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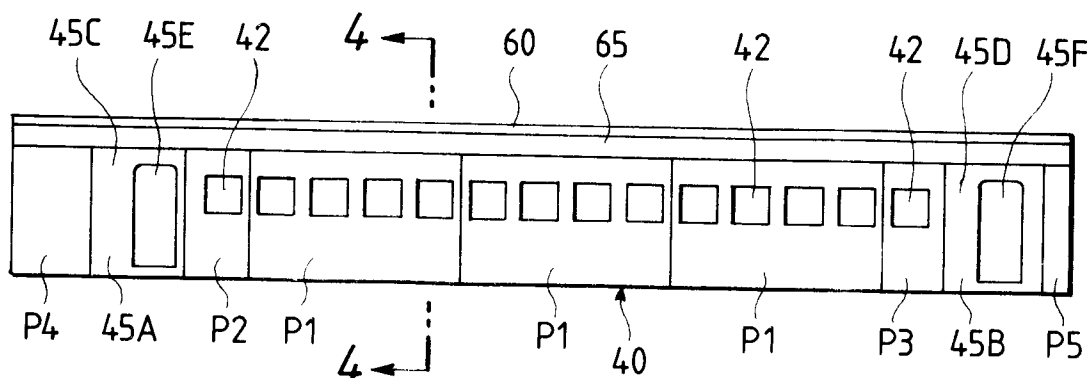
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(54) **Vehicle having car body of laminated panel structure side construction.**

(57) A car body of a railway vehicle is manufactured by employing laminated panels (P1-P5) such as honeycomb panels. Windows (42) of a side of the vehicle have a constant pitch in the longitudinal direction. A side construction of the side of the vehicle is provided by honeycomb panels in which the length of some panels (P1) is standardized at plural times the pitch of the window. Three panels (P1) having the length of four times the pitch of the windows are welded to each other, and at their ends are welded to the honeycomb panels (P3,P4) for adjusting length. Since many honeycomb panels of the side construction of the car body are standardized, the body can be manufactured a low cost. The honeycomb panel structure can be used in other vehicles of one train.

FIG. 1



Background of the invention:

The present invention relates to a vehicle having a car body of a laminated panel structure side construction and, more particularly relates to a railway vehicle having a car body of a laminated panel structure side construction in which the side construction of the car body is constructed of plural sheet laminated panels such as laminated panels having a plurality of honeycomb cores (honeycomb panels) and in which the sheet laminated panels are welded to each other.

A car body of a railway vehicle is classified generally into a plurality of classes of cars such as the ordinary car, the superior car, the compartment car and the dining car. The construction of such a car body of the railway vehicle differs respectively in accordance with the purpose of use of the vehicle.

For example, between the superior car and the ordinary car there are made distinctions by varying the size of the seat, the interval between the front seat and the rear seat and the size of the window. A train for running a long distance is constructed by connecting the above stated plurality of kinds of cars.

One conventional car body structure for a railway vehicle has been designed and manufactured with an individual car body for each purpose of use. Another conventional car body structure for the railway vehicle is disclosed, for example, in EP-A-71689.

In the latter conventional railway vehicle, so as to meet the demands of use, the vehicle has been constructed as a car body in which the car main body is the same for different uses and employs a car body structure in which the interior equipment of the car such as the seats and partition walls can be arranged freely.

Besides, in the railway vehicle which runs at high speed, it is desired to attain a light-weight of the car body, improvement in the rigidity of the car body and further improvement in the strength of the car body. From the above points of views, it has been proposed to construct the car body in accordance with a welded laminated panel structure comprised of a plurality of soldered honeycomb panels which are made of a light alloy metal such as an aluminum alloy.

The honeycomb panel constituting the car body comprises two sheet face plates and cores having many hexagonal (or other) shape cells between the sheet face plates. Further, thick combination members are arranged on the outer peripheral portion between two sheet face plates. Two sheet face plates, the cores and the combination members are united as one body by soldering or brazing.

The honeycomb panels are welded to each other at the combination members and further the honeycomb panels are welded to a member such as a post. Thus one car body of the vehicle is manufactured. This type of car body of a railway vehicle is disclosed,

for example, in Japanese Patent Laid-Open No. 90468/1991.

Within the above stated conventional techniques, in the former method for designing and manufacturing the individual car body for each purpose, the size of the window, the interval between two adjacent windows and the position of the entrance and exit doorways etc. differ among the leading car or the intermediate car etc. or according to the ordinary car, the superior car or the dining car etc.

Accordingly, in the above conventional technique, it is necessary to design and manufacture each individual car body even in the same train and, therefore, it is difficult to reduce the design steps and the manufacture steps of the car body for the vehicle.

Further, within the above stated conventional techniques, the latter technique in which the vehicle structure is constructed so that the car bodies are made the same and the interior equipment of the car such as the seats, the partition walls can be arranged freely, however, there exist the following problems.

When the arrangement of the seats in the superior car or the compartment room etc. is varied, since the interval between the seats along the car disagrees with the interval between two adjacent windows, the passenger's view to the outside of the car may be obstructed. Further, it is difficult to arrange rooms such as the lavatory room or the luggage room etc. in which the arrangement of the windows is unnecessary, and also it lowers the degree of freedom in the construction of the car body.

Besides, a vacuum furnace is used for the manufacture of the laminated panel for constructing the car body. In the vacuum furnace the two sheet face plates are pressed from outside, and since the soldered laminated panel is manufactured by heating (about 500°C - 600°C), the manufacturing cost of the laminated panel increases highly. As a result, it is desirable to standardize the dimensions of the laminated panel so as to reduce the manufacturing cost in the vacuum furnace.

With the welding of plural sheet laminated panels, the large car body is manufactured. From the standpoint of the reduction in length of the welding line of the laminated panel, it is desirable to make the dimensions of the laminated panel as large as possible. As a result, it is desirable to employ a large dimension laminated panel as much as possible and also it is desirable to standardize the laminated panel so as to restrict the number of different kinds of the laminated panels.

Summary of the Invention:

An object of the present invention is to provide a vehicle having a car body of a laminated panel structure side construction wherein the laminated panel for constructing the car body can be highly standardized.

Another object of the present invention is to provide a vehicle having a car body of a laminated panel structure side construction wherein the length of the welding line for welding the laminated panel structures for constructing the car body can be shortened.

A further object of the present invention is to provide a vehicle having a car body of a laminated panel structure side construction wherein the amount of welding in the laminated panel structure can be reduced.

According to the present invention, a vehicle having a car body of a laminated panel structure side construction comprises: a car body comprising a floor construction, a side construction, a roof construction and an end construction; the side construction of the car body having a laminated panel structure; the laminated panel structure of the side construction comprised two sheet face plates and cores having a plurality of cells provided between the two sheet face plates; and plural windows provided on the laminated panel structure of the side construction with a substantially uniform pitch along to the longitudinal direction of the vehicle.

The laminated panel structure of the side construction is constructed by welding plural sheet laminated panels and the length in the longitudinal direction of the vehicle of each of the plural sheet laminated panels of the side construction is plural times the pitch of the window.

The side construction has preferably a first laminated panel group having plural sheet laminated panels, a second laminated panel group having plural sheet laminated panels and a third laminated panel group having plural sheet laminated panels; the length in the longitudinal direction of the vehicle of the first laminated panel group is the length of plural times of the pitch of the window; the length in the longitudinal direction of the vehicle of the second laminated panel group is same as the length in the longitudinal direction of the vehicle of the first laminated panel group; the length in the longitudinal direction of the vehicle of each of the plural laminated panels of the third laminated panel group is the same as the length in the longitudinal direction of two adjacent windows; each of the plural laminated panels of the first laminated panel group is welded in the longitudinal direction of the vehicle; each of the plural laminated panels of the second laminated panel group is welded in the longitudinal direction of the vehicle; and between the first laminated panel group and the second laminated panel group, each of the plural sheet laminated panels of the third laminated panel group is welded to the first laminated panel group and the second laminated panel group with the pitch of the window, respectively.

As stated above, according to the present invention the laminated panel constructing the car body of the vehicle is standardized in the longitudinal direc-

tion of the vehicle from the standpoints of the dimensions of the laminated panel. As a result, the laminated panel structure for use in the car body of the vehicle can be manufactured at low cost.

Since the laminated panel has plural times of the pitch of the window, during the manufacture of the car body the length of the welding line of the laminated panel structure can be short, which can lead to manufacture of the car body at low cost.

According to the present invention, since the side construction of the car body for use in the vehicle is constructed in which plural sheet laminated panels having the length of plural times of the pitch of the windows are put side by side along the longitudinal direction of the vehicle and the connection portions are welded, the laminated panel of the car body can be standardized and further the welding line of the laminated panel structure can be reduced and for this reason the car body of the vehicle can be manufactured at low cost.

Brief Description of Drawings:

Fig. 1 is a side view showing one embodiment of a side construction of an ordinary car according to the present invention;

Fig. 2 is a horizontal and longitudinal cross-sectional view showing an interior portion of the ordinary car of Fig. 1;

Fig. 3 is a plan view showing a roof construction of the ordinary car of Fig. 1;

Fig. 4 is a cross-sectional view showing of the ordinary car of Fig. 1 taken along the line 4-4 of Fig. 1;

Fig. 5 is a plan view showing one embodiment of the laminated panel for use in the car body of the vehicle according to the present invention;

Fig. 6 is an enlarged cross-sectional view showing of the laminated panel of Fig. 5 taken along the line 6-6 of Fig. 5;

Fig. 7 is an enlarged cross-sectional view showing of the laminated panel of Fig. 5 taken along the line 7-7 of Fig. 5;

Fig. 8 is a side view showing one embodiment of a side construction of a superior car according to the present invention;

Fig. 9 is a horizontal and longitudinal cross-sectional view showing an interior portion of the superior car of Fig. 8;

Fig. 10 is a side view showing one embodiment a side construction of a leading car according to the present invention;

Fig. 11 is a horizontal and longitudinal cross-sectional view showing an interior portion of the leading car of Fig. 10;

Fig. 12 is a side view showing one embodiment a side construction of a service car according to the present invention;

Fig. 13 is a horizontal and longitudinal cross-sectional view showing an interior portion of the service car of Fig. 12;

Fig. 14 is a side view showing one embodiment a side construction of a compartment car according to the present invention;

Fig. 15 is a horizontal and longitudinal cross-sectional view showing an interior portion of the compartment car of Fig. 14;

Fig. 16 is a side view showing one embodiment a side construction of another car body according to the present invention; and

Fig. 17 is a horizontal and longitudinal cross-sectional view showing an essential part of the side construction of the car body of Fig. 16.

Detailed Description of the Embodiment:

Several embodiments of a car body in a railway vehicle according to the present invention will be explained by way of example referring to Fig. 1 to Fig. 15. These embodiments show a representative organization of the railway vehicles which constructs one train.

Beneath each of Fig. 2, Fig. 9, Fig. 11, Fig. 13 and Fig. 15, partition lines are indicated. Each of these partition lines extends along to the longitudinal direction of the vehicle and has plural short vertical lines which cut the partition line. The interval between two adjacent short vertical lines on the partition line shows the longitudinal length (horizontal width) of a laminated panel etc.

First of all, referring to Fig. 1 to Fig. 4, the basic construction of the car body in the railway vehicle of this embodiment will be explained. In this embodiment, the ordinary class car is exemplified.

A car body of the ordinary car comprises a floor construction 30, a wall construction (herein called a side construction) 40 extending along the longitudinal direction of the vehicle, a roof construction 60 and a gable wall construction (herein called an end construction) 70 for closing the end of the vehicle in the longitudinal direction.

The side construction 40 of the car body is a substantially vertical structure. The side construction 40 has plural windows 42. Further, in each side of the vehicle, the side construction 40 has two entrance and exit doorways 45E and 45F near the ends in the longitudinal direction of the vehicle. Each end construction 70 has a connection doorway 72 for connecting to the adjacent vehicle at both ends of the car body, respectively. In this railway vehicle, a lavatory room 55 and a wash room 56 are provided as the service equipment.

In this embodiment of the present invention, as the construction members of the outer panels of the side construction 40 and the roof construction 60, there are employed soldered or brazed laminated

panel structures made of the light metal alloy such as an aluminum alloy.

This soldered laminated panel structure comprises two sheet rectangular face plates, cores and combination members, and these components are united into as one body by soldering. The core is, for example, a honeycomb core and joins the two sheet face plates. The core has a plurality of plates perpendicular to the two sheet face plates. The combination members are arranged at the periphery of the core and join the two sheet face plates.

The combination members disposed at the ends of the laminated panel of the vehicle are welded to combination members of adjacent laminated panels, whereby one large face plate panel structure such as the side construction or the roof construction is manufactured. The combination members are also welded as appropriate to ribs of a frame of the vehicle. This frame is constructed in a conventional manner.

The above stated car body structure is disclosed generally for example, in Japanese Patent Laid-Open No. 90468/1991. However, since shoulder portions 65 disposed at both sides of the roof construction 60 have small radius of curvature, an extruded material is employed.

In both of a left entrance and exit unit 45A for the entrance and exit doorway 45E and a right entrance and exit unit 45B for the entrance and exit doorway 45F, a laminated panel is not employed but an extruded member made of aluminum alloy is used. The left entrance and exit unit 45A comprises a frame of the entrance and exit doorway 45E and a shutter-boxing 45C of a sliding door (not shown) for opening and closing the entrance and exit doorway 45E. The right entrance and exit unit 45B comprises a frame of the entrance and exit doorway 45F and a shutter-boxing 45D of a sliding door (not shown) for opening and closing the entrance and exit doorway 45F.

Both entrance and exit units 45A and 45B are constructed as a combination member comprised of the extruded material member made of the light metal alloy and a plate.

Between the entrance and exit doorways 45E and 45F disposed near the ends of the vehicle, the side construction 40 of the car body is constructed of plural sheet laminated panels. In each side of the vehicle, between the entrance and exit doorways 45E and 45F, fourteen windows 42 are provided in total. All windows 42 are uniformly spaced on the respective laminated panels.

In this embodiment of the present invention, three kinds of laminated panels P1, P2 and P3 are arranged between the entrance and exit doorways 45E and 45F. The side construction 40 of one side of the vehicle is constructed by welding five sheet laminated panels which are three sheet laminated panels P1, one sheet laminated panel P2 and one sheet laminated panel P3. The three laminated panels P1 each

have the same dimensions and are comprised of a left laminated panel P1, a middle laminated panel P1 and a right laminated panel P1. Each has four windows 42. The longitudinal length (horizontal width) of the laminated panel P1 is four times the pitch of two adjacent windows 42. Three sheet honeycomb panels P1 are thus arranged side by side parallel to the longitudinal direction of the vehicle, as shown in Fig. 1.

The laminated panel P2 is arranged between the left entrance and exit unit 45A and the left laminated panel P1. The laminated panel P3 is arranged between the right entrance and exit unit 45B and the right laminated panel P1. By welding these five sheet laminated panels P1, P2 and P3 to form the large face plate laminated panel structure, the essential part of the side construction 40 of the car body is constructed.

At the side construction 40 disposed at the substantial central portion of the longitudinal direction of the vehicle, an indication light (not shown) is provided to indicate the open-closed state of the sliding doors of the entrance and exit doorways 45E and 45F. Accordingly, it is necessary to provide a fixing location and an installation hole for the indication light on one of the three panels P1, particularly the middle laminated panel P1.

From this standpoint, the middle laminated panel P1 differs slightly from the other two laminated panels P1. However, it is possible to provide the installation location and to form the installation hole on all three sheet laminated panels P1, and in such a case all three sheet laminated panels P1 are identical.

The passenger space having seats 52 and the lobbies of the entrance and exit doorways 45E and 45F are partitioned by walls 53 and 54, as shown in Fig. 2. The seats 52 are of rotary type so that the facing direction of the seat 52 is able to change 180°. The number of the seats 52 on each side is the same as the number of the windows 42, and the pitch of two adjacent seats 52 is same as the pitch of two adjacent windows 42. The center of the respective seat 52 corresponds with the center in the longitudinal direction of the respective window 42.

The gap between the partition wall 53 and the endmost seats 52a and the gap between the partition wall 54 and the endmost seat 52b is larger than half the pitch of the seats 52 (and the windows 42). The distance from the seats 52a to the wall 53 is substantially the same as the distance from the seats 52b to the wall 54.

Since the laminated panel P3 connects to the shutter-boxing 45D of the right entrance and exit unit 45B, the horizontal length of the laminated panel P3 is shorter than that of the laminated panel P2.

One sheet laminated panel P4 is provided between the left entrance and exit unit 45A and the respective end construction 70, and one further sheet laminated panel P5 is provided between the right en-

trance and exit unit 45B and the respective end construction 70. However, if the gap between the right entrance and exit port 45B and the respective end construction 70 is narrow, it is unnecessary to employ the laminated panel P5 but an extruded material member made of the aluminum alloy is employed.

The combined laminated panel structure of the roof construction 60 of the car body comprises four sheet laminated panels P21 all having the same dimensions, one sheet laminated panel P22 and one sheet laminated panel P23, as shown in Fig. 3. The laminated panels P22 and P23 are positioned respectively at the ends of the laminated panels P21. Each laminated panel P21 has the same longitudinal length as the laminated panel P1 of the side construction 40 of the car body.

The maximum dimensions of the laminated panel are determined in accordance with the size and the productivity of the vacuum furnace. Herein, in this embodiment of the present invention, the dimensions of the laminated panel P1 have the maximum dimensions within the various kinds of the laminated panels.

Next, taking the case of the laminated panel P1, the construction of the laminated panel structure in the vehicle will be explained with reference to Figs. 5 to 7.

The laminated panel P1 comprises essentially two sheet rectangular face plates 81A and 81B, plural honeycomb cores 82, four combination members 83, four window frames 84, and vertical reinforcement members 85 and 86.

The honeycomb cores 82 and the combination members 83 etc. are installed between the two sheet face plates 81A and 81B. The combination members 83 are installed along the four peripheral portions of the two sheet face plates 81A and 81B.

Each of the combination members 83 has a channel shape cross-section as shown in Fig. 6 and Fig. 7. The combination member 83 has three portions 83a, 83b and 83c as shown in Fig. 6. Each of two parallel portions 83a and 83b is thick enough to enable welding working. The two parallel portions 83a and 83b extend outwardly from the portion 83c.

The portion 83c of the combination member 83 connects the two portions 83a and 83b. Further this portion 83c is orthogonal to the two sheet face plates 81A and 81B and is parallel to the plates of the cores 82.

A square shape frame (combination member) 84 is provided on the four peripheral portions of the square shape window 42 as shown in Fig. 5. Each of the frames 84 has a channel cross-section and consists of three portions 84a, 84b and 84c as shown in Fig. 7. Each of the two parallel portions 84a and 84b of the frame 84 is thick enough to enable installation of a window apparatus (not shown).

The two parallel portions 84a and 84b of the

frame 84 face respectively toward the opening for the window 42. The longitudinal length of the portion 84a which is disposed at the side towards the passenger space is shorter than that of the portion 84b as shown in Fig. 7. The center portion 84c of the frame 84 connects the two parallel portions 84a and 84b and is orthogonal to the two sheet face plates 81A and 81B.

The honeycomb core 82 has many hexagonal cells and the plates constructing the cells are orthogonal to the two sheet face plates 81A and 81B.

Each of the three vertical reinforcement members 85 is made of a square shape tube. Each reinforcement member 85 is provided midway between two adjacent windows 42. As occasion demands, the reinforcement members 86 also of square tube shape are disposed above and below each window 42.

Further, as occasion demands, horizontal direction reinforcement members may be disposed between the combination members 83 and the vertical reinforcement members 85 and 86. The outer peripheral portions of the reinforcement members 85 and 86 are joined to the two sheet face plates 81A and 81B and the honeycomb cores 82 (as seen in Fig. 6).

The honeycomb cores 82 are disposed in each of the spaces which are formed by the two sheet face plates 81A and 81B, four combination members 83, four frames 84, three reinforcement members 85 and eight reinforcement members 86. The two sheet face plates 81A and 81B are soldered to the combination members 83, the frames 84, the reinforcement members 85 and 86 and the honeycomb cores 82. The honeycomb cores 82 are soldered to the adjacent portions of the combination members 83, the frames 84 and the reinforcement members 85.

Next, the manufacture of the above laminated panel P1 will be explained. All of the combination members 83, the frames 84, the reinforcement members 85 and 86 and the honeycomb cores 82 are put on the lower side face plate 81B, and above them the upper side face plate 81A is put on. The laminated panel P1 is thus manufactured according to the following known manufacture procedure.

If it is necessary to make a curved panel (for example, the laminated panel for the roof construction 60 and the laminated panel for the side construction 40), the plates of the honeycomb cores 82 disposed in the longitudinal direction of the vehicle are arranged along the longitudinal direction of the vehicle and are soldered, after they receive the bending. Further, the curved panel can be manufactured by the following procedure.

The lower side curved face plate 81B is put on a curved lower side metal die, and above it many plates constituting of the honeycomb cores 82 and the frame members 84 are put on. Next, above them the upper side curved face plate 81A is put, and the plates are pressed by an upper side metal die. Next the soldering is carried out.

The lower side metal die has a concave portion at its upper surface, and the upper side metal die has a convex portion at the lower surface. Each of the combination members 83, the reinforcement members 85 and the frame members 84 is formed with a curved shape at the faces which contact the two face plates 81A and 81B.

The plates of the honeycomb core 82 disposed in the longitudinal direction of the vehicle are put side by side in the direction (longitudinal direction of the vehicle) orthogonal to the direction of curvature of the metal die.

As a result, since the plates of the honeycomb cores 82 are orthogonal with curvature of the face plate 81A, the end portions of the plates of the honeycomb cores 82 which are at the inner side in the radial direction are contacted to each other, while the end portions of the plates of the honeycomb cores 82 which are at the outer side in the radial direction are separated from each other. If the spacing of the separated parts is small the end portions are joined to each other by the soldering material. Accordingly, the curved laminated panel can be obtained.

At the ends of the portions 83a and 83b of the combination members 83, the adjacent laminated panels, the floor construction 30, the shoulder portion 65, the entrance and exist units 45A, 45B etc. are welded to the combination members 83 and, thus the car body is manufactured. Further, the portions of the combination members 83 towards the car interior and the reinforcement members 85 are welded to ribs of the frame of the vehicle and form the installation locations for the interior decoration components.

Since the car body shown in Fig. 1 to Fig. 3 has the seats 52 for four people per row in the width direction of the vehicle, this car body is employed for use in an ordinary class car.

The car body shown in Fig. 8 and Fig. 9 has the seats 52 for three people per row in the width direction of the vehicle and is employed for use in a superior class car. In the superior car, both the pitch of the windows 42 and the pitch of the seats 52 in the longitudinal direction of the vehicle are the same as in the ordinary car.

In the width direction the width of and the spacing between the seats 52 in the superior car are larger than in the ordinary car. In the superior car, the distinction from the ordinary car is achieved also by making more luxurious the interior decoration of the passenger space. The number of the windows 52 in the superior car is fourteen and is the same as that of the ordinary car.

In this superior car, there are a lavatory room 55, a wash room 56, a conductor's room 57 and a telephone booth 58. These components are given a generic name of the service domain. However, the ordinary car has no conductor's room 57 and no telephone booth 58.

The entrance and exit doorway 45E of the superior car exists only at the left end of the vehicle in Fig. 8. The laminated panel structure of the side construction 40 of the car body in the superior car comprises three sheet laminated panels P1, one sheet laminated panel P2, one sheet laminated panel P6 and one sheet laminated panel P7 as shown in Fig. 8. The three sheet laminate panels P1 and one sheet laminated panel P2 are the same as the corresponding panels of the ordinary car.

Fig. 10 and Fig. 11 show the case of the leading car in which the passenger space is almost the same as in the ordinary car. Thus the pitch of the windows 42 and the pitch of the seats 52 are the same as in the case ordinary car shown in Fig. 1 and Fig. 2.

The laminated panel structure from the right entrance and exit unit 45B to the end construction 70 at the left end of the leading car comprises three sheet laminated panels P1 and one sheet laminated panel P2 and one sheet laminated panel P4.

One sheet laminated panel P4 is provided between the left entrance and exit unit 45A and the respective end construction 70. The three sheet laminate panels P1, one sheet laminated panel P2 and one sheet laminated panel P4 are the same as those of the ordinary car.

The outer wall of the leading portion 59 from the right entrance and exit unit 45B to the forward end is not constructed by laminated panels. The longitudinal length of the right entrance and exit unit 45B at the side of the shutter-boxing 45C is longer than the longitudinal length of the right entrance and exit unit 45B shown in Fig. 1.

Fig. 12 and Fig. 13 show a service car having a buffet 80 and a salon 85. The pitch of the windows 42 is the same as in the ordinary car shown in Figs. 1 and 2. The laminated panel structure of the side construction 40 of this car body comprises three sheet laminated panels P1, one sheet laminated panel P4, one sheet laminated panel P8 and one sheet laminated panel P7. Each of the laminated panels P1 has four windows 42, respectively. The laminated panel P4 has no window, the laminated panel P8 has two windows 42 and the laminated panel P7 has one window 42. The three sheet laminate panels P1 and the sheet laminated panel P4 are the same as the corresponding panels of the ordinary car of Figs. 1 and 2.

Fig. 14 and Fig. 15 show the compartment car having eight compartment rooms 90. The construction of the side construction 40 in this compartment car is the same as that of Fig. 8.

As stated above, since the longitudinal length of the laminated panel P1 is plural times of the longitudinal length of the pitch of the windows 42, the laminated panel P1 etc. can be standardized. Further, by employing the standardized laminated panels P1 etc. the essential part of one car body can be constructed. Further, since the length of the welding line for man-

ufacturing the laminated panel structure can be shortened, the car body can manufacture at the low cost.

The vehicles described above are examples, and various other kinds of combinations are possible, for example, one in which the compartment room 90 and the passenger space of the superior car are combined in one body.

In one train, several years after the manufacture of the vehicles, there may be changes desired in the balance of the passengers in the ordinary cars and in the superior cars, alternation in the service equipments such as the compartment room and the dining room, and change in the purpose of use of the train (from the use as a limited express to use as a local train) etc. In such cases, with the above embodiments of the present invention, since the window pitch of the vehicles is the same, there is no hindrance to the alteration of the interior equipment.

Another embodiment of the car body of a laminated panel structure side construction for the railway vehicle according to the present invention will be explained referring to Fig. 16. In this embodiment of the present invention, the laminated panel structure disposed between the entrance and exit units 45A and 45B is mainly explained.

In this embodiment of the present invention, the laminated panel structure of the side construction 40 of the car body is divided into three portions in the height direction (vertical direction) of the vehicle. Three layer laminated panel structures comprise a portion below the windows 42, a portion above the windows 42 and a portion (intermediate portion) at the level of the window 42.

The laminated panel structure of the lower portion of the window 42 comprises four rectangular laminated panels P31, one rectangular laminated panel P32 and one rectangular laminated panel P33. Each panel P31 has a longitudinal length of two times the pitch of the windows 42. The laminated panel P32 connects to the left entrance and exit unit 45A and the laminated panel P33 connects to the right entrance and exit unit 45B at the lower portion of the vehicle, respectively.

The laminated panel structure of the portion above the windows 42 comprises three rectangular laminated panels P41, one rectangular laminated panel P42 and one rectangular laminated panel P43. The laminated panel P42 connects to the left entrance and exit unit 45A and the laminated panel P43 connects to the right entrance and exit unit 45B at the upper portion of the vehicle, respectively.

The laminated panel structure of the portion at the level of the windows 42 comprises thirteen rectangular laminated panels P51, one rectangular laminated panel P52 and one rectangular laminated panel P53. Each of the laminated panels P51 is arranged between two adjacent windows 42. The laminated panel P52 connects to the left entrance and exit unit

45A and the laminated panel P53 connects to the right entrance and exit unit 45B at the intermediate portion of the vehicle, respectively.

The laminated panel structure of the roof construction 60 of this car body comprises five laminated panels P61, one sheet laminated panel P62 and one sheet laminated panel P63. Each panel P61 has a longitudinal length of two times the pitch of the windows 42.

Each laminated panel P41 is flat and is included in the side construction 40, but the laminated panels P41 can form a part of the roof construction 60 by bending the upper end portion of the laminated panel 41.

As shown in Fig. 16 and Fig. 17, each of the laminated panels P31-P33, P41-P43 and P51-P53 has the channel shape combination members 83 along the four side edges of its rectangular shape in the same way as shown in Fig. 5 to Fig. 7. The side construction 40 of the car body is constructed by joining the combination members 83 to each other. Further, the laminated panels P31-P33, P41-P43 and P51-P53 incorporates the vertical reinforcement members 85 in the interior of the panels. Horizontal reinforcement members may be provided on the laminated panels, as occasion demands.

The windows 42 are surrounded by the laminated panels P31-P33, the laminated panels P41-P43 and laminated panels P51-P53. Each window 42 is thus defined as a square shape opening as shown in Fig. 17. The respective combination members 83 forming the circumference of the window 42 have a suitable shape for installation of the window. For example, in the frames (combination members) 84 shown in Fig. 7, the lengths of two parallel sections 84a and 84b of the combination member 84 are different. The alteration in lengths in two sections 84a and 84b of the combination member 84 is carried out, for example, by cutting the combination member 83 of the laminated panel in which the soldering working has been completed.

In this embodiment of the present invention, since the laminated panel structure of the side construction 40 of the car body are divided into three portions of laminated panel structure in the height direction of the vehicle, each of the laminated panels disposed at the side construction 40 is narrower, so that the diameter and the size of the vacuum furnace can be small.

Further, since the frame of one window 42 is constructed by the welding of for example four sheet laminated panels P31, P41, P51, the frame of the window 42 can be formed by the combination member 83 disposed on the end peripheral side of each laminated panel. Accordingly, the car body can be performed to have the light-weight structure.

For instance, it may be considered that the upper end and the lower end of the plural laminated panels

P51 extending over the height of the window are joined by the combination members and the obtained combined member is manufactured by soldering, and the upper panel P41 and the lower laminated panel P31 are combined to the thus obtained soldered member by welding. In this case, the combination members of the upper portion and the lower portion of the window 42 comprises the combination members for joining the laminated panels P51 and the horizontal direction combination members 83 of the laminated panels P41 and P31. Thereby the combination members have a double structure and it causes the increase in weight.

However, in the embodiment of the present invention shown in Fig. 17, since the laminated panel P51 is constructed uniformly, the combination members of the upper portion and the lower portion of the window 42 comprise only the combination members 83 of the laminated panels P41 and P31, therefore it can be attained the light-weight structure in the car body.

When the laminated panels P31, P41, P51 and P61 are joined, the vertical combination members 83 and the vertical reinforcement members 85 are joined to form one column in the vertical direction of the vehicle as shown in Fig. 17. As a result, the side construction 40 and the roof construction 60 of the car body are connected securely.

Further, when the width of the laminated panels P51 disposed at the windows (i.e. their length in the longitudinal direction of the vehicle) is small, the reinforcement member 85 of the laminated panel P51 is unnecessary and this case the combination members 83 of each of the laminated panels P51 connect to the panels 31 and the panels 41 in the vertical direction of the vehicle.

The reinforcement members 85 of the laminated panels P31, P41 may be arranged to connect to the laminated panels P51. If the width of the laminated panel P51 (i.e. its length in the longitudinal direction of the vehicle) is small, it can be made using extruded material members and the plates.

Further, the welding portions 91C between the laminated panels P61 are staggered relative to the welding portions 91B between the laminated panels P41 in the longitudinal direction of the vehicle. Similarly the welding portions 91B of the laminated panels P41 are staggered relative to the welding portions 91A of the laminated panels P31 in the longitudinal direction of the vehicle. Thus, as stated above, this embodiment of the present invention can prevent concentration of the welding portions of the laminated panels in the height direction of the vehicle.

Claims

1. A vehicle having a car body comprising a car body

comprising a floor construction, side constructions (40), a roof construction (60) and end constructions (70), each said side construction having at least partly a laminated panel structure of laminated panels (P1,P2,P3 etc) having two sheet face plates (81A,81B) and cores (82) having a plurality of cells between the two sheet face plates and there being

plural windows (42) in said laminated panel structure of said side construction (40) with a substantially uniform pitch along the longitudinal direction of the vehicle;
characterized in that:

said laminated panel structure of said side construction (40) is made at least partly by welding a plurality of first said sheet laminated panels (P1,P31,P41) each having a length in the longitudinal direction of the vehicle which is plural times of said pitch of said windows (42).

2. A vehicle having a car body according to claim 1, wherein the length in the longitudinal direction of the vehicle of each of said plurality of first sheet laminated panels (P1) is four times said pitch of said windows.

3. A vehicle having a car body according to claim 1 or claim 2 wherein said side construction (40) comprises at least one further sheet laminated panel (P2,P3 etc.) located between an entrance and exit doorway of said side construction and one of said first panels, and

the length in the longitudinal direction of the vehicle of said at least one further panel (P2,P3) is shorter than that of each of said first laminated panels.

4. A vehicle having a car body according to claim 1, wherein said side construction (40) is constructed at least partly by a first group of said laminated panels (P31), a second group of said laminated panels (P41) and a third group of said laminated panels (P51);

the length in the longitudinal direction of the vehicle of each of said panels (P31) of said first group is a plurality of times the pitch of said windows (42);

the length in the longitudinal direction of the vehicle of each of said panels (P41) of said second group is the same as that of said panels (P31) of said first group;

the length in the longitudinal direction of the vehicle of each of said panels (P51) of said third group is the same as the spacing in the longitudinal direction between two adjacent said windows (42);

said panels (P31) of said first group are welded together in the longitudinal direction of

the vehicle;

said panels (P41) of said second group are welded together in the longitudinal direction of the vehicle; and

between said first panel group and said second panel group in the vertical direction, each of said panels (P51) of said third laminated panel group is welded to said first panel group and said second panel group at a spacing equal to the longitudinal pitch of said windows (42).

5. A vehicle having a car body according to claim 4, wherein the length in the longitudinal direction of the vehicle of said panels of said first group and of said second group is two, three or four times the pitch of said windows.

6. A vehicle having a car body according to claim 4 or claim 5 wherein each of said panels of said first group, said second group and said third group has a rectangular outer periphery,

a combination member (83) for welding and joining is provided on each side of said periphery of each of said panels of said first group, said second group and said third group; and

said panels of said first group, said second group and said third group are welded to each other by means of said combination members.

7. A vehicle having a car body according to claim 6, wherein the welding lines (91A) of said panels of said first group to each other are staggered in the longitudinal direction of the vehicle from the welding lines (91B) of said panels of said second group to each other.

8. A vehicle having a car body according to claim 6, wherein each of said panels of said first group and said second group has at least one reinforcement member (85) extending in the vertical direction; and

at least one combined reinforcement body extending as a column in the vertical direction is comprised by said combination members and said reinforcement members of said first laminated panel group and said second laminated panel group.

9. A vehicle having a car body according to claim 6 wherein

each of said panels of said first group and said second group has at least one first reinforcement member (85) extending in the vertical direction;

each of said panels of said third group has a second reinforcement member (85) extending in the vertical direction;

at least one combined reinforcement body

extending as a column in the vertical direction is comprised by said combination members, said first reinforcement members of said first panel group and said second panel group and said second reinforcement members of said third panel group. 5

10. A vehicle having a car body according to any one of claims 4 to 9 wherein said roof construction is constructed at least partly by a fourth laminated panel group of sheet laminated panels (P61) having said sheet face plates and said cores providing cells, said panels (P61) of said fourth group having each a length in the longitudinal direction of the vehicle the same as that of said panels (P31) of said first panel group; 10
 said panels (P61) of said fourth group, being welded together in the longitudinal direction of the vehicle and welded to said panels (P51) of said second laminated panel group. 15
 20

11. A vehicle having a car body according to claim 10 wherein the welding lines (91B) of said panels of said second group to each other are staggered in the longitudinal direction of the vehicle from the welding lines (91C) of said panels of said fourth group to each other. 25

12. A train which is a combination of different kinds of vehicles, characterized in that: 30
 the different kinds of vehicles comprise a service vehicle and a passenger vehicle having passenger space with plural seats in the width direction of the vehicle and in the longitudinal direction of the vehicle, and 35
 the service vehicle and the passenger vehicle each have plural windows with substantially the same pitch in the longitudinal direction.

13. A train which is a combination of different kinds of vehicles characterized in that: 40
 the different kinds of vehicles comprise at least one vehicle having ordinary class passenger space and at least one vehicle having superior class passenger space, each such vehicle 45
 having plural windows with substantially the same pitch along in longitudinal direction, and each such vehicle having seats with the same longitudinal pitch as the longitudinal pitch of the windows, and the seats being plural in number in the width direction and in the longitudinal direction of the vehicle. 50

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FIG. 1

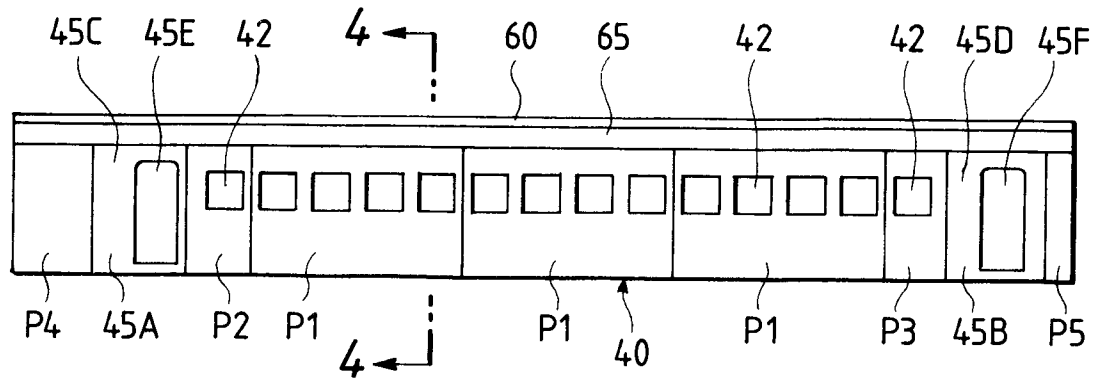


FIG. 2

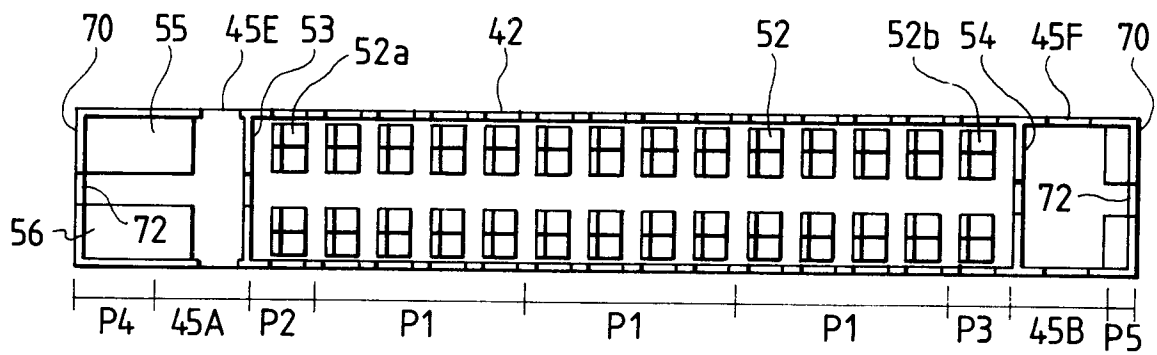


FIG. 3

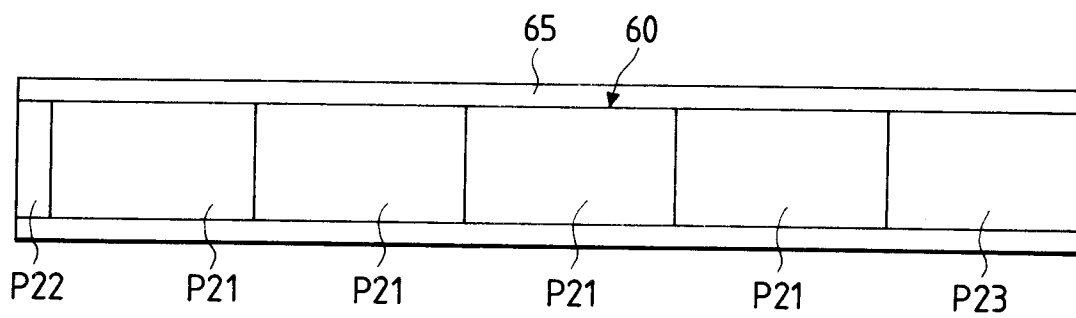


FIG. 4

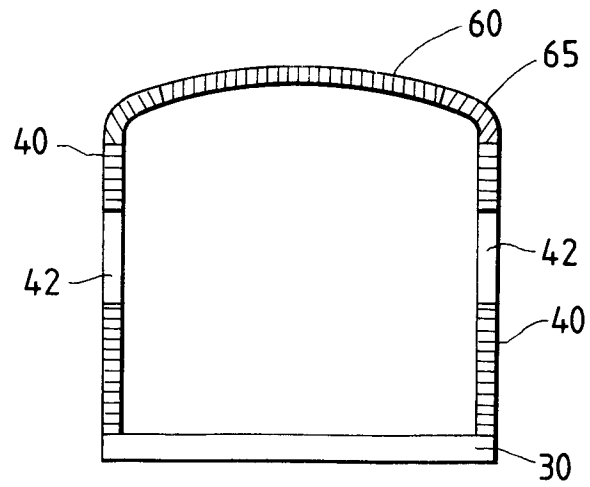


FIG. 5

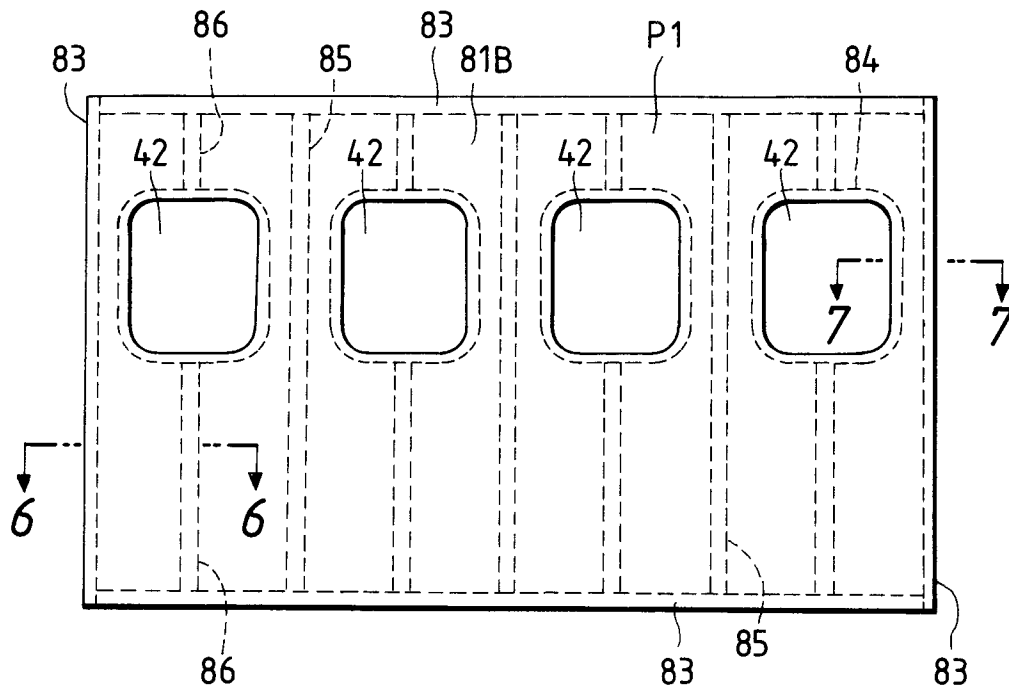


FIG. 6

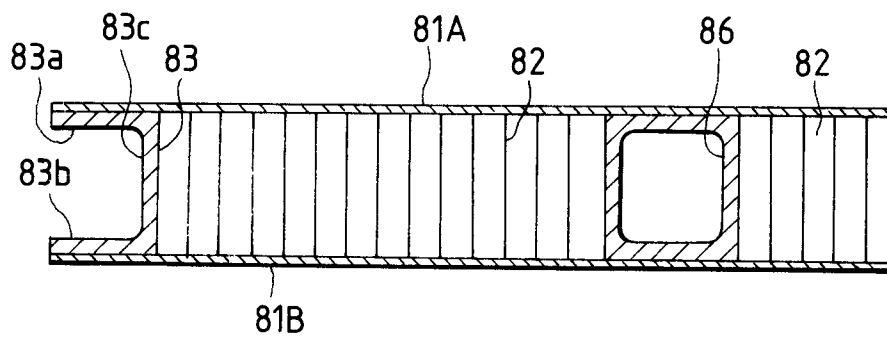


FIG. 7

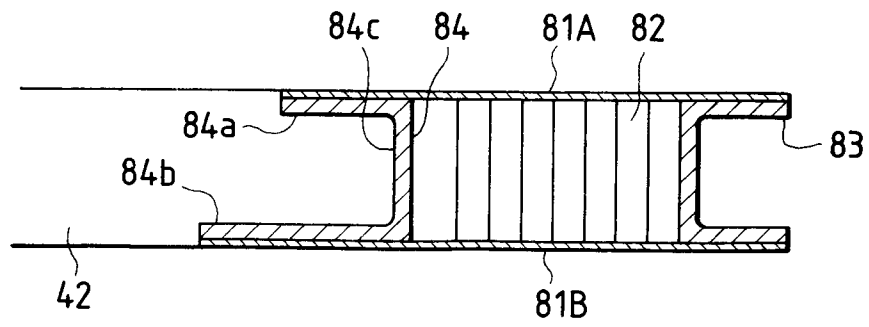


FIG. 8

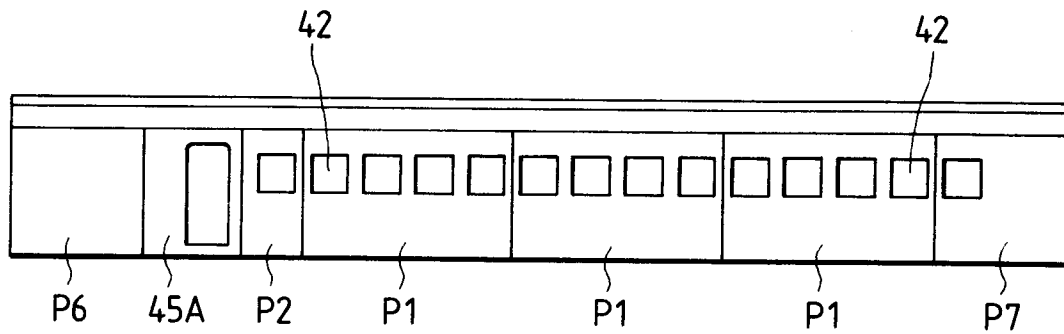


FIG. 9

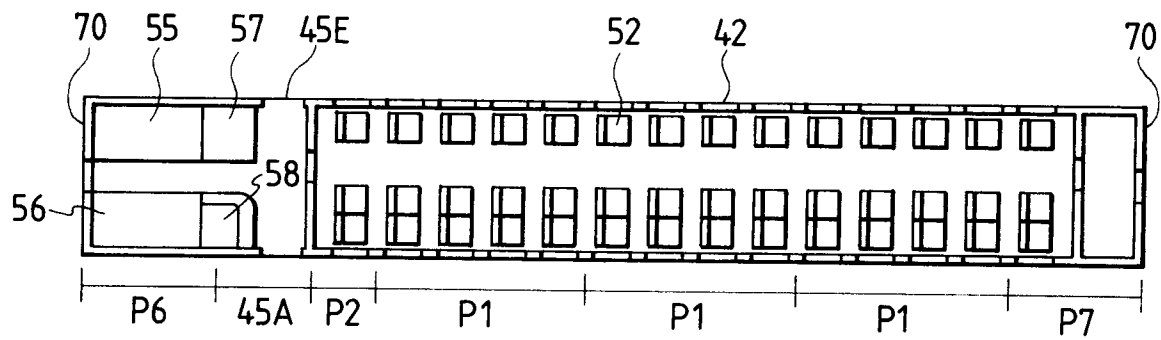


FIG. 10

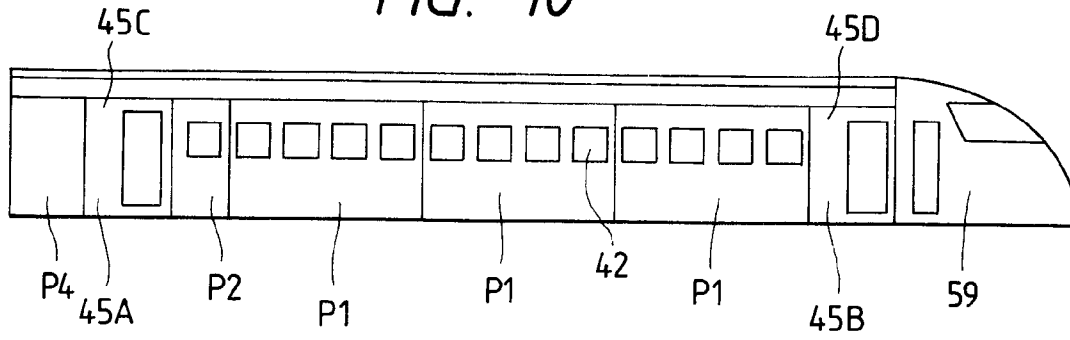


FIG. 11

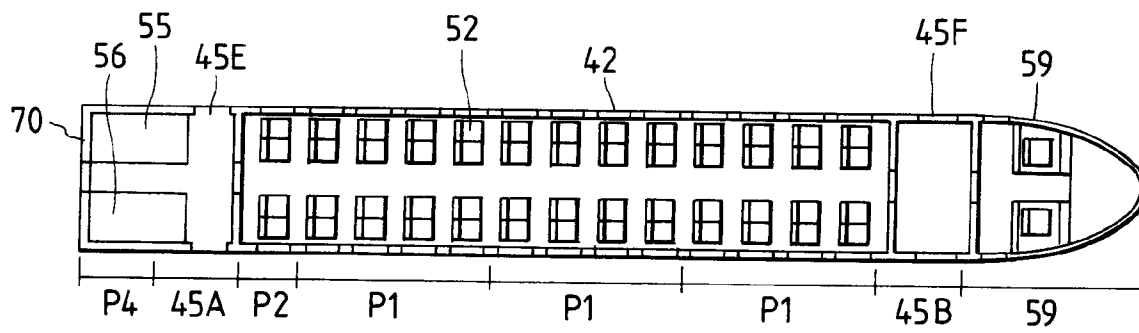


FIG. 12

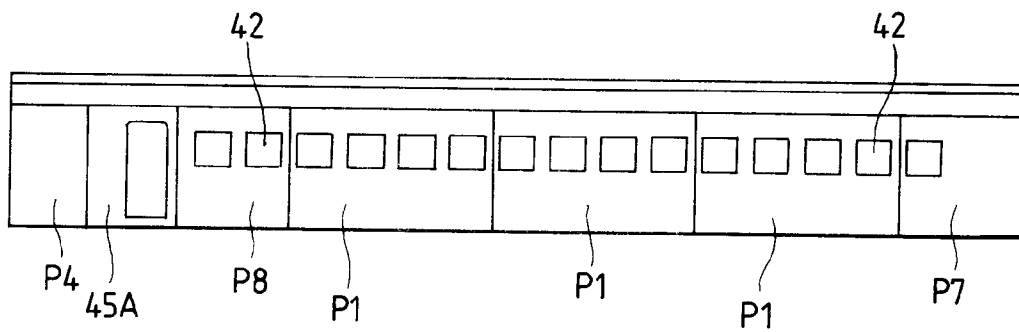


FIG. 13

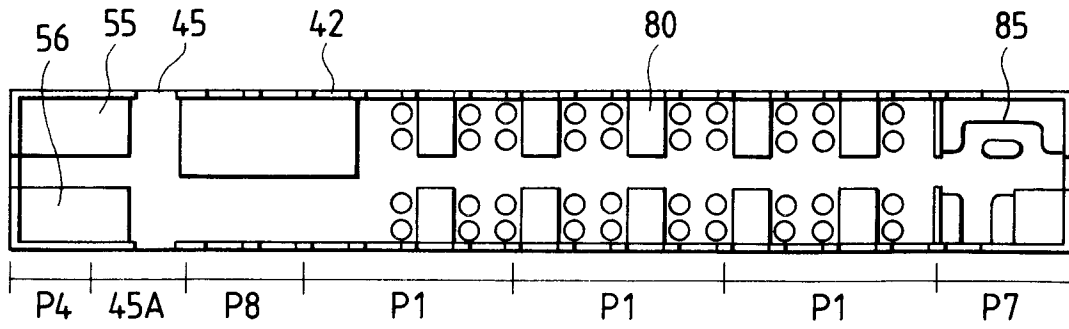


FIG. 14

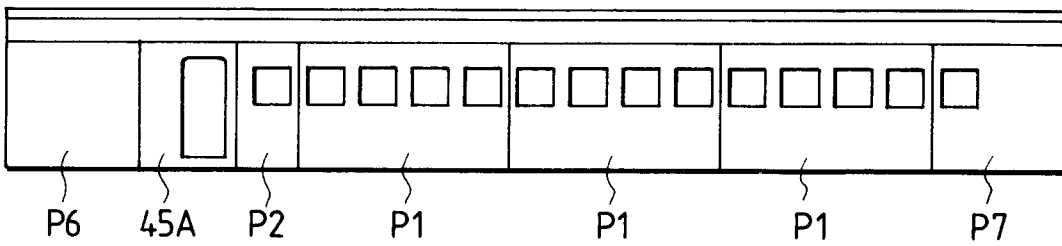


FIG. 15

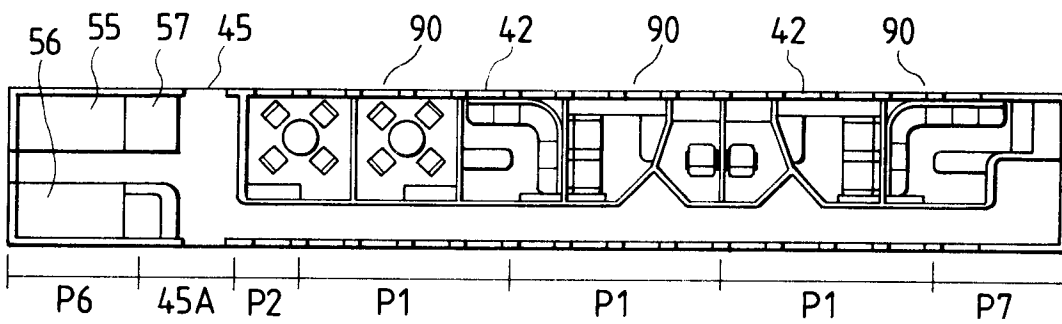


FIG. 16

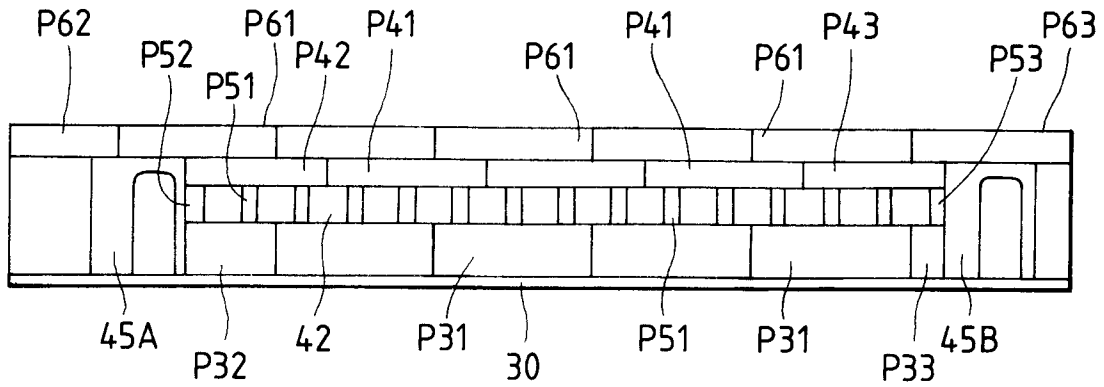
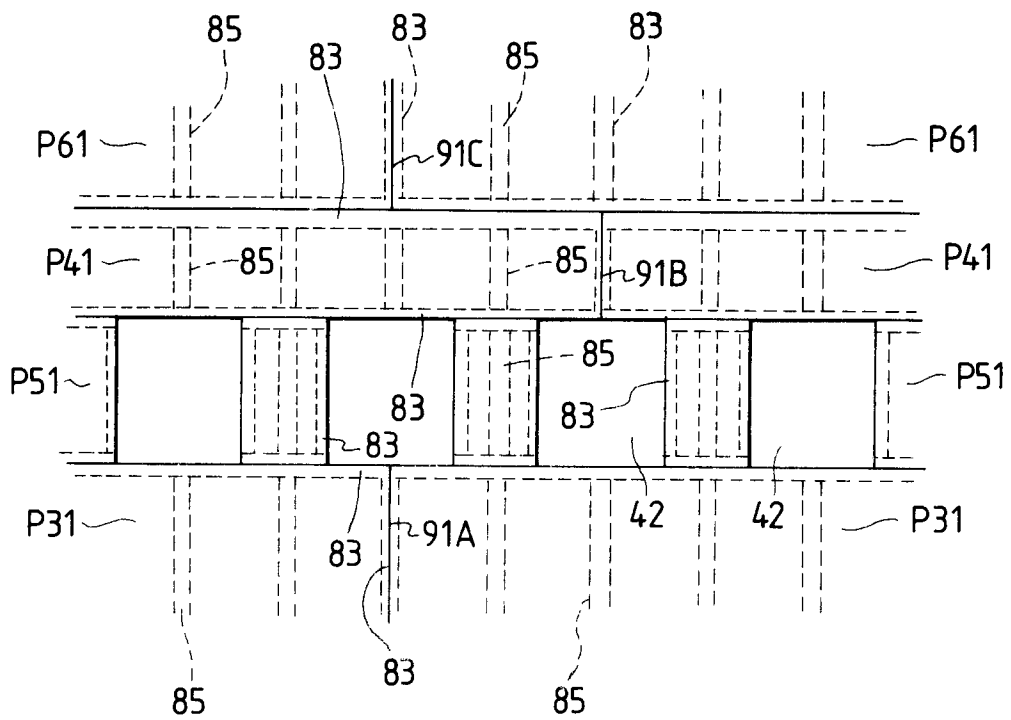


FIG. 17





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 31 0637

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,P	EP-A-0 474 510 (HITACHI LTD.) * abstract; claims 1-6,8-10; figures 1-4,6 *	1,2,6,10	B61D17/04 B61D17/08
A,D	EP-A-0 405 889 (HITACHI LTD.& JP 390468) * abstract; claims 1-7,9,10,16,20; figures 1-3,10-12,16 *	1,8	
A	EP-A-0 260 200 (ALSTHOM) * abstract; claims 1,6,9; figure 1 *	1	
A	FR-A-2 635 064 (C.I.M.T. LORRAINE) * the whole document *	1	
A	EP-A-0 354 436 (C.I.M.T. LORRAINE) * abstract; figure 1 *	1	
A,D	EP-A-0 071 689 (M.B.B.) * abstract; figures 4-6 *	12-13	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B61D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27 JANUARY 1993	Examiner SCHMAL R.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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