DESCRIPTION

CONTAINER REFRIGERATION APPARATUS

TECHNICAL FIELD

[0001]

The present disclosure relates to a container refrigeration apparatus.

BACKGROUND ART

[0002]

A container refrigeration apparatus has included a casing configured to close an opening of a container body (see, for example, Patent Document 1). This casing includes an external casing near the outside of the container body, and an internal casing near the inside of the container body. The internal casing is fitted to the side of the external casing near the inside of the container.

[0003]

The casing has a lower portion having a protrusion that protrudes toward the inside of the container. The casing includes side plates extending from the lower end to the upper end of the protrusion. The casing has side plate extension parts which are separate from the respective side plates and which extend the respective side plates upward from the protrusion.

CITATION LIST

PATENT DOCUMENTS

[0004]

Patent Document 1: Japanese Patent No. 4281823

SUMMARY

metal components (41 to 44) combined together, and each side plate (41) is one of the sheet metal components, and is thickest of the sheet metal components.

[0029]

According to the thirteenth aspect, the side plates (41) are the thickest of the sheet metal components (41 to 44) of the casing (11). The side plates (41) themselves have high rigidity. This can increase the strength of the casing (11) to an adequate degree.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

FIG. 1 is a perspective view illustrating a container refrigeration apparatus according to an embodiment as viewed from outside.

FIG. 2 is a cross-sectional view taken along line II-II shown in FIG. 1.

FIG. 3 is a perspective view illustrating a container refrigeration apparatus from which a partition plate is detached as viewed from inside.

FIG. 4 is a piping system diagram illustrating a refrigerant circuit.

FIG. 5 is a perspective view of an external casing as viewed from inside.

FIG. 6 is a perspective view of a casing that includes an external casing and an internal casing covering the external casing, as viewed from inside.

FIG. 7 is a cross-sectional view of the casing taken along line VII-VII in FIG. 6, as viewed from above.

FIG. 8 is a perspective view of the same cross section of the casing as that illustrated in FIG. 7.

FIG. 9 is an enlarged cross-sectional view of a joint between a column member and a side plate (taken along line IX-IX in FIG.6).

FIG. 10 is a side view of the casing.

rectangular plate member, and is spaced apart from, and faces, the inner surface of the casing (11). This partition plate (18) separates the internal storage space (S2) from the cargo storage space (S3) in the container body (1). The partition plate (18) indicated by the phantom lines in FIG. 3 is supported by side plates (41), a center stay (43), and side stays (44) of the casing (11).

[0040]

An intake port (18a) is formed between the upper end of the partition plate (18) and a ceiling surface of the container body (1). Air in the cargo storage space (S3) of the container body (1) is taken into the internal storage space (S2) through the intake port (18a). The lower end of the partition plate (18) has an outlet (18b) through which air is blown into the cargo storage space (S3).

[0041]

As shown in FIG. 4, the container refrigeration apparatus (10) includes the refrigerant circuit (20) that allows a refrigerant to circulate therethrough to perform a vapor compression refrigeration cycle. The refrigerant circuit (20) is a closed circuit including a compressor (21), a condenser (radiator) (22), an expansion valve (expansion mechanism) (23), and an evaporator (24), which are connected together in this order through a refrigerant pipe (28).

[0042]

As shown in FIGS. 1 and 2, the compressor (21) and the condenser (external heat exchanger) (22) are housed in the external storage space (S1). An external fan (25) is disposed above the condenser (22). The external fan (25) is driven in rotation by an external fan motor (25a), guides air outside the container body (1) into the external storage space (S1), and sends the guided air to the condenser (22). The condenser (22) exchanges heat between a refrigerant inside the condenser (22) and outside air.

[0043]

[0055]

The internal casing (13) has plate-shaped edge portions (49c) each formed by bending an associated one of left and right edge portions of the second front panel (49b). The plate-shaped edge portions (49c) extend in the top-to-bottom direction of the internal casing (13). The first fastener (61) of each intermediate member (60) has a hook portion (65) having a U-shaped cross section and hooked on an associated one of the plate-shaped edge portions (49c). The hook portion (65) extends in the top-to-bottom direction of the internal casing (13).

[0056]

Portions of the intermediate members (60) forming the left and right edge portions of the respective frames have the same cross-sectional shape as a whole in the top-to-bottom direction of the casing. In addition, the entire intermediate members (60) forming the respective frames including their upper and lower edge portions also have the same cross-sectional shape.

[0057]

In contrast, the second front panel (49b) of the internal casing (13) is provided only above the protrusion (11a), and is not provided below the upper end of the protrusion (11a). Thus, the plate-shaped edge portions (49c) are absent below the upper end of the protrusion (11a). A cross section of a portion of the casing below the upper end of the protrusion (11a) is different from the cross section shown in FIG. 9 in that the plate-shaped edge portions (49c) are absent below the upper end of the protrusion (11a) as described above. Since the plate-shaped edge portions (49c) are absent below the upper end of the protrusion (11a), the first fasteners (61) are fastened to the associated second side plates (41) such that their hook portions (65) pinch the respective plate-shaped edge portions (49c) only above the protrusion (11a), whereas the first fasteners (61) are fastened to the associated second side plates (41) only through the rivets (70) below the upper end of the protrusion (11a).

[0058]

(60) are made of a resin material having a lower thermal conductivity than the column members (50) and the second side plates (41) do.

[0068]

According to this configuration, the intermediate members (60) provided between the internal casing (12) and the external casing (13) and having a low thermal conductivity make it difficult for external heat to be transferred from the external casing (12) to the internal casing (13). As a result, for example, if the internal space is cooled to about 0ºC in a high-temperature environment where the outdoor air temperature is about 35ºC, heat outside the container can be substantially prevented from being transferred from the external casing (12) to the internal casing (13).

[0069]

According to the foregoing configuration, both the external casing (12) and the internal casing (13) are made of a metal material, and have high strength. This can reduce the load applied to the intermediate members made of a resin material.

[0070]

In this embodiment, the column members (50) and the associated intermediate members (60) are fixed together through the rivets (70) vertically spaced apart from one another, and so are the side plates (41) and the associated intermediate members (60). In particular, the distance between each adjacent pair of some of the rivets (70) arranged above the protrusion (11a) is shorter than the distance between each adjacent pair of the other rivets (70) arranged within the range from the lower end to the upper end of the protrusion (11a).

[0071]

According to this configuration, the intermediate members (60) made of a resin material can be firmly fastened to the associated column members (50) and the associated second side plates (41) using the rivets (70). In addition, the distance between each adjacent pair of the some of the rivets (70) arranged above the upper end of the protrusion

second fasteners (62) each have the projection (66) extending in the top-to-bottom direction and fitting in the groove (53) of the associated column member (50).

[0075]

In this embodiment, the intermediate members (60) are fastened to the external casing (12) through the associated second fasteners (62) in addition to the fastening members (70). If the fastening members (70), such as the rivets, are used, the intermediate members (60) made of resin each have through holes through each of which an associated one of the fastening members (70) is passed. This may cause cracks to extend from areas surrounding the through holes of the intermediate members (60). In contrast, in this embodiment, the simply configured second fasteners (62), which also experience forces, reduce cracks.

[0076]

As can be seen from the foregoing description, according to this embodiment, the intermediate members (60) made of resin are not only fixed to the associated column members (50) and the associated side plates (41) through the rivets (70), but also each provided with the hook portion (65) and the projection (66). The hook portion (65) has a U-shaped cross section, and is hooked on the associated plate-shaped edge portion (49c). The projection (66) fits in the groove (53) of the associated column member (50). Thus, the load is substantially prevented from being concentrated on portions of the intermediate members. This reduces damage to the intermediate members.

[0077]

‹‹Other Embodiments››

The above-described embodiment may be modified as follows.

[0078]

In the foregoing embodiment, the second side plates (41) of the internal casing (13) are integrated with the associated side surfaces of the protrusion (11a). A lower portion of the entire top-to-bottom length of each of the second side plates (41) corresponding to the