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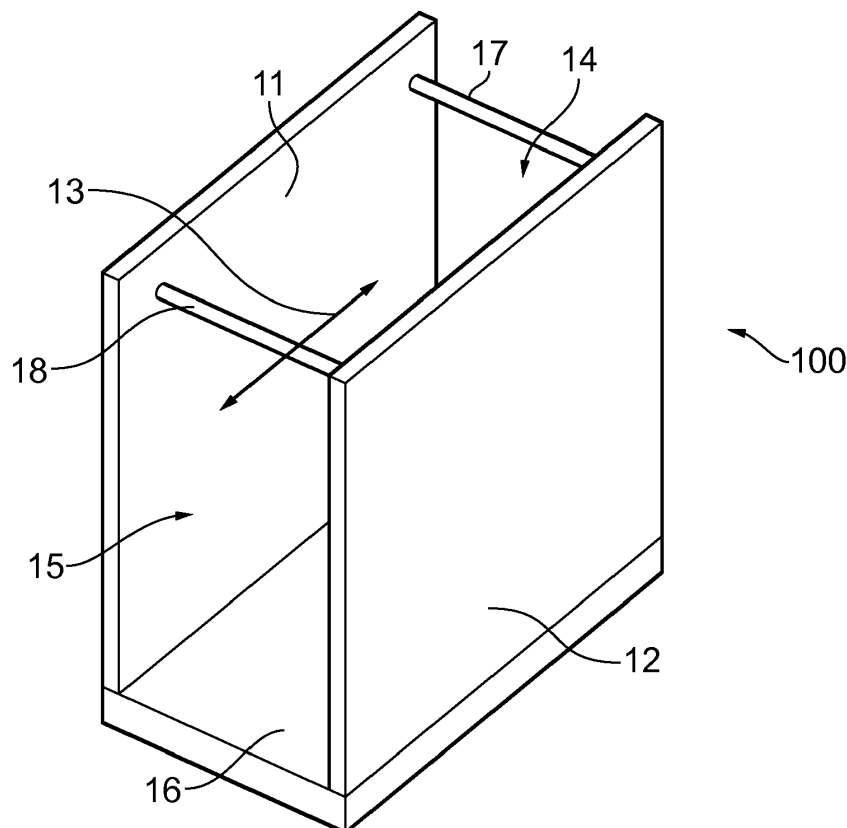
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(54) WAVE-GENERATOR SYSTEM AND CHASSIS

(57) The present invention relates to wave-generator for generating waves in a pool, lido, lake, or sea bay. The wave generator comprises a chassis which has opposite first and second side walls separated by a connecting

element joining the walls. There are opposite first and second openings into a passage through the chassis intermediate the side walls. Waves are generated in the passage and may exit from either opening.

**FIG. 1****EP 3 546 676 A1**

Description

Field of the Invention

[0001] The present invention relates to wave-generator for generating waves in a pool, lido, lake, or sea bay. More particularly it relates to a chassis in an assembly of a wave generator and a closure in the assembly.

Background

[0002] Recreational swimmers and surfers and professional surfers enjoy predictable waves in a pool, lido, lake, or sea bay. The height of natural waves varies from day to day.

[0003] A man-made wave generator system may be constructed to produce waves of a preselected height, period, and where the waves curl over and break.

[0004] Constructing a man-made wave generator of the size of a lake or sea bay is a complex engineering endeavor.

[0005] The present invention discloses product and system for constructing a man-made wave generator which is within practical limits for cost and build time.

Summary of the Invention

[0006] According to a first aspect of the invention, there is a chassis for a wave generator comprising opposite first and second side walls separated by a connecting element joining the walls, characterised by opposite first and second openings into a passage through the chassis intermediate the side walls.

[0007] When the chassis is assembled into a wave generator system, waves are generated in the passage and may exit from either opening. Advantageously the chassis may be placed as a unit into the wave generator system, easing assembly in the field.

[0008] Preferably the connecting element is rigid to fix the side walls at a permanent distance of separation. The width of the passage is fixed by the distance of separation.

[0009] Preferably the distance of separation is from 2.4 to 2.43 m to fit within a shipping container or so that the chassis may be fabricated from a shipping container.

[0010] Preferably the connecting element is directly connected to the walls. Hence the chassis is formable just two side walls which are preferably identical, and the connecting element.

[0011] Preferably the connecting element fixes the side walls mutually parallel. The passage has side walls which are parallel and the width the passage is invariant from first opening to the second opening.

[0012] Preferably the chassis includes a third opening into the passage intermediate the side walls and the first and second openings. In use the chassis is oriented with the third opening uppermost. Hence that passage has an open ceiling provided by the third opening. Advanta-

geously height of waves generated in the passage is unlimited.

[0013] In use the chassis may be rested on a floor of a pool or lake bed or seabed. The chassis is oriented so that the side walls extend vertically up from the floor or seabed. The lowermost edge of the side walls rest on the pool floor or seabed.

[0014] Preferably the connecting element comprises a third wall from the first side wall to the second side wall and opposite the third opening. In use the chassis oriented with the third wall lowermost. Hence the third wall forms a floor of a trough having the two sidewalls. The trough is formed without need to rest the chassis on the pool floor or seabed. Advantageously a wave generator assembled including the chassis may be used in deep water and floated or otherwise supported above the pool floor or seabed.

[0015] Preferably the connecting element comprises a plate. Preferably the side walls also comprise plates. Advantageously channel may formed from the plates.

[0016] Preferably each side wall and the third wall are each formed from a single plate such that the chassis is formed of three plates. Preferably the plates are rectangular. Preferably the plates are joined edge to edge or proximate the edges.

[0017] Preferably the connecting element is connected proximate to a corner of the first side wall and a corner of the second side wall. Preferably the connecting element comprises a first bar or first platform, more preferably a rod threaded at both ends for bolting to the first and second side walls.

[0018] Preferably the connecting element and more preferably the first bar or platform is external to the passage. Preferably the first platform is proximate the first opening. Advantageously a wave is swept up in the passage does not to get wet a drive mechanism mounted on a portion of the connecting element that is external to the passage and preferably proximate the first opening.

[0019] Preferably the connecting element comprises a second bar or second platform connected proximate to corners of the first and second sidewalls that are adjacent to the corners to which the first bar is connected. Preferably the third opening into the passage, which is mentioned above, is separated from the first and openings by the first and second bars.

[0020] Preferably the first bar or platform is more distal from the third wall than the second platform.

[0021] Preferably the connecting element comprises a first pair including a first connecting portion and a second connecting portion. The first connecting portion is attached to the first side wall and the second connecting portion is attached to the second side wall. Preferably the first bar or platform comprise the first pair.

[0022] Preferably the connecting element comprises the first platform arranged external from the passage and proximate the first opening including a means for mounting a drive mechanism for driving a piston in the passage.

[0023] Preferably the first side wall is connected to the

second side wall by a joint between the first connecting portion and the second connecting portion of the first pair.

[0024] In this manner the connecting element comprises the first and second connecting portions attached to the first and second side walls respectively joinable to connect the first and second side walls.

[0025] Preferably the connecting element comprises a second pair including a third connecting portion and a fourth connecting portion which are attached to the first and second side walls respectively. The first and second side walls are connected by a second joint between the third and fourth connecting portions.

[0026] Preferably the third wall is similarly joined by a joint between fifth and sixth connecting portions to connect the first and second side walls.

[0027] Preferably the third and fourth connecting portion, and the fifth and the sixth connecting portion, are joinable in like manner to the first and second connecting portions.

[0028] Preferably the chassis comprises a first unit including the first wall and first connecting portion and a second unit comprising the second wall and second connecting portion. Preferably the units are a pair. Preferably each unit is substantially half of the chassis.

[0029] Preferably the first platform is proximate the first opening and the second platform is proximate the second opening. Preferably the first platform is further from the floor of the trough than the second platform. Preferably the first platform comprises a mounting means for a piston drive mechanism. Advantageously the piston drive mechanism on the first platform is dry and is above waves swept toward the first opening in use.

[0030] Preferably the first and second openings have substantially equal cross-sectional areas. Preferably the cross section of passage is invariant from the first opening to the second opening. Advantageously waves generated in the passage travel without restriction from the first opening to the second opening.

[0031] Preferably the cross section of the first opening and the second opening is rectangular.

[0032] Preferably the chassis comprises a protector to prevent a user's hand or foot from inadvertently entering the second opening. Preferably the protector comprises a grill, net, or web which covers the second opening.

[0033] Preferably the grill, net, or web leaves at least ninety percent of the second opening open to the passage so as to provide free flow of water or out of the passage.

[0034] Preferably the protector is joined to the first side wall and second side wall. Preferably the protector is joined to the connecting element.

[0035] Preferably the protector reaches from the first side wall to the second side wall.

[0036] The chasses described above are placed adjacent one after the other to assemble a wave generator system. Preferably the chasses are prefabricated.

[0037] According to a second aspect of the invention, there is a wave generator system for generating waves

in a swimming pool, lido, lake, or sea bay, comprising: a plurality of the chasses mentioned above, characterised that the chasses are staggered adjacently with the passages parallel and the side walls partially overlapping forming parallel panels longer than the passages.

[0038] The wave generator system has the first openings adjacent and staggered in the direction of the passages which is the direction from the first opening of each passage to the second opening of each passage.

[0039] Preferably the distance between the side walls of each chassis which defines the width of each passage also defines the width of each channel.

[0040] Preferably the length of all the chasses in the wave generator system is the same.

[0041] Preferably each chassis is staggered the same length in the direction of the passage. The second opening of each chassis is also staggered the same length in the same direction.

[0042] Preferably adjacent chasses are joined together. Preferably a joint is formed by a side wall of one chassis against a side wall of an adjacent chassis. Advantageously the joined sidewalls have strength and stiffness of two together. The thickness, weight, and cost of each side wall individually is reduced.

[0043] Preferably the first side wall and preferably the second side wall of each chassis comprise the joint in a form of a hook or clevis which hooks over the side wall of the adjacent chassis. Advantageously the chasses are joinable to be lower a one chassis into position beside the other where the joint hooks over the side wall of the adjacent side wall. Similarly the chasses may be disconnected by raising a chassis to unjoin it from the adjacent chassis.

[0044] Preferably the first opening of each chassis faces the same direction in the wave generator system. Preferably the first opening of each chassis is covered by a closure.

[0045] Preferably the wave generator system comprises the closure over the first openings of each chassis. The second opening of each chassis in the system is uncovered and faces the opposite direction from the second opening of each chassis.

[0046] The closure and chasses together form parallel channels in the wave generator system. Each channel includes the passage of one the chasses.

[0047] Preferably each closure is spaced a distance from each respective first opening. Each channel is longer than the passage it includes by the distance. Advantageously, large waves may be generated efficiently in a long channel.

[0048] Preferably the closure is stepped so that it has a staircase cross section. The closure comprises alternating steps and risers. Each step covers one of the first openings.

[0049] Preferably the closure is stepped at right angles so that each step in the staircase is at a right angle to an adjoining riser.

[0050] Preferably each adjacent step is opposite a re-

spective adjacent first opening. Preferably the cross section area of each step corresponds to and is preferably the same as the cross section area of each first opening.

[0051] Preferably the width of each step is the same as the distance between the side walls of each passage.

[0052] Preferably adjacent risers are placed against respective adjacent sidewalls of respective adjacent chasses. Preferably the closure is connected to the chasses by a joint between where the closure is against the chasses.

[0053] Preferably the closure is a corrugated panel. Preferably the panel is a corrugated metallic panel or a polymeric panel.

[0054] Preferably each chassis, the closure and the joints comprise a material which does not corrode or rust in water. Preferably they are coated or painted to prevent rust and corrosion.

[0055] Preferably each chassis, the closure and the joints are comprised of concrete.

[0056] Preferably the side walls comprise a material which is water proof. Preferably the side walls prevent water from flowing through them due to their structural continuity and their material being impervious to water. Advantageously water sweep through the passage is confined between the side walls.

[0057] Preferably each chassis and the preferably the closure is supported on a bottom of the pool or bay to form a floor under the passages. Preferably the sidewalls rise as wall from the floor. Preferably the closure rises as a wall from the floor.

[0058] Preferably the chasses and closure are completely submerged so water from the pool, lake or sea fills the channels, or the water partially fills the channels.

[0059] Preferably the chasses and closure are partly submerged so that a portion of the side walls and closure extend above the water surface.

[0060] Preferably the wave generator system includes a piston in each of the channels. The piston is displaceable along the channel. As the piston is displaced along the channel it sweeps water in the passages toward the closure on a first stroke and toward the second openings on the return stroke.

[0061] Preferably the piston slip fits along the side walls of the chassis. The width of the piston cross section is less than the width of the passage to allow for the slip fit.

[0062] Preferably the piston is arranged to displace by the first and return strokes wholly within the passage of the chassis.

[0063] Preferably the piston is arranged to displace within the channel including the passage.

[0064] Preferably the chassis comprises a track for the piston to slide or roll along as the piston is displaced by the first and return strokes. Preferably the first sidewall comprises the track.

[0065] Preferably the second side wall comprise a second track similar to the track on the first side wall.

[0066] Preferably each track extends from proximate the first opening to proximate the second opening.

[0067] Preferably each track has a triangular cross section with two vertices where the track joins the side wall and the third vertex protruding into the passage.

[0068] The track stiffens the side wall and maintains the position of the piston in a position with respect to edges of the side wall intermediate the first and second openings. The piston cross section is maintained in position in the passage and channel for displacing water.

[0069] Preferably the chassis comprises a means for including and preferably attaching a driving mechanism for displacing the piston.

[0070] The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Brief Description of the Figures

[0071]

Figure 1 is an isometric view of a chassis first embodiment for use in a wave generator system;

Figure 2 is an isometric view of a closure for use with the chassis first embodiment in a wave generator system;

Figure 3 is an isometric view of a chassis second embodiment for use in a wave generator system;

Figure 4 is a view of a first portion of a second embodiment of the chassis first parallel to the second wall;

Figure 5 is a view of the first portion of the second embodiment transverse to the second wall; and

Figure 6 is an isometric view of a wave generator system.

Detailed Description of the Invention

[0072] Referring to the Figures, there is shown in Figure 1 first embodiment of a chassis 100 for a wave generator. The chassis 100 is designed for use with a closure 200 shown in Figure 2 in a wave generator system 300 shown in Figure 6.

[0073] There is shown in Figure 3 a second embodiment of a chassis 1100 for a wave generator. The second embodiment of the chassis 1100 is also designed for use with a closure 200 shown in Figure 2 in a wave generator system in a like manner as the first embodiment of the chassis 100.

[0074] The chassis 100 of the first embodiment comprises a first side wall 11 and a second side wall 12. The first and second side walls are opposite to each other. Likewise, the chassis 1100 of the second embodiment comprises a first side wall 111 and an opposite second side wall 112.

[0075] In the first embodiment, the first side wall 11 is separated from the second side wall 12 by connecting elements 16, 17, 18 joining the side walls. Like wise in the second embodiment, the first side wall 111 is separated from the second side wall 112 by connecting elements 116, 1162, 117, 1172, 118, 1182 joining the side walls.

[0076] In the first embodiment, the connecting elements 16, 17, 18 are continuous from the first side wall to the second side wall.

[0077] In the first embodiment connecting elements 17 and 18 are connected to a corner of the first side wall and a corner of the second side wall. These connecting elements 17, 18 comprise a bar with opposite ends bolted to the first and second side walls. The third opening into the passage 13 is separated from the first and second openings 14, 15 by the first and second bars 17, 18.

[0078] In the second embodiment, the connecting elements comprises a first pair 116, 1162, a second pair 117, 1172, and a third pair 118, 1182. The first pair is connected together. The second pair is connected together. The third pair is also connected together. In the second embodiment the first side wall 111 and the second side wall 112 are connected as a result of the first, second, and third pairs of the connecting elements being connected together.

[0079] In the second embodiment, the connecting elements 117, 1172, 118, 1182 are in the form of platforms partially covering the passage 113. The platforms provide a base for mounting a driving mechanism for a piston which sweeps water through the passage.

[0080] The platforms 117, 1172 proximate the first opening are further from the floor connecting means 116, 1162 than the platforms 118, 1182 proximate the second opening. This arrangement helps keep a drive mechanism mounted on the platforms proximate the first opening dry as a wave is built up by sweeping water toward the first opening.

[0081] As shown in Figures 1 and 6, the chassis 100 of the first embodiment has a first opening 14 and a second opening 15. The first opening 14 is opposite the second opening 15.

[0082] Similarly, the chassis 1100 of the second embodiment has a first opening which is opposite second opening 115. The first opening cannot be seen in Figure 3 because it is hidden by the first wall 111 and the connected second pair of connecting elements 117, 1172.

[0083] The first and second opening are openings into a passage indicated by arrow 13 in Figures 1 and 6 and by the arrow 113 in Figure 3. The passage goes through the chassis intermediate the side walls 11 and 12.

[0084] Figure 6 shows the wave generator system 300. The first chassis 100 and a second chassis 101 are shown in the system. The first and second chassis 100, 101 are adjacent to each other.

[0085] The second embodiment of the chassis 1100 is not shown in Figure 6. However, the assembled chassis 1100 of the second embodiment shown in Figure 3 can

replace the chassis 100 first embodiment. A chassis of second embodiment can replace the second chassis 101 of the first embodiment in Figure 6. Hence a wave generator system comprising chassis of the second embodiment is assembled in like manner to the wave generator system shown in Figure 6.

[0086] The chassis 100, 1100 has a first passage 13, 113. The second chassis 101 has a second passage 23. The first passage 13 is parallel to the second passage 23.

[0087] The side walls 11, 12 of the first chassis 100 partially overlap the side walls 21, 22 of the second chassis 101. The side walls only partially overlap because the chassis are staggered.

[0088] In a wave generator system comprising chassis 1100 of the type of the second embodiment, the chassis are staggered within overlap possible by length of overlap of connecting means 116, 117, 118 of a first chassis 1100 to the corresponding connecting means 1162, 1172, 1182 of a second chassis.

[0089] As shown in Figure 6 using chassis of the first embodiment, the second side wall 12 of the first chassis 100 is located adjacent the first side wall 21 of the second chassis 101. The partial overlap of the adjacent sidewalls 12, 21 forms a panel which longer than the passages 13, 23.

[0090] Although not shown in Figure 6, a third chassis could be placed adjacent the second chassis 101. In like manner, the second wall 22 of the second panel 22 would be adjacent the first wall of the third panel.

[0091] The direction of stagger of the first chassis with respect to the second chassis is in the direction of the parallel passages 13, 23. A wave generator system comprising chassis 1100 the second embodiment, staggers the second chassis in the direction of passage 113.

[0092] The first and second chassis are staggered in the direction of the passages 13, 23.

[0093] The first opening 14 of the first chassis 101 provides an opening into the first chassis from the same direction as the first opening 24 into the second chassis 101.

[0094] The second opening 15 of the first chassis 101 provides an opening into the first chassis from the same direction as the second opening 25 into the second chassis 101.

[0095] The second openings 15, 25 are uncovered and are openings through which waves are swept out of the passages 13, 23. In like manner waves are swept out of uncovered second opening 115 and an uncovered second opening of an adjacent chassis of a wave generator system comprising chassis of the second embodiment.

[0096] The first openings 14, 24 are covered by the closure 200 as shown in Figure 6. In like manner the first opening at the opposite end from the passage 113 from the second opening 115 in the chassis of the second embodiment is covered by the closure 200 in a wave generator system using chassis of the second embodiment.

[0097] The closure 200 is shown in particular in Figure

2. The closure 200 is stepped so that it has a staircase cross section. The closure comprises alternating steps 32, 34, 36 and risers 31, 33, 35.

[0098] As shown in Figure 6, the first step 32 of the closure 200 covers the first opening 14 of the first chassis 100. The second step 34 of the closure 200 covers the first opening of the second chassis 101.

[0099] The closure 200 and chasses 100, 101 together form parallel channels in the wave generator system.

[0100] For a wave generator system comprising chasses of the first embodiment 100, 101 there is a first channel which includes the first passage 13. For a wave generator system comprising chasses 1100 of the second embodiment there is a first channel which includes the first passage 113.

[0101] The first channel is walled by a first panel and a second panel. The first panel includes partially overlapping first side wall 11 adjacent the first riser 31. The second panel was mentioned previously. It includes partially overlapping second side wall 12 of the first chassis and the first side wall 21 of the second chassis.

[0102] The second channel includes the second passage 23. The second channel is walled by a third panel and a fourth panel. The third panel includes partially overlapping first side wall 21 adjacent the second riser 33. The fourth side panel includes the second side wall 22 of the second chassis and the first side wall of the third chassis. The third chassis was mentioned previously. It is not shown in Figure 6.

[0103] Each closure is spaced a distance from each respective first opening. This is distance indicated d_1 to the first opening 14 of the first chassis 100. It is the distance indicated d_2 to the first opening 24 of the second chassis 101.

[0104] The channel formed by the first chassis 100 and the closure 200 is longer than the first passage 13 by the distance d_1 . The channel formed by the second chassis 101 and the closure 200 is longer than the second passage 23 by the distance d_1 .

[0105] The length of the first passage 13 is also the length of the first side wall 11 and the second side wall 12 of the first chassis 100. The length of the second passage 23 is also the length of the first side wall 21 and the second side wall 22 of the second chassis 101.

[0106] The length of the first channel is the length of the first passage 13 plus distance d_1 . Similarly, the length of the second passage 23 plus distance d_2 is the length of the second channel.

[0107] The width of the first step 32 is also the width of the first channel or the first passage 13. The width of the second step 34 is the width of the second channel or the second passage 23.

[0108] The riser 31 is placed against the first side wall 11 of the first chassis 100. The riser 33 is the riser adjacent to riser 31. Riser 33 is placed against the first side wall 21 of the second chassis 101. The first and second chasses are adjacent to each other because the second wall 12 of the first chassis is placed against the first wall

21 of the second chassis 101.

Index of Labelled Features in Figures

5	[0109]	
100	first chassis, first embodiment	
1100	first chassis, second embodiment	
101	second chassis	
200	closure	
300	wave generator system	
11	first side wall of first chassis, first embodiment	
111	first side wall of chassis, second embodiment	
12	second side wall of first chassis, first embodiment	
112	second side wall of chassis, second embodiment	
13	passage through first chassis, first embodiment	
113	passage through chassis, second embodiment	
14	first opening into passage through first chassis	
141	riser edge of third opening and of 2 nd side wall second embodiment	
142	parallel edge to floor plate of third opening and of 2 nd side wall 2 nd embodiment	
15	second opening into passage through first chassis, first embodiment	
115	second opening into passage through chassis, second embodiment	
16	connecting means floor plate of first chassis	
116	connecting means floor plate chassis, 2 nd embodiment, first portion	
1162	connecting means floor plate chassis, 2 nd embodiment, 2 nd portion	
17	connecting means to corners of 1 st and 2 nd wall opposite floor plate, 1 st embodiment	
117	connecting means at edge of 2 nd wall proximate 1 st opening and opposite floor plate of chassis, 2 nd embodiment	
1172	connecting means at edge of 1 st wall proximate 1 st opening and opposite floor plate of chassis, 2 nd embodiment	
18	connecting means at corner of 2 nd wall opposite floor plate of first chassis	
118	connecting means at edge of 2 nd wall proximate 2 nd opening and opposite floor plate of chassis, 2 nd embodiment	
1182	connecting means at edge of 1 st wall proximate 2 nd opening and opposite floor plate of first chassis, 2 nd embodiment	
21	first side wall of second chassis	
22	second side wall of first chassis	
23	passage through second chassis	

- 24 first opening into passage through second chassis
- 25 second opening into passage through second chassis
- 26 connecting means in form of a floor plate of second chassis 5
- 27 connecting means in form of a first bar of second chassis
- 28 connecting means in form of a second bar of second chassis 10
- 31, 33, 35 risers of closure in form of a stair case
- 32, 34, 36 steps of closure in form of a stair case
- 400 first portion of first chassis, second embodiment
- 401 second portion of second chassis, second embodiment 15

[0110] The invention has been described by way of examples only. Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the claims.

Claims

1. A chassis for a wave generator comprising opposite first and second side walls separated by a connecting element joining the walls, **characterised by** opposite first and second openings into a passage through the chassis intermediate the side walls. 35
2. A chassis according to claim 1 wherein the connecting element is rigid to fix the side walls at a permanent distance of separation. 40
3. A chassis according to claim 1 or 2 wherein the connecting element is directly connected to the walls. 45
4. A chassis according to any preceding claim wherein the connecting element fixes the side walls mutually parallel. 50
5. A chassis according to any preceding claim including a third opening into the passage intermediate the side walls and the first and second openings. 55
6. A chassis according to any preceding claim wherein the connecting element comprises a plank connected to the first and second side panels forming a trough.
7. A chassis according to any preceding claim wherein the first and second openings have substantially

equal cross-sectional areas.

8. A chassis according to any preceding claim wherein the first and second openings are rectangular.
9. A chassis according to any preceding claim wherein the first and second side walls are rectangular.
10. A chassis according to any preceding claim wherein the connecting element comprises first and second connecting portions attached to the first and second side walls respectively joinable to connect the first and second side walls.
11. A chassis according to claim 10 comprising a first unit including the first wall and first connecting portion and a second unit comprising the second wall and second connecting portion.
12. A chassis according to any preceding claim, wherein the connecting element comprises a first platform external from the passage and proximate the first opening including a means for mounting a drive mechanism for driving a piston in the passage.
13. A wave generator system for generating waves in a swimming pool or bay, comprising: a plurality of the chassis according to any one of claims 1 to 9 staggered adjacently with the passages parallel and the side walls partially overlapping forming parallel panels longer than the passages.
14. A wave generator system according to claim 13 comprising a closure over the first openings.
15. A wave generator system according to claim 14 wherein the closure is stepped comprising first surfaces opposite the second openings.

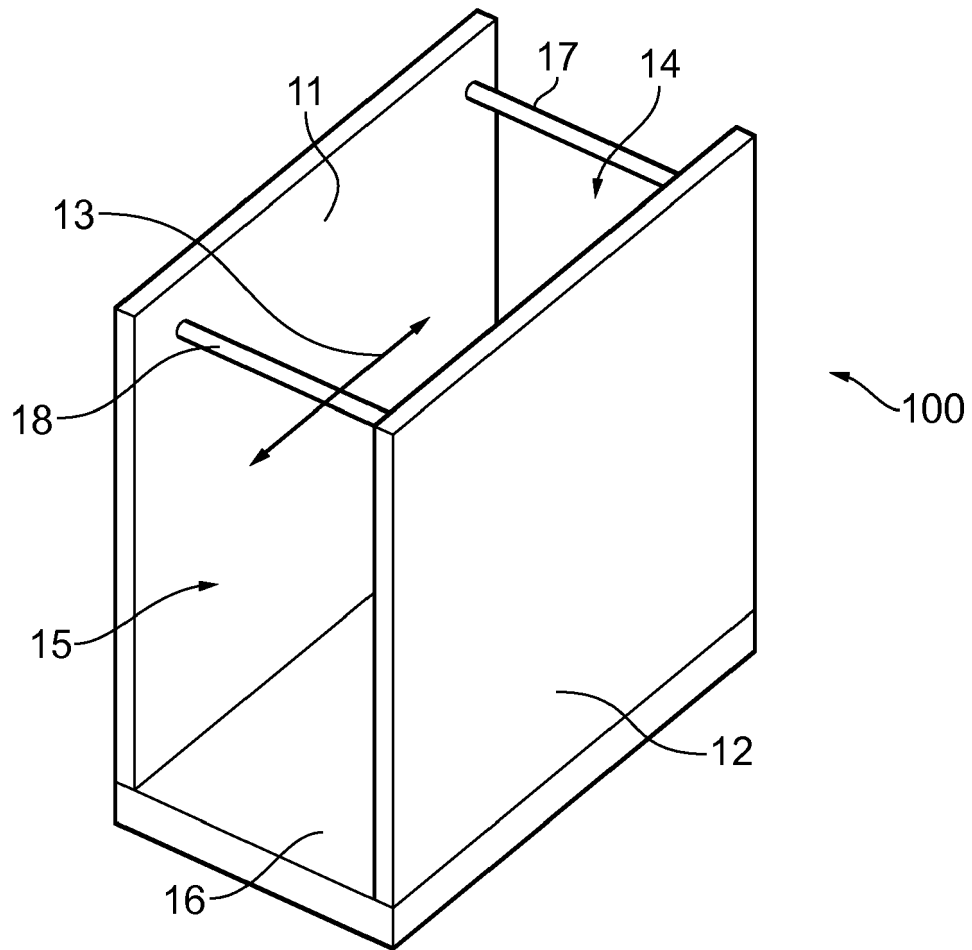


FIG. 1

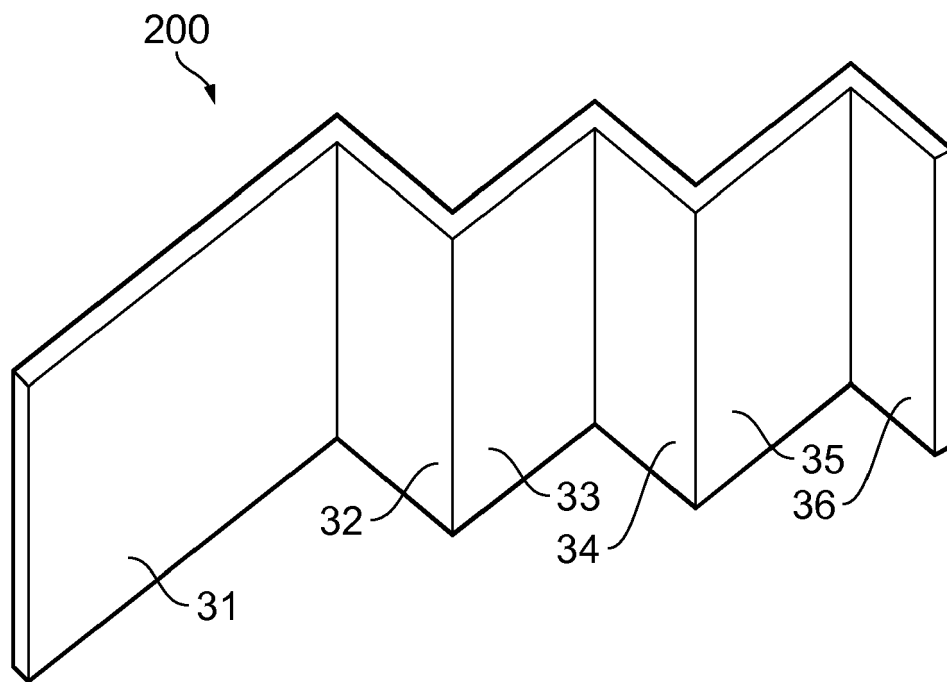


FIG. 2

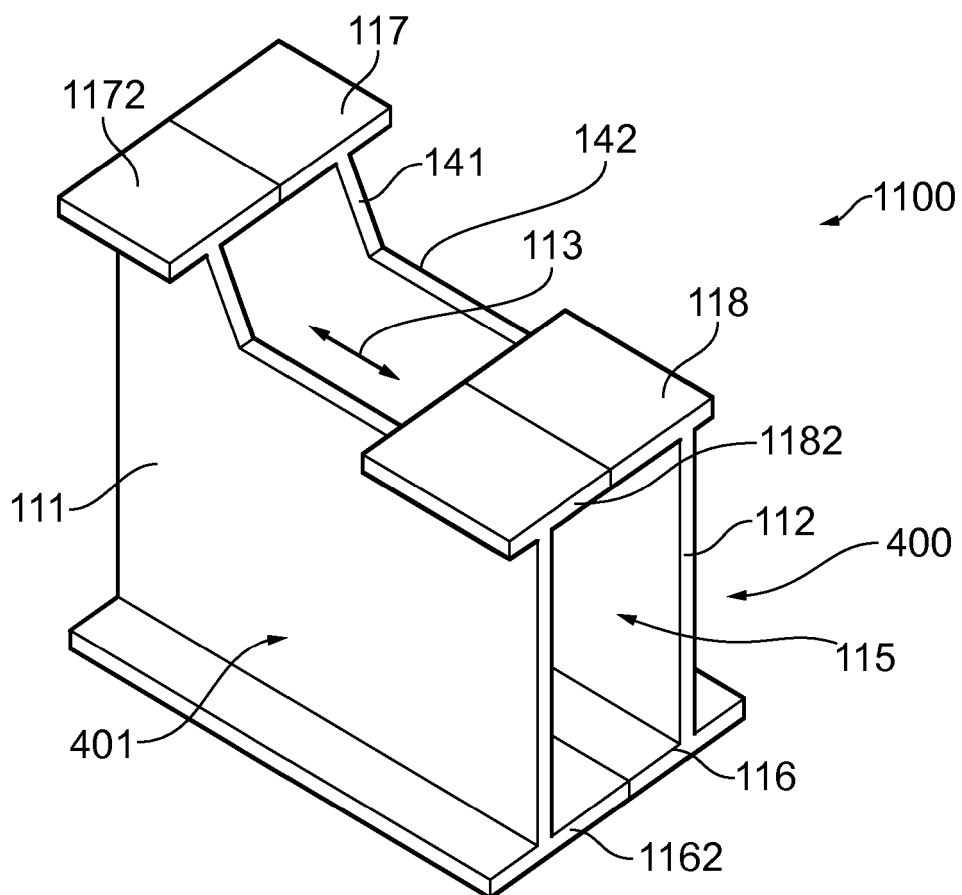


FIG. 3

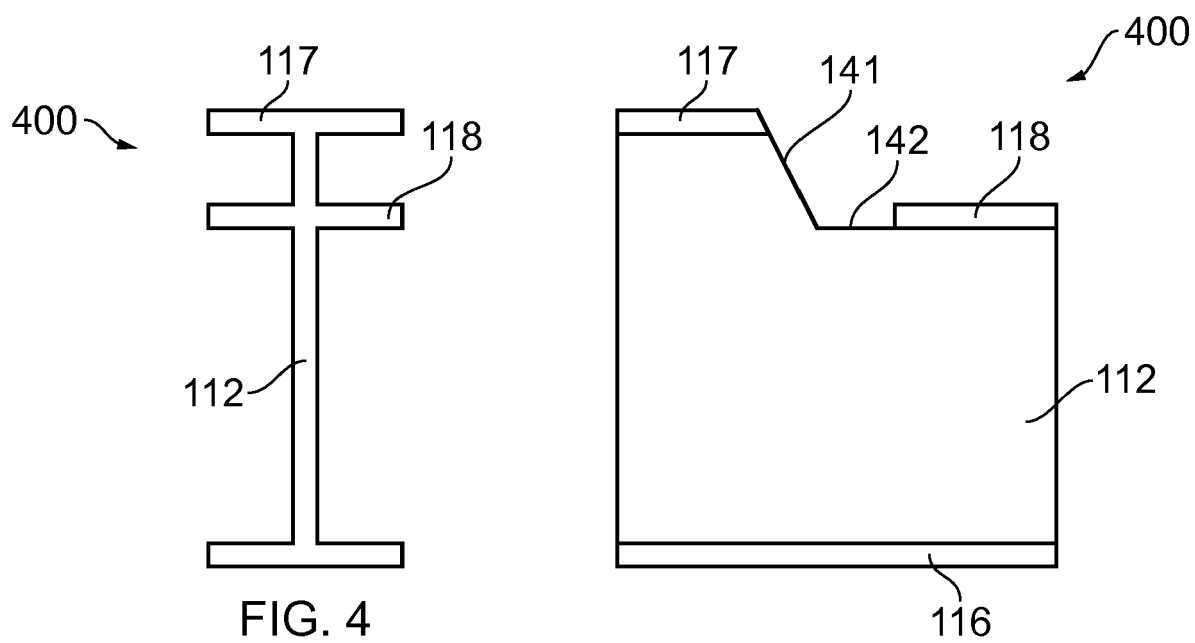


FIG. 4

FIG. 5

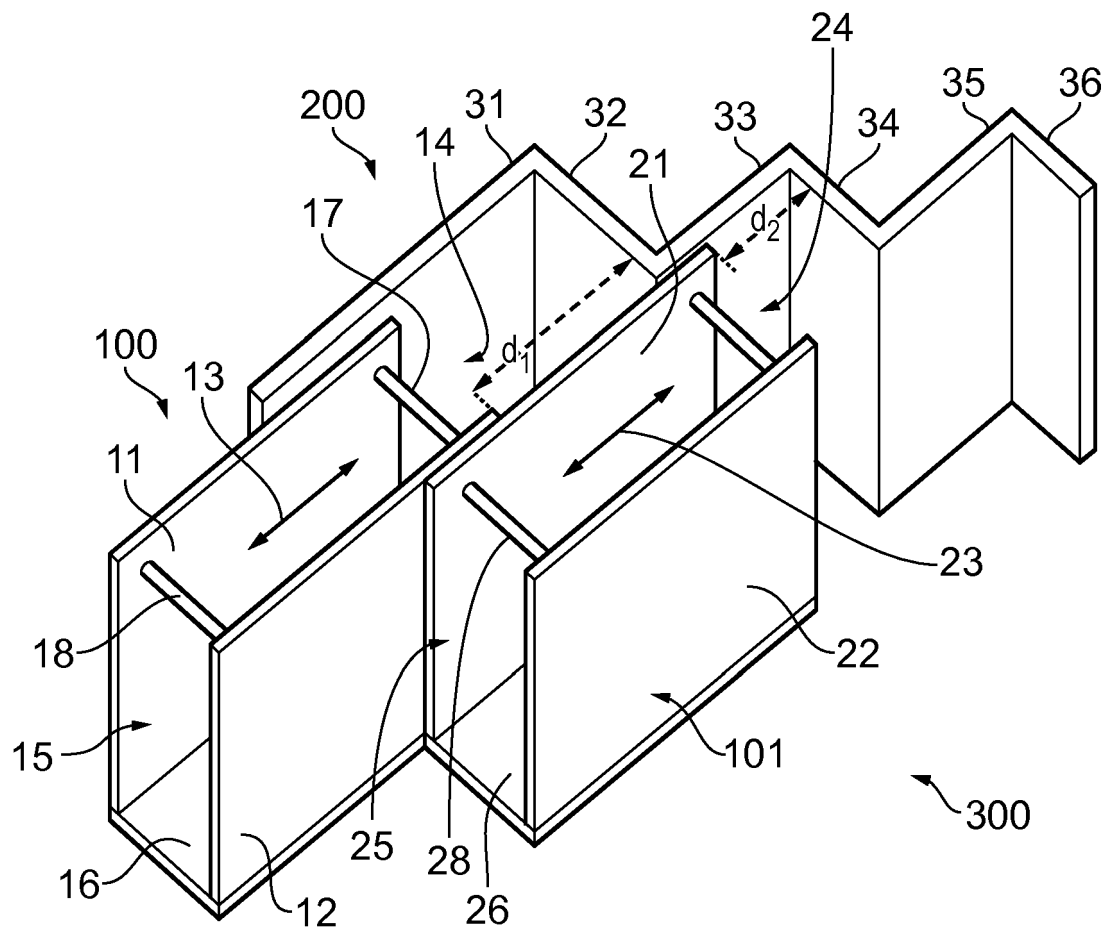


FIG. 6



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 16 4041

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* figure 1 *	13-15	

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	* figure 1 *		

The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) E04H B63B F04D A63B
Place of search		Date of completion of the search	Examiner
Munich		25 September 2018	Brucksch, Carola
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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 EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 16 4041

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