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(54) Title: POWER SUPPLY RACK

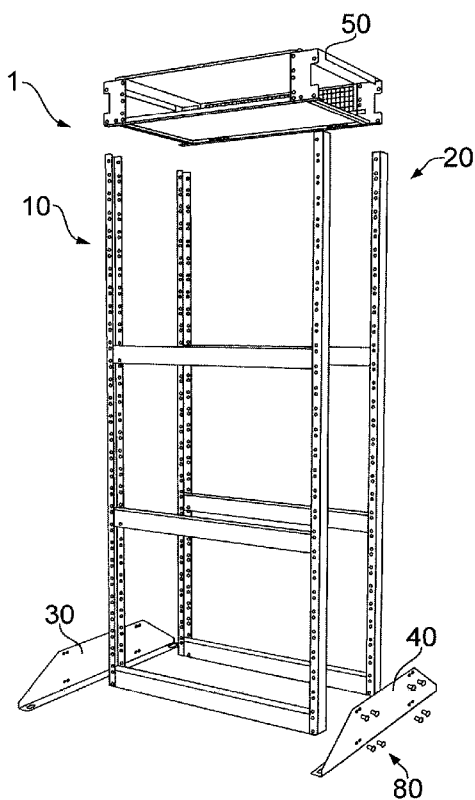


FIG. 2

(57) Abstract: The present invention relates to a power supply rack (1) comprising a first supporting frame (10), a second supporting frame (20), a first base member (30), a second base member (40), and a power supply housing (50). The first supporting frame (10) comprises first and second longitudinal members (11, 12) connected to each other by means of an upper cross member (13a) and a lower cross member (13b). The second supporting frame (20) comprises first and second longitudinal members (21, 22) connected to each other by means of an upper cross member (23a) and a lower cross member (23b). The power supply rack (1) may be configured from a first assembled state to a second assembled state. The first and second supporting frames (10, 20) are provided adjacent to each other in the first assembled state. The first and second base members (30, 40) are fixing the first and second supporting frames (10, 20) to each other in the first assembled state. The first and second supporting frame (10, 20) are provided at a distance from each other in the second assembled state and is connected to each other by means of the first and second base members (30, 40) and the power supply housing (50) in the second assembled state.

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POWER SUPPLY RACK

FIELD OF THE INVENTION

The present invention relates to a power supply rack. The present invention also relates to a power supply rack assembly.

5 BACKGROUND OF THE INVENTION

Power supply racks or power supply cabinets are used to house power supply systems. Power supply systems are typically AC-DC converters connected to mains or distributed AC energy sources, battery back-up, and DC-DC converters and/or DC-AC converters supplying energy to the load. The load is here typically equipment such as
10 telecommunication equipment, military equipment, computer server equipment etc, which require a stable DC power. The battery serves as a backup capacity if failures in the mains occur.

One prior art power supply cabinet is shown in fig. 1. This type of cabinet is relatively heavy and is time-consuming to assemble. It is therefore normal to ship these ready
15 assembled and mounted, with considerable transportation cost associated with volume and weight. Moreover, a relatively high amount of material is needed. Also, the air circulation around the batteries is poor.

The object of the present invention is to provide an improved power supply rack. The rack should be small in order to provide for an efficient transportation and reduced use of
20 materials, it should be easy to assemble at the location of use, and it should be robust in order to prevent damages during transportation and use.

SUMMARY OF THE INVENTION

The present invention relates to a power supply rack comprising:

- 25 - a first supporting frame comprising first and second longitudinal members connected to each other by means of an upper cross member and a lower cross member;
- a second supporting frame comprising first and second longitudinal members connected to each other by means of an upper cross member and a lower cross member;
- a first base member;
- a second base member;
- 30 - a power supply housing;

where the power supply rack may be configured from a first assembled state to a second assembled state;

where the first and second supporting frames are provided adjacent to each other in the first assembled state;

where the first and second base members are fixing the first and second supporting frames to each other in the first assembled state;

5 where the first and second supporting frame are provided at a distance from each other in the second assembled state and is connected to each other by means of the first and second base members and the power supply housing in the second assembled state.

10 In one embodiment, the power supply housing in the first assembled state is provided in a compartment defined as the space above the upper cross members between the respective longitudinal members.

In one embodiment, the rack further comprises a substantially U-shaped upper battery supporting member and a substantially U-shaped lower battery supporting member.

15 In one embodiment, the upper and lower battery supporting members are connected to the first and second longitudinal members of the first supporting frame in the second assembled state.

In one embodiment, the upper and lower battery supporting members in the first assembled state are provided in a compartment defined as the space above the lower cross members and below the upper cross members and between the respective longitudinal members.

20 In one embodiment, the distance D2 between the first and second supporting frame in the second assembled state are less than half the length of a standard battery length SBL.

In one embodiment, the rack comprises a pallet connection bracket connected to the first and/or second supporting structure.

25 In one embodiment, the upper cross members form an upper battery shelf and the lower cross members form a lower battery shelf in the second assembled state.

The invention also relates to a power supply rack assembly comprising:

- at least two power supply racks as defined above, provided in their first assembled state;
- a packaging container for each of the power supply racks;
- a pallet;

30 - a pallet connection bracket fixed to the pallet and fixed to the respective power supply racks through the packaging container.

In one embodiment, the respective power supply racks are provided in an upright position on the pallet in which the lower cross members are provided below the upper cross

members, and where the pallet connection bracket is fixed to the lower part of the first and second longitudinal members.

DETAILED DESCRIPTION

5 Embodiments of the invention will now be described in detail with reference to the enclosed drawings, where:

Fig. 1 illustrates a prior art power supply rack;

Fig. 2 illustrates a perspective view of a first embodiment during assembly to the second assembled state;

Fig. 3a illustrates a supporting frame;

10 Fig. 3b illustrates a perspective view of a battery supporting member;

Fig. 3c illustrates a perspective view of a base member;

Fig. 3d illustrates a perspective view of a power supply housing, here shown with converters mounted into the housing;

15 Fig. 4a illustrates the rack during assembly to a first assembled state (a transport state) where the power supply housing is omitted;

Fig. 4b illustrates the rack during assembly to the first assembled state where the power supply housing is ready to be lowered into its position;

Fig. 4c illustrates the rack in its first assembled state;

Fig. 5a illustrates a second embodiment of the rack in its second assembled state;

20 Fig. 5b illustrates a side view of a battery supporting member;

Fig. 6 illustrates a perspective side view of the rack with batteries, where the power supply housing is omitted;

Fig. 7 illustrates a side view of the rack with batteries, where one battery is pulled out of the upper shelf;

25 Fig. 8 illustrates a power supply rack assembly in the form of a pallet with several packaging containers containing power supply racks;

Fig. 9 illustrates the assembly of fig. 8, but where the packaging containers are removed;

Fig. 10 illustrates the assembly of fig. 8, where the one packaging container has been opened.

It is now referred to fig. 2. The first embodiment of the power supply rack comprises a first supporting frame 10, a second supporting frame 20, a first base member 30, a second base member 40 and a power supply housing 50.

5 The first supporting frame 10 is illustrated in fig. 3 and comprises first and second longitudinal members 11, 12 connected to each other by means of an upper cross member 13a and a lower cross member 13b. The longitudinal members 11, 12 are here substantially U-shaped profiles oriented in parallel with respect to each other. The cross members 13a, 13b are also substantially U-shaped profiles oriented in parallel with respect to each other and oriented perpendicularly with respect to the first and second longitudinal members 11, 10 12. The first and second longitudinal members 11, 12 are connected to the cross members 13a, 13b by means of fastening devices such as screws, nails etc, alternatively the members can be welded to each other or fastened to each other in other ways.

In fig. 3a it is shown that the first supporting frame 10 comprises a middle cross member 13c provided below the upper cross member 13a and above the lower cross member 13b.

15 The second supporting frame 20 comprises first and second longitudinal members 21, 22 connected to each other by means of an upper cross member 23a and a lower cross member 23b in a similar or identical way as the first supporting frame 10. Also the second supporting frame 20 may comprise a middle cross member 23c, as shown in fig. 5a.

20 The power supply rack 1 may be configured from a first assembled state to a second assembled state. The first assembled state is a transportation state in which total volume of the rack is reduced, as will be described more in detail below. The first assembled state is shown in fig. 4c. The second assembled state is an operative state in which batteries may be provided in the rack. The second assembled state is shown in fig. 5a, fig. 6 and fig. 7.

25 The first and second supporting frame 10, 20 are provided at a distance from each other in the second assembled state and are connected to each other by means of the first and second base members 30, 40 and the power supply housing 50 in the second assembled state. In fig. 5a and fig. 7 it is shown that the first and second base members 30, 40 are connecting the lowermost parts of the first and second supporting frames 10, 20 to each other and the power supply housing 50 is connecting the uppermost parts of the first and 30 second supporting frames 10, 20 to each other. Here, in the second assembled state, the upper cross members 13a, 23a form an upper battery shelf and the lower cross members 13b, 23b form a lower battery shelf. Moreover, the middle cross members (13c, 23c) also form a middle battery shelf.

35 The first base member 30 and the second base member 40 are providing a stable foundation for the rack in the second assembled state, i.e. it is preventing the rack from tipping over when loaded with batteries. The base members 30, 40 are preferably fixed to the first and second supporting frames 10, 20 by means of releasable fastening devices 70 such as screws etc. The base members 30, 40 may be formed as an L-shaped profile, thereby

allowing the base members 30, 40 to be secured to the floor by means of bolts etc if necessary or if required.

5 The power supply housing 50 is providing a compartment for power supply equipment such as converters, connection interfaces for wires to the batteries, fuses, control systems for the converters etc. Typically, the power supply housing 50 may be 1U high and 19'' width.

10 In the first assembled state, the first and second supporting frames 10, 20 are provided adjacent to each other. Moreover, the first and second base members 30, 40 are being used to fix the first and second supporting frames 10, 20 to each other, as shown in fig. 4a. Here, fastening devices, for example screws, are used to fasten the first and second base members 30, 40 and the first and second supporting frames 10, 20 to each other, in order to provide a rigid structure that will not move in relation to each other during transportation.

15 In fig. 4b and 4c, it is shown that the power supply housing 50 in the first assembled state is provided in a compartment A defined as the space above the upper cross members 13a, 23a between the respective longitudinal members 11, 12, 21, 22. Hence, the power supply housing 50 is protected by the respective longitudinal members 11, 12, 21, 22.

20 In fig. 4a it is shown that the power supply housing 50 has an height H_{50} , a width W_{50} and depth D_{50} . A height H_1 between the upper cross members 13a, 23a and an upper end of the respective longitudinal members 11, 12, 21, 22 are larger than or equal to the depth D_{50} of the power supply housing 50. A width W_1 between the first longitudinal members 11, 21 and the second longitudinal members 12, 22 are larger than or equal to the width W_{50} of the power supply housing 50. Preferably also the depth D_1 of the first and second supporting frame 10, 20 in the first assembled state is larger than or equal to the height H_{50} of the power supply housing 50.

25 It is now referred to fig. 5a and fig. 5b. Here it is shown that the rack 1 further comprises a substantially U-shaped upper battery supporting member 60a and a substantially U-shaped lower battery supporting member 60b. The upper and lower battery supporting members 60a, 60b are connected to the first and second longitudinal members 11, 12 of the first supporting frame 10 in the second assembled state. The upper and lower battery supporting members 60a, 60b provides that the batteries are not pushed to far into the upper and lower shelves formed by the upper and lower cross members 13a, 13b. This is shown in fig. 7. A middle battery supporting member 60c is also shown here for the middle shelf formed by the middle cross member 13c. After insertion of the batteries into the shelves, further battery supporting members 61b, 61c (shown in fig. 7) may be connected to the first and second longitudinal members 21, 22 of the second supporting frame 20 in the second assembled state. Hence, the batteries are secured from falling off the shelves in both directions (sideways movement of the batteries are prevented by the longitudinal members 11, 12, 21, 22).

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The upper and lower battery supporting members 60a, 60b are in the first assembled state provided in a compartment B or compartment C shown in fig. 4b, where the compartment B and C are defined as the space above the lower cross members 14a, 24a and below the upper cross members 13a, 23a and between the respective longitudinal members 11, 12, 21, 22. In fig. 4b, compartment B is defined as the space below the middle cross member 13c and compartment C is defined as the space above the middle cross member 13c. The battery supporting members 60a, 60b have a width W60 less than or equal to the width W1 between the first longitudinal members 11, 21 and the second longitudinal members 12, 22 in order to be provided in the compartment B or C.

Preferably, the distance D2 shown in fig. 7 between the first and second supporting frame 10, 20 in the second assembled state are less than half the length of a standard battery length SBL. The standard IEC 297-2 is defining a power supply rack standard with size 600x600mm (width x depth), and where the batteries used for such racks must be dimensioned accordingly. Therefore, the batteries typically have a length SBL as indicated in fig. 7 equal to 560 mm. The length D2 in this case would be less than 280 mm.

In fig. 5a, 6 and 7 it is shown that the rack 1 further comprises plates 35, 45 connected between the first and second supporting frames 10, 20. The purpose of these plates is to stabilize the rack further.

It is now referred to fig. 8, 9 and 10. Here it is shown that the rack 1 comprises a pallet connection bracket 70 connected to the first and/or second supporting structure 10, 20 for fixation of the rack to a pallet.

The present invention also relates to a power supply rack assembly indicated by reference number 100 in fig. 8, 9 and 10.

The power supply rack assembly 100 comprises at least two power supply racks 1 as described above, where the racks 1 are provided in their first assembled state. A packaging container 2 is provided around each of the power supply racks 1 for protection. The packaging container 2 is typically a cardboard container or similar. The assembly also comprises a pallet 3. The pallet connection bracket 70, either being a part of the rack 1 or the assembly 100, is fixed to the pallet 3 and fixed to the respective power supply racks 1 through the packaging container 2. Preferably the container 2 comprises a recess in the area of fixation to the bracket 70. In this way, nine racks 1, each enclosed within its container 2, may be stored on a standard EUR-pallet (1200 x 800 mm). As shown, the respective power supply racks 1 are provided in an upright position on the pallet 3 in which the lower cross members 13b, 23b are provided below the upper cross members 13a, 23a, and where the pallet connection bracket 70 is fixed to the lower part of the first and second longitudinal members 11, 12, 21, 22.

In this way the packaging and transportation of racks 1 may be more efficient and standardized. It is then possible to provide a "basic" rack and a "custom" rack in an easy

way, where a “basic” rack comprises only the strictly necessary components and the “custom” rack comprises more components based on the customers specification. The basic rack 1 will then for example comprise two supporting frames 10, 20, two base members 30, 40, three battery supporting members 60a, 60b, 60c and one power supply housing 50, and
5 nine such racks 1 are provided as a basic power supply rack assembly 100. It should be noted that there are no electronic components in this basic version, the power supply housing 50 may be empty.

If some customers wants modifications, the basic rack 1 may be easily upgraded by opening the top of the packaging container 2, lift out the power supply housing 50 and add
10 electronic components, such as a converters etc, to the housing, and then insert it into the packaging container 2 again. Moreover, additional battery supporting members 61a, 61b, 61c may be added into the compartment A, as shown in fig. 10. Also other components may be added.

15

CLAIMS

1. Power supply rack (1) comprising:

5 - a first supporting frame (10) comprising first and second longitudinal members (11, 12) connected to each other by means of an upper cross member (13a) and a lower cross member (13b);

- a second supporting frame (20) comprising first and second longitudinal members (21, 22) connected to each other by means of an upper cross member (23a) and a lower cross member (23b);

- a first base member (30);

10 - a second base member (40);

- a power supply housing (50);

where the power supply rack (1) may be configured from a first assembled state to a second assembled state;

15 where the first and second supporting frames (10, 20) are provided adjacent to each other in the first assembled state;

where the first and second base members (30, 40) are fixing the first and second supporting frames (10, 20) to each other in the first assembled state;

20 where the first and second supporting frame (10, 20) are provided at a distance from each other in the second assembled state and is connected to each other by means of the first and second base members (30, 40) and the power supply housing (50) in the second assembled state.

25 2. Power supply rack (1) according to claim 1, where the power supply housing (50) in the first assembled state is provided in a compartment (A) defined as the space above the upper cross members (13a, 23a) between the respective longitudinal members (11, 12, 21, 22).

3. Power supply rack (1) according to claim 1 or 2, where the rack (1) further comprises a substantially U-shaped upper battery supporting member (60a) and a substantially U-shaped lower battery supporting member (60b).

30 4. Power supply rack (1) according to claim 3, where the upper and lower battery supporting members (60a, 60b) are connected to the first and second longitudinal members (11, 12) of the first supporting frame (10) in the second assembled state.

5. Power supply rack (1) according to claim 3 or 4, where the upper and lower battery supporting members (60a, 60b) in the first assembled state are provided in a compartment

(B; C) defined as the space above the lower cross members (14a, 24a) and below the upper cross members (13a, 23a) and between the respective longitudinal members (11, 12, 21, 22).

5 6. Power supply rack (1) according to any one of the above claims, where the distance D2 between the first and second supporting frame (10, 20) in the second assembled state are less than half the length of a standard battery length SBL.

7. Power supply rack (1) according to any one of the above claims, where the rack (1) comprises a pallet connection bracket (70) connected to the first and/or second supporting structure (10, 20).

10 8. Power supply rack (1) according to any one of the above claims, where the upper cross members (13a, 23a) form an upper battery shelf and the lower cross members (13b, 23b) form a lower battery shelf in the second assembled state.

9. Power supply rack assembly (100) comprising:

15 - at least two power supply racks (1) according to claim 1 provided in their first assembled state;

- a packaging container (2) for each of the power supply racks (1);

- a pallet (3);

- a pallet connection bracket (70) fixed to the pallet (3) and fixed to the respective power supply racks (1) through the packaging container (2).

20 10. Power supply rack assembly (100) according to claim 9, where the respective power supply racks (1) are provided in an upright position on the pallet (3) in which the lower cross members (13b, 23b) are provided below the upper cross members (13a, 23b), and where the pallet connection bracket (70) is fixed to the lower part of the first and second longitudinal members (11, 12, 21, 22).

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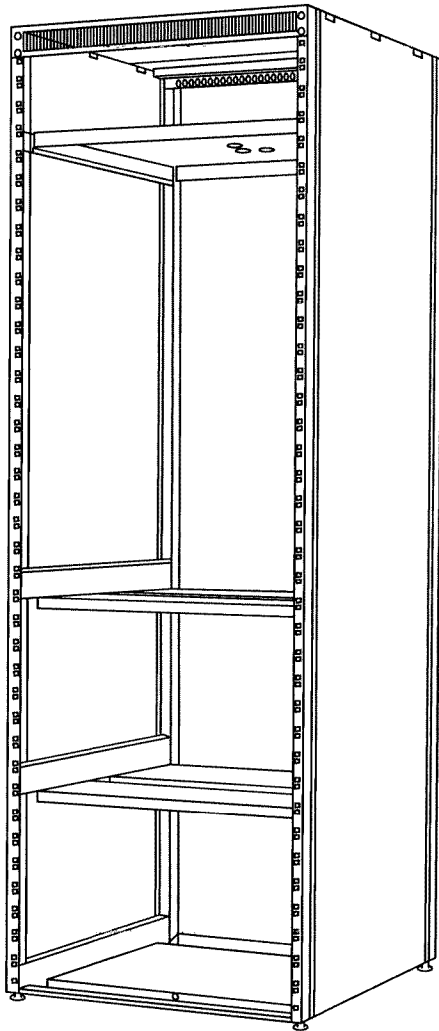


FIG. 1 (Prior Art)

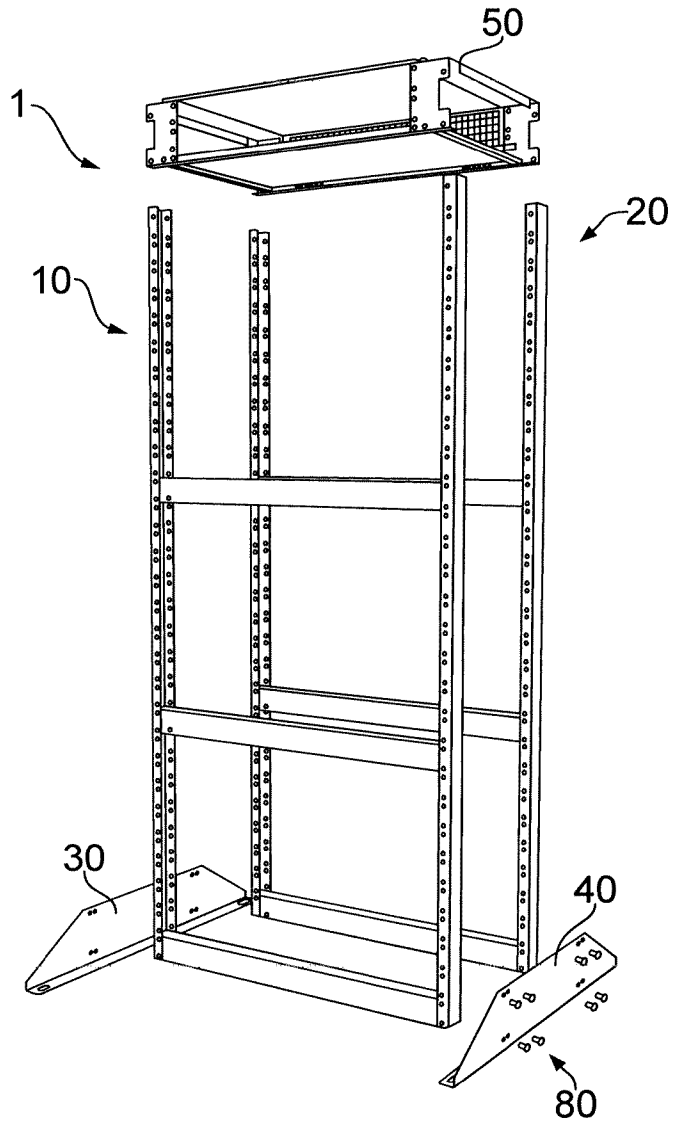


FIG. 2

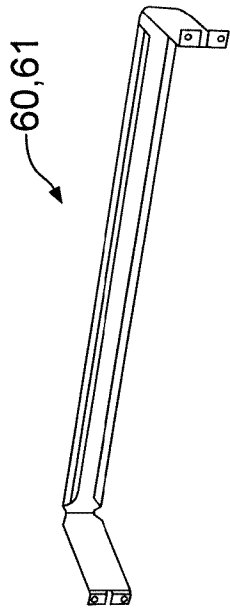


FIG. 3b

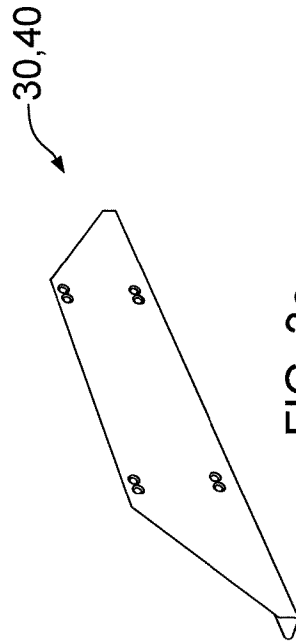


FIG. 3c

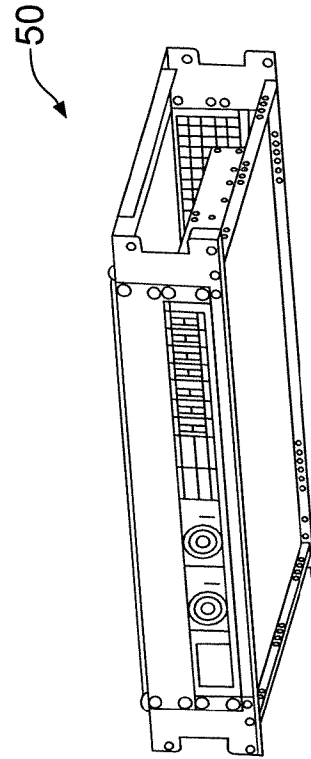


FIG. 3d

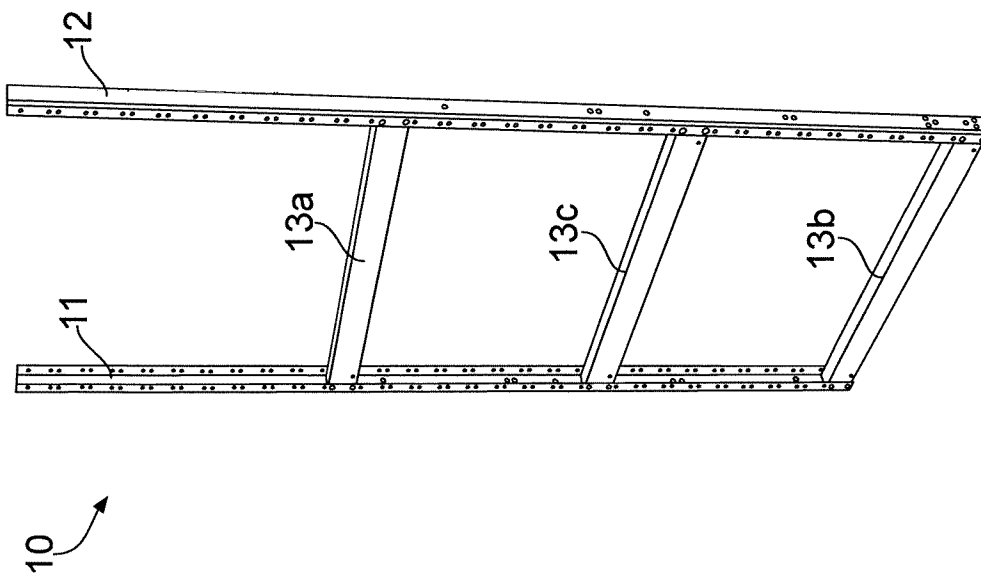


FIG. 3a

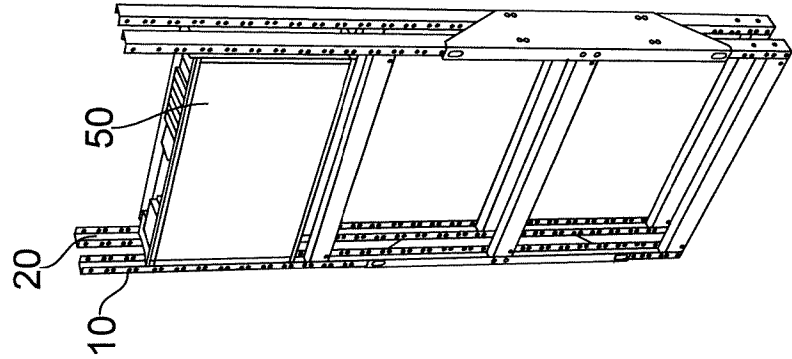


FIG. 4c

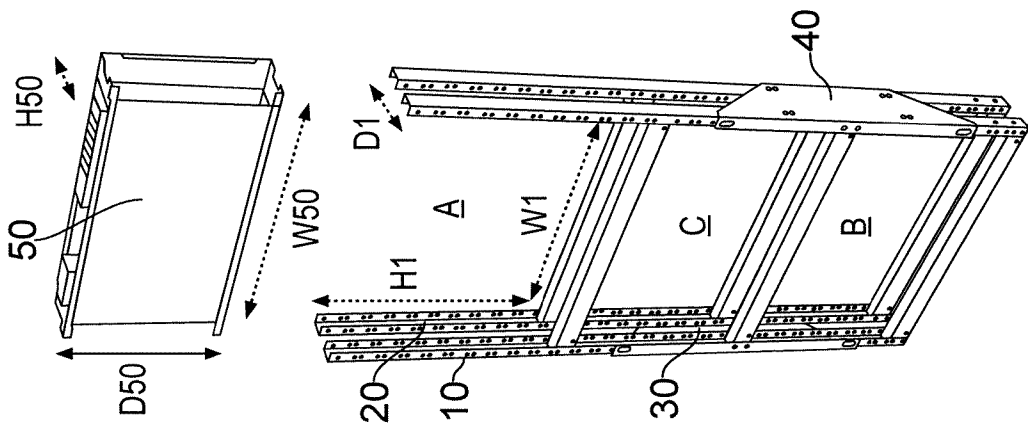


FIG. 4b

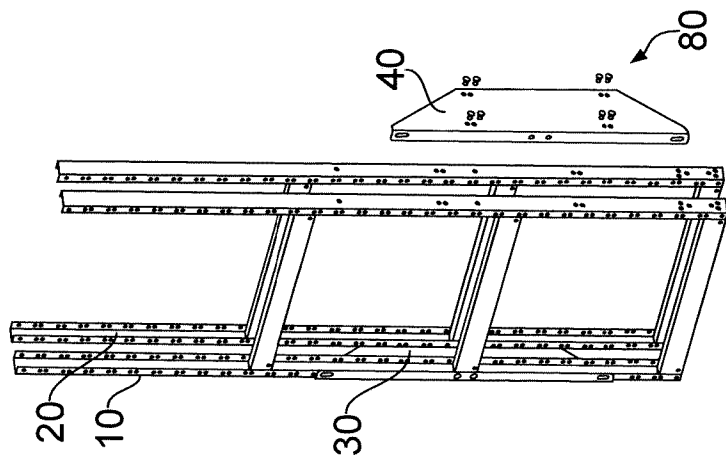
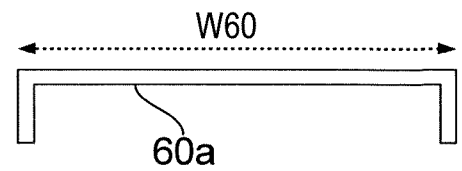
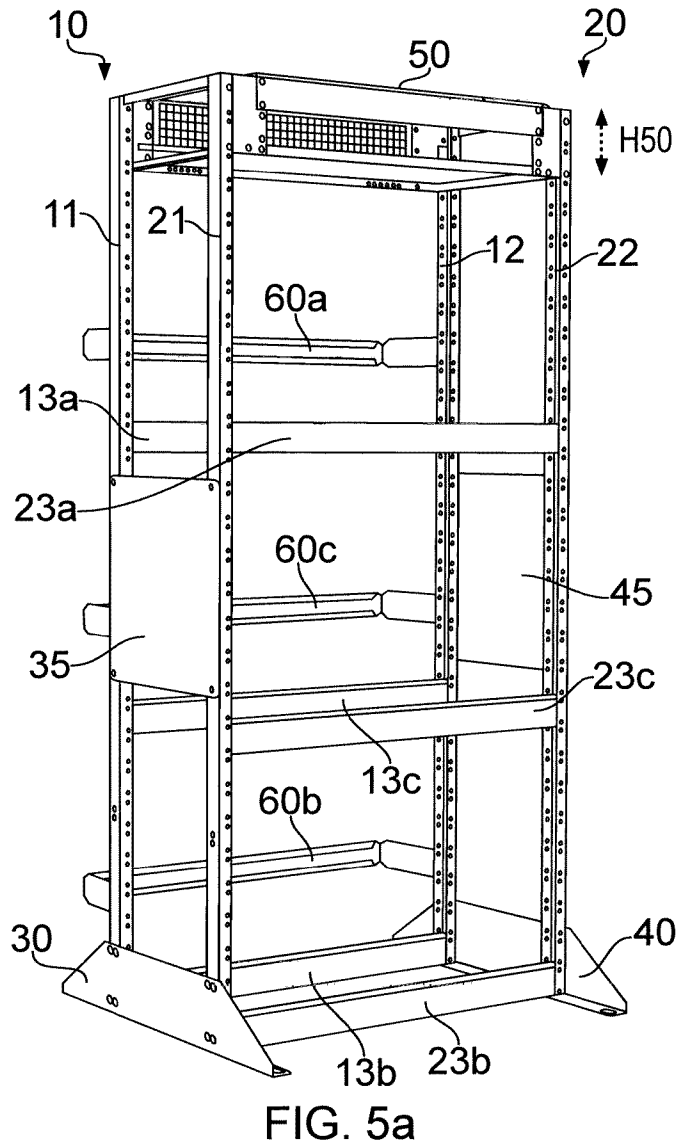


FIG. 4a



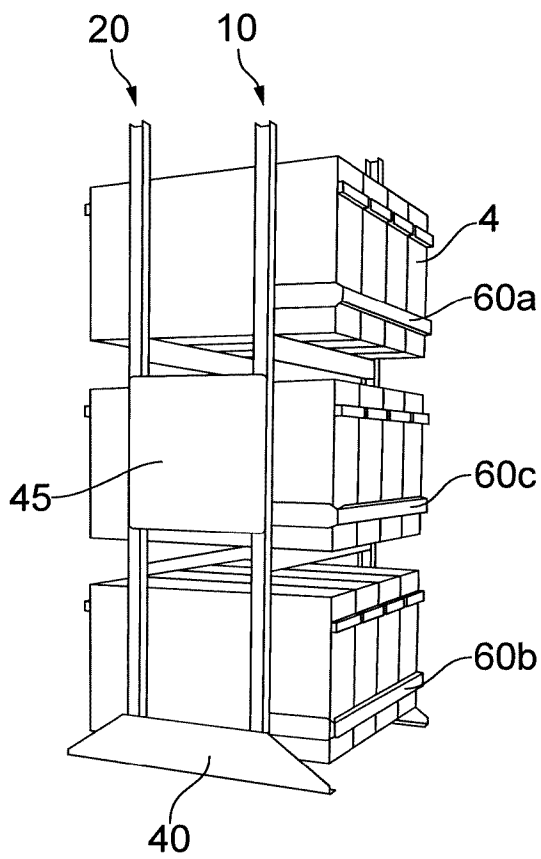


FIG. 6

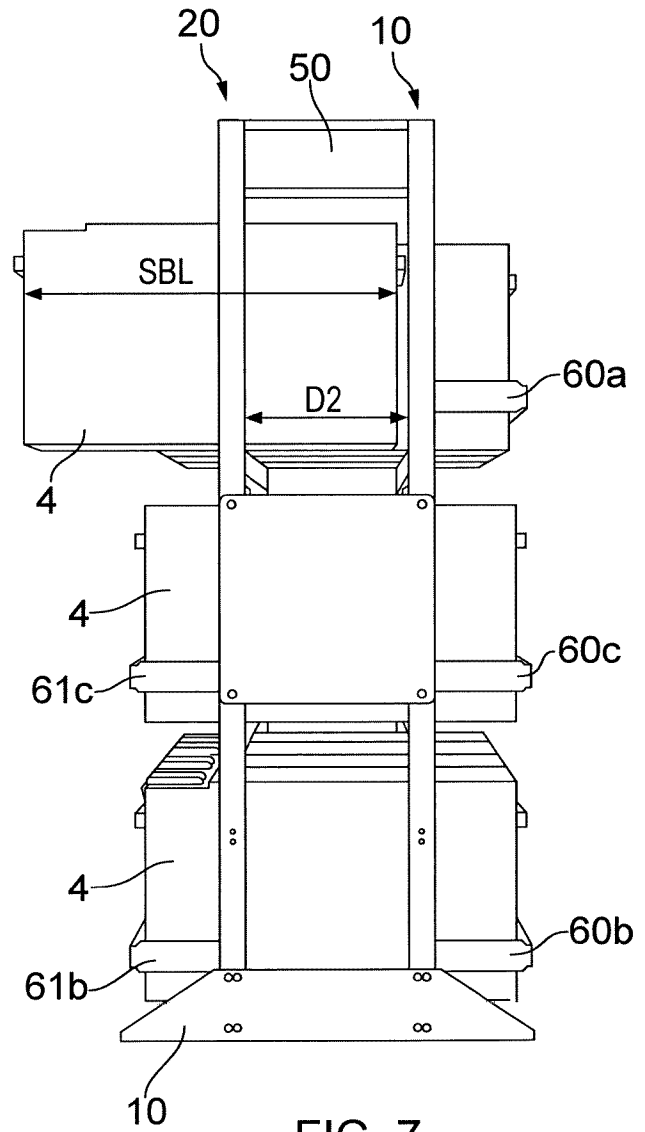


FIG. 7

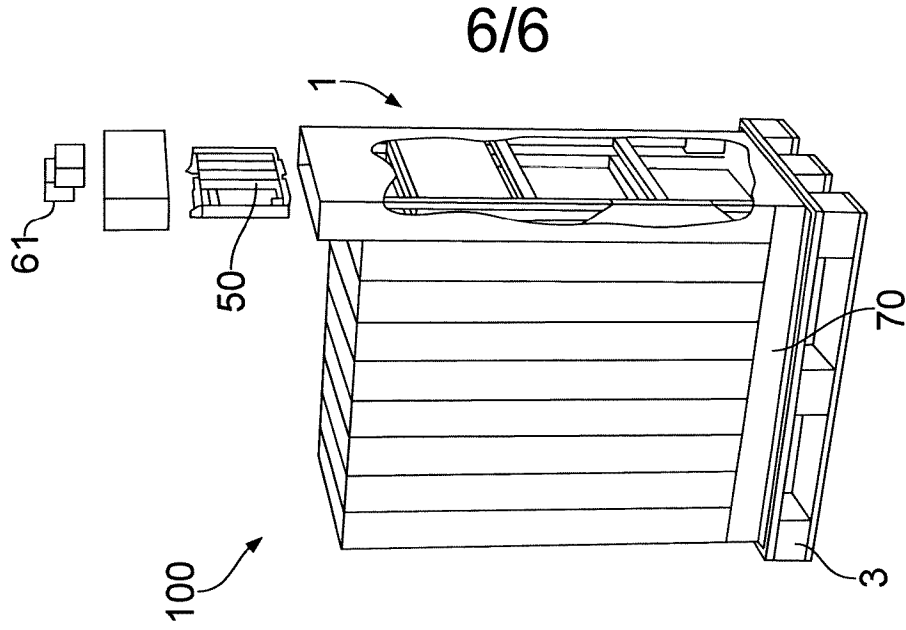


FIG. 10

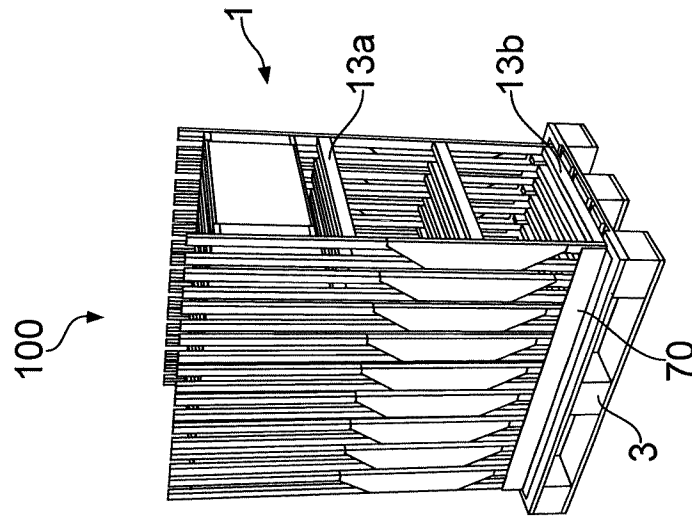


FIG. 9

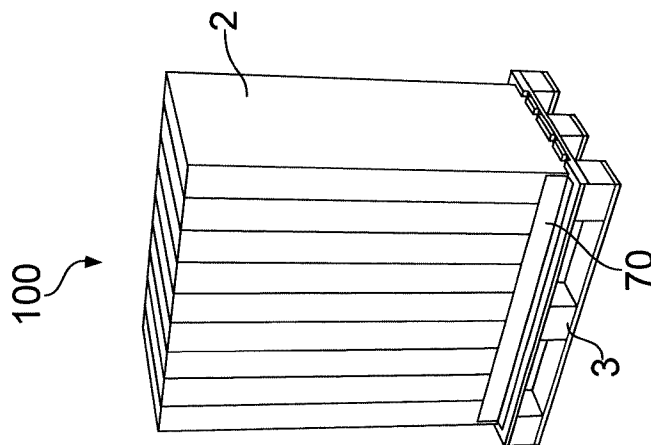


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/069141

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05K7/18
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
H05K A47B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2009/134251 A1 (HEWLETT PACKARD DEVELOPMENT CO [US]; CONN KEVIN D [US]; SELVIDGE DAVID) 5 November 2009 (2009-11-05)	1
A	paragraph [0021]; figure 1 -----	2-10
Y	EP 1 855 513 A1 (NORTHROP GRUMMAN CORP [US]) 14 November 2007 (2007-11-14)	1
A	paragraph [0023]; figures 1,5 -----	2-10
A	GB 2 095 101 A (AMCO ENG) 29 September 1982 (1982-09-29)	1-10
A	page 2, line 46 - line 59; figures 1,3 -----	1-10
A	US 5 685 442 A (YOSHINO SHUJI [JP] ET AL) 11 November 1997 (1997-11-11)	1-10
	column 3, line 31 - column 4, line 17; figures 1,4 -----	

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search 10 December 2013	Date of mailing of the international search report 20/12/2013
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Rubenowitz, Astrid
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/069141

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