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(54) **Title**: A DRUM-LIFTERS ASSEMBLY FOR WASHING MACHINE

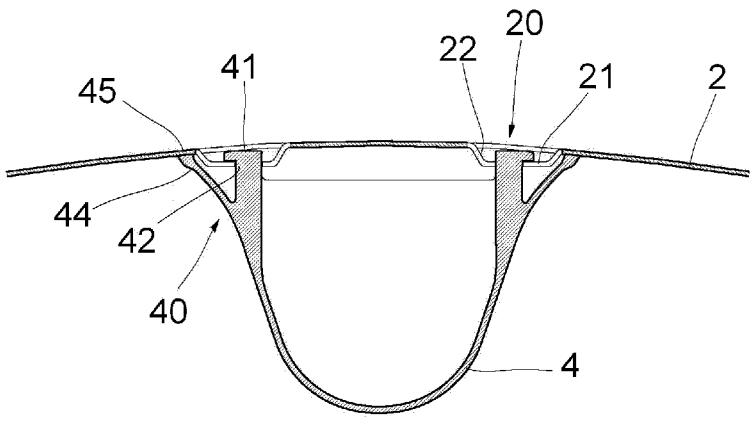

FIG. 16

(57) **Abstract**: A drum (1) for washing machine is disclosed, comprising a cylindrical metal band (2) and a plurality of lifters (4) with elongated body and base adapted to be disposed on the internal surface of the band, said band (2) comprising slots (20; 120) and said lifter (4) comprising feet (40; 140) adapted to be engaged inside said slots (20; 120). Said slots (20; 120) are obtained on a flat portion (22; 122) partially surrounded by a drawn portion (21; 121) of the band, in such a way that said flat portion (22; 122) with slots is situated at a level different from said band (2); said drawn portion (21; 121) being provided with opening (23; 123) in communication with said slot in order to insert the foot (40; 140) of the lifter.

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Description

A drum-lifters assembly for washing machine.

The present patent application for industrial invention relates to a drum-lifters assembly for a washing machine.

Referring to Figs. 1 and 2, a drum of a washing machine is illustrated, generally indicated with numeral (1). The drum (1) comprises a front flange (A), a back flange (B) and a cylindrical flange (2) closed as shell. The front flange (A), the back flange (B) and the cylindrical flange (2) are mechanically joined in order to create a shell.

The shell of the drum (1) is adapted to contain the laundry during the washing process. Inside the drum (1), elements, defined as lifters (4) are contained. The purpose of lifters (4) is to drag the laundry during the rotation of the drum (1). Said lifters (4) have an elongated shape and are disposed inside the drum (1), generally in number of three, mutually spaced by 120° and parallel to the axis of the drum. Therefore, hereinafter the axial or longitudinal direction indicates the direction of the length of the lifter, whereas the transversal direction indicates the direction of the width of the lifter.

Said lifters (4) are obtained from molding plastic material and have a rounded base that copies the internal surface of the band (2), wheras the body of the lifters (4) takes different shapes, in order to drag and mix the laundry better.

The connection between the plastic lifters (4) and the steel band (2) of the drum is made by means of a series of feet (40) protruding relative to the base of the lifter, which are engaged in suitable slots (20) obtained on the steel wall of the band (2).

Figs. 3 – 11 illustrate a fixing system of said feet of the lifter according to the prior art.

Referring to Figs. 4A and 5A, the foot (240) of the lifter comprises an enlarged head (241) and a stem (242). In the enlarged head a groove (243) is obtained, facing towards the outside of the lifter.

Referring to Fig. 3, according to the prior art, the slots (220) obtained on the cylindrical surface of the band (2) have a wide portion (221) adapted to receive the head (241) of the foot and a narrow portion (222) adapted to tighten the stem (242) of the foot in correspondence of the groove (243).

The assembly between lifter (4) and band (2) is made by means of a first radial movement of the lifter and a second axial movement of the lifter.

Referring to Figs. 6 and 7, by moving the lifter in radial direction (direction of arrow F1), the head (241) of the feet is received in the wide portion (221) of the slot.

Referring to Figs. 8 and 9, by then moving the lifter in axial direction (direction of arrow F2), the stems (41) of the feet are inserted in the narrow portion (222) of the slot, thus inserting the edge of the narrow portion of the slot into the groove (243) of the foot.

So, the lifter is firmly locked in radial direction, because the head (241) of the feet, being wider, provides locking of the foot in the narrow portion (222) of the slot.

Referring to Figs. 3, 10 and 11, a cutoff tab (203) is obtained in the band (2) to avoid the backward travel of the lifter (in axial direction). As shown in Fig. 11, the tab (203) is folded against a support obtained on the lifter (4).

Said fixing system of the prior art requires a first cutoff portion (wide portion (221) of the slot) on the band (2) in order to receive the head of the foot and a contiguous second cutoff portion (narrow portion (222) of the slot) in order to receive the stem of the foot. It appears evident that the cutoff portion on the band is large, because in addition to the functional portion (222) necessary to fix the foot, said system also requires cutting off an additional portion (221) exclusively necessary to insert the head of the foot.

It must be considered that, at the end of the washing cycle, during spinning, the drum is rotated at high speed to eliminate absorbed water in as much as possible. Therefore, the drum is stressed by centrifugal forces generating high stress on the band in tangential direction. Such stress is concentrated in the proximity of the slots used to fix lifters, such stress being

directly proportional to the surface of the cutoff portions of the slots because the resistant section is consequently reduced.

Moreover, being the drum made starting from a planar band wrapped as a cylinder with edges joined by means of welding or mechanical seaming, such a concentration of stress is more critical in the joining area intrinsically provided with lower resistance.

DE 33 17 201 discloses a tub of a washing machine comprising a cylindrical band with elongated body and a base adapted to be disposed on the internal surface of the band. Said band comprises slots and drawn portions provided with openings. Lifters comprise feet adapted to engage into the slots and engagement means adapted to engage into the openings of the drawn portions.

The purpose of the present invention is to eliminate the drawbacks of the prior art, in the attempt to minimize the concentration of stress on the drum, reducing the cutoff portions of the band of the drum with respect to the prior art by means of a different geometry of the area where lifters are joined with the band of the drum.

This purpose is achieved according to the invention, with the characteristics claimed in independent claim 1.

Advantageous embodiments appear from the dependent claims.

The invention consists in creating a difference of level or "step" on the band of the drum between the fixing surface and the portion adapted to receive the head of the foot, no longer having to cut off the band for the portion adapted to receive the head of the foot.

For example, the lower level can be obtained by drawing the fixing areas towards the inside of the drum, whereas the higher level corresponds to the external diameter of the band. However, such a step can be also created with an inverse process, leaving the fixing areas on the band of the drum and drawing towards the outside the areas adapted to receive the head of the foot.

In any case, the cutting off of the slot is only limited to the fixing area, no longer having to cut off the area adapted to receive the head of the foot,

which is housed in the difference of level that has been suitably created. It must be considered that, compared to the prior art, the invention allows for a considerable reduction of cut off portions, equal to approximately 50-60%.

Two embodiments of the invention are provided herein.

According to the first embodiment, the lifter is brought against the internal surface of the band with a radial movement and then is longitudinally translated in such a way that the feet can engage in the slots.

According to the second embodiment, the lifter is first compressed in transversal direction and then inserted in radial direction at the level of the slots and finally released. By expanding in transversal direction, the feet are engaged in the slots.

In both cases, if the lifter is fixed towards the inside, the band is not provided with external projections. In such a way, the distance between the drum and the tub can be reduced, thus advantageously increasing the washing volume of the washing machine.

In order to avoid releasing the lifters, in boch cases, an edge of the slot is directly folded against the head of the foot. Therefore, it is no longer necessary to create additional cut off portions to obtain the non-return tabs, as required by the prior art.

Further characteristics of the invention will appear clearer from the description below, which refers to merely illustrative, not limiting, embodiments, illustrated in the attached drawings, wherein:

Fig. 1 is a perspective view of a drum-lifters assembly in assembled condition;

Fig. 2 is an exploded perspective view of the drum-lifter assembly of Fig. 1.

Fig. 3 is a plan view of a portion of the band of a drum according to the prior art;

Fig. 4 is longitudinal sectional view of a portion of band and lifter according to the prior art;

Fig. 4A is an enlarged view of the detail enclosed in circle A of Fig. 4.

Fig. 5 is cross-sectional view of a portion of band and lifter of Fig. 4.

Fig. 5B is an enlarged view of the detail enclosed in circle B of Fig. 5.

Figs. 6 and 7 respectively correspond to Figs. 4 and 5 further to a radial movement of the lifter;

Figs. 8 and 9 respectively correspond to Figs. 6 and 7 further to a longitudinal movement of the lifter;

Figs. 10 and 11 respectively correspond to Figs. 8 and 9 further to folding a fixing wing obtained on the band;

Fig. 12 is a plan view of a portion of the band of a drum according to a first embodiment of the invention;

Fig. 13 is a longitudinal sectional view of a portion of band and lifter according to a first embodiment of the invention;

Fig. 13A is an enlarged view of the detail enclosed in circle A of Fig. 13.

Fig. 14 is a cross-sectional view of the portion of band and lifter of Fig. 13.

Fig. 14B is an enlarged view of the detail enclosed in circle B of Fig. 14.

Figs. 15 and 16 respectively correspond to Figs. 13 and 14 further to a radial movement of the lifter;

Figs. 17 and 18 respectively correspond to Figs. 15 and 16 further to a longitudinal movement of the lifter;

Figs. 19 and 20 respectively correspond to Figs. 17 and 18 further to folding a fixing wing obtained on the band;

Fig. 21 is a plan view of a portion of the band of a drum according to a second embodiment of the invention;

Fig. 22 is a longitudinal sectional view of a portion of band and lifter according to the second embodiment of the invention;

Fig. 22A is an enlarged view of the detail enclosed in circle A of Fig. 22.

Fig. 23 is a cross-sectional view of the portion of band and lifter of Fig. 22.

Fig. 23B is an enlarged view of the detail enclosed in circle B of Fig. 23.

Figs. 24 and 25 respectively correspond to Figs. 22 and 23 further to a radial movement of the lifter and a compression of the feet of the lifter;

Figs. 26 and 27 respectively correspond to Figs. 24 and 25 further to spring back to the original position of the feet of the lifter;

Figs. 28 and 29 respectively correspond to Figs. 26 and 27 further to folding a fixing wing obtained on the band.

Referring to Figs. 12 to 20 a first embodiment of the invention is disclosed, wherein elements that are identical or correspond to the ones already described are indicated with the same numerals, omitting their detailed description.

Referring to Figs. 13A and 14A, the lifter (4) is provided with feet (40). Each foot (40) comprises an enlarged head (41) and a stem (42) orthogonally protruding from the base of the lifter. The head (41) forms a surface in undercut (43) with the stem, facing towards the outside of the lifter.

The feet are concealed inside the lifter, being covered by the sides (44) of the lifter. The sides (44) have a stop surface (45) adapted to stop against the band of the drum.

Also referring to Fig. 12, a plurality of slots (20) with basically T-shaped profile is obtained in the band (2) of the drum. Each slot (20) is partially surrounded by a U-shaped drawn portion (21), in such a way to leave an opening (23) to access the slot (20), facing the lifter in longitudinal direction. The drawn portion (21) protrudes towards the inside of the drum and ends with a flat portion (22) protruding towards the inside of the drum, relative to the cylindrical surface of the band (2). The T-shaped slot (20) is obtained in the flat portion (22), in communication with the opening (23) of the drawn portion (21).

Referring to Figs. 15 and 16, the lifter (4) is moved radially (in the direction of arrow F1) towards the band of the drum, until the stop surface (45) of the sides of the lifter stops against the internal surface of the band (2). In such a situation, the head (41) of the foot is stopped against the internal

surface of the band (2), in the proximity of the opening (23) of the drawn portion (21) surrounding the slot (20).

Referring to Figs. 17 and 18, the lifter (2) is translated in longitudinal direction (direction of arrow F2) in such a way that the head (41) of the foot of the lifter enters the slot (20), passing through the opening (23) of the drawn portion. As shown in Fig. 18, the surface in undercut (43) of the head stops against the flat external surface (22) of the drawn portion and the stop surface (45) of the wing stops against the internal surface of the band, thus holding the lifter and preventing it from moving in radial direction.

Referring to Fig. 19 and 20, the lifter (4) is provided with at least one foot (40') with rounded angular portion (46) facing the lifter in longitudinal direction, disposed in the joint between head and stem of the foot.

The band (2) is provided with a slot (20') in correspondence of said foot (40'). The band (2) is provided with a folding edge (3) shaped as a semicircle, disposed in the opening (23) of the drawn portion (21) of the slot (20').

The edge (3) is folded towards the inside of the band, in such a way to stop against the rounded angular portion (46) of the foot, thus stopping the longitudinal sliding movement of the lifter.

Referring to Figs. 21 to 29 a second embodiment of the invention is disclosed, wherein elements that are identical or correspond to the ones already described are indicated with the same numerals, omitting their detailed description.

Referring to Figs. 22A and 23A, the lifter (4) is provided with feet (140) basically similar to the feet (40) of the first embodiment. The only difference consists in the fact that each foot (140) is provided with angular rounding off (148) in the joint portion of the head (41), facing towards the inside of the lifter.

Also referring to Fig. 21, a plurality of slots (120) with basically rectangular profile and rounded corners is obtained in the band (2) of the drum Each slot (120) is partially surrounded by a U-shaped drawn portion (121) in such a way to leave an opening (123) to access the slot (120), facing the lifter in longitudinal direction, towards the inside of the lifter. The drawn

portion (121) protrudes towards the inside of the drum and ends with a flat portion (122) protruding towards the inside of the drum, relative to the surface of the band (2). The slot (120) is obtained in the flat portion (122), in communication with the opening (123) of the drawn portion (121).

Referring to Figs. 24 and 25, the lifter 4 is precompressed in the direction of arrows (X), that is to say the feet (140) of the lifter are elastically folded in transversal diretion towards the inside of the lifter.

The precompressed lifter is moved radially (in the direction of arrow F1) towards the band of the drum, until the stop surface (45) of the wing (44) of the foot of the lifter is stopped against the internal surface of the band (2). In such a situation, the head (41) of the foot is stopped against the internal surface of the band (2), in the proximity of the opening (123) of the drawn portion (121) surrounding the slot (120).

Referring to Figs. 26 and 27, the lifter (2) is released (i.e. precompression is removed). Consequently, the feet (140) of the lifter are elastically bent outwards to return in their original position. So, the head (41) of the foot of the lifter enters the slot (120), passing through the opening (123) of the drawn portion.

As shown in Fig. 27, the surface in undercut (43) of the head is stopped against the flat external surface (122) of the drawn portion and the stop surface (45) of the sides of the lifter is stopped against the internal surface of the band, thus holding the lifter and preventing it from moving in radial direction.

Referring to Figs. 28 and 29, the band (2) is provided with a folding edge (103) shaped as a semicircle, disposed in the opening (123) of the drawn portion (121) of the slot (120'). The edge (103) is folded towards the inside of the drum, in such a way to stop against the rounded angular portion (146) of the foot. So, a possible compression of the feet towards the inside of the lifter is stopped, thus avoiding the accidental release of the lifter.

Numerous variations and amendments can be made to the present embodiments of the invention, within the reach of an expert of the field, while still falling within the scope of the invention described in the enclosed claims.

Claims

1) A washing machine drum (1) comprising a cylindrical metal band (2) and a plurality of lifters (4) with elongated body and base adapted to be disposed on the internal surface of the band, said band (2) comprising slots (20; 120) and said lifter (4) comprising feet (40; 140) adapted to be engaged inside said slots (20; 120), characterized in that said slots (20; 120) are obtained on a flat portion (22; 122) partially surrounded by a drawn portion (21; 121) of the band, in such a way that said flat portion (22; 122) with slots is situated at a level different from said band (2); said drawn portion (21; 121) being provided with opening (23; 123) in communication with said slot in order to insert the foot (40; 140) of the lifter.

2) A drum (1) as claimed in claim 1, characterized in that said drawn portion (21; 121) of the band is obtained towards the inside of the band (2) to avoid parts externally protruding from the band.

3) A drum (1) as claimed in claim 1 or 2, characterized in that said foot (40; 140) comprises stem (42) and enlarged head (41) in such a way to form a surface in undercut (43) facing the inside of the lifter and adapted to be situated on said flat portion (22; 122) with slot of the band, said lifter being provided with lateral sides (44) that cover the feet (40; 140); said sides (44) of the lifter being provided with a stop surface (45) adapted to stop against the internal surface of the band.

4) A drum (1) as claimed in any one of the preceding claims, characterized in that said opening (23) of the drawn portion is faced in longitudinal direction of the lifter, in such a way to allow for inserting the foot (40) in the slot (20) by translating the lifter in longitudinal direction.

5) A drum (1) as claimed in any one of claims 1 to 3, characterized in that said opening (123) of the drawn portion is faced in transversal direction towards the inside of the lifter, in such a way to allow for inserting the foot (140) in the slot (120) by pre-compressing the feet in transversal direction towards the inside of the lifter and releasing the feet in transversal direction towards the outside of the lifter.

6) A drum (1) as claimed in any one of the preceding claims, characterized in that said band (2) is provided with at least one edge (3; 103) foldable towards the inside of the band, disposed in correspondence of said opening (23; 123) of the drawn portion of the band, in order to stop against a portion (46; 146) of said head (41) of the foot (40; 140), thus preventing said lifter from moving.

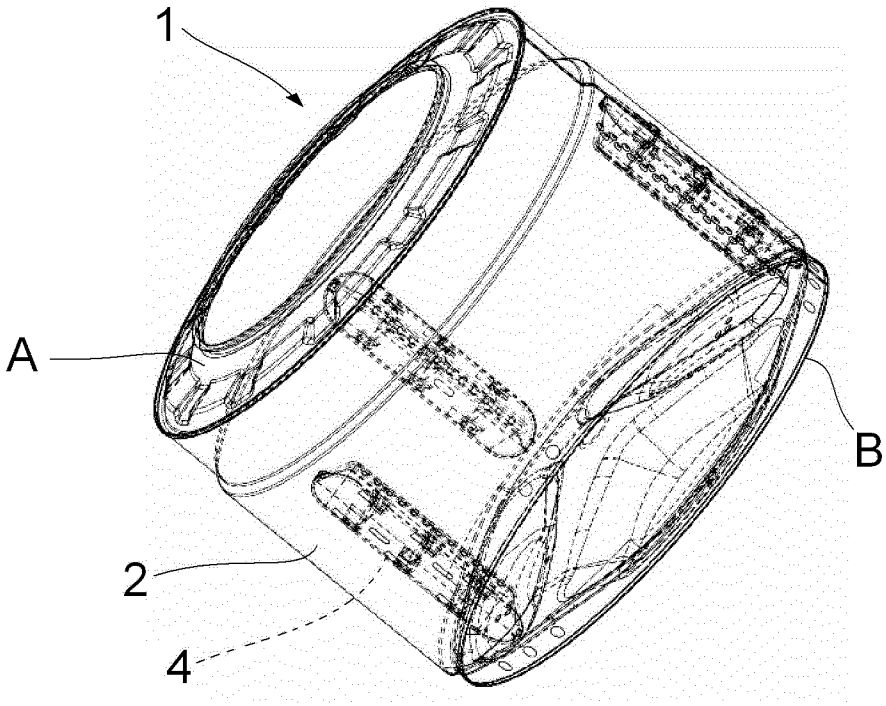

FIG. 1

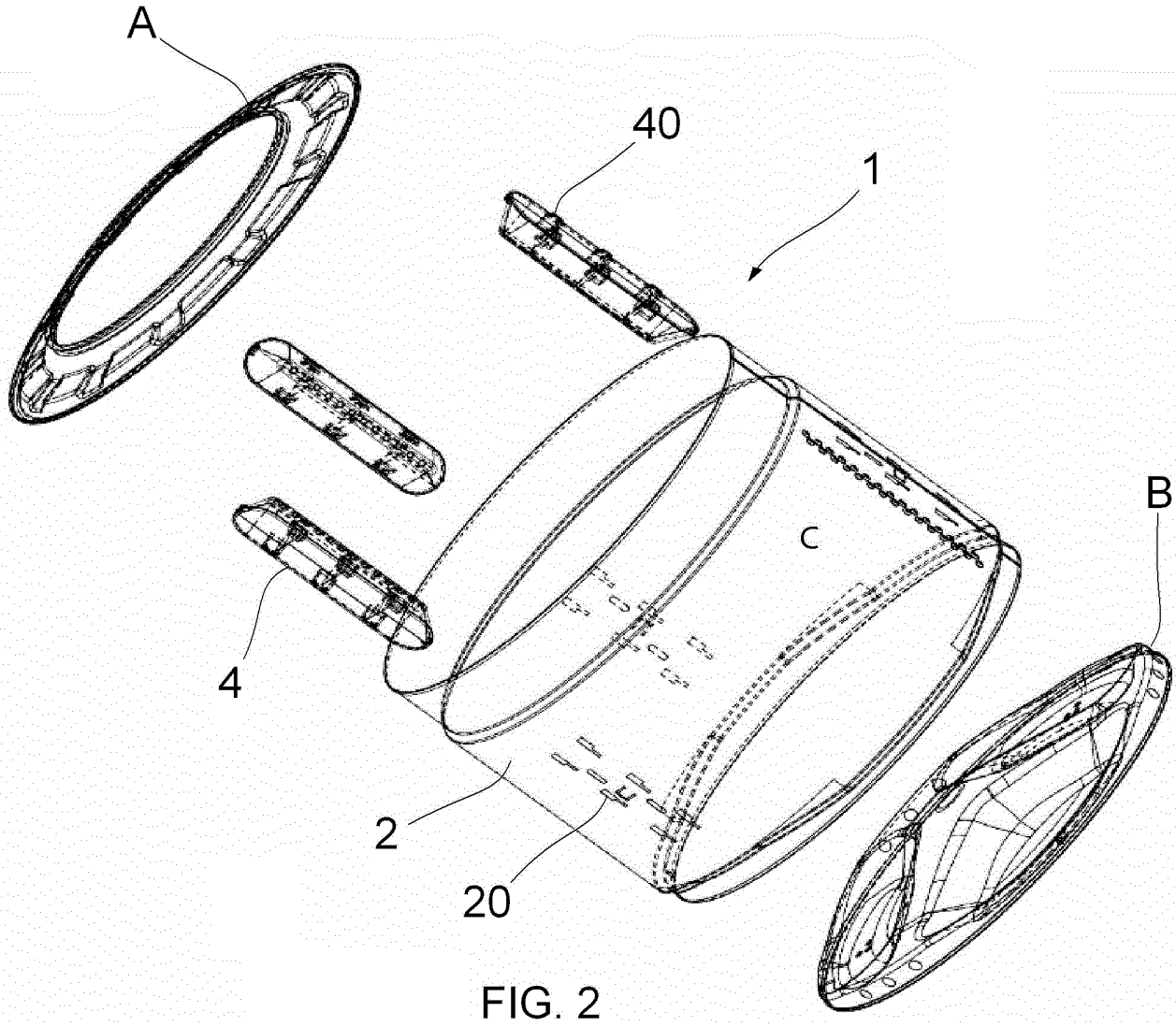

FIG. 2

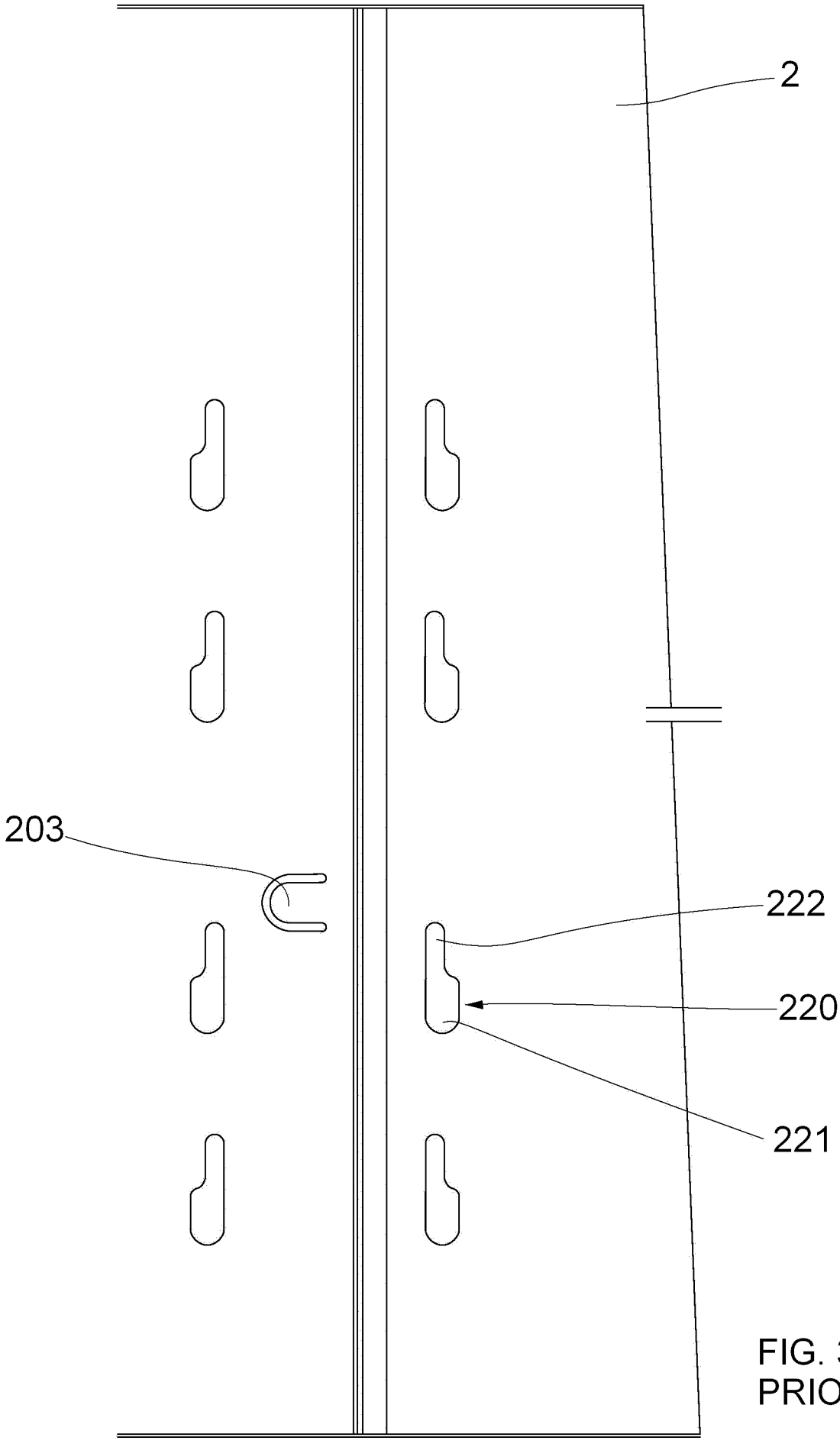

FIG. 3
PRIOR ART

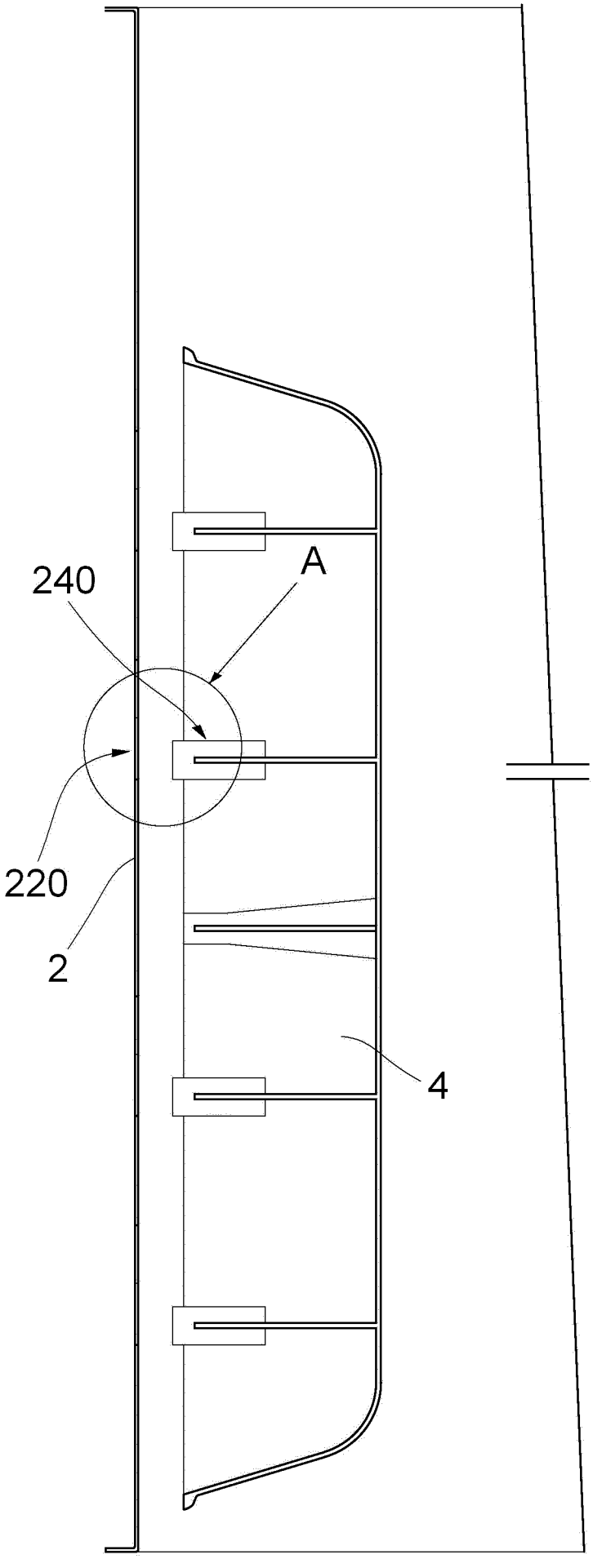

FIG. 4

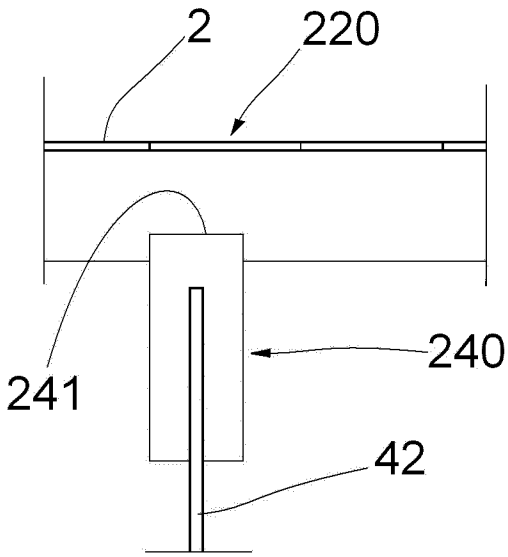

FIG. 4A

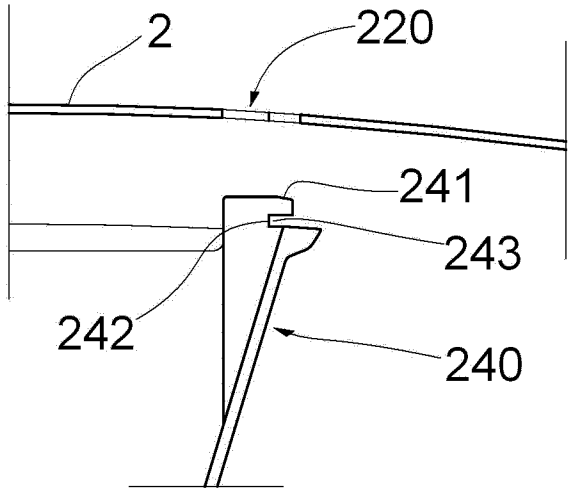

FIG. 5B

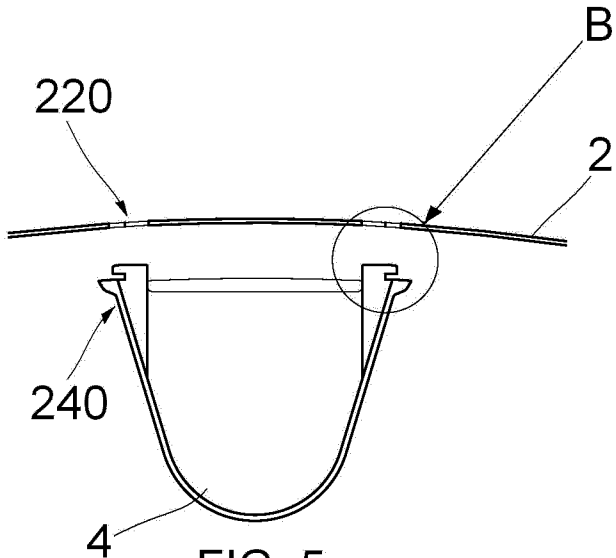

FIG. 5
PRIOR ART

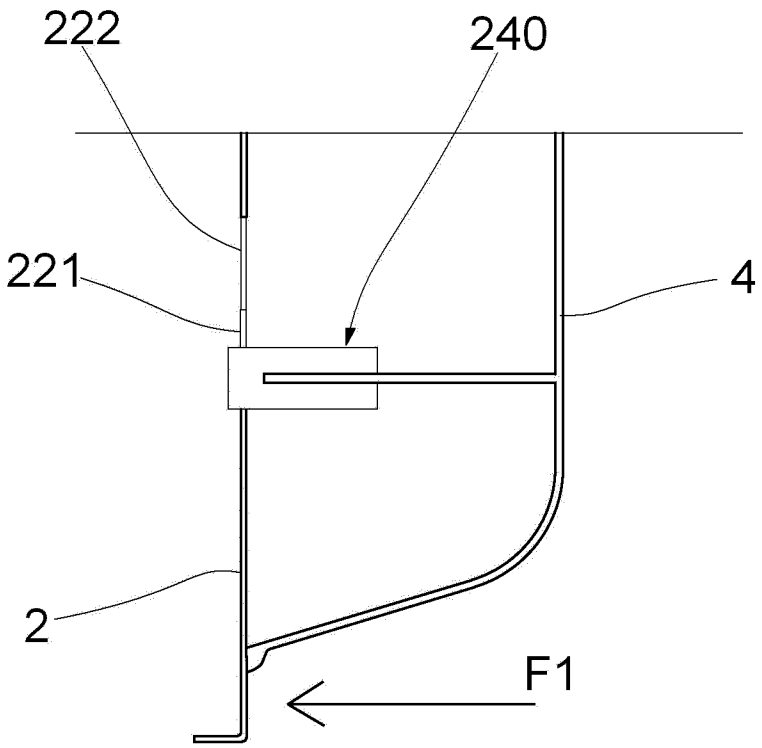

FIG. 6

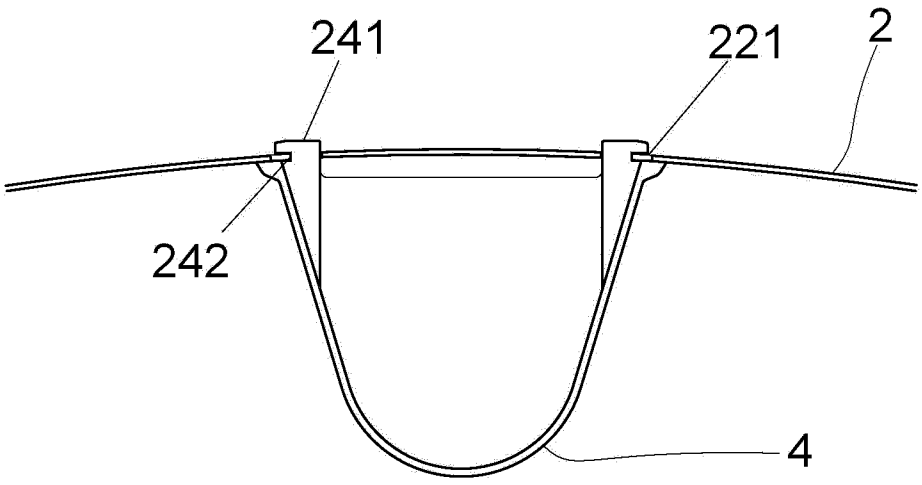

FIG. 7
PRIOR ART

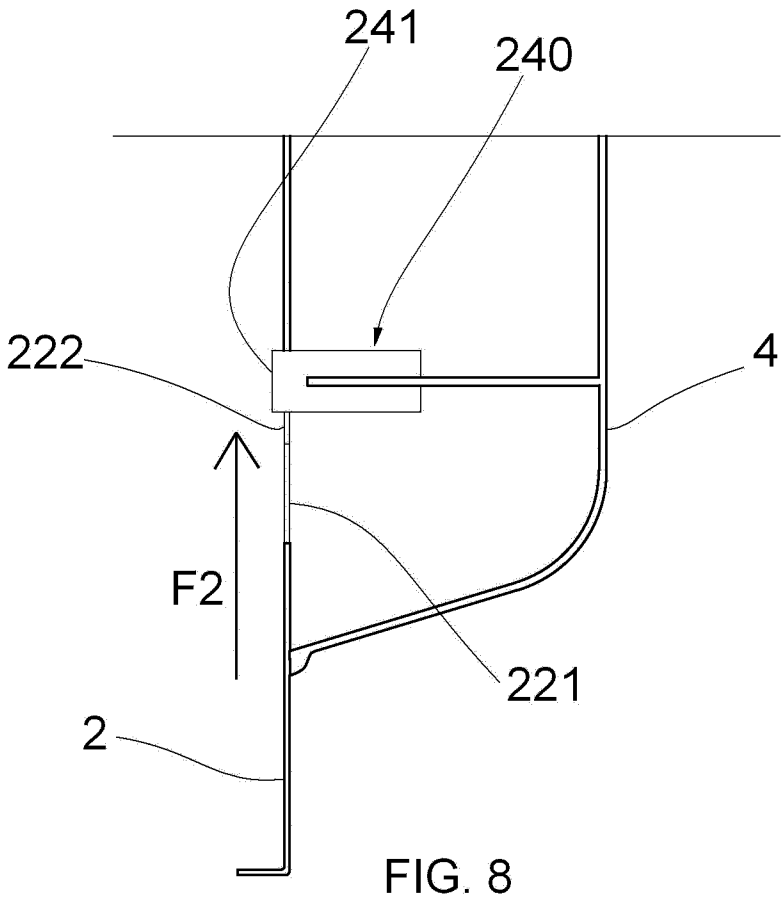

FIG. 8

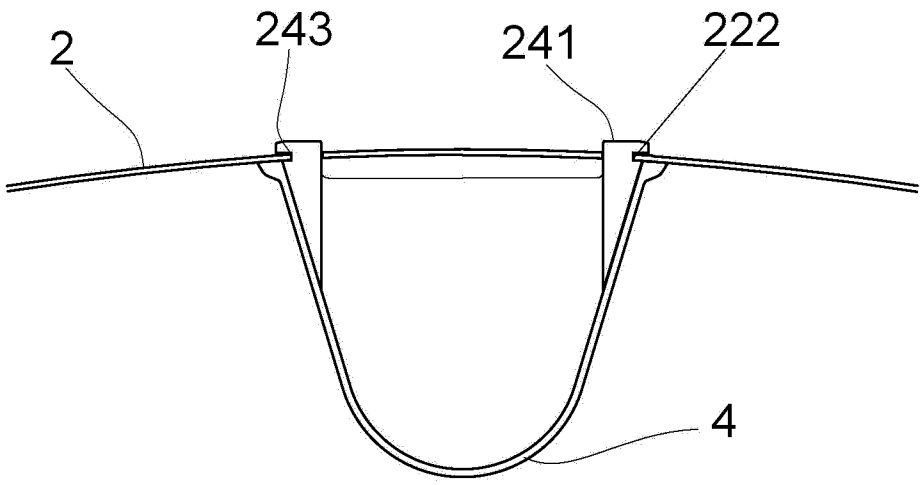

FIG. 9
PRIOR ART

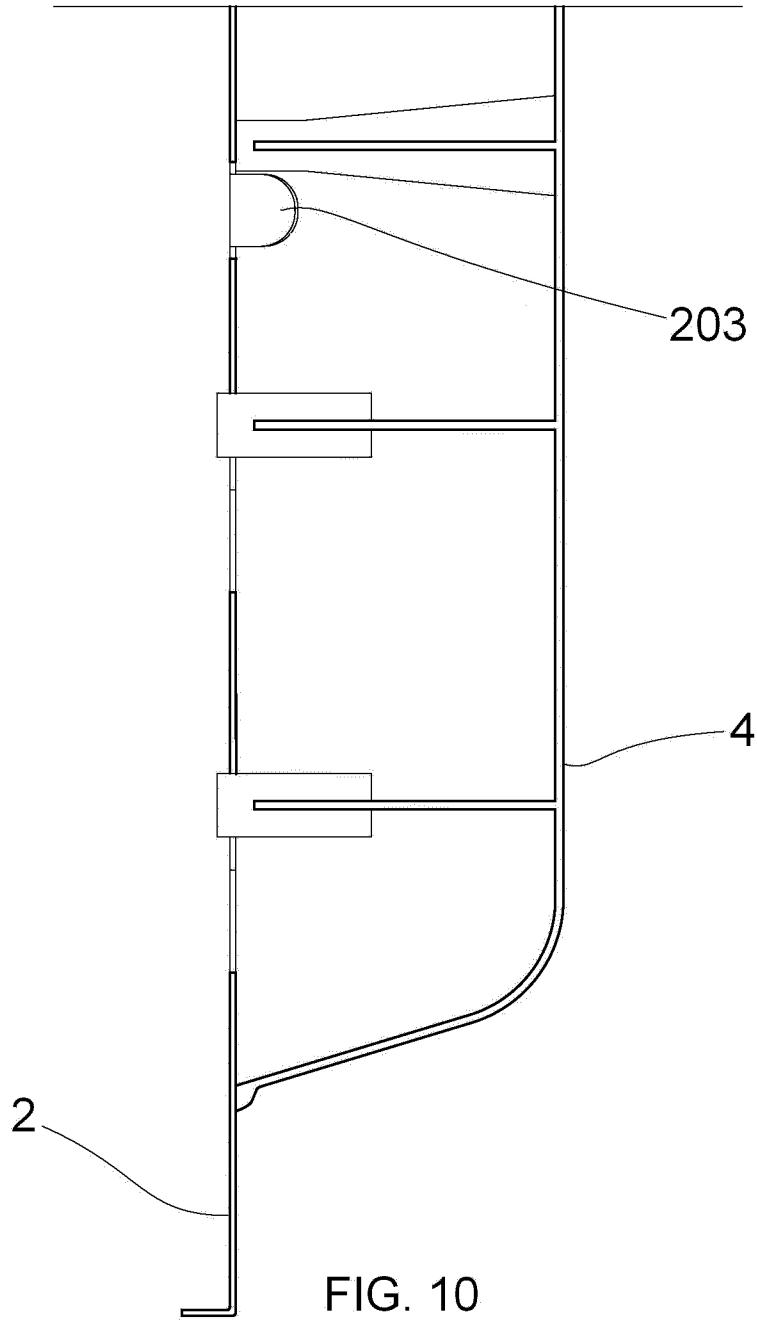

FIG. 10

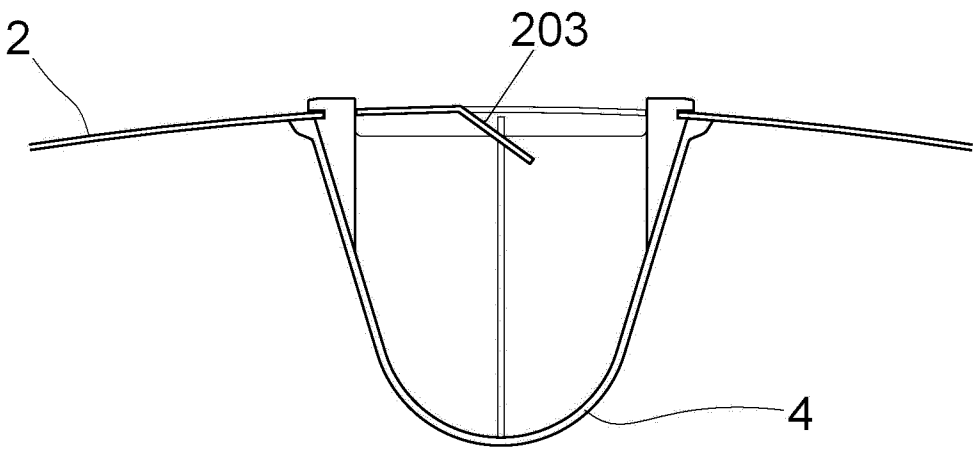

FIG. 11
PRIOR ART

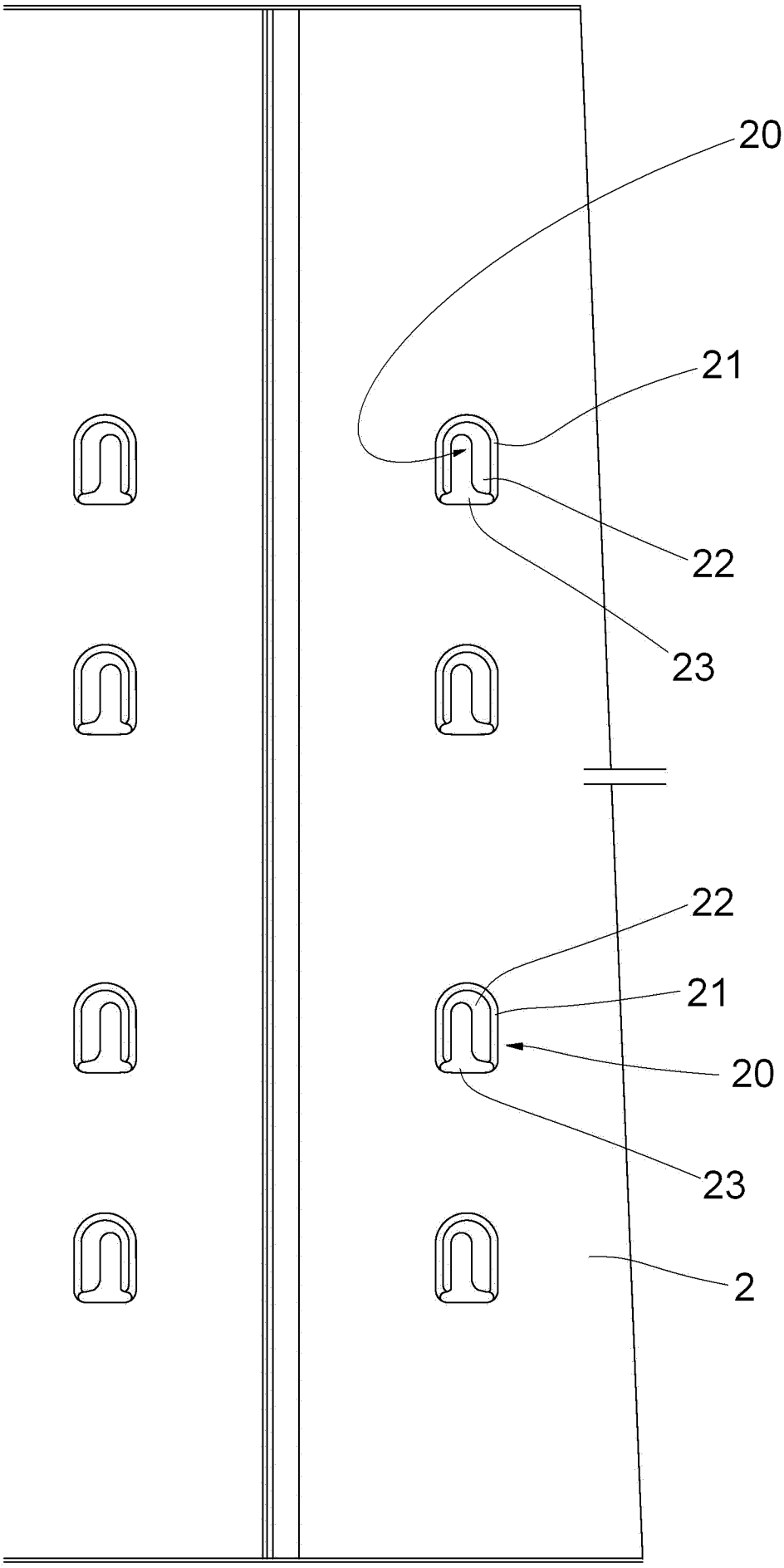

FIG. 12

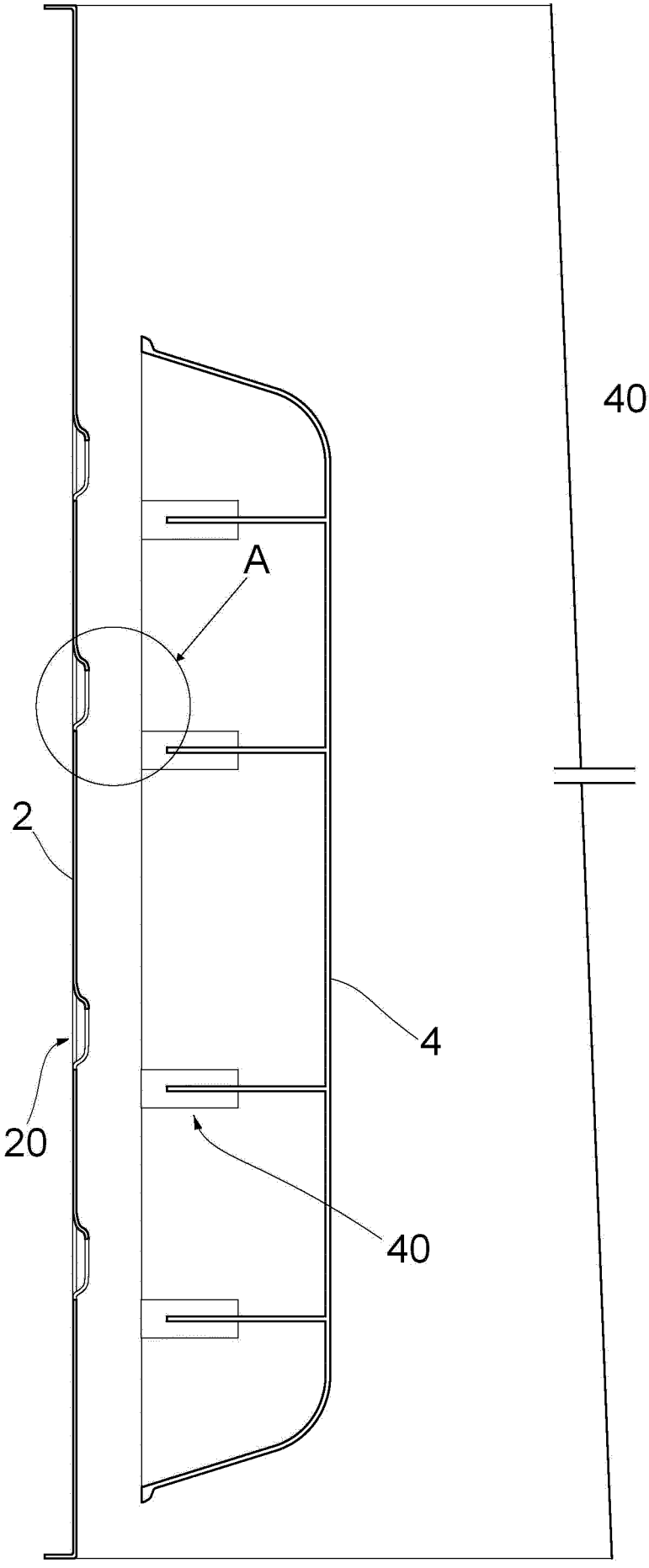

FIG. 13

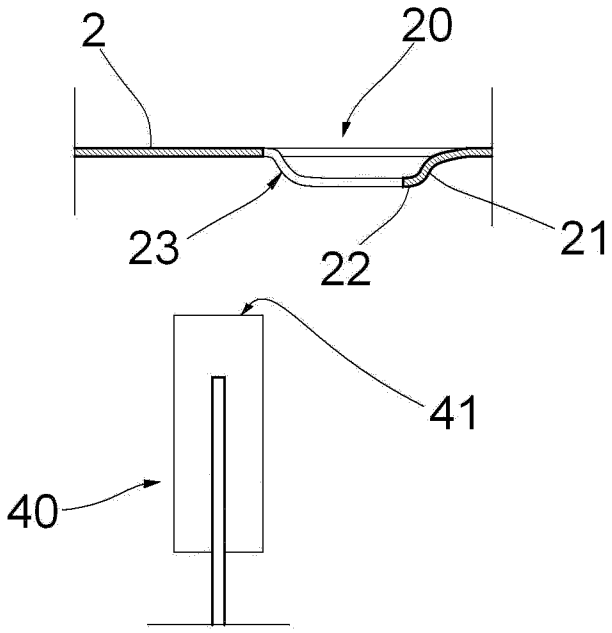

FIG. 13A

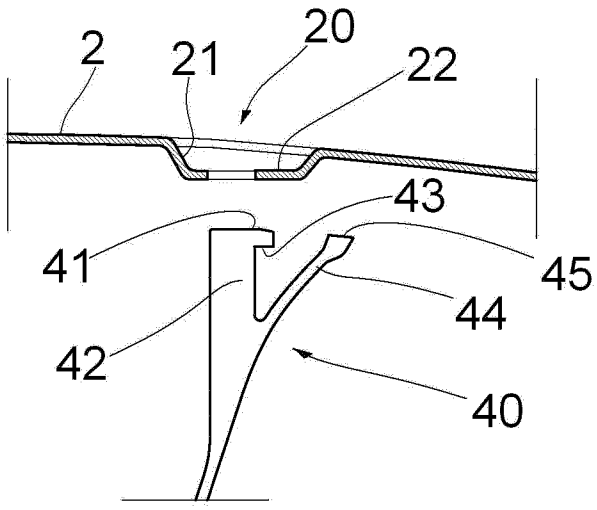

FIG. 14B

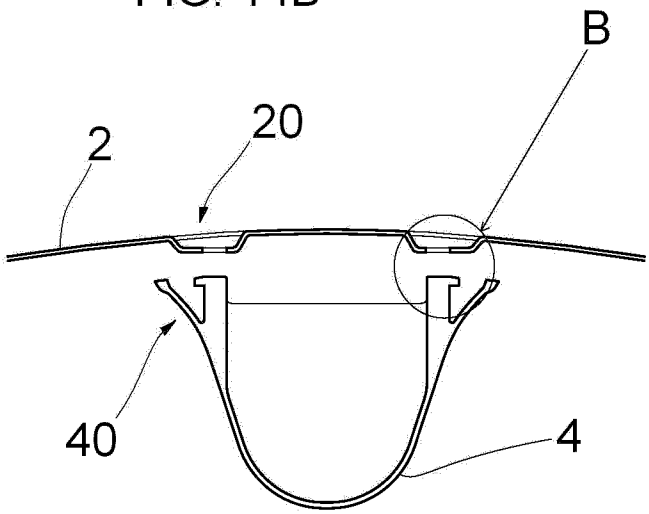

FIG. 14

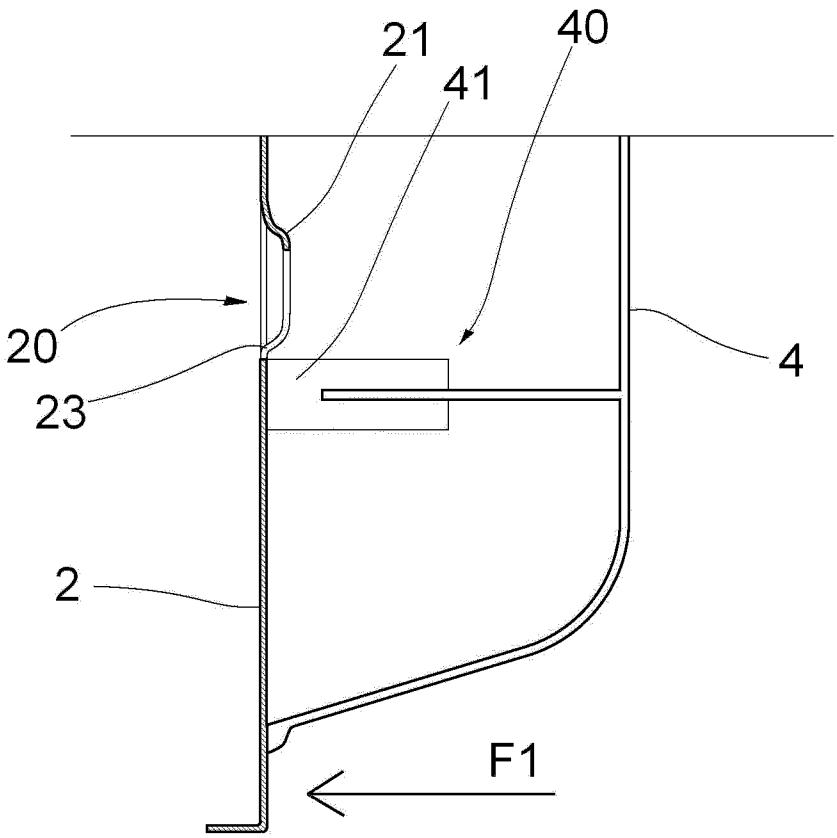

FIG. 15

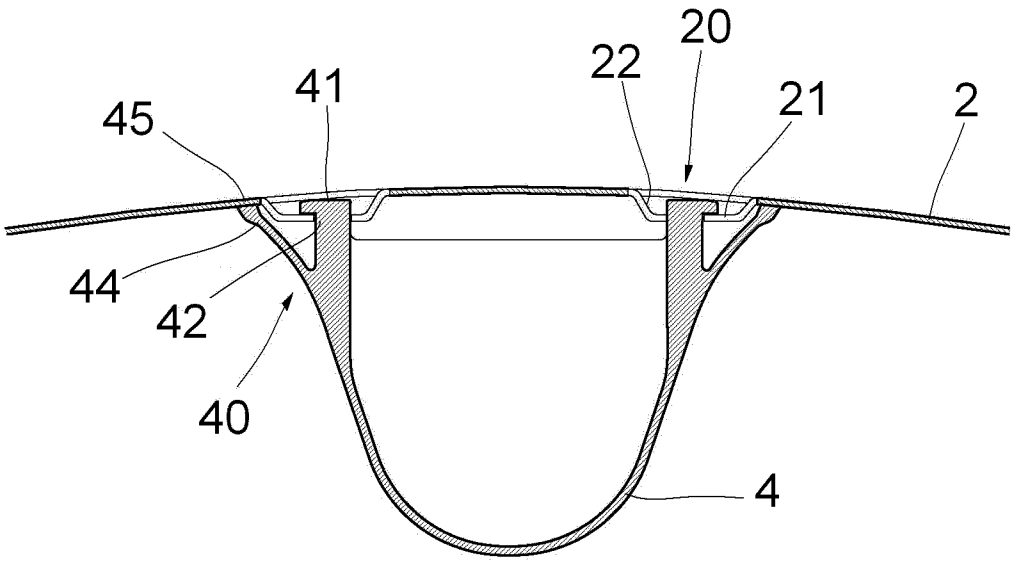

FIG. 16

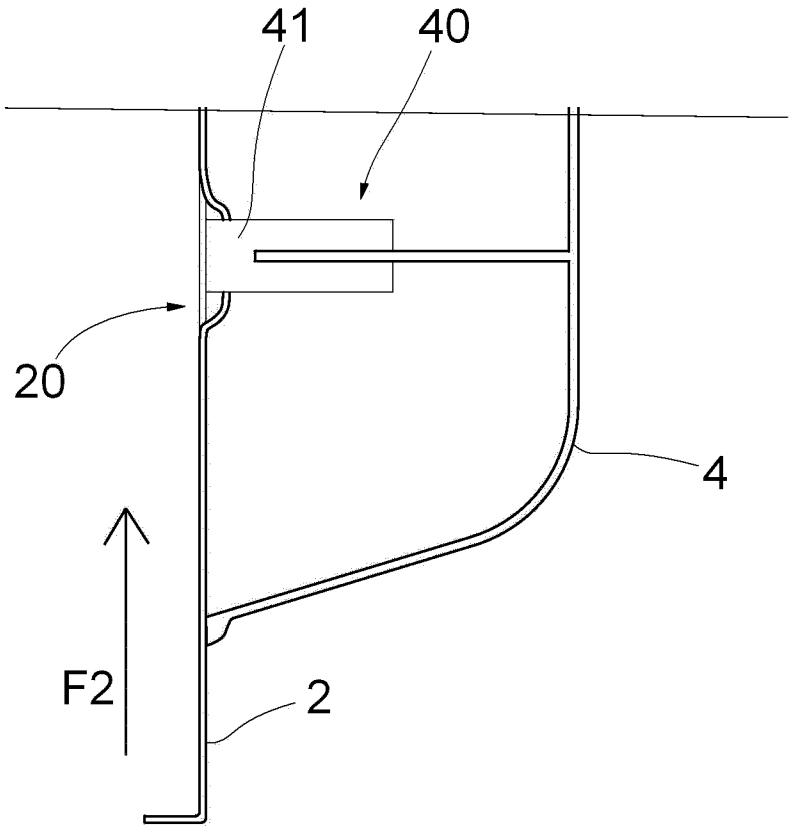

FIG. 17

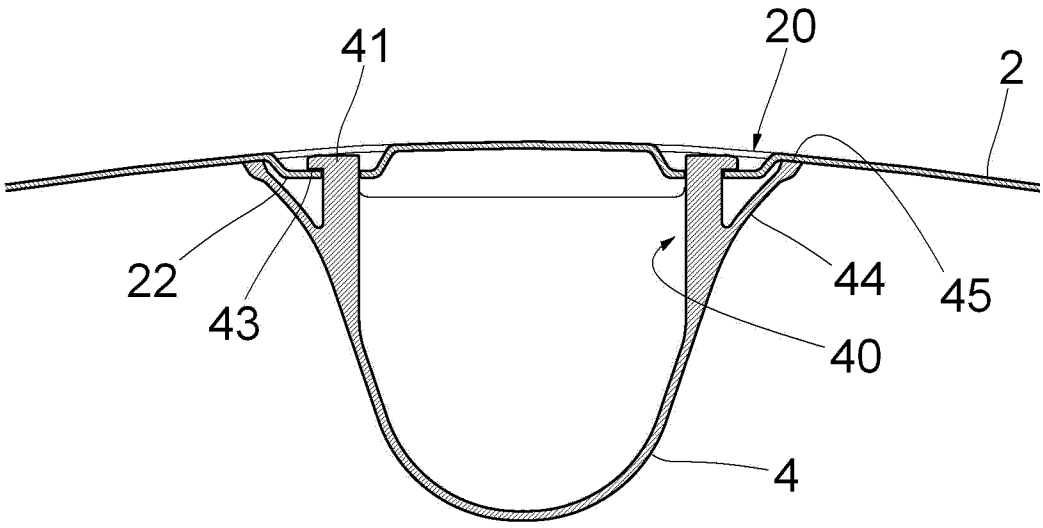

FIG. 18

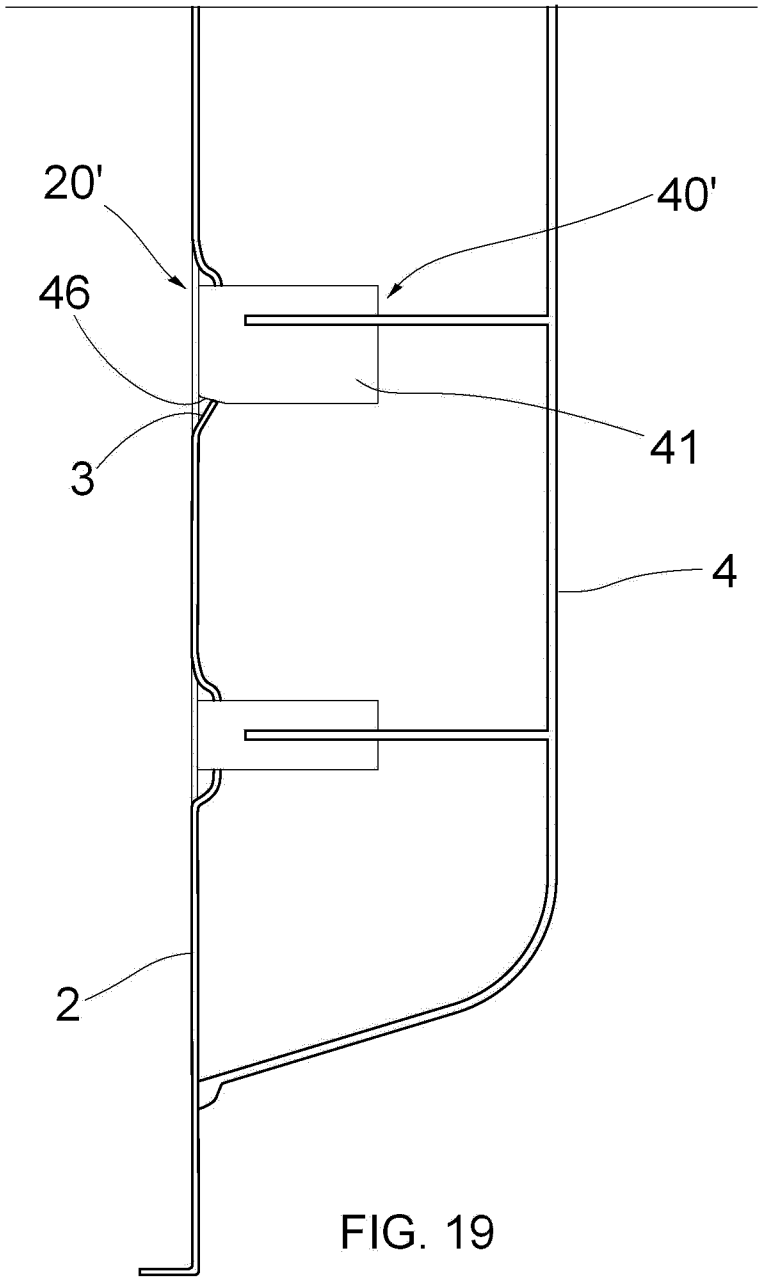

FIG. 19

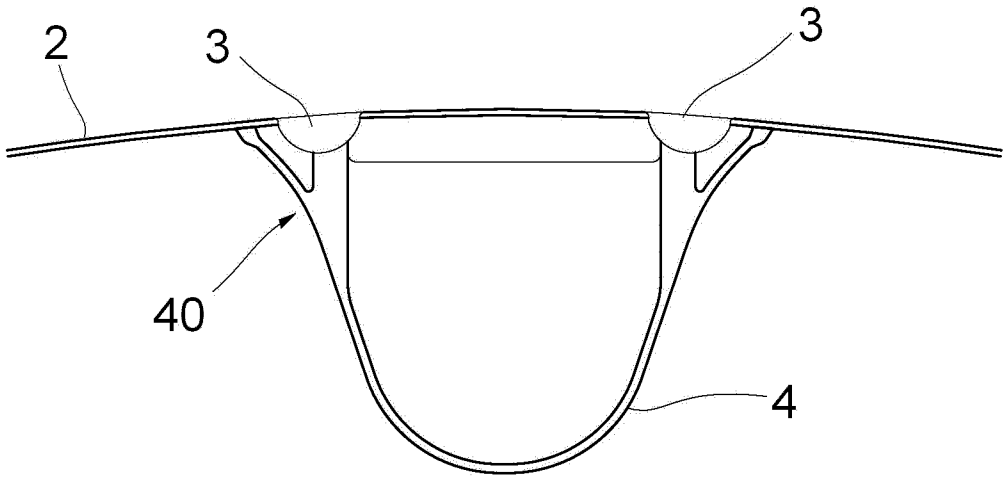

FIG. 20

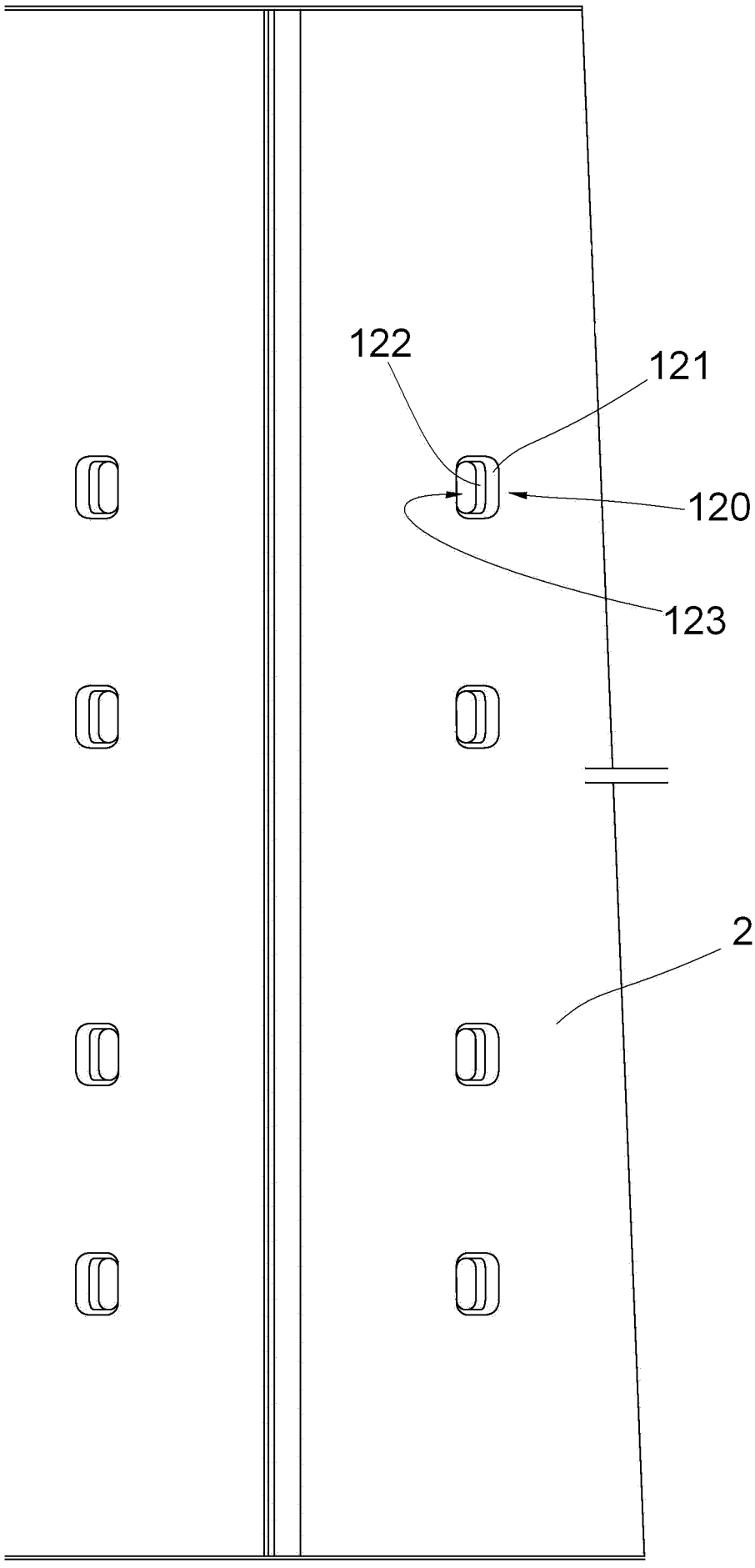

FIG. 21

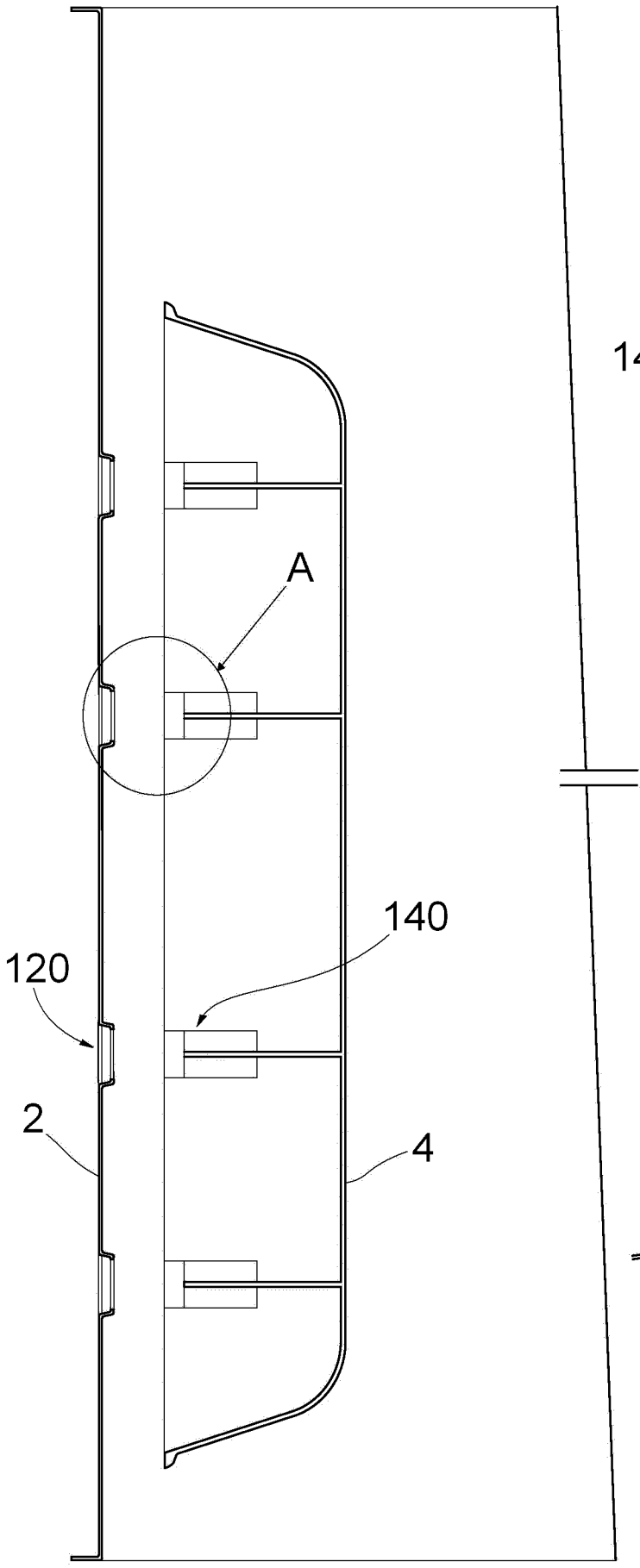

FIG. 22

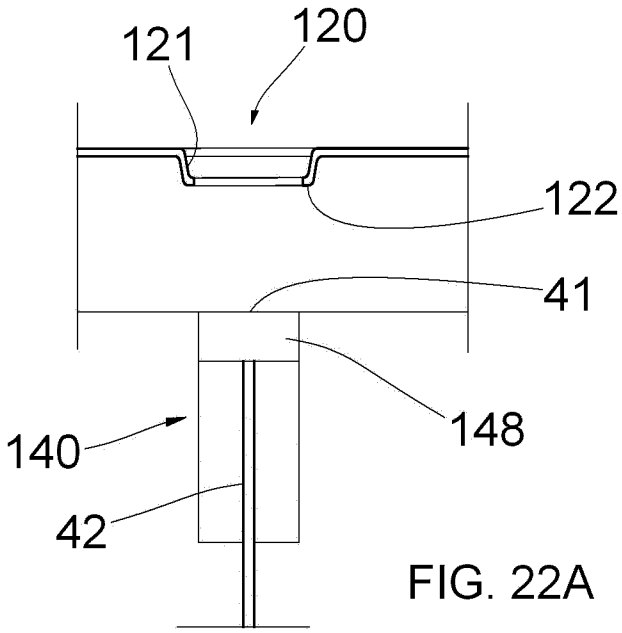

FIG. 22A

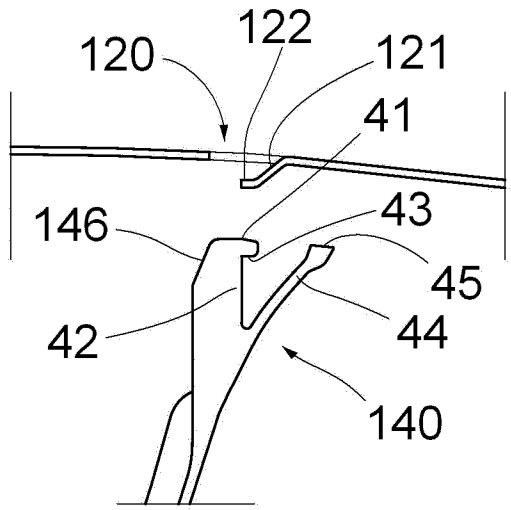

FIG. 22B

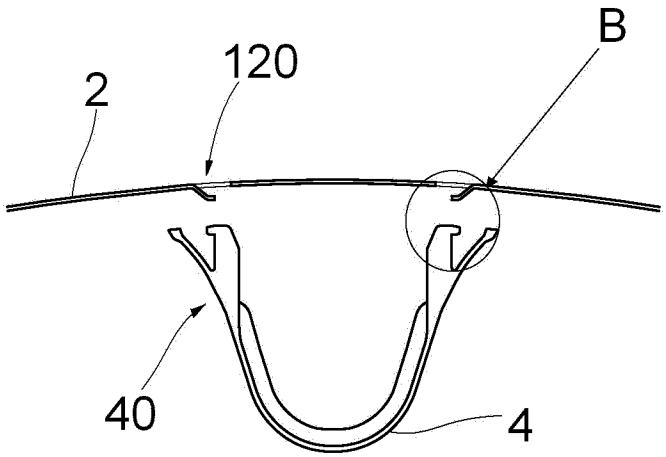

FIG. 23

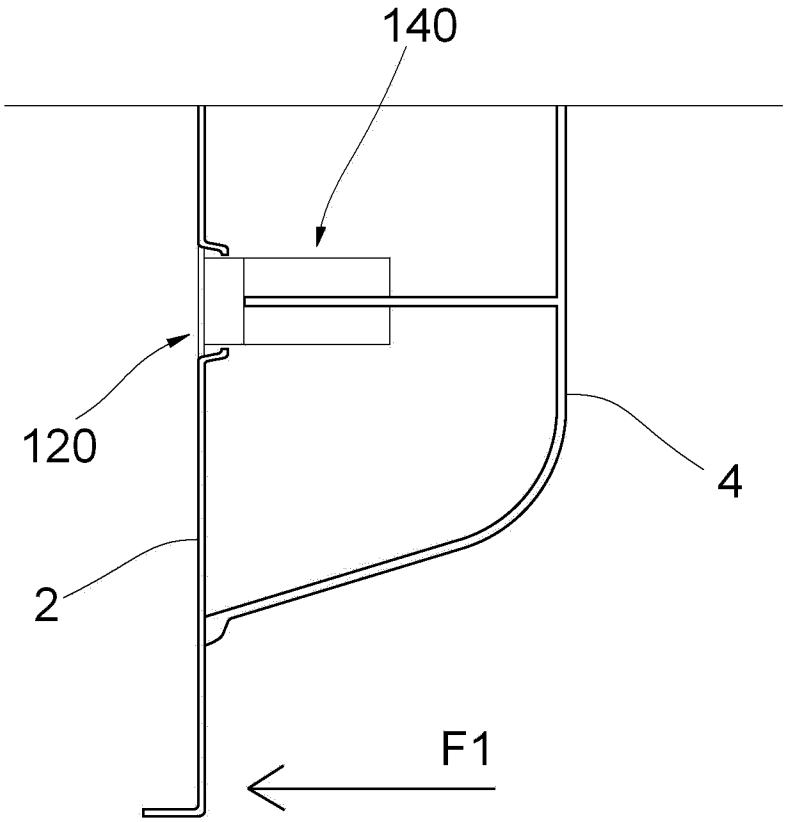

FIG. 24

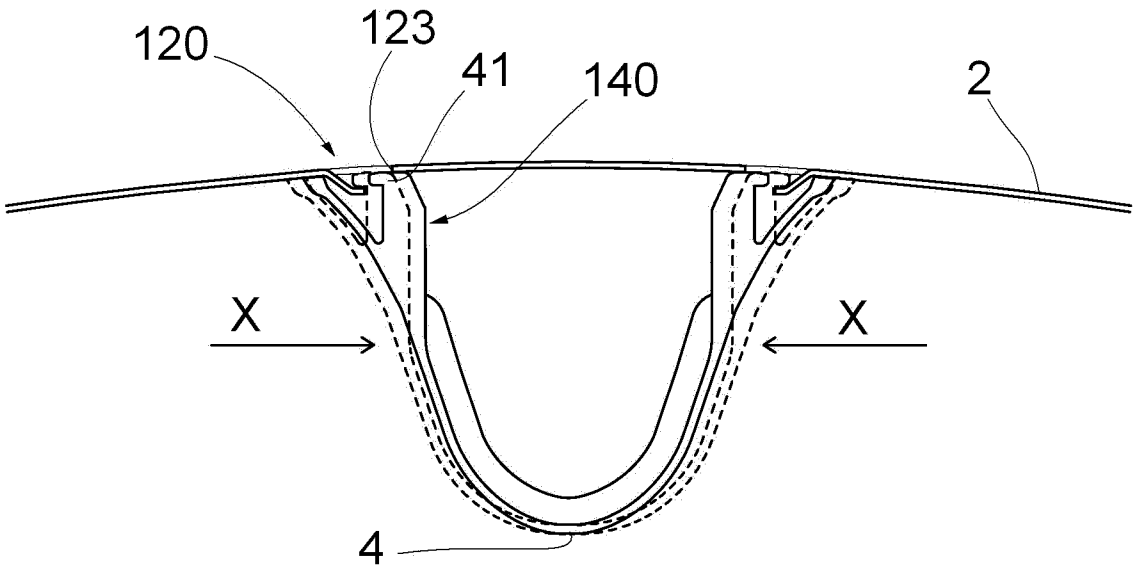

FIG. 25

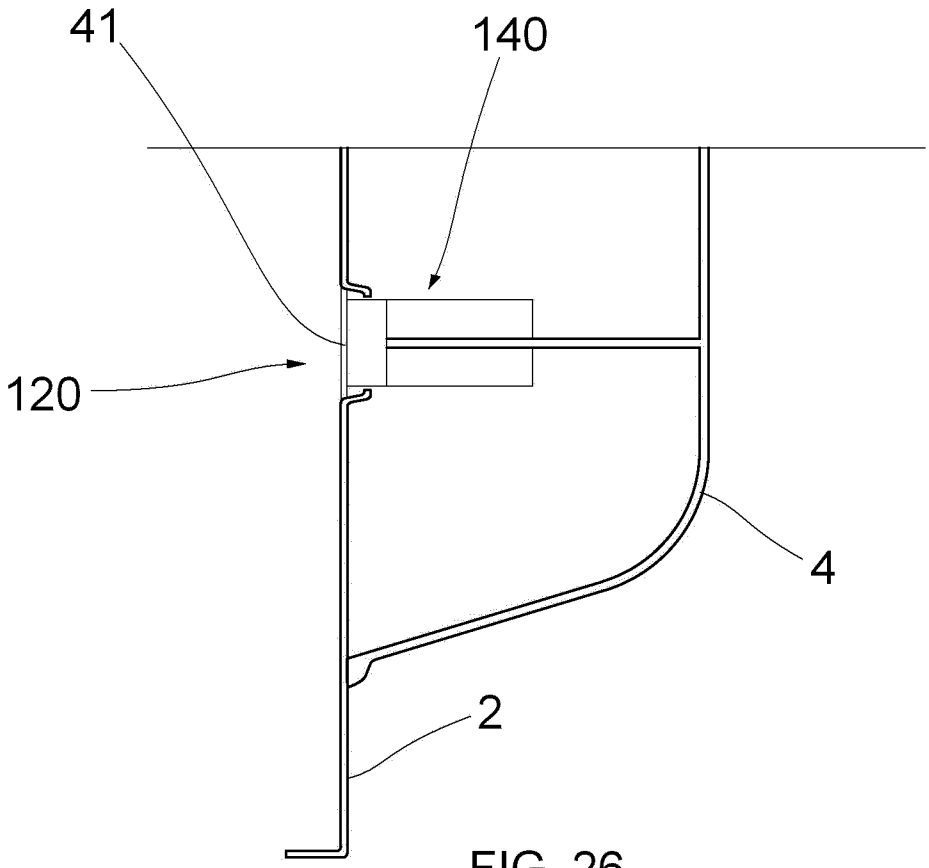

FIG. 26

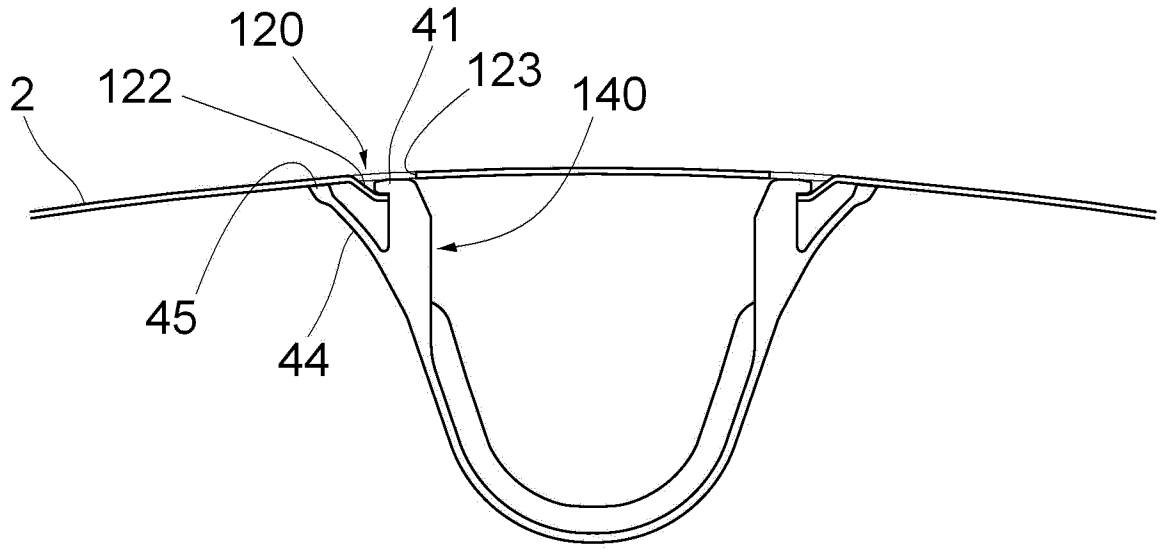

FIG. 27

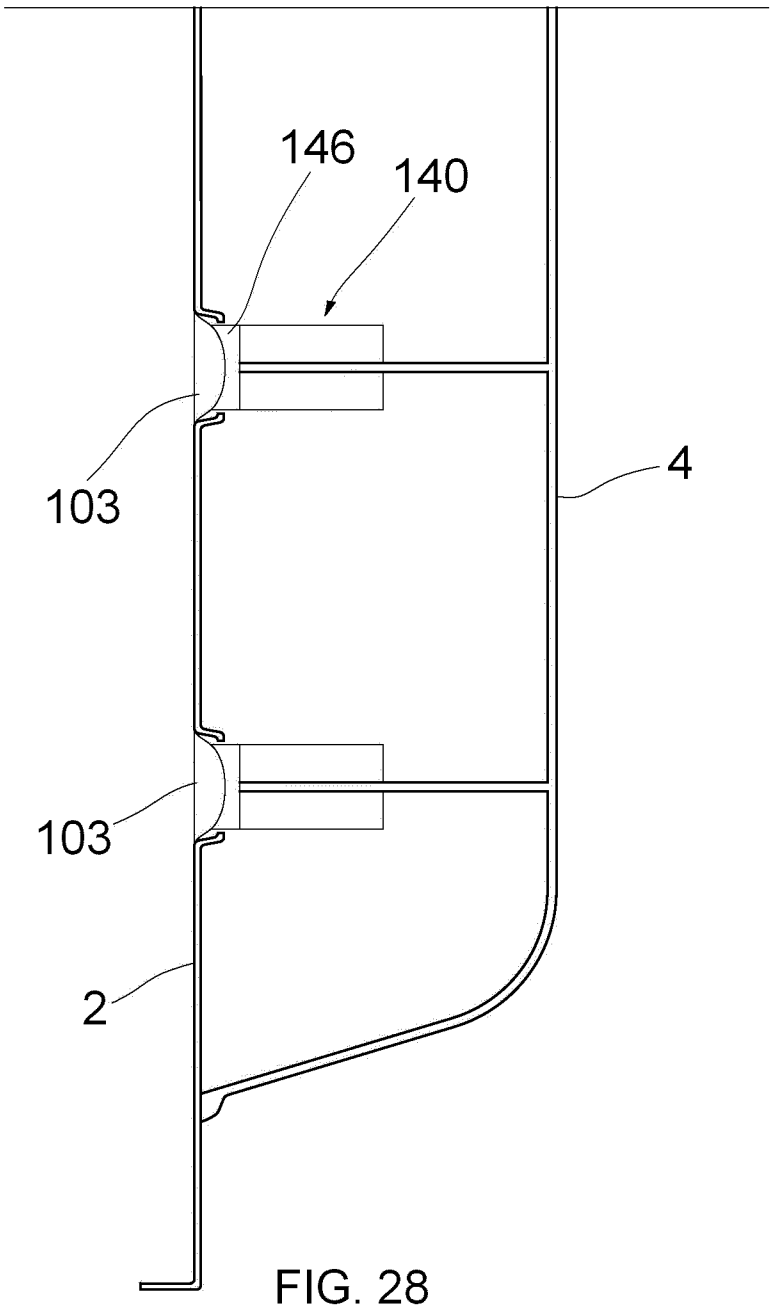

FIG. 28

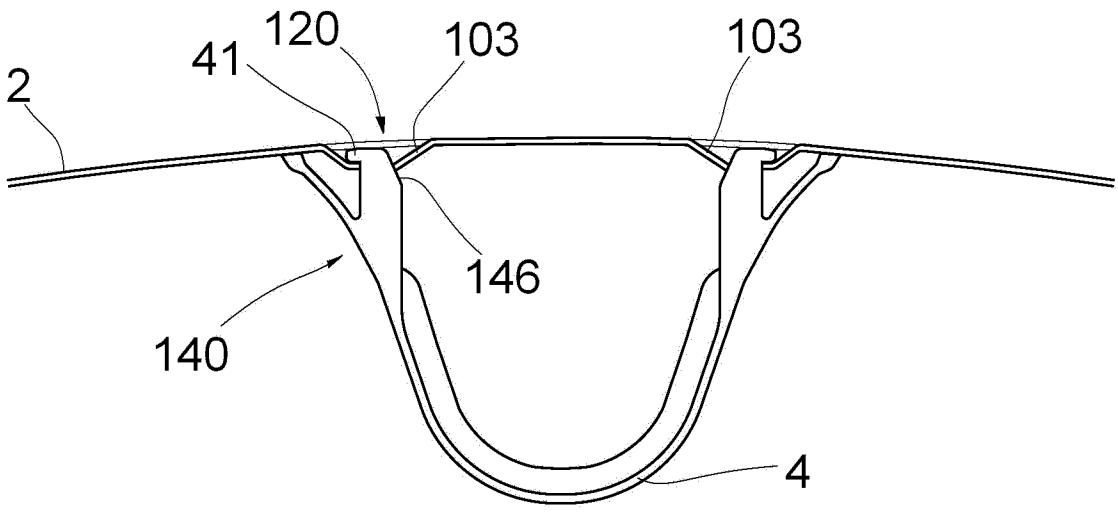

FIG. 29