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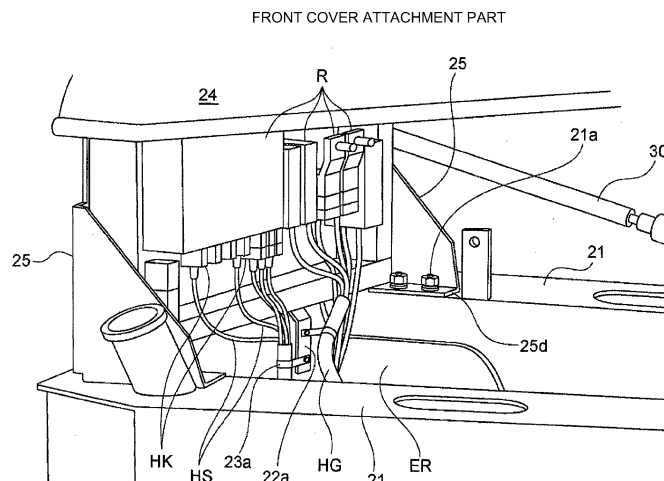
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(54) **ELECTRICAL-COMPONENT ATTACHMENT STRUCTURE FOR FORKLIFT**

(57) An object is to provide an electrical-component attachment structure for a forklift whereby electrical components around an engine is concentrated in a single place, so that it possible to prevent an electrical harness from contacting the engine and facilitate maintenance of the electrical components. An electrical-component attachment structure for a forklift 1 includes a pair of right and left side frames 21, a pair of right and left side covers 26 disposed so as to face an engine and a plurality of devices for the forklift disposed between the pair of side

frames 21, the side covers being erected on upper surfaces of the pair of side frames 21, a front cover 25 for closing a front end side of the side covers 26, mounted to the side frames removably, and an engine hood 24 covering an upper end of an engine room ER surrounded by the side covers 26 and the front cover 25. The front cover includes a side to which a plurality of kinds of electrical components R for operating the forklift 1 is attached, the side being adjacent to the engine room ER.

FIG.3



Description

TECHNICAL FIELD

[0001] The present invention relates to an electrical-component attachment structure for an engine room of a forklift.

BACKGROUND

[0002] A forklift is often used to promote work efficiency of transportation, loading, and unloading of various objects. There is employed a method using power from a battery or an internal combustion engine mounted on a forklift as a driving source of the forklift.

[0003] In a case where an internal combustion engine is used, operation of the internal combustion engine increases the temperature of the internal combustion engine itself, and the peripheral members are also heated by radiation heat dissipated from the internal combustion engine.

[0004] Electrical components for a vehicle (including a forklift) are required to have heat insulating property. Thus, many electrical components have a resin outer shell, and may fail to function sufficiently by receiving high heat.

[0005] Patent Document 1 discloses an example of a countermeasure technique against such high heat.

[0006] Patent Document 1 discloses a battery forklift track including a controller for controlling a traveling motor and a work motor for driving drive wheels and work devices mounted to the forklift via a bracket removably fixed to the counterweight.

[0007] With the controller attached to the counterweight having a high heat content via the bracket, the disclosed technique discharges the heat generated by the controller from the counterweight via the bracket.

[0008] Further, Patent Document 2 discloses attaching an engine hood to an erected board disposed behind the engine hood via a pair of right and left hinges.

[0009] The pair of right and left hinges has a structure such that the engine hood is removed from a vehicle body by moving the hinges in the axial direction of the rotational shafts of the hinges with respect to the rotational shafts.

[0010] In this way, the work for maintenance and repair of a forklift is facilitated.

Citation List

Patent Literature

[0011]

Patent Document 1: Japanese Unexamined Patent Application Pub. No. H7-172800

Patent Document 2: Japanese Unexamined Patent Application Pub. No. H10-310386

SUMMARY

Technical Problem

[0012] In Patent Document 1, however, it is necessary to provide a recess on the counterweight to attach the controller.

[0013] The counterweight is to prevent rear wheels from moving upward about front wheels of the forklift when a weight load from loads is applied to a load lifting unit of the forklift, so that the forklift can be driven and steered.

[0014] Thus, if the recess is to be disposed on the counterweight, it is necessary to increase the size of the counterweight to secure a suitable weight.

[0015] However, increasing the size of the counterweight detracts the maneuverability, which is an important function of the forklift.

[0016] Further, the structure disclosed in Patent Document 2 is for removing the engine hood from the vehicle to perform maintenance and repair on the forklift. Thus, no technique is disclosed in relation to protection of electrical components from radiation heat of an engine.

[0017] The present invention was made in view of the above issues. An object is to provide an electrical-component attachment structure for a forklift for concentrating electrical components disposed around an engine in a single location so that an electrical harness does not contact the engine and maintenance of the electrical components is facilitated.

Solution to Problem

[0018] To achieve the above object, the present invention is capable of providing an electrical-component attachment structure for a forklift, including: a pair of right and left side frames extending in a vehicle front-rear direction of the forklift at an interval in a vehicle width direction; a pair of right and left side covers disposed so as to face an engine and a plurality of devices for the forklift which are disposed between the pair of side frames, the side covers being erected on upper surfaces of the pair of side frames; a front cover for closing a front end side in the vehicle front-rear direction of the side covers in the vehicle width direction, the front cover being disposed over the pair of right and left side frames and mounted to the pair of right and left side frames removably; and an engine hood covering an upper end of a space surrounded by the side covers and the front cover. The front cover includes a side to which a plurality of kinds of electrical components for operating the forklift is attached, the side being adjacent to the engine.

[0019] Further, preferably in the present invention, the electrical-component attachment structure may further include an electrical-component board to which the plurality of kinds of electrical components is attached. The electrical-component board may be attached to the side adjacent to the engine of the front cover removably by a

fastening member.

[0020] Accordingly, with the electrical components attached to the front cover that is attachable and removable to and from the vehicle body, the electrical harness connected to the electrical components easily gather, which makes it easier to prevent the electrical harness from contacting or approaching the engine.

[0021] If the electrical components were disposed dispersedly around the engine, harnesses would be arranged extensively around the engine and the number of clamps supporting the electric harnesses and the support brackets fixing the clamps would be increased, which results in cost increase, deterioration in maintainability, wire layout error, and interruption of air ventilation around the engine. These situations can be prevented with the above configuration.

[0022] Further, since the front cover can be removed from the side frames along with the electrical-component board to which the plurality of kinds of electrical components is attached, maintenance of the electrical components is facilitated.

[0023] Further, preferably in the present invention, the electrical-component board may be attached so that a side of the electrical-component board to which the plurality of kinds of electrical components is attached is facing the front cover.

[0024] Accordingly, with the side to which the electrical-components are attached facing the front board side, the electrical components are protected from the radiation heat of the engine, which makes it possible to maintain the performance of the electrical components and to improve the durability.

[0025] Further, preferably in the present invention, connectors of an electrical harness for operating the electrical components may be abutted and directly connected to electrical terminals disposed on the electrical components.

[0026] Accordingly, it is possible to prevent the electrical harnesses branched from the electrical harness to the respective electrical components from rocking due to vibration of the vehicle and from contacting the engine or other components to become damaged.

[0027] Further, since rocking of the branched electrical harnesses is restricted, it is no longer necessary to provide the clamps for supporting the branched electrical harnesses and the brackets for supporting the clamps, for instance.

[0028] Further, preferably in the present invention, an attachment part of the front cover to the side frames is covered by the engine hood.

[0029] The upper surfaces of the side frames can also serve as a floor surface during work of a driver. Thus, according to the present invention, reducing even a part of the fastening members for attaching the front cover to the side frames makes it possible to improve safety of work of the driver.

[0030] Further, preferably in the present invention, the front cover and/or the electrical-component board may

include a clamp bracket for fixing a clamp which supports the electrical harness.

[0031] Accordingly, while the front cover is removed from the side frames for maintenance of the electrical components, the electrical harness is clamped on the front cover, which prevents deformation of or damage to the joint between the electrical components and the branched electrical harnesses by simultaneously moving (as far as bending) the electrical harness, and which makes it easier to see the assembly of the joint. Thus, it is possible to prevent wrong connection between the electrical components and the branched electrical harnesses after replacement, which improves maintainability.

Advantageous Effects

[0032] According to the present invention, the electrical components around the engine is concentrated in a single place, which makes it possible to prevent the electrical harness from contacting the engine and to facilitate maintenance of the electrical components.

BRIEF DESCRIPTION OF DRAWINGS

[0033]

FIG. 1 is a schematic side view of a forklift according to one embodiment of the present invention.

FIG. 2 is a front perspective view of an engine hood part of the present invention.

FIG. 3 is a diagram illustrating a front cover to which electrical components are attached, according to the first embodiment of the present invention.

FIG. 4 is a diagram illustrating a front cover to which electrical components are attached, according to the second embodiment of the present invention.

FIG. 5 is a detail view individually illustrating the front cover according to one embodiment of the present invention.

DETAILED DESCRIPTION

[0034] Embodiments of the present invention will now be described in detail with reference to the accompanying drawings. It is intended, however, that unless particularly specified, dimensions, materials, shapes, relative positions and the like of components described in the embodiments shall be interpreted as illustrative only and not limitative of the scope of the present invention.

(First embodiment)

[0035] FIG. 1 is a schematic side view of a forklift according to one embodiment of the present invention.

[0036] A forklift 1 includes a vehicle body 2, a load lifting unit 7 mounted to a front part of the vehicle body 2, a head guard 5 mounted to an upper part of the vehicle

body 2, front wheels 8, rear wheels 9 mounted to the rear of the vehicle body 2, a counterweight 3 mounted to the rear of the vehicle body 2, a steering wheel 4 for steering the rear wheels 9, and a seat 10 for seating a driver. The head guard 5 is to prevent a load from falling onto a driver's seat due to collapse of loads lifted by the load lifting unit 7. The front wheels 8 are driving wheels for moving the forklift 1. The rear wheels 9 are steering wheels of the forklift 1. The counterweight 3 has a weight such that the rear wheels 9 do not become spaced from the road surface due to the weight of loads on the load lifting unit 7, and such that the rear wheels 9 can contact the road surface firmly.

[0037] Since the forklift 1 is steered by the rear wheels 9, the traveling direction of the vehicle body 2 cannot be changed unless the rear wheels 9 are brought into firm contact with the road surface by the counterweight 3.

[0038] The load lifting unit 7 includes forks 72 having an L shape as seen from the side, on which loads are to be placed, a back rest 73 to which the forks 72 are attached, a mast 71 for supporting the back rest 73 slidably in the vertical direction, a lift chain (not illustrated) for sliding the back rest 73 in the vertical direction, and a tilt cylinder (hydraulic pressure) 76 for tilting the mast 71 and an assist mast 75 to adjust tips of the forks 72, disposed in the mast 71.

[0039] The tips of the forks 72 are tilted (adjusted) upward and downward to insert the forks 72 under a load, so that the load is placed on the forks 72.

[0040] The assist mast 75 is slid by a lift cylinder (hydraulic pressure) that is not illustrated, upward and downward with respect to the mast 71.

[0041] As illustrated in FIGs. 2 and 3, the vehicle body 2 of the forklift 1 includes a pair of right and left side frames 21 extending in the front-rear direction of the forklift 1 and arranged at an interval in the vehicle width direction, and a front cross member (not illustrated) at the front and a rear cross member (not illustrated) at the rear connecting the pair of right and left side frames 21 in the vehicle width direction. The front and rear cross members are arranged at an interval in the front-rear direction.

[0042] Further, an engine, a device for driving the front wheels, a hydraulic pump for generating hydraulic cylinder as a power source of a hydraulic device or the like, and a device for driving and work such as a steering device for the rear wheels (not illustrated) are mounted between the pair of right and left side frames 21.

[0043] Still further, a cover and the like covering the top of these devices are provided.

[0044] A pair of right and left side covers 26 is disposed removably so as to be erected at a position facing the engine and various devices of the forklift, and on the upper surfaces of the pair of side frames 21. A front cover 25 is disposed at a position for closing front ends of the side covers 26 in the vehicle front-rear direction so as to be disposed over the pair of right and left side frames 21. The front cover 25 is removably attached to the pair of right and left side frames. An engine room ER is a space

surrounded by the side covers 26 and the front cover 25. An engine hood 24 covers the upper end of the engine room ER.

[0045] The front end surface of the counterweight 3 closes an opening formed by the pair of right and left side covers 26 and the engine hood 24 at the rear side of the vehicle.

[0046] Further, at the region in front of the front cover, the upper plane between the pair of right and left side frames 21 is covered by a floor board 27 on which the driver's feet are to be rested to operate the forklift 1.

[0047] The engine hood 24 is pivotable toward the rear of the vehicle about hinges (not illustrated) disposed on a boundary between the counterweight 3 and the rear edge of the engine hood 24.

[0048] Here, the reference sign 30 indicates a damper device that assists the backward pivot of the engine hood 24 via the hinges.

[0049] Further, a hook unit 28 for stopping the backward pivot of the engine hood 24 is disposed on the front edge of the engine hood 24.

[0050] The hook unit 28 includes a hook portion 28a fixed to the front cover 25, and a hook lever 28b fixed to the engine hood 24 side.

[0051] The hook portion 28a is engaged with the hook lever 28b by rotating an operation lever 28c of the hook lever 28b downward about the rotational shaft of the hook lever 28b, and moving the engagement part at the lower end of the hook lever 28b downward. The moved engagement part is rotatable in the vehicle front-rear direction. Thus, the engagement of the hook portion 28a with the hook lever 28b is completed by (manually) shifting the engagement part to the hook portion 28a to rotate the hook lever 28b upward again.

[0052] FIG. 5 is a diagram individually illustrating the front cover 25.

[0053] The front cover 25 is a single piece integrally including a cover body 25a formed in a substantially rectangular shape closing a space between the pair of right and left side covers 26, an upper flange portion 25b which is an upper edge of the cover body 25a bended rearward (to the side the electrical components are mounted to), side flange portions 25c bended rearward from the opposite edges in the vehicle width direction of the cover body 25a so as to maintain the rigidity and inclination of the cover body 25a in the front-rear direction, and attachment portions 25d bended inwardly in the vehicle width direction from the lower edge of the side flange portions 25c to be placed on the upper surfaces of the side frames 21. The front cover 25 is fastened to the side frames 21 by bolts 21a being fastening members at the attachment portions 25d.

[0054] The upper flange portion 25b has the functions of maintaining the rigidity of the cover body 25a and protecting the electrical components R described below.

[0055] Specifically, with the upper flange portion 25b bended toward the side to which the electrical components are attached, it is possible to prevent the electrical

components from getting wet with the upper flange portion 25b even if rainwater passes through the gap around the engine hood 24 when it rains.

[0056] Further, as illustrated in FIG. 4, the attachment portions 25d of the front cover 25 are fastened from above by the bolts 21a being fastening members to the upper surfaces of the side frames 21.

[0057] As illustrated in FIG. 3, an engine, a device for driving the front wheels, a hydraulic pump that generates hydraulic pressure as a power source of the hydraulic devices or the like, and a number of electrical components R are attached to the back surface (facing the engine) of the front cover 25. The electrical components R control operation of traveling and work devices such as a steering device for the rear wheels.

[0058] As illustrated in FIG. 4, many electrical components R are attached to the back surface of the body portion 25a of the front cover 25.

[0059] Each electrical component R includes an electrical terminal (not illustrated) for electrical connection.

[0060] On the other hand, an electrical harness HG connected to the electrical terminals is arranged inside the engine room ER.

[0061] The electrical harness HG includes a bundle of wires connected to the electrical components covered by a tube member having heat resistant property and flexibility.

[0062] From the electrical harness HG, branch harnesses HS electrically connected to the respective electrical components R are branched. Each branch harness HS includes a coupler HK at its distal end. The couplers HK are directly connected to the electrical terminals of the respective electrical components R.

[0063] Further, at the lower part of the body portion 25a of the front cover 25, a clamp 23 for fixing the electrical harness HG and a clamp bracket 22 for fixing the clamp 23 to the front cover 25 are fixed.

[0064] The electrical harness HG is fixed to the front cover 25, and the branched harnesses HS branched from the electrical harness HG are connected to the electrical terminals of the electrical components R.

[0065] Thus, the branched harnesses HS are fixed at both of the electrical harness HG and the corresponding electrical component R, which prevents rocking of the branched harnesses HS due to vibration of the vehicle.

[0066] The electrical harness HG and the branched harnesses HS are fixed while being gathered toward the body portion 25a of the front cover 25.

[0067] Thus, even if the forklift 1 travels on a rough road, it is possible to prevent damage to the electrical harness HG and the branched harnesses HS due to approach or contact with the engine.

[0068] The maintenance of the electrical components R is carried out in the following order. First, the hook unit 28 of the front cover 25 is disconnected and the engine hood 24 is pivoted toward the rear of the vehicle.

[0069] Then, the side covers 26 are removed from the side frames 21, the bolts 21a attaching the front cover

25 to the side frames 21 are removed, and the front cover 25 is inclined forward. Finally, the maintenance is performed.

[0070] After the maintenance is completed, assembly is carried out in the reverse order of the above.

[0071] When the front cover 25 is removed from the side frames 21 for maintenance of the electrical components R, it is possible to move (as far as bend) the electrical harness HG and the branched harnesses HS at the same time if the electrical harness HG is clamped on the front cover 25.

[0072] Thus, it is possible to prevent deformation or damage of the joint between the electrical components R and the branched harnesses HS.

[0073] Further, since there is a good view of a connection state of the joint, it is possible to prevent an error when reconnecting the electrical components and the branched electrical harnesses after replacement, which improves maintainability.

(Second embodiment)

[0074] The present embodiment is different from the first embodiment only in that the front cover 25 further includes an electrical-component board 29. Configuration except for the electrical-component board 29 is the same as that in the first embodiment, and thus it is not described below in particular.

[0075] Further, the same feature is indicated by the same reference number in accordance with the above description.

[0076] In the present embodiment, as illustrated in FIG. 4, the electrical-component board 29 is further provided for the front cover 25 at the engine room ER side.

[0077] The electrical-component board 29 is fastened to the body portion 25a of the front cover 25 by bolts 21a being fastening members.

[0078] The electrical-component board 29 is mounted to the body portion 25a so that a side of the electrical-component board 29 to which more than one of the electrical components R are attached is facing the body portion 25a side of the front cover 25.

[0079] In the present embodiment, the number of mounted electrical components is large, so the number of electrical harnesses HG and branch harnesses HS is increased as well.

[0080] Accordingly, at the lower part of the body portion 25a of the front cover 25, clamps 23a for fixing the electrical harness HG and clamp brackets 22b, 22c for fixing the clamps 23a to the front cover 25 are fixed.

[0081] Further, the clamp bracket 22 and the electrical-component board 29 are fastened together by the attachment bolts 21a of the electrical-component board 29, so that the electrical harness HG is fixed to the front cover 25 by the clamps 23a.

[0082] With the above configuration, the same effect as that of the first embodiment can be achieved.

[0083] Furthermore, in the present embodiment, the

electrical-component board 29 is mounted to the body portion 25a so that a side of the electrical-component board 29 to which more than one of the electrical components R are attached is facing the body portion 25a side of the front cover 25.

[0084] In this way, radiation heat of the engine is blocked by the electrical-component board 29 for the electrical components R, which results in a good effect for an electrical control unit that is particularly likely to be affected by heat.

Industrial Applicability

[0085] The present invention relates to an electrical-component attachment structure disposed in an engine room of a forklift.

Reference Signs List

[0086]

1	Forklift
2	Vehicle body
5	Head guard
7	Load lifting unit
21	Vehicle body frame
22a, 22b, 22c	Clamp bracket
23a	Clamp
24	Engine hood
25	Front cover
26	Side cover
27	Floor board
28	Hook unit
29	Electrical-component board
ER	Engine room
HG	Electrical harness
HK	Coupler
HS	Branch harness
R	Electrical component

Claims

1. An electrical-component attachment structure for a forklift, comprising:

a pair of right and left side frames extending in a vehicle front-rear direction of the forklift at an interval in a vehicle width direction;

a pair of right and left side covers disposed so as to face an engine and a plurality of devices for the forklift which are disposed between the pair of side frames, the side covers being erected on upper surfaces of the pair of side frames;

a front cover for closing a front end side in the vehicle front-rear direction of the side covers in the vehicle width direction, the front cover being disposed over the pair of right and left side

frames and mounted to the pair of right and left side frames removably; and

an engine hood covering an upper end of a space surrounded by the side covers and the front cover,

wherein the front cover includes a side to which a plurality of kinds of electrical components for operating the forklift are attached, the side being adjacent to the engine.

2. The electrical-component attachment structure for a forklift according to claim 1, further comprising an electrical-component board to which the plurality of kinds of electrical components are attached, the electrical-component board being attached to the side adjacent to the engine of the front cover removably by a fastening member.
3. The electrical-component attachment structure for a forklift according to claim 2, wherein the electrical-component board is attached so that a side of the electrical-component board to which the plurality of kinds of electrical components are attached is facing the front cover.
4. The electrical-component attachment structure for a forklift according to any one of claims 1 to 3, wherein connectors of an electrical harness for operating the electrical components are abutted and directly connected to electrical terminals disposed on the electrical components.
5. The electrical-component attachment structure for a forklift according to any one of claims 1 to 4, wherein an attachment part of the front cover to the side frames is disposed at a position covered by the engine hood.
6. The electrical-component attachment structure for a forklift according to any one of claims 1 to 5, wherein the front cover and/or the electrical-component board includes a clamp bracket for fixing a clamp which supports the electrical harness.

FIG.1

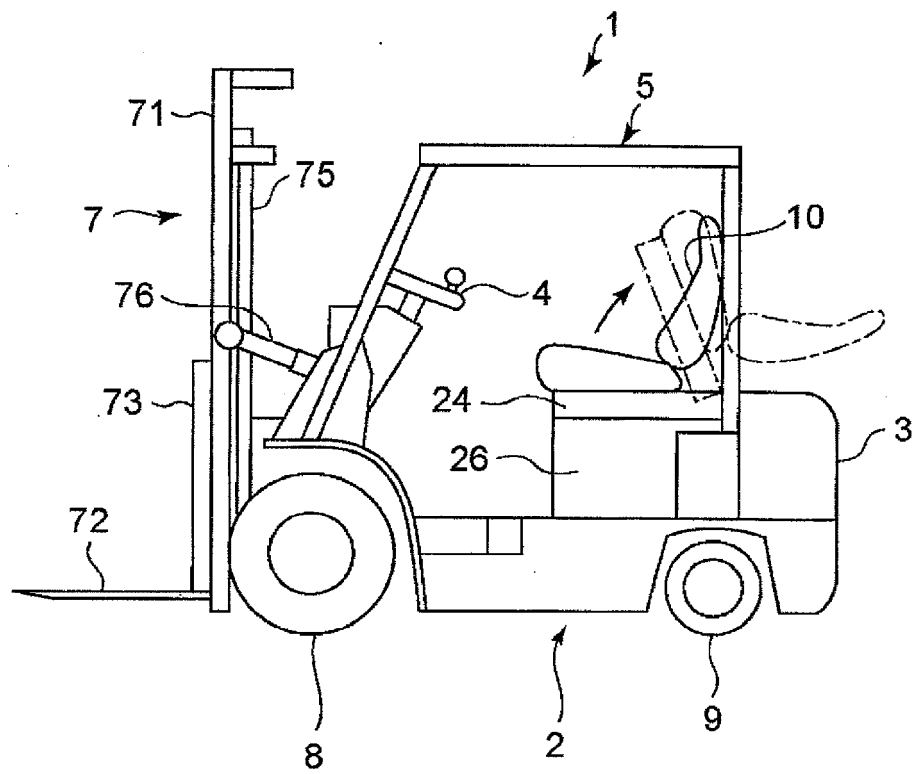


FIG.2

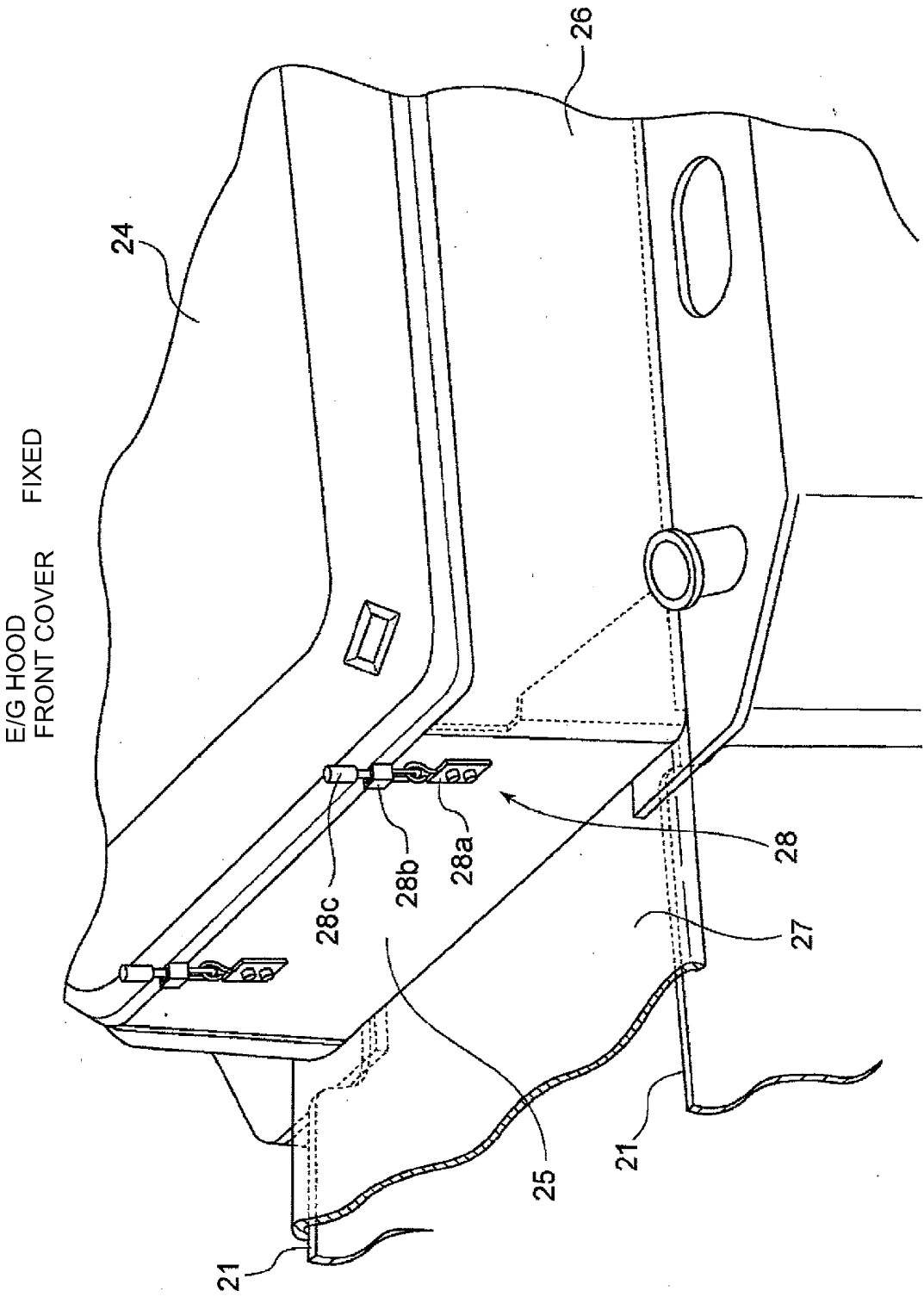


FIG. 3

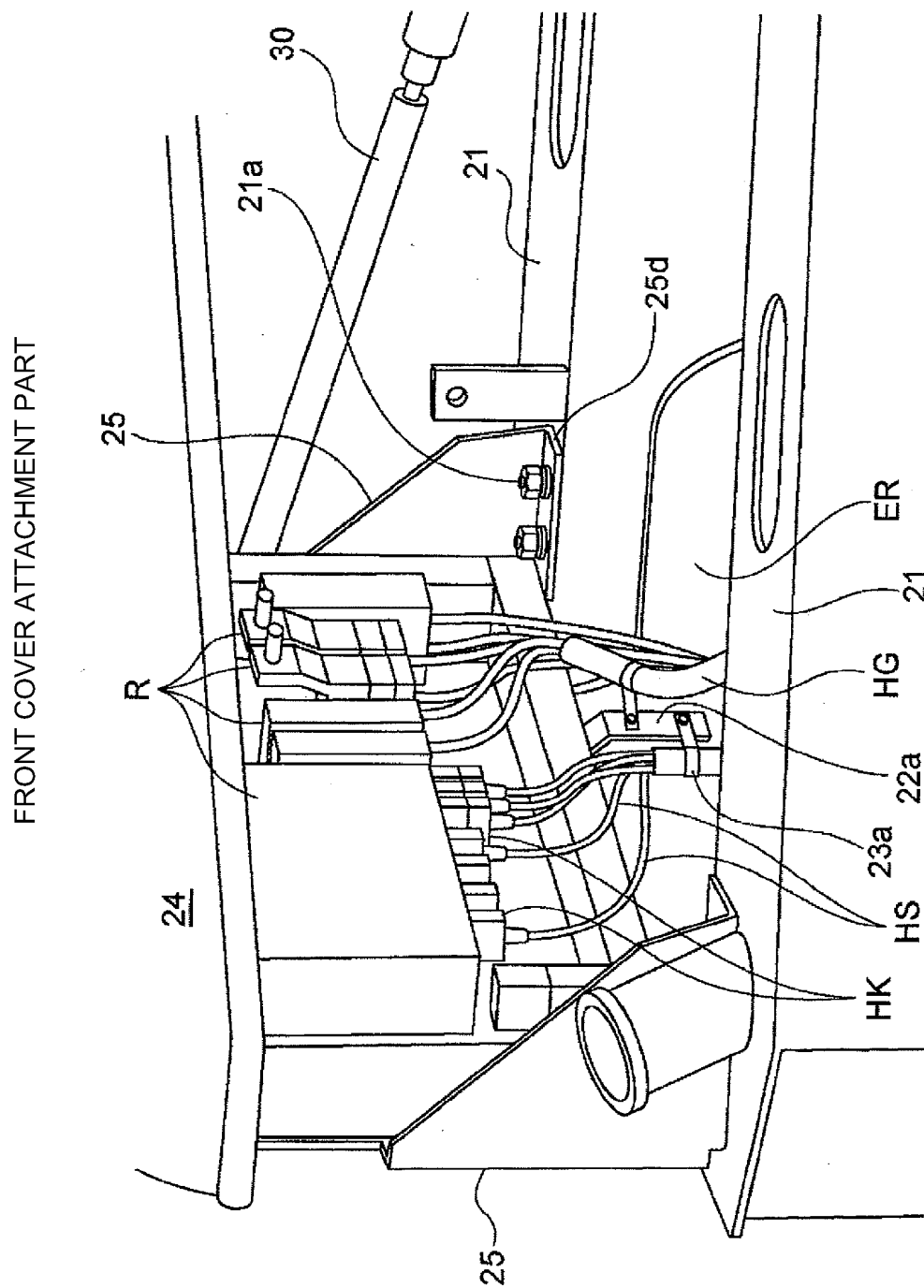


FIG.4

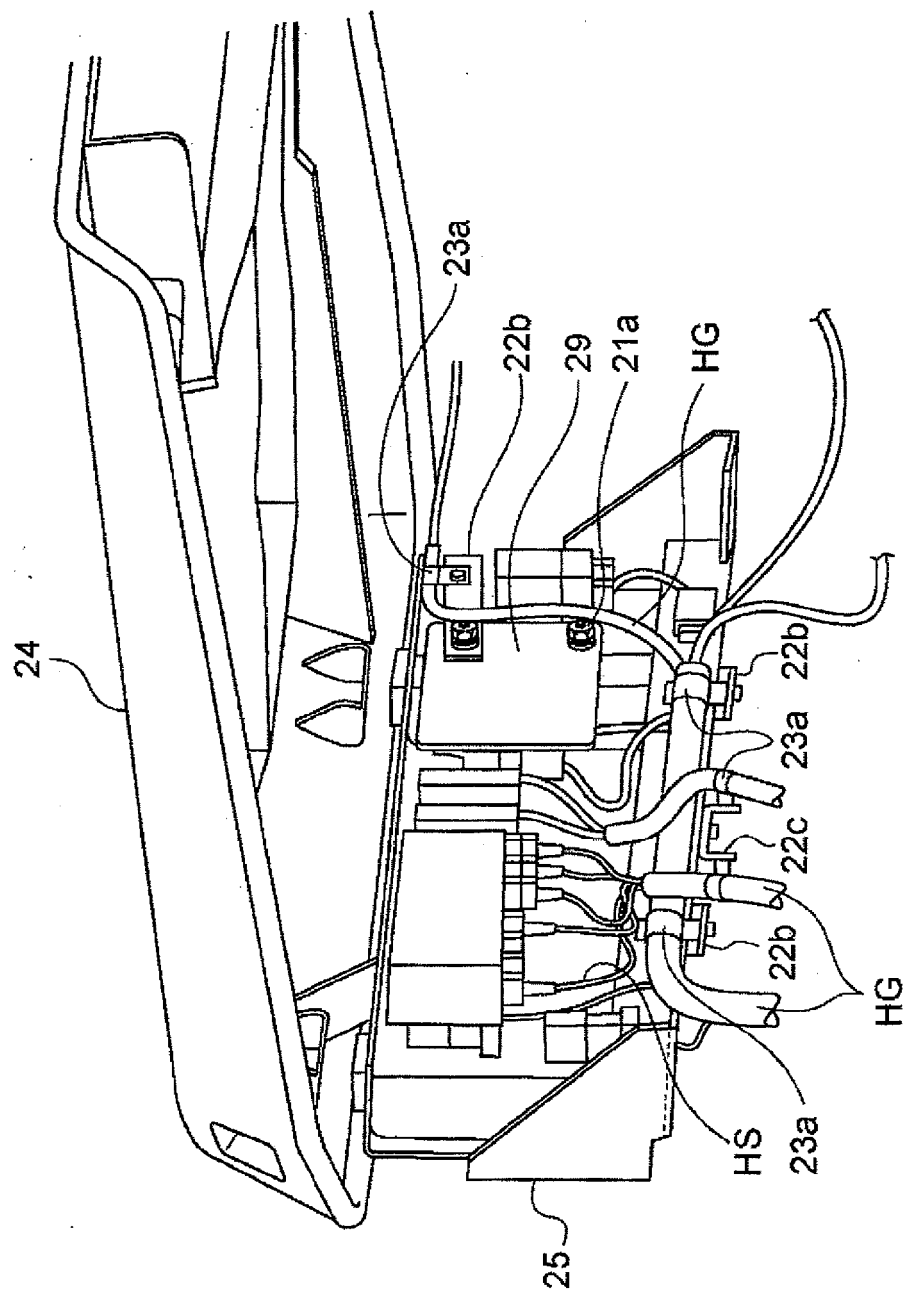
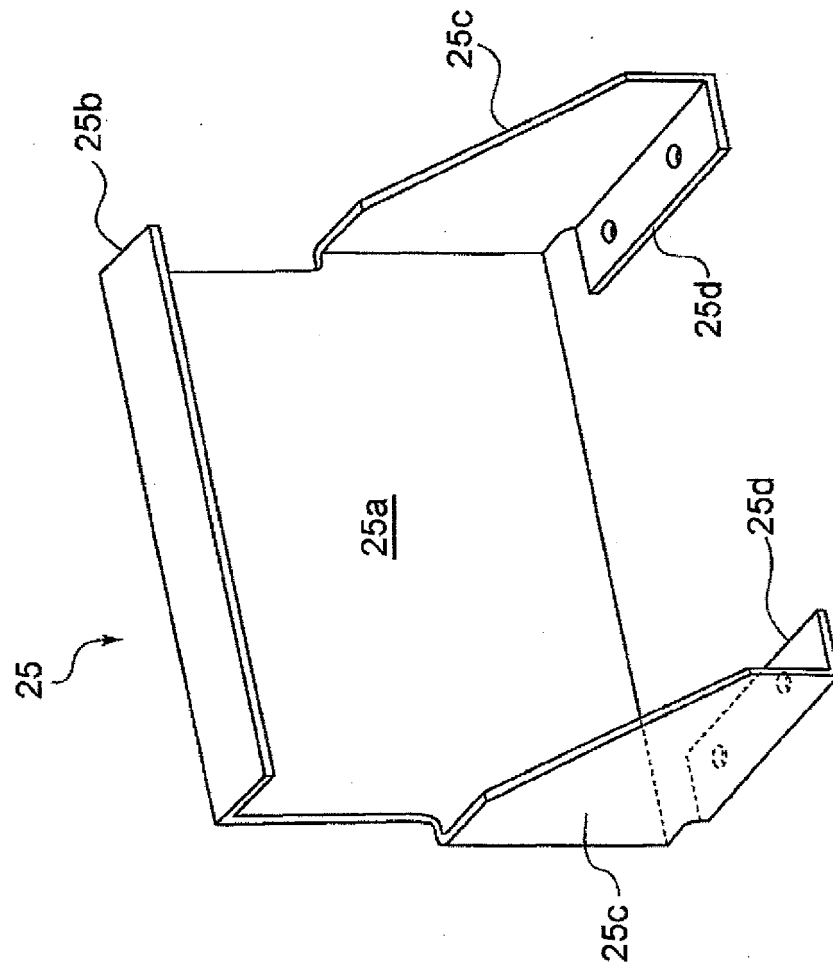


FIG.5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/080961

A. CLASSIFICATION OF SUBJECT MATTER

B66F9/075 (2006.01) i, B66F9/24 (2006.01) i

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)

B66F9/075, B66F9/24

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-2592 A (Toyota Industries Corp.), 08 January 2003 (08.01.2003), paragraphs [0023] to [0027], [0067]; fig. 1 to 2 (Family: none)	1-6
Y	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 102838/1991 (Laid-open No. 42300/1993) (Komatsu Forklift Co., Ltd.), 08 June 1993 (08.06.1993), paragraph [0007]; fig. 1 (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
25 February, 2013 (25.02.13)Date of mailing of the international search report
05 March, 2013 (05.03.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/080961

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 3040051 U (Denyo Co., Ltd.), 05 August 1997 (05.08.1997), paragraph [0009]; fig. 1 (Family: none)	1-6
Y	JP 9-12289 A (Toyoda Automatic Loom Works, Ltd.), 14 January 1997 (14.01.1997), paragraphs [0024] to [0025]; fig. 1 to 2 (Family: none)	2-4, 6
Y	JP 2006-54219 A (Hoshizaki Electric Co., Ltd.), 23 February 2006 (23.02.2006), paragraph [0035]; fig. 4 to 5 (Family: none)	3
Y	JP 11-314897 A (Toyoda Automatic Loom Works, Ltd.), 16 November 1999 (16.11.1999), paragraph [0015]; fig. 1 to 6 (Family: none)	6

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP H10310386 B [0011]