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(54) **A REFRIGERATED CONTAINER**

KÜHLCONTAINER

CONTENANT REFRIGERE

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## Description

The present invention concerns a double-walled refrigerated container having an inner cladding and an outer cladding comprising horizontal and vertical, substantially plane sheet members to form the internal and external, respectively, wall, roof and bottom faces of the claddings as well as an intermediate, bonded insulation layer of plastics foam, said sheet members of the outer cladding being attached to the load receiving frame of the container, which comprises upper and lower longitudinal girders as well as upper and lower transverse girders and vertical corner posts at the gables, the lower longitudinal girders being made of sheet members which, seen in cross-section, are smoothly, openly bent profiles, such that the thickness of the insulation layer in the transition between side wall and bottom substantially corresponds to or is greater than the thickness of the side wall insulation layer.

Today refrigerated containers of the type mentioned above are widely used for oversea transportation of food products which must be kept cooled at temperatures within very narrow temperature ranges depending upon the nature of the transported goods. These may in particular be meat, fruit or vegetables. Therefore, strict requirements are made with respect to the tightness and the insulation capacity of the container during use for an extended period of time. Also, it is desired to utilize the transport volume of the container as well as possible within the given maximum outer dimensions of the container and particularly in view of the insulation capacity, strength and weight of the refrigerated container. These are factors which are of decisive importance for the transport factors which are of decisive importance for the transport earning capacity when using the refrigerated container in question. It should also be mentioned that the maintenance costs of the refrigerated container should be kept as low as possible.

EP-B-0 064 712 discloses a refrigerated container of the type mentioned in the opening paragraph comprising an outer cladding of corrugated wall sheets, where the vertical corrugations of the sheets are terminated inwardly spaced from the sheet rim. The external wall sheets are connected with the upper and lower longitudinal girders and the corner posts by encircling weld seams. As shown in the drawing, the container bottom is supported by underlying, transverse, strong profiles which are connected with the lower longitudinal girders.

WO 88/07485 discloses a refrigerated container having a self-supporting floor structure comprising a plane steel floor sheet, an upper extruded T-floor of aluminium and an intermediate, bonded insulation layer of high density foam, such as polyurethane foam having a density from 80 to 90 kg/m<sup>3</sup>. This document exclusively provides teachings for the construction of the floor of the refrigerated container, and thus not for a strong and tight construction of the entire refrigerated container as

such.

EP-A-0 348 629 discloses another refrigerated container having a self-supporting bottom structure including a plane bottom sheet, an upper extruded T-floor of aluminium and an intermediate, bonded, foamed insulation layer. As shown in the drawing, the longitudinal girder comprises a stiffening L-profile which is coextensive with the longitudinal girder and is positioned inside the insulation. Nothing is said about the longitudinal joints between the longitudinal girder and the bottom sheet and the external side sheets, and thus nothing about how to obtain a strength-imparting construction of the entire refrigerated container as such.

In spite of the knowledge of the two last-mentioned documents there is today no refrigerated containers in the market which comprise a self-supporting bottom structure having a plane bottom sheet which is free of strong downwardly extending and transversely extending corrugations which provide the desired strength of the container bottom, or which are free of strong transversely extending, underlying I-profiles which have to be welded or riveted to the lower longitudinal girders by time-consuming operations, or refrigerated containers which are free of inner, longitudinal stiffening profiles in the insulation foam at the transition between bottom and side wall. Of course, these downwardly extending corrugations or underlying I-profiles undesirably occupy a not insignificant part of the internal, effective transport volume of the refrigerated container corresponding to the corrugations or the height of the profiles, if, other things being equal, the insulation capacity of the container bottom is to be maintained. In the known refrigerated containers the thickness of the insulation layer in the bottom is frequently reduced, however, in order to obtain an inner transport volume in the refrigerated container as effective as possible, but this consequently results in a significantly deteriorated insulation capacity of the container bottom. The use of longitudinal stiffening profiles in the insulation foam results in undesirable "thermal bridges" in the transition between the bottom and the side wall.

Further, it is time-consuming and cumbersome to mount the profiles, in particular because of the subsequent long foaming of the insulation layer in the area around the profiles and in cavities which are formed between the profiles and the sheet members on which the profiles are mounted. Frequently, considerable areas are left unfoamed, causing an additionally diminished insulation capacity.

Accordingly, the object of the present invention is to provide a refrigerated container of the type mentioned in the opening paragraph which has an optimum utilization of the internal effective transport volume of the refrigerated container, and which is simultaneously both diffusion-tight, strong and has an optimum insulation capacity in particular at the bottom and the transition between the bottom and the side walls also after an extended period of use.

The double-walled refrigerated container of the present invention is characterized in that said intermediate insulation layer extends uninterruptedly through the transition between side wall and bottom wall, in that all joints between the sheet members of the inner cladding are all-welded to provide a completely diffusion-tight, strong and rigid inner shell, and in that the sheet members of the outer cladding, which form the bottom face or the sheet members of the lower longitudinal girders, comprise longitudinal, downwardly extending corrugations which extend close to the joint between said sheet members.

This structure provides a refrigerated container which has a particularly low weight and high insulation capacity as well as a maximum internal, effective transport volume in relation to the known refrigerated containers. The inner cladding and the outer cladding exclusively comprise sheet members, and the container is thus free of substantial protruding parts or profiles which either extend longitudinally inside the insulation foam, or protrude from the outer side of the container thereby occupying space, and which were necessary in the past to stiffen the container bottom transversely. Further, maximum insulation capacity is maintained at said transitions without thermal bridges.

Since all joints with the sheet members of the inner cladding are all-welded the inner cladding will serve as a load receiving, strong and rigid inner shell in use. Both the inner cladding, the outer cladding and the frame parts can thereby be made of lighter materials than known before. During use for an extended period of time the inner cladding of the container will still be diffusion-tight, in contrast to the known refrigerated containers in which the inner cladding always comprises sheet members which are riveted or glued together.

The all-welded inner cladding thus ensures that no water vapour diffusion takes place from the outside and into the container goods and from the inside and out into the insulation. Similarly, diffusion of the CFC reduced cell gas from the insulation of the container into the container goods is prevented.

The combination of the all-welded inner shell, the smoothly bent shape of the lower longitudinal girder and the downwardly extending corrugations ensures that the container can be made free of internal longitudinal profiles extending inside the insulation foam. In other words, there is provided a strong and rigid refrigerated container with an optimum insulation capacity, in particular at the bottom and at the transitions between side wall and bottom.

Expedient embodiments of the refrigerated container of the invention are disclosed in claims 2-10.

The invention will be explained more fully below with reference to the drawing, in which

fig. 1 is a partially sectional view of the refrigerated container of the invention, but on a somewhat incorrectly drawn scale to show the annular insulation

layer more clearly,

fig. 2 is an enlarged sectional view through a lower part of the container at the transition between bottom and side wall,

fig. 3 is a vertical section through the container gable which comprises the doors,

fig. 4 is a horizontal section through the same.

The double-walled refrigerated container 1 shown in fig. 1 comprises an inner cladding 2 of an aluminium sheet material and an outer cladding 3 of a steel sheet material. The refrigerated container 1 moreover comprises an intermediate, bonded insulation layer 4 of extruded polystyrene foam in the bottom and of polyurethane foam in other parts of the container.

The inner cladding 2 comprises vertical sheet members 5, 6, which form the internal wall faces of the inner cladding, as well as horizontal sheet members 7, which form the internal roof faces. The inner cladding 2 moreover comprises a T-floor 8 of extruded aluminium profiles welded together. All joints between the sheet members 5, 6, 7 of the inner cladding and the T-floor 8 are all welded to provide a completely diffusion-tight, strong and rigid inner shell.

The outer cladding 3 comprises substantially plane sheet members 9, 10, and 11 of a steel material to form the external wall, roof and bottom faces. The sheet members may be provided with transverse, slightly downwardly pressed corrugations 22 extending spaced from the longitudinal sheet edges.

The refrigerated container 1 comprises a load receiving frame which comprises mutually welded upper and lower longitudinal girders 12, 13 as well as upper and lower transverse girders 14, 15 and vertical corner posts 16 at the gables. The upper and lower longitudinal girders 12, 13 are formed of sheet members which, seen in cross-section, are evenly and openly bent profiles, such that the thickness of the insulation layer in the transition between side wall and bottom and between side wall and roof substantially corresponds to or is greater than the thickness of the side wall or roof insulation layer 4. A maximum insulation capacity is hereby maintained in said transitions without thermal bridges. In the embodiment shown in fig. 2 the lower longitudinal girders 13, seen in cross-section, are in the form of a "soft" L-profile so that the bent shape gives the transition of the outer cladding from vertical to horizontal sheet members the form of an external bevel, which has a considerably damage-limiting function in the handling of the container.

All joints 17 between the sheet members 9, 10, 11 of the outer cladding and the load receiving frame 13, 14, 15, 16 of the container are all-welded to provide a completely diffusion-tight, strong and rigid outer shell. Welding may take place e.g. by resistance or laser weld-

ing. However, the joints 17 may also be provided by a combination of gluing and spot welding, the essential thing being that a diffusion-tight, strong and rigid outer shell is provided. Gluing may e.g. be effected with polyurethane glue.

As shown in fig. 2, the lower longitudinal girders 13 comprise a longitudinal, downwardly protruding slight corrugation 18, which extends close to the joint 17 between the longitudinal girder concerned and the bottom sheet 11. The longitudinal corrugation 18 protrudes sufficiently down from the bottom to support the container if it is placed with its bottom directly on the ground, and will simultaneously "push" any small stones away, without the bottom being deformed. The longitudinal corrugation 18 also contributes to the desired stiffening of the transition between bottom and side wall.

In this embodiment the inner cladding and the outer cladding exclusively comprise sheet members and are substantially free of essential protruding parts or profiles which either extend longitudinally inside the insulation foam or protrude from the outer side of the container, including the bottom, in a space-requiring manner. The container will simultaneously be both more rigid and strong and also have a lower weight as well as higher insulation capacity in relation to the known refrigerated containers, and moreover a greater internal transport volume in the refrigerated container will be obtained. The container also has smooth and clean outer and inner faces. The diffusion-tight, strong and rigid outer cladding and inner cladding ensures a long container service life, since the container will not be just as subject to degradation of the insulation material as the known refrigerated containers, in which most of the sheet members are riveted or glued to the frame.

It should be mentioned that the insulation layer 4 may be formed by plastics foam which have been pre-manufactured in blocks, which are glued together with the sheet members of the inner cladding 2 and the outer cladding 3, or which are foamed directly between the inner cladding 2 and the outer cladding 3 to fix these. The insulation layer 4 may e.g. comprise extruded polystyrene foam in blocks having a weight of 40 kg/m<sup>3</sup> in the container bottom and polyurethane foam having a weight of 60 kg/m<sup>3</sup> in the walls and of 50 kg/m<sup>3</sup> in the roof. It should moreover be mentioned that the longitudinal girders may be bent of stainless steel sheets having a thickness of 3.5 mm, and that the outer sheet members of the outer cladding may be made of stainless steel sheet material having a thickness of 0.7-2.0 mm. The sheet members of the inner cladding are made of aluminium sheet material having a thickness of 3.5 mm.

At the container gables, e.g. the gable comprising the doors 118, the sheet members 6, 7 and 8 of the inner cladding may be welded to an internal frame 19 of sheet material. The sheet members 9, 10 and 11 in the outer cladding of the container may be welded to an external frame at the gable, said external frame being

formed by the welded transverse girders 14, 15 and the vertical corner posts 16. An annular insert of a resilient material 20 may be interposed between the internal frame 19 of sheet material and the external strength-imparting profile frame. The inner cladding and the outer cladding can hereby work slightly with respect to each other because of varying temperature influences and coefficients of thermal expansion, without involving any risk of leakages that might reduce the insulation capacity, while obviating galvanic corrosion that may occur at a metallic connection between inner cladding and outer cladding.

The container doors 118 may be provided with an annular, inwardly extending knife or strip 21, which is pressed into a further intermediate insert 20a of rubber or directly into the resilient insert 20 upon closure of the doors 118. This ensures particularly reliable sealing of the doors 118.

Many modifications can be made within the scope of the claims, since e.g. the longitudinal girders may be bent of sheet members which have many different cross-sectional shapes, e.g. an arc shape.

#### Claims

1. A double-walled refrigerated container (1) having an inner cladding (2) and an outer cladding (3) comprising horizontal and vertical, substantially plane sheet members (6, 7, 8; 9, 10, 11) to form the internal and external, respectively, wall, roof and bottom faces of the claddings (2, 3) as well as an intermediate, bonded insulation layer (4) of plastics foam, said sheet members (9, 10, 11) of the outer cladding (3) being attached to the load receiving frame of the container (1), which comprises upper and lower longitudinal girders (12, 13) as well as upper and lower transverse girders (14, 15) and vertical corner posts (16) at the gables, the lower longitudinal girders (13) being made of sheet members which, seen in cross-section, are smoothly, openly bent profiles, such that the thickness of the insulation layer (4) in the transition between side wall and bottom substantially corresponds to or is greater than the thickness of the side wall insulation layer (4), **characterized** in that said intermediate insulation layer extends uninterruptedly through the transition between side wall and bottom, in that all joints (9) between the sheet members (6, 7, 8) of the inner cladding (2) are all-welded to provide a completely diffusion-tight, strong and rigid inner shell, and in that the sheet members (11) of the outer cladding, which form the bottom face or the sheet members (12, 13) of the lower longitudinal girders, comprise longitudinal, downwardly extending corrugations (18) which extend close to the joint (17) between said sheet members.

2. A double-walled refrigerated container according to

claim 1, **characterized** in that the bent shape of the longitudinal girders (12, 13) gives the transitions of the outer cladding (3) from vertical to horizontal sheet members (9, 10, 11) the form of an external bevel.

3. A double-walled refrigerated container according to claim 1 or 2, **characterized** in that the sheet material of the longitudinal girders (12, 13) has a thickness which is between 2 and 10 times the thickness of the sheet members (9, 10, 11) of the outer cladding.

4. A double-walled refrigerated container according to one or more of claims 1-3, **characterized** in that all joints (17) between the sheet members (9, 10, 11) of the outer cladding and the load receiving frame (12, 13, 14, 15, 16) of the container (1) are all-welded to provide a completely diffusion-tight, strong and rigid outer shell.

5. A double-walled refrigerated container according to claim 3, **characterized** in that the sheet material of the longitudinal girders (12, 13) has a thickness of 3.5 mm, and the sheet members (9, 10, 11) of the cladding have a thickness of between 0.7 and 2.0 mm.

6. A double-walled refrigerated container according to one or more of claims 1-5, **characterized** in that the insulation layer (4) in the container bottom is formed by polystyrene foam having a weight of 30-50 kg/m<sup>3</sup> and are formed by polyurethane foam having a weight of 40-70 kg/m<sup>3</sup> in other parts of the container.

7. A double-walled refrigerated container according to one or more of claims 1-6, **characterized** in that all said joints (9, 17) are resistance welded.

8. A double-walled refrigerated container according to one or more of claims 1-7, **characterized** in that the sheet members (9, 10, 11, 12, 13) of the outer cladding are formed by stainless steel sheet material.

9. A double-walled refrigerated container according to one or more of claims 1-8, **characterized** in that the inner cladding is formed by aluminium sheet material.

10. A double-walled refrigerated container according to one or more of claims 1-9, **characterized** in that the longitudinal joints between the internal sheet members (8, 5) of the bottom and the side walls, seen in cross-section, are free of sharp corners and have a smoothly curved transition (fig. 2).

## Patentansprüche

1. Doppelwandiger Kühlcontainer (1) mit einer inneren Verkleidung (2) und einer äußeren Verkleidung (3), der horizontale und vertikale, im wesentlichen ebene Plattenelemente (6, 7, 8; 9, 10, 11), um die inneren und äußeren, jeweiligen Wand-, Decken- und Bodenflächen der Verkleidungen (2, 3) zu bilden, sowie eine Verbundisolierzwischenschicht (4) aus Kunststoffschäum aufweist, wobei die Plattenelemente (9, 10, 11) der äußeren Verkleidung (3) an dem lastaufnehmenden Rahmen des Containers (1) angebracht sind, der obere und untere Längsträger (12, 13) sowie obere und untere Querträger (14, 15) und an den Giebeln vertikale Eckpfosten (16) aufweist, wobei die unteren Längsträger (13) aus Plattenelementen angefertigt sind, die im Querschnitt stetig und offen gebogene Profile sind, so daß die Dicke der Isolierschicht (4) in dem Übergang zwischen der Seitenwand und dem Boden im wesentlichen der Dicke der Seitenwandisolierschicht (4) entspricht oder größer ist als dieser, dadurch gekennzeichnet, daß sich die Zwischenisolierschicht kontinuierlich durch den Übergang zwischen der Seitenwand und dem Boden erstreckt, daß alle Stoßstellen (9) zwischen den Plattenelementen 6, 7, 8) der inneren Verkleidung (2) durchgehend verschweißt sind, um einen vollständig diffusionsdichten, stabilen und festen Innenmantel vorzusehen, und daß die Plattenelemente (11) der äußeren Verkleidung, die die Bodenfläche der Plattenelemente (12, 13) bilden, oder die unteren Längsträger sich der Länge nach, nach unten erstreckende Auskragungen (18) haben, die sich nahe der Stoßstelle (17) zwischen den Plattenelementen erstrecken.

2. Doppelwandiger Kühlcontainer nach Anspruch 1, **dadurch gekennzeichnet, daß** die gebogene Form der Längsträger (12, 13) den Übergängen der äußeren Verkleidung (3) von den vertikalen zu den horizontalen Plattenelementen (9, 10, 11) die Form einer äußeren Abschrägung verleiht.

3. Doppelwandiger Kühlcontainer nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** das Plattenmaterial der Längsträger (12, 13) eine Dicke hat, die das zwei- bis zehnfache der Dicke der Plattenelemente (9, 10, 11) der äußeren Verkleidung ist.

4. Doppelwandiger Kühlcontainer nach einem oder mehreren der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** alle Stoßstellen (17) zwischen den Plattenelementen (9, 10, 11) der äußeren Verkleidung und des

lastaufnehmenden Rahmens (12, 13, 14, 15, 16) des Containers (1) durchgehend verschweißt sind, um einen vollständig diffusionsdichten, stabilen und festen Außenmantel vorzusehen.

5. Doppelwandiger Kühlcontainer nach Anspruch 3, **dadurch gekennzeichnet, daß** das Plattenmaterial der Längsträger (12, 13) eine Dicke von 3,5 mm hat und die Plattenelemente (9, 10, 11) der Verkleidung eine Dicke zwischen 0,7 und 2,0 mm haben.
6. Doppelwandiger Kühlcontainer nach einem oder mehreren der Ansprüche 1 bis 5, **dadurch gekennzeichnet, daß** die Isolierschicht (4) in dem Containerboden durch Polystyrenschaum gebildet ist, der ein Gewicht von 30 bis 50 kg/m<sup>3</sup> hat, und in anderen Teilen des Containers durch Polyurethanschaum mit einem Gewicht von 40 bis 70 kg/m<sup>3</sup> gebildet ist.
7. Doppelwandiger Kühlcontainer nach einem oder mehreren der Ansprüche 1 bis 6, **dadurch gekennzeichnet, daß** alle Stoßstellen (9, 17) widerstandsgeschweißt sind.
8. Doppelwandiger Kühlcontainer nach einem oder mehreren der Ansprüche 1 bis 7, **dadurch gekennzeichnet, daß** die Plattenelemente (9, 10, 11, 12, 13) der äußeren Verkleidung durch rostfreies Stahlblechmaterial gebildet sind.
9. Doppelwandiger Kühlcontainer nach einem oder mehreren der Ansprüche 1 bis 8, **dadurch gekennzeichnet, daß** die innere Verkleidung aus Aluminiumblechmaterial gebildet ist.
10. Doppelwandiger Kühlcontainer nach einem oder mehreren der Ansprüche 1 bis 9, **dadurch gekennzeichnet, daß** die Längsstoßstellen zwischen den Innenblechelementen (8, 5) der Boden- und der Seitenwände im Querschnitt ohne scharfe Kanten sind und einen leicht gekrümmten Übergang haben (Fig. 2).

## Revendications

1. Contenant réfrigéré à double paroi (1) ayant un placage intérieur (2) et un placage extérieur (3) comprenant des éléments de paroi horizontaux et verticaux sensiblement plans (6, 7, 8; 9, 10, 11) destinés à former respectivement les faces de côté, de plafond et de fond intérieures et extérieures des placages (2, 3), ainsi qu'une couche d'isolation intermédiaire collée (4) de matière plastique alvéo-

laire, lesdits éléments en tôle (9, 10, 11) du placage extérieur (3) étant fixés sur le cadre porteur du contenant (1), qui comprend des poutres longitudinales supérieures et inférieures (12, 13), ainsi que des poutres transversales supérieures et inférieures (14, 15) et des montants d'angle verticaux (16) au niveau des pignons, les poutres longitudinales inférieures (13) étant faites d'éléments en tôle qui, vus en coupe transversale, sont des profilés ouverts cintrés de manière légère et franche, de sorte que l'épaisseur de la couche d'isolation (4) dans la zone de transition entre la paroi latérale et le fond correspond sensiblement ou est supérieure à l'épaisseur de la couche d'isolation (4) de la paroi latérale, caractérisé en ce que ladite couche d'isolation intermédiaire s'étend sans discontinuer sur toute la zone de transition entre la paroi latérale et le fond, en ce que toutes les liaisons d'assemblage (9) entre les éléments en tôle (6, 7, 8) du placage intérieur (2) sont réalisées par soudage en continu pour donner une enveloppe intérieure totalement étanche à la diffusion, robuste et rigide, et en ce que les éléments en tôle (11) du placage extérieur, qui constituent la face formant fond des éléments en tôle (12, 13) des poutres longitudinales inférieures, présentent des ondulations longitudinales (18) s'étendant vers le bas, qui aboutissent tout près de la liaison d'assemblage (17) entre lesdits éléments en tôle.

2. Contenant réfrigéré à double paroi selon la revendication 1, caractérisé en ce que la configuration cintrée des poutres longitudinales (12, 13) confère aux transitions au niveau du placage extérieur (3) entre les éléments en tôle verticaux et horizontaux (9, 10, 11) la forme d'un biseau extérieur.
3. Contenant réfrigéré à double paroi selon la revendication 1 ou 2, caractérisé en ce que la tôle des poutres longitudinales (12, 13) a une épaisseur qui se situe entre 2 et 10 fois l'épaisseur des éléments en tôle (9, 10, 11) du placage extérieur.
4. Contenant réfrigéré à double paroi selon l'une ou plusieurs des revendications 1-3, caractérisé en ce que toutes les liaisons d'assemblage (17) entre les éléments en tôle (9, 10, 11) du placage extérieur et le cadre porteur (12, 13, 14, 15, 16) du contenant (1) sont réalisées par soudage en continu pour donner une enveloppe extérieure totalement étanche à la diffusion, robuste et rigide.
5. Contenant réfrigéré à double paroi selon la revendication 3, caractérisé en ce que la tôle des poutres longitudinales (12, 13) a une épaisseur de 3,5 mm, et les éléments en tôle (9, 10, 11) du placage ont une épaisseur se situant entre 0,7 et 2,0 mm.

6. Contenant réfrigéré à double paroi selon l'une ou plusieurs des revendications 1-5, caractérisé en ce que la couche d'isolation (4) au fond du contenant est constituée par de la mousse de polystyrène d'un poids de 30-50 kg/m<sup>3</sup> et est constituée par de la mousse de polyuréthane d'un poids de 40-70 kg/m<sup>3</sup> dans les autres parties du contenant. 5
7. Contenant réfrigéré à double paroi selon l'une ou plusieurs des revendications 1-6, caractérisé en ce que toutes lesdites liaisons d'assemblage (9, 17) sont réalisées par soudage par résistance. 10
8. Contenant réfrigéré à double paroi selon l'une ou plusieurs des revendications 1-7, caractérisé en ce que les éléments en tôle (9, 10, 11, 12, 13) du placage extérieur sont réalisés en tôle d'acier inoxydable. 15
9. Contenant réfrigéré à double paroi selon l'une ou plusieurs des revendications 1-8, caractérisé en ce que le placage intérieur est réalisé en tôle d'aluminium. 20
10. Contenant réfrigéré à double paroi selon l'une ou plusieurs des revendications 1-9, caractérisé en ce que les liaisons d'assemblage longitudinales entre les éléments intérieurs en tôle (8, 5) du fond et des parois latérales, vues en coupe transversale, sont exemptes d'angles vifs et forment une transition légèrement incurvée (fig.2). 25  
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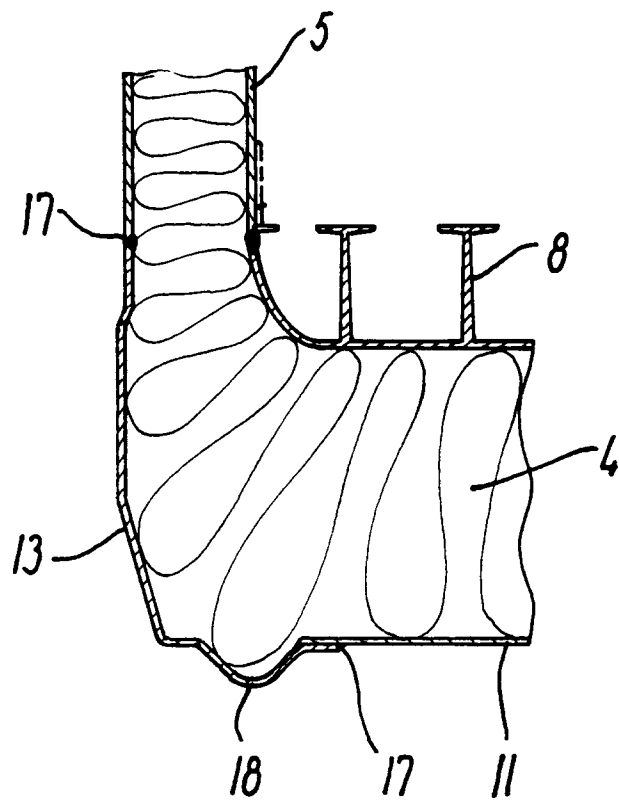


FIG.2



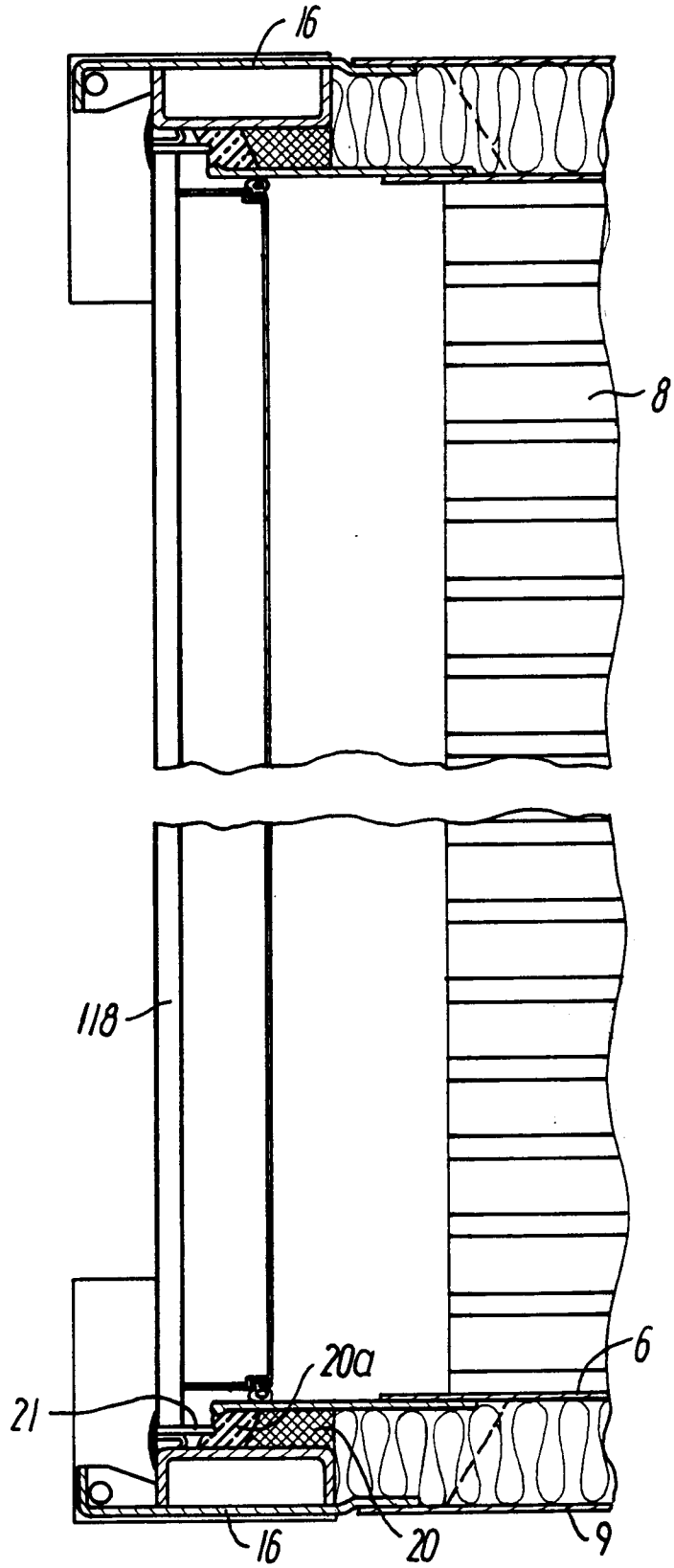


FIG.4