A device (1), according to one of the previous claims, characterised in that the pressure of air (19) in the internal jacket (14) of the working body (2) is reused to reduce power demand for compression of atmospheric air (18) to required pressure.

11. A device (1), according to one of the previous claims, characterised in that the filling air manifold (7) is installed inside or outside the water shaft (20) or in a separate shaft or piping.

12. A device (1), according to one of the previous claims, characterised in that the water in the water shaft (20) with the device (1) can be replaced by a liquid of a higher specific weight than that of water (17).

13. A device (1), according to one of the previous claims, characterised in that the compressed air (19) filled in internal jackets (14) of the working bodies (2) can be replaced by any gas of a lower density than that of air (18).

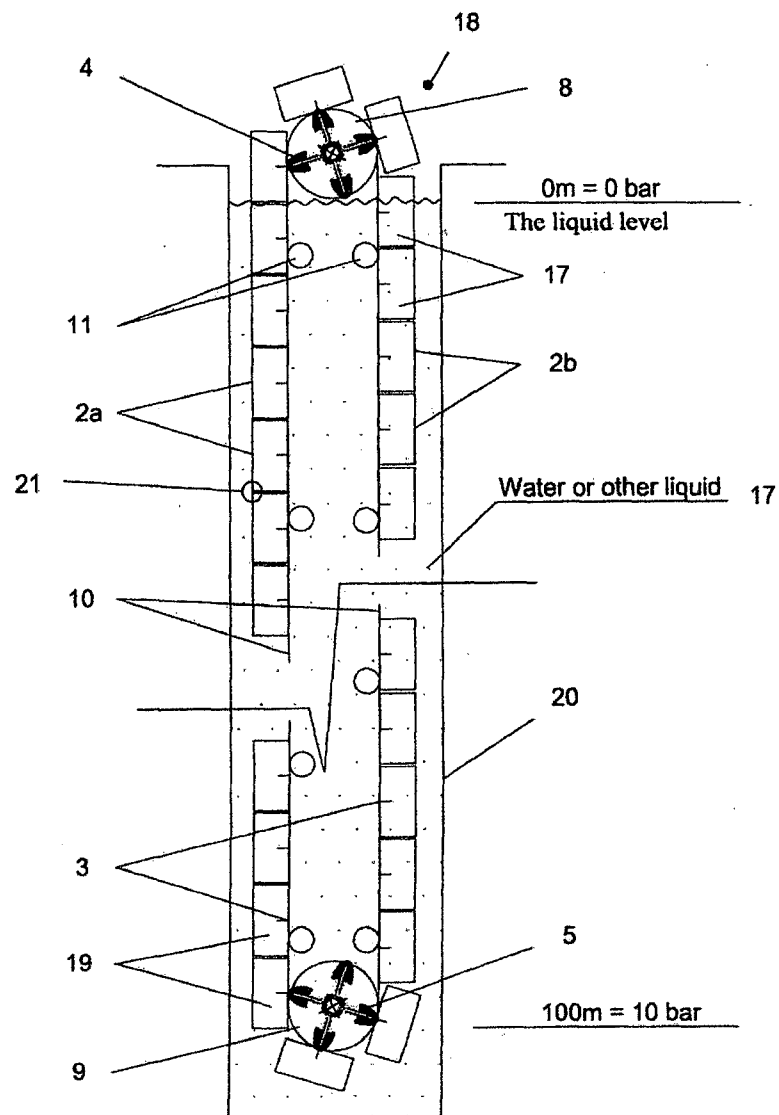
14. A device (1), according to one of the previous claims, characterised in that it is possible to adapt the depth of the water shaft (20) with the device (1) variably to the transferred power output.

15. A device (1), according to one of the previous claims, characterised in that the arising kinetic energy is taken from the device (1) by means of the driving mechanism (12) of the main rotary system in the top section of the device (1) or by means of the main rotary system (9) in the bottom section of the device (1).

16. A procedure, according to one of the above claims 1 to 15, characterised in that more devices (1) can be connected with each other to increase the generated power.

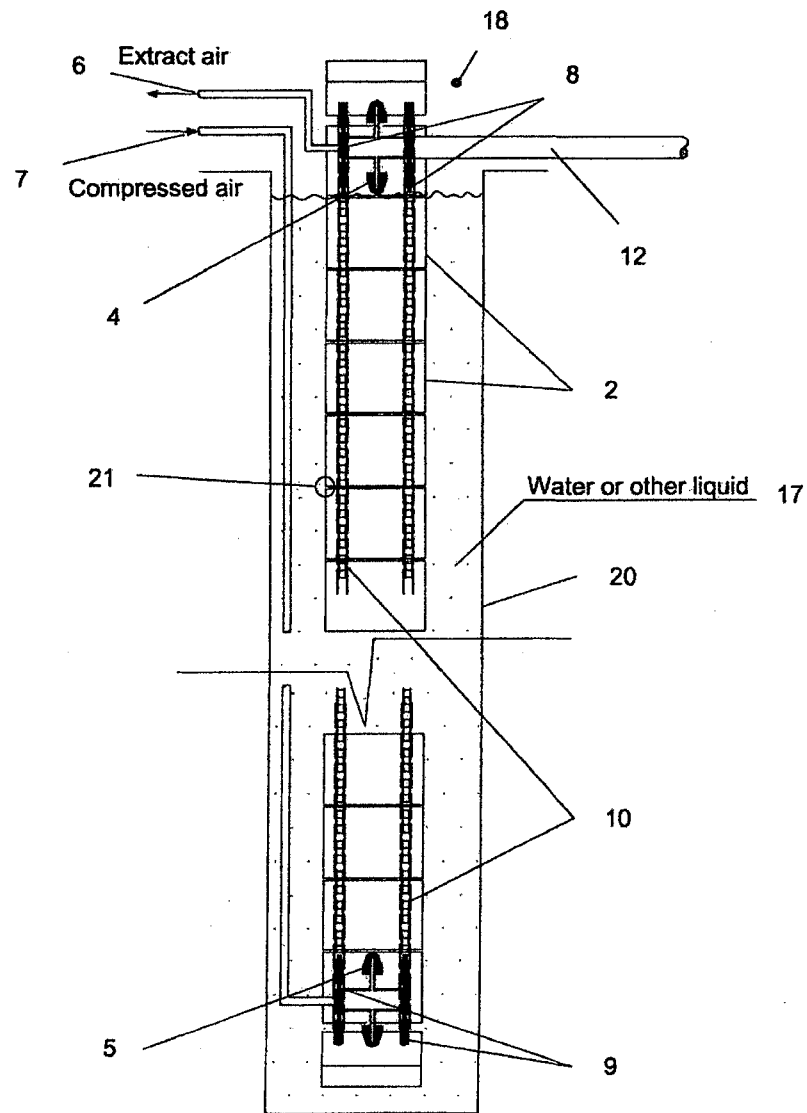
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Fig.1: Schematic layout of the new device 1



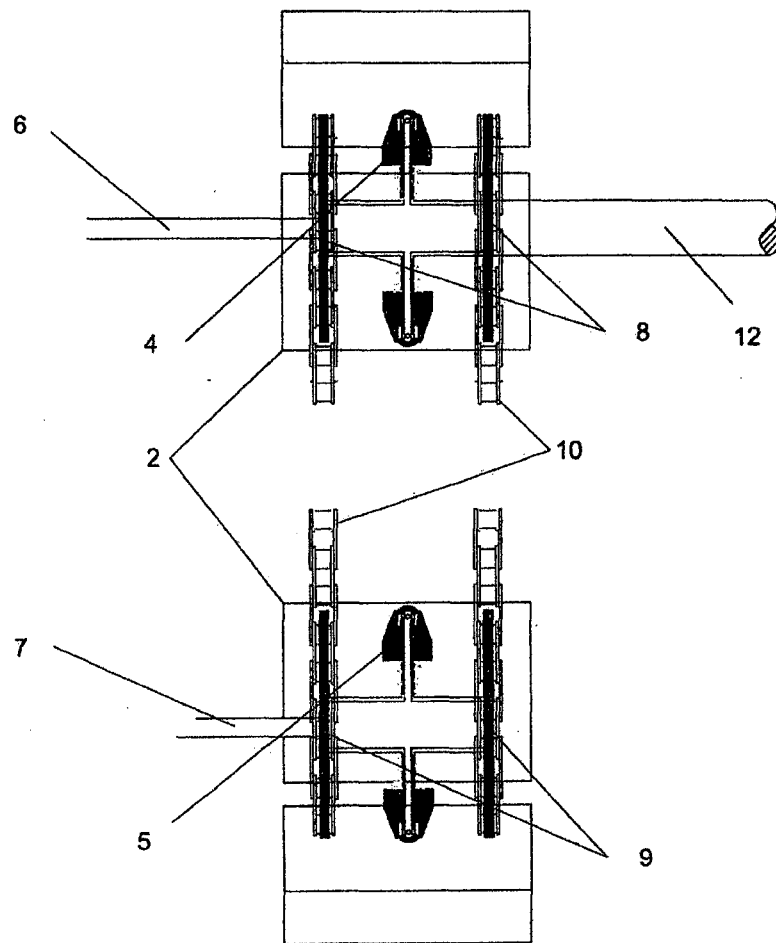
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Fig.2: Schematic layout of the new device 1 (side view)



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Fig.3: Detail of the main rotary system in the top and bottom of the device



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Fig.4: Working body 2 in working position

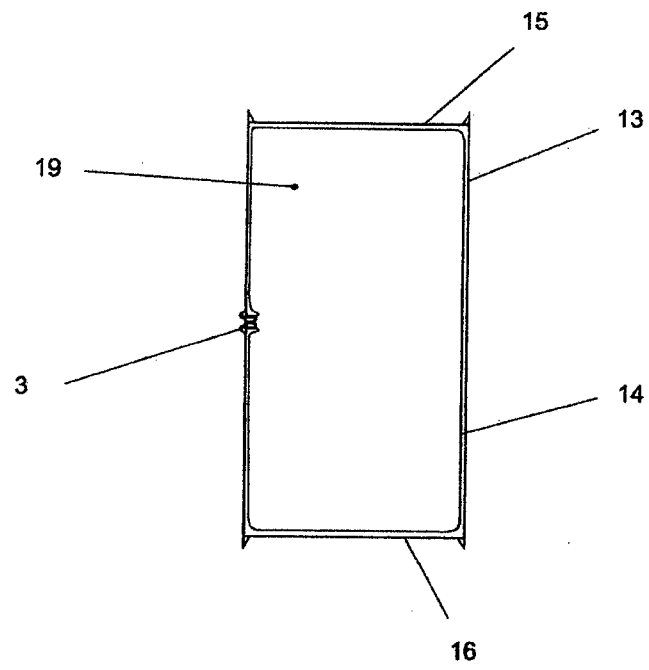
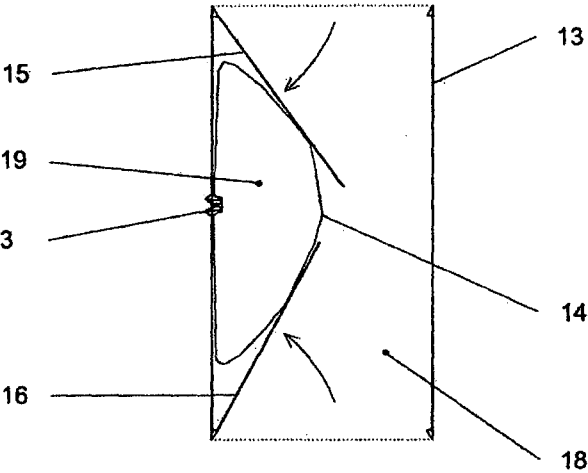
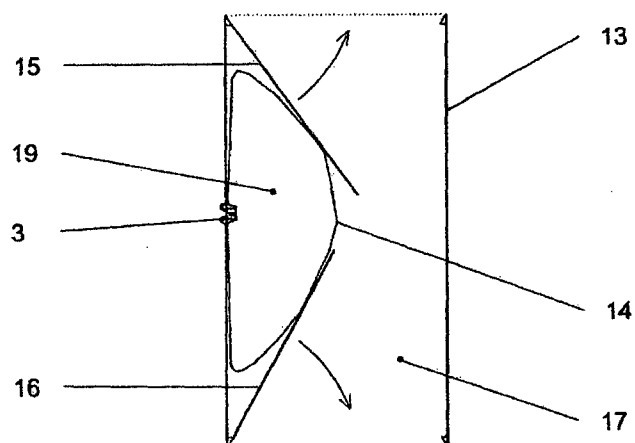


Fig.5: Working body 2 of evacuating air (gas)



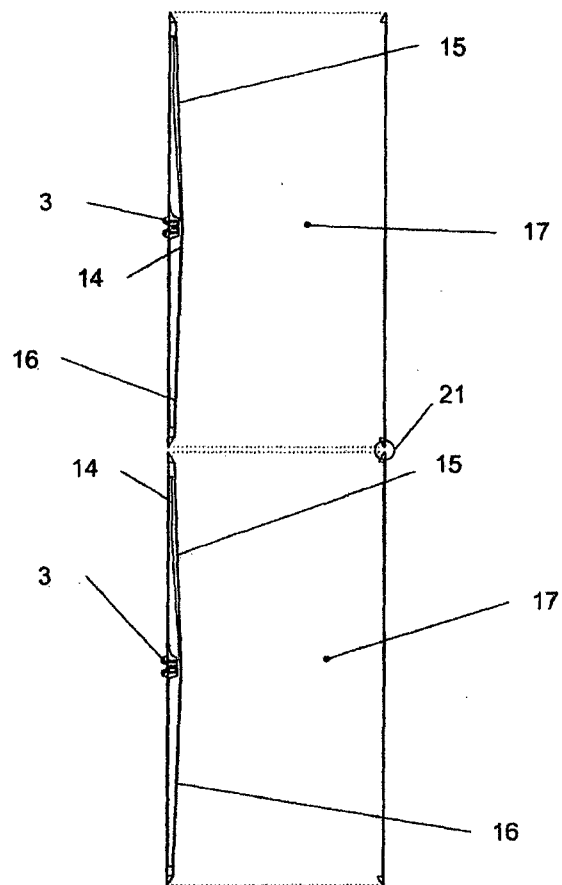
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Fig.6: Working body 2 in filling of air (gas)



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Fig.7: Working body 2 fluid movement down



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/162356 AI (HASTINGS DOUGLAS REYNOLDS [US]) 7 July 2011 (2011-07-07)	1,3,4,7, 11-13 , 15 , 16
Y	paragraphs [0025] , [0038] - [0042] ,	5,6,9 , 10
A	[0045] ; claim 1; figures 1-6, 9	2
Y	US 4 498 294 A (EVERETT THOMAS D [US]) 12 February 1985 (1985-02-12) column 4, line 26 - line 68 column 11, line 21 - line 31; figure 1	5,6,9
Y	US 5 899 066 A (BRASSEA-FLORES ANGEL [US]) 4 May 1999 (1999-05-04)	10
A	column 13, line 30 - column 14, line 34; figures 8-10	1
A	JP 2008 215334 A (KOBASHIGAWA YOSHIMASA) 18 September 2008 (2008-09-18) abstract; figures 1,2 ,5,6	1-16



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/CZ2013/00Q026

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2011162356	AI	07-07 -201 1	NONE	

US 4498294	A	12-02 -1985	NONE	

us 5899066	A	04-05 -1999	us 5685 147 A	11-11-1997
			us 5899066 A	04--05-1999

J P 20082 15334	A	18-09 -2008	NONE	
