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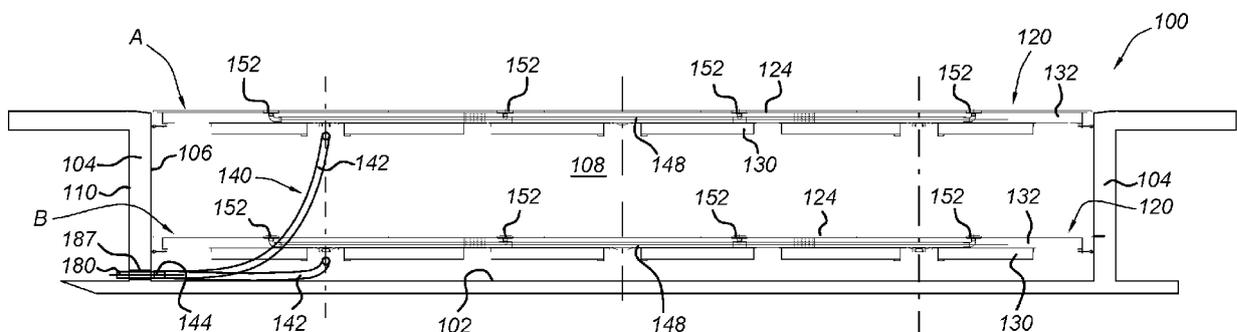
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(54) **WATER DISTRIBUTION SYSTEM FOR A SWIMMING POOL**

(57) The invention relates to an assembly of a swimming pool floor adjustable in a height direction relative to a pool bottom of a swimming pool, the adjustable pool floor having a top side and a bottom side facing away from each other, and wherein the adjustable pool floor is provided with at least one passage for letting water through, the passage opening out to at least the top side;

and a water distribution system comprising a water distribution conduit and at least one water inlet and at least one water outlet in fluid connection with the conduit, wherein the water outlet is connected to the passage of the adjustable pool floor and opening out to the top surface, and wherein in use the water inlet is in fluid connection with a water treatment system.

**Fig. 3**



## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The invention relates to an assembly of a water distribution system and a swimming pool floor that is adjustable in height. Furthermore, the invention relates to a pool floor that is adjustable in height, the adjustable pool floor comprising a water distribution system. In addition, the invention relates to a swimming pool comprising such an assembly or such an adjustable pool floor.

#### 2. Description of the Related Art

**[0002]** Swimming pools with pool floors that are adjustable in a height direction to obtain a desired depth, are known in the art. Being able to adjust the depth of a swimming pool has the advantage that the swimming pool can be used for different events, such as swimming lessons to small children for which smaller depths are required, and swimming competitions with regular depths, or even acrobatic diving for which relatively large depths are required.

**[0003]** Swimming pools are usually required to have water treatment systems that filter and/or clean the water from the swimming pool for re-use. The refreshment rate of the swimming pool water, i.e. the flow of water from the treatment system into the swimming pool, is subject to safety and health regulations, which, amongst others, require that the water volume of the swimming pool is refreshed within a certain time.

**[0004]** It is found that adjustable pool floors work as a barrier to the refreshment of the total water volume of the swimming pool, caused by the location of the water outlets of the water treatment system for the refreshed water flow into the swimming pool. These outlets are usually located near the bottom of the pool, and thus underneath the adjustable pool floor. As such, the water volume below the adjustable pool floor is refreshed at a higher rate than the water volume above the adjustable pool floor, i.e. the treated water is not distributed evenly over the whole of the water volume in the swimming pool.

**[0005]** A proposed solution is to provide more water outlets into the swimming pool and at different locations. However, it is found that, although the treated water is more evenly distributed into the swimming pool, the adjustable pool floor still acts as a barrier.

**[0006]** It would therefore be desirable to provide water distribution system that alleviates at least some of the perceived inconveniences of the prior art.

### BRIEF SUMMARY OF THE INVENTION

**[0007]** According to the invention there is provided an assembly of:

- a swimming pool floor adjustable in a height direction relative to a pool bottom of a swimming pool, the adjustable pool floor having a top side and a bottom side facing away from each other, and wherein the adjustable pool floor is provided with at least one passage for letting water through, the passage opening out to at least the top side; and
- a water distribution system comprising a water distribution conduit and at least one water inlet and at least one water outlet in fluid connection with the conduit, wherein the water outlet is fluidly connected to the passage of the adjustable pool floor, and wherein in use the water inlet is in fluid connection with a water refreshment system.

**[0008]** The swimming pool floor that is adjustable in height comprising a water distribution system, or an assembly thereof, has the advantage that filtered and/or cleaned water from a water treatment system is more evenly distributed in a swimming pool. The treated water is directly distributed through the adjustable pool floor by means of the at least one passage. As such, the adjustable pool floor would therefore be less of a barrier for the even distribution of refreshed water in the swimming pool.

**[0009]** The swimming pool floor adjustable in a height direction, i.e. an adjustable pool floor, can be either a buoyant pool floor or a non-buoyant pool floor. A buoyant pool floor will float to the water surface of the swimming pool if not forced in a downward direction, i.e. to increase the depth the buoyant pool floor needs to be pulled further under water and to decrease the depth, the buoyant pool floor can be released to float to a certain depth and then held at that depth by a pulling force. A non-buoyant floor will sink to a swimming pool bottom, i.e. to decrease the depth the non-buoyant pool floor is pushed in an upward direction to overcome gravitational forces and to increase the depth the pushing forces can be released to sink the non-buoyant pool floor towards the swimming pool bottom.

**[0010]** The adjustable pool floor is provided with at least one passage that extends between the top side and the bottom side of the adjustable pool floor. The passage opens out to at least the top side, i.e. the passage can be a through opening extending from the bottom surface to the top surface, but can also open out to only the top side.

**[0011]** The water distribution system transports water from a water inlet that in use is in fluid connection with the water treatment system, to a water outlet that is connected to the passage in the adjustable pool floor. In its simplest form, it may comprise a single conduit provided with the mentioned inlet and outlet. Further distribution may then take place through the adjustable pool floor e.g. via distribution channels or conduits. Alternatively the water distribution system may comprise a plurality of conduits e.g. branched together and having multiple outlets. The water outlet or outlets may be connected to the adjustable pool floor at the bottom side of the adjustable

pool floor where the passage opens out to. In use the water flow goes from the water inlet to the water outlet of the water distribution system, and through the passage in the adjustable pool floor into the swimming pool. The water flow is thus directed in a height direction from the bottom surface to the top side of the adjustable pool floor. The water flows from the passage in a direction extending from the top surface, into the swimming pool.

**[0012]** According to an embodiment, the water distribution conduit further comprises at least one relatively rigid part connected to the adjustable pool floor and comprising the at least one water outlet at one end, and a relatively flexible part extending from another end of the relatively rigid part to the at least one water inlet at a free end, wherein the relatively rigid part and the relatively flexible part are in fluid communication with each other.

**[0013]** The relatively rigid part can comprise any pipe that is not especially made for bending, i.e. regular PVC pipe used for water transport. The rigid part is connected to the adjustable pool floor and distributes the water over the area of the adjustable pool floor through the passage, preferably by means of multiple passages in the adjustable pool floor. The relatively flexible part is used to accommodate the height differences of the adjustable pool floor when adjusted in height during use. The flexible part may be a corrugated pipe or a concertina pipe or a hose.

**[0014]** Preferably, the adjustable pool floor comprises a top deck and a floor structure, wherein at least part of the water conduit is located between the top deck and the floor structure. The floor structure may comprise a frame that supports the top deck.

**[0015]** The water conduit can be partly enclosed, or sandwiched, between the top deck and the floor structure. Additionally, the floor structure may comprise at least one buoyant body that gives the adjustable pool floor buoyancy with respect to water, such that the adjustable pool floor is a buoyant pool floor. The buoyant body may comprise a buoyant material (relative to water), such as a foam, for example expanded polystyrene (EPS) or a polyurethane foam. Alternatively or additionally, the buoyant body may comprise at least one compartment filled with air or with another light weight, buoyant material.

**[0016]** The top surface of the top deck may form the top side of the adjustable pool floor, such that the passage is provided through at least the top deck. The top surface of the top deck or top side may be provided with an anti-slip surface or layer. The top deck may form the flooring layer of the adjustable pool floor. The top deck may comprise a relatively rigid and strong material, such as a polymeric material, for example a thermoplastic material such as polypropylene or polyethylene, or a reinforced thermosetting polymer, such as a glass fibre reinforced polyester.

**[0017]** According to a further embodiment, between a lower side of the floor structure and the top deck a space is formed in which space at least part of the water conduit is accommodated.

**[0018]** The floor structure can comprise a frame made of a plurality of profiles that are connected to each other. The floor structure may function as a supporting structure on which the top deck is supported. Between the top deck and the lower side of the floor structure, a space is created, in which the part of the water distribution conduit is accommodated. Preferably, the relatively rigid part of the conduit is accommodated in this space.

**[0019]** Preferably, the passage is provided with an adjustable grille for adjusting a water flow through the passage. The adjustable grille allows to vary the distribution of water over the area of the adjustable pool floor by adjusting the water flow through the passage.

**[0020]** According to an embodiment, the adjustable pool floor is provided with a plurality of passages, and the water distribution system is provided with a plurality of water outlets, wherein each water outlet is connected with a respective passage in the adjustable pool floor. Using more than one, preferably more than two, passages in the adjustable pool floor, the distribution of refreshed water is spread more evenly over the area of the adjustable pool floor and thus over the volume of the swimming pool. Preferably, at least part of the water distribution conduit is parallel to at least one of a longitudinal and transverse directions of the adjustable pool floor, and wherein the plurality of passages is distributed in a line parallel to the at least one of the longitudinal and transverse directions of the adjustable pool floor.

**[0021]** The water distribution system may comprise more than one water distribution conduit, of which each water inlet is in use connected to the water treatment system. The water distribution conduit may comprise a web of conduits extending in both a longitudinal and transverse direction. The water distribution conduit may alternatively comprise several branches that extend from the relatively rigid part and/or of the relatively flexible part to in use optimize the transport and distribution of the refreshed water over the area of the adjustable pool floor.

**[0022]** The adjustable pool floor may comprise a plurality of openings extending from the top side to the bottom side, providing a fluid connection between the top side and the bottom side of the adjustable pool floor. These openings are used to let water pass when the adjustable pool floor is moved up or downwards. The movement of the adjustable pool floor may be hampered by the weight of the water displacement by the adjustable pool floor with every movement in the height direction. The openings allow the water to pass and the movement of the adjustable pool floor is facilitated.

**[0023]** Furthermore, the invention relates to a swimming pool floor adjustable in a height direction relative to a pool bottom of a swimming pool, being an adjustable pool floor, wherein the adjustable pool floor has a top side and a bottom side facing away from each other, and wherein the adjustable pool floor is provided with at least one passage for letting water through, the passage opening out to at least the top side; wherein the adjustable pool floor is further provided with a water distribution sys-

tem comprising a water distribution conduit and at least one water inlet and at least one water outlet in fluid connection with the conduit, wherein the water outlet is in fluid connection to the passage of the adjustable pool floor, and wherein in use the water inlet is in fluid connection with a water treatment system.

**[0024]** The swimming pool floor with the water distribution system can be configured as an assembly of separate parts or as a pre-assembled self-contained unit. Both configurations can contain the features of the invention as described above.

**[0025]** The invention also relates to a swimming pool comprising:

- a pool bottom,
- a peripheral upstanding pool wall having an interior side and an exterior side, the pool wall having at least one opening from the exterior side to the interior side of the pool wall,
- a water treatment system connected to the opening in the pool wall, and
- an assembly as described previously, or a swimming pool floor as described above, wherein the water inlet of the water distribution system is in fluid communication with the water treatment system through the opening in the pool wall.

**[0026]** The swimming pool can thus comprise an assembly comprising:

- a pool floor adjustable in a height direction relative to a pool bottom of the swimming pool, wherein the adjustable pool floor is provided with at least one through passage in the height direction for letting water through; and
- a water distribution system comprising a water distribution conduit and at least one water inlet and at least one water outlet in fluid connection with the conduit, wherein the water outlet is in fluid connection to the passage of the adjustable pool floor, and wherein the water inlet is in fluid communication with the water refreshment system through the opening in the pool wall.

**[0027]** Alternatively, the swimming pool can comprise a swimming pool floor adjustable in a height direction relative to a pool bottom of a swimming pool, being an adjustable pool floor, wherein the adjustable pool floor has a top side and a bottom side facing away from each other, and wherein the adjustable pool floor is provided with at least one passage for letting water through, the passage opening out to at least the top side; wherein the adjustable pool floor is further provided with a water distribution system comprising a water distribution conduit, at least one water inlet and at least one water outlet in fluid connection with the conduit, wherein the water outlet is in fluid connection to the passage of the adjustable pool floor, and wherein the water inlet is in fluid connec-

tion with a water treatment system.

**[0028]** In addition to the adjustable pool floor and the water distribution system or the swimming pool floor, described previously, a swimming pool may further be provided with water inlets at the usual locations in the swimming pool wall or swimming pool bottom to have water flowing from the water treatment system into the swimming pool at different locations.

**[0029]** According to an embodiment, the water distribution conduit further comprises at least one relatively rigid part connected to the adjustable pool floor and comprising the at least one water outlet at one end, and a relatively flexible part extending from another end of the relatively rigid part to the at least one water inlet, wherein the relatively rigid pipe and the relatively flexible part are in fluid communication with each other.

**[0030]** The relatively flexible part of the water distribution conduit may accommodate any difference in height when the adjustable pool floor is moved in the height direction.

**[0031]** The water distribution system preferably comprises a plurality of water distribution conduits, wherein each water distribution conduit is in fluid connection with the water inlet (into the water distribution system). Preferably, the water distribution system comprises a plurality of water inlets, wherein each water inlet is in fluid connection with the respective water distribution conduit and the water treatment system. Alternatively, more than one water distribution conduit is connected to a single water inlet, such that the plurality of water distribution conduits form branches extending from one water inlet, forming a branched water distribution system.

**[0032]** Additionally, the swimming pool wall may comprise a plurality of openings from the exterior side to the interior side of the pool wall, wherein each water inlet of the water distribution system is in fluid connection with the water treatment system through a respective opening in the pool wall. It will be understood that such openings may also be made through the pool bottom rather than through the pool wall.

**[0033]** Using more than one water distribution conduit in the water distribution system gives the advantage that the distribution of the water over the area of the adjustable pool floor, and thus over the volume of the swimming pool, can be controlled and/or adjusted more accurately. In addition, using more conduits means that the diameter of the flexible part of the conduit can be decreased, thereby increasing the flexibility of the flexible part. Height differences can then be accommodated by the flexible parts more easily.

**[0034]** It will also be understood that, while the invention has been described in relation to water outlets connected to the adjustable floor, a simple reversal of this arrangement, with water being extracted through the adjustable floor via the distribution system would also be covered by the present claims.

**[0035]** The invention further relates to a method for improving water distribution in a swimming pool having an

adjustable floor. According to the method, treated water may be released directly into the volume of water that lies above the adjustable floor. In the present context, treated water is intended to refer to filtered or cleaned water, which has been treated in a water treatment system prior to being returned to the pool. Furthermore, 'directly' implies that the treated water flows from the water treatment system into the volume above the adjustable floor without first passing through or mixing with water in the volume below the adjustable floor or vice-versa. In other words, the water treatment system is in fluid connection with the water volume above the adjustable floor, other than via the water volume below the adjustable floor. According to the method, greater control of the water distribution may be achieved and water quality may be maintained more reliably, independent of the position of the adjustable floor.

**[0036]** In one embodiment, the method may comprise releasing the treated water through at least one passage in the adjustable floor. In general a plurality of passages will be provided, ensuring good distribution over the floor area. Other configurations may however be contemplated with the water being released around edges of the floor.

**[0037]** The amount of water that is released above the adjustable floor will depend upon many factors. In general, the actual volume of circulation will depend upon the volume of the pool. For this reason, reference is often given to turnover time i.e. the amount of time required for a volume equal to the total volume of the pool to be circulated through the treatment system. Values for turnover depend on pool usage and bather load but may vary from 4 hours to less than 20 minutes. According to an aspect of the invention, a volume of treated water released directly into the volume above the adjustable floor may be between 10% and 90% of the total of the treated water, optionally between 20% and 80% of the total of the treated water. As an example, if a 5000 m<sup>3</sup> pool must be refreshed every 2 hours, this requires a flow rate of 2500 m<sup>3</sup>/hour. Delivery of 50% of the water to the region above the adjustable floor would require 1250 m<sup>3</sup>/hour delivery into this region. It will be understood that the percentage delivery to the region or removal from the region will also be affected by whether the adjustable floor covers the whole of the pool or is e.g. only present at the deep end.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0038]**

Figure 1 shows a schematic overview of a swimming pool with an adjustable pool floor and a water distribution system according to an embodiment of the invention.

Figure 2a shows a detail of the adjustable pool floor and the water distribution system of Fig. 1.

Figure 2b shows a cross section of the adjustable

pool floor in a transverse direction.

Figure 2c shows a detail of the water distribution conduit of fig. 2b.

Figure 3 shows a cross section of the swimming pool of fig. 1 in a longitudinal direction.

#### DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

**[0039]** Figure 1 shows a schematic overview of a swimming pool 100 with an adjustable pool floor 120 and a water distribution system 140 installed according to an embodiment of the invention. The water distribution system 140 includes two water distribution conduits that each comprises a relatively flexible part 142 and a relatively rigid pipe part 172. The relatively rigid part 172 of each water distribution conduit includes a main pipe 146 that is connected to two branched pipes 148. The flexible part 142 of the conduit is connected to a water inlet 144 that is in fluid connection with a water treatment system (not shown), and comprises a flexible hose. The flexible hose 142 extends from the water inlet 144 to the main pipe 146 that is connected to the adjustable pool floor. Figure 2a shows that the main pipe 146 has two branches 148 that extend from the main pipe. The branches 148 are each connected to a plurality of passages 150 extending through a top side of the adjustable pool floor. The passages 150 are each covered by an adjustable grille 152 to be able to adjust the water flow coming out of the passages 150.

**[0040]** In the embodiment shown in figures 1 and 2a, a movement transfer arrangement 162 that is provided to transfer movement of an actuator 160 to the adjustable pool floor 120 for moving the adjustable pool floor 120 up and down is shown. The branched pipes 148 are parallel oriented and spaced apart from the movement transfer arrangement 162, being a cable pulley system. The actuator 160 is depicted as a hydraulic cylinder that is connected with an end to the cable pulley system.

**[0041]** Figs. 1 and 2a furthermore show a plurality of elongate grilles 170 provided in the adjustable pool floor that cover a plurality of through openings (not shown) along a longitudinal direction of the adjustable pool floor 120. The openings allow water to pass through the adjustable pool floor upon movement in the height direction.

**[0042]** Figure 2b shows a cross section of the adjustable pool floor in a transverse direction. It is shown that the adjustable pool floor comprises a top deck 122 having a top surface 124, and a floor structure 130 that comprises buoyant bodies formed as compartments 134 filled with a buoyant material, making the adjustable pool floor 120 a buoyant pool floor. The top surface 124 may be provided with an anti-slip layer to prevent users of the swimming pool from slipping. The floor structure 130 comprises a frame assembled from longitudinal and transverse profiles 126. Between a lower side of the floor structure 130, at which the buoyant body is provided, and the top deck 122 a space 132 is formed. The space 132 that is formed between the top deck 122 and the lower

side of the floor structure 130 is used to accommodate the rigid part 172 of the water distribution conduit, also shown in figure 2c. The floor structure also functions as a support structure to support the top deck.

**[0043]** Figure 2c shows a detail of the water distribution conduit of fig. 2b. This detail shows the water outlet 154 of the water distribution system 140. The water outlet 154 is in fluid connection to the passage 150 by means of a fit-form or a clamping connection and forms a fluid connection between the passage 150 and the water distribution conduit.

**[0044]** Figure 3 shows a cross section of the swimming pool 100 of fig. 1 in a longitudinal direction. The swimming pool 100 has a pool bottom 102 and a peripheral up-standing pool wall 104 with an interior side 106 facing the interior of the swimming pool 108 and an exterior side 110. An opening 187 extends through the pool wall 104 to accommodate a connection element 180 to fluidly connect the water inlet 144 of the water distribution system with the water treatment system (not shown). The flexible part 142 of the water distribution conduit is fluidly connected with one end to the water inlet 144. At another end, the flexible hose 142 of the water distribution conduit is connected to the main pipe 146 of the rigid part 172 of the water distribution conduit (shown in figure 1). Figure 3 shows additionally, that the flexible hose 142 accommodates any height changes when the depth of the adjustable pool floor 120 is changed from depth A to depth B and vice versa.

**[0045]** The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. It will be apparent to the person skilled in the art that alternative and equivalent embodiments of the invention can be conceived and reduced to practice. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

## Claims

### 1. Assembly of:

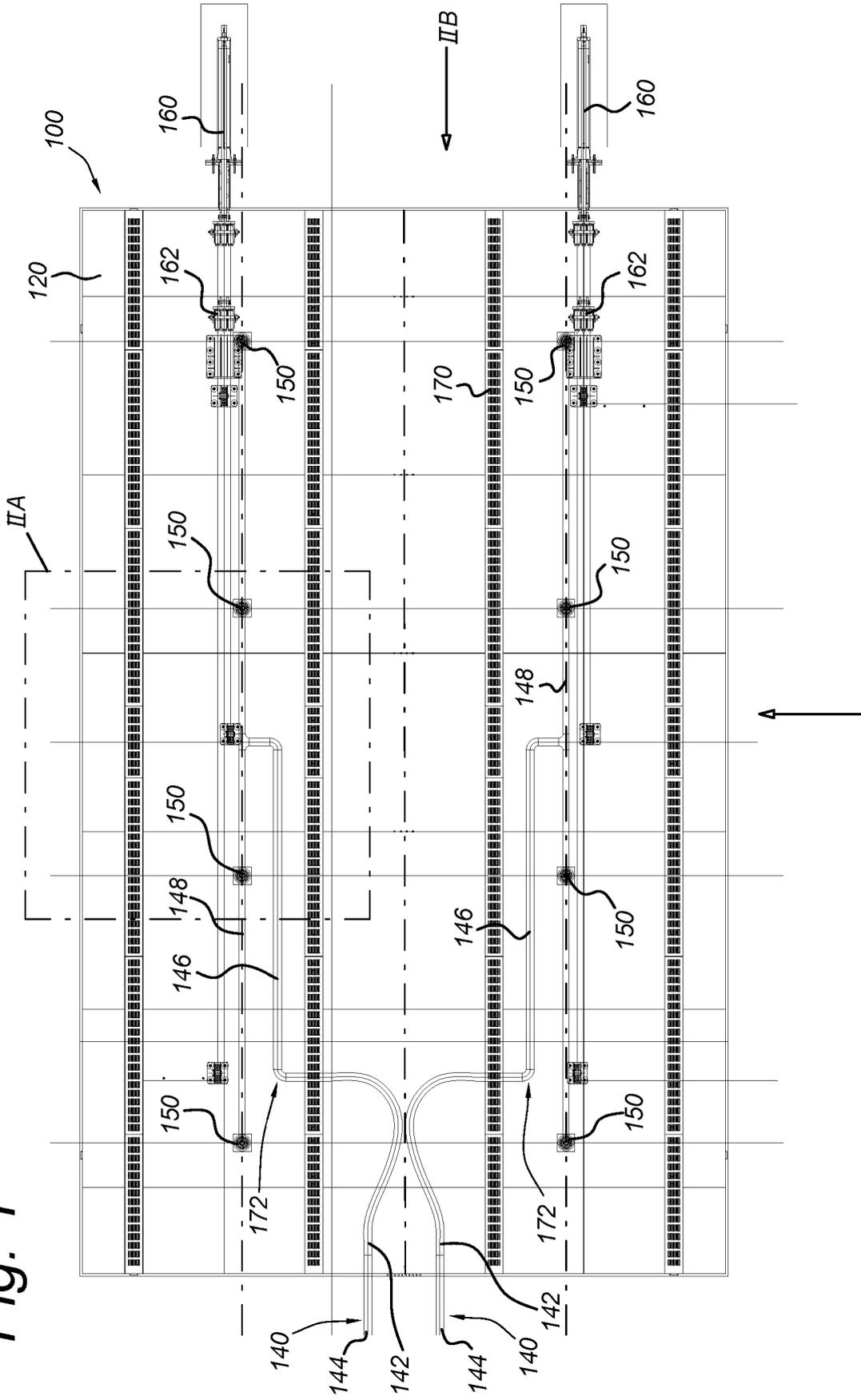
- a swimming pool floor adjustable in a height direction relative to a pool bottom of a swimming pool, the adjustable pool floor having a top side and a bottom side facing away from each other, and wherein the adjustable pool floor is provided with at least one passage for letting water through, the passage opening out to at least the top side; and
- a water distribution system comprising a water distribution conduit and at least one water inlet and at least one water outlet in fluid connection

with the conduit, wherein in use the water outlet is fluidly connected to the passage of the adjustable pool floor, and wherein in use the water inlet is in fluid connection with a water treatment system.

2. Assembly according to claim 1, wherein the water distribution conduit further comprises at least one relatively rigid part connected to the adjustable pool floor and comprising the at least one water outlet at one end, and a relatively flexible part extending from another end of the relatively rigid part to the at least one water inlet at a free end, wherein the relatively rigid part and the relatively flexible part are in fluid communication with each other.
3. Assembly according to claim 1 or 2, wherein the adjustable pool floor comprises a top deck and a floor structure, wherein at least part of the water conduit is located between the top deck and the floor structure.
4. Assembly according to claim 3, wherein between a lower side of the floor structure and the top deck a space is formed in which space at least part of the water conduit is accommodated.
5. Assembly according to claim 2 and any of claims 3-4, wherein the relatively rigid part is located between the top and the floor structure.
6. Assembly according to any of claims 3-5, wherein the passage of the adjustable pool floor is provided in the top deck only.
7. Assembly according to any of the preceding claims, wherein the passage is provided with an adjustable grille for adjusting a water flow through the passage.
8. Assembly according to any of the preceding claims, wherein the adjustable pool floor is provided with a plurality of passages, and wherein the water distribution system is provided with a plurality of water outlets, wherein each water outlet is connected with a respective passage in the adjustable pool floor.
9. Assembly according to claim 8, wherein at least part of the water distribution conduit is parallel to at least one of a longitudinal and transverse directions of the adjustable pool floor, and wherein the plurality of passages is distributed in a line parallel to the at least one of the longitudinal and transverse directions of the adjustable pool floor.
10. Assembly according to any of the preceding claims, wherein the adjustable pool floor is a buoyant pool floor.

11. Assembly according to claim 10, wherein a buoyant body is provided at a bottom side of the adjustable pool floor.
12. Assembly according to any preceding claims, wherein the top side of the adjustable pool floor comprises a polymeric material.
13. Assembly according to any of the preceding claims, wherein a top surface of the top side of the adjustable pool floor comprises an anti-slip surface.
14. Assembly according to any of the preceding claims, wherein the water distribution system is integrated with the adjustable floor.
15. Swimming pool comprising:
- a pool bottom,
  - a peripheral upstanding pool wall having an interior side and an exterior side, the pool wall or pool bottom having at least one opening from the exterior side to the interior side,
  - a water treatment system connected to the opening, and
  - an assembly according to any of claims 1-14, wherein the water inlet of the water distribution system is in fluid communication with the water treatment system through the opening.
16. Swimming pool according to claim 15, wherein the water distribution conduit further comprises at least one relatively rigid part connected to the adjustable pool floor and comprising the at least one water outlet at one end, and a relatively flexible part extending from another end of the relatively rigid part to the at least one water inlet, wherein the relatively rigid part and the relatively flexible part are in fluid communication with each other.
17. Swimming pool according to claim 16, wherein the relatively flexible part of the water distribution conduit accommodates any difference in height when the buoyant pool floor is moved in the height direction.
18. Swimming pool according to any of claims 15-17, wherein the water distribution system comprises a plurality of water distribution conduits and water inlets, wherein each water inlet is in fluid connection with the respective water distribution conduit; and wherein the swimming pool wall or pool bottom comprises a plurality of openings from the exterior side to the interior side, wherein each water inlet of the water distribution system is in fluid connection with the water treatment system through a respective opening.
19. Method for improving water distribution in a swimming pool with an adjustable floor, the method comprising releasing treated water directly into the volume above the adjustable floor.
20. Method according to claim 19, the method comprising releasing the treated water through at least one passage in the adjustable floor.
21. Method according to claim 19 or claim 20, wherein a volume of treated water released directly into the volume above the adjustable floor is between 10% and 90% of the total of the treated water, optionally between 20% and 80% of the total of the treated water.
22. Method according to any of claims 19 to 21, wherein the method is carried out with an assembly according to any of claims 1 to 14 or in a swimming pool according to any of claims 15 to 18.

Fig. 1



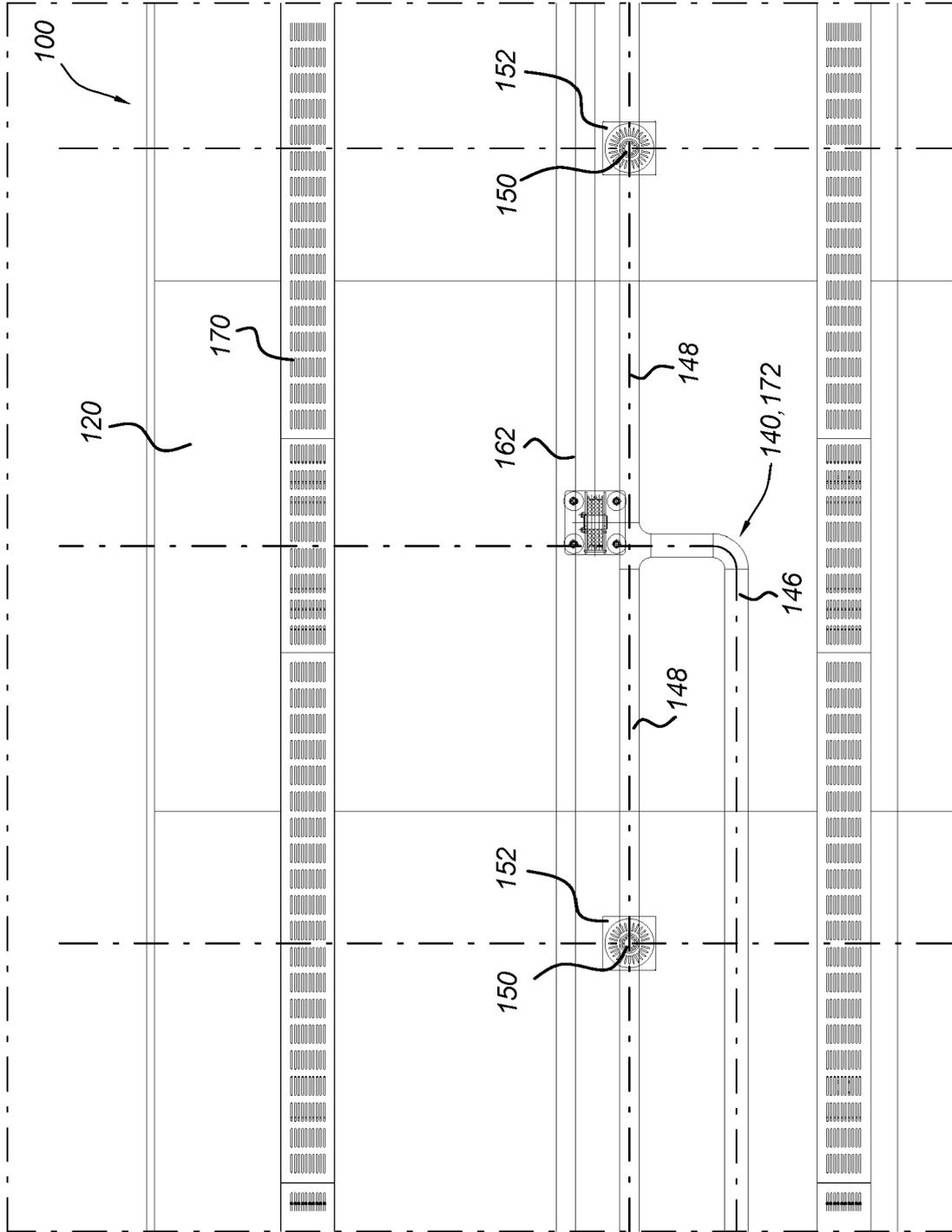


Fig. 2A

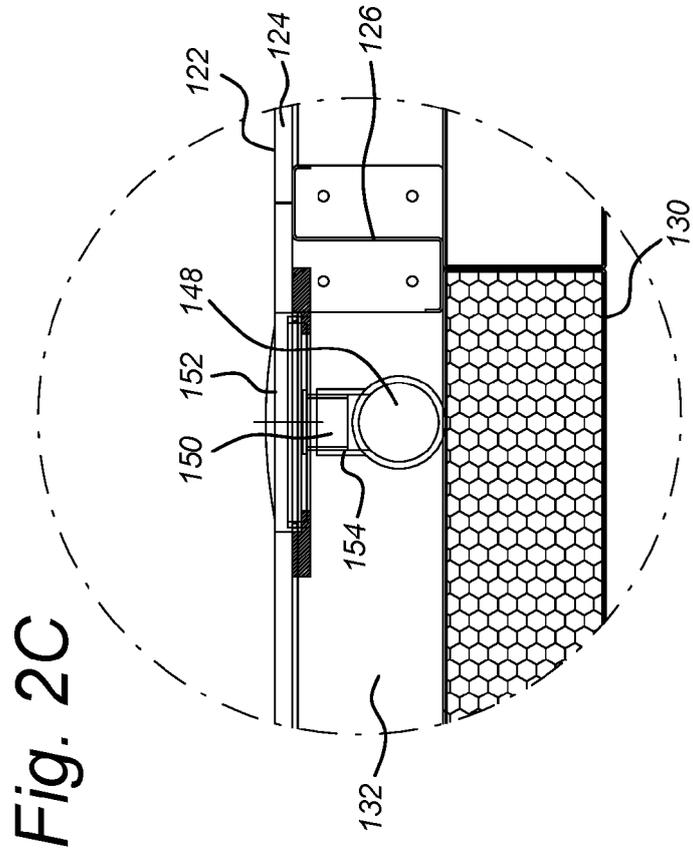
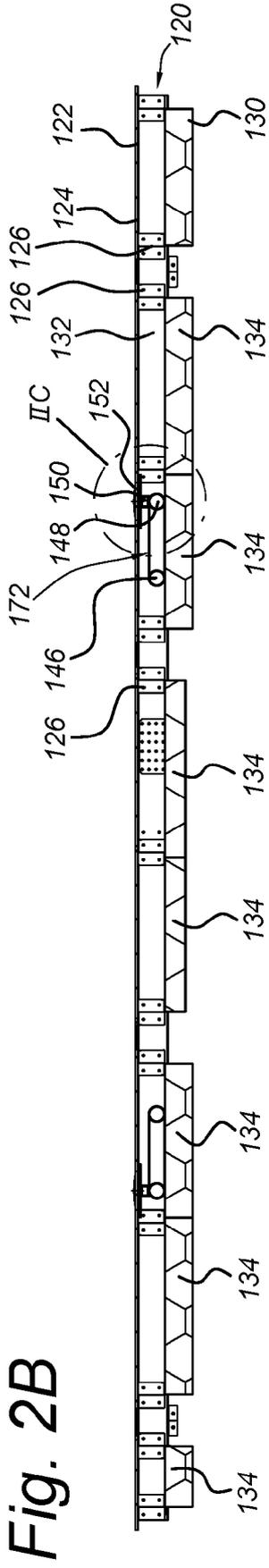


Fig. 3

