(12)Indian Patent Application

---

(21) Application Number: 201641029272

(22) Filing Date: 29/08/2016 (43) Publication Date: 09/03/2018

(71) Applicant(s): L&T TECHNOLOGY SERVICES LIMITED

(72) Inventor(s): SENTHILKUMAR, C
ARAVIND, S

(51) International Classifications: F24F 5/00 F25D 16/00 F25D 3/00

(54) Title: SLIDING REMOTE EVAPORATOR WITH FLEXIBLE PARTITION

(57) Abstract: According to an embodiment of the invention, a refrigeration system 100 for a transportation container 102 is disclosed. The refrigeration system 100 includes a refrigeration unit 110. The refrigeration unit 110 is mounted on the container 102. The refrigeration system 100 further includes at least one evaporator unit 112, 114, 116 in communication with the refrigeration unit 110. According to an embodiment, at least one of the evaporator unit 112, 114, 116 is movably attached on an inside surface of the container 102. The evaporator unit 112, 114, 116 is attached to the container 102 in such a way that the evaporator unit 112, 114, 116 is selectively movable inside the closed space 102. The refrigeration system 100 further includes an arrangement 126 such that the evaporator unit 112, 114, 116 maybe movable without completely being detached from the surface of the closed space 102.

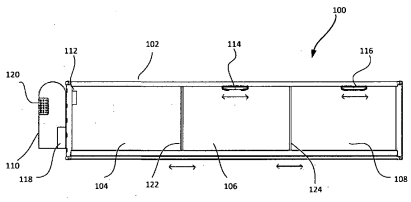
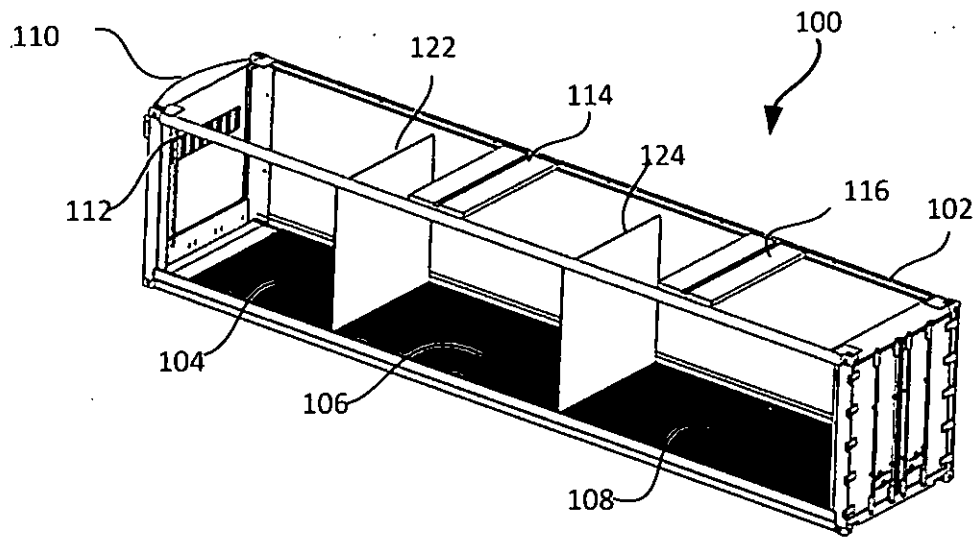


Figure 1

SLIDING REMOTE EVAPORATOR WITH FLEXIBLE PARTITION

ABSTRACT

According to an embodiment of the invention, a refrigeration system 100 for a transportation container 102 is disclosed. The refrigeration system 100 includes a refrigeration unit 110. The refrigeration unit 110 is mounted on the container 102. The refrigeration system 100 further includes at least one evaporator unit 112, 114, 116 in communication with the refrigeration unit 110. According to an embodiment, at least one of the evaporator unit 112, 114, 116 is movably attached on an inside surface of the container 102. The evaporator unit 112, 114, 116 is attached to the container 102 in such a way that the evaporator unit 112, 114, 116 is selectively movable inside the closed space 102. The refrigeration system 100 further includes an arrangement 126 such that the evaporator unit 112, 114, 116 may be movable without completely being detached from the surface of the closed space 102.



We claim:

1. A refrigeration system 100 for a transportation container 102, the system comprising:

a refrigeration unit 110 mounted on the container 102; and

at least one evaporator unit 112, 114, 116 in communication with the refrigeration unit 110, movably attached on an inside surface of the container 102 wherein the evaporator unit 112, 114, 116 is selectively movable inside the container 102 such that the movement is without completely detaching the evaporator unit 112, 114, 116 from the surface of the container 102.

2. The refrigeration system 100 for a transportation container 102 as claimed in claim 1, wherein the container 102 further comprises of at least one partitions 122, 124 movable horizontally along the length of the container 102 or along the width of the container 102.

3. The refrigeration system 100 for a transportation container 102 as claimed in claim 2, wherein the partitions 122, 124 is detachable from the container 102.

4. The refrigeration system 100 for a transportation container 102 as claimed in claim 1, wherein the evaporator units 112, 114, 116 is movable horizontally in a direction along the length of the container 102, movable horizontally in a direction along the width of the container 102 or movable vertically in a direction along the height of the container 102.

5. The refrigeration system 100 for a transportation container 102 as claimed in claim 4, wherein the movement of the evaporator units 112, 114, 116 in the container 102 is on a guide rail arrangement 128.

6. The refrigeration system 100 for a transportation container 102 as claimed in claim 5, wherein the movement of the evaporator units 112, 114, 116 on the guide rail arrangement 120 is a sliding movement.

7. The refrigeration system 100 for a transportation container 102 as claimed in claim 1, wherein a refrigerant flow between the refrigeration unit 110 and the evaporator units 112, 114, 116 is in a hose 132.

8. The refrigeration system 100 for a transportation container 102 as claimed in claim 7, wherein the hose 132 is a flexible hose, an extendible hose or a stretchable hose.

9. The refrigeration system 100 for a transportation container 102 as claimed in claim 7, wherein the hose 132 is stored in a winding arrangement.

Dated this 29th day of August 2016

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai, TN, 600089

FIELD OF INVENTION

This invention relates generally to refrigeration systems, and, more particularly, to transport refrigeration system.

BACKGROUND

A conventional transport refrigeration system typically include a refrigerant compressor, a condenser, a main evaporator and one or more remote evaporators connected via appropriate refrigerant lines in a closed refrigerant flow circuit. The refrigeration unit is powered by either vehicle engine or from external power supply. The refrigeration unit may include a housing mountable to the exterior of the front wall of the transport container of the vehicle with the main evaporator disposed on the interior of the front wall such that the air may be circulated over the evaporator coil by means of an evaporator fan associated with the evaporator coil. The refrigeration unit must have sufficient refrigeration capacity to maintain the goods stored within the various compartments of the refrigerated container at the particular desired compartment temperatures over a wide range of outdoor ambient temperatures and load conditions.

The refrigerated container may have one or more temperature controlled regions with a partition. Each temperature controlled region may have at least one remote evaporator unit. The placement of remote evaporator unit in the temperature region is such to have substantially uniform cooling in said region. The partition(s) may be removed to increase the storage space of one or more compartment(s). However, it is not possible to move one or more remote evaporator on removing one or more partition. This may result in uneven temperature within the combined temperature region. To achieve substantial cooling, one or more remote

evaporator should be relocated to other partition, if one of the remote evaporator is turned off when the cargo is unloaded.

It is an objective of the disclosure to address one or more drawbacks listed above.

SUMMARY OF THE INVENTION

According to an embodiment of the invention, a refrigeration system for a transportation container is disclosed. The refrigeration system includes a refrigeration unit. The refrigeration unit is mounted on the container. The container is divided into several compartments by several partitions so that each compartment can be provided cooling at a different temperature. The refrigeration system may also include at least one evaporator unit in communication with the refrigeration unit, movably attached on an inside surface of the container. The evaporator unit is attached to the container in such a way that it is movable on a guide rail arrangement within the container without being completely detached from the surface of the container.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawing:

Figure 1 illustrates a side view of an exemplary transport refrigeration system according to an embodiment of the invention.

Figure 2 illustrates an isometric view of the transport refrigeration system according to an embodiment of the invention.

Figure 3 illustrates a partial isometric view of an arrangement for moving at least one evaporator unit within the container according to an exemplary arrangement of the invention.

Figure 4 illustrates a partial isometric view of an arrangement for moving at least one evaporator unit in three axis within the container according to an embodiment of the invention.

Figure 5 illustrates an isometric view of the arrangement of a refrigerant line between the refrigeration unit and the evaporator unit according to an embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

The invention will now be illustrated in detail with reference to accompanying drawing. Figure 1 and Figure 2 illustrates an exemplary refrigeration system 100 operating in a vapour compression cycle for a container 102 according to an embodiment of the invention. The container 102 may belong to a transportation vehicle such as but not limited to truck, trailer, cargo etc. The container 102 may have one or more compartments 104, 106, 108. As illustrated, the refrigeration system 100 may have a refrigeration unit 110 and one or more evaporator units 112, 114, 116. According to an embodiment, the refrigeration unit 110 may include at least one refrigerant compressor 118 and at least one condenser/gas cooler 120. According to another embodiment, at least one evaporator unit 112, 114, 116 may be placed inside the refrigeration unit 110. According to yet another embodiment, the refrigeration unit 110 may be a conventional refrigeration unit of a refrigeration system. The refrigeration unit 110 may be connected to one or more evaporator units 112, 114, 116 through refrigerant lines (not shown) in a closed refrigerant flow circuit. According to an embodiment, all the evaporator units 112, 114, 116 may be connected to a single refrigeration unit 110.

The refrigeration unit 110 may be located outside the container 102 and the evaporator units 112, 114, 116 may be provided inside the container 102. According to an embodiment, the number of evaporator units 112, 114, 116 may be proportional to the number of compartments 104, 106, 108. As illustrated in figure 1, the container 102 may have one evaporator unit 112, 114, 116, positioned in each compartment 104, 106, 108. According to an embodiment, one of the evaporator unit 112 may be fixed in one of the compartment 104 and the evaporator units 114, 116 may be movable in other compartment 106, 108. According to exemplary embodiment, the fixed evaporator unit 112 may have a higher cooling capacity than the other movable evaporator units 116, 118. The compartments 104, 106, 108 may have at least one removable partition 122, 124 between two consecutive compartments 104,106, 108. According to an embodiment, the partitions 122, 124 may be movable horizontally along the length of the container 102 and along the width of the container 102. According to another embodiment, the partitions 122, 124 may be detachable from the container 102. According to an embodiment, the partitions 122, 124 may be removed by partially rotating the partition and then lifting up. The refrigeration system 100 may further include an arrangement 126 for moving at least one of the evaporator units 112, 114, 116 within the container 102.

Figure 3 illustrates a partial isometric view of the arrangement 126 for the movement of the evaporator units 112, 114, 116 within the container 102. According to an embodiment, the movement of the evaporator units 112, 114, 116 in the container 102 may be on a guide rail arrangement 128. The movement of the evaporator units 112, 114, 116 on the guide rail arrangement 128 may be a sliding movement. The evaporator units 112, 114, 116 move on the guide rail arrangement 128 using elements such as but not limited to a fastener assembly, a sliding actuator etc.. According to an embodiment, the arrangement for the movement of the evaporator units 112, 114, 116 may be such that the evaporator units 112, 114, 116 may be

movable horizontally along the length of the container 102 or along the width of the container 102. According to another embodiment, the arrangement for the movement of the evaporator units 112, 114, 116 may be such that the evaporator units 112, 114, 116 may be movable vertically along the height of the container 102. The evaporator units 112, 114, 116 may be movable in the container 102 without detaching the evaporator units 112, 114, 116 from the guide rail arrangement 128.

Figure 4 illustrates a partial isometric view of an arrangement 126 for moving at least one evaporator 112, 114, 116 unit in three axis within the container 102. According to an embodiment, the arrangement 126 may include a support 130 for enabling movement of at least one evaporator unit 112, 114, 116 within the container 102. The support 130 may enable movement of the evaporator unit 112, 114, 116 horizontally along the width of the container 102 or vertically along the height of the container 102. According to an embodiment, the vertical movement of the support 130 may be a telescopic movement.

According to an embodiment the movement of the evaporator units 112, 114, 116 on the guide rail arrangement 128 may be manual. The manual system may enable a person to move the evaporator units 112, 114, 116 at the desired position manually. According to another embodiment, the movement of the evaporator units 112, 114, 116 on the guide rail arrangement 128 may be automatic. The automatic system for movement of the evaporator units 112, 114, 116 on the guide rail arrangement 128 may be operated by a computer program. According to an embodiment a user may enter the desired location coordinates in the computer and the evaporator units 112, 114, 116 may automatically move to the exact position within the container 102. According to another embodiment, the user may move the evaporator units 112, 114, 116 to the desired location using a joystick or a switch. The evaporator units 112, 114, 116 may be suitably rearranged/adjusted within the compartment 102, 104, 106 as per goods,

space, load and flow requirement within the container 102. The rearrangement may enable uniform flow/cooling throughout the occupied space within the container 102, efficient energy management and reduced load on the compressor.

Figure 5 illustrates a partial view of the arrangement of a refrigerant line between the refrigeration unit 110 and the evaporator units 112, 114, 116. A refrigerant may flow between the refrigeration unit 110 and the evaporator units 112, 114, 116 through the refrigerant line. According to an embodiment, the refrigerant line may be a hose 132. According to another embodiment the hose 132 may be a flexible hose or an extendible hose or a stretchable hose made of material such as but not limited to nylon, synthetic, other flexible material etc. An arrangement for the storage of the hose 132 may be provided such that the length of the hose 132 may vary depending on the movement of the evaporator units 112, 114, 116 within the container 102. According to an embodiment the hose 132 may be stored in a winding arrangement. The winding arrangement may unwind as the evaporator units 112, 114, 116 move away from the refrigeration unit 110.

In the drawings and specification there has been set forth preferred embodiments of the invention, and although specific terms are employed, these are used in a generic and descriptive sense only and not for purposes of limitation. Changes in the form and the proportion of parts, as well as in the substitution of equivalents, are contemplated as circumstances may suggest or render expedient without departing from the spirit or scope of the invention.

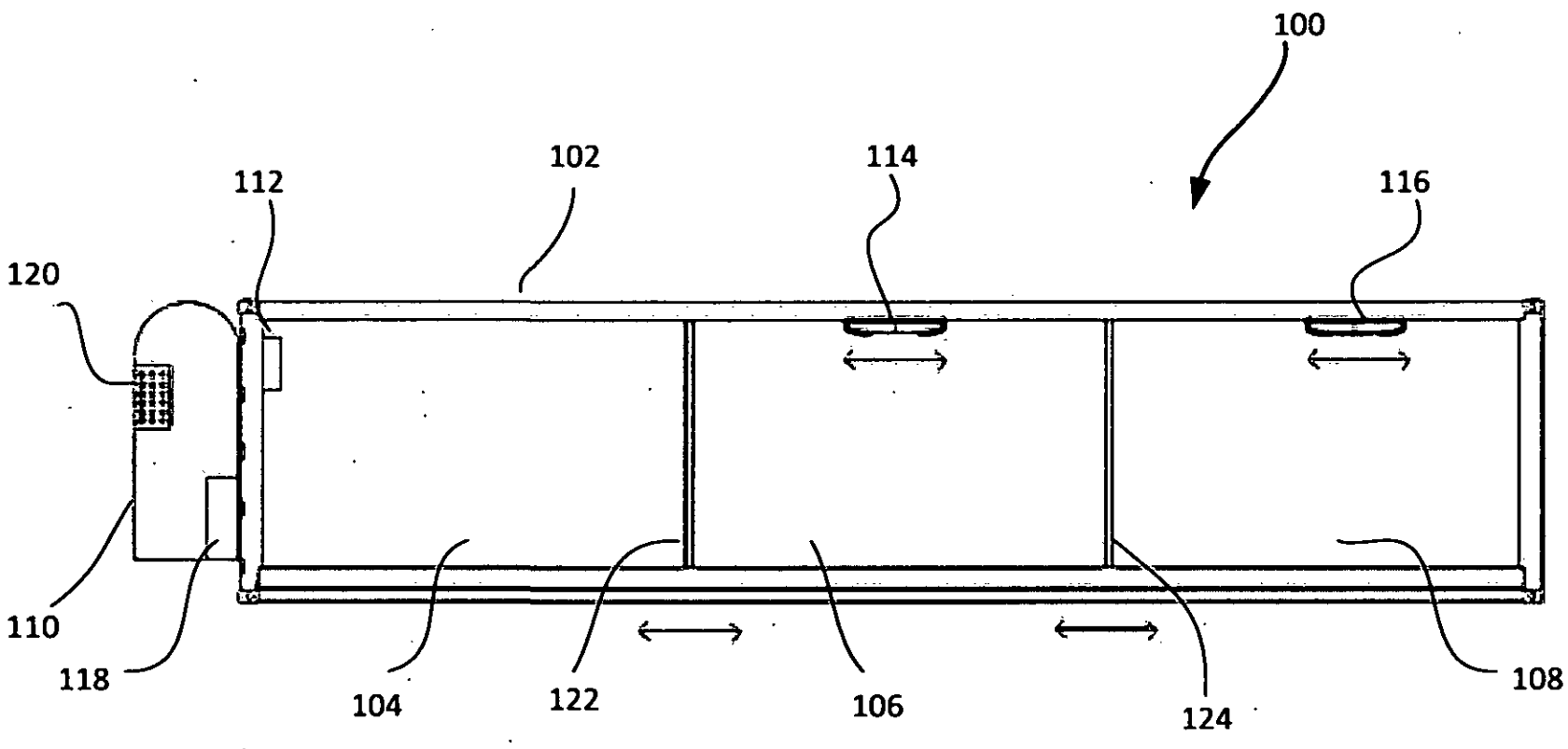


Figure 1

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L & T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089

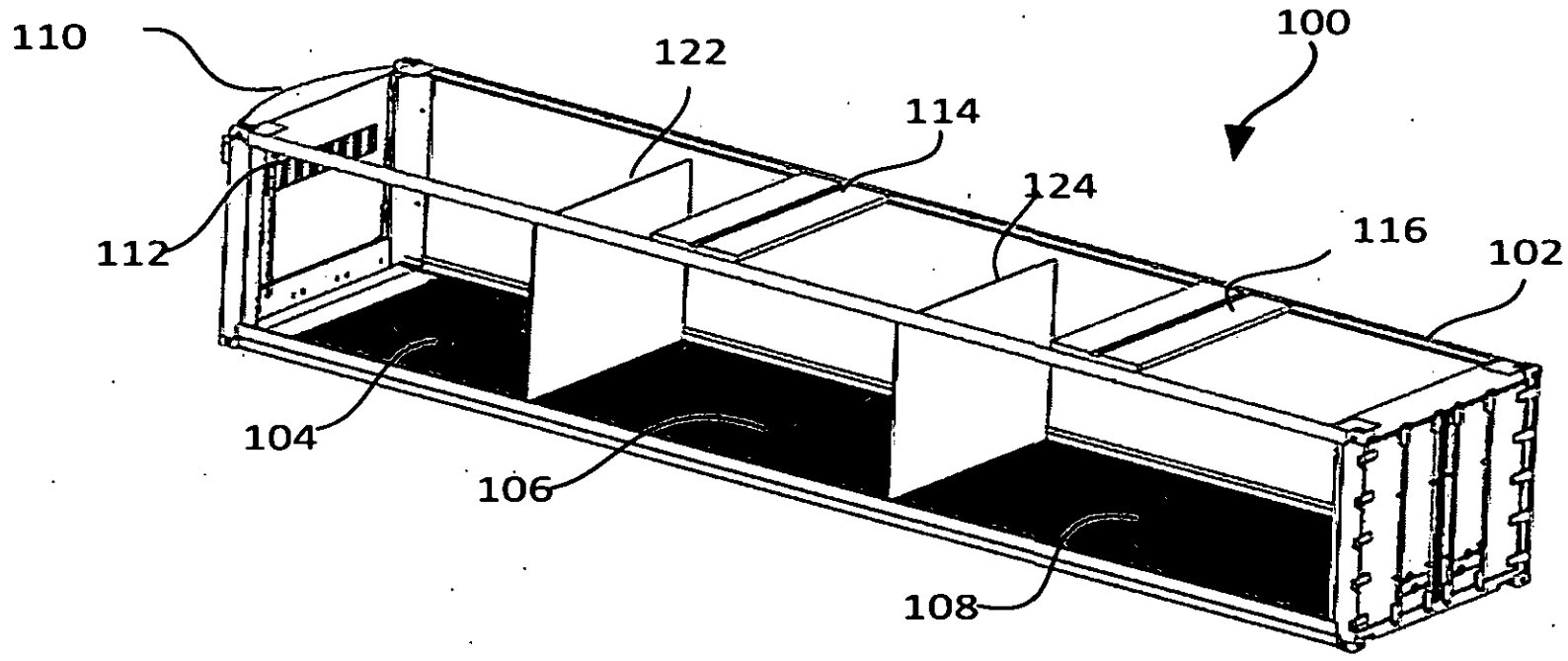


Figure 2

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L & T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089

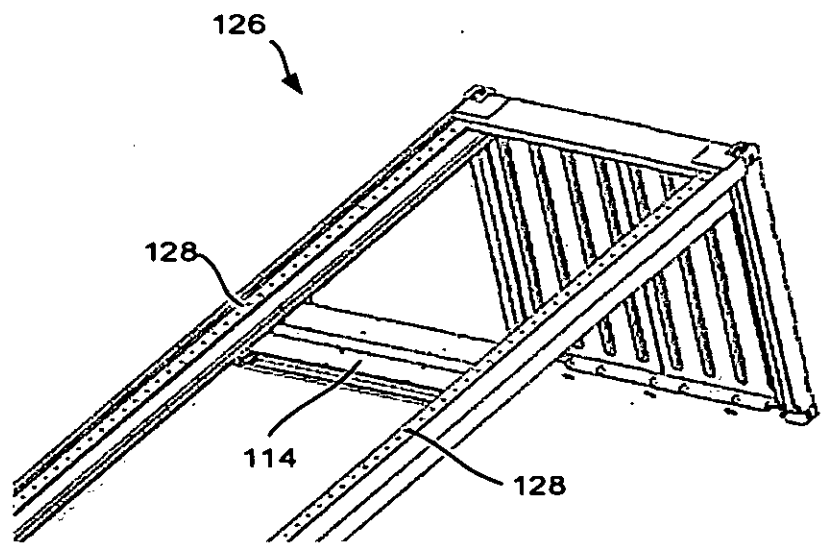


Figure 3

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L & T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089

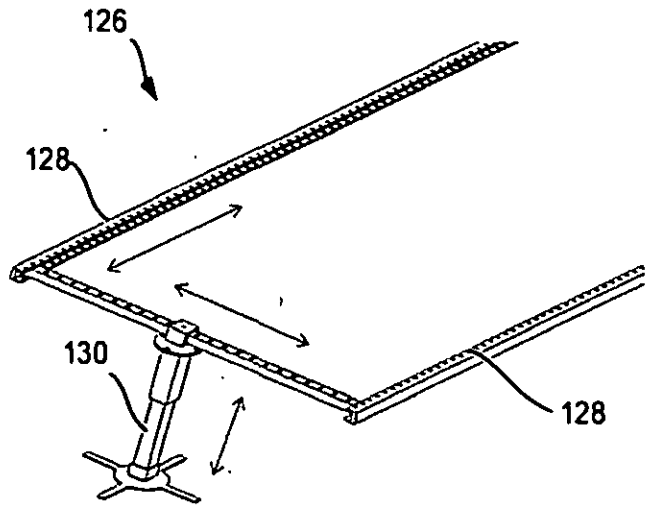


Figure 4

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L & T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089

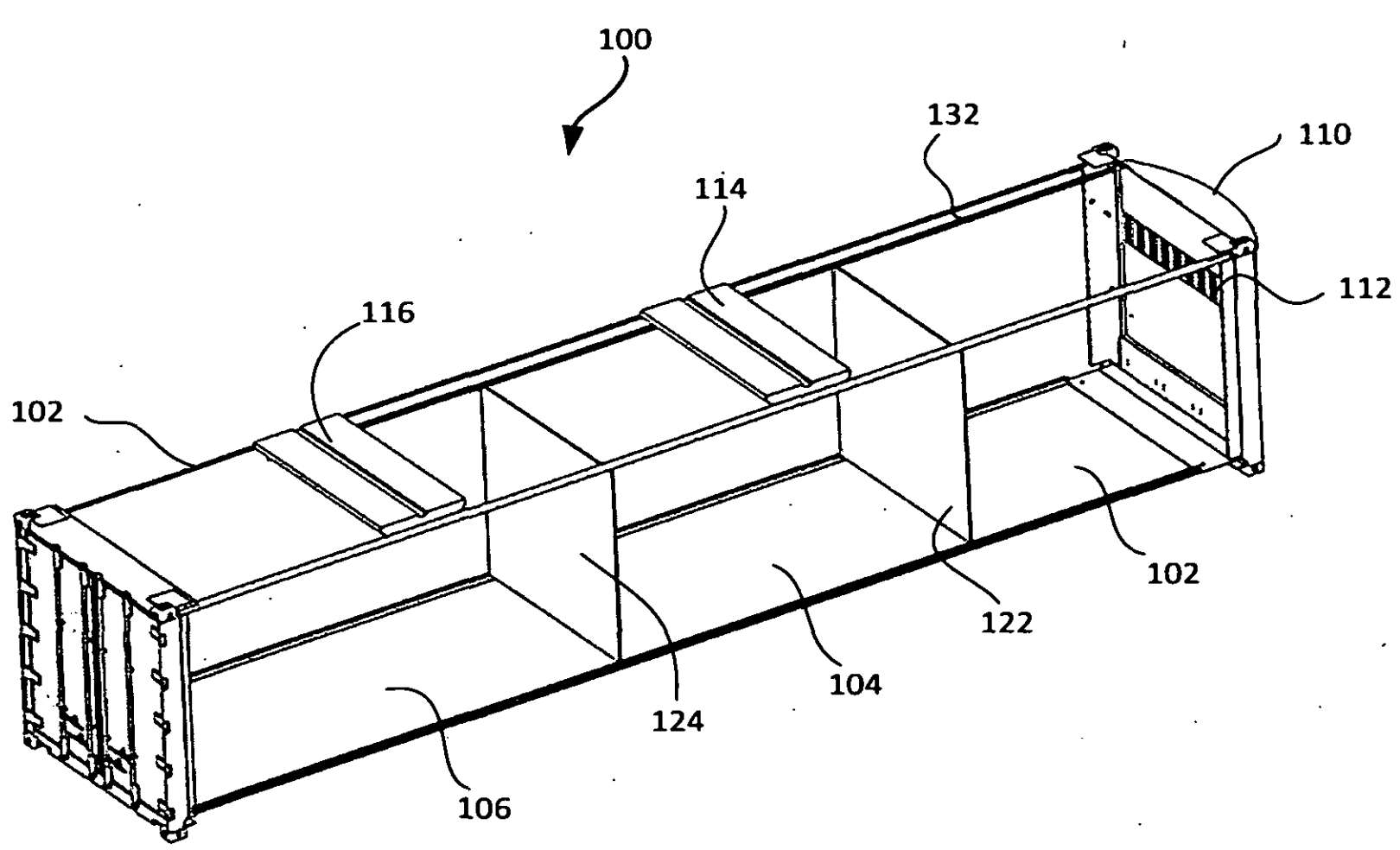


Figure 5

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L & T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai -600089