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(54) **Bathtub having selfsustaining walls.**

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Description

Present invention pertains to bathtubs and in particular bathtubs manufactured from plastic materials.

Today there is the use of manufacturing plastic material bathtubs (such as disclosed in the DE-A-2702295) for reasons of low cost and easy working. The process used to be followed is that of vacuum thermoshaping through which a plastic material sheet, for example from methyl metacrylate, usually well stiff at ambient temperature as well as at the usual temperature of hot water in a bathtub, is heated to the softening point and laid down against a hollow mold by applying a vacuum at suitable points.

This process produces tub shells having excellent shape and finishing needing few, if any, further working for having their ultimate appearance and the full utilizability.

The only serious problem with these so obtained shells is their intrinsic brittleness or weakness, due to wall thinness, preventing their direct use in installations, as said shells could easily open or crack even under relatively mild strains. A largerly used remedy against this problems consists in exterally coating said shells by means of glass fabric layers soaked by hardenable resins, such as polyesters, producing a sustaining structure provided with substantial mechanical strenght in order to however prevent damages to said shell, specifically the ones connected with the use of a bathtub.

This external coating with glass fabric layers soaked by hardenable resin has however, further to give the external wall of the tub a poor aesthetic appearance, the serious problem of raising the wall thickness thereof to the point to allow just a partial entry of the external part of a tub in the internal part of another tub so that in storing and shipping people are compelled to take into account an encumbrance similar to a parallelepiped enclosing the same, with poor space use problems heavily affecting said storage and shipping costs.

According to EP-A-126832 the shell of the bathtub is provided with a supporting body, having regularly reinforced ribs forming a grid, onto which the shell abuts.

To avoid this excessive encumbrance problem should be devised bathtub shells with such a self-sustaining structure to prevent substantial distortions thereof under usual strains due to use or piling-up, but altogether so thin to allow piling-up with entry of any shell in each other leading to both storage and shipping space substantial economies.

This is achieved by a bathtub comprising a simple completely selfsustaining shell characterized by comprising a strengthening a rib or ridge structure, consisting of a modular grid, having the duty, of uniformely distribute in said shell the strains due to the load of water and , possibly, or a person lying in said tub, said shell modular structure comprising a radial rib assembly depending from a shell edge and joining in at least one point on the bottom thereof, said ribs starting from points distributed on said shell edge in order to form a rectangular grid with substantially uniform members having the duty of distributing the most uniformly the possible said strains.

In particular, said ribs converging on the bottom are connected each other by curved surfaces, either hollow or convex with respect to the shell inside, giving the shell an appearance as of a sea shell and a particularly high strength.

Preferably, the curved surfaces connecting said ribs are arranged symmetrically around a longitudinal axis of said shell with a hollow first major surface, symmetrically divided by said longitudinal axis, going from the upper edge at the head side to the convergence point of the ribs on the bottom of the shell, flanked by two hollow curved surfaces in turn adjacent third hollow surfaces continuining in fourth surfaces, which can be either hollow or convex, in turn continuing in fifth hollow surfaces adjacent a last hollow surface symmetrically divided by said shell longitudinal axis at the foot side of the tub.

More preferably said first hollow major surface is so shaped to form an anatomic back.

Still more preferably, said two second hollow surfaces, adjacent said first hollow surface, form niches delimited at half height by bottom planes forming two arms.

Further preferably, said fourth curved convex surfaces end as lowered with respect to the tub edge forming two support planes symmetrically arranged with respect to the longitudinal axis of the tub itself.

According to a second embodiment, said modular shell structure is formed by an assembly of protruding and re-entring areas connected by ribs similar to the ribs sustaining a boat planking, which are formed by connecting surfaces between said protruding areas and said re-entring areas, said ribs being arranged in two substantially perpendicular groups each other intersecting in order to form a rectangular grid having substantially uniform members and having the duty of distributing the most uniformely the possible said strains.

Particularly the areas protruding to inside said shell form as two substantially perpendicular bands of which a first major band is parallel and symmetric with respect to a longitudinal axis of said shell and a second minor band is substantially perpendicular with respect to said first major band intersecting it at a place substantially near the foot side of said shell.

More preferably, said first major band is shaped at the head side of said shell in order to form an anatomic back.

Still preferably, two re-entring areas adjacent said major band at head side are provided with two niches delimited at half height by bottom planes forming two arms.

Further preferably, said second protruding minor band ends against the edge of the tub with two lowered areas forming two support planes symmetrically arranged with respect to the longitudinal axis of the shell itself.

The features and the advantages of the present invention will be made more apparent by the following detailed description of its embodiments, not given in limiting sense provided with the enclosed drawings, wherein:

figure 1 is a diagrammatical perspective view of a selfsustaining tub shell structure according to a first embodiment of present invention;

figure 2 is a diagrammatical perspective view of selfsustaining tub shell structure according to a second embodiment of present invention;

figure 3 is a perspective view of an installed bathtub formed by a selfsustaining shell of the first embodiment;

figure 4 is a perspective view of an installed bathtub formed by a selfsustaining shell of the second embodiment.

Considering the first embodiment and particularly figure 1, it is seen that the first tub 10 embodiment, having selfsustaining walls according to the present invention, consists of a shell 12, formed for example by vacuum themoshaping of a thermoplastic material sheet, comprising an edge 14 according to a substantially rectangular frame from which depends a hull 16 forming the part of the tub intended to contain the water. From the edge 14 along the internal walls of the tub depend ribs or ridges 18a-l which, starting from points 20a-l on the edge of the hull 16, descend to a connection area 22 usually strengthened for housing accesories such as the tub drain. The points 20a-l are arranged in order to lay on a grid having rectangular substantially regular loops formed by intersecting straight lines 24a-e which provides a substantially uniform distribution of the strains on the hull 16 due to the presence of water and or of the body of a person in the tub 10. Of course, said tub 10 abuts in a usual way with its bottom and edge 14 on a structure 26, such as a brick wall structure tiled or panelled, and also on the floor of the room in which the bathtub is installed.

Considering now the second embodiment of this tub and particularly figure 2 in this case a selfsustaining wall tub 30 according to the present invention consists of a shell 32 also formed by vacuum thermoshaping from a thermoplastic material sheet, comprising an edge 34 according to a rectangular fram frome which a hull 36, forming the part of the tub intedend to contain water, descends.

The internal walls of the hull 36 have two inside protruding areas of which a first major area or band 38 is arranged parallel and symmetric with respect to a longitudinal axis 39 of the tub itself and a minor area or band 40 is sustantially perpendicular with respect to the major area 38 crossing the same near the foot side of the tub. The two band areas 38 and 40 delimit adjacent lowered areas 42a-f, of which two areas 42b and 42e have intermediate depth and four areas 42a, 42c, 42d, and 42f are the deepest, forming among them rib connections 44a-l having a strengthening duty similar to that of the ribs of a boat hull. The rib connections 44a-l are in line with straight lines 45a-e crossing each other to form a grid having rectangular uniform loops providing a substantially uniform distribution of the strains applied to the hull 36 by the presence of water and/or the body of a person in the bathtub itself.

Of course, said tub 30, showing on the external wall of its hull 36 re-entring band areas 46 and 48 respectively corresponding to band areas 38 and 40 inside protruding, abuts in a usual way with its bottom and the edge 34 against a structure 50, such as a brick structure, tilable or panelable for aesthetic purposes, as well as on the floor of the room in which the bathtub is installed.

From the review of figures 1 and 2 it appears that in both the tub embodiments the external walls of the respective shells 12 and 32 repeat substantilly on the contrary the internal walls, in the sense that to protruding members in the internal walls correspond re-entring members in the external walls and viceversa. This fact allows to superimpose and entry one into the other the shells 12 or 32 of similar kind which can be each other piled-up without damages with the simple interposition on thin antiscratch material sheets in order to use at most the room in stores and shipping means. For example, these shells 12 and 32 lend themselves very well to storage in compact packages and to shipping in standard modular containers allowing their maximum filling.

Referring now to figure 3 it is seen an installed bathtub having ribbed shell embodied according to figure 1 example.

In a corner of a bathroom between two tiled vertical walls 60 and 62 and also a tiled floor 64, is installed a bathtub manufactured according to the tub 10, having the ribbed shell 12 of figure 1.

Said tub, surrounded and supported by a brick structure, defined by the tiled walls 66 and 68, comprises a rectangular frame edge 74 from which descends a ribbed shell 76 provided with ribs protruding to the inside indicating the limits among

hollow surfaces such as the surfaces 78a-h, or between hollow and convex surfaces, such as the surfaces 80a and 80b terminating a little below the rectangular edge 74 for defining two article support planes 82a and 82b.

Further, the hollow surfaces 78b and 78h are formed as deep niches housing, at half height, support planes having duty of arms 84 and 85 and the hollow surface 78a is so shaped to form an anatomic back affording particular comfort to the bathtub.

Referring at last to figure 4, it is seen an installed bathtub having a ribbed shell according to the embodiment of figure 2.

In a corner of a bathroom between two vertical tiled walls 60 and 62 and an also tiled floor 64 is installed a bathtub manufactured according to the tub 30, having ribbed shell 32 of figure 2. Said tub, surrounded and supported by a brick structure defined by the tiled walls 66 and 68, comprises a rectangular frame edge 94 from which descends a ribbed shell 96 provided with a first major raised band area 98 arranged according to the length of the tub, and with a second minor raised band area 100 substantially perpendicular with respect to the major band area 98, said band area 100 terminating with two planes 102a and 102b a little below the frame 94 operating as article supporting planes.

At the head side of the tub the raised band 98 is surrounded by two lowered niches 104a and 104b, terminating at half height with two planes 106a, and 106b, operating as arms.

Similarly at the foot side there are two lowered areas 108a and 108b delimited by the two raised bands 96 and 100. On the bottom of the tub the lowered areas prosecute delimited by the raised bands 98 and 100 for assuring the presence of strenghtening ribs in the whole tub. The major raised band 98 is shaped at the head side to form an anatomic back 110 affording particular comfort to the tub.

A further thickness step 112 at half height supplies a supplementar orizontal rib further cooperating to strengthen the shell 96.

What has been hereabove stated depictes two embodiments of the invention, given in not limiting sense, and it will appear to those skilled in the art fully equivalent changements, alterations and substitutions, to be considered here covered.

Claims

1. Bath tub, having selfsustaining walls, formed by a single shell, characterized by comprising a strengthening rib or ridge structure consisting of a modular grid, having the duty of uniformely distribute in said shell the strains due to the load of water, and possibly of a person lying in said tub, that said shell modular structure comprising a radial rib assembly (18a-l) depending from a shell edge (14) and joining in at least one point (22) of the bottom of the shell, said ribs (18a-l) starting from points (20a-l) distributed along said shell edge (14) in order to form a rectangular grid with substantially uniform members having the duty of distributing the most uniformly the possible said strains.

2. Bath tub, according to claim 1, characterized in that said ribs (18a-l) converging on the bottom are connected to each other by curved surfaces, either hollow or convex, giving the shell (12) an appearance as of a sea shell and a particularly high strength.

3. Bath tub, according to claim 2, characterized in that the curved surfaces connecting said ribs (18a-l) are arranged symmetrically around a longitudinal axis of said shell (12) with a hollow first surface (78a), symmetrically divided by said longitudinal axis, going from the upper edge (14) at the head side of the tub to the convergence point (22) of the ribs (18a-l) on the bottom of the shell (12), flanked by two hollow curved surfaces (78b, 78h) in turn adjacent third hollow surfaces (78c,78g), continuing in fourth surfaces (80a, 80b), which can be either hollow or convex, in turn continuining in fifth hollow surfaces (78d, 78f) adjacent a last hollow surface (78e) symmetrically divided by said shell (12) longitudinal axis at the foot side of the tub.

4. Bath tub , according to claim 3, characterized in that said first hollow major surface (78a) is shaped to form an anatomic back (86).

5. Bath tub, according to claim 3, characterized in that said second hollow surfaces (78b, 78h) adjacent said first hollow surface (78a) form niches delimited at half height by bottom planes forming two arms (84,85).

6. Bath tub, according to claim 3, characterized in that said fourth surfaces (80a, 80b), if convex form two support planes (82a, 82b) symmetrically arranged with respect to the longitudinal axis of the shell (12).

7. Bath tub, having selfustaining walls, formed by a single shell, characterized by comprising a strengthening rib or ridge structure consisting of a modular grid, having the duty of uniformely distribute in said shell the strains due to the load of water, and possibly of a person

lying in said tub said modular shell structure being formed by an assembly of protruding areas (38, 40) and re-entring areas (42a-f) connected by ribs (44a-l), similar to the ribs substaining a boat planking, which are formed by connecting surfaces between said protruding areas (38, 40) and said re-entring areas (42a-f), said ribs (44a-l) being arranged in two substantially perpendicular groups each other intersecting in order to form a rectangular grid having substantially uniform members and having the duty of distributing the most uniformely the possible said strains.

8. Bath tub, according to claim 7, characterized in that the areas (38, 40) protruding inside said shell (12), are formed as two substantially perpendicular bands of which a first major band (38) is parallel and symmetric with respect to a longitudinal axis (39) of said shell and a second minor band (40) is substantially perpendicular with respect said first major band (38), intersecting it at a place substantially close to the foot side of said shell (12).

9. Bath tub, according to claim 8, characterized in that said first major band (38, 98) is shaped at the head side of said shell (32) in order to form an anatomic back (110).

10. Bath tub, according to claim 8, characterized in that two re-entring or lowered areas (42a-f) adjacent said major band (38, 98) at the head side are provided with two niches (104a, 104b) delimited at half height by bottom planes forming two arms (106a, 106b).

11. Bath tub, according to claim 8 characterized in that said second protruding minor band (40, 100) ends against the edge (34, 94) of the tub with two lower areas (102a, 102b) forming two support planes symmetrically arranged with respect the longitudinal axis of the shell (12) itself.

Patentansprüche

1. Badewanne, mit selbsttragenden Wänden, die durch einzelne Schale gebildet ist, gekennzeichnet durch das Aufweisen einer verstärkenden Rippen- oder Kantenstruktur, die aus einem modularen Gitter besteht, das die Aufgabe der gleichmäßigen Verteilung der Belastung aufgrund der Last des Wassers und möglicherweise einer in der Wanne liegenden Person hat, wobei die modulare Schalenstruktur eine radiale Rippenanordnung (18a-l) aufweist, die sich von einer Schalenkante (14) heraberstreckt und an mindestens einem Punkt (22) des Bodens der Schale zusammenläuft, wobei die Rippen (18a-l) an Punkten (20a-l) beginnen, die entlang der Kante (14) verteilt sind, um ein rechteckiges Gitter mit im wesentlichen gleichen Teilen zu Bilden, das die Aufgabe hat, die Belastung so gleichmäßig wie möglich zu verteilen.

2. Badewanne nach Anspruch 1, dadurch gekennzeichnet, daß die an dem Boden zusammenlaufenden Rippen (18a-l) miteinander durch gekrümmte Oberflächen, entweder hohl oder konvex verbunden sind, die der Schale (12) das Aussehen einer Meeresmuschel und eine insbesonders hohe Festigkeit geben.

3. Badewanne nach Anspruch 2, dadurch gekennzeichnet, daß die die Rippen (18a-l) verbindenden gekrümmten Oberflächen symmetrisch um eine Längsachse der Schale angeordnet sind, wobei eine hohle erste Oberfläche (78a), die symmetrisch von der Längsachse unterteilt wird, von der oberen Kante (14) an der Kopfseite der Wanne zu dem Konvergenzpunkt (22) der Rippen (18a-l) an dem Boden der Schale (12) geht, die von zwei hohlen gekrümmten Oberflächen (78b, 78h) flankiert ist, an die wiederum dritte hohle Oberflächen (78c, 78g) angrenzen, die in vierten Oberflächen (80a, 80b) fortgesetzt werden, die entweder hohl oder konvex sein können, die wiederum in fünften hohlen Oberflächen (78d, 78f) fortgesetzt werden, an die benachbart eine letzte hohle Oberfläche (78e) angrenzt, die symmetrisch von der Längsachse der Schale (12) unterteilt wird und an dem Fußende der Wanne vorgesehen ist.

4. Badewanne nach Anspruch 3, dadurch gekennzeichnet, daß die erste hohle Hauptoberfläche (78a) zum Bilden eines anatomischen Rückens (86) geformt ist.

5. Badewanne nach Anspruch 3, dadurch gekennzeichnet, daß die zweiten hohlen Oberfläche (78b, 78h), die benachbart zu der ersten hohlen Oberfläche (78a) sind, zwei Nischen bilden, die an halber Höhe durch Bodenebenen begrenzt sind, die zwei Arme (84, 85) bilden.

6. Badewanne nach Anspruch 3, dadurch gekennzeichnet, daß die vierten Oberflächen (80a, 80b), wenn sie konvex sind, zwei Unterstützungsebenen (82a, 82b) bilden, die symmetrisch in Bezug auf die Längsachse der Schale (12) angeordnet sind.

7. Badewanne mit selbsttragenden Wänden, die durch eine einzelne Schale gebildet ist, gekennzeichnet durch das Aufweisen einer verstärkenden Rippen- oder Kantenstruktur, die aus einem modularen Gitter besteht, daß die Aufgabe der gleichmäßigen Verteilung der Belastung aufgrund der Last des Wassers und möglicherweise einer in der Wanne liegenden Person in der Schale hat, wobei die modulare Schalenstruktur durch eine Anordnung von vorstehenden Flächen (38, 40) und eingezogene Flächen (42a-f) gebildet ist, die durch Rippen (44a-l) verbunden sind, die ähnlich den Rippen sind, die eine Bootsbeplankung stützen, die durch verbindende Oberflächen zwischen den vorstehenden Flächen (38, 40) und den eingezogene Flächen (42a-f) gebildet sind, wobei die Rippen in zwei im wesentlichen senkrechten Gruppen angeordnet sind, die einander zum Bilden eines rechteckigen Gitters schneiden, das im wesentlichen gleichförmige Teile aufweist und die Aufgabe hat, die Belastung so gleichmäßig wie möglich zu verteilen.

8. Badewanne nach Anspruch 7, dadurch gekennzeichnet, daß die Flächen (38, 40), die innerhalb der Schale (12) vorstehen, als zwei im wesentlichen senkrechte Bänder gebildet sind, von denen ein erstes Hauptband (38) parallel und symmetrisch zu einer Längsachse (39) der Schale ist, und ein zweites Nebenband (40) im wesentlichen senkrecht in Bezug auf das erste Hauptband (38) ist und dieses an einer Stelle im wesentlichen nahe dem Fußende der Schale (12) schneidet.

9. Badewanne nach Anspruch 8, dadurch gekennzeichnet, daß das erste Hauptband (38, 98) an dem Kopfende der Schale (32) zum Bilden eines anatomischen Rückens (110) geformt ist.

10. Badewanne nach Anspruch 8, dadurch gekennzeichnet, daß die eingezogene oder abgesenkten Flächen (42a-f) benachbart zu dem Hauptband (38, 98) an dem Kopfende mit zwei Nischen (104a, 104b) gebildet sind, die auf halber Höhe durch Bodenebenen begrenzt sind, die zwei Arme (106a, 106b) bilden.

11. Badewanne nach Anspruch 8, dadurch gekennzeichnet, daß das zweite vorstehende Nebenband (40, 100) an der Kante (34, 94) der Wanne endet, wobei zwei abgesenkte Flächen (102a, 102b) zwei Unterstützungsebenen bilden, die symmetrisch in Bezug auf die Längsachse der Schale (12) selbst angeordnet sind.

Revendications

1. Baignoire présentant des parois auto-portantes, formée par une coque unique, caractérisée par le fait de comprendre une structure de nervure ou de moulure de renforcement consistant en un quadrillage modulaire ayant la capacité de distribuer uniformément dans ladite coque les contraintes dues à la charge de l'eau et éventuellement d'une personne reposant dans ladite baignoire, cette dite structure modulaire de coque comprenant un ensemble de nervures radiales (18a à 18l) dépendant d'un bord de coque (14) et se rejoignant en au moins un point (22) du fond de la coque, lesdites nervures (18a à 18l) partant de points (20a à 20l) distribués le long dudit bord de coque (14) afin de former un quadrillage rectangulaire comportant des organes sensiblement uniformes ayant la capacité de distribuer le plus uniformément possible lesdites contraintes.

2. Baignoire selon la revendication 1, caractérisée en ce que lesdites nervures (18a à 18l) convergeant au fond sont reliées entre elles par des surfaces incurvées, creuses ou bien convexes, fournissant à la coque (12) une apparence de coquille de crustacé et une résistance particulièrement élevée.

3. Baignoire selon la revendication 2, caractérisée en ce que les surfaces incurvées reliant lesdites nervures (18a à 18l) sont agencées symétriquement autour d'un axe longitudinal de ladite coque (12), une première surface creuse (78a), divisée symétriquement par ledit axe longitudinal, partant du bord supérieur (14) du côté tête de la baignoire vers le point de convergence (22) des nervures (18a à 18l) situé au fond de la coque (12), entourée de deux surfaces incurvées creuses (78b, 78h) à leur tour adjacentes à des troisièmes surfaces creuses (78c, 78g), se prolongeant par des quatrièmes surfaces (80a, 80b) qui peuvent être creuses ou bien convexes, se prolongeant à leur tour par des cinquièmes surfaces creuses (78d, 78f) adjacentes à une dernière surface creuse (78e) divisée symétriquement par ledit axe longitudinal de la coque (12), du côté pied de la baignoire.

4. Baignoire selon la revendication 3, caractérisée en ce que ladite première surface creuse (78a) principale est configurée de manière à présenter la forme d'un dos anatomique (86).

5. Baignoire selon la revendication 3, caractérisée en ce que lesdites secondes surfaces creuses

(78b, 78h) adjacentes à ladite première surface creuse (78a) forment des rentrants délimités à mi-hauteur par des plans inférieurs formant deux bras (84, 85).

6. Baignoire selon la revendication 3, caractérisée en ce que lesdites quatrièmes surfaces (80a, 80b), si elles sont convexes, forment deux plans de support (82a, 82b) agencés symétriquement par rapport à l'axe longitudinal de la coque (12).

7. Baignoire, présentant des parois auto-portantes, formée par une coque unique, caractérisée par le fait de comprendre une structure de nervure ou de moulure de renforcement consistant en un quadrillage modulaire ayant la capacité de distribuer uniformément dans ladite coque les contraintes dues à la charge de l'eau et éventuellement d'une personne reposant dans ladite baignoire, ladite structure modulaire de coque étant formée par un ensemble de zones saillantes (38, 40) et de zones rentrantes (42a à 42f) reliées par des nervures (44a à 44l), analogues aux nervures soutenant un vaigrage de bateau, qui sont formées par des surfaces de liaison entre lesdites zones saillantes (38, 40) et lesdites zones rentrantes (42a à 42f), lesdites nervures (44a à 44l) étant agencées en deux groupes sensiblement perpendiculaires se coupant entre eux, de manière à former un quadrillage rectangulaire présentant des organes sensiblement uniformes et ayant la capacité de distribuer le plus uniformément possible lesdites contraintes.

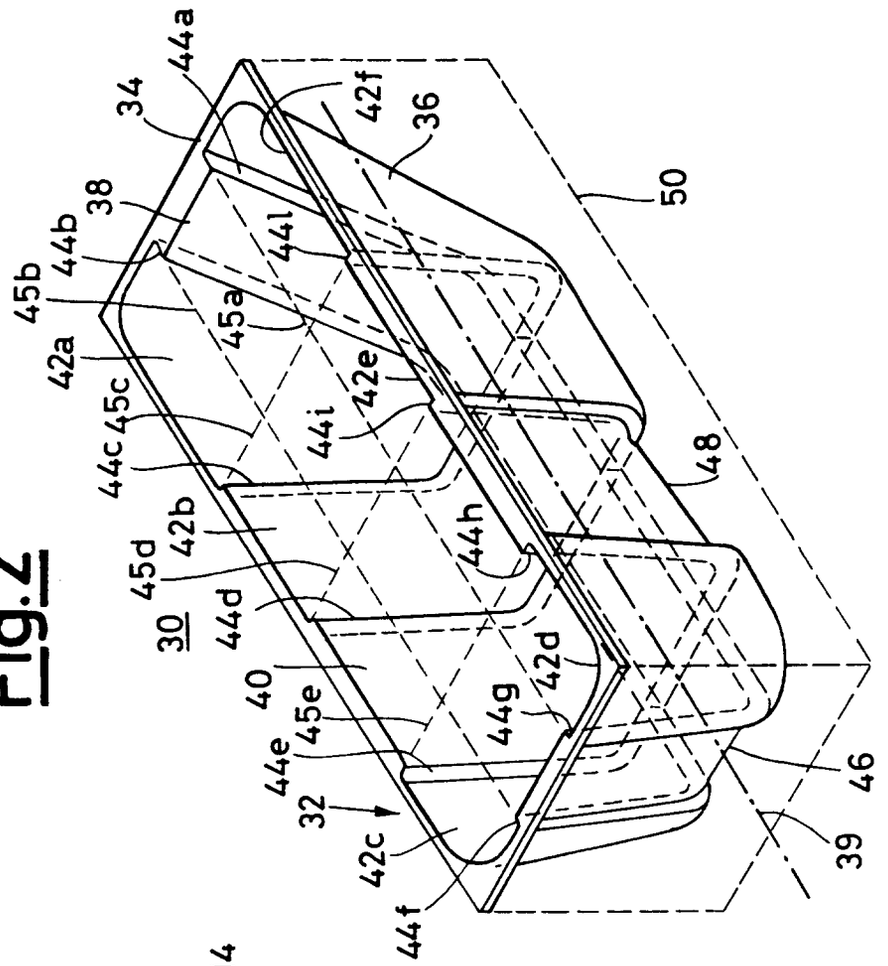
8. Baignoire selon la revendication 7, caractérisé en ce que les zones (38, 40) faisant saillie à l'intérieur de ladite coque (12) sont formées comme deux bandes sensiblement perpendiculaires, parmi lesquelles une première bande principale (38) est parallèle et symétrique par rapport à un axe longitudinal (39) de ladite coque et une seconde bande mineure (40) est sensiblement perpendiculaire à ladite première bande principale (38), en la coupant en une place à proximité du côté pied de ladite coque (12).

9. Baignoire selon la revendication 8, caractérisée en ce que ladite première bande principale (38, 98) est formée du côté tête de ladite coque (32) afin de former un dos anatomique (110).

10. Baignoire selon la revendication 8, caractérisée en ce que deux zones rentrantes ou abaissées (42a à 42f) adjacentes à ladite bande principale (38, 98) du côté tête sont pourvues de deux rentrants (104a, 104b) délimités à mi-hauteur par des plans inférieurs formant deux bras (106a, 106b).

11. Baignoire selon la revendication 8, caractérisée en ce que ladite seconde bande mineure (40, 100) saillante se termine contre le bord (34, 94) de la baignoire, par deux zones inférieures (102a, 102b) formant deux plans de support agencés symétriquement par rapport à l'axe longitudinal de la coque (12) même.

Fig.2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42f
36
50
38
44b
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42a
42e
45c
44i
44c
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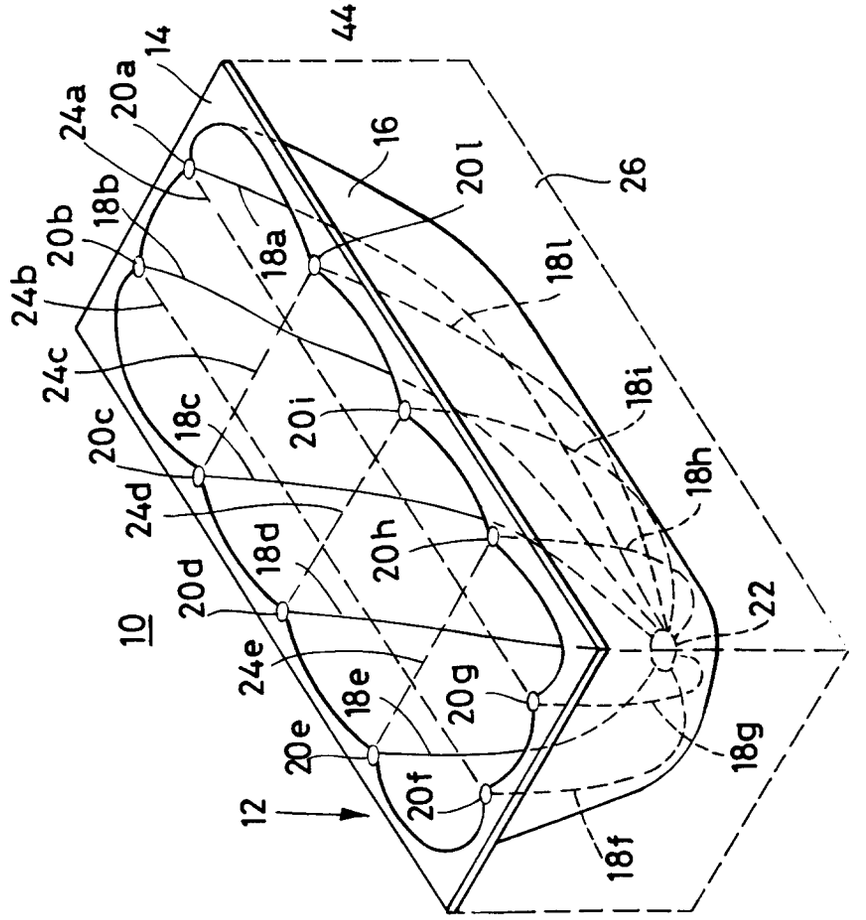
42c
39
44f

Fig.1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20a
16
20l
26
18b
20b
18a
18l
24b
24c
18i
20c
18c
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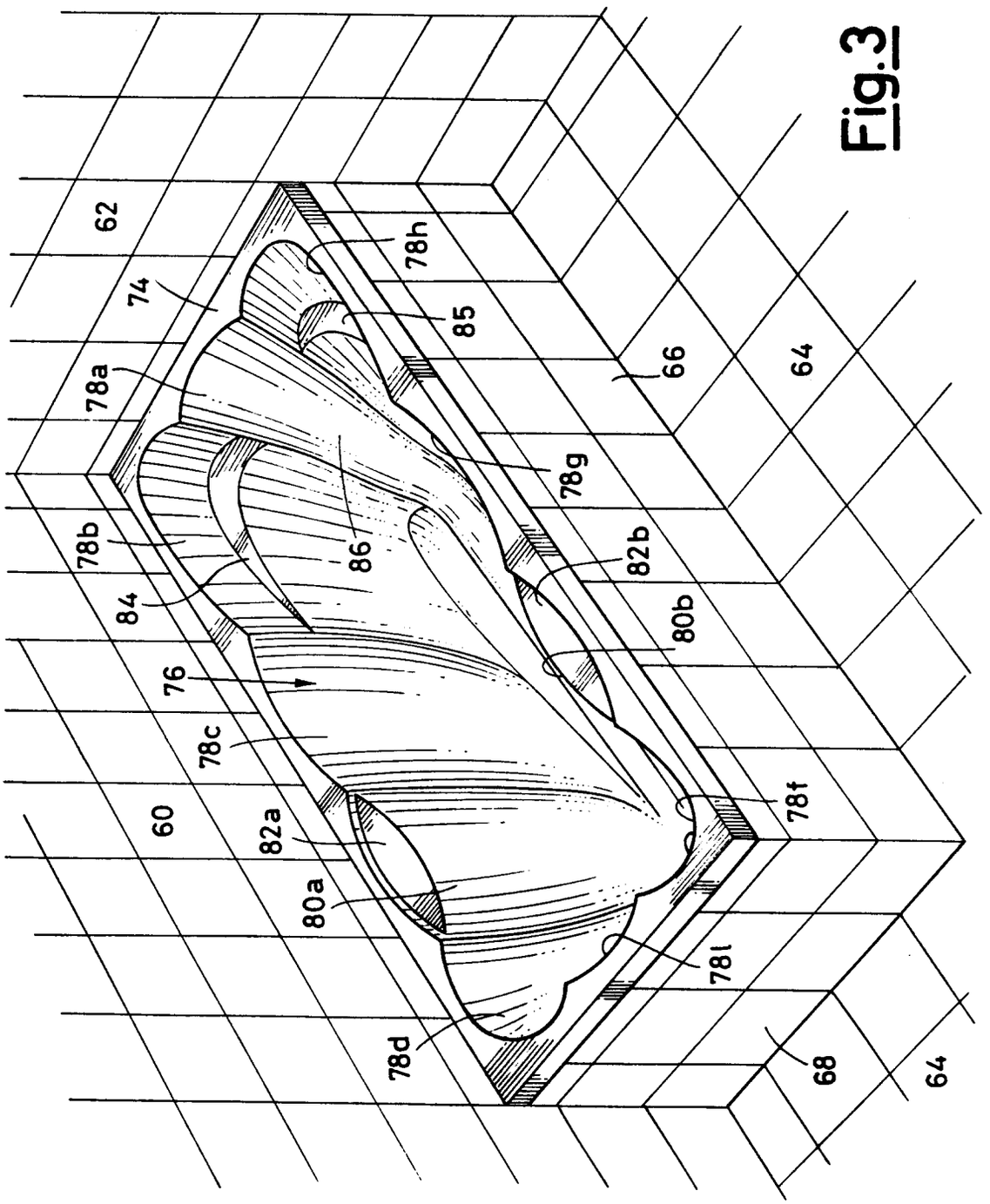
20g
20e
18g
12
20f
18f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74
78a
78b
84
76
78c
60
82a
80a
78d
78h
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78g
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82b
80b
78f
78l
68
64

Fig.3

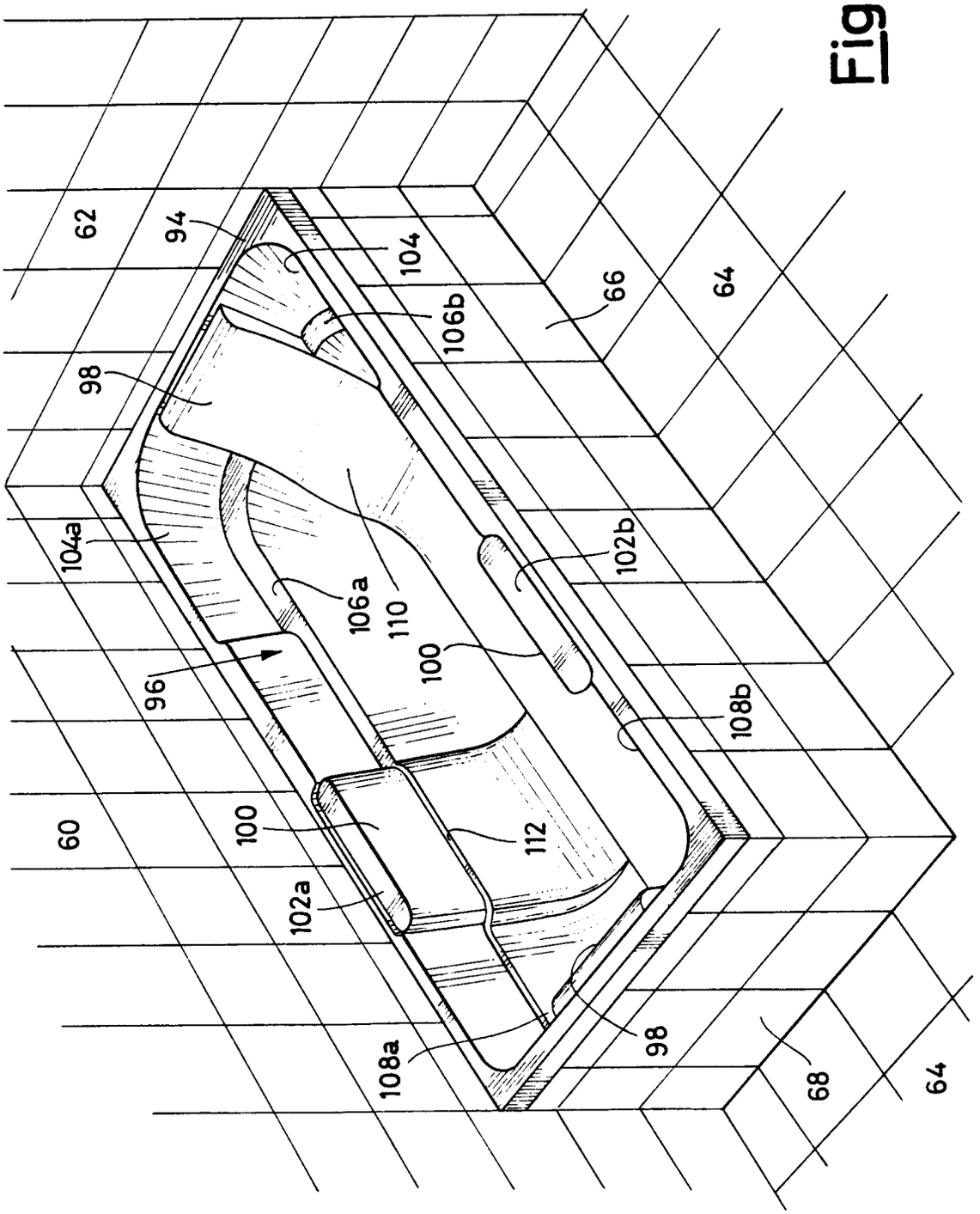
62
94
104
106b
66
64
98
104a
102b
106a
110
100
96
108b
60
100
112
102a
108a
98
68
64

Fig.4