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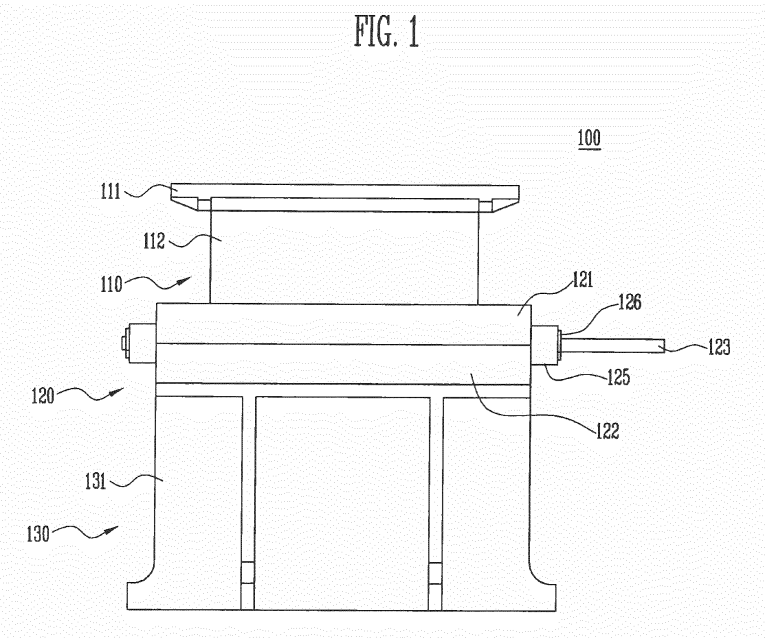
(54) Support structure for liquid cargo storage tank

(57) A support structure for a liquid cargo storage tank according to an embodiment of the present invention includes an insulation unit provided at a liquid cargo storage tank, a support unit provided under the insulation unit and provided at a body of a ship, and a distance control unit provided between the insulation unit and the support unit and controlling a distance between the insulation unit and the support unit.
since an entire height of a support structure for a liquid cargo storage tank according to the present invention is primarily controlled by a filling member, and is subsequently reset by a distance control unit, the support structure may tightly contact the liquid cargo storage tank while the height of the support structure is provided at an appropriate height between the liquid cargo storage tank and the body of the ship, so that the support structure may stably support the liquid cargo storage tank.

FIG. 1



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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Korean patent application number 10-2013-0062782 filed on May 31, 2013, in the Korean Intellectual Property Office, the entire disclosure of which is incorporated by reference herein.

BACKGROUND

[0002] An embodiment relates generally to a support structure for a liquid cargo storage tank.

2. Related Art

[0003] With the advent of liquefied gases, as an energy source, liquefied gas carriers are used to carry these liquefied gases in bulk from a production base to varying locations in order to use them as energy. The liquefied gas carriers carry the liquefied gases at very low temperatures below zero, whereby the volume of liquefied gases is reduced to thereby increase the amount of liquefied gases being carried.

[0004] A liquefied gas carrier includes a liquid cargo storage tank (independent tank) as a cargo that keeps and stores liquefied gases in a ship. The liquid cargo storage tank may include an insulation structure to prevent the ship body from being affected by the temperature of the liquefied gases.

[0005] A support structure is required between the liquid cargo storage tank and the ship. However, when the liquid cargo storage tank is loaded onto the ship, the support structure may fail to tightly support the liquid cargo storage tank due to deformations of the ship body and the liquid cargo storage tank, and an installation error may occur. Therefore, there is concern about stability issues relating to the support structure.

SUMMARY OF THE INVENTION

[0006] Various embodiments relate to a support structure for a liquid cargo storage tank that is adjustable in height in order to tightly contact a liquid cargo storage tank and a body of a ship.

[0007] A support structure for a liquid cargo storage tank according to an embodiment of the present invention may include an insulation unit provided at a liquid cargo storage tank, a support unit provided under the insulation unit and provided at a body of a ship, and a distance control unit provided between the insulation unit and the support unit and controlling a distance between the insulation unit and the support unit.

[0008] The distance control unit may include a first plate provided at the insulation unit and a second plate facing the first plate and provided at the support unit, and slope blocks inserted/withdrawn between the first plate and the second plate to control a distance between the first plate and the second plate.

[0009] The distance control unit may further include tensile members extending between the first plate and the second plate, and the slope blocks are penetrated by the tensile members so as to be guided by the tensile members, are sloped and gradually decrease in width toward one side.

[0010] The slope blocks may be arranged in pairs, and the distance between the first plate and the second plate may be controlled by a distance between a pair of the slope blocks.

[0011] The pair of the slope blocks may decrease in width toward a side where the pair of the slope blocks are close to each other, and the distance between the first plate and the second plate may be wider as the pair of the slope blocks are closer to each other.

[0012] Top portions of the slope blocks may be sloped downward toward one side, and first receiving grooves corresponding to an angle of inclination of the slope blocks may be formed in the first plate.

[0013] Lower portions of the slope block may be sloped upward toward one side, and second receiving grooves corresponding to an angle of inclination of the slope blocks may be formed in the second plate.

[0014] The distance control unit further may include fix blocks provided outside the slope blocks so that the tensile members pass through the fix blocks, and fixing members penetrated by the tensile members and received in the fix blocks to bind the tensile members to the fix blocks.

[0015] Holes including saw-toothed inner circumferential surfaces may be formed through centers of the fixing members so that the tensile members pass through the holes, and the fixing members may be shaped like a circular truncated cone and press, contact and fix the tensile members as the fixing members are inserted into the fix blocks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a front view illustrating a support structure for a liquid cargo storage tank according to an embodiment of the present invention;

FIG. 2 is a cross-sectional view illustrating the support structure for the liquid cargo storage tank;

FIG. 3 is a perspective view illustrating a top portion of a first plate in the support structure for the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 4 is a perspective view illustrating a bottom portion of the first plate in the support structure for the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 5 is a perspective view illustrating a top portion of a second plate in the support structure for a liquid

cargo storage tank according to an embodiment of the present invention;

FIG. 6 is a cross-sectional view illustrating a distance control unit to show a state in which the first plate and the second plate are separated from each other in the support structure for the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 7 is a cross-sectional view illustrating the distance control unit to show a state in which the first plate and the second plate meet in the support structure for the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 8 is a perspective view illustrating a portion of the distance control unit the support structure in the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 9 is a perspective view illustrating a slope block in the support structure for the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 10 is a cross-sectional view illustrating the slope block in the support structure for the liquid cargo storage tank according to an embodiment of the present invention;

FIG. 11 is a cross-sectional view illustrating a state in which a fixing member is provided in a fix block according to an embodiment of the present invention in the support structure for the liquid cargo storage tank according to an embodiment of the present invention; and

FIG. 12 is a side cross-sectional view illustrating the state in which the fixing members is provided on the fixe block the support structure for the liquid cargo storage tank according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0017] Hereinafter, various embodiments will be described in detail with reference to the accompanying drawings. The figures are provided to allow those having ordinary skill in the art to understand the scope of the embodiments of the disclosure. The present invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art.

[0018] FIG. 1 is a front view illustrating a support structure of a liquid cargo storage tank according to an embodiment of the present invention. FIG. 2 is a cross-sectional view illustrating the support structure of the liquid cargo storage tank according to an embodiment of the present invention.

[0019] As illustrated in FIGs. 1 and 2, a support structure 100 for a liquid cargo storage tank according to an embodiment of the present invention may include an insulation unit 110, a distance control unit 120 and a support unit 130.

[0020] The insulation unit 110 may reduce heat transfer so as to prevent a body of a ship (not illustrated) from being affected by the temperature of a liquid cargo in a liquid cargo storage tank (not illustrated). The insulation unit 110 may be provided under the liquid cargo storage tank and include a tank fixing plate 111 and a filler member 112.

[0021] The tank fixing plate 111 may contact and be connected to a lower portion of the liquid cargo storage tank. The tank fixing plate 111 may be subject to anodization. The tank fixing plate 111 may correspond to a bottom surface of the liquid cargo storage tank. For example, when the bottom surface of the liquid cargo storage tank is a flat horizontal surface, a top surface of the tank fixing plate 111 may be formed in a shape of a flat plate. On the other hand, when the bottom surface of the liquid cargo storage tank is corrugated, the top surface of the tank fixing plate 111 that contacts the bottom surface of the liquid cargo storage tank may be correspondingly corrugated.

[0022] The filler member 112 may primarily control the entire height of the support structure 100 for the liquid cargo storage tank. For example, the filler member 112 may include a resin block having a substantially rectangular parallelepiped shape, which is a polyhedron, or be formed of monomer cast nylon. The filler member 112 may be formed by filling resin, and a height of the filler member 112 may be determined by the distance between the liquid cargo storage tank and the body of the ship. For example, a top plate (not illustrated) may be provided under the filler member 112.

[0023] After the support structure 100 for the liquid cargo storage tank and the liquid cargo storage tank are provided on the ship, the distance control unit 120 may re-control the entire height of the support structure 100 for the liquid cargo storage tank in order to prevent the distance between the liquid cargo storage tank and the support structure 100 for the liquid cargo storage tank due to an installation error. The distance control unit 120 may be provided under the insulation unit 110. The distance control unit 120 may include a first plate 121, a second plate 122, tensile members 123, fix blocks 125 and fixing members 126. The distance control unit 120 may include slope blocks 124, which will be described below with reference to the drawings.

[0024] The support unit 130 may be provided under the distance control unit 120. The insulation unit 110, the distance control unit 120 and the support unit 130 may be arranged in a row. The support unit 130 may be connected to the distance control unit 120 by a bolt, be provided on the body of the ship and support the liquid cargo storage tank. The support unit 130 may include a support 131. The support 131 may include a plurality of vertical steel sheets which cross and are connected to each other in order to support the liquid cargo storage tank.

[0025] Hereinafter, the configuration and operations of the distance control unit 120 will be described.

[0026] FIG. 3 is a perspective view illustrating a top portion of the first plate in the support structure for the liquid cargo storage tank according to an embodiment of the present invention. FIG. 4 is a perspective view illustrating a bottom portion of the first plate in the support structure for the liquid cargo storage tank according to an embodiment of the present invention. FIG. 5 is a perspective view illustrating a top portion of the second plate in the support structure for the liquid cargo storage tank according to an embodiment of the present invention.

[0027] The first plate 121 and the second plate 122 are described with reference to FIGs. 3 and 5. The entire height of the support structure 100 for the liquid cargo storage tank may vary depending on whether the first plate 121 and the second plate 122 meet or are separated from each other, so that the first and second plates 121 and 122 may cause the liquid cargo storage tank and the insulation unit 110 to contact each other. The second plate 122 may face the first plate 121. First tensile member grooves 121A may be formed in the first plate 121 so that the tensile members 123 may be received in the first tensile member grooves. Second tensile member grooves 122A may be formed in the second plate 122 so that the tensile members 123 may be received in the second tensile member grooves 122A corresponding to the first tensile member grooves 121A. Therefore, the position of the tensile members 123 may be determined by providing the tensile members 123 between the first plate 121 and the second plate 122, and a direction in which the slope blocks 124 move inside may be guided in a longitudinal direction of the tensile members 123.

[0028] In addition, the first plate 121 may include first receiving grooves 121B corresponding to an angle of inclination of the slope blocks 124. Each of the first receiving grooves 121B may be formed at both ends of each of the first tensile member grooves 121A. The second plate 122 may include second receiving grooves 122B corresponding to the angle of inclination of the slope blocks 124. Each of the second receiving grooves 122B may be formed at both ends of each of the second tensile member grooves 122A. Therefore, the slope blocks 124 may be slidably provided between the first plate 121 and the second plate 122. For example, a sliding plate (not illustrated) may be provided over the first plate 121 so that the insulation unit 110 may slide against the distance control unit 120, depending on expansion and contraction of the liquid cargo storage tank.

[0029] Hereinafter, control of the distance between the plate 121 and the second plate 122 by the slope blocks 124 will be described with reference to the drawings.

[0030] FIG. 6 is a cross-sectional view illustrating the distance control unit to show a state in which the first plate and the second plate are separated from each other in the support structure for the liquid cargo storage tank according to an embodiment of the present invention. FIG. 7 is a cross-sectional view illustrating the distance control unit to show a state in which the first plate and the second plate meet in the support structure for a liquid cargo storage tank according to an embodiment of the present invention. FIG. 8 is a perspective view illustrating a portion of the distance control unit in the support structure for a liquid cargo storage tank according to an embodiment of the present invention.

[0031] FIG. 9 is a perspective view illustrating a slope block in the support structure for the liquid cargo storage tank according to an embodiment of the present invention. FIG. 10 is a cross-sectional view illustrating the slope block in the support structure for the liquid cargo storage tank according to an embodiment of the present invention. FIG. 11 is a cross-sectional view illustrating a state in which a fixing member is provided in a fix block according to an embodiment of the present invention in the support structure for a liquid cargo storage tank. FIG. 12 is a side cross-sectional view illustrating the state in which the fixing member is provided in the fix block according to an embodiment of the present invention in the support structure for a liquid cargo storage tank.

[0032] Referring to FIGS. 6 to 8, the tensile members 123 may be engaged with the first tensile member grooves 121A, shown in FIG. 4, and the second tensile member grooves 122A, shown in FIG. 5. The tensile members 123 may extend between the first plate 121 and the second plate 122 and protrude at both ends of the first plate 121. A pair of the slope blocks 124 may be formed at both ends of the tensile member 123 and may be inserted and withdrawn in the longitudinal direction of the tensile member 123. In other words, as illustrated in FIG. 7, when the first plate 121 and the second plate 122 meet, if the slope blocks 124 move inward, as illustrated in FIG. 6, the first plate 121 may slide against the slope blocks 124, so that the first plate 121 and the second plate 122 may be separated from each other.

[0033] As illustrated in FIGs. 8 and 10, since the tensile members 123 pass through the slope blocks 124, the slope blocks 124 may be guided by the tensile members 123. The slope blocks 124 may be sloped and decrease in width toward one side. The slope blocks 124 may be arranged in pair. As described above with reference to FIGs. 6 and 7, the distance between the first plate 121 and the second plate 122 may be controlled by the distance between the slope blocks 124. The width of the slope blocks 124 may decrease toward a side where a pair of the slope blocks 124 are close to each other. As the slope blocks 124 are closer to each other, the distance between the first plate 121 and the second plate 122 may increase.

[0034] For example, first through holes 124A may be formed in the slope blocks 124 so that the tensile members 123 may pass through the first through holes 124A. The slope blocks 124 may be sloped and decrease in width in a direction in which the tensile members 123 pass through the first through holes 124A and the slope blocks 124 move inside so that the distance between the first plate 121 and the second plate 122 may be control-

led. In other words, an upper portion of the slope block 124 may be sloped downward toward one side, and a lower portion of the slope blocks 124 may be sloped upward toward one side.

[0035] The slope blocks 124 may be formed between the first plate 121 and the second plate 122. When the first plate 121 is placed over the slope blocks 124, the first plate 121 may be supported by the second plate 122 and move inward along the tensile members 123 and slide against the first receiving grooves 121B and the second receiving grooves 122B.

[0036] When the first plate 121 and the second plate 122 meet, the height of the support structure 100 for a liquid cargo storage tank may be appropriately controlled by the filler member 112, and the liquid cargo storage tank and the support structure 100 for the liquid cargo storage tank may tightly contact each other. As a result, the slope blocks 124 may protrude outside the first plate 121 and the second plate 122 so that the first plate 121 and the second plate 122 may meet as illustrated in FIG. 7.

[0037] A gap may be formed between the support structure 100 for the liquid cargo storage tank and the liquid cargo storage tank due to improper filing of the filler member 112 or an installation error. In this case, as illustrated in FIG. 6, the slope blocks 124 may be completely inserted into the first plate 121 and the second plate 122 and push the first plate 121 upwards by a distance to which the slope blocks 124 move inside the first plate 121 and the second plate 122, so that the first plate 121 and the second plate 122 may be separated from each other. In this manner, the entire height of the distance control unit 120 may be controlled.

[0038] As illustrated in FIGs. 11 and 12, second through holes 125A may be formed in the fix blocks 125 and face the first through holes 124A. The tensile members 123 may be inserted into the second through holes 125A. The fix blocks 125 may be provided outside the slope blocks 124, and the fixing members 126 may be inserted into the fix blocks 125. An inner circumferential surface of the fix block 125 and an outer circumferential surface of the fixing member 126 may be threaded so that the fix block 125 and the fixing member 126 may be coupled to each other with a screw.

[0039] The fixing members 126 may bind the fix blocks 125 to the tensile members 123. The fixing members 126 may be shaped like a circular truncated cone so that the fixing members 126 may be inserted into the fix blocks 125. The fix blocks 125 may include grooves shaped like a circular truncated cone corresponding to the circular truncated cone shape of the fixing members 126. A hole may be formed through the center of the fixing member 126, and an inner circumferential surface of the hole may be saw-toothed and divided into pieces (three parts in the present embodiment). For example, since the fixing members 126 are inserted into the fix blocks 125, the fixing members 126 may press and fix the tensile members 123.

[0040] As described above, according to an embodiment of the present invention, the entire height of the support structure for a liquid cargo storage tank may be primarily controlled by the filler member 112, and subsequently, the height may be reset by the distance control unit 120. Therefore, the support structure may tightly contact the liquid cargo storage tank while the height of the support structure is provided at an appropriate height between the liquid cargo storage tank and the body of the ship. As a result, the support structure may stably support the liquid cargo storage tank.

[0041] According to an embodiment of the present invention, since an entire height of a support structure for a liquid cargo storage tank is primarily controlled by a filling member, and is subsequently reset by a distance control unit, the support structure may tightly contact the liquid cargo storage tank while the height of the support structure is provided at an appropriate height between the liquid cargo storage tank and the body of the ship. Therefore, the support structure may stably support the liquid cargo storage tank.

Claims

1. A support structure for a liquid cargo storage tank, comprising:

   an insulation unit provided at a liquid cargo storage tank;
   a support unit provided under the insulation unit and provided at a body of a ship; and
   a distance control unit provided between the insulation unit and the support unit and controlling a distance between the insulation unit and the support unit.

2. The support structure of claim 1, wherein the distance control unit comprises:

   a first plate provided at the insulation unit and a second plate facing the first plate and provided at the support unit; and
   slope blocks inserted/withdrawn between the first plate and the second plate to control a distance between the first plate and the second plate.

3. The support structure of claim 2, wherein the distance control unit further comprises tensile members extending between the first plate and the second plate, and
   the slope blocks are penetrated by the tensile members so as to be guided by the tensile members, are sloped and gradually decrease in width toward one side.

4. The support structure of claim 3, wherein the slope

blocks are arranged in pairs, and the distance between the first plate and the second plate is controlled by a distance between a pair of the slope blocks.

5. The support structure of claim 4, wherein the pair of the slope blocks decrease in width toward a side where the pair of the slope blocks are close to each other, and the distance between the first plate and the second plate is wider as the pair of the slope blocks are closer to each other.

6. The support structure of claim 5, wherein top portions of the slope blocks are sloped downward toward one side, and
first receiving grooves corresponding to an angle of inclination of the slope blocks are formed in the first plate.

7. The support structure of claim 5, wherein lower portions of the slope block are sloped upward toward one side, and
second receiving grooves corresponding to an angle of inclination of the slope blocks are formed in the second plate.

8. The support structure of claim 5, wherein the distance control unit further comprises:

fix blocks provided outside the slope blocks so that the tensile members pass through the fix blocks; and
fixing members penetrated by the tensile members and received in the fix blocks to bind the tensile members to the fix blocks.

9. The support structure of claim 8, wherein holes including saw-toothed inner circumferential surfaces are formed through centers of the fixing members so that the tensile members pass through the holes, and the fixing members are shaped like a circular truncated cone and press, contact and fix the tensile members as the fixing members are inserted into the fix blocks.

FIG. 1

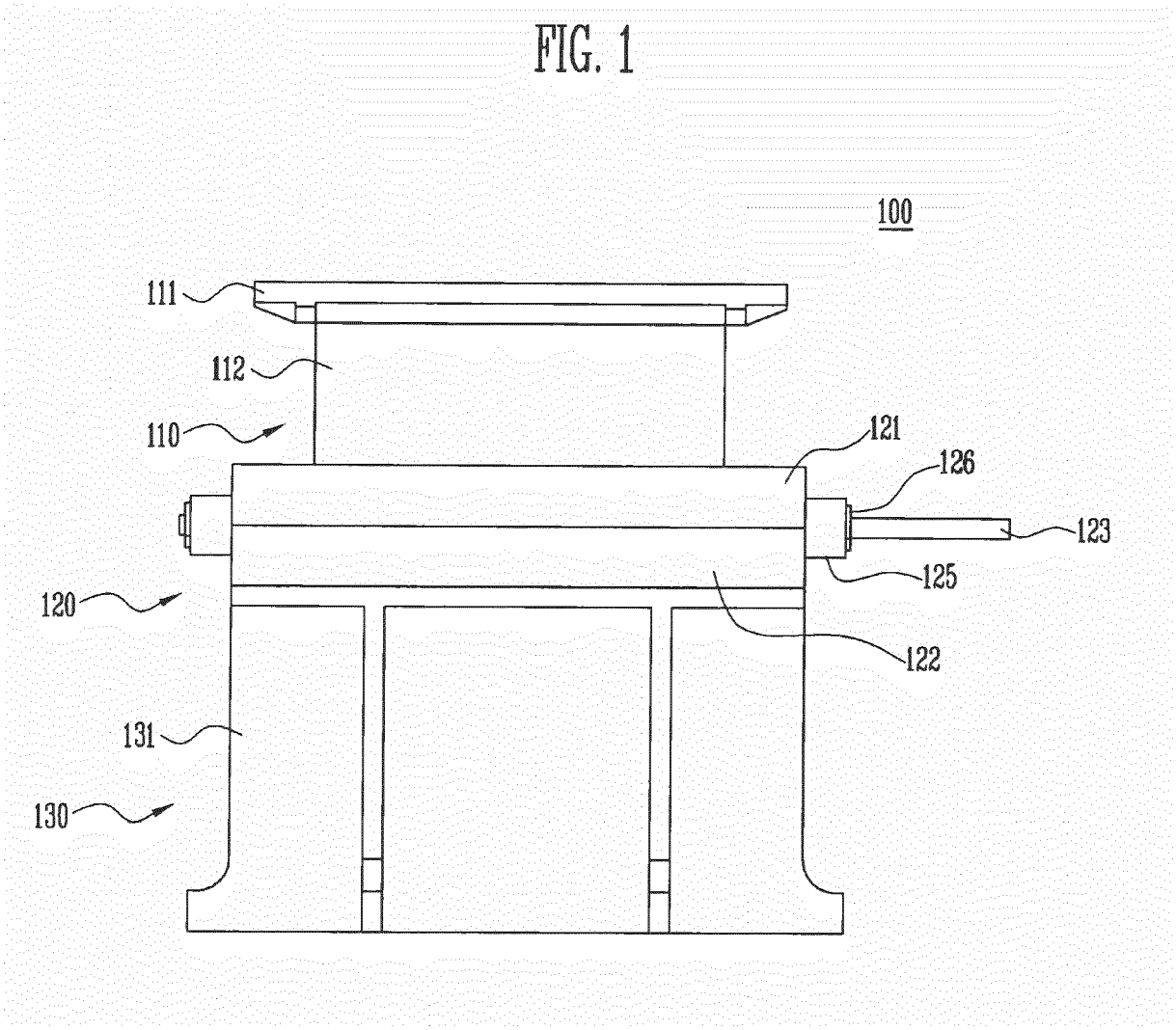


FIG. 2

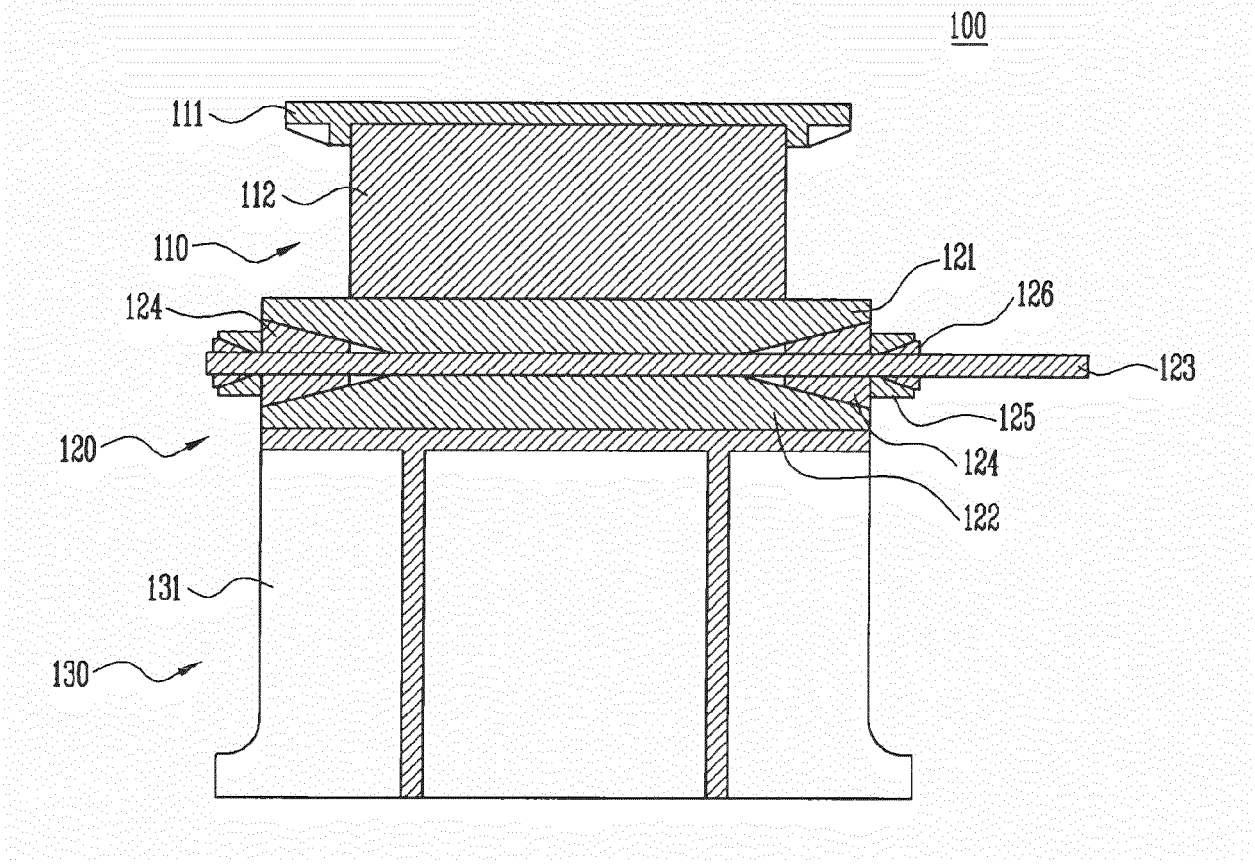


FIG. 3

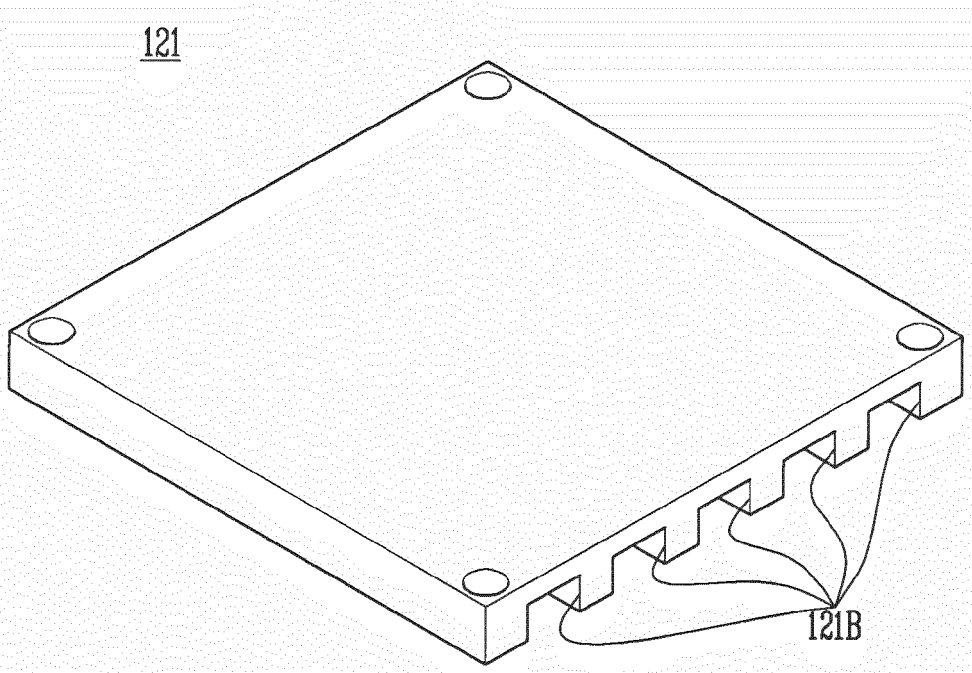


FIG. 4

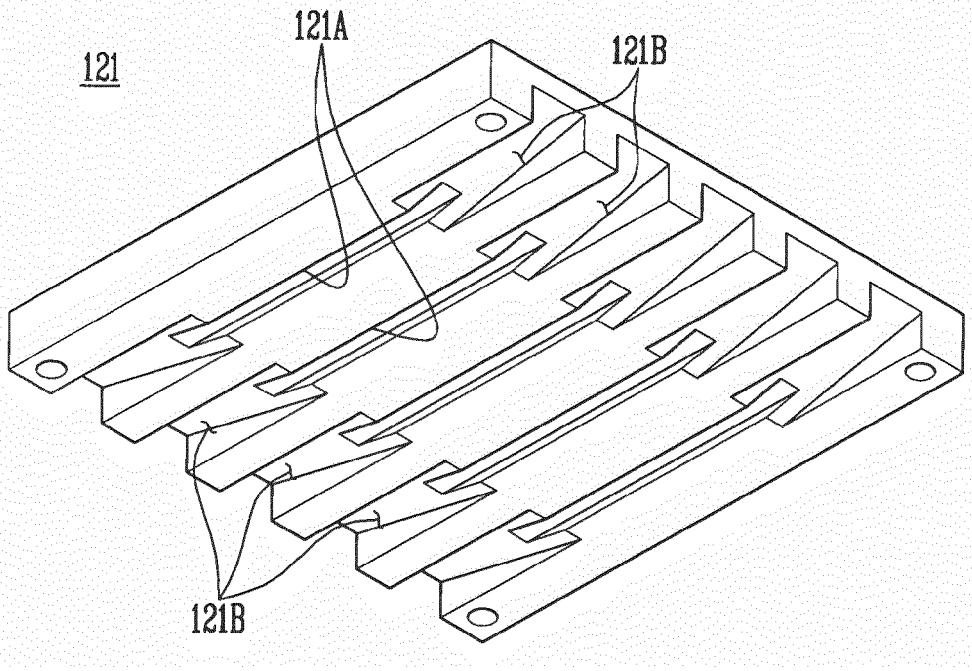


FIG. 5

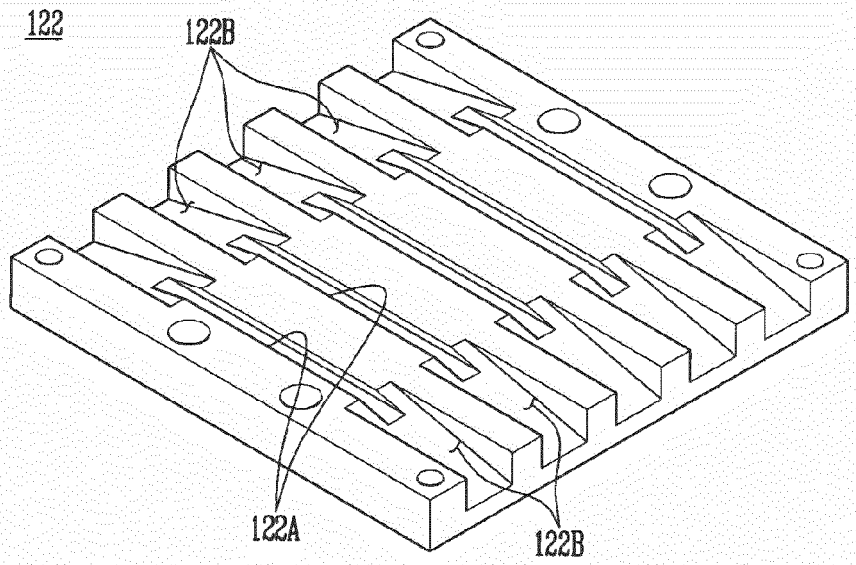


FIG. 6

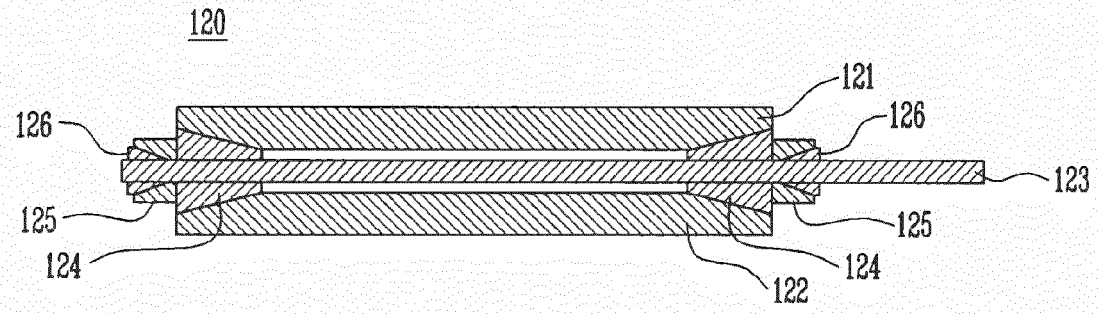


FIG. 7

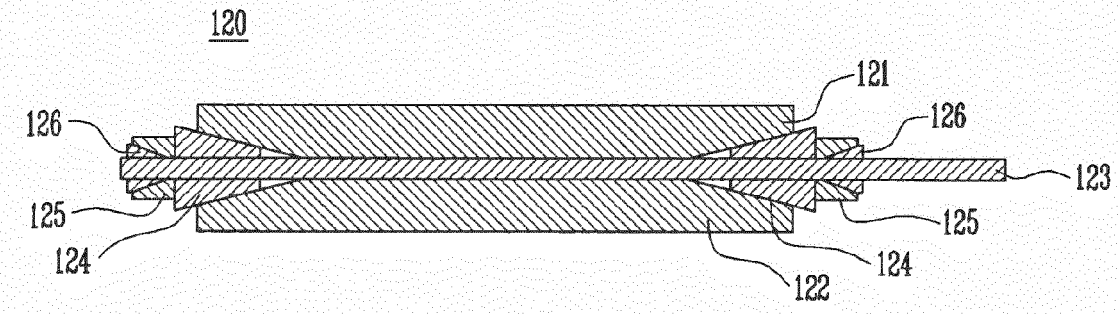


FIG. 8

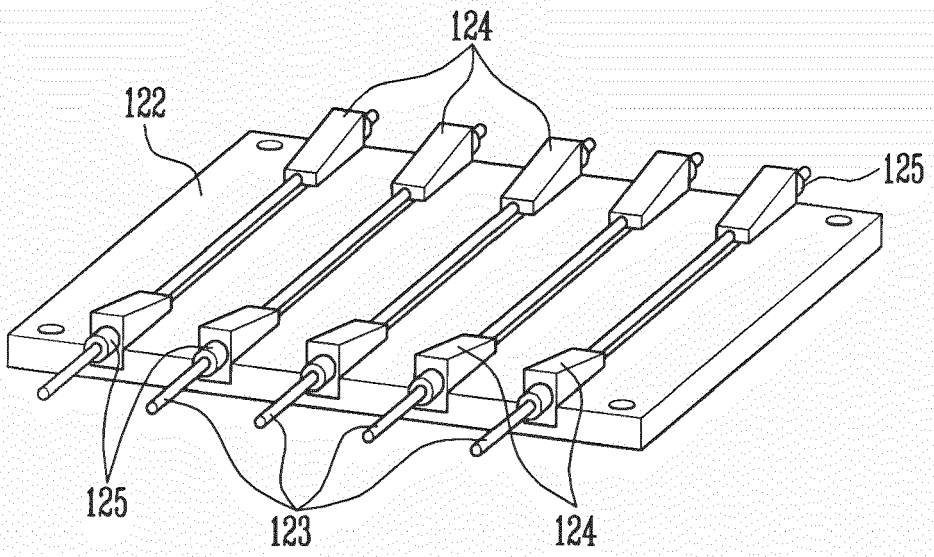


FIG. 9

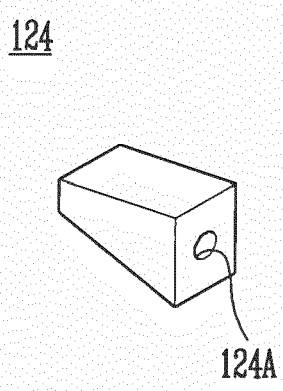


FIG. 10

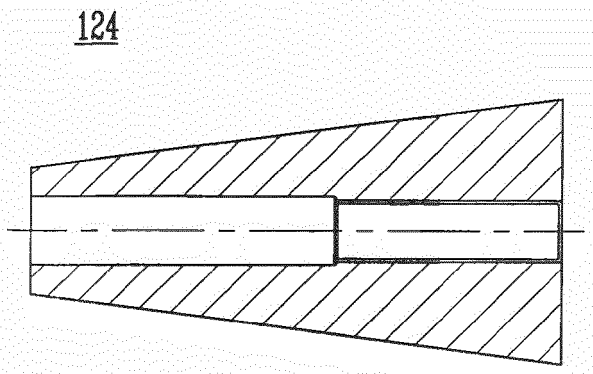


FIG. 11

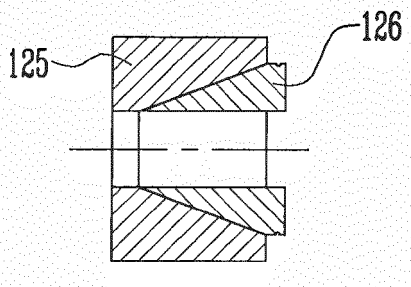
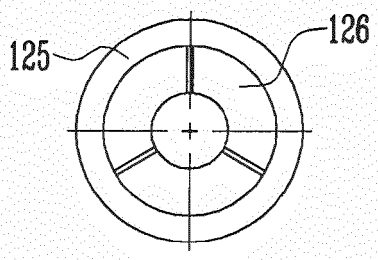


FIG. 12



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EUROPEAN SEARCH REPORT

Application Number
EP 14 15 5768

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X Y	US 3 071 094 A (RENE LCROUX) 1 January 1963 (1963-01-01) * column 3, line 1 - column 5, line 56 * -----	1 2-9	
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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	24 November 2014	Stängl, Gerhard

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 15 5768

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-11-2014

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REFERENCES CITED IN THE DESCRIPTION

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