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(54) Gangway cloth for railway vehicle and connecting gangway

(57) In a gangway cloth, there is provided a gangway cloth which is excellent in a stretching property, an elongation stress, a tear stress, a light-proofing and a durability, it is intended to improve a durability of a bottom fabric in the gangway cloth forming a connecting gangway for a railway vehicle, and it is intended to make a repairing operation easy and reduce a repairing cost in comparison with the conventional repair, in the case that the bottom cloth of the gangway cloth is broken. Accordingly, in the gangway cloth for the railway vehicle, cloth (2) constituted by synthetic fiber knitted fabric is provided in a stretchy sheet (1) by bonding only a string (3) in a surface portion thereof by an adhesive agent (5) having a stretching property, and a string surface of the cloth (2) constituted by the knitted fabric is coated by a soft type coating material (6) having a stretching property so as not to bury a stitch (4) of the cloth (2). Further, in the connecting gangway for the railway vehicle, there is provided an anti-sagging apparatus (26, 27) which arranges diaphragm frames (17) between front and rear gangway metal frames (15), cylindrically arranges gangway cloth (7) along an outer periphery of the diaphragm frames (17) and fastens front and rear ends of the gangway cloth (7) to both of the gangway metal frames (15), thereby holding a bottom cloth (7a) of the gangway cloth (7) without fixing it to the diaphragm frames (17). Further, in the connecting gangway for the railway vehicle, the diaphragm frames (17) are arranged between the front and rear gangway metal frames, the gangway cloth (7) is cylindrically arranged along the outer periphery of the diaphragm frames (17), the front and rear ends of the gangway cloth (7) are fastened to both of the gangway metal frames, the gangway cloth (7) is separately constructed by an upper gangway cloth (7e) constituted by a top cloth (7c) and side clothes (7d) and a lower gangway cloth (7g) constituted by the bottom cloth (7a) and side clothes (7f), lower portions of the side clothes in the upper gangway cloth (7e) and upper portions of the side clothes (7f) in the lower gangway cloth (7g) are overlapped with each other so as to be assembled, and the lower gangway cloth (7g) is structured such as to be capable of being separately taken out from the upper gangway cloth (7e).

FIG.1A

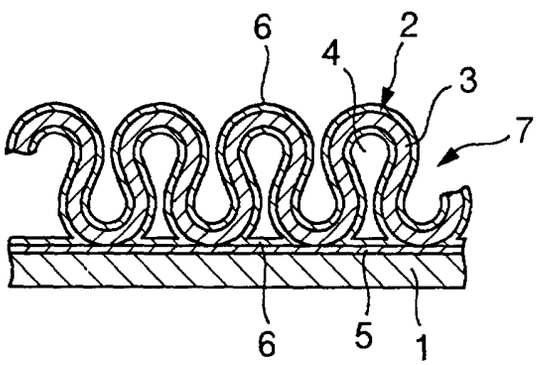

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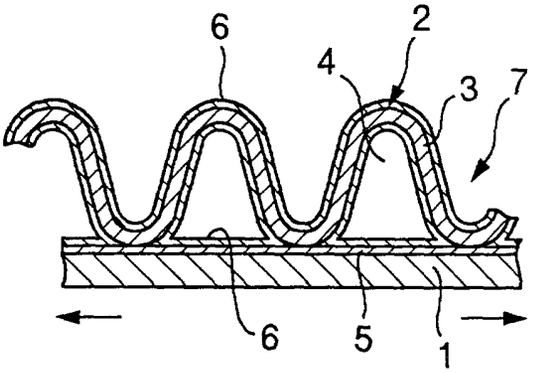
FIG.1B



Description

FIELD OF THE INVENTION

[0001] The present invention relates to gangway cloth for a railway vehicle and a connecting gangway.

DESCRIPTION OF RELATED ART

[0002] Conventionally, gangway cloth for a railway vehicle obtained by fixing a stretchable elastic body to stretchable cloth has disclosed, for example, in Japanese Unexamined Utility Model Examined Publication JP-Y2-07-38043.

[0003] In the conventional gangway cloth mentioned above, there has been a first problem that the gangway cloth has a stretching property, however, has low elongation stress and tear stress, and can not accommodate itself to a repeating displacement due to a long time traveling of a vehicle, whereby a tear or a breakage is easily generated in a connecting portion between a gangway metal frame and a diaphragm frame or the like and the gangway lacks durability.

[0004] Further, conventionally, in a connecting gangway for the railway vehicle, there has been a structure in which the gangway metal frames are arranged in front and at the rear thereof, the diaphragm frames are arranged between both of the gangway metal frames, cylindrical gangway cloth is arranged on an outer periphery thereof, and the gangway cloth is fixed to the both gangway metal frames and the diaphragm frames. Further, a bottom cloth of the gangway cloth is generally fixed to a bottom portion of the diaphragm frames by a cloth presser 35, and this kind of structure is disclosed, for example, in Japanese Patent Unexamined Publication JP-A-06-255482.

[0005] In the conventional structure in which the bottom cloth of the gangway cloth is fixed to the bottom portion of the diaphragm frames as mentioned above, in the case that the vehicles between which the connecting gangway is connected are relatively displaced in a lateral direction, the bottom cloth of the gangway is easily broken.

[0006] That is, since a placing interval between the diaphragm frames is generally narrow, the bottom cloth fixed to the diaphragm frames is restricted by the diaphragm frames so as to have a small freedom of deformation. Further, when the vehicles are relatively displaced in the lateral direction, a swing motion is increased in a lower portion of the connecting gangway and an impact load is largely applied to the bottom cloth of the gangway cloth due to expansion and contraction. Accordingly, there has been a second problem that a lot of fine wrinkles are generated on the bottom cloth as shown in Fig. 10, whereby the bottom cloth is early broken in comparison with an upper cloth of the gangway cloth so as to reduce a durability of the gangway cloth.

[0007] Further, when the vehicles are relatively displaced in the lateral direction, the swing motion is increased in the lower portion of the connecting gangway and the impact load due to the expansion and contraction applied to the bottom cloth of the gangway cloth is large, so that the bottom cloth is easy to be early broken in comparison with the cloth on the upper side. In the case that the bottom cloth is early broken, it can be considered to repair the broken portion by attaching a filler cloth to the broken portion by a sewing thread or an adhesive agent, however, in the case that the gangway cloth is formed by the stretch cloth, the tear of the stretch cloth is generated due to the sewing thread and a bonding property between the stretch cloth and the filler cloth is not sufficiently secured by the adhesive agent, so that it is hard to repair the broken portion. Accordingly, in the case that the bottom cloth is broken, it is necessary to resole whole of the gangway cloth, so that there has been a third problem that time and cost are increased for repairing.

SUMMARY OF THE INVENTION

[0008] With respect to the first problem, an object of the present invention is to provide gangway cloth in which elongation stress, tear stress and the like are high, and a durability is improved.

[0009] In order to solve the first problem mentioned above, in accordance with a first aspect of the present invention, there is provided gangway cloth for a railway vehicle comprising:

a stretchy sheet; and
a cloth made of a synthetic fiber knitted fabric,

wherein only a thread on a surface portion of the cloth is bonded to the sheet by an adhesive agent having an elongation property, and a thread surface of the cloth made of the knitted fabric is coated by a soft type coating material having an elongation property so as not to fill stitches of the cloth.

[0010] In the first aspect mentioned above, the sheet may be formed by a soft type synthetic resin or a synthetic rubber.

[0011] Further, in the aspects mentioned above, the thread of the cloth made of the knitted fabric may be formed by a fiber having high function and high performance.

[0012] Furthermore, in the aspects mentioned above, the thread of the cloth made of the knitted fabric may be formed by an aramid fiber.

[0013] Moreover, in the aspects mentioned above, the soft type coating material may be formed by a resin having a light-proofing and a coloring property or a rubber.

[0014] With respect to the second problem mentioned above, an object of the present invention is to increase a freedom of the bottom cloth of the gangway cloth without being restricted by the diaphragm frames, so as to increase a durability of the gangway cloth.

[0015] In order to solve the second problem mentioned above, in accordance with a second aspect of the present invention, there is provided a connecting gangway for a railway vehicle comprising:

diaphragm frames arranged between front and rear gangway metal frames;
a gangway cloth arranged along an outer periphery of the diaphragm frames so as to form a cylindrical shape; and
front and rear ends of said gangway cloth being fastened to both of the gangway metal frames,

wherein anti-sagging means for holding the bottom cloth of the gangway cloth without fixing it to the diaphragm frames is provided.

[0016] In the second aspect mentioned above, the anti-sagging means may be formed by arranging a band-like anti-sagging piece in a longitudinal direction of the connecting gangway in the bottom portion of the gangway cloth, adhering front and rear ends of the anti-sagging piece to both of the gangway metal frames, supporting the anti-sagging piece to the diaphragm frames without fixing it to the diaphragm frames, and fixing to a suitable position together with the bottom surface of the gangway cloth.

[0017] Further, in the second aspect mentioned above, the anti-sagging means may be formed by fastening one end of a hanging string to one side portion of the connecting gangway, fastening another end to another side portion of the connecting gangway, and passing a middle portion of the hanging string over an outer surface of the bottom cloth of the gangway cloth so as to receive the bottom cloth of the gangway cloth by the hanging string.

[0018] Furthermore, in the aspects mentioned above, the anti-sagging piece or the hanging string constituting the anti-sagging means may be formed by a stretch material.

[0019] Further, the other object of the present invention is to provide a connecting gangway for a railway vehicle which can solve the third problem mentioned above.

[0020] In order to solve the third problem mentioned above, in accordance with a third aspect of the present invention, there is provided a connecting gangway for a railway vehicle comprising:

diaphragm frames arranged between front and rear gangway metal frames;
gangway cloth arranged along an outer periphery of the diaphragm frames so as to form a cylindrical shape; and
front and rear ends of the gangway cloth being fastened to both of the gangway metal frames,

wherein the gangway cloth is separated into an upper gangway cloth constituted by a top cloth and a side cloth, and a lower gangway cloth constituted by a bottom cloth and a side cloth, a lower portion of the side cloth in the upper gangway cloth and an upper portion of the side cloth in the lower gangway cloth are overlapped with each other so as to be assembled, and the lower gangway cloth can be taken out from the upper gangway cloth in a separated manner.

[0021] In the third aspect mentioned above, the structure may be made such that the overlapped portion between the upper gangway cloth and the lower gangway cloth is fixed to the gangway metal frame and the diaphragm frames by pressing metals capable of being taken out from an outer side thereof, and the bottom cloth of the lower gangway cloth is not fixed to the diaphragm frames.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Figs. 1A and 1B are cross sectional views showing a gangway cloth for a railway vehicle in accordance with the present invention, in which Fig. 1A shows a contracted state and Fig. 1B shows an expanded state;
Fig. 2 is a side elevational view showing a first embodiment of a connecting gangway in which the gangway cloth shown in Fig. 1 is used;
Fig. 3 is a bottom elevational view as seen from a line III-III in the connecting gangway in Fig. 2;
Fig. 4 is a cross sectional view of the connecting gangway in Fig. 2, in which a right half corresponds to a cross sectional view along a line IVA-IVA in Fig. 2 and a left half corresponds to a cross sectional view along a line IVB-IVB in Fig. 2;
Fig. 5 is a cross sectional view along a line V-V in Fig. 4;
Fig. 6 is a cross sectional view along a line VI-VI in Fig. 4;
Fig. 7 is a cross sectional view along a line VII-VII in Fig. 4;
Fig. 8 is a cross sectional view along a line VIII-VIII in Fig. 4;
Fig. 9 is a bottom elevational view of the connecting gangway in Fig. 2, showing a state that vehicles are relatively displaced in a lateral direction;
Fig. 10 is a bottom elevational view of a conventional connecting gangway for comparing with the state in Fig. 9;
Fig. 11 is a cross sectional view showing a second embodiment of the connecting gangway in which the gangway cloth shown in Fig. 1 in accordance with the present invention is used, in which a right half is a cross sectional view corresponding to the cross section along the line IVA-IVA in Fig. 2 and a left half is a cross sectional view corresponding to the cross section along the line IVB-IVB in Fig. 2;
Fig. 12 is a cross sectional view showing a state that

a lower gangway cloth of the gangway cloth is separated in the connecting gangway shown in Fig. 11;
Fig. 13 is a side elevational view of a lower portion of the connecting gangway in Fig. 11;
Fig. 14 is a side elevational view of a lower portion of a connecting gangway in accordance with the present invention, showing a third embodiment of the connecting gangway in which the gangway cloth in Fig. 1 is used;
Fig. 15 is a bottom elevational view of the connecting gangway in Fig. 14;
Fig. 16 is a side elevational view showing a fourth embodiment in which the connecting gangway shown in Figs. 2 to 9 is applied to a two pieces type gangway;
Fig. 17 is a front elevational view of one of the connecting gangway in Fig. 16; and
Fig. 18 is a side elevational view showing a state that the connecting gangway is separated in the two pieces type gangway in Fig. 16.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] A description will be given of embodiments in accordance with the present invention with reference to the accompanying drawings.

[0024] Figs. 1A and 1B are cross sectional views of gangway cloth constituting a connecting gangway for a railway vehicle, and in the drawing, reference numeral 1 denotes a stretchy sheet. The sheet 1 is formed in a plate shape by a stretchable material such as a soft synthetic resin, a synthetic rubber or the like. The sheet 1 can be expanded and contracted in all the directions thereof.

[0025] Reference numeral 2 denotes a cloth structured such as to be stretchable. The cloth 2 is formed by a knitted fabric in which string 3 is knitted in a loop shape and stitches 4 are connected, and the structure is made such that in the case that a load is applied to the cloth 2 in all the directions, the string 3 in the loop portion is deformed as shown in Fig. 1B to expand the cloth 2, and when the load mentioned above is lost, the string 3 is returned to the loop shape as shown in Fig. 1A to contract the cloth 2. In this case, in Figs. 1A and 1B, an actual cross sectional shape of the knitted fabric cloth 2 is omitted or briefly described, and only one loop-like fiber is expressed.

[0026] The string 3 of the cloth 2 employs a synthetic fiber. Further, as the synthetic fiber, a vinylon fiber, a nylon fiber, a polyester fiber or a polyamide fiber may be preferably employed. Further, it is more preferable to employ a fiber having a high function and a high performance such as para-group aramid fiber, meta-group aramid fiber, all aromatic polyester fiber, high intensity polyethylene fiber or the like. In this case, the high function fiber means a fiber which is excellent in a particular function such as durability, a chemical resistance, an optical property or an electrical property. Further, the high performance fiber means a fiber which is significantly excellent in a strength and a degree of elasticity in comparison with a normal synthetic fiber, in this case, generally, the strength is equal to or more than 20 g/d and the degree of elasticity is equal to or more than 500 g/d.

[0027] Further, a soft type adhesive agent 5 having a stretching property is applied onto a surface of the sheet 1 mentioned above, and the cloth 2 mentioned above is bonded and fixed by the adhesive agent 5 so as to form a complex sheet. As the adhesive agent 5, for example, a rubber type adhesive agent having a stretching property is used.

[0028] Further, in this bonding operation, only the string 3 on the surface portion in the bonding side of the cloth constituted by the knitted fabric is bonded.

[0029] Next, a soft type coating material is applied onto the surface of the string 3 of the cloth 2 in accordance with coating or the like so as not to bury the stitch 4 formed by the string 3, whereby a coated film 6 is formed on the surface of the string 3. As this soft type coating material, it is possible to employ a soft type rubber or a soft type synthetic resin having elasticity (a stretching property), a light-proofing and a coloring property.

[0030] Since the coated film 6 is attached without burying the stitch 4 as mentioned above, a stretching effect of the sheet 1 and the cloth 2 is not obstructed. Further, a function and a performance of the high function fiber and the high performance fiber are improved by the coated film 6, and in the fiber made of a material being inferior in view of a light-proofing, abrasion resistance and resistance to fatigue from folding, the coated film 6 reinforces these properties. Further, in the aramid fiber which is hard to be colored, it is possible to color the gangway cloth in a desired color by forming the coated film 6 with the colored coating material. Accordingly, it is possible to intend to improve a tensile strength, a light-proofing (a weather resistance) and a coloring property of the gangway cloth by the coated film 6.

[0031] The gangway cloth for the railway vehicle 7 is formed in accordance with the structure mentioned above.

[0032] Figs. 2 to 9 show a first embodiment of a connecting gangway for a railway vehicle which uses the gangway cloth 7 mentioned above and is provided with the anti-sagging mechanism of the lower gangway cloth according to the present invention.

[0033] Fig. 2 is a side elevational view of a structure in which the connecting gangway is provided between the vehicles, and Fig. 3 is a bottom elevational view thereof. The structure is made such that gangway seats 12 and 13 are fixed to surfaces 10a and 11a of end framings of the connected vehicle bodies 10 and 11, and gangway metal frames 15 and 16 provided in front and rear ends (hereinafter, it is assumed that a passage direction is a longitudinal direction) of the connecting gangway 14 are detachably fixed to the gangway seats 12 and 13.

[0034] A description will be given in detail of the structure of the connecting gangway 14 with reference to Figs. 4 to 9. In this case, a right half in Fig. 4 corresponds to a cross sectional view along a line IVA-IVA in Fig. 2 and a left half corresponds to a cross sectional view along a line IVB-IVB in Fig. 2. Further, in order to clarify the structure of the parts, the parts are described in an exploded manner. Fig. 5 is a cross sectional view along a line V-V in Fig. 4, Fig. 6 is a cross sectional view along a line VI-VI in Fig. 4, Fig. 7 is a cross sectional view along a line VII-VII in Fig. 4, Fig. 8 is a cross sectional view along a line VIII-VIII in Fig. 4, and Fig. 9 is a bottom elevational view of a state that the gangway is deformed when the vehicles are relatively displaced in a lateral direction from the state in Fig. 3.

[0035] The gangway cloth 7 constituting the connecting gangway 14 employs the structure shown in Figs. 1A and 1B, and is structured such as to be arranged in shape of almost square column as shown in Fig. 4 along two gangway metal frames 15 and 16 formed in substantially a square shape and an outer periphery of a predetermined number of diaphragm frames 17 formed in substantially a square shape and arranged between the gangway metal frames 15 and 16, thereby covering an outer periphery of a passage 18 as shown in Fig. 4. The gangway cloth 7 is fixed to the gangway metal frames 15 and 16 by holding the gangway cloth 7 between the gangway metal frames 15 and 16 and a pressing metal 19 and fastening them by a small screw 20 and a nut 21, as shown in Figs. 5 to 8. Further, the gangway cloth 7 is fixed to the diaphragm frame 17 by holding the gangway cloth 7 between the diaphragm frame 17 and pressing metals 22a and 22b and fastening them by a blind rivet 23 or the like, as shown in Figs. 5 to 7.

[0036] Side clothes 24 are arranged on outer surfaces of both sides in a lateral direction (a direction perpendicular to the passage direction) of the gangway cloth 7, as shown in Fig. 4, and the side clothes 24 are fixed to the gangway metal frames 15 and 16 and the diaphragm frame 17 together with the gangway cloth 7 by the pressing metals 19 and 22b, the small screw 20, the nut 21 and the blind rivet 23, as shown in Fig. 6.

[0037] An upper outer surface of the gangway cloth 7 is covered by a covering cloth 25 as shown in Figs. 4 and 5, and both sides of the covering cloth 25 come down to the outer surfaces of the side clothes 24 as shown in Fig. 4, and both side portions thereof are overlapped with upper portions of the side clothes 24 and pressed by the pressing metal 22b. Further, front and rear end portions of the covering cloth 25 are fixed to the gangway metal frames 15 and 16 by the pressing metal 19, the small screw 20 and the nut 21 as shown in Fig. 5.

[0038] Next, a description will be given of a bottom portion structure of the connecting gangway 14 mentioned above.

[0039] An upper anti-sagging piece 26 is arranged in a longitudinal direction of the gangway on an upper surface (an inner surface side) of a center portion of the bottom cloth 7a in the gangway cloth 7 (a center portion in a lateral direction of the gangway), as shown in Fig. 7, and a lower anti-sagging piece 27 is arranged in a longitudinal direction of the gangway on a lower surface (an outer side) thereof. Both of the anti-sagging pieces 26 and 27 are formed in shape of belt having a small width so as to be positioned about the center of the gangway, and are made of a stretchable material.

[0040] The upper anti-sagging piece 26 mentioned above is provided in a tensional manner, as shown in Fig. 7, in a state that front and rear ends thereof are fixed to the gangway metal frames 15 and 16 by a fixing plate 28, a screw 29 and a nut 30. Further, a middle of the upper anti-sagging piece 26 is supported to the diaphragm frame 17 through the upper surface of the diaphragm frame 17 in the bottom side, and is further connected to the bottom cloth 7a in the gangway cloth 7 by a pressing metal 31, a screw 32 and a nut 33. The upper anti-sagging piece 26 and the diaphragm frame 17 are not fixed to each other, and the upper anti-sagging piece 26 is slidably supported to the upper surface of the diaphragm frame 17. As mentioned above, since the bottom cloth 7a of the gangway cloth 7 is connected to the upper anti-sagging piece 26 which is provided between both of the gangway metal frames 15 and 16 in the tensional manner and supported by the diaphragm frame 17, it is possible to prevent the bottom cloth 7a of the gangway cloth 7 from sagging.

[0041] The lower anti-sagging piece 27 mentioned above is provided in a tensional manner, as shown in Fig. 7, in a state that front and rear ends thereof are fixed to the gangway metal frames 15 and 16 by the pressing metal 19, the screw 29 and the nut 30, and the bottom cloth 7a of the gangway cloth 7 is fixed to a middle of the lower anti-sagging piece 27 by a pressing metal 51, the screw 32 and the nut 33. Accordingly, it is also possible to prevent the bottom cloth 7a of the gangway cloth 7 from sagging by the lower anti-sagging piece 27.

[0042] Generally, since the bottom cloth 7a of the gangway cloth 7 tends to sag due to an empty weight thereof as shown by a dotted line 7b in Fig. 4, it is possible to prevent the bottom cloth 7a of the gangway cloth 7 from interfering with a connecting device 36 by preventing the sagging by the anti-sagging pieces 26 and 27 as mentioned above, and it is possible to obtain a structure suitable for a vehicle which has no sufficient space between the connecting device 36 and a floor 18a of the passage 18.

[0043] In this case, the front and rear ends of the bottom cloth 7a in the gangway cloth 7 are fixed to the front and rear gangway metal frames 15 and 16 by the pressing metal 19, the fixing plate 28, the screw 29 and the nut 30.

[0044] Since the band-like anti-sagging pieces 26 and 27 are provided only on the center portion in the lateral direction of the bottom cloth 7a in the gangway cloth 7, in the case that the lateral displacement is generated

between the vehicles 10 and 11, as shown in Fig. 9, the bottom cloth 7a of the gangway cloth 7 can deform with sufficient margin in the freely deformable wide area portion 7b except the gangway metal frames 15 and 16 and the band-like anti-sagging pieces 26 and 27.

[0045] That is, as shown in Fig. 10, if the bottom cloth 7a of the gangway cloth 7 is fixed to the diaphragm frame 17 along the diaphragm frame 17 by the cloth presser 35 in the same manner as that of the upper cloth presser 22a of the gangway, the bottom cloth 7a is fixed with a narrow gap by a plurality of diaphragm frames 17 arranged in parallel with a narrow gap between the gangway metal frames 15 and 16, so that a freedom of the bottom cloth 7a becomes significantly small.

[0046] Generally, since the impact due to the vehicle swing at a time when the vehicles are relatively displaced in the lateral direction is greater in the bottom portion side, an impact load due to the expansion and contraction applied to the bottom cloth 7a of the gangway cloth 7 is greater, so that the bottom cloth is early broken in comparison with the upper portion of the gangway cloth.

[0047] Accordingly, in the structure in which the freedom of the bottom cloth 7a is significantly small as shown in Fig. 10, the gap is narrow and a lot of wrinkles 37 are generated as shown in Fig. 10, so that the bottom cloth 7a is early broken and the load due to the expansion and contraction of the bottom cloth 7a is largely applied to a combined portion between the diaphragm fame 17 and the pressing metal 25, whereby the bottom cloth 7a tends to be broken at this portion. However, in the structure in which the freedom of the bottom cloth 7a in the gangway cloth 7 is increased as the present embodiment, it is possible to reduce the stress applied to the bottom cloth 7a in the lateral displacement of the vehicles, reduce the breakage as mentioned above, and extend a service life of the gangway cloth 7.

[0048] Figs. 11 to 13 shows a second embodiment of a connecting gangway using the gangway cloth 7 shown in Figs. 1A and 1B, which is modified from the embodiment of the connecting gangway shown in Figs. 2 to 9.

[0049] A right half in Fig. 11 is a cross sectional view corresponding to the cross section along the line IVA-IVA in Fig. 2 and a left half is a cross sectional view corresponding to the cross section along the line IVB-IVB in Fig. 2. Further, in order to clarify the structure of the parts, the parts are described in an exploded manner.

[0050] The gangway cloth 7 in a connecting gangway 14A shown in Fig. 11 also uses the gangway having the structure shown in Fig. 1. The gangway cloth 7 is structured such that both side lower portions of the gangway cloth 7 formed in shape of almost square column shown in Fig. 4 are separated and the separated portions are overlapped. That is, the gangway cloth 7 is constituted by an upper gangway cloth 7e comprising a top cloth 7c and both side clothes 7d, and a lower gangway cloth 7g comprising the bottom cloth 7a and both side clothes 7f standing up from both sides of the bottom cloth 7a, and both side clothes 7f of the lower gangway cloth 7g are overlapped with outer surfaces of lower portions 7h of both side clothes 7d in the upper gangway cloth 7e. These overlapped portions are indicated by reference symbol W.

[0051] Further, the pressing metal 19 shown in Figs. 4 to 8 is modified to be constituted, as shown in right halves in Figs. 11 and 12 and Fig. 13, by an overlapped portion pressing metal 19a positioned outside the overlapped portion W between the lower portion of the upper gangway cloth 7e and the upper portion of the lower gangway cloth 7g, an upper pressing metal 19b separated with the overlapped portion pressing metal 19a, and a lower pressing metal 19c separated with the overlapped portion pressing metal 19a. Then, both of side clothes 7f of the lower gangway cloth 7g are overlapped on the outer surfaces of the lower portions 7h of both of the side clothes 7d in the upper gangway cloth 7e, the side clothes 24 are overlapped on the outer surfaces of the side clothes 7f of the lower gangway cloth 7g, the overlapping pressing metals 19a are overlapped on the outer surfaces of the side clothes 24 and these are detachably fixed to the gangway metal frames 15 and 16 by fastening them with the small screws 20 and the nuts 21 in the same manner as that shown in Fig. 6.

[0052] Further, the gangway cloth or the like is fastened to the diaphragm frame 17 by separately constructing the pressing metal by the pressing metal 22a in the upper surface side, the pressing metal 22b in the side portion and the overlapping pressing metal 22c for pressing the overlapped portion W between the lower portions 7h of both of the side clothes 7d and both of the side clothes 7f of the lower gangway cloth 7g, as shown in Fig. 11, the left half in Fig. 12 and Fig. 13, and fastening them to the diaphragm frame 17 by the blind rivet 23, as shown in Figs. 5 and 6.

[0053] Since the other structure is the same as that of the embodiment shown in Figs. 2 to 9, the same reference numerals are attached to the same elements as those mentioned above, and a description thereof will be omitted.

[0054] In the embodiment in Figs. 11 to 13, in the case of traveling in a state that the connecting gangway is connected to the vehicle and a damage such as a breakage or the like is generated in the lower gangway cloth 7g due to an aged deterioration, the damage can be repaired in accordance with the following procedure.

[0055] At first, the overlapping pressing metals 19a and 22c and the lower pressing metal 19c are taken out from the gangway metal frames 15 and 16 by removing the small screws 20 fastening them, and the upper anti-sagging piece 26 is taken out from the diaphragm frame 17 by removing the fixing plate 28, the screw 29, the nut 30, the screw 32 and the nut 33 shown in Fig. 7.

[0056] Accordingly, as shown in Fig. 12, it is possible to separately take out the lower gangway cloth 7g from the upper gangway cloth 7e. Then, a new lower gang-

way cloth 7g is assembled in a reverse procedure to the procedure mentioned above in place of the removed lower gangway cloth 7g.

[0057] Since a connecting and separating operation in the overlapped portion W between the upper gangway cloth 7e and the lower gangway cloth 7g can be performed on the basis of a fixing and removing operation of the screw, the nut or the like to the overlapping pressing metals 19a and 22c and the anti-sagging pieces 26 and 27, it is possible to significantly easily repair the bottom cloth for a short time in comparison with the structure in which the gangway cloth is integral all around the periphery as shown in Fig. 4.

[0058] Further, in a state that the lower gangway cloth 7g is assembled in the upper gangway cloth 7e in the manner mentioned above, a rainwater slides down along the outer side surface of the side cloth 24 through the surface of the covering cloth 25, so that the rainwater does not enter within the lower gangway cloth 7g from the overlapped portion W and an excellent submersion prevention can be achieved by a simple structure which requires no bonding.

[0059] Figs. 14 and 15 show a third embodiment of a connecting gangway for a vehicle using the gangway cloth 7 shown in Figs. 1A and 1B and provided with an anti-sagging mechanism which is different from the embodiment mentioned above.

[0060] A gangway cloth 7 of a connecting gangway 14B in accordance with the third embodiment is formed by the cloth having the structure shown in Figs. 1A and 1B, and the gangway cloth 7 is provided and fixed between the gangway metal frames 15 and 16 in the same manner as that of the first embodiment shown in Figs. 2 to 9. Further, the gangway cloth 7 is fixed to the diaphragm frame 17 by the pressing metal 22a on the upper surface side and the pressing metal 22b on the side portion. In this case, there is no anti-sagging pieces 26 and 27 shown in the first embodiment mentioned above. Further, the bottom cloth 7a in the gangway cloth 7 and the cloth which is positioned slightly above from the bottom cloth 7a at both sides are simply in contact with the respective diaphragm frames 17 without being mechanically connected thereto.

[0061] Latches 40a and 40b are protruded from the respective side surfaces of both of the gangway metal frames 15 and 16 and the pressing metal 22b in the side portion.

[0062] One end of a hanging string 41 made of an elastic material is clasped with one latch 40a in one (front) gangway metal frame 15, and this hanging string 41 comes downward from the latch 40a along one side portion of the gangway cloth 7, passes through the middle of the gangway metal frame 15 and the diaphragm frame 17 on an outer bottom surface of the bottom cloth 7a in the gangway cloth 7 and comes upward along another side portion of the gangway cloth 7 so as to clasp an end portion thereof with another latch 40b, thereby being arranged in shape of U around both of the latches 40a and 40b. Further, the upper portion of the hanging string 41 is fastened to the gangway metal frames 15 and 16 by the pressing plate 42. Further, the hanging string 41 is, as shown in Fig. 14, provided in a tensional manner so as to always apply a tensile force for hanging upward the bottom cloth 7a of the gangway cloth 7.

[0063] Further, the same hanging string 41 as that mentioned above is arranged in shape of U between one latch 40a and another latch 40b of the pressing metal 22b in the diaphragm frame 17 in the same manner as that mentioned above, and bottom cloth 7a of the gangway cloth 7 is hanged upward by the hanging string 41. In this case, between the adjacent diaphragm frames 17, the hanging string 41 passes on the outer bottom surface of the bottom cloth 7a in the middle of the adjacent diaphragm frames 17.

[0064] The hanging string 41 is simply in contact with the gangway cloth 7 in the other portions than the latches 40a and 40b and the pressing plate 42 and is not fixed to the gangway cloth 7.

[0065] In addition, the portions which are not indicated in Figs. 14 and 15 have the same structure as that of the first embodiment mentioned above.

[0066] In accordance with the third embodiment, the bottom cloth 7a of the gangway cloth 7 is hanged and held by the hanging string 41 so as to prevent the bottom cloth 7a from hanging down and interfering with the connecting device 36. Further, since the bottom cloth 7a of the gangway cloth 7 is only in contact with the diaphragm frame 17 without mechanical connection, in the case that the vehicles are relatively displaced in the lateral direction as shown in Fig. 9 mentioned above, the bottom cloth 7a of the gangway cloth 7 slides against the diaphragm frame 17 without stopping the movement by the diaphragm frame 17, thereby being freely deformed. Accordingly, in accordance with the present third embodiment, it is also possible to obtain the same effect as that described as to the embodiment in Fig. 9 and it is possible to improve a durability of the gangway cloth 7.

[0067] In this case, the third embodiment can be applied to the type in which the gangway cloth 7 is separated into the upper and lower portions as described in the second embodiment.

[0068] Further, the gangway cloth 7 in Figs. 1A and 1B, the first embodiment shown in Figs. 2 to 9, the second embodiment shown in Figs. 11 to 13 and the third embodiment shown in Figs. 14 to 15 can be also applied to a two pieces type gangway as shown in Figs. 16 to 18.

[0069] Figs. 16 to 18 shows a fourth embodiment structured such that two connecting gangways 14 in accordance with the first embodiment are used so as to constitute a two pieces type gangway 14C. The fourth embodiment is structured such that one gangway metal frame 15 of one connecting gangway 14 is fixed to a surface 10a of end framing of one vehicle body 10, one gangway metal frame 15 of another connecting gangway 14 is fixed to a surface 11a of end framing of another

vehicle body 11, and respective another gangway metal frames 16 and 16 (middle metal frames) of both of the connecting gangways 14 and 14 are bonded to each other so as to be connected in such a manner as to be capable of freely separated by fastening metals 50 and 51. Fig. 18 shows a state that both of the connecting gangways 14 and 14 are separated.

[0070] In accordance with the fourth embodiment, it is also possible to obtain the same operation and effect as those of the first embodiment mentioned above.

[0071] By respectively setting both of the connecting gangways 14 and 14 in the fourth embodiment to the connecting gangway 14A in accordance with the second embodiment or the connecting gangway 14B in accordance with the third embodiment, it is also possible to obtain the same operation and effect as those of the second embodiment or the third embodiment in the two pieces type gangway.

[0072] In this case, in the connecting gangway in accordance with the first embodiment shown in Figs. 2 to 9, the connecting gangway in accordance with the second embodiment shown in Figs. 11 to 13, the connecting gangway in accordance with the third embodiment shown in Figs. 14 and 15 and the connecting gangway shown in Figs. 16 to 18, the gangway may be formed by the other gangway cloth than the gangway cloth in accordance with the present invention shown in Figs. 1A and 1B.

[0073] In accordance with the first aspect of the present invention, since each of the constituting elements of the gangway cloth has a stretching property and the coating material is provided so as to bury the stretch of the cloth constituted by the knitted fabric, it is possible to construct the gangway cloth excellent in a stretching property. Further, a durability of the string constituted by the knitted fabric can be added and increased by the coating material.

[0074] Further, by using the high function and high performance fiber for the string of the cloth constituted by the knitted fabric, it is possible to constitute the gangway cloth having a high tensile strength and a high tear strength. Accordingly, it is possible to provide the gangway cloth having a high elongation stress and high tear stress and an improved durability in comparison with the conventional gangway cloth mentioned above.

[0075] Further, by employing the resin having a light-proofing and a coloring property or the rubber for the coating material covering the surface of the cloth constituted by the knitted fabric, in the case of using an aramid fiber lacking the light-proofing and the coloring property for the string of the cloth constituted by the knitted fabric, it is possible to compensate for the light-proofing and the coloring property.

[0076] Further, in accordance with the second aspect of the present invention, since the bottom cloth of the gangway cloth is not fixed to the diaphragm frames, a freedom of deformation of the bottom cloth is increased in comparison with the conventional structure in which the bottom cloth is fixed to the diaphragm frames, and the bottom cloth can deform with sufficient margin in a wide region between both of the metal frames, so that it is possible to reduce a stress applied to the bottom cloth of the gangway cloth at a time when the vehicles are relatively displaced in the lateral direction or the like, and it is possible to improve a durability in comparison with the conventional structure in which the bottom cloth is fixed to the diaphragm frames.

[0077] Further, since the bottom cloth of the gangway cloth is held by the anti-sagging means, it is possible to prevent the bottom cloth from sagging even if the bottom cloth is not fixed to the diaphragm frame, and the bottom cloth does not interfer with the connecting device or the like so as not to be broken.

[0078] Further, in accordance with the third aspect of the present invention, in the case that the bottom cloth of the gangway cloth is broken, a repair can be performed by replacing only the lower gangway cloth without taking out the upper gangway cloth, and the repairing operation can be easily performed in comparison with the repair by means of the conventional filler cloth mentioned above. Further, the repair can be easily and at a low cost performed in comparison with the structure in which the whole of the gangway cloth is replaced in accordance with the conventional art.

[0079] Further, by pressing the overlapped portion between the upper gangway cloth and the lower gangway cloth to the gangway metal frame and the diaphragm frames by the pressing metal so as to fix them, it is possible to closely attach the gangway clothes in the overlapped portion to each other so as to easily secure a water proofing property of the overlapped portion.

Claims

1. A gangway cloth for a railway vehicle comprising a stretchy sheet (1), and cloth (2) made of synthetic fiber knitted fabric, wherein

   only a thread (3) on a surface portion of the cloth (2) is bonded to the sheet (1) by an adhesive agent (5) having an elongation property, and

   a thread surface of the cloth (2) made of the knitted fabric is coated by a soft type coating material (6) having an elongation property so as not to bury stitches (4) of the cloth (2).

2. The gangway cloth of claim 1, wherein said sheet (2) is a soft type synthetic resin or a synthetic rubber.

3. The gangway cloth of claim 1 or 2, wherein said thread (3) of the cloth (2) made of the knitted fabric is a fiber having high function and high performance, preferably an aramid fiber.

4. The gangway cloth of any of claims 1 to 3, wherein said soft type coating material (6) is a resin having a light-proofing and a coloring property or a rubber.

5. A connecting gangway for a railway vehicle comprising:

diaphragm frames (17) arranged between front and rear gangway metal frames (15, 16);
gangway cloth (7) arranged along an outer periphery of the diaphragm frames (17) so as to form a cylindrical shape; and
front and rear ends of the gangway cloth (7) being fastened to both of the gangway metal frames (15, 16),

wherein anti-sagging means (26, 27, 41) for holding the bottom cloth (7a) of said gangway cloth (7) without fixing it to said diaphragm frames (17) is provided.

6. The connecting gangway of claim 5, wherein said anti-sagging means is formed by

arranging a band-like anti-sagging piece (26, 27) in a longitudinal direction of the connecting gangway (14) in the bottom portion of the gangway cloth (7),
fixing front and rear ends of the anti-sagging piece (26, 27) to both of the gangway metal frames (15, 16),
supporting said anti-sagging piece (26,27) to the diaphragm frame (17) without fixing it to the diaphragm frame (17), and
fixing to a suitable position together with the bottom surface of the gangway cloth (7).

7. The connecting gangway of claim 5, wherein said anti-sagging means is formed by

fastening one end of a hanging string (41) to one side portion of the connecting gangway (14B),
fastening another end to another side portion of the connecting gangway (14B),
passing a middle portion of the hanging string (41) on an outer surface of the bottom cloth (7a) of the gangway cloth (7), and
receiving the bottom cloth (7a) of the gangway cloth (7) by said hanging string (41).

8. The connecting gangway of claim 6 or 7, wherein the anti-sagging piece (26, 27) or the hanging string (41) constituting said anti-sagging means is formed by a stretchy material.

9. A connecting gangway for a railway vehicle comprising:

diaphragm frames (17) arranged between front and rear gangway metal frames (15, 16);
a gangway cloth (7) arranged along an outer periphery of the diaphragm frames (17) so as to form a cylindrical shape; and
front and rear ends of the gangway cloth (7) being fastened to both of the gangway metal frames (15, 16),

wherein said gangway cloth (7) is separated into an upper gangway cloth (7e) constituted by a top cloth (7c) and a side cloth (7d), and a lower gangway cloth (7g) constituted by a bottom cloth (7a) and a side cloth (7f), a lower portion of the side cloth (7d) in the upper gangway cloth (7e) and an upper portion of the side cloth (7f) in the lower gangway cloth (7g) are overlapped with each other so as to be assembled, and the lower gangway cloth (7g) can be taken out from the upper gangway cloth (7e) in a separated manner.

10. The connecting gangway of claim 9, wherein

the overlapped portions (W) between said upper gangway cloth (7e) and the lower gangway cloth (7g) are fixed to the gangway metal frames (15, 16) and the diaphragm frames (17) by a pressing metal (19a, 22c) capable of being taken out from an outer side thereof, and
the bottom cloth (7a) of the lower gangway cloth (7g) is not fixed to the diaphragm frames (17).

FIG.1A

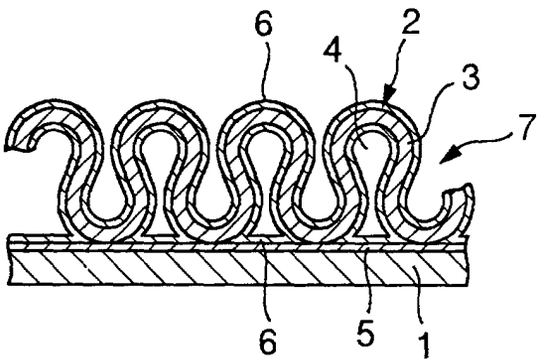


FIG.1B

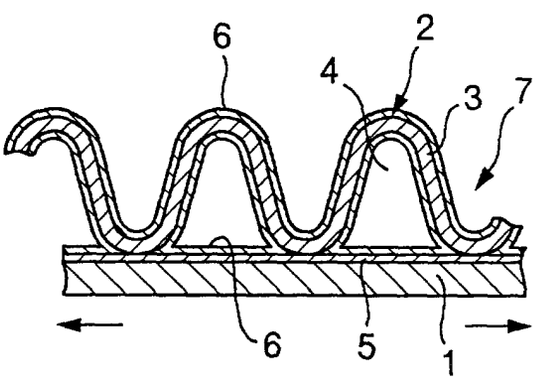


FIG.2

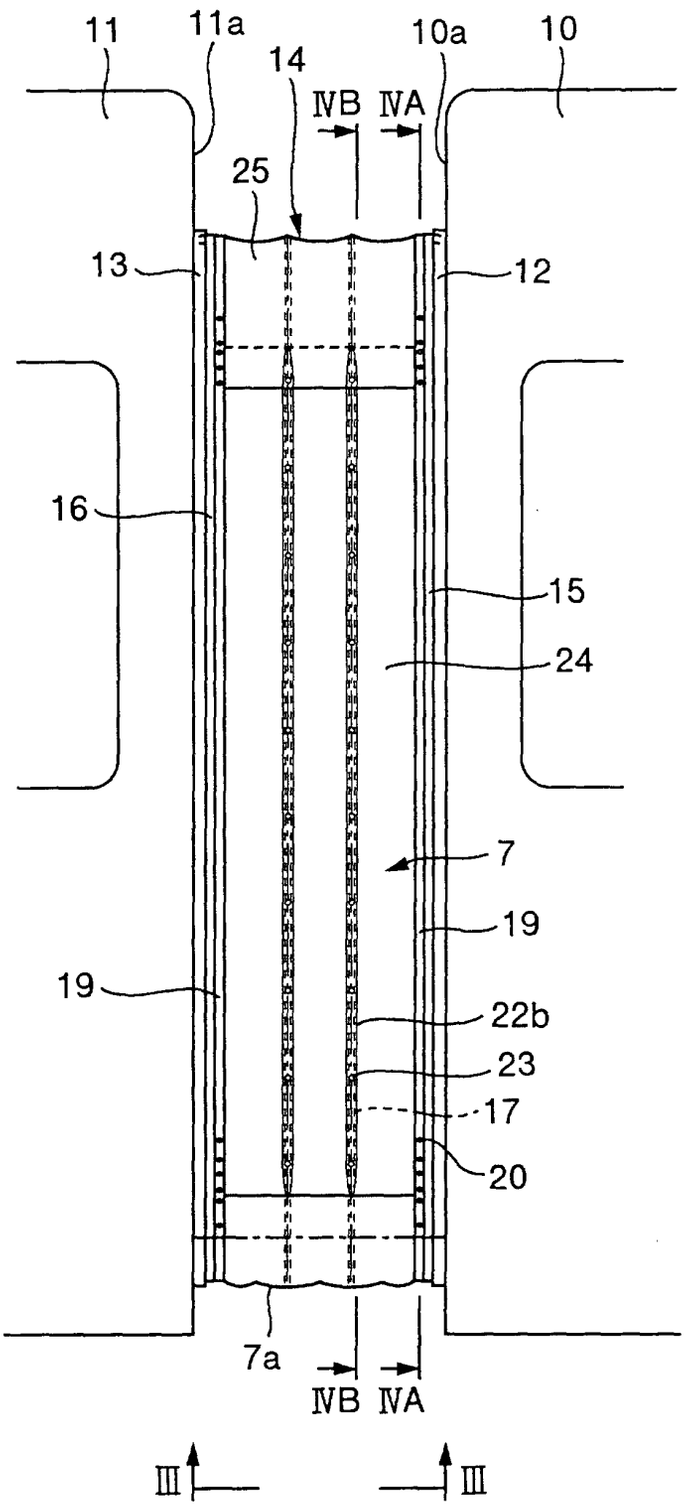

11
11a
14
10a
10
ⅣB
ⅣA
25
13
12
16
15
24
7
19
19
22b
23
17
20
7a
ⅣB
ⅣA
Ⅲ
Ⅲ

FIG.3

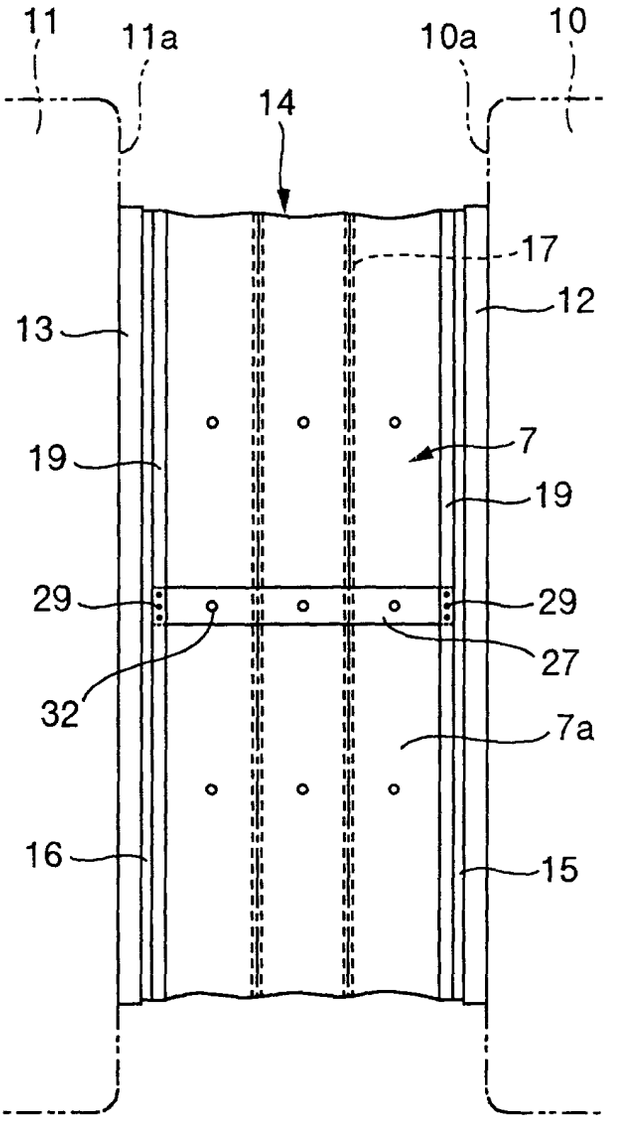
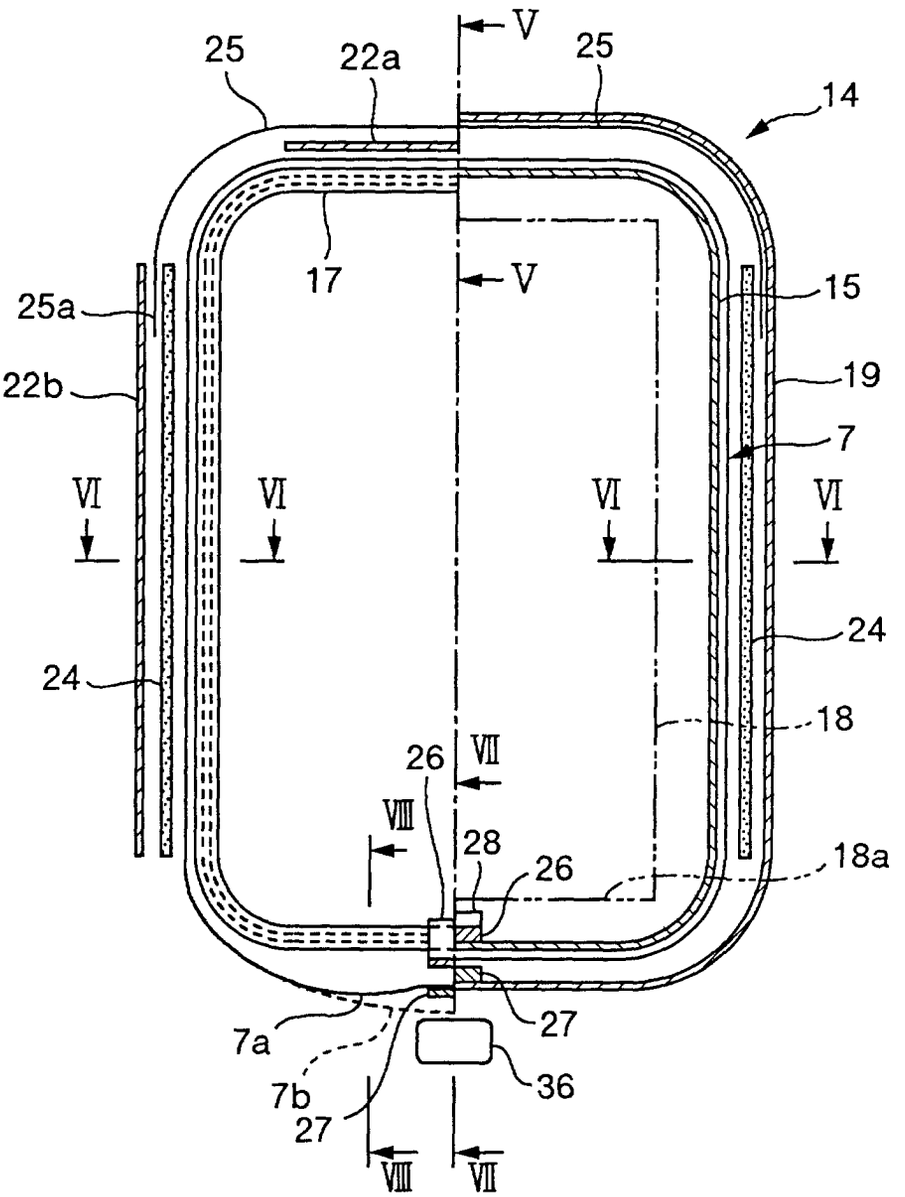


FIG.4


V
25
22a
25
14
17
V
15
25a
19
22b
7
VI
VI
VI
VI
24
24
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VII
VIII
28
26
18a
27
7a
36
7b
27
VIII
VII

FIG.5

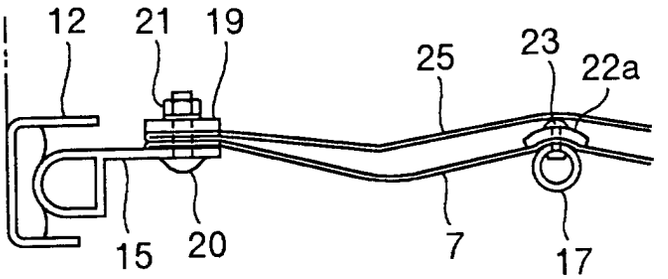


FIG.6

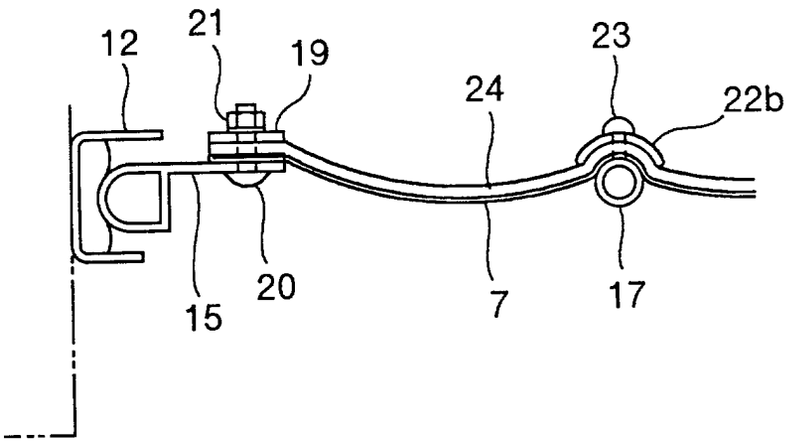


FIG.7

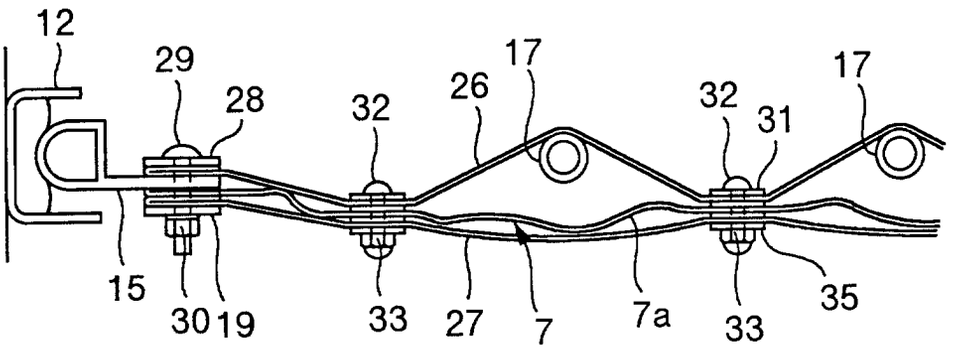

12
29
28
32
26
17
32
31
17
15
30
19
33
27
7
7a
33
35

FIG.8

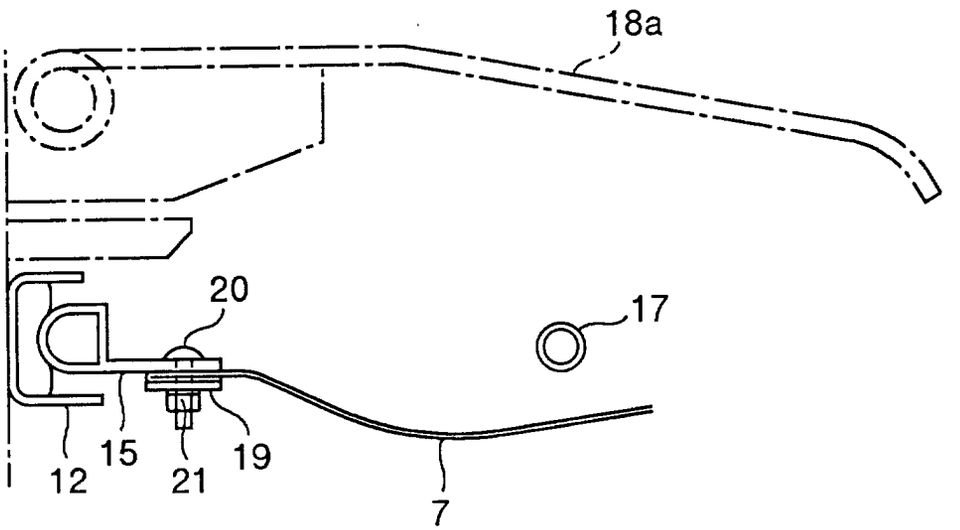

18a
20
17
12
15
21
19
7

FIG.9

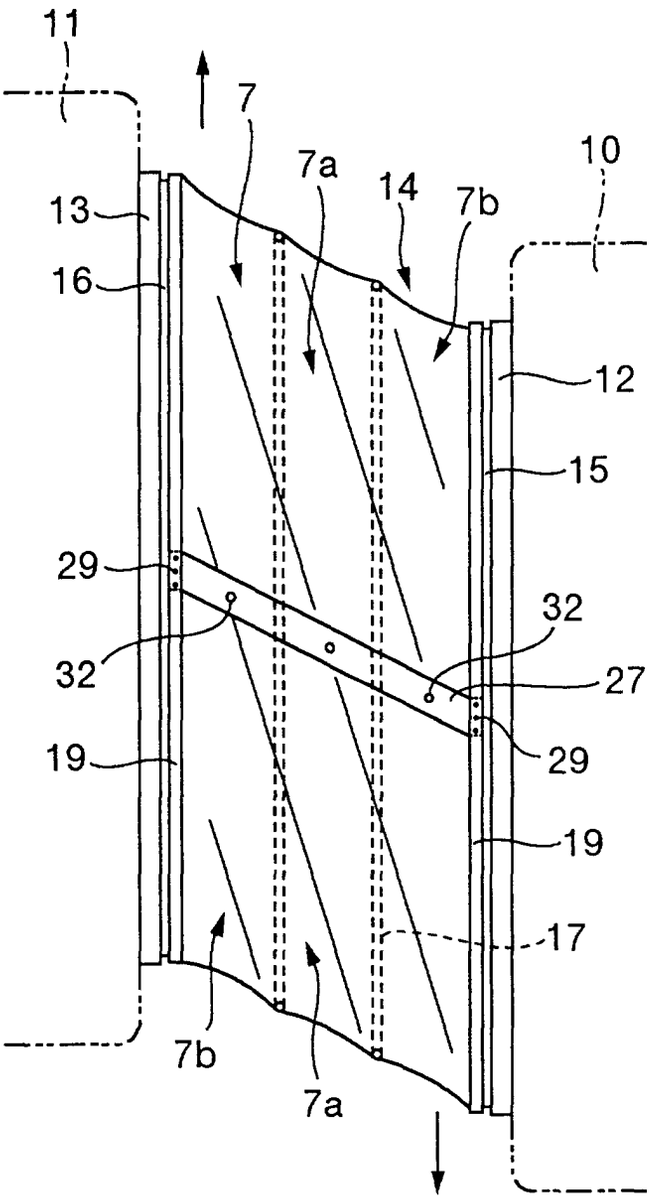


FIG.10

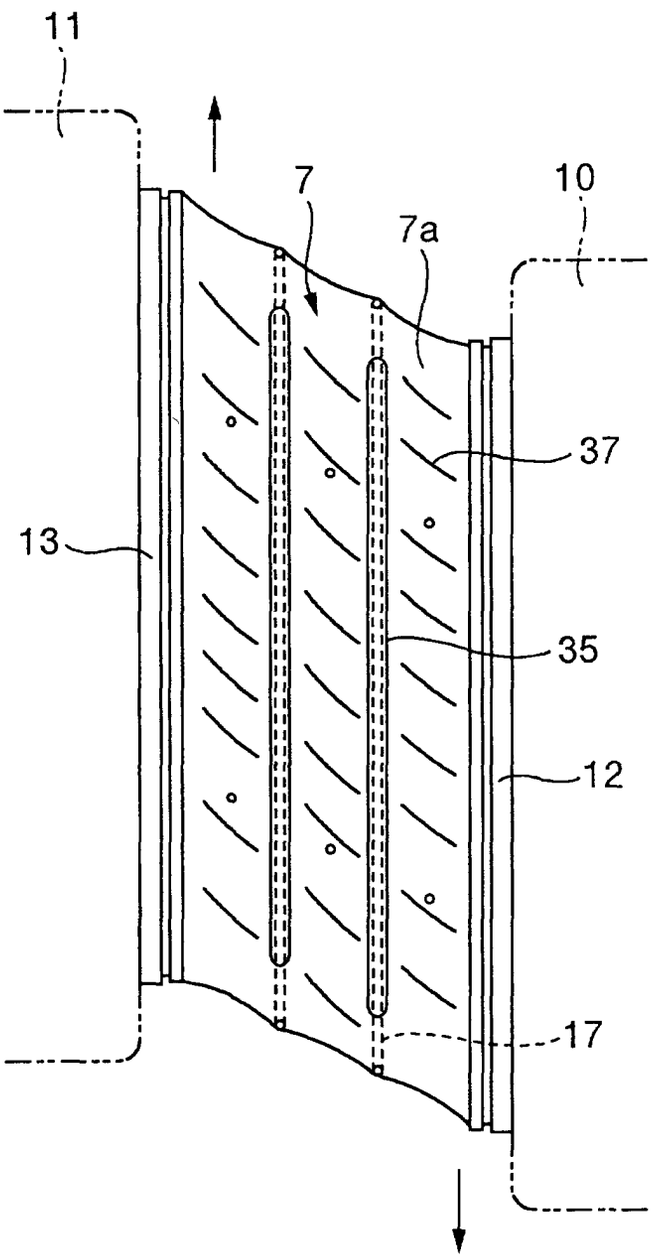


FIG.11

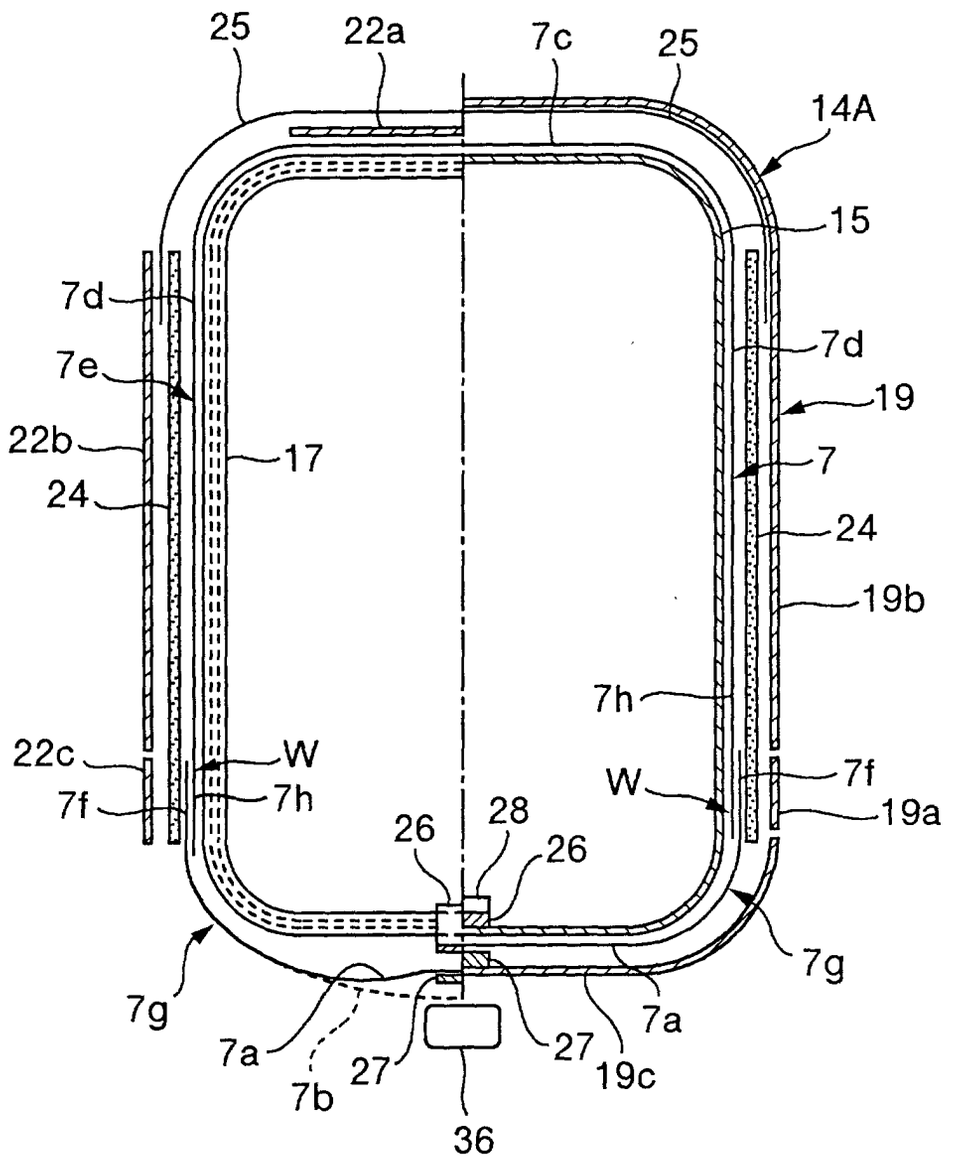
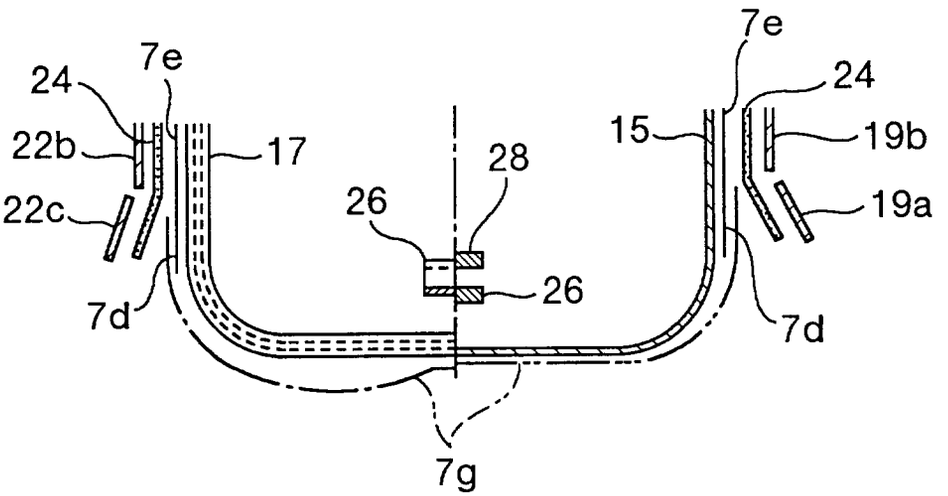

25
22a
7c
25
14A
15
7d
7e
22b
24
17
7d
19
7
24
19b
7h
22c
W
7f
7h
W
7f
19a
26
28
26
7g
7g
7a
7b
27
27
7a
19c
36

FIG.12


7e
24
22b
22c
7d
17
26
28
26
7g
7e
24
15
19b
19a
7d

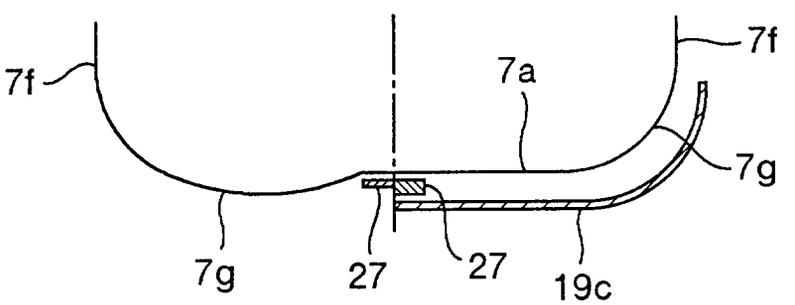

7f
7f
7a
7g
7g
27
27
19c

FIG.13

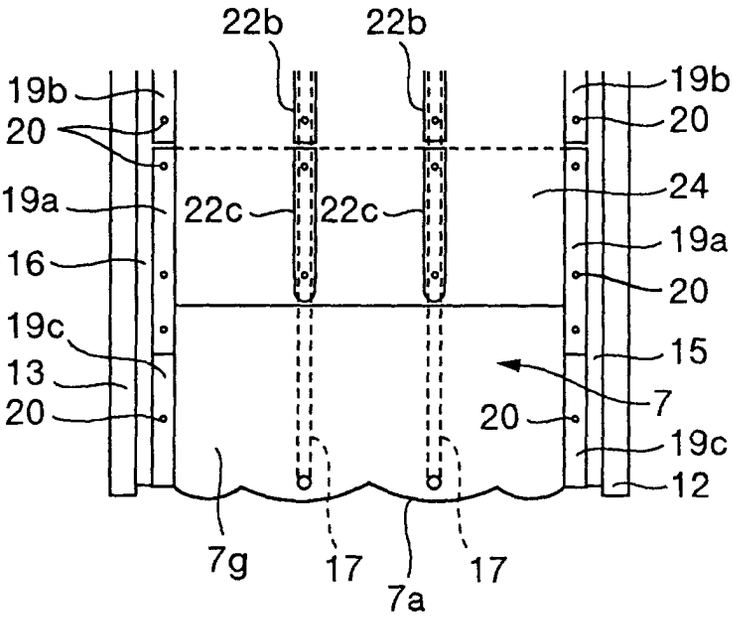

22b
22b
19b
20
19a
16
19c
13
20
22c
22c
19b
20
24
19a
20
15
7
20
19c
12
7g
17
7a
17

FIG.14

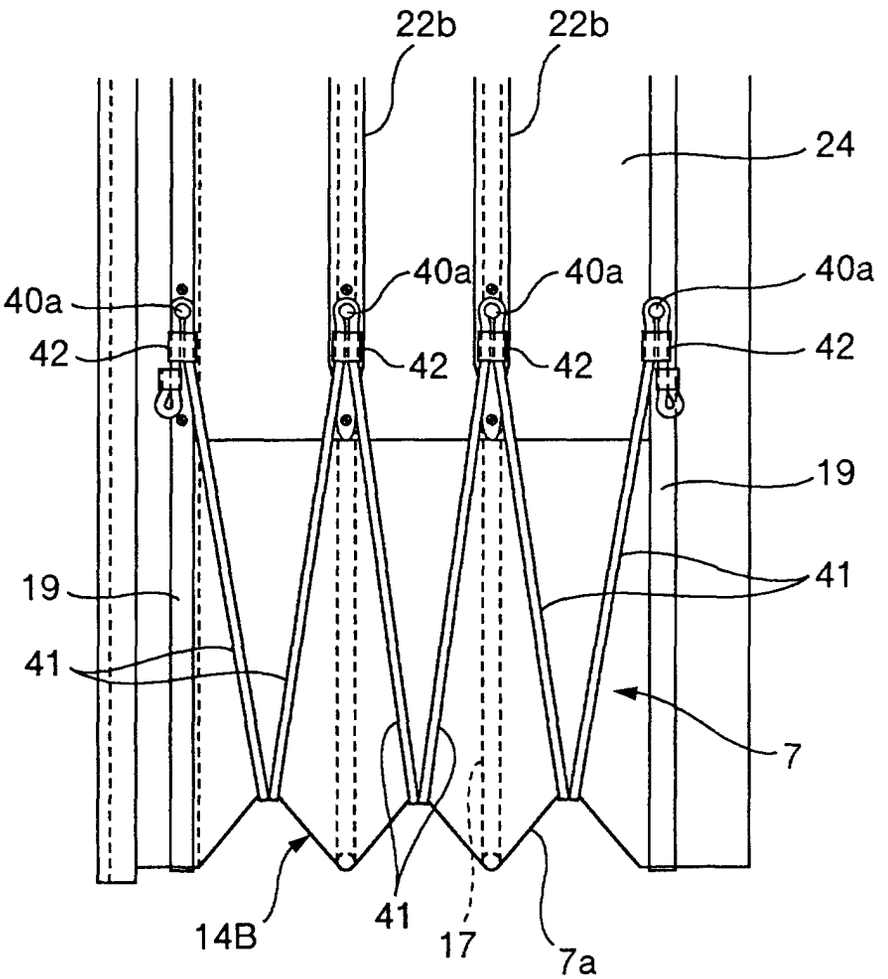


FIG.15

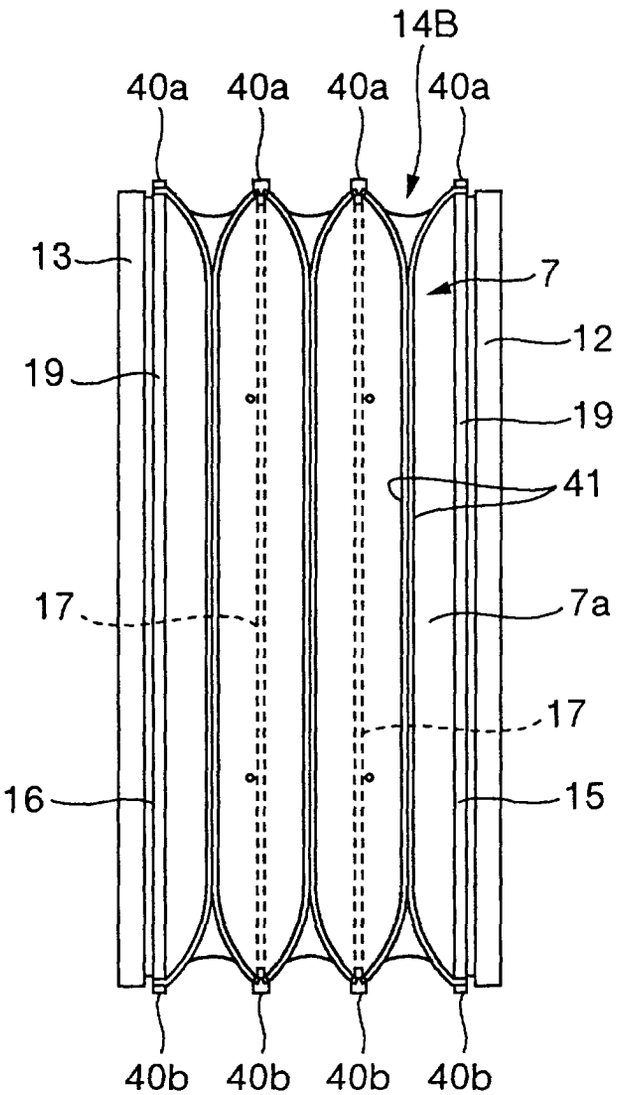


FIG.16

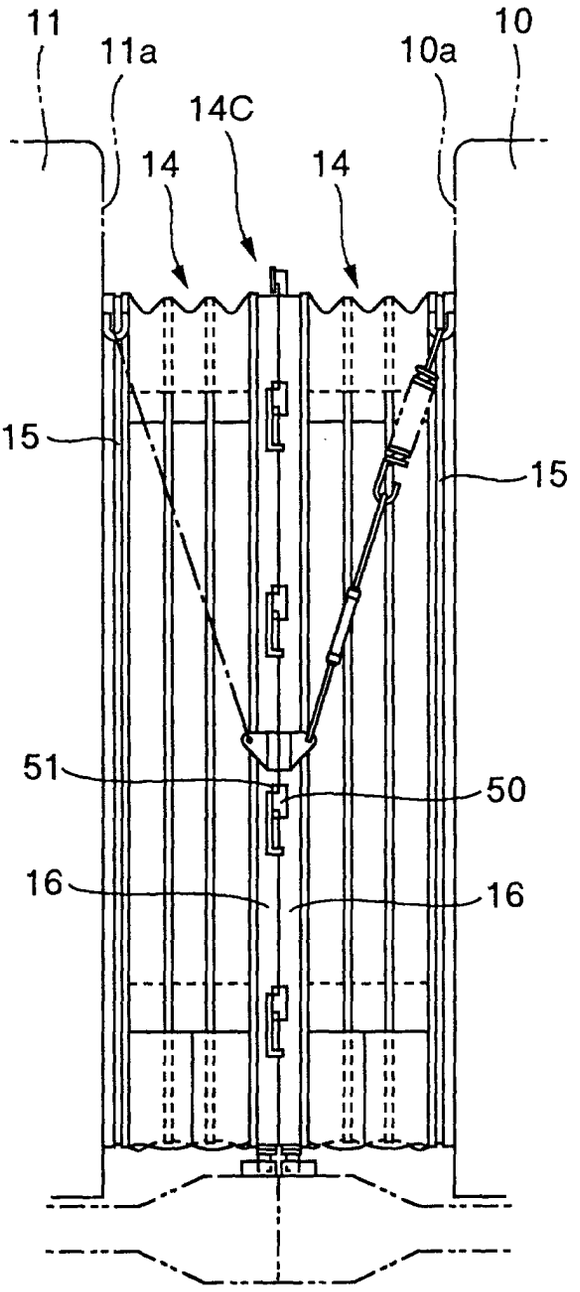


FIG.17

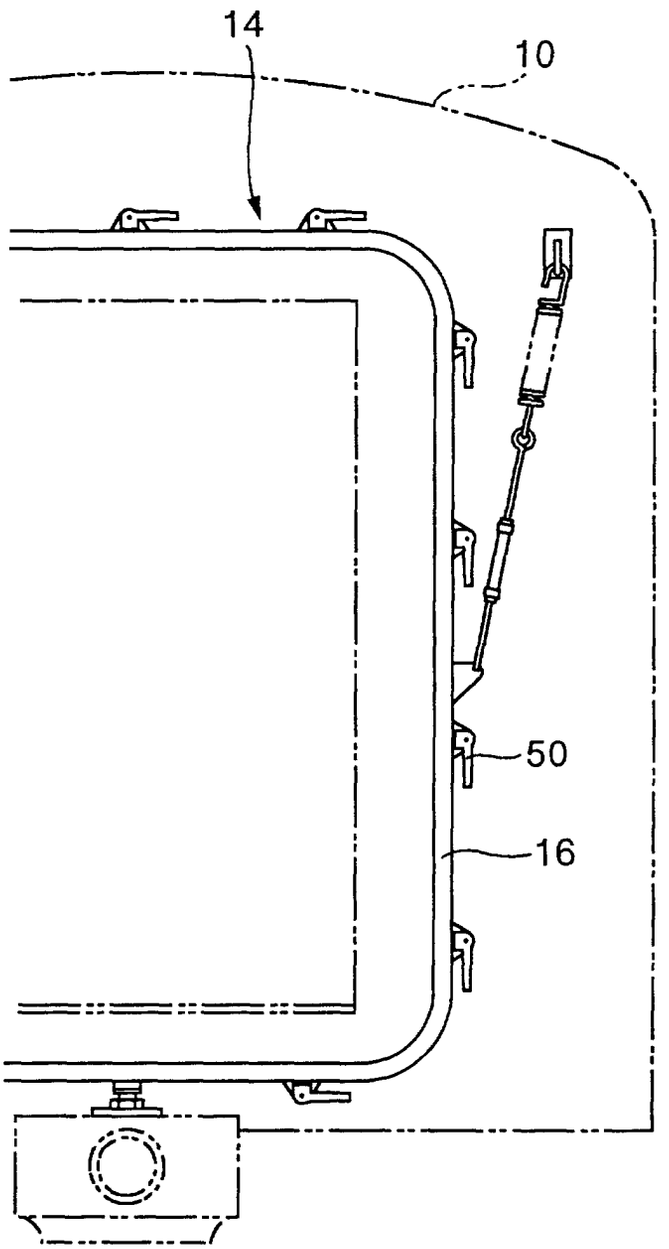


FIG.18