(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 088 792 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.11.2022 Bulletin 2022/46

(21) Application number: **22171653.3**

(22) Date of filing: **04.05.2022**

(51) International Patent Classification (IPC):
A63B 26/00 *(2006.01)* ***A63G 9/00*** *(2006.01)*
A47B 13/10 *(2006.01)* ***A47C 3/025*** *(2006.01)*
A47D 9/02 *(2006.01)* ***A63G 31/06*** *(2006.01)*
A47D 13/10 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A63G 31/06; A47B 13/10; A47C 3/0252; A47C 3/0255; A47D 9/02; A47D 13/10; A63B 26/003; A63G 9/00

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **04.05.2021 MX 2021005264**
18.06.2021 US 202117351472

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(54) **SIMPLE PENDULUM SYSTEM WITH CONTROLLED OSCILLATION AND TRAJECTORY**

(57) A system of a plurality of pendulums with controlled oscillation and trajectory comprising a static structure and a non-static structure wherein the non-static structure comprises four vertical arms forming the plurality of pendulums, wherein the static structure comprises a plurality of fastening points to anchor a plurality of ropes to said plurality of pendulums, and the non-static structure rigidly couples said plurality of pendulums and transforms said plurality of pendulums into a single, oscillating mass.

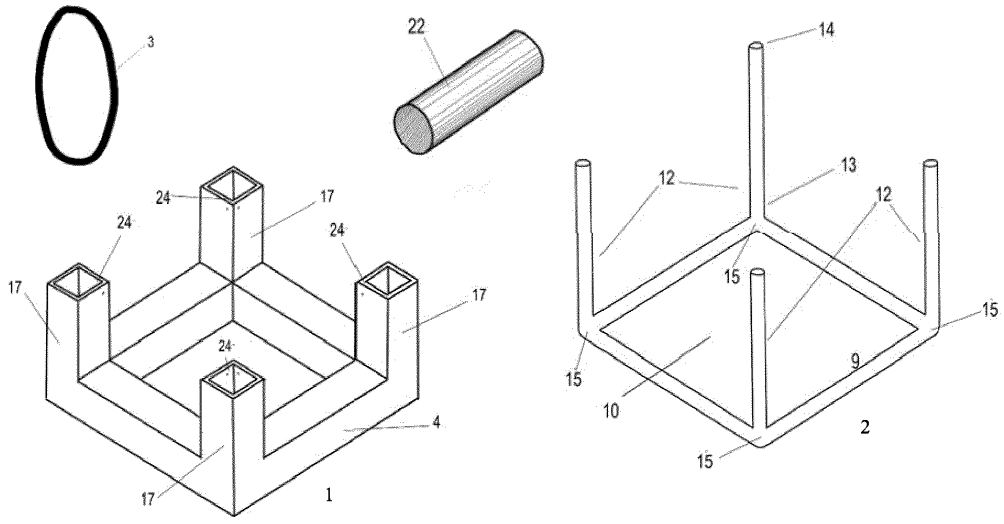

Fig. 01

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Description

BACKGROUND OF THE INVENTION

[0001] There are different types of swings, cribs, beds, furniture and other elements that move based on oscillatory movement from one or more pendulums or suspension points; the foregoing with vastly different purposes in different industries, among them, to enjoy an experience either recreational, relaxing, or simply pleasant for the user.

[0002] Currently, all flotation devices that facilitate to the user the sensation of simple harmonic motion, such as flotation tanks, for instance, require, among many other factors, that the user enters in contact with water and salts, which may, at any given moment, affect the skin and/or the use of an external device or contraption generating motion by means of an electric current, and/or being encapsulated or enclosed inside a tank and/or undergoing certain temperature control.

[0003] Pendulum movement requires a fixed point to suspend a mass by means of a rope or arm. Devices that provide the user with the experience of a pendulum movement require a structure that is invariably external to the tilting mass or object. On the other hand, any object that floats in a fluid is susceptible to oscillatory movements. Said devices that use this principle to provide the user with the experience of an oscillating movement, require a tank with a size sufficiently larger than the floating object.

[0004] These known ways to enjoy the oscillating movement require wide spaces, large structures, in some cases heavy, as well as large amounts of fluids and even additional systems to improve comfort.

[0005] Disadvantages of the prior art are solved with the system object of this invention, which allows the user to enjoy the sensation of an oscillating movement anywhere, the main advantage of the present invention being to reduce the size of the structures, achieve a versatile device, not requiring special facilities or to have permanent spaces.

[0006] Likewise, the present invention solves the problem of being able to count on greater stability by restricting the pendulums inside the posts, limiting the amplitude of the oscillation of the mass and thus its displacements and trajectories, making the system much more stable and safer.

[0007] As mentioned above, observing the need to take advantage of that movement or trajectory and so that in any object or piece of furniture in which a person may sit or lay down enjoy precisely that oscillatory movement without the need for so much space, robust or external elements, and with stability, the present invention proposes a system that is autonomous, and capable of oscillating internally, thus transferring that simple harmonic movement to its upper part, in a controlled and stable manner, or any other object placed in said part. In other words, a system that allows to deliver the oscillatory movement outside the geometry of the structure that contains the pendulum is proposed, in this particular case, above said structure.

[0008] The system proposed has been conceived to fully solve this problem based on two structures jointed therein, a static one with a plurality of fastening points (four) to anchor a plurality of ropes (four) to the plurality of pendulums (four); the other (non-static structure) that rigidly couples the masses of the plurality of pendulums (four) and transforms them into a single, oscillating mass. Likewise, it also has a plurality of vertical arms (four) that replicate the oscillatory movement of the plurality of pendulums (four) in the upper part of the geometry of the system in a homogeneous and controlled manner. This is possible, since the solution proposes to deliver the oscillatory movement of the pendulum in the upper part of its geometry and recover it with any object that is placed on it.

[0009] According to an aspect of the invention, a simple pendulum system with controlled oscillation and trajectory comprises a set of structures, a static structure and a non-static structure, one inside the other, connected and integrated by means of four ropes from four pendulums, in such a manner that structures work as four interconnected pendulums, which transfer the trajectory by means of four vertical rods pointing above its mass, the system has two structures, a first structure (static structure) of rectangular tube profile (PTR) and a second structure (non-static structure) with a solid circular section profile (round bar) placed inside the first structure and in which both structures are articulated by means of four ropes with equal length, connecting the four points of suspension with the four mooring points and in which the points of suspension are placed in the upper part of each post of the first structure, while the mooring points are located in each node of the second structure. The first structure is fixed, resting on its frame, horizontally, and the second structure is suspended inside the first structure free to move transversally and longitudinally.

[0010] According to another aspect of the invention, the four ropes can operate as pendulums with suspension points and mooring points independent from each other and masses coupled by the frame of the second structure or non-static structure.

[0011] According to a further aspect of the invention, the first structure can be achieved by forming a quadrangular frame with a rectangular tube profile (RTP) and in which the upper horizontal surface has, in each corner of the frame a hole of the same section and dimension of the RTP used for the posts in such a manner that said holes are connected to the in-side of the frame and the posts, said posts have perforations on their two faces of the RTP with a common edge, one perforation per face placed as close as possible to the end of the post and the common edge and in which the edge without perforation of each post is attached to the frame over each hole and inside the frame, thus guaranteeing that the post is perpendicular to the frame's surface.

[0012] According to an additional aspect of the invention, the second structure can be formed with a profile from a solid circular section (round bar) to form a quadrangular frame with four arms, placed in each corner, perpendicular to the surface of the frame and in which the length of the arms shall be longer than the posts, and sufficient in order to tower above the posts when the system has been assembled in order to prevent the object being placed above the arms of the second structure to enter in contact with the posts of the first structure.

[0013] According to another aspect of the invention the second structure can be placed in such a position that the frame is positioned below and the arms are pointing upwards, stringing four ropes, one in each arm of the second structure, introducing a second structure (inside the first structure) and once this has occurred, each rope is tossed in a radial direction, surrounding the section of elements of the frame, continuing with the vertical sense and inside the post of the first structure to direct afterwards the rope towards the point of suspension aligning the end of the rope with the axis of the perforations, with the rope mounted on the bolt and the latter being supported on the sides of the post.

[0014] The advantages offered by the system according to the invention are evident.

[0015] Among other uses, the system according to the invention offers the user an experience similar to that of floating in a fluid, with the advantage of not having to submerge in it or come into contact with substances to which a user may be sensitive. Similarly, there is no need to temporarily confine a user to a tank that can alter the user's emotional state.

PREFERRED EMBODIMENT OF THE INVENTION

[0016] The invention refers to a system of a plurality of pendulums with controlled oscillation and trajectory with two structures of similar design (a quadrangular frame four with vertical posts or arms attached to the corners of the frame).

[0017] In order to complement the description and with the purpose of providing a better understanding of the characteristics of the invention, the present description is accompanied by drawings, as an integral part of the same, for illustrative and non-limiting purposes, representing the following:

Figure 01 shows an exploded perspective view of some components of the system according to the present invention;
Figure 02 shows a perspective view of some components of the system according to the present invention;
Figure 03 shows an exploded perspective view and a detail view of some components of the system according to the present invention;
Figure 04 shows a perspective view of a system according to the invention.

[0018] More in detail:

Figure 01: Shows the components of the system, a static structure 1 with a rectangular tube profile (RTP) formed by a quadrangular frame 4 with four vertical posts 17, one on each corner of the frame 4; a non-static structure 2 with a solid circular section profile (Round Bar) with a rectangular frame 9 to rigidly couple the masses of the four pendulums located in the nodes 15 and that operate as fastening points 16 and four vertical arms 12, to transfer the controlled oscillation and trajectory produced by the four pendulums; one rope 3 with closed ring shape, illustrative of the four ropes 3 required by the system to joint both a static structure 1 and a non-static structure 2 thus allowing the non-static structure 2 to swing inside the static structure 1; a bolt 22 of metallic material, illustrative of the four bolts 22 required by the system to form the four suspension points 24, in which the four ropes 3 are mounted.

Fig. 02: The frame 4 of the static structure 1 with a rectangular tube profile (RTP) requires four holes 8 to connect the inside of each one of the four posts 17 with the inside of the frame 4, located in the four corners of the frame 4; likewise, in the lower horizontal surface 6 it is necessary to retire the whole face of the frame 4 in order to allow the free pass of the non-static structure 2 at the moment of assembling the system.

Fig. 03: The system's components ready to conclude the assembly, the non-static structure 2 below the static structure 1 with the four arms 12 of the non-static structure 2 in line with the axes of each one of the four posts 17 of the static structure 1. The four ropes 3, each surrounding the base of one of the four arms 12 and the elements or horizontal rods 11 of the frame 9 in the fastening point 16 directed to each one of the four points of suspension 24 to be aligned with the axis of the perforations 18 and conclude with the placement of the four bolts 22.

Fig. 04: With all the elements in position and the bolts 22 in place, the system 25 is ready to function, the four ropes are mounted on the bolts 22, in the four suspension points 24 and surrounding the frame 9 that couples the masses of the four pendulums at the four fastening points 16, forming the articulations among the static structure 1 and the non-static structure 2. With the four tensed ropes 3, the frame 9 becomes the oscillating mass with a limited trajectory inside the static structure 1 and which throughout each one of the four arms 12 shall transfer, in a homogeneous and controlled manner, the oscillation and trajectory to the upper part of the system 25 where it shall replicate the swing with equal magnitude and trajectory, but in an opposite direction to the frame's 9. The upper end 14 of the four arms 12 are in condition to receive the intended object or piece of furniture in order to provide it with a control-

led oscillation and trajectory.

[0019] The system according to the present invention comprises a static structure 1 having a rectangular tube profile (RTP) and a non-static structure 2 having a solid circular section profile (Round Bar) placed inside of the static structure 1. Both are jointed therein through four ropes 3 each of said ropes with equal length, which connect, one by one, each of the four suspension points 24 with the four fastening points 16. The four suspension points 24 are located in the upper part of each one of the four posts 17 of the static structure 1, while the four fastening points 16 are located in each one of the four nodes 15 of the non-static structure 2. The static structure 1 is fixed resting on its frame 4, horizontally, on any flat surface, for example, the floor. The non-static structure 2 is suspended within the static structure 1, free to move transversally and longitudinally. The four ropes 3 operate as pendulums with independent suspension points 24 and independent fastening points 16 and coupled by the frame 9 of the non-static structure 2, giving said non static structure 2, a swinging movement which is a product of the action of the forces relating to the gravity and tension of the four ropes 3. The upper end of each one of the four arms 14, of the non-static structure 2, replicates the swinging movement of its end attached to each one of the four nodes 13, in equal magnitude, but in an opposite direction.

[0020] The static structure 1 having a quadrangular frame 4 with a rectangular tube profile (RTP), in which its upper horizontal surface 5 must have, in each one of the four corners of the frame 4, a hole 8 of the same section and dimension as the RTP used for each one of the four posts 17; each hole 8 will allow to connect the inside of the frame 4 with the inside of each one of the four posts 17. On the horizontal lower surface 6 of said static structure 1, the whole face 7 of the frame 4 must be retired, thus allowing the free transit of the non-static structure 2, at the moment of assembly. The four posts 17 of the static structure 1 must have perforations 18 on both sides 19 of the RTP with a common edge 20, one perforation per side 19 located as close as possible to the end of each one of the four posts 21 and the common edge 20. The diameter of the perforations 18 is in function of the diameter of the bolts 22 that will be accommodated. The end without perforations 23 of each one of the four posts 17 is attached to the frame 4 above each hole 8 on the frame 4, making sure that each one of the four posts 17 is perpendicular to the frame's surface 10. The bolts 22 must have the mechanical properties required and sufficient to resist, without any deformation, the weight of the non-static structure 2 plus the weight of the object placed above said non static structure.

[0021] The non-static structure 2 having a solid circular section profile (Round Bar) also form a quadrangular frame 9 with four arms 12, with each one of said four arms located in each corner, perpendicular to the frame's surface 10. The length of each one of the four arms 12 shall be longer than that of each one of the four posts 17, long enough to tower over each one of said four posts 17 when the system is assembled, thus avoiding that the object placed above the arms 12 of the non-static structure 2gets in contact with any of the four posts 17 of the static structure 1. The material of each one of the four ropes 3 must have all the mechanical properties required and sufficient to resist the friction and tensile, flection, torsion and cutting efforts produced by the tension and movements of the system in operation. Each one of the four ropes 3 shall have a closed ring shape.

[0022] In order to assemble the system, the non-static structure 2 is placed in a position that allows the frame 9 to be placed below and with the arms 12 pointing upwards, stringing the four ropes 3, one in each one of the four arms 12 of the non-static structure 2. Then, the non-static structure 2 is introduced in the static structure 1 and upon completion of this assembly, each one of the four ropes 3 is pulled in a radial direction, embracing the base of each one of the four arms 13 and is also rotated, changing the direction of the starting pull, thereby surrounding the section of the elements 11 of the frame 9, continuing with the pull in a vertical direction and through the inside of each one of the four posts 17 of the static structure 1, leading each one of the four ropes 3 to each one of the four suspension points 24, aligning the end of each one of the four ropes with the axis of each one of the perforations 18 and placing a bolt 22, with each one of the four ropes 3 mounted on the bolt 22 and the bolt being supported on the sides 19 of each one of the four posts 17. Upon completion of the process above, the assembled system is rested on the surface on which said system will be used.

[0023] For illustrative and non-limiting purposes, the RTP (Rectangular Tube Profile) and Round Bar (Solid circular section profile) have been chosen as the preferred embodiment of the system, due to their mechanical characteristics of resistance, however, the system may be embodied using several other materials (wood, MDF, acrylic, aluminum, etc.), as long as the required structural stability is preserved for its functioning. The choice of materials may change the embodiment methods, but not the essence of the system itself, which is the combination of an internal swinging structure and a fixed support and contention structure, which transfers its oscillation to an external object mounted on said structure.

[0024] In the foregoing, the preferred embodiments have been described, but it is to be understood that those skilled in the art will be able to make modifications and changes without thereby departing from the relative scope of protection, as defined by the claims attached.

Claims

1. A system of a plurality of pendulums with controlled oscillation and trajectory said system comprising:

two structures jointed therein, the two structures comprising a static structure (1) and a non-static structure (2), the non-static structure (2) comprises four vertical arms that form the plurality of pendulums, wherein the static structure (1) comprises a plurality of fastening points to anchor a plurality of ropes (3) to said plurality of pendulums, and the non-static structure (2) rigidly couples said plurality of pendulums and transforms said plurality of pendulums into a single, oscillating mass,

wherein the static structure (1) comprises a rectangular base having a tube profile, wherein the rectangular base comprises four horizontal tubular members, wherein the static structure (1) comprises four posts (17) extending from an upper surface of the rectangular base, and the non-static structure (2) comprises four horizontal rods (11), each horizontal rod of the four horizontal rods (11) is positioned between two adjacent vertical arms of the four vertical arms (12) such that a first vertical arm of the four vertical arms (12) is connected to a first adjacent vertical arm of the two adjacent vertical arms via a first horizontal rod of the four horizontal rods (11) and the first vertical arm of the four vertical arms (12) is connected to a second adjacent vertical arm of the two adjacent vertical arms via a second horizontal rod of the four horizontal rods (11),

wherein each of the four vertical arms (12) is positioned within and connected to an inside of each post of the four posts (17) via a rope of the plurality of ropes (3), and the four horizontal rods (11) are positioned within the rectangular base, and

the four vertical arms (12) are configured to replicate oscillatory movement of said plurality of pendulums in an upper part of a geometry of said system in a homogeneous and controlled manner.

2. The system according to claim 1, wherein each of the four ropes (3) have an equal length and are connected by four points of suspension to fastening points (16) and wherein the four points of suspension are placed in an upper part of each one of the four posts (17) of the static structure (1), while each of the four fastening points (16) are located in each node of the non-static structure, and

wherein the static structure (1) is static, resting horizontally on its rectangular base and the non-static structure (2) is suspended inside the static structure (1), free to move transversally and longitudinally.

3. The system according to claim 1, wherein the four ropes (3) each include independent points of suspension and independent fastening points and wherein masses are coupled by the four horizontal rods and four vertical arms (12) of the non-static structure (2).

4. The system according to claim 1, wherein in each of four corners of the rectangular base there is a hole having same section and dimension as the four posts (17), each of said holes connect an inside of the rectangular base with an inside of each one of the four posts (17), said posts (17) have perforations on two sides, said perforations sharing a common edge, one perforation of said perforations per side placed as close as possible to an end of each post and to the common edge, and in which an edge without a perforation of each one of the four posts is attached to one of the rectangular base on each hole in the rectangular base, thus ensuring that each one of the four posts (17) is perpendicular to an upper surface of the rectangular base.

5. The system according to claim 1, wherein each one of the four vertical arms (12) is placed in each of four corners of the non-static structure (2), perpendicular to an upper surface of the rectangular base and in which a length of each of the four vertical arms (12) is longer than a length of each of the four posts (17), long enough to tower above each one of the four posts (17) when the system has been assembled in order to prevent an that the object, being placed above the four vertical arms (12) of the non-static structure (2), from contacting any of the four posts (17) of the static structure (1).

6. The system according to claim 1, wherein each of the four vertical arms (12) are pointing upwards and wherein each one of the four ropes (3) being mounted on a bolt (22) and the bolt (22) being supported on a side of each one of the four posts (17).

7. The system according to claim 1 wherein the plurality of pendulums does not require suspension points external to the system to obtain a controlled oscillation and trajectory.

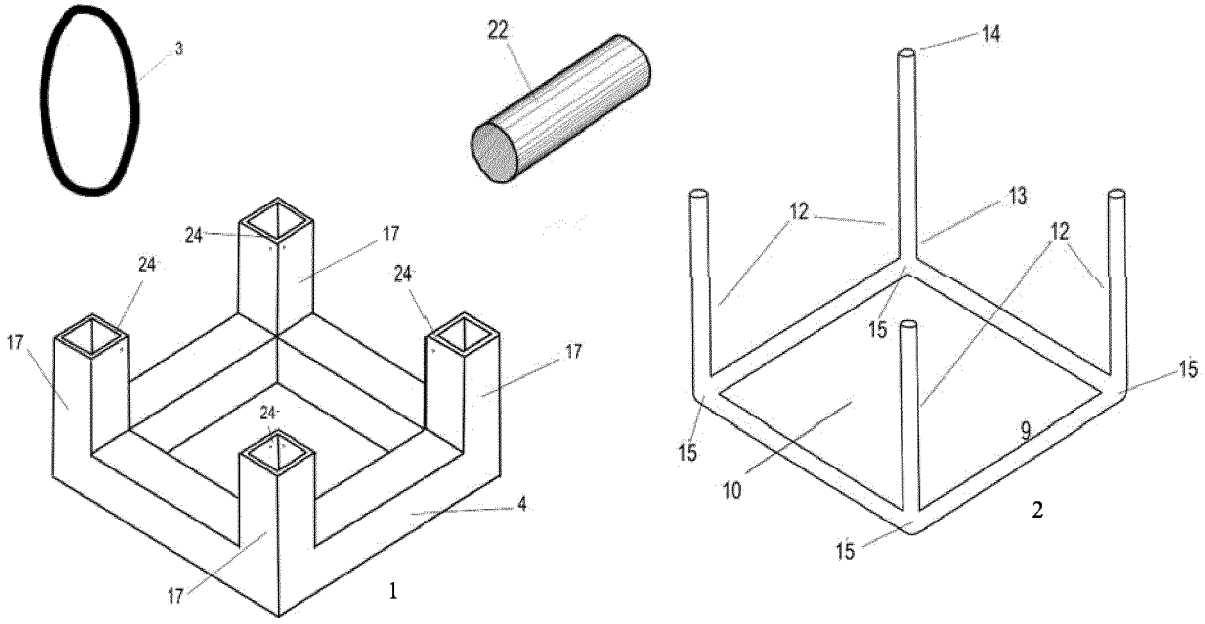
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Fig. 01

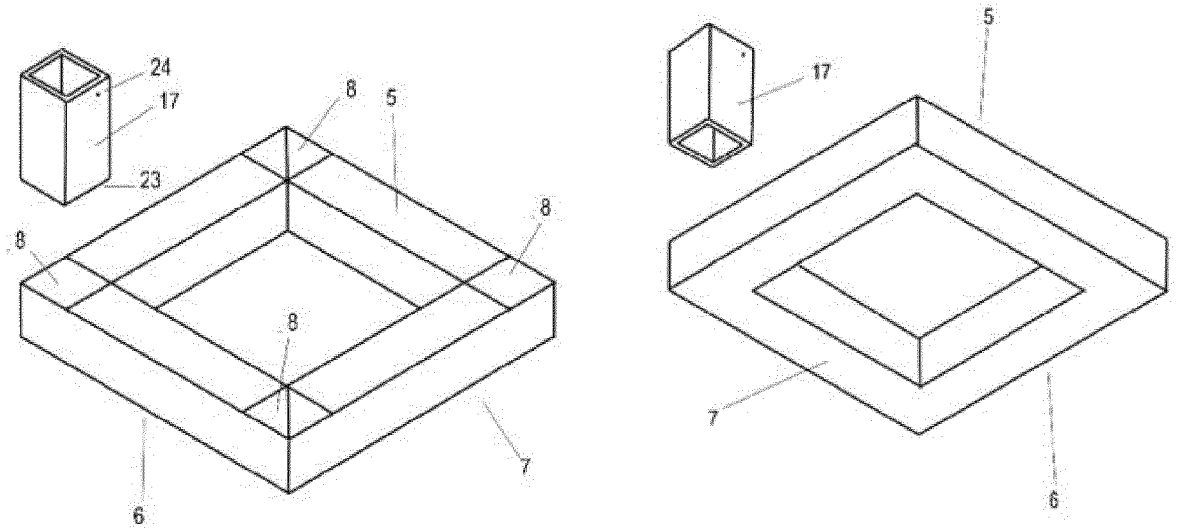
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Fig. 02

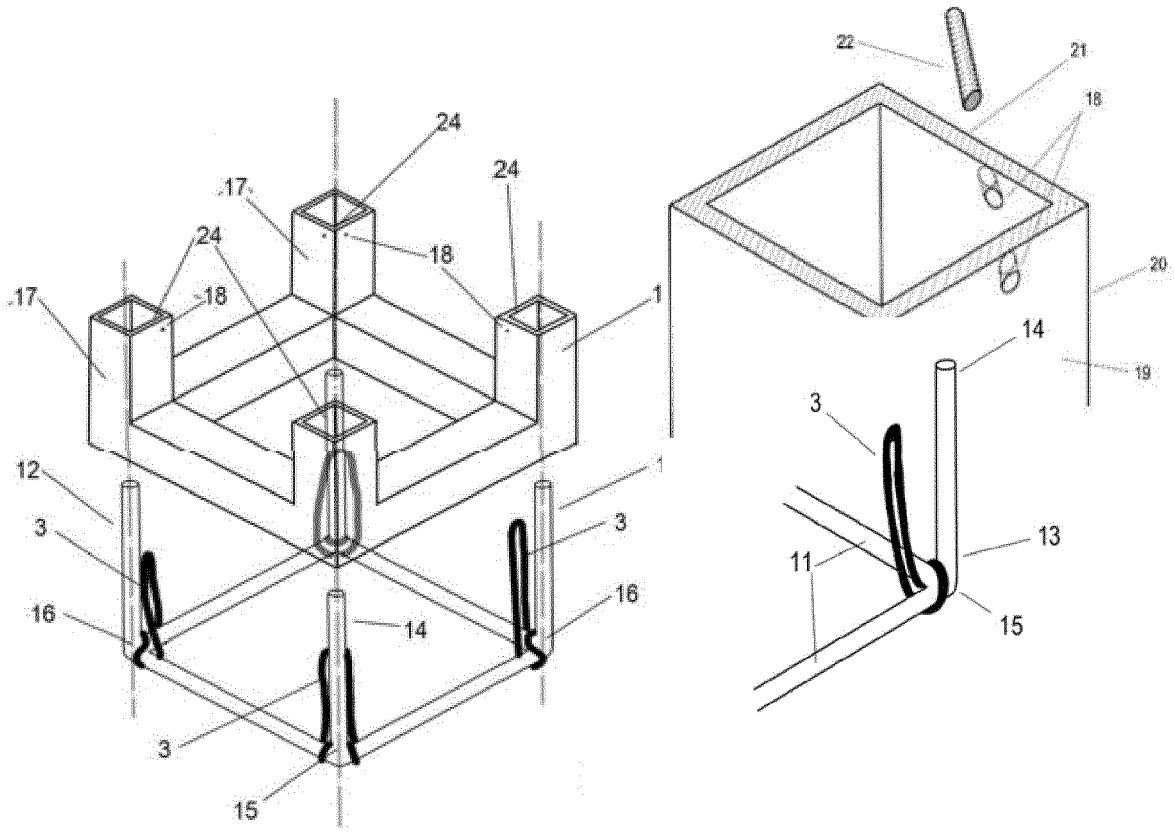

Fig. 03

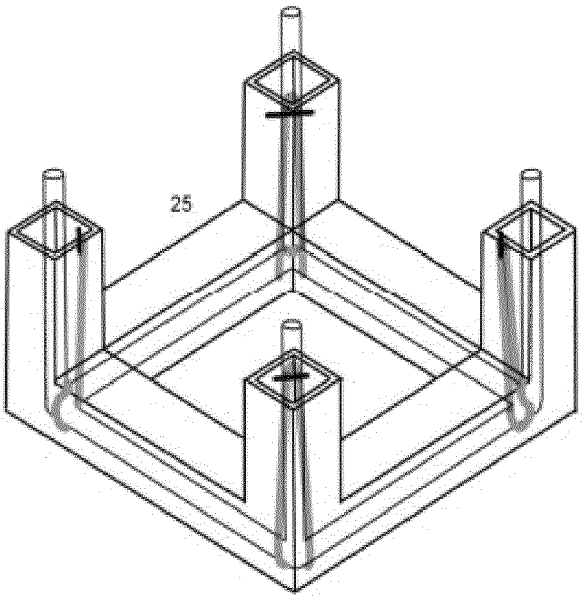

Fig. 04

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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 October 2022	Bagarry, Damien

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