

PLATFORM OF VEHICLE FOR HIGH LIFT WORK

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a platform of a vehicle for high lift work used for work at a high place, such as loading of cargoes into an airplane or a ship, maintenance, checking, and cleaning.

Description of the Background Art

[0002] For such a vehicle for high lift work, for example, when in-flight meal, furnishings, baggage, etc. are loaded into an airplane, after a truck body is brought close to an airframe, a work bed is brought close to a loading port in the airframe at a high place by using a link mechanism provided on the truck body to load the in-flight meal etc. via a platform extending from the work bed (refer to Patent Document 1, for example).

[0003]

[Patent Document 1] Japanese Utility Model Publication No. 4-8156

[0004] However, the distal end of the conventional platform has a square shape having two right-angled corners, so that if the loading port in the airframe is provided adjacently above a main wing, it is sometimes difficult to raise the platform together with the work bed when the vehicle is brought too close to the main wing. Therefore, the worker must pay attention to the positional relationship between the main wing and the distal end of platform, and there is a room for improvement in workability at the time when the platform is raised or lowered.

SUMMARY OF THE INVENTION

[0005] The present invention has been made in view of the above circumstances, and accordingly an object thereof is to alleviate a load imposed to the worker by the distal end corner portion of platform becoming a hindrance when the platform is raised or lowered for work at a high place and to thereby improve the workability at the time when the platform is raised or lowered.

[0006] The present invention provides a platform of a vehicle for high lift work provided with a self-propelled truck body having a cabin at the front thereof, a work bed provided so as to be elevatable with respect to the truck body, and a platform extending from the front surface of the work bed, characterized in that the platform is of a rectangular flat plate shape having two corner portions at the distal end thereof, and at least one of the corner portions is cut to form a cut portion. In this case, the platform can be provided with an auxiliary platform capable of being pulled out in the front direction from the cut portion of the platform. In this case, an actuator capable of storing and pulling out the auxiliary platform is preferably provided between the auxiliary platform and the platform.

[0007] In the present invention, in the case where the platform is provided with a main platform of a rectangular flat plate shape having two corner portions at the distal end thereof and a sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to the main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, at least one of the two corner portions forming the distal end corner portions of the platform at least at the time when the sub-platform is stored is cut to form a cut portion. Alternatively, in the present invention, in the case where the platform is provided with a main platform of a rectangular flat plate shape having two corner portions at the distal end thereof, a first sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to the main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, and a second sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to the main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, at least one of the two corner portions forming the distal end corner portions of the platform at least at the time when the sub-platform is stored is cut to form a cut portion.

[0008] Specifically, in the case where the platform is formed by at least one set of the main platform and the sub-platform, and when the sub-platform is stored, the sub-platform protrudes from the main platform and the corner portion thereof becomes a portion forming the distal end corner portion of the platform, the cut portion has only to be provided at least on the sub-platform. Likewise, in the case where when the sub-platform is stored, the main platform protrudes from the sub-platform and the corner portion thereof becomes a portion forming the distal end corner portion of the platform, the cut portion has only to be provided at least on the main platform. Further, in the case where the cut portions are provided on both of the main platform and the sub-platform, the distal ends of the cut portions may be aligned with each other. Also, the shape of the cut portion may be any shape that does not become a hindrance as the distal end corner portion of platform, such as a shape formed by cutting the distal end corner portion of the main platform or the sub-platform into a straight-line form or a curved shape.

[0009] In the case where the auxiliary platform is provided, the auxiliary platform capable of being pulled out in the front direction from the cut portion of the sub-platform can be provided on the sub-platform.

[0010] Alternatively, in the case where the auxiliary platform is provided, the auxiliary platform may be provided with an urging force generating element, which urges the auxiliary platform in the front direction to push out the auxiliary platform from the sub-platform, between the auxiliary platform and the sub-platform, and may also be provided with interlock storage means, which stores the auxiliary platform in the sub-platform in association with the storage motion of the sub-platform, between the auxiliary platform and the main platform.

[0011] According to the present invention, since at least one of the distal end corner portions of platform is cut to form the cut portion, as compared with the conventional rectangular platform having two corner portions at the distal end of platform, a burden imposed to the

worker by work performed when the platform is raised or lowered, for example, work such as the positioning between a main wing and the distal end of the platform or the fine adjustment at the time when the platform is raised or lowered is alleviated. According to the present invention, therefore, the workability at the time when the platform is raised and lowered can be improved.

[0012] Further, in the present invention, if the auxiliary platform capable of being pulled out in the front direction from the cut portion of platform is provided, a larger space can be secured when work is performed by raising the platform.

[0013] Also, when the auxiliary platform is provided, if the actuator capable of storing and pulling out the auxiliary platform is provided between the auxiliary platform and the platform, the auxiliary platform is put in and taken out easily, so that the workability at the time of platform formation can be improved.

[0014] On the other hand, in the present invention, if the platform is provided with the main platform of a rectangular flat plate shape having two corner portions at the distal end thereof and the sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to the main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, and at least one of the two corner portions forming the distal end corner portions of the platform at least at the time when the sub-platform is stored is cut to form the cut portion, in addition to the improvement in workability at the time when the platform is raised and lowered, a larger space can be secured when work is performed by raising the platform. Moreover, according to the above-described configuration, in the case where the sub-platform is stored in the main platform with the corner portion of the sub-platform being lapped on the corner portion of the main platform, the transverse width of the sub-platform can be kept at a maximum with respect to the transverse width of the main platform, so that the work space of the sub-platform can also be kept at a maximum.

[0015] Alternatively, in the present invention, even if the platform is provided with the main platform of a rectangular flat plate shape having two corner portions at the distal end thereof, the first sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to the main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, and the second sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to the main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, and at least one of the two corner portions forming the distal end corner portions of the platform at least at the time when the sub-platform is stored is cut to form the cut portion, in addition to the improvement in workability at the time when the platform is raised and lowered, a larger space can be secured by the sub-platform when work is performed by raising the platform. Moreover, in this case, since the two sub-platforms can be put in and taken out of the main platform separately, for example, even if an airframe door is opened outward, the interference of the distal end of the sub-platform with the airframe door etc. can be prevented.

[0016] Further, in the present invention, if the auxiliary platform capable of being pulled out in the front direction from the cut portion of the sub-platform is provided, a larger space can be secured when work is performed by raising the platform.

[0017] Also, when the auxiliary platform is provided, if the actuator capable of storing and pulling out the auxiliary platform is provided between the auxiliary platform and the sub-platform, the auxiliary platform is put in and taken out easily, so that the workability at the time of platform formation can be improved.

[0018] Alternatively, when the auxiliary platform is provided, if the auxiliary platform is provided with the urging force generating element, which urges the auxiliary platform in the front direction to push out the auxiliary platform from the sub-platform, between the auxiliary platform and the sub-platform, and is also provided with the

interlock storage means, which stores the auxiliary platform in the sub-platform in association with the storage motion of the sub-platform, between the auxiliary platform and the main platform, when the sub-platform is pushed out of the main platform at the time of platform formation, the auxiliary platform is also pushed automatically out of the sub-platform in association with the pull-out motion of the sub-platform by the urging force generating element, by which the platform can be completed. Also, when the sub-platform is stored in the main platform, the interlock storage means can automatically store the auxiliary platform in the sub-platform in association with the storage motion of the sub-platform, so that the workability at the time of platform formation can be improved.

[0019] Also, the interlock storage means is a link mechanism, a cam mechanism, or the like provided between the auxiliary platform and the main platform. In particular, if as the cam mechanism, a mechanism consisting of a slave element swinging on one of the auxiliary platform and the main platform and a guide portion which is provided on the other platform to slide the distal end of the slave element along with the storage motion of the sub-platform in the direction such that the auxiliary platform is stored in the sub-platform is used, the structure for putting in and taking out the auxiliary platform is a simple structure of the urging force generating element and the cam mechanism, so that the manufacturing cost can be kept low. Also, since the motion for putting in and taking out the auxiliary platform also does not require the supply of energy from the outside, so that this configuration is advantageous in terms of environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

[Figure 1] A side view of a lift truck, being one embodiment of the present invention, which is used at an airport and has a box-type cargo bed for loading in-flight meal etc. into an airplane.

[Figure 2] Top views of a platform, Figure 2(a) showing a state in which the platform is placed on a frame and is in a neutral position at

which platforms are stored, Figure 2(b) showing a state in which a later-described sub-platform is pulled out of a later-described main platform in the front direction, and Figure 2(c) showing a state in which later-described auxiliary platforms are pulled out of the sub-platform in the front direction.

[Figure 3] Top views of a principal portion, Figures 3(a) and 3(b) illustrating distal end constructions of a main platform and a sub-platform.

[Figure 4] A top view of a principal portion showing a state in which a lift truck is stopped near an airframe in the above embodiment.

[Figure 5] A side view showing a lift truck together with an airframe and a main wing in the above embodiment.

[Figure 6] A top view of a principal portion showing a work state in which cargoes etc. are loaded by extending a platform from a lift truck in the above embodiment.

[Figure 7] Top views showing another mode for putting in and taking out the auxiliary platforms, Figure 7(a) showing a state in which a platform is at a neutral position at which the platform is placed on the frame and platforms are stored, and Figure 7(b) showing a state in which a sub-platform is pulled out of a main platform in the front direction, and further auxiliary platforms are pulled out in the front direction.

[Figure 8] Views showing a state in which a platform is at a neutral position at which the platform is placed on a frame, and platforms are stored, Figures 8(a) and 8(b) being a top view and a side view, respectively.

[Figure 9] A top view of a principal portion showing a state in which a main platform is slid to the left-hand side with respect to a fixed platform.

[Figure 10] A top view of a principal portion showing a state in which sub-platforms and an auxiliary platform are pulled out in the front direction from a main platform having been slid to the left-hand side.

[Figure 11] A top view of a principal portion showing a state in which a lift truck is stopped near an airframe.

[Figure 12] A top view of a principal portion showing a state in which sub-platforms and an auxiliary platform are set to a loading port.

[Figure 13] A top view of a principal portion showing a work state in which a platform is extended from a lift truck to load cargoes etc.

[Figure 14] A top view of a principal portion showing a state in which sub-platforms and an auxiliary platform are set to a loading port having no obstacle such as a main wing.

[Figure 15] A top view of a principal portion showing a state in which a main platform is slid to the left-hand side with respect to a fixed platform, and sub-platforms and an auxiliary platform are pulled out of the main platform 320 in the front direction, showing a third embodiment of the present invention.

[0021] Embodiments of the present invention will now be described with reference to the accompanying drawings. In the following explanation, the direction in which a driver seat is located is taken as the front, and upper, lower, right and left directions are defined by the direction viewed from the driver.

[0022] Figure 1 is a side view of a lift truck 100, being one embodiment of the present invention, which is used at an airport and has a box-type cargo bed for loading in-flight meal etc. into an airplane.

[0023] The lift truck 100 includes a self-propelled truck body 120 having a cabin 110 at the front thereof, a pantographic link mechanism 130 provided on a truck body frame 121 mounted on the truck body 120, and a box-type cargo bed (work bed) 140 elevating on the truck body 120 by means of the link mechanism 130. At four places at the front, rear, right and left of the truck body frame 121, stabilizing hydraulic jacks 122 are provided to secure stability against wind pressure at the time when the box-type cargo bed 140 is raised.

[0024] The link mechanism 130 is made up of two inside links 131 arranged in parallel with each other transversely and two outside links 132 arranged in parallel with each other transversely, a link shaft 133 for rotatably supporting the side links 131 and 132, and a hydraulic lift cylinder 134 provided between the side links 131 and 132.

[0025] The inside links 131 are configured so that portions near the upper ends thereof are connected integrally by a front shaft 151, and the lower ends thereof are supported so as to be movable along the truck body frame 121. The outside links 132 are also configured so that portions near the upper ends thereof are connected integrally by a rear shaft 152, and the lower ends thereof are fixed to the truck body frame 121 by a fixing shaft 150 so as to be turnable. The front shaft 151 and the rear shaft 152 each extend in a rectangular cargo bed frame 160 for holding the box-type cargo bed 140. Thereby, the link mechanism 130 is raised and lowered by the extension and retraction of the hydraulic lift cylinder 134 while the box-type cargo bed 140 is kept in a state of being parallel with a road surface with respect to the truck body 120. In this embodiment, a direct-acting mechanism consisting of rollers, rails, etc. is provided between the box-type cargo bed 140 and the cargo bed frame 160, so that the cargo bed frame 160 supports the box-type cargo bed 140 so as to be movable along a beam 160a of the cargo bed frame 160.

[0026] In this embodiment, the box-type cargo bed 140 has a platform 200 extendable in the front direction of the vehicle to load meal and cargoes into the airplane. In the ordinary state, for example, during the running of vehicle, the platform 200 is supported in a state of being in contact with a frame 123 fixed to the truck body frame 121 as indicated by region A in Figure 1, and is placed at a predetermined upper position of the cabin 110 provided on the truck body 120.

[0027] Also, in this embodiment, at the front of the box-type cargo bed 140, transversely opened doors 143 of a hinged double construction having two right and left doors are provided. These doors 143 are turnably attached to the inner wall of the box-type cargo bed 140 via a hinge. The door 143 consists of a plurality of doors 143a, 143b and 143c. When the doors 143 are opened toward the platform 200 after the floor surface height of the box-type cargo bed 140 coincides with the floor surface height of a main platform 210, the doors 143 form platform protective walls by being slid along the platform 200 as

indicated by region B.

[0028] On a front roof of the box-type cargo bed 140, a rain-averting canopy 144, which is stored in the roof at the time of running and is taken out as necessary, is provided. This canopy 144 improves the work environment in bad weather by being raised and extended by a hydraulic cylinder, not shown. Reference numeral 145 denotes a handrail that is foldably provided on the platform 200 for the safe of workers.

[0029] Next, a first embodiment of the platform 200 in accordance with the present invention will be explained with reference to Figure 2. Figures 2(a) to 2(c) are top views of the platform 200, Figure 2(a) showing a state in which the platform 200 is placed on the frame 123 and is in a neutral position at which the platforms are stored, Figure 2(b) showing a state in which a later-described sub-platform 220 is pulled out of the later-described main platform 210 in the front direction, and Figure 2(c) showing a state in which later-described auxiliary platforms 230 are pulled out of the sub-platform 220 in the front direction. Also, Figures 3(a) and 3(b) are top views of a principal portion, for illustrating distal end constructions of the main platform 210 and the sub-platform 220.

[0030] The platform 200 is one independent unit as shown in Figure 2, and consists of the main platform 210, the sub-platform 220, and two auxiliary platforms 230, these platforms being operated independently.

[0031] As indicated by the solid line in Figure 3(a), the main platform 210 is of a rectangular flat plate shape having two right-angled corner portions 211e at a distal end 211, and as shown in Figure 2, brackets 213 are integrally provided at both sides of the main platform 210. Each of the brackets 213 is provided with two rollers 214 in the vertical direction, and the rollers 213 are attached to each of two guide rails 142 extending upward from front both sides of the box-type cargo bed 140. Thereby, when the box-type cargo bed 140 begins to rise, the guide rails 142 move relative to the main platform

210. Therefore, although the box-type cargo bed 140 is raised while the platform 200 is kept at a position indicated by region A in Figure 1, when the height of floor surface of the box-type cargo bed 140 coincides with the floor surface height of the main platform, the main platform 210 comes into contact with a lower end portion of the guide rail 142 and is fixedly held on the box-type cargo bed 140, so that the platform 200 rises integrally with the box-type cargo bed 140.

[0032] As indicated by the chain line in Figure 3(a), the sub-platform 220 is inherently analogous to the main platform 210 indicated by the chain line. The sub-platform 220 is also of a rectangular flat plate shape having two right-angled corner portions 221e stored by being lapped on the corner portions 211e of the main platform 210, and can be moved longitudinally with respect to the main platform 210 by already-known means such as rollers.

[0033] By contrast, in this embodiment, as shown in Figure 3(b), both portions S in which the corner portion 211e of the main platform 210 and the corner portion 221e of the sub-platform 220 are lapped on each other are cut slantwise, by which cut portions 212 and 222 indicated by the broken line are provided on the main platform 210 and the sub-platform 220, respectively. Thereby, as shown in Figure 2(a), when the sub-platform 220 is stored in the main platform 210, the distal end 221 and the cut portion 222 of the sub-platform 220 are also stored in the distal end 211 and the cut portion 212 of the main platform in a lapped manner. The cut portions 212 and 222 may be provided at least one of the two portions S according to the application.

[0034] Also, in this embodiment, at the time when the sub-platform 220 is stored, the distal ends of the cut portions 221 and 222 are aligned with each other by cutting the portion S forming the distal end corner portion of the platform 200. However, in the case where at the time when the sub-platform 220 is stored, the sub-platform 220 protrudes from the main platform 210 and the corner portion 221e thereof forms the distal end corner portion of the platform 200, the cut portion 222 may be provided at least on the sub-platform 220.

Likewise, in the case where at the time when the sub-platform 220 is stored, the main platform 210 protrudes from the sub-platform 220 and the corner portion 211e thereof forms the distal end corner portion of the platform 200, the cut portion 212 may be provided at least on the main platform 210. Specifically, in the present invention, at least when the sub-platform 220 is stored, at least one of two corners forming the distal end corner portions of the platform 200, namely, two corner portions 211e of the main platform 210, two corner portions 221e of the sub-platform 220, or two corner portions consisting of the corner portions 211e and 221e formed by lapping of the main platform 210 and the sub-platform 220 may be cut to form cut portions.

[0035] At the distal end 221 of the sub-platform 220, a protector rubber 223, which is a tubular buffering member, is provided, and between the sub-platform 220 and the main platform 210, a hydraulic or electrically controlled actuator 240 is provided. By the extension and retraction of the actuator 240, the main platform 210 can be moved in the longitudinal direction so that the sub-platform 220 can be pulled out of the distal end 211 of the main platform 210 and be stored in the main platform 210.

[0036] As shown in Figure 2(c), the auxiliary platform 230 is a flat plate shaped platform substantially having a fan shape, which can be pulled out in the front direction from the cut portion 222 of the sub-platform 220. In this embodiment, the auxiliary platform 230 has a distal end 231 which is stored by being lapped on the cut portion 222 of the sub-platform 220, and can be pulled out in the front direction from the cut portion 222. Specifically, the auxiliary platform 230 has a protector rubber 232, which is a tubular buffering member, at the distal end thereof, and can be pulled out of the cut portion 222 and stored by the extension and retraction of an actuator 250, which is pivotally supported so as to be rotatable with respect to the sub-platform 220 and the auxiliary platform 230 and is disposed between the auxiliary platform 230 and the sub-platform 220.

[0037] Next, the specific operation of this embodiment will be

explained with reference to Figures 1 to 5. Figure 4 is a top view of a principal portion showing a state in which the lift truck 100 is stopped near an airframe 10. Also, Figure 5 is a side view showing the lift truck 100 together with the airframe 10 and a main wing 11. Figure 6 is a top view of a principal portion showing a work state in which cargoes etc. are loaded by extending the platform 200 from the lift truck 100.

[0038] As shown in Figure 4, usually, the lift truck 100 must be stopped substantially perpendicularly to the airframe 10. In the case where a loading port (airframe door) 12 of the airframe 10 is located adjacently above the main wing 11, for the conventional platform, the distal end corner portion thereof becomes a hindrance when the platform is raised or lowered. Therefore, the worker must pay attention to the positional relationship between the main wing 11 and the distal end of platform 200, and there is a room for improvement in workability at the time when the platform is raised or lowered.

[0039] Thereupon, for the lift truck 100 in accordance with the present invention, a passage for joining the lift truck 100 substantially perpendicularly to the airframe 10 is formed between the box-type cargo bed 140 and the loading port 12 by following the procedure described below.

[0040] In this embodiment, first, as shown in Figure 4, after the lift truck 100 is stopped by being brought to a position near the loading port 12 of the airframe 10, hydraulic jacks 122 are lowered to stabilize the truck 100. Then, the box-type cargo bed 140 is raised by the link mechanism 130 until the floor surface height thereof coincides with the floor surface height of the loading port 12. In this case, since the portion S in which the corner portions 211e and 221e of the main platform 210 and the sub-platform 220 are lapped on each other is cut slantwise to provide the cut portions 212 and 222 in the main platform 210 and the sub-platform 220, respectively, a clearance C2 is secured between the distal end corner portion of the platform 200 and the main wing 11. Therefore, even if the box-type cargo bed 140 is raised or

lowered, the distal end corner portion of the platform 200 does not become a hindrance. As a result, a burden imposed to the worker by work such as the positioning between the main wing 11 and the distal end of the platform 200 or the fine adjustment at the time when the platform is raised or lowered is alleviated as compared with the conventional rectangular platform having two right-angled corner portions at the distal end of platform. Therefore, according to the above-described configuration, the workability at the time when the platform 200 is raised and lowered can be improved. In addition, in this case, because the distal end corner portion of the platform 200 does not become a hindrance, the lift truck 100 can be advanced to a position near the loading port 12, and resultantly the extension amount of the sub-platform 220 can be kept to a minimum.

[0041] Next, when the box-type cargo bed 140 is raised by the link mechanism 130 until the floor surface height thereof coincides with the floor surface height of the loading port 12, the link mechanism 130 is stopped, and then as shown in Figure 5, the box-type cargo bed 140 is slid forward along the cargo bed frame 160. Then, as shown in Figure 2(b), this sub-platform 220 is pulled out of the distal end 211 of the main platform 210 in the front direction by the extension of the actuator 240. In this case, since the sub-platform 220 is provided on the main platform 210, even if the target position such as the loading port 12 above the main wing of airplane lies at a far place, the platform 200 can be set at the target position, and a larger space can be secured by the sub-platform 220 when work is performed by raising the platform 200. In addition, according to the above-described configuration, in the case where as shown in Figure 3, the sub-platform 220 is stored in a state in which the corner portion 221e thereof laps over the corner portion 211e of the main platform 210, a transverse width $W2$ of the sub-platform 220 can be secured to a maximum with respect to the transverse width $W1$ of the main platform 210, so that a work space provided by the sub-platform 220 can be secured to a maximum.

[0042] When the sub-platform 220 is pushed out of the main platform 210 to a position at which the sub-platform 220 does not come into contact with the airframe 10 by the extension of the actuator 240, as shown in Figure 2(c), the auxiliary platforms 230 are pushed out of the cut portions 222 of the sub-platform 220 in the front direction toward the airframe 10 by the extension of the actuators 250. In this case, since the auxiliary platforms 230 are provided, a space for performing work by raising the platform 200 can further be increased.

[0043] Also, in this embodiment, in providing the auxiliary platforms 230, instead of manual operation, the actuator 250 is provided between the auxiliary platforms 230 and the sub-platform 220 to allow the auxiliary platforms 230 to be stored and pulled out. Thereby, the putting in and taking out of the auxiliary platforms 230 are facilitated, so that the workability at the time of platform formation can be improved.

[0044] For the putting in and taking out of the auxiliary platforms 230, a configuration as explained below can be adopted instead of the use of the actuator. Figures 7(a) and 7(b) show another mode for putting in and taking out the auxiliary platforms 230. Figure 7(a) is a top view showing a state in which the platform 200 is at a neutral position at which the platform 200 is placed on the frame 123 and the platforms are stored, and Figure 7(b) is a top view showing a state in which the sub-platform 220 is pulled out of the main platform 210 in the front direction, and further the auxiliary platforms 230 are pulled out in the front direction.

[0045] In this embodiment, the auxiliary platform 230 is provided with an urging force generating element 260 between the auxiliary platform 230 and the sub-platform 220 to automatically pull out the auxiliary platform 230 from the sub-platform 220. The urging force generating element 260 is a gas damper which is pivotally supported so as to be swung with respect to the auxiliary platform 230 and the sub-platform 220 and urges the auxiliary platform 230 in the front direction to pull out the auxiliary platform 230 from the cut portion

222 of the sub-platform 220. The urging force generating element 260 may be, for example, a metal spring or the like. Also, the auxiliary platform 230 is provided with interlock storage means 270 between the auxiliary platform 230 and the main platform 210 to store the auxiliary platform 230 in the sub-platform 220 in association with the storage motion of the sub-platform 220. This interlock storage means 270 is a link mechanism or a cam mechanism that swingingly connects two link members to each other and connects the end portions thereof to the auxiliary platform 230 and the main platform 210.

In this embodiment, the cam mechanism is used.

[0046] The cam mechanism 270 includes a slave element 271 consisting of a lever etc. that is swung by the auxiliary platform 230, a cam roller 272 provided at the tip end of the lever 271, and a guide portion 273 which is provided on the main platform 210 and is slid in the direction such that the cam roller 272 of the lever 271 is stored in the sub-platform 220 by the auxiliary platform 230 along with the storage motion of the sub-platform 220. The guide portion 273 is a block having a linear cam surface, but may be a rail etc. Also, the cam mechanism 270 may be configured so that the lever 271 is provided on the main platform 210 and the guide portion 273 is provided on the auxiliary platform 230.

[0047] According to the above-described configuration, at the time of formation of the platform 200, if the sub-platform 220 is pulled out of the main platform 210 by the extension of the actuator 240, the auxiliary platform 230 is also pushed automatically out of the sub-platform 220 in association with the pull-out motion of the sub-platform 220 by the gas damper 260, by which the platform 200 can be completed. Also, if the sub-platform 220 is stored in the main platform 210 by the retraction of the actuator 240, the cam roller 272 of the lever 271 slides the block 273 in the direction such that the auxiliary platform 230 is stored in the sub-platform 220, so that the auxiliary platform 230 can automatically be stored in the sub-platform 220 in association with the storage motion of the sub-platform 220, so

that the workability at the time of platform formation can be improved. In addition, in this case, since a structure for putting in and taking out the auxiliary platform 230 is a simple structure of the gas damper 260 and the cam mechanism 270, the manufacturing cost can be kept low. Also, the motion for putting in and taking out the auxiliary platform 230 does not require the supply of energy from the outside, so that this configuration is advantageous in terms of environment.

[0048] Next, a platform 300 of a second embodiment of the present invention will be explained. In this embodiment, the same reference numerals are applied to elements that are the same as those in the first embodiment, and the explanation thereof is omitted.

[0049] Figures 8(a) and 8(b) are a top view and a side view, respectively, showing a state in which the platform 300 is at a neutral position at which the platform 300 is placed on the frame 123, and platforms are stored. Figure 9 is a top view of a principal portion showing a state in which a main platform 320 is slid to the left-hand side with respect to a later-described fixed platform 310. Figure 10 is a top view of a principal portion showing a state in which later-described sub-platforms 330 and 340 and auxiliary platform 350 are pulled out in the front direction from the main platform 320 having been slid to the left-hand side.

[0050] As shown in Figure 8, the platform 300 is one independent unit, and consists of the fixed platform 310, the main platform 320, the two sub-platforms 330 and 340, and the one auxiliary platform 350, these platforms being operated independently.

[0051] The fixed platform 310 is of a rectangular flat plate shape. On the front surface of the fixed platform 310, a slit 311, which has a great transverse width and is open toward both sides, is formed, and on both sides thereof, as in the case of the first embodiment, brackets 312 are provided integrally. Each of the brackets 312 is also provided with two rollers 313 in the vertical direction, and the rollers 313 are attached to each of two guide rails 142 extending upward from front both sides of the box-type cargo bed 140. Thereby, when the box-

type cargo bed 140 begins to rise, the guide rails 142 raises the box-type cargo bed 140 while the platform 300 is kept at a position indicated by region A in Figure 1. However, when the height of floor surface of the box-type cargo bed 140 coincides with the floor surface height of the main platform, the platform 300 rises integrally with the box-type cargo bed 140.

[0052] Also, the fixed platform 310 has an extending portion 314 protruding forward in the front lower portion of the slit 311.

The extending portion 314 is provided with a roller 315 at the distal end 314t, and supports a main portion 321 of the later-described main platform 320 by the roller 315. The extending portion 314 may be a skeleton structure to reduce the weight of the fixed platform 310.

Also, in the slit 311, a guide rail 316 is provided. The guide rail 316 supports rollers 324 provided in a projecting portion 322 of the later-described main platform 320. Thereby, the main platform 320 is supported so as to be slidably along the slit 311 by the fixed platform 310.

[0053] As shown in Figure 8, the main platform 320 includes the main portion 321 having a transverse width W_2 greater than the transverse width W_1 of the fixed platform 310 and the projecting portion 322 having a transverse width W_3 narrower than the transverse width W_s of the slit 311 in the fixed platform 310, which connects with a rear part of the main portion 321 and is inserted in the slit 311. Also, between the main portion 321 and the projecting portion 322, a height difference 323 is formed. By this height difference 323, a floor surface 321f of the main platform 320 (main portion 321) forms a flat floor surface so as to coincide with a floor surface 310f of the fixed platform 310 as shown in Figure 8(b).

[0054] Further, between the fixed platform 310 and the projecting portion 322 of the main platform 320, as shown in Figure 8(a), a hydraulic or electrically-controlled actuator 360 is provided. By the extension and retraction of this actuator 360, the main platform 320 is slid along the width direction of the fixed platform 310.

[0055] Also, as shown in Figures 8, 9 and 10, the main platform 320 is provided with two passages with different transverse widths, which are open to a front surface 320t, and a tilt portion 320I with a gentle slope is formed near the distal end of the main platform 320. Thereby, when a first sub-platform 330 and a second sub-platform 340 are inserted in the respective passages, the floor surface 321f of the main platform 320 connects with a floor surface 330f of the sub-platform 330 via the tilt portion 320I without a height difference, and also connects with a floor surface 340f of the sub-platform 340 via the tilt portion 320I without a height difference.

[0056] As indicated by the broken line in Figure 10, the sub-platform 330 is of a substantially rectangular flat plate shape the rear part of which protrudes. On the front surface of the sub-platform 330, a protector rubber 331, which is a tubular buffering member, is provided, and at both sides thereof, rollers 332 are provided. Between the sub-platform 330 and the main platform 320, a hydraulic or electrically-controlled actuator 370 is provided. Thereby, the sub-platform 330 is moved longitudinally with respect to the main platform 320 by the extension and retraction of the actuator 370, and thus can be pulled out of the distal end 320t of the main platform 320 and stored in the main platform 320. Likewise, as indicated by the broken line in Figure 10, the sub-platform 340 is also of a substantially rectangular flat plate shape the rear part of which protrudes. On the front surface of the sub-platform 340, a protector rubber 341, which is a tubular buffering member, is provided, and at both sides thereof, rollers 342 are provided. Between the sub-platform 340 and the main platform 320, a hydraulic or electrically-controlled actuator 380 is provided. Thereby, the sub-platform 340 is also moved longitudinally with respect to the main platform 320 by the extension and retraction of the actuator 380, and thus can be pulled out of the distal end 320t of the main platform 320 and stored in the main platform 320.

[0057] In this embodiment, both of the sub-platforms 330 and 340 are moved by the rollers 332 and 342 only. However, means such that

guide rails for slidably supporting the sub-platforms 330 and 340 via the rollers 332 and 342 are provided in the passages may be used. Also, in this embodiment, although the transverse width W4 of the sub-platform 330 is narrower than the transverse width W5 of the sub-platform 340 ($W5 > W4$) as shown in Figure 10, these transverse widths W4 and W5 may be equal to each other.

[0058] In this embodiment, the main platform 320 inherently has a rectangular flat plate shape having two right-angled corner portions 320e at the distal end 320t. The sub-platform 330 is of a rectangular flat plate shape having a right-angled corner portion 330e such that the sub-platform 330 is stored in the main platform 320 with a distal end 330t of the sub-platform 330 lapped on the corner portion 320e of the main platform 320. On the other hand, the sub-platform 340 is also, inherently, of a rectangular flat plate shape having a right-angled corner portion such that the sub-platform 340 is stored in the main platform 320 with a distal end 340t of the sub-platform 340 lapped on the corner portion of the main platform 320. In this embodiment, however, a portion in which a left corner portion of the main platform 320 and a left corner portion of the sub-platform 340 are lapped on each other is cut slantwise, by which cut portions 325 and 343 are provided on the main platform 320 and the sub-platform 340, respectively. Thereby, when the sub-platform 340 is stored in the main platform 320 as shown in Figure 8(a), the sub-platform 340 is stored with the distal end 340t and the cut portion 343 thereof lapped on the distal end 320t and the cut portion 325 of the main platform.

[0059] Also, in this embodiment as well, a portion S forming a distal end corner portion of the platform 300 at the time when the sub-platform 340 is stored is cut, and the distal ends of the cut portions 325 and 343 are aligned with each other. In the case where the sub-platform 340 protrudes from the main platform 320 at the time when the sub-platform 340 is stored, and the corner portion thereof is a portion forming the distal end corner portion of the platform 300, at least the sub-platform 340 has only to be provided with the cut

portion 343. Likewise, in the case where the sub-platform 320 protrudes from the sub-platform 340 at the time when the sub-platform 340 is stored, and the corner portion thereof is a portion forming the distal end corner portion of the platform 300, at least the main platform 320 has only to be provided with the cut portion 325. That is to say, in the present invention, at least the corner portion forming the distal end corner portion of the platform 300 at the time when the sub-platform 340 is stored, namely, the left corner portion of the main platform 320, the left corner portion of the sub-platform 340, or the left corner portion consisting of a corner portion formed by lapping the main platform 320 on the sub-platform 340 has only to be cut to form the cut portion. The cut portion may be provided only between the right corner portion 320e of the main platform 320 and the right corner portion 330e of the sub-platform 330 or both of the cut portions 325 and 343 may be provided according to the application. In this case as well, at least the corner portion forming the distal end corner portion of the platform 300 at the time when the sub-platform 340 is stored, namely, the right corner portion 320e of the main platform 320, the right corner portion 330e of the sub-platform 330, or the left corner portion consisting of the corner portions 320e and 330e formed by lapping the main platform 320 on the sub-platform 330 has only to be cut to form the cut portion.

[0060] As shown in Figure 10, as in the case of the first embodiment, the auxiliary platform 350 is of a substantially fan-shaped flat plate shape, having a distal end 350t stored by being lapped on the cut portion 343 of the sub-platform 340, and can be pulled out of the cut portion 343 in the front direction. In this case, the auxiliary platform 350 also has a protector rubber 351, which is a tubular buffering member, at the distal end 350t thereof. By the extension and retraction of an actuator disposed between the sub-platform 340 and the auxiliary platform 350 as shown in Figure 2, the auxiliary platform 350 can be pulled out of and stored in the cut portion 343 by a gas damper disposed between the sub-platform 340 and the auxiliary

platform 350 and a cam mechanism disposed between the main platform 320 and the auxiliary platform 350.

[0061] Next, the specific operation of this embodiment will be explained with reference to Figures 8 to 13.

[0062] Figure 11 is a top view of a principal portion showing a state in which the lift truck 100 is stopped near the airframe 10. Also, Figure 12 is a top view of a principal portion showing a state in which the sub-platforms 330 and 340 and the auxiliary platform 350 are set to the loading port 12. Figure 13 is a top view of a principal portion showing a work state in which the platform is extended from the lift truck 100 to load cargoes etc.

[0063] In the case where the loading port 12 of the airframe 10 is located above the main wing 11 and a door 13 is opened to the left outward, as shown in Figure 11, when the lift truck 100 is stopped, it is necessary to set a clearance C1 between the lift truck 100 and an engine 14 at 1.1 meters, and also to set a horizontal distance C2 between the left distal end corner portion of the platform 300 and the main wing 11 at 1 meter or larger. In this case, since another vehicle 400 is stopping on the right, the lift truck must be stopped substantially perpendicularly to the airframe 10.

[0064] For the lift truck 100 in accordance with the present invention, a passage connecting with the loading port 12 substantially perpendicularly to the airframe 10 is formed between the box-type cargo bed 140 and the loading port 12 by following the procedure described below.

[0065] In this embodiment, first, as shown in Figure 11, after the lift truck 100 is brought close to a position near the loading port 12 of the airframe 10, the hydraulic jacks 122 are lowered to stabilize the truck 100. Then, the box-type cargo bed 140 is raised by the link mechanism 130 until the floor surface height thereof coincides with the floor surface height of the loading port 12. In this case, since the cut portions 325 and 343 are provided on the main platform 320 and the sub-platform 340, respectively, as in the first embodiment, a

burden imposed to the worker by work such as the positioning between the main wing 11 and the distal end of the platform 300 or the fine adjustment at the time when the platform is raised or lowered is alleviated as compared with the conventional rectangular platform having two right-angled corner portions at the distal end of platform. Therefore, according to the above-described configuration, the workability at the time when the platform 300 is raised or lowered can be improved, and the extension amounts of the sub-platforms 330 and 340 can be kept to a minimum.

[0066] Next, after the box-type cargo bed 140 is raised by the link mechanism 130 until the floor surface height thereof coincides with the floor surface height of the loading port 12, the link mechanism 130 is stopped, and then the box-type cargo bed 140 is slid forward along the cargo bed frame 160 (refer to Figure 5). Then, as shown in Figure 9, the actuator 360 is extended to slide the main platform 320 to the left-hand side (in the figure, to the upside) with respect to the fixed platform 310. In this case, since on the front surface of the fixed platform 310, the slit 311 which is open toward both sides is formed, the projecting portion 322 of the main platform 320, which has a transverse width narrower than that of the slit 311, is inserted into the slit 311, and the remaining portion (main portion 321) of the main platform is supported by the flat plate shaped extending portion 314 provided at a lower part of the front surface of the fixed platform 310, even if the transverse width W_2 of the floor surface 321f of the main platform 320 is set equal or greater than the transverse width W_1 of the fixed platform 310, the main platform 320 can be slid with respect to the fixed platform 310. In this case, a large work space can be secured while a function of sliding the main platform 320 with respect to the fixed platform 310 is maintained. In addition, according to the above-described configuration, since the transverse width W_3 of the projecting portion 322 of the main platform 320 is narrower than the transverse width W_s of the slit 311 in the fixed platform 310, the amount of slide of the main platform 320 increases resultantly.

Therefore, even if the transverse width $W2$ of the floor surface 321f of the main platform 320 is set equal or greater than the transverse width $W1$ of the fixed platform 310, a necessary amount of slide of the main platform 320 can be secured.

[0067] Subsequently, as shown in Figure 10, the actuators 370 and 380 are extended to push out the sub-platforms 330 and 340, respectively, from the main platform 320 in the front direction (in the figure, to the right-hand side) toward the airframe 10. In this case, as shown in Figure 12, the sub-platform 340 is positioned at a position at which the protector rubber 341 does not come into contact with the airframe 10 by using the actuator 380, and the auxiliary platform 350 is pushed out of the cut portion 343. Since the airframe door 13 opens the loading port 12 to the left outward, the sub-platform 330 is positioned at a position at which the protector rubber 331 does not lap over the airframe door 13 by using the actuator 370.

[0068] In this case, since the main platform 320 is provided with the sub-platforms 330 and 340, even if the target position such as the loading port 12 above the main wing of airplane lies at a far place, the platform 300 can be set at the target position, and a larger space can be secured by the sub-platforms 330 and 340. In addition, according to the above-described configuration, a sliding operation of the main platform 320 for preventing the interference of the distal end of the sub-platform 330 with the airframe door 13 can be kept to a minimum. Therefore, the work time for loading of cargoes etc. and maintenance at a high place is shortened, which results in improved work efficiency. In addition, in this case, since the two sub-platforms 330 and 340 can be put in and taken out of the main platform 320 separately, the interference of the distal end of the sub-platform 330 with the airframe door 13 etc. can be prevented.

[0069] In this embodiment, as shown in Figure 13, a detachable auxiliary plate 390 is placed between the sub-platform 340 and the loading port 12. However, work may be performed without the use of the auxiliary plate 390.

[0070] In this embodiment, to set the platform 300 to the loading port 12, as shown in Figure 12, the main platform 320 is positioned at a position at which the center axis O1 of the sub-platform 340 substantially coincides with the center axis O of the loading port 12 by the actuator 360. If the sub-platform 340 is arranged on the side such that the main platform 320 is difficult to slide, for example, due to the existence of the main wing 11, the center axis O1 of the sub-platform 340 lies at a position at a shortest distance from the center axis O of the loading port 12. Therefore, in the case where the transverse width W5 of the sub-platform 340 is narrower than the width W4 of the sub-platform 330, even in the state in which the main platform 320 is difficult to slide, the center axis O1 of the sub-platform 240 has only to be slid in the direction of the center axis O of the loading port 12. As a result, the amount of slide of the main platform 320 is kept at a minimum, so that the work time for loading of cargoes etc. and maintenance at a high place is shortened, which results in improved work efficiency.

[0071] Figure 14 is a top view of a principal portion showing a state in which the sub-platforms 330 and 340 and the auxiliary platform 350 are set to the loading port 15 having no obstacle such as the main wing 11. In this case, since a door 16 of the loading port 15 is opened to the right outward, the main platform 320 may be slid to the left-hand side to align the sub-platform 340 with the loading port 15. However, according to the platform 300 of this embodiment, the following operation is performed so that the work space is made as uniform as possible.

[0072] First, when work is performed by using the lift truck, usually, if the lift truck is advanced with a vehicle axis Ov coinciding with the center axis O of a loading port 15, the platform 300 can be set easily to the loading port 15. However, if the transverse width of the sub-platform 330 is greater than that of the sub-platform 340, when the lift truck is advanced with a vehicle axis Ov coinciding with the center axis O of a loading port 15, the center axis O2 of the sub-platform 330

lies at a position shortest from the center axis O of the loading port 15. Therefore, in the case where the transverse width W5 of the sub-platform 340 is narrower than the transverse width W4 of the sub-platform 330, even in a state in which the main platform 320 can be slid freely, the center axis O2 of the sub-platform 330 has only to be slid toward the center axis O of the loading port 15. As a result, the amount of slide of the main platform 320 is kept at a minimum, so that the work time for loading of cargoes etc. and maintenance at a high place is shortened, which results in improved work efficiency.

[0073] As a modification of the second embodiment, the main platform 320 may be supported so as to be slidable along the transverse width by the extending portion 314 only without providing the slit 311 in the fixed platform 310.

[0074] Figure 15 is a top view of a principal portion showing a state in which the main platform 320 is slid to the left-hand side with respect to the fixed platform 310, and the sub-platforms 330 and 340 and the auxiliary platform 350 are pulled out of the main platform 320 in the front direction, showing a third embodiment embodying the above-described concept. In this embodiment, the same reference numerals are applied to elements that are the same as those shown in Figures 1 to 14, and the explanation thereof is omitted.

[0075] In this embodiment, on a front surface 310t of the fixed platform 310, a guide rail 316 is provided in place of the slit 211. On the other hand, on the rear surface of the main platform 320, the rollers 324 are directly provided on the rear surface of the main portion 321 without providing the protruding portion 322. Specifically, in this embodiment, the fixed platform 310 supports the main portion 321 of the main platform 320 by means of the roller 315 provided at the distal end 314t of the extending portion 314, and also supports the rollers 324 provided in the main portion 321 of the main platform 320 by means of the guide rail 316. Thereby, the main platform 320 is supported by the fixed platform 310 so as to be slidable along the transverse width thereof.

[0076] In this case as well, the platforms 310 and 320 are connected to each other by the actuator 360 disposed on the extending portion 314, and the extending portion 314 is provided at a lower part of the front surface 310t of the fixed platform 310. Since the extending portion 314 supports the main platform 320 provided with the floor surface 321f coinciding with the floor surface 310f of the fixed platform 310, even if the floor surface 321f of the main platform 320 is secured so as to be equal to or greater than the transverse width of the fixed platform 310, the main platform 320 can be slid with respect to the fixed platform 310. Therefore, in this embodiment as well, a large work space can be secured while a function of sliding the main platform 320 with respect to the fixed platform 310 is maintained. Regarding the guide rail 316 and the rollers 324, the rollers may be provided on the front surface 310t of the fixed platform, and the guide rail for supporting the rollers may be provided on the rear surface of main portion of the main platform 320.

[0077] The above description merely shows one embodiment of the present invention, and various changes and modifications can be made. For example, although the work bed is a box-type cargo bed for loading in-flight meal in the above-described embodiments, the work bed may be a flat plate shaped work bed used for airframe maintenance etc.

[0078] Also, the platform is not limited to the plurality of platforms sliding with respect to each other as described in the above embodiment, but may be a platform that slides directly with respect to the box-type cargo bed 140, or may be a platform that is directly fixed to the box-type cargo bed 140 and does not slide. In such a case as well, as in the case of the above-described embodiments, at least one of portions forming the distal end corner portions of platform is cut to form a cut portion, and an auxiliary platform may be provided in this cut portion. As in the case of the above-described embodiments, the pull-out and storage operation of the auxiliary platform is not limited to manual operation, but may be performed by an actuator provided between the platforms. Also, the shape of cut portion is not limited

to the straight-line shape formed by cutting the distal end corner portion of platform slantwise as in the above-described embodiments, but may be a curved shape such that the distal end corner portion does not become a hindrance.

Claims

1. A platform of a vehicle for high lift work provided with a self-propelled truck body having a cabin at the front thereof, a work bed provided so as to be elevatable with respect to the truck body, and a platform extending from the front surface of the work bed, characterized in that

said platform is provided with a main platform of a rectangular flat plate shape having two corner portions at the distal end thereof and a sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to said main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof; and at least one of the two corner portions forming the distal end corner portions of said platform at the time when said sub-platform is stored is cut to form a cut portion.

2. A platform of a vehicle for high lift work provided with a self-propelled truck body having a cabin at the front thereof, a work bed provided so as to be elevatable with respect to the truck body, and a platform extending from the front surface of the work bed, characterized in that

said platform is provided with a main platform of a rectangular flat plate shape having two corner portions at the distal end thereof, a first sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to said main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof, and a second sub-platform which is stored so as to be capable of being pulled out in the front direction with respect to said main platform and has a rectangular flat plate shape having two corner portions at the distal end thereof; and at least one of the two corner portions forming the distal end corner portions of said platform at least at the time when said sub-platform is stored is cut to form a cut portion.

3. The platform of a vehicle for high lift work according to claim 1 or 2, characterized in that said sub-platform is provided with

an auxiliary platform capable of being pulled out in the front direction from the cut portion of said sub-platform.

4. The platform of a vehicle for high lift work according to claim 3, characterized in that an actuator capable of storing and pulling out said auxiliary platform is provided between said auxiliary platform and said sub-platform.

5. The platform of a vehicle for high lift work according to claim 3, characterized in that

said auxiliary platform is provided with an urging force generating element, which urges said auxiliary platform in the front direction to push out said auxiliary platform from said sub-platform, between said auxiliary platform and said sub-platform, and

said auxiliary platform is provided with interlock storage means, which stores said auxiliary platform in said sub-platform in association with the storage motion of said sub-platform, between said auxiliary platform and said main platform.