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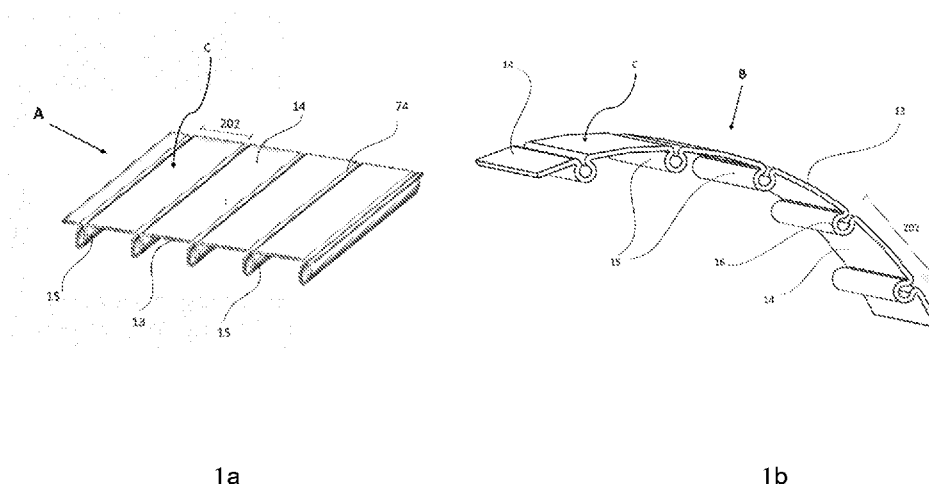


Figure (1)

(57) Abstract: The present invention relates to Construction Composite elements and their manufacturing methods, and they are distinguished by their uses and applications for the construction of various types of buildings and facilities, whether structural or architectural elements, and the focus will be on the role of these elements in the manufacture and construction of liquid tanks in general and the ease of their applications specifically in rainwater harvesting tanks, and this is considered as a single method for its various applications, the construction composite elements comprise of various synthetic fibres of specific sizes and engineering designs that are manufactured through an apparatus, molds and advanced coating systems that allow for continuous, fast and mass production manufacturing, and these aforementioned technologies combine with each other to form the construction composite elements that characterised by the creation of tubular voids that receive metallic or non metallic tubes or sections to form the structural frames and walling for tanks or any other facility, these elements can be manufactured in plain or curved shapes as shown in figure (1).

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Construction Composite Elements

Description

Background of the Invention

Farming on agricultural terraces on the slopes of the mountains has always been one of the daily practices of many peoples and nations on this land in ancient times and in our present time, and the need for water to cultivate different trees is of course an important necessity, it is the criterion for the success of agricultural economics, especially with the increase in the world's population and the need to increase crops and achieve food security for the people, rainwater is one of the blessings that descend from the sky in seasons and a number of times during the year, but it has not been exploited optimally. 5 10

And with the presence of advanced technologies today and trying to find many solutions to take advantage of rainwater, yet we have not seen creative solutions spread all over the world and are characterized by ease of implementation and price competition, and therefore thinking has been made to find inventive and innovative solutions that are sustainable, fast and easy to implement, and price competitive to store harvested rainwater so that agricultural sustainability will be achieved and achieving the purpose of establishing these reservoirs, which is the rapid spread of these reservoirs and the maximum benefit from them in increasing the number of trees, whether fruitful or that form the green layer in nature. 15 20

The conventional methods used for manufacturing tanks in factories or installing them directly on sites are many and varied, but the most important and most of them are limited to six types, namely: 25

- 1- Concrete tanks that constructed directly at the sites.
- 2- Metallic tanks that its segments are manufactured in factories and then installed at sites.

3- Non-metallic tanks that its segments are manufactured in factories and then installed at sites.

4- Plastic tanks of all kinds, which are completely manufactured inside factories, and later transported and installed at sites.

5- Fiberglass tanks are completely manufactured inside factories, later transported and installed at sites. 5

6- High Density Polyethylene (HDPE) cubes installed on top of each other using the interlock method, or male and female, according to the required capacity, and then wrapped with membranes to prevent water leakage out, and then buried underground. 10

All of the above-mentioned methods provided solutions for storing water of all kinds, but it has not developed significantly during the past five decades, as it still lacks flexibility in transportation and installation on sites, especially for rainwater harvesting projects, which are the most important focus of the subject of this invention, and these projects are planned to spread to all Agricultural terraces in mountains and valleys to find solutions for irrigation from rainwater harvesting to increase agricultural products that contribute to achieving food security for countries. 15

And the Kingdom of Saudi Arabia is not an exception to these countries, especially since it has vast agricultural areas on the slopes of the mountains and in the valleys and reefs extending from Taif region through Al-Baha region and Asir region to Jizan region with its heights and agricultural terraces in Faifa Mountains. 20

If we take an example, one of the important programs recently approved by the government of the Kingdom of Saudi Arabia, which is the Rural Development Program, which has allocated more than nine billion riyals, and the program aims to exploit rainwater harvesting to be a basic source for irrigation of huge quantities of fruit trees and other types of Agricultural 25

products that contribute to achieving the food security for the country, and this program is set to develop and rehabilitate agricultural terraces, and the Green Saudi and Green Middle East Initiative was recently announced, which aims to plant 50 billion trees, and of course, this need is not limited to these local and regional programs. Every country in the world has a similar need in one way or another to harvest rainwater. Indeed, the United Nations World Food Program may be the main starting point for using this invention to achieve food security for poor countries. 5

Based on the data of this program which approved by the government, whose first stages of implementation have begun, we can imagine the huge number of agricultural lands spread from Taif region through Al-Baha region, then Asir region and Jizan region, whose areas are measured in thousands of square kilometers, and we imagine how the materials of wood and cement and steel will be transported for the construction of concrete tanks on those agricultural terraces and the same applies to metallic tanks or how the plastic tanks and fiberglass tanks that were manufactured in the factories will be transported to the agricultural terraces, as they need large trucks for transport and large cranes to put them on their sites on the agricultural terraces and of course it needs roads to reach to each piece Land intended to be provided with tanks for rainwater harvesting. 10 15 20

If we assume for the sake of arguments the possibility of cutting roads to these agricultural terraces, then we can imagine the very high costs of implementing them, paving and maintaining these works from the high impact of heavy water currents and heavy rains.

And the most dangerous subject is the disastrous environmental impact on nature and the loose of huge quantity of trees and farming lands due to these costly alternatives.

Therefore, we came out with radical innovative solutions to this problem, and these solutions lie in the current invention, which is characterized by the production of fast manufacturing, efficient and cost 5

competitive products produced in very large quantities of very important materials like synthetic fabrics of all kinds and Polyurea fast setting coating and lightweight forming and supporting boards that stabilize the tank body inside the ground and not be affected after filling by rainwater. These solutions presented in the invention are considered to be lightweight and portable products that can be easily transported and handled by humans, animals, small transport vehicles, or even temporary cable cars. 10

If we look at the manufacturing or construction systems for tanks of prior art, they all failed to reveal a rainwater storage and harvesting system in an effective, flexible and fast-to-implement manner, and this is according to what we see from these solutions presented in the previous art, so we do not find a real competitor to the idea of the present invention that is being implemented. In a completely different way, it is characterized by several unique innovative and creative features, and the most important of these advantages are the following: 15 20

- 1- The present invention offers an integrated solution, not a partial solution.
- 2- The present invention can be implemented in the high mountains, on the foothills, on the sides of wadis, and in flat desert lands. 25
- 3- The present invention deals with the issue of consuming large areas of agricultural land and implemented in a strip area that does not affect the distribution of trees within agricultural lands, regardless of their shape and area.
- 4- The invention can create completely new agricultural terraces by simply digging, inserting reservoirs into the ground, and then re-burying, and this in itself is considered a highly economical solution. 30

- 5- The invention is multiple functional so that it can form completely new agricultural terraces and can achieve successes for livestock in addition to agricultural wealth by completing the natural cycle theory that is integrated between the water, agriculture and life system.
- 6- The current invention is highly price competitive and this is what makes it possible to spread internationally. 5

General Discretion

The invention comprises of Construction Composite elements with multiple functions and applications that consists of woven or non-woven synthetic fabrics of multiple sizes and thicknesses that are produced through a manufacturing apparatus and strip molds that allow the synthetic fabrics to be inserted inside them and sealed to form tubular voids and quickly release the synthetic fabrics after coating the upper surface of them with Polyurea fast setting coating, then coating the other side of the Construction Composite elements and reinforcing it with lightweight boards also coated with Polyurea fast setting coating materials. The Construction Composite elements are installed together by means of jointing and connection techniques that are fixed by the male and female method, and then coating the joints with polyurea materials. 10 15 20

Brief Description for the drawings:

Figure No. (1) illustrates the form (A) of the flat Construction Composite elements and the model (B) of the curved Construction Composite elements. 25
 Figure No. (2) shows a part enlarged for tubular voids and how they work.
 Figure No. (3) shows the curved Construction Composite elements without coating and with top coating.
 Figure No. (4) Two profile sections showing one of them with the formation and support boards from the bottom side and the other without them. 30
 Figure No. (5) shows one of the Construction Composite elements that contain lightweight forming and support boards from the top.
 Figure No. (6) Some forms of tubular voids, their ease of flexibility, and the possibilities of adding other shapes of any kind. 35
 Figure No. (7) Part of the longitudinal horizontal tank body with individual Construction Composite elements.

Figure No. (8) A complete tank body is vertically installed with single Construction Composite elements (8 A), and a complete tank body is vertically installed with double compound structural elements (8 B).

Figure No. (9) Section and isometric view of a tank with a triangular segment.

Figure No. (10) horizontal section of walls with double Construction Composite elements. 5

Figure No. (11) two detailed sections of the perpendicularity of the tubular voids.

Figure No. (12) illustrates one of the forms of jointing and connection between the Construction Composite elements. 10

Figure No. (13) A detailed figure of a longitudinal horizontal tank.

Figure No. (14) illustrative diagram of work stages for manufacturing.

Figure No. (15) shows a conceptual industrial production line

Figure No. (16) shows two models for the Construction Composite elements in a singular layer. 15

Figure No. (17) shows a conceptual section of a wall consisting of two Construction Composite elements.

Detailed Description 20

Figure No. (1) illustrates the important part and the basic element in the invention. Rather, it is the idea of the invention itself, which consists of non-woven synthetic fabrics 14 in their normal state. The selected synthetic fabrics are of multiple thicknesses and the thickness of the piece 13 depends on the area of the Construction Composite Element and the applications that will be used in it. It is prepared at the beginning of Manufacturing as one piece completely flat in the required size and weight after completion of its manufacture, which allows it to be carried and handled inside the factory, stored, shipped and transported by trucks to the installation sites or near the place of the installation site, after placing the piece on the dedicated device that contains molds consisting of metallic or non-metallic elements and these the molds take the form of a transverse or longitudinal strip that allows folding a part of the same synthetic fabrics to form tubular voids 15 in any shape to be designed according to the sections in Figure (6) and after inserting the synthetic fabrics 14 into the strip molds and sealing them and then coating them from the upper side C and displacing the moving rib to remove the piece from the molds that form the tubular voids 15 and allows for adhesion and contact between the two parts of the synthetic fabrics 74 by a simple manual 35

press or a mechanism that makes it tightly adherent to prevent the coating from entering the space formed during the spraying process, and then inserted metallic or non-metallic tubes and sections that are hollow or solid, or in any form of metallic or other non-metallic sections, square or rectangular, or the shapes of distinct metallic or non-metallic sections such as (I) beams, H-shaped beams, T-shaped beams, or flat sections are inserted into the tubular voids and then the coating is sprayed on the upper outer surface of the C using polyurea coating or other high-tech coating materials that contain relative flexibility in order to be able to bend the slide later during the installation process in the sites for curved walls. As for flat walls, strong and solid non elastomeric coating materials can be used, when the coating is sprayed on the outer surface C and because the polyurea coating solidifies during The first minute after spraying, this allows for a quick installation of the synthetic fabrics strip A and B on the molds for forming the tubular voids 15 and determining the distance between each tubular voids and the other 202, and then spraying the upper surface C with coating materials, then take it out of the molds within 3-5 minutes, re-insert a new strip, and so on.

Figure (2) shows an enlarged part of bended synthetic fabric 74, which is clearly from the same body as the synthetic fabric slice 14, whose thicknesses vary 13 according to the required strength of the construction element to be manufactured. Also, the tubular voids 5 formed as a result of bending 74 the synthetic fabric 14 shows the tube 16 that inserted Inside the tubular voids and its thickness 17 is determined according to the required strength of the wall to be built or according to the engineering specifications of the construction element.

Figure No. (3) shows the curved construction composite elements (B), which are composed of curved synthetic fabrics 14, which are bent 74 into strip molds to form transverse tubular voids 15, and the tubes are inserted 75 inside them. Polyurea coating 17 is sprayed on the upper surface of the synthetic fabrics 14 and then the molds are released, the tubes 75 are drawn out, the construction element (B) is removed, and the other side containing the transverse tubular voids 15 is coated.

It is joined and fixed with a polyurea coating 17 with another slide on the two sides that do not contain tubular voids 15 and the other slide must contain 15 longitudinal tubular voids for strengthening in the opposite direction to form a very strong slide with two outer faces each face contains tubular voids 15 for strengthening in The direction is perpendicular to the other, and other types

of fast setting and cured coatings can be used on synthetic fabrics 14 instead of polyurea coating, and polyurea coatings are sprayed with thicknesses 18 in various thicknesses according to the design. The larger the size of the facility, the more thicknesses of the polyurea 18

The spaces 202 that are located between the tubular voids 15 are supported with lightweight reinforcing boards 28 to perform two jobs simultaneously, the first is to reinforce the inner tank wall or the wall of any facility and the second is the thermal insulation of the tank or any facility. These boards are sprayed with polyurea coating 17 on all sides. It is pre-installed and fixed by polyurea coating 17 also curved construction composite elements can be manufactured based on their engineering design and the diameter of the circle forming a cylindrical tank or circular facility, so that they are made on molds such as those used in flat construction elements, but they use a curved device with curved strip molds and there is another option which is manufacturing them by bending the flat type of construction composite elements, if it is made of synthetic fabrics and flexible coating of polyurea, is done during the installation of parts in factories or sites, and it is strengthened with pipes, columns and beams formed according to the required bending of the construction element.

Figure No. (4) shows two sections of curved construction composite elements (B), the first (4a) without the top coating for polyurea materials and without forming and supporting boards, and the second (4b) contains polyurea coating for the upper part and contains the forming and supporting boards on the lower side of it. In the first (4a) the profile of the synthetic fabrics 23 is clear and the tubular voids 24 are in a circular shape. The tubular voids 24 can be formed in any other sectioned shape because the molds that form them are flexible to give us any shape. Its design, whether it is tubes with a circular or oval section, or I- beam shaped or T-beam shaped or H-beam shaped sections, or rectangular flat sections, as the upper surface 26 is shown before spraying with polyurea coating.

The second figure (4b) shows the formation of the synthetic fabrics 23 in a curved manner and the underside 25 of the synthetic fabrics 23 forms a place 27 for the lightweight rectangular forming and supporting boards 28 that are reinforced and fixed from the inside with a polyurea coating.

Figure No. (5) shows a segment B of curved construction composite elements, which consist of synthetic fabrics 51 and have tubular voids 47 designed in the outer-upper direction. The upper side here B of synthetic fabrics 51 forms

rectangular or square spaces for mounting and fixing the supporting boards 46 and these boards may be made of polystyrene, styrofoam or rock wool materials to fix them from the outside, It is thin or thick depending on the area formed between the tubular voids 47 and depends on the size and capacity of the tank or facility that will be built with this construction element, The bottom part of the fabrics 41 is sprayed with polyurea coating or other coatings to be the final inner face of the wall. 5

Figure No. (6) shows some forms of tubular voids that receive metallic or non-metallic tubes and sections that are hollow or solid, designed to be used to reinforce the walls of tanks or any other constructions in a transverse or longitudinal manner. As it is clear, the tubular voids can be formed according to the shape of the tubes and metallic sections or non metallic that will be used inside it, therefore, the synthetic fabric 301 receives the shape with a circular section and the synthetic fabric 300 receives the shape with an oval section. Pipes with a circular or oval section may be completely solid and the figure shows the tubular voids formed from the synthetic fabrics 302 that receive the I beam-shaped sections Or tubular voids formed from synthetic fabrics 303 that receive inverted T beam-shaped section or tubular voids formed from synthetic fabrics 304 that receive flat section, and there is also the possibility of adding other shapes of any kind. 10 15 20

Figure No. (7) A part of the tank body of the longitudinal type manufactured by the single curved construction composite elements. We clearly see the horizontal longitudinal tubular voids 102 from the inside and the circular tubular voids around the tank from the outside 101, and it is clear that the synthetic fabrics 103 were coated on both sides with polyurea coating It is noticeable that the reservoir wall consists of one layer of construction composite elements. The reason is that its diameter is small and does not deserve two layers, as is the case in Figure (8). This type can be installed above the ground and protected with wire mesh cubes filled with stones or it may be partially or entirely buried under the ground. 25 30

Figure No. (8) shows two models 8a and 8b for two vertical tanks, the first is a complete tank body of the vertical type 8A which is manufactured by the single curved construction composite elements and we clearly see the longitudinal tubular voids 102 from the inside and the circular tubular voids around the tank from the outside 101, as it appears that Synthetic fabrics 103 have been coated on both sides with polyurea coating. Connected foundations 35

107 are installed, which have another system with the same idea of the invention, but here they contain a larger internal space that receives reinforcing bars and receives concrete mixture, Inside the foundation molds, tubular voids are designed to receive metallic or non-metallic tubes and metallic or non metallic sections solid or hollow that inserted inside the tubular voids, so that their installation with each other is fast, tight and homogeneous. 5

The second type (8b) is a complete tank body of the vertical type that is manufactured by the double curved construction composite elements. We can clearly see the longitudinal tubular voids 102 from the inside and the circular tubular voids 101 around the tank from the outside. 10

This type of vertical tanks is constructed by using of the curved construction composite elements 103, that they are pre-engineered pre-designed before manufacturing and calculate the diameter of the tank and the longitudinal and transverse divisions and according to the size of the required tank, then the strip foundations 107 are installed, which have another system with the same idea of the invention, but here it contains a larger internal space. It receives reinforcing bars and receives concrete mixture, and inside the foundation molds, the tubular voids are designed to receive the metallic or non-metallic hollow or solid tubes and sections that inserted in the tubular voids of the walls so that their installation with each other is fast, tight and homogeneous. 15 20

Figure No. (9) is a special type of rainwater harvesting tanks used in agricultural lands for narrow agricultural terraces and it is made using flat construction composite elements, all three composite boards that form a part of the tank body are installed next to each other according to the required length of the tank and the sizes of the boards are larger and smaller According to the required capacity of the reservoir, and it is noticed in the side section in Figure 9A that the section of the final shape of the rainwater harvesting tank is a right-angled triangle with a vertical façade A that works as a wall that usually retains soil, but in this case it is considered a wall retaining water and this wall A is one of the construction composite elements that has an outer face 81 is synthetic fabrics 92 coated with polyurea materials and coated with anti-ultraviolet coating materials, unless metallic or non-metallic mesh cubes are added to be filled with stones to give additional supporting strength and give a beautiful view that suggests the prevailing rural style, flat construction composite elements that represents all the walls of the tank contains tubular voids 82 distributed on all the external facades of destinations A, B, and C and 25 30 35

contains inside them tubes or Metallic or non-metallic hollow or solid sections are connected to each other when the parts of the tanks are installed with each other, but these pipes and sections contain at their ends a place for installing the connecting screws that control the closure of the two sides of the end of each tank, and it is also clear the formation and support boards 91 that make the body of the tank Coherent and solid, especially after coating all faces 92 and elements with polyurea coating materials, and another type of reinforcement is added 86, which is a strong column perpendicular to a 90-degree angle to the B board and centered at the right angle of the tank 85, The method of installing the parts of the tank with each other is done by the methods mentioned in Figure 12, and this is evident in the jointing and connection techniques 93, and the angles of the triangle 83, 85, 88 are strengthened by means of triangular plates. This type of tank is equipped with a mechanism to receive rainwater 89, which allows the water to enter without the entry of impurities. This type of tanks is manufactured completely flat in factories and is carried and transported inside trucks in the manner of flat panels and is formed, fixed and installed directly in the sites, and the goal as was mentioned previously in the background of the invention is that it is an ideal solution for places that are difficult to reach with equipment, trucks and cranes.

Figure No. (10) is a horizontal section of the double wall 600, which contains two construction composite elements facing the inside that have been completely coated with polyurea coating 601 and contain tubular voids 603 that meet inward with both types of intercourse. Either there are hollow tubular sections 604 inside them or there are tubular sections 606 filled with flexible polymeric mixtures 605 and these tubular voids 603 are connected to the synthetic fabrics 701 by two layers of the same body of synthetic fabrics 701 adhered to each other 602 working to receive the horizontal reinforcing bars 607 and after the installation process for the strips with each other and with the elements and sections of the stiffeners the space formed between them 608 is filled With foamed concrete, polymeric, cured clays, styrofoam or polyurethane foam.

Figure No. (11A) shows an enlarged section of two layers of construction composite elements adhering to each other by demonstrating the intersection of the tubular voids A and B with each other to give the structural body great strength and durability, and these two tubular voids are linked by the adhesion of two layers of synthetic fabrics coated with polyurea materials and these

Partial is what gives us the flat layer 702, which adheres to the layer 703, which is also coated with polyurea coating, so the two layers with synthetic fabrics 704 with polyurea coating from all sides, and this in the end gives us 6 total layers 4 of which are polyurea and two layers of synthetic fabrics 704, which is clear from the figure the start of bending of the synthetic fabrics 705, which then form the tubular voids 706, and these formed tubular voids receive within them 709 tubes and metallic or non-metallic sections 707 as shown in Figure 11B. 5

Figure No. (11B) also shows an enlarged section of two layers of the construction composite elements adhering to each other by demonstrating the intersection of the tubular voids A and B with each other to give the structural body great strength and durability, which is largely achieved when inserting metallic or non-metallic tubes and sections 707 that are It can be hollow with a large thickness of 708 or regular thicknesses, or it may be completely solid, and these two tubular voids are linked by the adhesion of two layers of synthetic fabrics coated with polyurea materials and this part is what gives us the flat layer 702 that adheres to the 703 layer also coated with polyurea coating, thus the two layers that are attached to the phrase About the synthetic fabrics 704 is coated with polyurea coating from all sides, and this in the end gives us 6 total layers, 4 of which are polyurea and two layers of synthetic fabrics 704. 10 15 20

Figure No. (12) is one of the most important jointing and connection techniques in the theory of the male 721 and the female 720, and this part is designed in a solid stripe method in the case of flat board walled construction composite elements such as those boards that are used for tanks with triangular sectors as in Figure 9 and are flexible in The case of curved construction composite elements as in Figure 1B and can be made of plastic materials or polymeric materials or other types of metallic or non-metallic materials. The bonding techniques are installed on one end part of the synthetic fabrics 723 sprayed with a fast setting polyurea coating 726, this part of the joints is coated after the installations with a polyurea coating 726 with a thickness higher than the normal thickness applied to the walls. 25 30

Figure No. (13) shows a longitudinal horizontal tubular tank that is placed directly on the ground or buried underground partially or entirely. The tanks of large diameters and sizes consist of curved construction composite elements 711 with double walls whose inner walls contain tubular 35

voids 710, so that the inner side of the walls 712 is smooth coated with polyurea coating materials, and these elements are connected to each other with techniques of jointing and connection 715 which having multiple forms and functions and perhaps the most important of them The jointing and connection techniques that were explained in Figure No. (12) and the space between the two curved construction composite elements as detailed in Figure 10 is filled with polystyrene materials, polyurethane foam, polymeric concrete, foam concrete or even clay mixtures, and this type of tanks Its ends are equipped with a tight cover 713, engineered so that its edge 714 overlaps the tank body tightly, and then it is completely coated with polyurea materials and is installed inside the factories or directly in the sites, and the tank is equipped with 16 upper holes according to international engineering specifications and in the case of rainwater harvesting tanks These openings are prepared and rehabilitated so that they receive rainwater and open and close automatically.

Figure No. (14) shows the details of the sequence of manufacturing stages. In the first stage in manufacturing, the device that contains the molds that form the tubular voids is prepared according to the design of the segmented unit 501, and then the piece of non-woven synthetic fabrics is prepared, for example, 1.5 meters x 3 meters and divided horizontally Or vertically, with equal sizes 502, after which lines are drawn on the surface of the synthetic fabrics to determine the locations of the horizontal or vertical tubular voids that make the inlets of the stiffeners according to the divided distances 503 and in the next stage, the synthetic fabrics are bent in the places marked by lines and inserted into the blank of the strip molds 504, then pressure follows. The molds are inside the device to press on the bent synthetic fabrics 505, and then tubes with an outer diameter equal to the inner diameter of the tubular voids used for the stiffeners 506 are inserted and thus the shape of the formed unit is as in Figure No. (3) and in the next stage, a fast setting polyurea coating is sprayed on the upper surface of the fabrics, which we get one flat surface 507 and after three minutes of polyurea coating, the pressure in the molds can be released and the piece can be moved out 508, Next, the piece is placed on a flat surface on the face that was painted facing down and sprayed polyurea paint on the other side that contains the tubular voids and stiffeners 509, and then the two elements are affixed to each other on the flat sides by polyurea 601 and in the result we will have Unit contains 602 horizontal and vertical stiffeners, and the process is repeated repeatedly to produce large quantities of elements in each production line 603.

Figure No. (15) shows the industrial production line for the production of construction composite elements starting from the placement of the synthetic fabrics reel 800, whose dimensions have been determined from length, width, weight and thickness, because this definitely results in the final product, the synthetic fabric 801 pulled over the top of the table or apparatus 808 which contain on top of it strip molds 807 transverse or longitudinal, and inside it a hydraulic device that allows for the closing and opening movement of the molds 807 in which synthetic fabrics 801 are inserted and sealing on them, a layer of Polyurea coating 802 sprayed by coating spray gun 806 which the coating solidified in one minute then it adhere to the synthetic fabrics and form a layer on the upper surface 803, then after one minute the strip molds 807 releases synthetic fabrics and move it horizontally on wheels 809 and 810 in an innovative way allowing the side that has been coated to face down on another table 813 and the side that contains the tubular voids 804 is facing up to receive Polyurea coating also followed by affixing the lightweight forming and reinforcing boards 805 in the space between the tubular voids 804 and the lightweight forming and reinforcing boards Thickness is as the thickness of the tubular voids in order to be a uniform, flat layer after being completely coated with polyurea materials, forming and reinforcing boards are installed in a semi-automatic manner from inside the shelves 811 directly after spraying the polyurea coating on the synthetic fabrics through the device and table 812 and the products come out as integral construction elements after Cut into parts according to design, the plant has a very flexible structure containing channels 814 allowing the movement of the 815 polyurea spray hoses that come from the spraying machines 816.

Figure No. (16) shows two examples of the construction composite element in a single way. The first is 16 A consisting of synthetic fabrics 1001, bent before being sprayed 1000 to form the tubular voids inside the molds and sealed on them 1004 until they are ready for spraying the polyurea coating, the thickness of the synthetic fabrics 1002 is chosen according to the design and strength of the construction composite element, the thicker the synthetic fabrics , the stronger the construction element will be.

The second model 16b shows the construction element after coating it with polyurea from all sides to give us the smooth inner surface 1006, whose direction is usually inside the tank or facility, and the tubular voids 1005 coated with polyurea materials are usually outside or inside the wall if the facility uses the combined construction elements in a double way, as in Figure

No. (10) or Fig. No. (17), it is also important to determine the opening of the tubular voids 1008 that receive the tubes or metallic or non-metallic sections that are hollow or solid in various forms, and as we mentioned that the thickness of the synthetic fabrics 1007, the more it increases, the strength of its durability increases, to a large degree, especially after coating it with polyurea materials, it gives tremendous strength that can withstand all the forces of pressure and tension in the facility. 5

Figure No. (17) shows a conceptual section of a wall consisting of two construction composite elements in which the tubular voids 904, 905, 907 and 908 are faced towards inside the wall, so that they are interlocked with each other, the tubular voids of the 1st element interlocked with the tubular voids from the 2nd one and they interconnected to each other by metallic or non-metallic tubes or sections which inserted inside the tubular voids so that it forms a tight force that does not allow the movement of the construction elements inward or outward due to the compressive forces resulting from pouring the vacuum 911 with concrete, clay or sand materials or other mixtures, therefore, during the installation phase, for example, the tubular voids 905 is moved to the place designated for it 906 to directly insert the tube into the two tubular voids 904 and 905 and thus the case is repeated with all tubular voids and their connection with each other, the inside part of the synthetic fabrics 900 is towards the inside of the tank or facility and is sprayed with Polyurea coating before installation and coated with the installation voids again and the the outer segment 903 shall be sprayed with polyurea coating or any other paints that protect the outer surface from ultraviolet rays, the inner sides of the two construction elements 902 may not need to be coated with polyurea materials because they will receive concrete, clay or sand mixtures that will intertwine with the synthetic fabrics filaments in a stronger way, and there are important cases where the polyurea coating is sprayed on all internal and external facades and with higher thicknesses if the diameters of the tanks or structures are Large and if their uses and applications are for underground buildings such as aircraft, weapons bunkers, advanced command centers, or other facilities that require enormous force against pressure, tensile and explosive forces, and in some cases lightweight forming and supporting boards 910 are used in the spaces between the tubular voids in order to give ease and cohesion during installation and it has other functions, including thermal and sound insulation if the facility needs it, and as was detailed in Figure (12), the jointing and connection between the construction composite 35

elements is done by the jointing and connection elements 902 according to the male and female theory.

Method of manufacturing construction composite elements

The construction composite elements are manufactured by couple of methodologies, one of it is a production lines equipped with electrical and mechanical devices, conveyors, stands and various molds.

The production line starts with stands for synthetic fabric according to their weight, width, length and thickness, the starting edge of the synthetic fabric is pulled and passed on the apparatus table surface that contains tubular strip molds that are adjustable in the form of any space required according to Figure No. (6) and more, and at the end of the apparatus table there is Belt or conveyor belts that move the bodies forward after the completion of the treatment of the construction element and coating it with fast setting and hardening coating materials (one minute) to be flipped in an innovative way on the other side to be coated also with fast setting hardening coating when needed, as well as fixing forming and supporting boards in the spaces between the tubular voids and takes its thickness.

There are always hydraulic devices that work to lock and release the molds and tubular voids according to the required designs, as well as electromechanical devices for movement up and down and handling.

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Claims

The invention claimed is:

- 1- Construction Composite elements and methods of their manufacture that have plurality applications and uses in the construction of facilities in general, consisting of synthetic fibres textiles of various sizes and thicknesses, fast-setting and hardening coating materials, and a manufacturing device that contains molds that work to form tubular voids that act as reinforcing elements after coating them with fast-setting coating materials and inserting pipes, columns and bridges inside them For the purpose of strengthening the structural elements in addition to installing lightweight panels in the spaces between the tubular voids for the purpose of strengthening and forming the walls. All of them are coated after the manufacturing of the composite structural elements is completed, they are installed to each other in factories or directly on sites to give the function designed for it.
- 2- Construction Composite elements according to claim 1 are geometrically designed elements in rectangular or square shapes of multiple sizes and thicknesses, manufactured in a flat or curved manner to form the basic part or element of the construction that is the subject of the invention.
- 3- Synthetic fibers textiles according to claim 1 are woven or non-woven industrial fabrics or geotextiles made of polyethylene, polyester materials or polypropylene materials with multiple thicknesses, weights and technical specifications. It also includes high-tensile and resistant materials, woven and non-woven fabrics, such as Kevlar materials, or ultra high molecular weight polyethylene (UHMWPE) and carbon fiber materials.
- 4- The manufacturing device and molds according claim 1 is an integrated industrial production line that consists of a flat or curved structure such as a large table that initially contains structures carrying synthetic fiber rolls of any kind, structures on which molds are placed, structures bearing compressors and hydraulics that are used for lifting or Pressure or lateral or vertical movement and molds are designed in a striped manner and with large and small cross-sectional sizes according to the type of structural design of the element and according to the applications and its work is to contain the synthetic fibers inside them in a flat or bent manner in the form of pipes and metal or non-metallic sectors during the coating process on the upper surface and allow the release of the synthetic fibers after Paint finished.
- 5- Tubular voids according to claim 1 are made by quick and innovative manufacturing methods. The fibers can be bent and inserted into strip molds in sizes 3, 5, 10, 20 cm or more than that or less to give after coating the surface

of the upper element and liberating the parts that It has been bent to give multiple sizes of tubular spaces receiving any type or size of steel or non-metallic, rigid or flexible tubes and sections that are used for the structural support of the building, tank or facility to be installed by these elements. Or longitudinal, and tubular voids can be distributed on the surface of the composite structural elements in an irregular way 5

6- Distribution of tubular voids on the surface of the structural elements in an irregular manner according to claim 5 in order to follow in its design the geometric shapes as requested, it can be a cover for the giant circular tanks and this makes its distribution on the surface radially from the center to the outside 10

7- The manufacturing process of tubular voids according to claim 5 is carried out by bending the synthetic fibers, inserting them into the strip molds and sealing them, and then coating the upper surface of the fibers with a polyurea coating.

8- Columns, tubes and bridges according to claim 1 are the metallic or non-metallic elements and sections that are inserted into the tubular spaces during the manufacturing process in factories or during installation at sites to give the structural elements the advantage of strengthening and supporting. They can be straight or bent, and can be hollow or solid. 15

9- The reinforcing elements according to claim 1 are strip reinforcing elements distributed on the walls of the internal or external flat or curved structural elements and fixed horizontally, vertically, at an angle or in the form of a circular collar on the wall of cylindrical tanks from the inside or outside. 20

10- Forming and reinforcing boards according to claim 1 are polystyrene boards, reinforced polyurethane boards, Styrofoam boards, rock wool slides and rolls, or polyethylene foam slides, which spray these boards from all sides with polyurea paint before installing them in their places and then fixing them. In the spaces that lie between the tube spaces by polyurea coating, the supporting materials also include galvanized metal mesh materials, plastic mesh materials, or fiberglass mesh materials that are fixed on the forming and reinforcing panels directly or after coating them with polyurea materials. 25 30

11- The fast-setting and hardening coating according to claim 1 is a polyurea coating material, polyurethane coating material, modified polyurethane coating or polyurea ballistic resistant and bulletproof coating designed for military use.

12- Multiple applications and uses according to claim 1 includes segmented walls for making tanks of all kinds in factories or installing them directly on sites and forming them in various shapes, architectural uses of buildings, and structural and construction uses in building underground or above ground hideouts, hangars, advanced underground command centres, domes and awnings. 35 40

13- Tanks according to claim 12 are tanks for the purpose of storing liquids in general, water, rainwater harvesting, sewage or industrial wastewater, chemicals storage, petroleum and petrochemicals.

14- Tanks according to claim 12 can be for storing grains and bulk materials.

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15- The shapes of tanks according to claim 12 may be horizontal or vertical cylindrical or cubical, horizontal or vertical rectangle sides, or be in the form of a triangular pyramidal.

16- The applications according to claim 1 can be any building, like mosques, domes, fast erection emergency evacuation facilities, open or closed awnings, underground shelters for dwellings, mobile hospitals, and civil installations such as large sewage pipes, rainwater drainage pipes, high pressure pipes and tunnel casings, or tunnels under sea water, or large channels under roads, or any civil or architectural works to which the complex structural elements apply.

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17- Methods of installing composite construction elements according to claim 1 is represented by several methods that facilitate the installation process between elements in factories or sites directly with the theory of the game of lego, male and female or interlock, in addition to mechanical installation and intense polyurea coating on the connections.

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Drawings

(1/17)

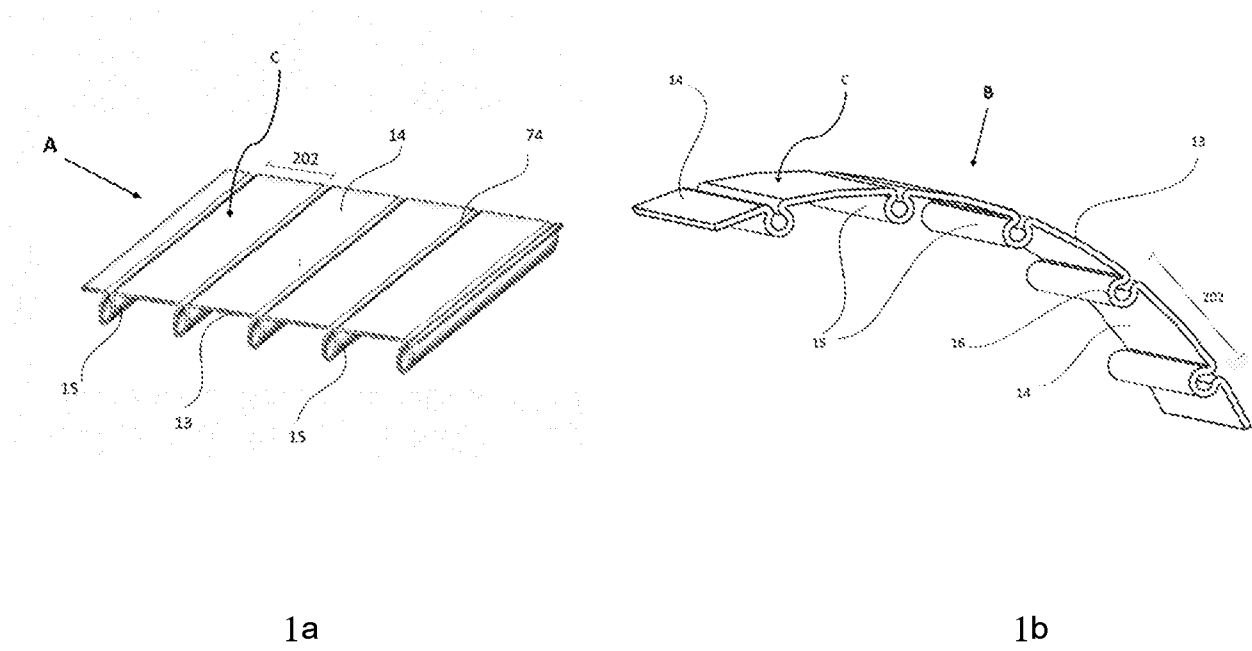


Figure (1)

(2/17)

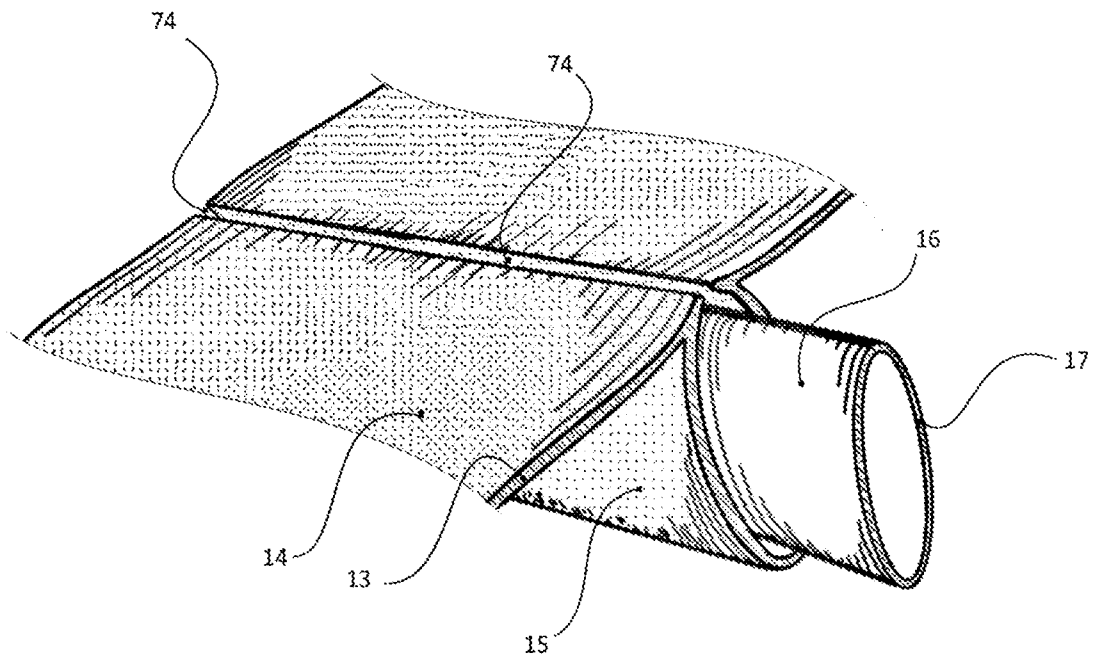
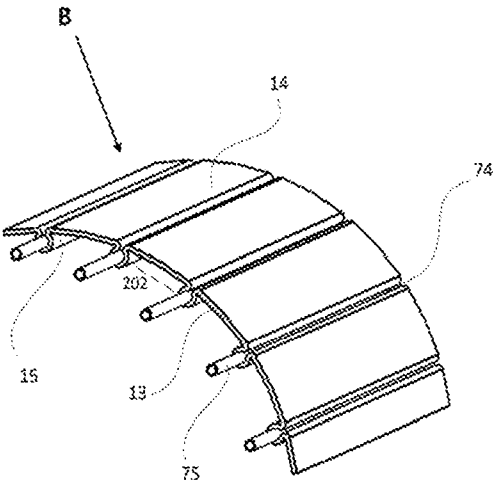
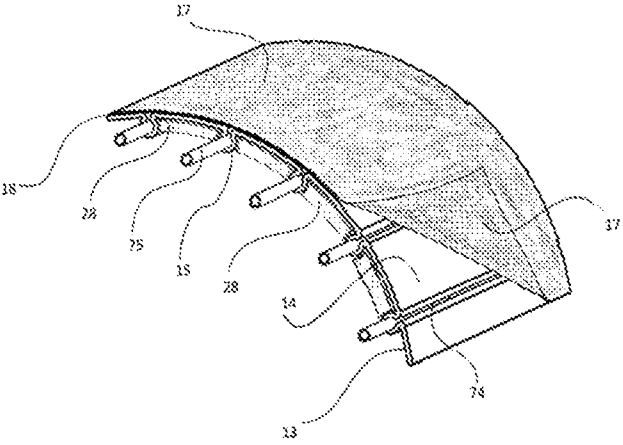


Figure (2)

(3/17)



3a



3b

Figure (3)

(4/17)

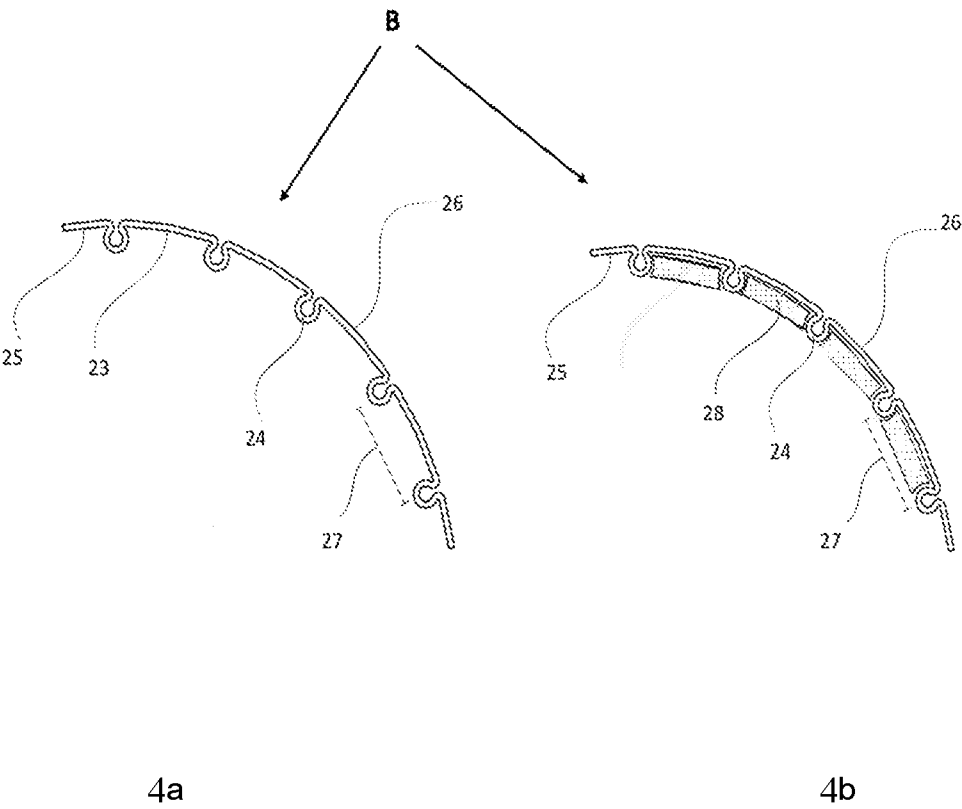


Figure (4)

(5/17)

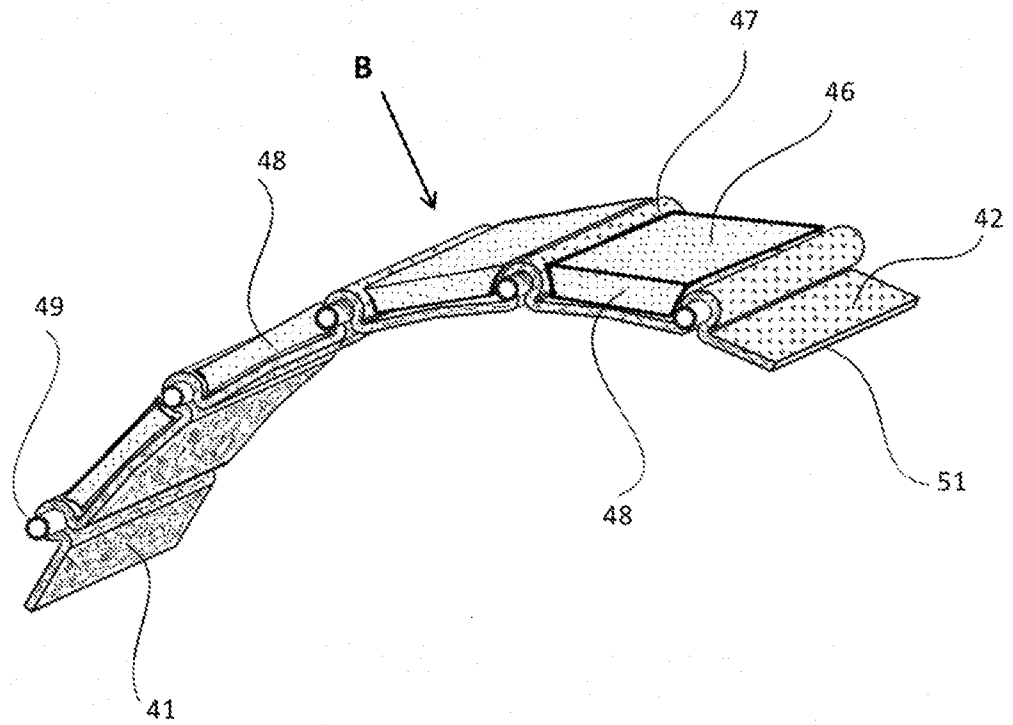


Figure (5)

(6/17)

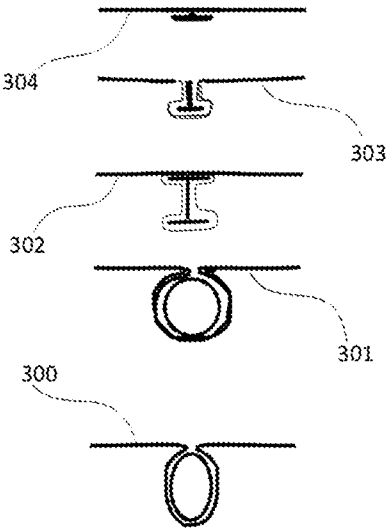


Figure (6)

(7/17)

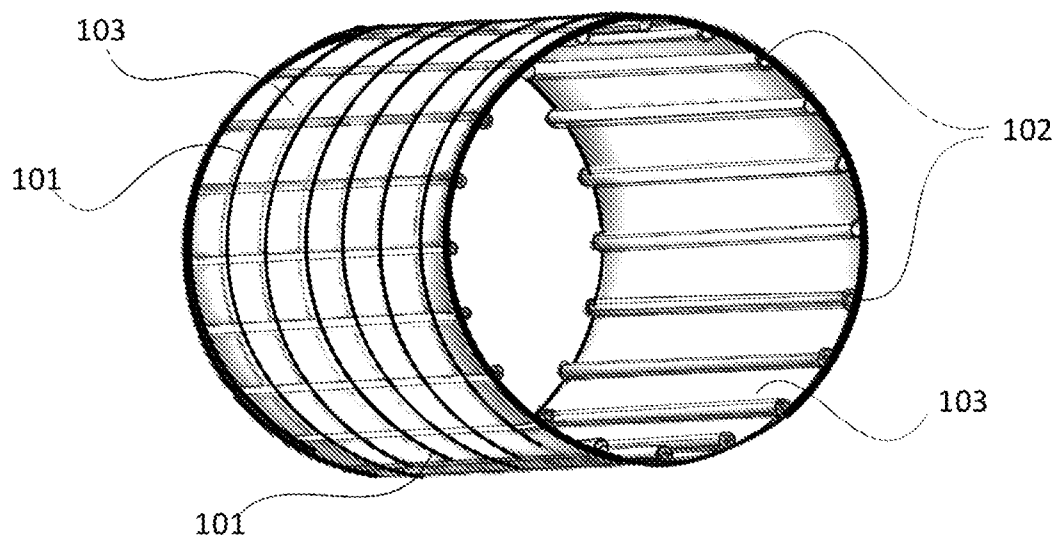


Figure (7)

(8/17)

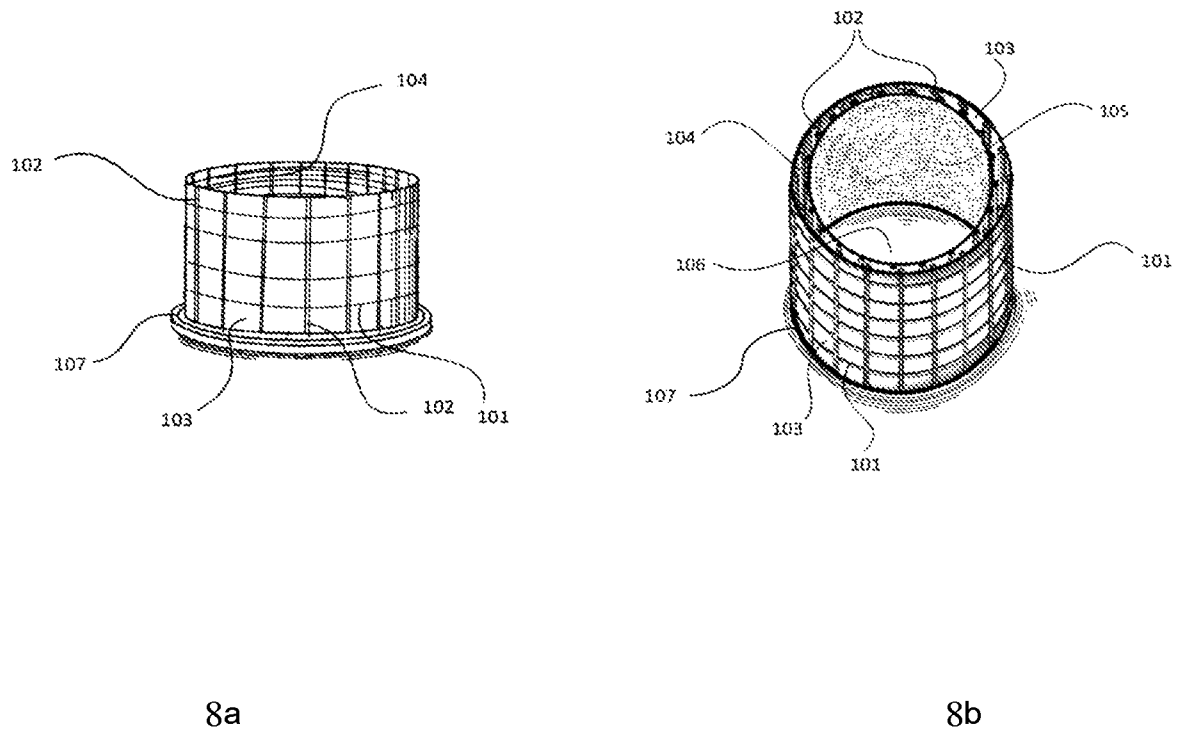


Figure (8)

(9/17)

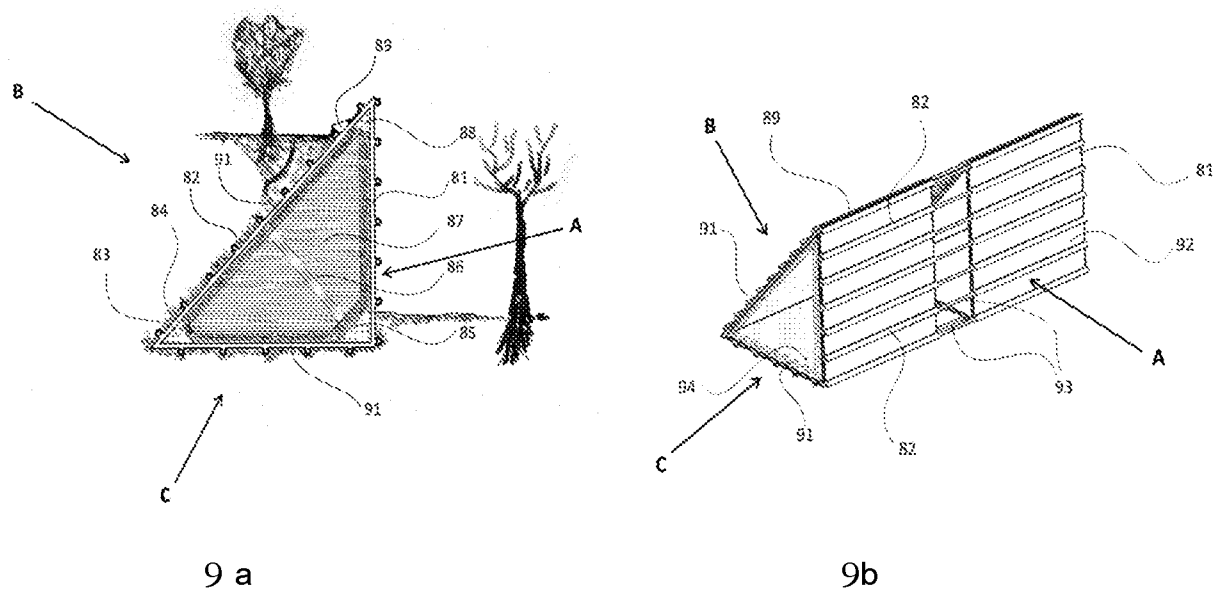


Figure (9)

(10/17)

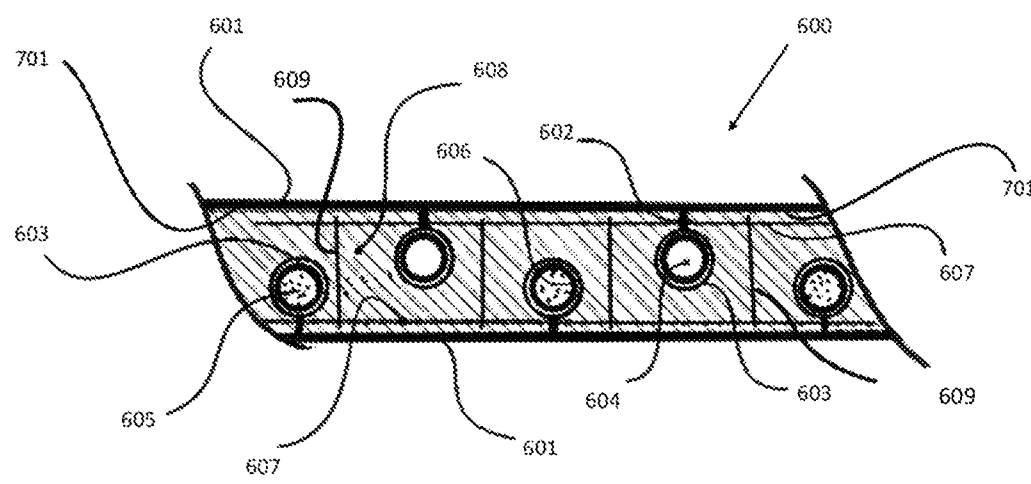


Figure (10)

(11/17)

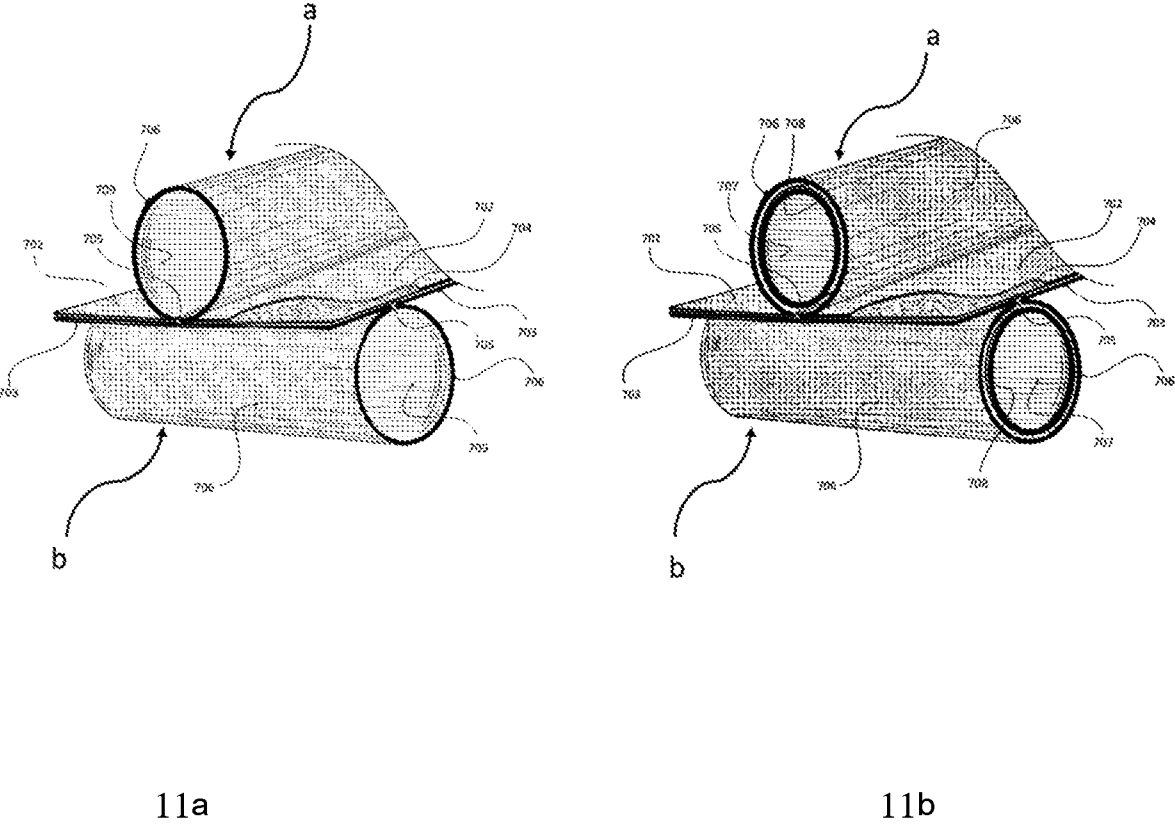


Figure (11)

(12/17)

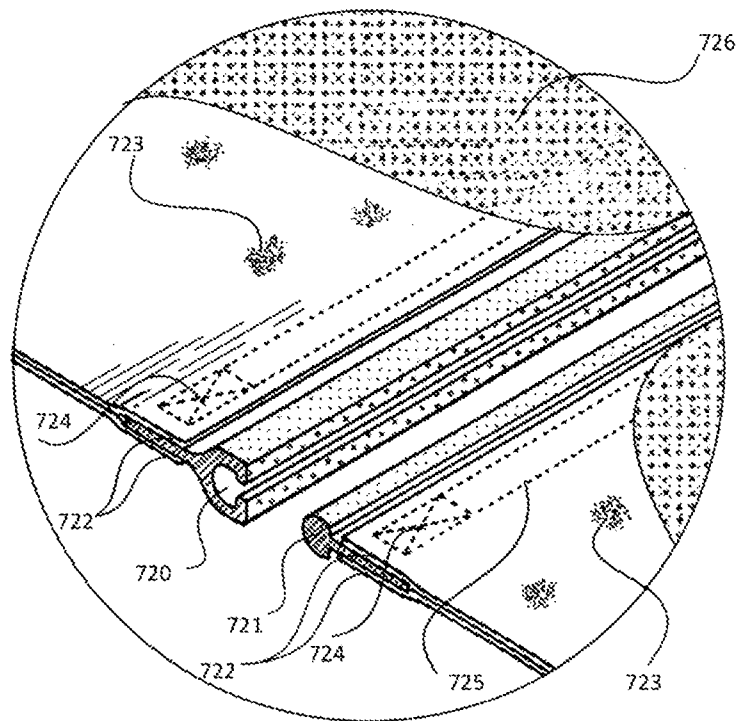


Figure (12)

(13/17)

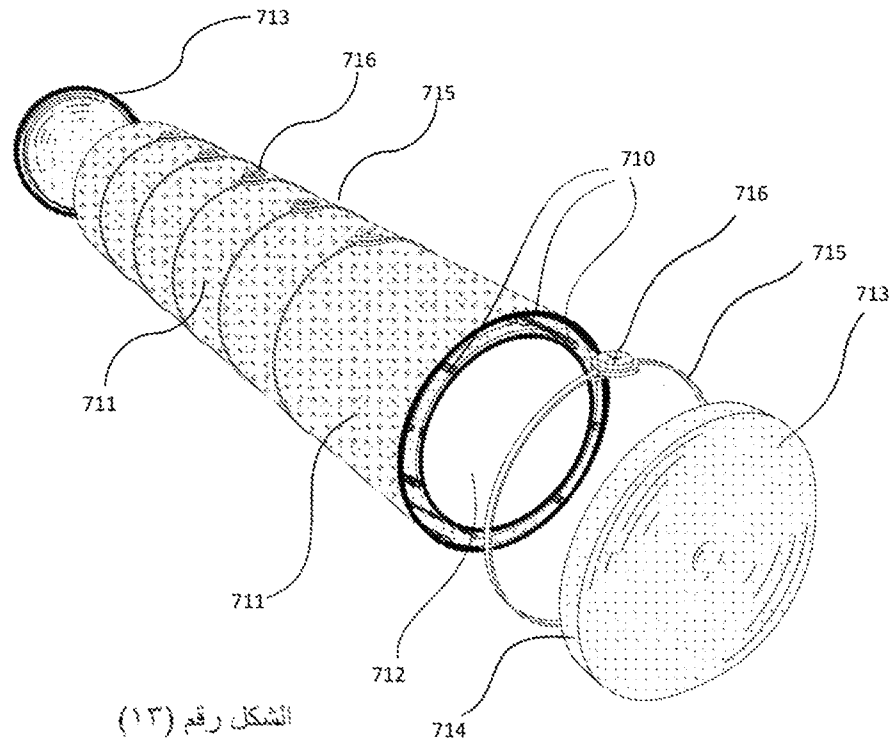


Figure (13)

(14/17)

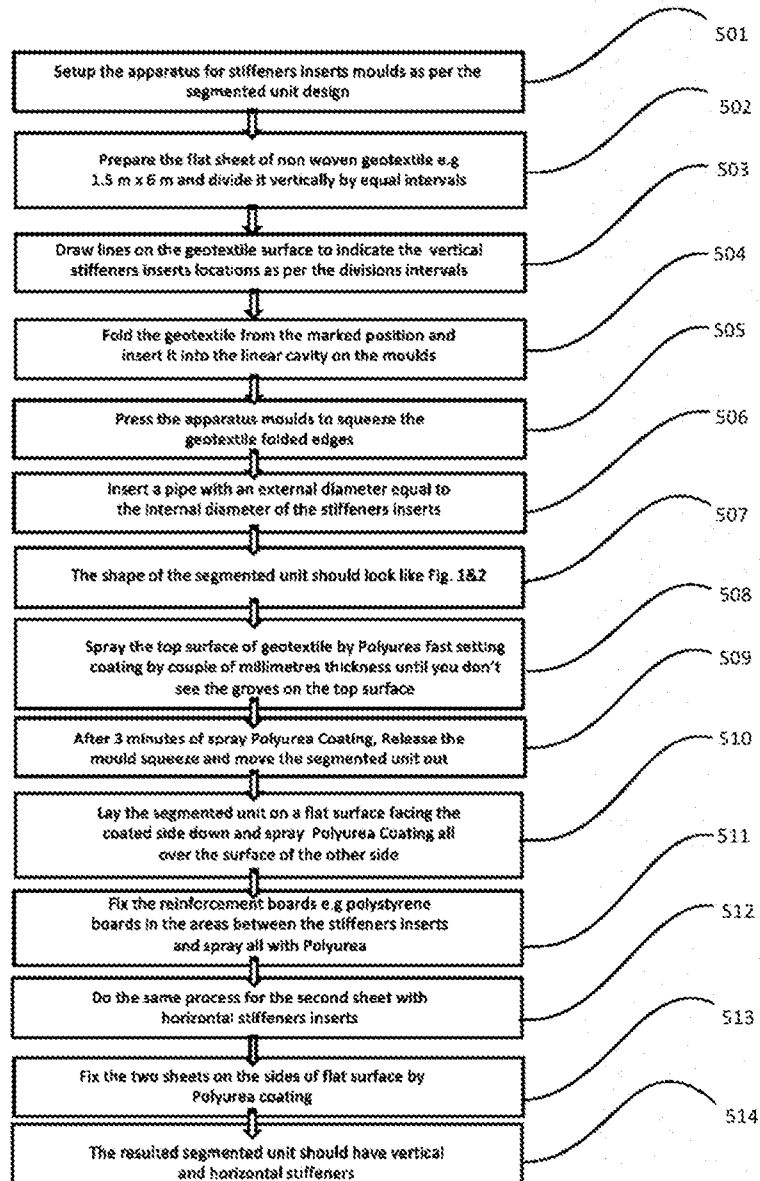


Figure (14)

(15/17)

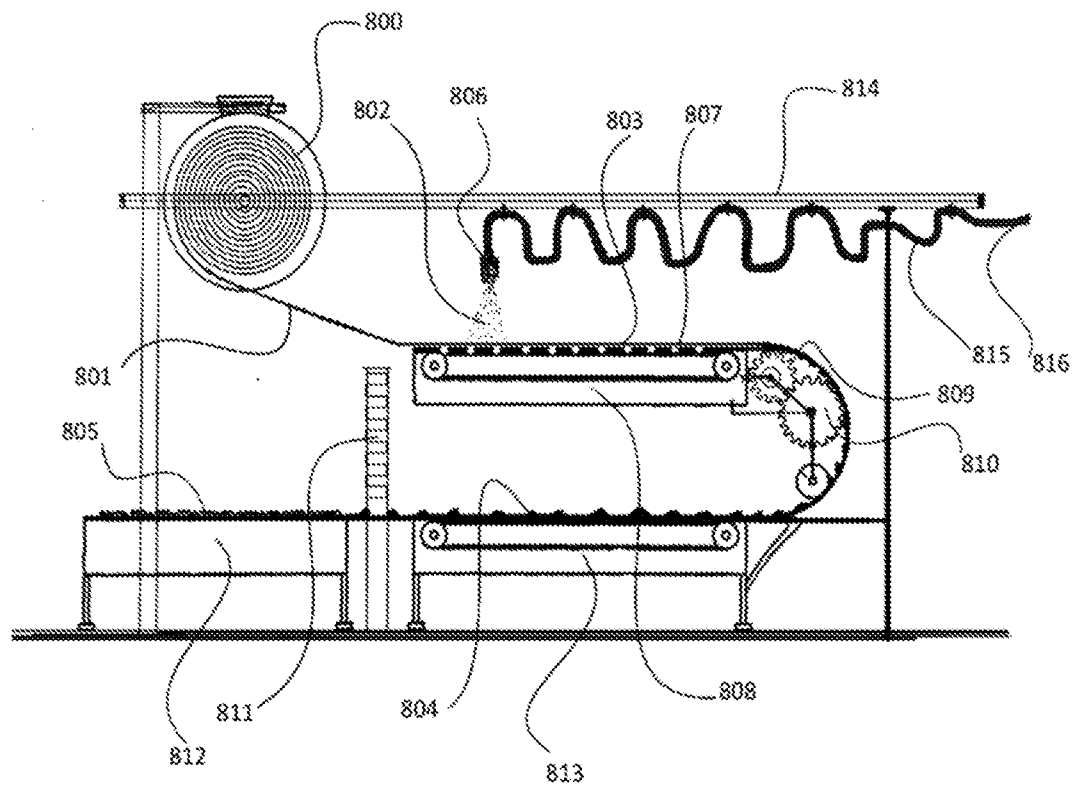


Figure (15)

(16/17)

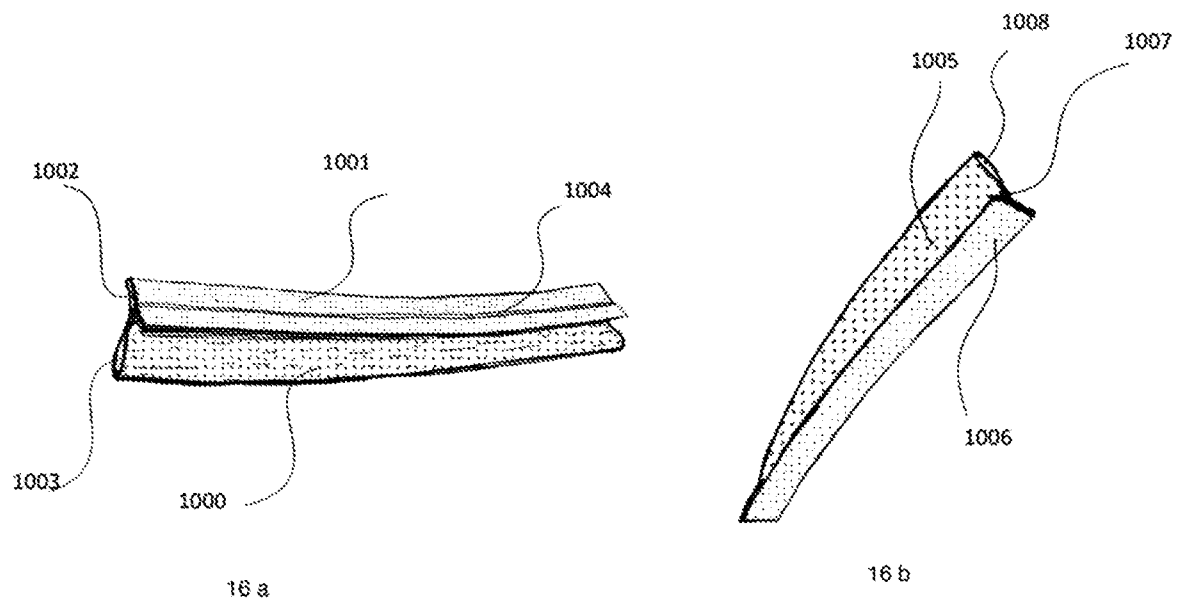


Figure (16)

(17/17)

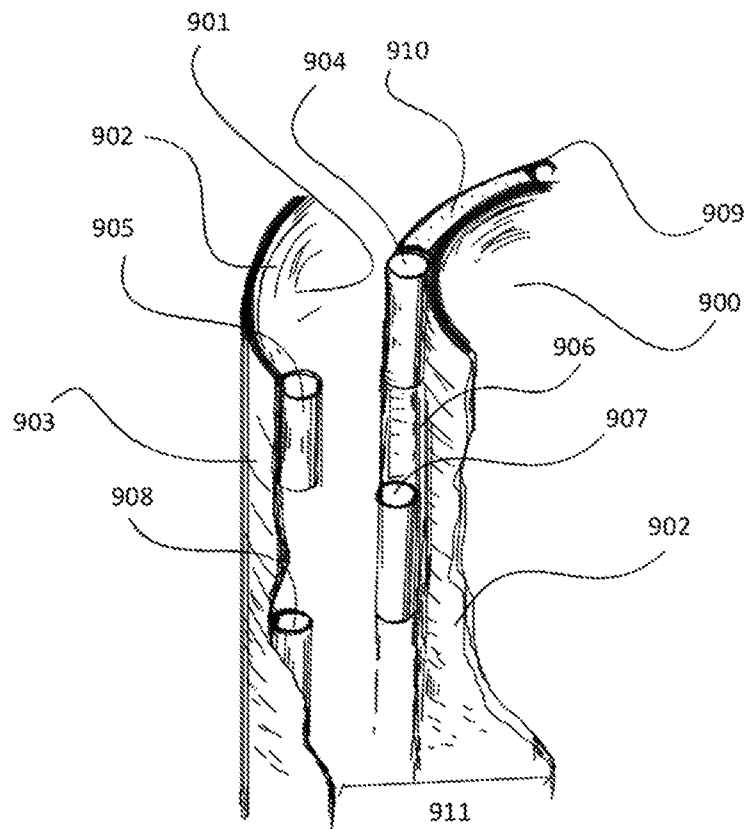


Figure (17)