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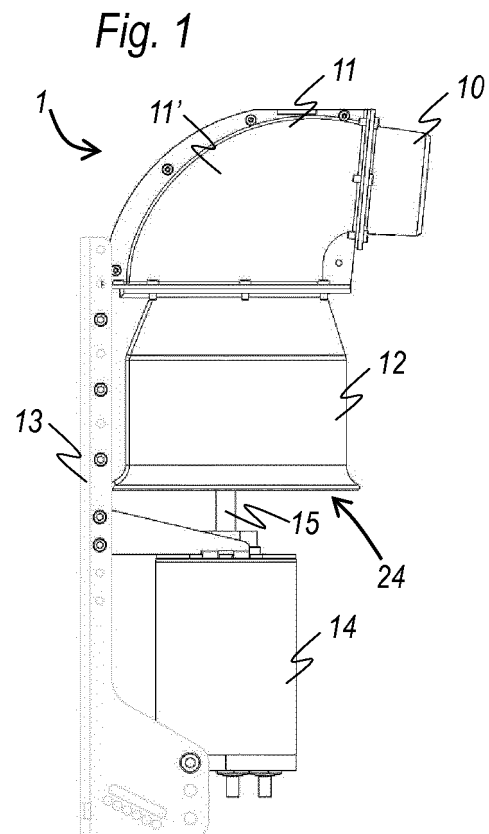
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(54) **COUNTER-CURRENT SWIMMING DEVICE**

(57) The invention provides a counter-current swimming device for a swimming pool, the device comprising:

- a lower housing part having an inlet,
- an upper housing part, connected to the lower housing part
- an outlet nozzle connected to the upper housing part, so that the lower housing part, the upper housing part and the outlet nozzle form a flow channel, wherein the device further comprises:
- a propeller screw configured to, when the device is installed in a swimming pool, accelerate water into the inlet, and
- a motor coupled to the propeller screw,

wherein the upper housing part has an upper housing part entrance and an upper housing part exit, wherein the upper housing part entrance has a larger cross section than the upper housing part exit. The coupling between the motor and the propeller screw may be a magnetic coupling with permanent magnets on the propeller side of the coupling.



Description

Field of the invention

[0001] The invention relates to a counter-current or counter flow swimming device. Such a device can be both added to an existing pool or built-in. The purpose of the device is to create the possibility to swim in any size swimming pool by generating a current strong enough to keep a swimmer in place. By achieving the right amount of flow in the water, the swimmer can continue to swim in a fixed position in the basin.

Background of the invention

[0002] Known systems make use of a pump outside of the swimming pool (typically in the technical space). Water is transported through conduits. Drawbacks of these systems are the loss of power in the conduits and a too narrow current from the circular outlet, making it difficult for the swimmer to stay in the correct position.

[0003] Another drawback is that such deeply integrated systems make it difficult and expensive to add counter-current swimming capability to an existing pool.

[0004] Published patent application US 2017 / 191281 A1 discloses a system which can be used as an add-on box. The box has a motor in it and a straight tube is placed directly in front of the motor, with a 2-bladed open propeller screw which pushes the water straight through the round outlet (of the same diameter as the propeller) into the pool. The water is sucked in through the grid over the entire front side of the cabinet (on installation) or via grids on several sides (surface).

[0005] It is an object to provide an improved counter-current swimming device.

Summary of the invention

[0006] According to a first aspect, the invention provides a counter-current swimming device for a swimming pool, the device comprising:

- a lower housing part having an inlet,
- an upper housing part, connected to the lower housing part
- an outlet nozzle connected to the upper housing part, so that the lower housing part, the upper housing part and the outlet nozzle form a flow channel,

wherein the device further comprises:

- a propeller screw configured to, when the device is installed in a swimming pool, accelerate water into the inlet, and
- a motor coupled to the propeller screw.

[0007] Further embodiments may have one or more of the following additional features:

- the upper housing part is in the form of a bend;
- the upper housing part has an upper housing part entrance and an upper housing part exit, wherein the upper housing part entrance has a larger cross section than the upper housing part exit (in other words, the flow path through the upper housing part is tapering);
- when the device is installed in a pool, the inlet is located lower than the outlet;
- when the device is installed in a pool, the bend transforms the flow path, in the direction of the water flow, from a (mostly) vertical path to a (mostly) horizontal path;
- the opening of the outlet nozzle may be oval in shape;
- the oval opening of the outlet nozzle may have a major axis in the horizontal (when installed) direction.

[0008] In an embodiment according to the invention, the propeller screw is coupled to the motor through a magnetic coupling. The magnetic coupling may comprise an upper coupling part, mechanically connected to the propeller screw, and a lower coupling part, mechanically connected to the motor, with a waterproof seal between the upper and lower coupling parts.

[0009] In an embodiment, the upper coupling part may comprise permanent magnets. In a further embodiment, the lower coupling part may comprise electro magnets or permanent magnets.

[0010] In an embodiment according to the invention, the propeller screw has overlapping blades. The screw may have two or four overlapping blades.

[0011] In an embodiment according to the invention, the bend is located between the propeller screw and the outlet. The bend may be over an angle of at least 60 degrees, preferably at least 80 degrees, more preferably at least 90 degrees of arc.

[0012] In an embodiment according to the invention, the outlet nozzle is tapering. In a further embodiment, the cross section of the flow path, from the entrance of the upper housing part to the outlet opening is monotonically decreasing (defined here as: nowhere increasing but it may be constant in parts).

[0013] The invention thus provides a device with a compact cabinet with a motor powered propeller in which the (low-voltage) motor drives, for example, a multi-bladed (four-bladed) overlapping screw (with specially developed blades and pitch) push the water through a narrower round tube, after which the water jet flows through a considerably narrower oval shaped water outlet and into the pool.

[0014] Due to the overlapping blades of the screw no water can leak back so that the pressure in the narrow (tapered) housing parts and outlet nozzle may be further increased.

[0015] The water jet has therefore gained a lot of speed when entering the pool. As a result, significantly less volume displacement of water is required for a high flow rate than with prior art devices (efficiency improvement).

[0016] The applied principle (compared to the operating principle of prior art devices) can be described as that of water displacement combined with a pressure increase instead of only water displacement.

[0017] By placing the water outlet not directly in front of the motor and propeller, but sending it to the outlet via a bend, the device can be built more compactly than in the prior art systems. In addition, more efficient use is made of the naturally present water pressure in the basin for sufficient water supply.

[0018] The device's grates for the suction of water are located deeper under the water surface where the natural water pressure is higher. The water supply is more efficient by using this natural water pressure combined with the pressure-increasing principle that is used in the device (so less water displacement is required for a strong flow rate).

[0019] Due to more efficient water supply, smaller grids can be used for sufficient water intake, which makes a more compact device possible.

[0020] The dimensions of the new product may be L: 400 mm x W: 200 mm x D: 200 mm. This makes it applicable in practically every size of swimming pool. It will be clear to the skilled person that devices according to the invention can deviate from the above given example dimensions. Dimensions could be in the ranges 200 mm < L < 1200 mm, 100 mm < W < 600 mm, 100 mm < D < 600 mm.

[0021] A magnetic coupling can be used for transmission from motor to propeller screw. Normally use is made of a watertight bearing between motor and screw to realize water tightness of the motor. But the bearings rotate and that is a significant weak point in the water tightness. By using magnetic coupling, a completely sealed enclosure around the motor is made possible, so that the water resistance of the motor is no longer an issue. Moreover, the magnetic coupling has advantages in that it allows the coupling to slip to prevent damage to the motor if the propeller gets stuck and, particularly if electro magnets are used on the driving part of the coupling, it is possible to easily disengage the coupling for maintenance purposes.

[0022] In an embodiment, the motor is included in a motor housing and said motor housing is filled with a cooling liquid. The motor housing is sealed so that the cooling liquid cannot mix with the environment of the device. In an embodiment, the motor inside the motor housing is also filled with the cooling liquid. The use of cooling liquid helps to prevent the motor from running to hot. Applicant has found that the use of cooling liquid allows for compacter designs, compared with traditional cooling means such as fins, without impairing the functioning of the motor.

[0023] The invention further provides an assembly of two, three, or four counter-current swimming devices as described above installed on a single fastening frame. The invention also provides a swimming pool with at least one counter-current swimming device as described

above.

Brief description of the Figures

[0024] Embodiments of the present invention will be described hereinafter, by way of example only, with reference to the accompanying drawings which are schematic in nature and therefore not necessarily drawn to scale. Furthermore, like reference signs in the drawings relate to like elements.

Figure 1 schematically shows a side view of a counter-current swimming device according to an embodiment of the invention;

Figure 2 schematically shows a perspective view of a counter-current swimming device in a double configuration according to an embodiment of the invention;

Figure 3 schematically shows a front view of a counter-current swimming device according to an embodiment of the invention;

Figures 4 and 5 schematically show side and perspective views with exposed inside details of a counter-current swimming device according to an embodiment of the invention;

Figures 6 and 7 schematically show side views of a counter-current swimming device having (electro)magnetic coupling according to an embodiment of the invention;

Figures 8 and 9 schematically show perspective views of a counter-current swimming device having (electro)magnetic coupling according to an embodiment of the invention;

Figure 10 schematically shows a motor housing and (electro)magnetic coupling according to an embodiment of the invention;

Figures 11 and 12 schematically shows a detail of a magnetic coupling according to an embodiment of the invention;

Figures 13 and 14 schematically show the motor housing according to an embodiment of the invention;

Figures 15 - 17 show a swimming pool with one or more a counter-current swimming devices according to an embodiment of the invention; and

Figures 18a - 18c schematically show side, front and perspective views of a counter-current swimming device according to an embodiment of the invention.

Detailed description

[0025] Figure 1 schematically shows a side view of a counter-current swimming device 1 according to an embodiment of the invention. The device can be installed against a side wall 31 of a swimming pool 30 (see figures 12-14) using a fastening frame 13 attachable to the device 1. The device 1 comprises a motor housing 14, which comprises a motor 18 (figure 6) coupled to propeller shaft

15. The motor 18 may be an electric motor, more specifically a low voltage electric motor. The propeller shaft 15 has a propeller screw 17 (shown in figures 4-6).

[0026] The device further comprises a lower housing part 12 connected to an upper housing part 11, which is in turn connected to an outlet nozzle 10. The lower housing part 12, upper housing part 11, and outlet nozzle 10 form a flow path for water from a swimming pool (when the device is installed in said pool). The upper housing part 11 is in the form of a bend 11'. The device may be provided in a cabinet (not shown) with sufficient grids provided in the cabinet to let water into the flow path.

[0027] The upper housing part 11 has an entrance 25 cross section (see figure 6), at the connection with the lower housing part 12, and an exit 26 cross section at the connection with the outlet nozzle 10. In an embodiment, the entrance cross section is larger than the exit cross section. In an embodiment, the exit cross section is oval in shape. In an embodiment, the major and minor axis of the exit cross section are both smaller than a diameter of the entrance cross section. In an embodiment, the entrance cross section is circular. In another embodiment, the entrance cross section is an oval, with a major axis that is larger than a major axis of the exit cross section.

[0028] In an embodiment, the outlet nozzle 10 provides a further narrowing of the flow path. In an embodiment, the flow path is continuously becoming more narrow starting from just before the bend 11' up to the outlet nozzle 10.

[0029] Prior art counter-current swimming devices tend to widen the flow path as the path nears the outlet. This is done on the presumption that such a widening of the flow path would allow a swimmer to feel a wide counter-current rather than a narrow jet, making it easier to, literally, stay in the flow. Meanwhile, at the entrance the prior art systems tend to have a relatively narrow flow path to save space.

[0030] However, the applicant has surprisingly found that the counter-current is improved when at the entrance the flow path is relatively wide, and it is narrowed somewhat towards the end. This may be in part due to the pressure increase effects described earlier.

[0031] Figure 2 schematically shows a perspective view of the counter-current swimming device 1 according to an embodiment of the invention.

[0032] Figure 3 schematically shows a front view of a double configuration 2 comprising two counter-current swimming devices 1 according to an embodiment of the invention installed on a single fastening frame 13'. In an embodiment (not shown in figure 3), the devices are at a slight angle with respect to each other, so that each nozzle is pointing a little bit away from the other nozzle, thus widening the output current of the combined flows. This has the effect of allowing optimization of the output current profile.

[0033] The devices 1 can be used in a configuration with practically any number of devices. For most practical

pool sizes, Applicant envisages configurations of 1, 2, 3 or 4 or more counter-current swimming devices 1. The devices can be on a shared fastening frame 13, 13'. Outlet openings 16 of each device may be set so that the overall current outlet of the combined devices is optimized. In case of two or more devices, the outlet openings can be pointed in directions in a symmetric (seen from the point of view of a centreline through the pool) fashion, so that the centre device(s) are pointed mostly along the length of the pool and the outer device are pointed somewhat more towards the respective sides of the pool. In this manner, a broad counter-current profile can be achieved while still keeping the multiple counter-current swimming devices 1 in a central place. Vice versa, each of the multiple devices can be pointed more towards a centre line of the pool, again in a symmetric fashion, so that a more narrow but stronger current is created in the centre of the pool.

[0034] In an embodiment, the orientation of the multiple devices is user-adjustable to a degree, so that a user can change the orientation of the devices and thus optimize the current pattern for his/her use.

[0035] The outlet opening 16 in each device 1 has an oval cross section. The oval cross section has a horizontal (when in operation) major axis and a vertical minor axis. The minor axis of the oval cross section is smaller than the diameter of the circular cross section of the upper housing part 11 entrance 25.

[0036] Figures 4 and 5 schematically show side and perspective views with exposed inside details of a counter-current swimming device according to an embodiment of the invention. These figures show the propeller screw 17 connected to the propeller shaft 15 and configured to provide water into the flow path formed by the lower and upper parts 12, 11 and outlet nozzle 10. The propeller screw 17 can be a double-bladed screw to prevent water from being pushed back in the opposite direction of the flow path.

[0037] In an embodiment most clearly shown in figure 4, the lower housing part 12 is tapering (having an increasingly smaller cross section) towards the upper housing part 11.

[0038] Figures 6 and 7 schematically show side views of a counter-current swimming device 1 having an (electro)magnetic coupling 19, 20 according to an embodiment of the invention. The coupling comprises a lower coupling part 20, mechanically connected to a motor shaft 23 (see figure 10) and an upper coupling part 19, mechanically connected to the propeller shaft 15. The lower and/or upper coupling parts 20, 19 comprise magnets to enable the (electro)magnetic coupling.

[0039] The magnets may be permanent magnets or electro magnets. However, given the fluid environment of the device 1, at least on the upper coupling part 19 the use of permanent magnets is preferred. Between the lower and upper coupling parts a waterproof layer 21 is provided. On the motor (lower) side of the magnetic coupling, either permanent or electro magnets may be used. The

use of electro magnets provides the additional advantage that it becomes possible to electrically disengage the coupling, for example for testing or maintenance purposes.

[0040] The use of the waterproof layer 21 makes it possible to completely encapsulate the motor housing 14 in a waterproof seal (of which the waterproof layer 21 can be a part), without any moving parts having to penetrate said seal. This improves both the safety and the robustness of the device 1 considerably.

[0041] An added benefit of the (electro)magnetic coupling is that it allows the lower coupling part 20 to slip with respect to the upper coupling part 19. For example, in case the propeller screw becomes stuck on something, the coupling can be allowed to slip, thus preventing damage to the motor 18. In case of a hard mechanical coupling between the motor shaft 23 and the propeller shaft 15, it is much more likely that the motor 18 will become damaged when the propeller screw 23 is stuck.

[0042] Figures 8 and 9 schematically show perspective views of the counter-current swimming device 1 having the (electro)magnetic coupling 19, 20 according to an embodiment of the invention and figure 10 schematically shows a close up of the motor housing 14 and (electro)magnetic coupling 19, 20.

[0043] Figure 11 shows a folded-open view of the magnetic coupling of figure 10. The upper coupling part 19 is mechanically (rigidly) connected with the propeller shaft 15. The lower coupling part 20 is mechanically (rigidly) driven by the motor 18 via motor shaft 23. Permanent or electro magnets 27, 28 are arranged both in the upper coupling part 19 and the lower coupling part 20. Magnet 27 has opposed polarity to magnet 28, and is thus attracted by the latter. In stable condition, each magnet 28 in part 19 is aligned with a magnet 27 in part 20 and vice versa. The waterproof layer 21 is provided between upper and lower coupling parts 19, 20.

[0044] Figure 11 shows a top view of an alternative magnetic coupling. Here the upper coupling part 19' is partly inside the lower coupling part 20'. The upper coupling part 19' is again mechanically (rigidly) connected with the propeller shaft 15. The lower coupling part 20' is again mechanically (rigidly) driven by the motor 18 via motor shaft 23 (not shown). In the horizontal plane (seen as the device is installed, with a vertical propeller shaft), the permanent or electro magnets 27, 28 are arranged both in the upper/interior coupling part 19' and the lower/exterior coupling part 20'. The waterproof layer 21 is again provided between upper and lower coupling parts 19', 20'.

[0045] From figures 10, 11, and 12 it will be clear that different types of magnetic coupling are possible. What is important is that the two sides of the coupling can be waterproof insulated from each other, so that the motor housing 14, which comprises the motor 18 and the lower coupling part 20, 20', can be more easily waterproofed.

[0046] Figures 13 and 14 schematically show the motor housing and coupling according to an embodiment of

the invention. In figure 13, the magnetic coupling is used (as in figure 10) and in figure 14 the motor shaft 23 is directly connected to propeller shaft 15, with sealing ring 29 provided to allow the shafts 15, 23 to rotate without allowing swimming pool water into the motor housing 14. In both figure 13 and 14, the motor 18 comprises two parts, top motor part 18' is rotating together with shaft 23 and bottom motor part 18" is stable with respect to the motor housing 14. The skilled person will realize that other arrangements of the motor 18 inside motor housing 14 are possible.

[0047] In the embodiments of figures 13 and 14, the motor housing 14 and the top motor part 18' (which can contain coils with empty space around the coils) are filled with a cooling liquid C. Optionally, bottom motor part 18' (and therefore the entire motor 18) is filled with cooling liquid C as well. Applicant has found that without the cooling liquid, the motor may run too hot, necessitating traditional cooling means such as cooling fins and the like which have a negative influence on the compactness of the design.

[0048] Experiments with the cooling liquid have shown that it is possible to have a mere 12 degree Centigrade difference between the temperature of the cooling liquid (and therefore, of the motor) and the swimming pool water. The cooling effect was surprisingly larger than anticipated and allows for a more compact design. In typical applications, the motor housing 14 and empty spaces in the motor 18 are filled with air. However, applicant has found that the working of the motor 18 is not impaired if a suitable cooling liquid C is used.

[0049] A suitable cooling liquid C may be a liquid with good heat conducting properties, while having no or very limited electrical conductivity. A suitable cooling liquid may have a low viscosity. Anti-foaming additives may be used in view of the fact that the rotation of the top motor part 18' inside housing 14 causes flows in the cooling liquid C. Anti-corrosion additives may be used to protect the metal motor parts. The cooling liquid may be an oil, particularly a mineral oil. Based on the above requirements, a skilled person can find other suitable cooling liquids.

[0050] The cooling liquid is prevented, by the motor housing 14 including the waterproof layer 21, from becoming mixed with the environment of the motor housing 14, i.e. the swimming pool water. Obviously, with "waterproof" is also meant "cooling liquid proof".

[0051] Figures 15- 17 show one or more swimmers S and one or more counter-current swimming devices 1 according to an embodiment of the invention. The device 1 streams water from the outlet nozzle 10 which provides a current for the swimmer S to swim in without actually changing position. Figures 15 and 16 also include an indication of what is meant with the device 1 dimensions D (depth), L (length/height) and W (width).

[0052] The figures 15 - 17 also show a swimming pool 30 with one or more a counter-current swimming devices 1 according to an embodiment of the invention and one

or more swimmers S. In figure 15, the surface current is mainly from left to right (with the counter-current swimming device 1 on the leftmost wall), while the lower currents are from right to left. The device 1 thus causes a flow circulation in the swimming pool. This is also a reason why it is advantageous that the inlet of the device 1 is provided below the outlet 10.

[0053] Figures 16 and 17 show that multiple devices 1 can be used to create a counter-current for one (figure 16) or more (figure 17) swimmers S in the pool 31. The devices 1 will be fastened to the swimming pool wall 31.

[0054] Figures 18a - 18c schematically show side, front and perspective views of a counter-current swimming device according to an embodiment of the invention. This embodiment is the same as the embodiments of figure 1-9, except that there is no bend 11' in the upper housing part. In this embodiment, the upper housing part 11 is formed by the tapering part on top of the lower housing part 12, and the exit of said upper housing part 11 forms the outlet nozzle 10. In the embodiment, the flow path is continuously becoming more narrow starting from the exit of the lower housing 12 up to the exit of the upper housing 11. As can also be seen in figures 1-9, the propeller screw 17 can be located in the lower housing 11, so that the flow path is continuously becoming more narrow (that is, has a decreasing cross section) starting from the propeller screw 17 to the exit 10 of the upper housing 11.

[0055] It is advantageous that the counter-current swimming devices 1 can be attached to an existing pool 30 rather than being installed as an integral part of such a pool.

[0056] In the foregoing description of the figures, the invention has been described with reference to specific embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the scope of the invention as summarized in the attached claims.

[0057] In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

[0058] In particular, combinations of specific features of various aspects of the invention may be made. An aspect of the invention may be further advantageously enhanced by adding a feature that was described in relation to another aspect of the invention.

[0059] It is to be understood that the invention is limited by the annexed claims and its technical equivalents only. In this document and in its claims, the verb "to comprise" and its conjugations are used in their non-limiting sense to mean that items following the word are included, without excluding items not specifically mentioned. In addition, reference to an element by the indefinite article "a" or "an" does not exclude the possibility that more than one of the element is present, unless the context clearly

requires that there be one and only one of the elements. The indefinite article "a" or "an" thus usually means "at least one".

[0060] For convenience, below a list of figure item numbers and short descriptions is presented:

1:	counter-current swimming device
2:	assembly of two counter-current swimming devices
10:	outlet nozzle
11:	upper housing part
11':	bend in upper housing part
12:	lower housing part
13:	fastening frame
13':	double fastening frame
14:	motor housing
15:	propeller shaft
16:	outlet opening
17:	propeller
18:	motor
18':	top motor part
18'':	bottom motor part
19, 19':	upper coupling part
20, 20':	lower coupling part
21:	waterproof layer
22:	ball bearing
23:	motor shaft
24:	inlet opening
25:	upper housing part entrance
26:	upper housing part exit
27:	magnet (first polarity)
28:	magnet (second polarity)
29:	sealing ring
30:	swimming pool
31:	swimming pool wall
C:	cooling liquid
S:	swimmer

Claims

1. Counter-current swimming device (1) for a swimming pool, the device comprising:

- a lower housing part (12) having an inlet,
- an upper housing part (11), connected to the lower housing part
- an outlet nozzle (10) connected to the upper housing part, so that the lower housing part, the upper housing part and the outlet nozzle form a flow channel,

wherein the device further comprises:

- a propeller screw (17) configured to, when the device is installed in a swimming pool, accelerate water into the inlet, and
- a motor (18) coupled to the propeller screw,

wherein the upper housing part has an upper housing part entrance and an upper housing part exit, wherein the upper housing part entrance has a larger cross section than the upper housing part exit.

2. Counter-current swimming device (1) according to claim 1, wherein the flow channel is continuously becoming more narrow starting from the propeller screw (17) to the outlet nozzle (10) of the upper housing part (11). 5
3. Counter-current swimming device (1) according to claim 1 or 2, wherein the upper housing part has a bend (11') and, when the device is installed in a pool, the bend (11') transforms the flow path, in the direction of the water flow, from a vertical path to a horizontal path. 10 15
4. Counter-current swimming device (1) according to any one of the preceding claims, wherein the propeller screw (17) is coupled to the motor (18) through a magnetic coupling (19, 20, 19', 20'). 20
5. Counter-current swimming device (1) according to claim 4, wherein the magnetic coupling comprises an upper coupling part (19, 19'), mechanically connected to the propeller screw (17), and a lower coupling part (20, 20'), mechanically connected to the motor (18), with a waterproof seal (21) between the upper and lower coupling parts. 25 30
6. Counter-current swimming device (1) according to claim 5, wherein the upper coupling part comprises permanent magnets. 35
7. Counter-current swimming device (1) according to claim 5 or 6, wherein the lower coupling part comprises electro magnets. 40
8. Counter-current swimming device (1) according to any one of the preceding claims, wherein the propeller screw (17) has overlapping blades. 45
9. Counter-current swimming device (1) according to any one of the preceding claims, wherein the outlet nozzle (10) is tapering. 50
10. Counter-current swimming device (1) according to any one of the preceding claims, wherein the cross section of the flow path, from the entrance of the upper housing part (25) to an outlet opening (16) is nowhere increasing. 55
11. Counter-current swimming device (1) according to any one of the preceding claims, wherein the vertical dimension L, horizontal dimension W, and depth D are in the ranges $200\text{ mm} < L < 1200\text{ mm}$, $100\text{ mm} < W < 600\text{ mm}$, $100\text{ mm} < D < 600\text{ mm}$.

12. Counter-current swimming device (1) according to any one of the preceding claims, wherein the motor (18) is included in a motor housing (14), and said motor housing (14) is filled with a cooling liquid (C).

13. Assembly of two, three, or four counter-current swimming devices (1) according to any one of the preceding claims, installed on a single fastening frame 13'.

14. Swimming pool (30) comprising at least one counter-current swimming device (1) according to any one of the preceding claims.

Fig. 1

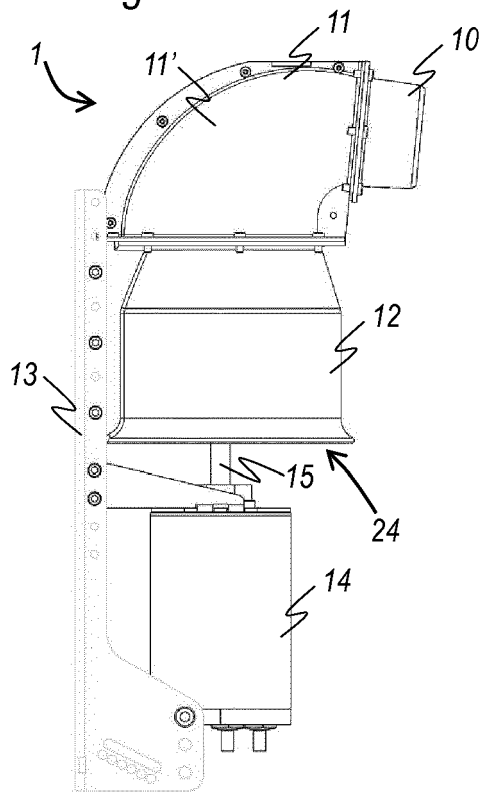


Fig. 2

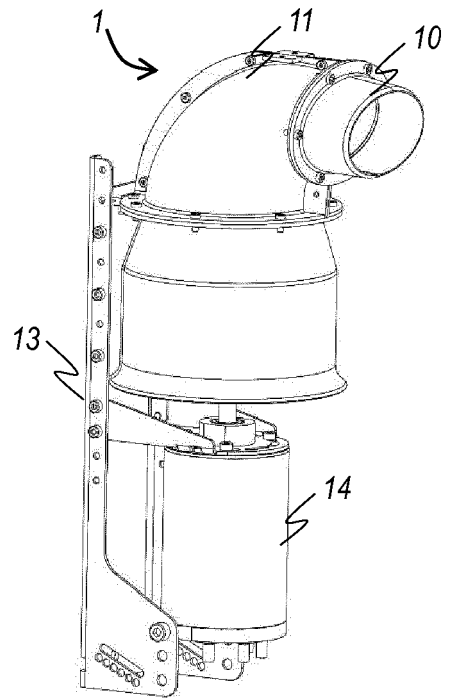
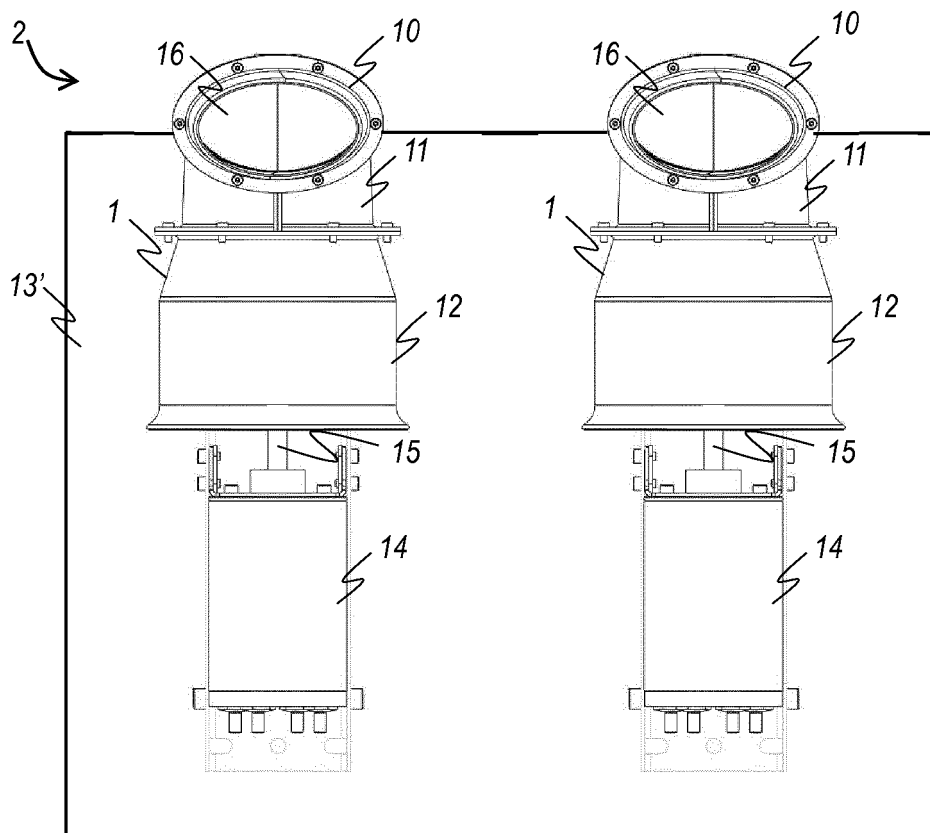
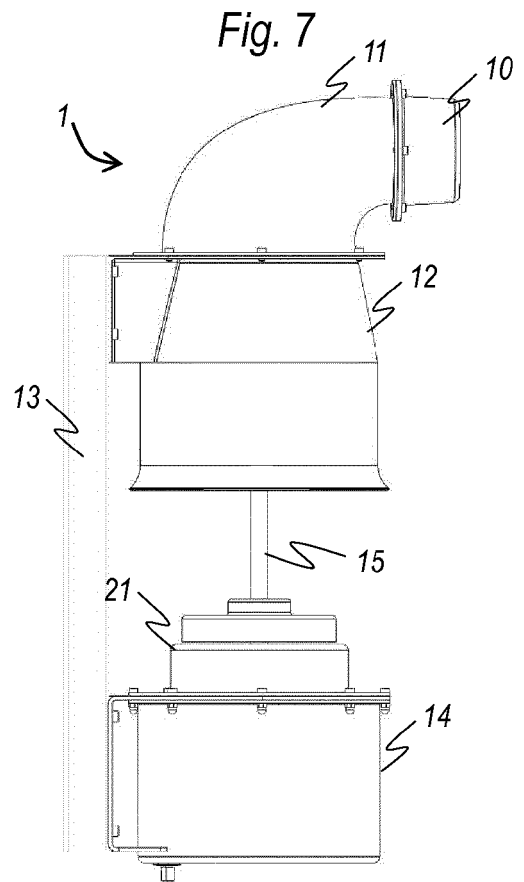
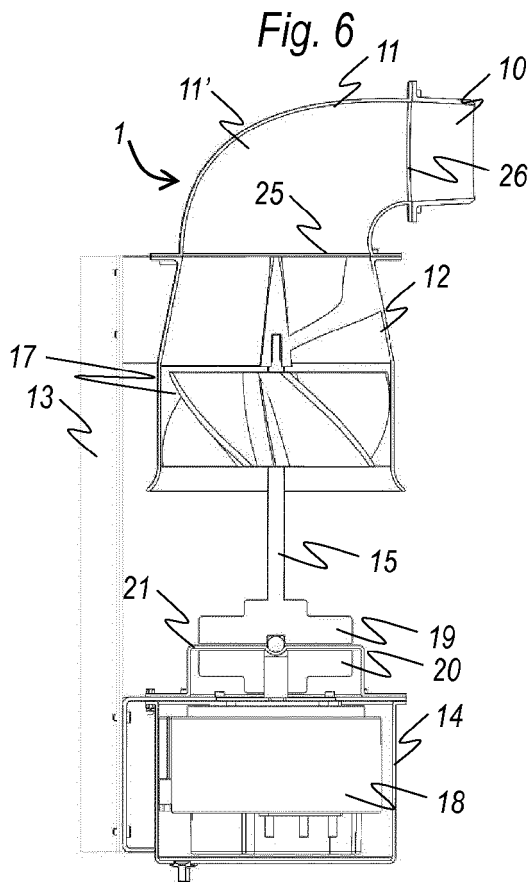
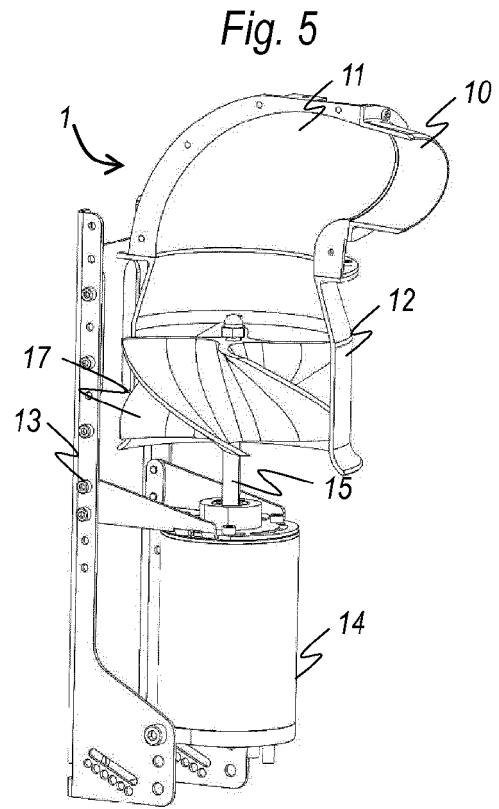
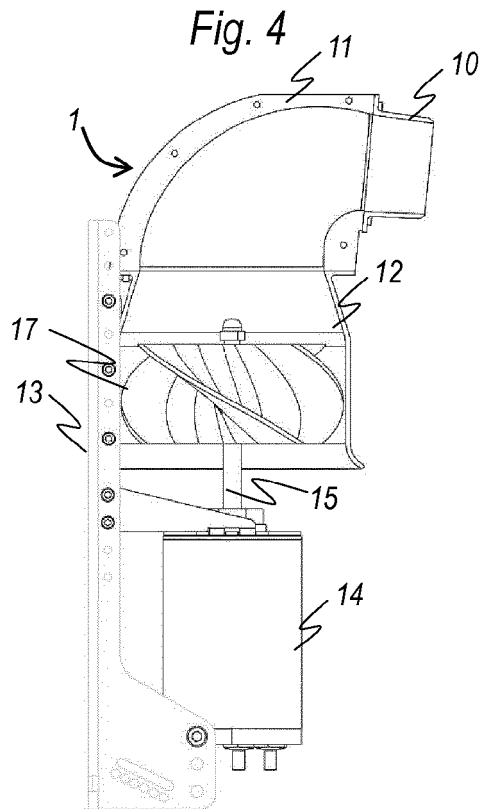


Fig. 3





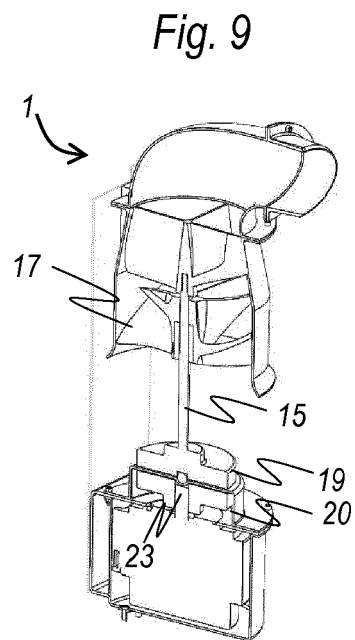
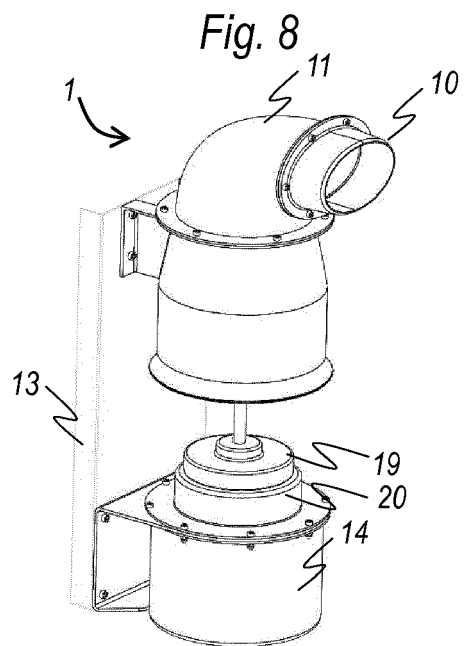


Fig. 10

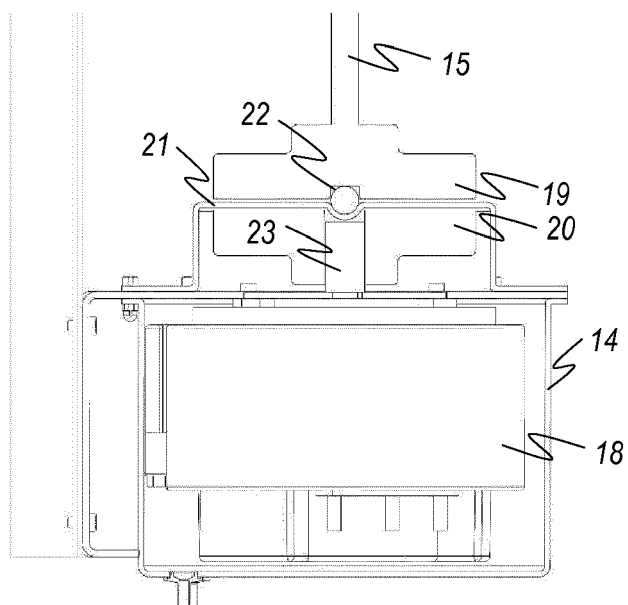


Fig. 11

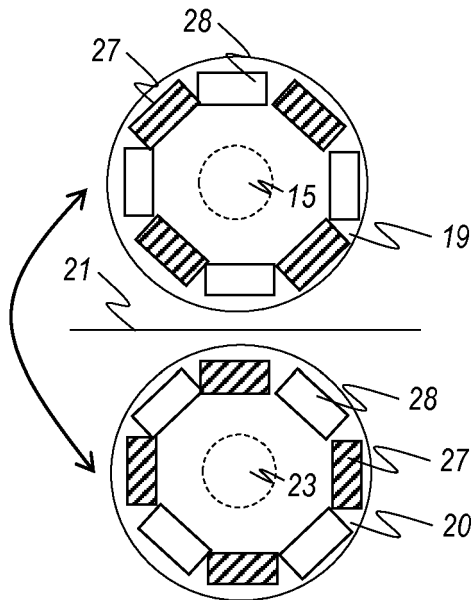


Fig. 12

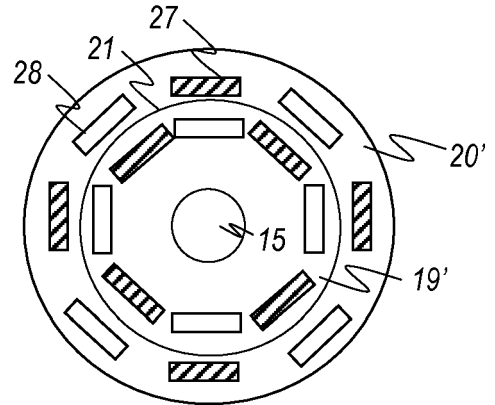


Fig. 13

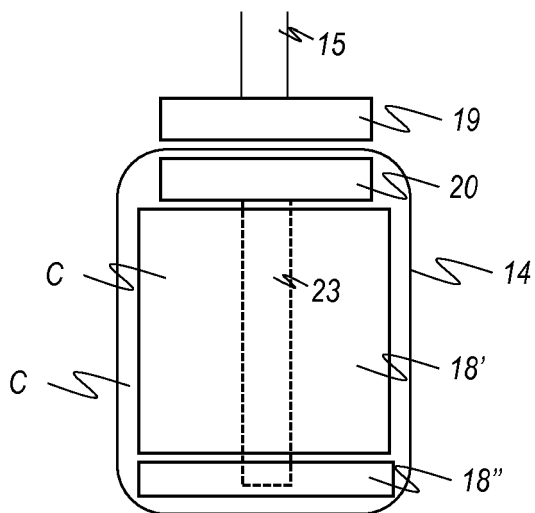
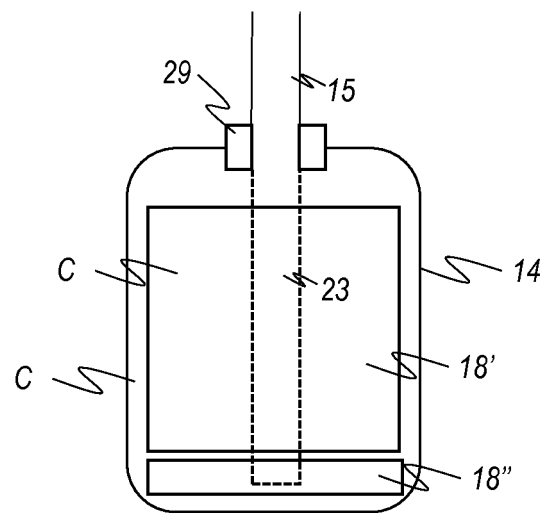
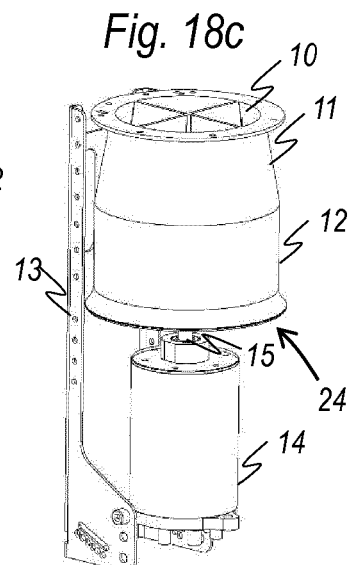
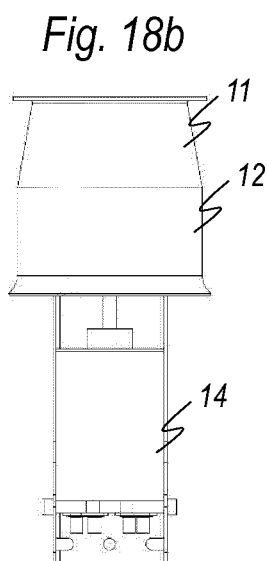
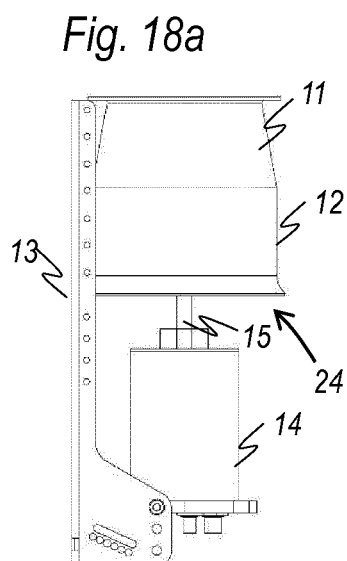
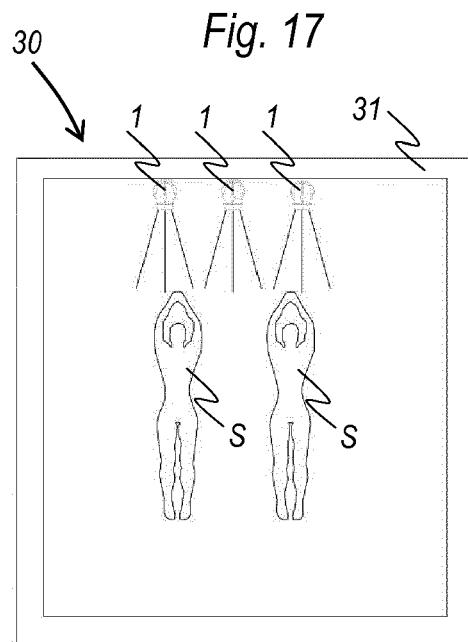
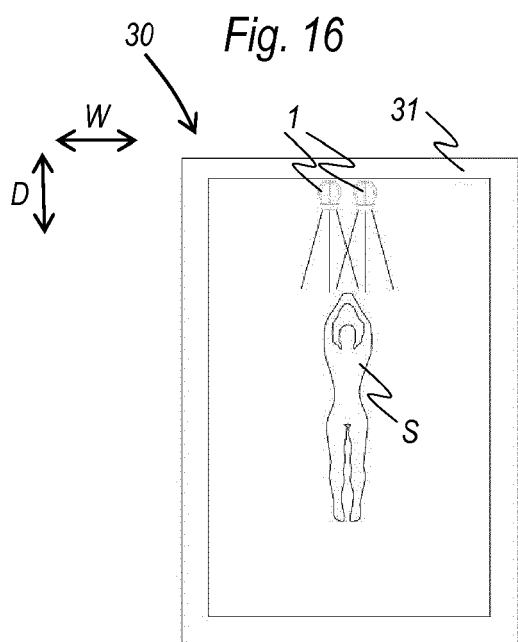
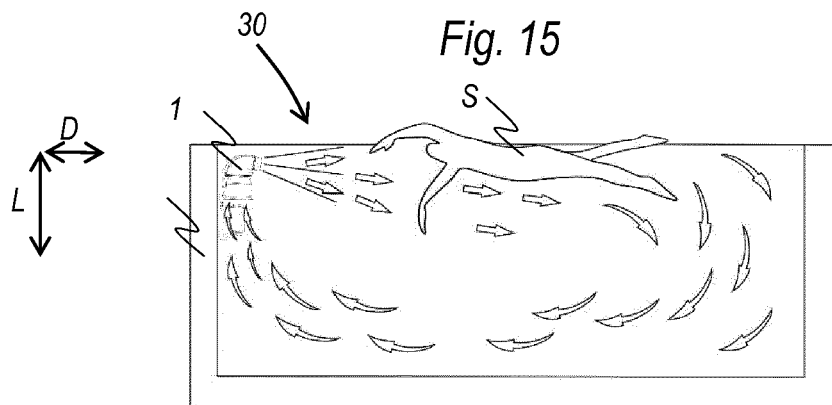


Fig. 14







EUROPEAN SEARCH REPORT

Application Number
EP 19 20 8890

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X	EP 0 017 973 A2 (LAING KARSTEN) 29 October 1980 (1980-10-29) * page 3, line 1 - page 5, line 17; figures 1-5 *	1-3, 8-10,12, 14	
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			TECHNICAL FIELDS SEARCHED (IPC)
			A63B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 March 2020	Examiner Jekabsons, Armands
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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