May 29, 1945. P. W. MILBURN ET AL 2,377,023

SHIPPING STRUCTURE

Filed Sept. 1, 1942 2 Sheets-Sheet 1

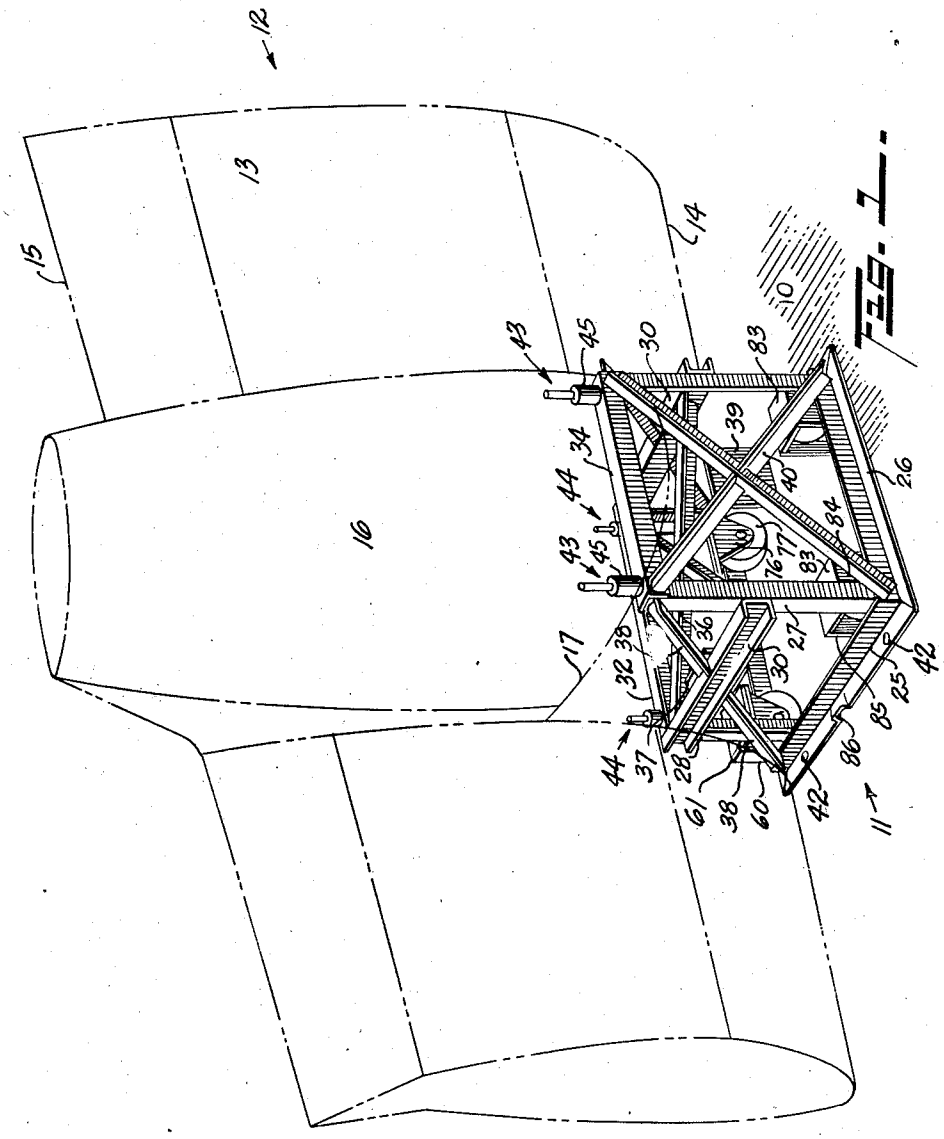


Fig. 1.

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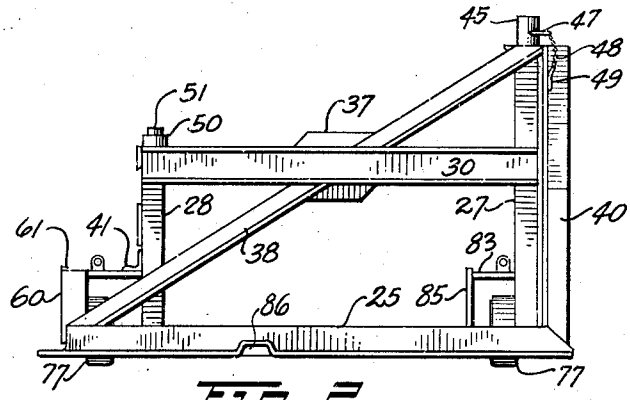


FIG. 2.

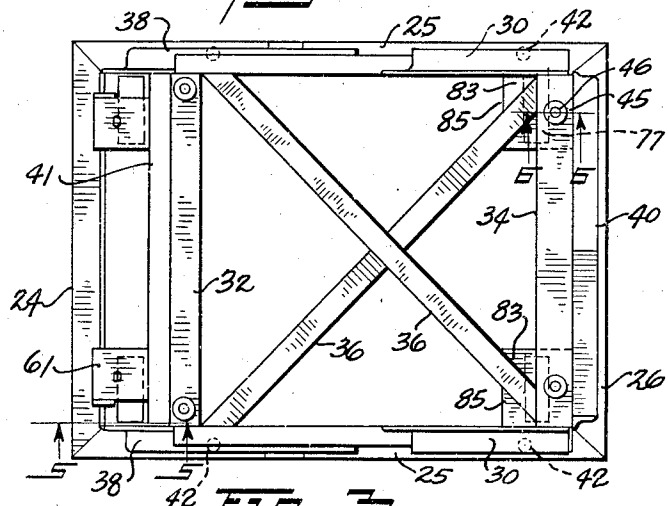


FIG. 3.

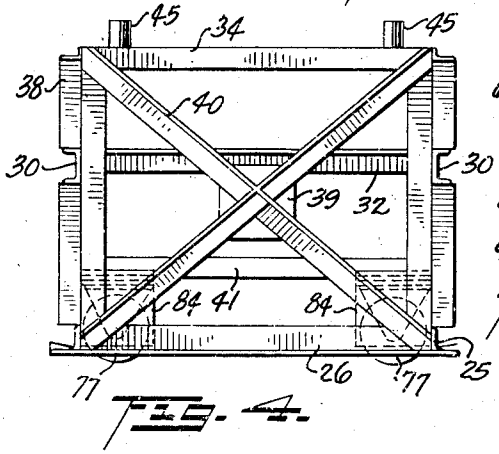


FIG. 4.

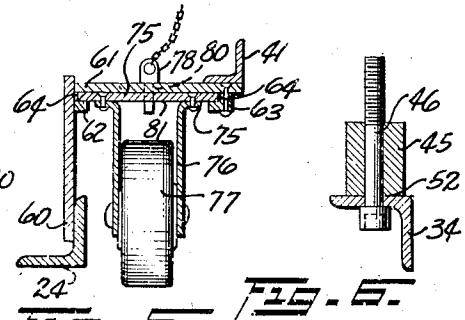


FIG. 5.

FIG. 6.

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SHIPPING STRUCTURE

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Application September 1, 1942, Serial No. 456,964

2 Claims. (Cl. 248—119)

This invention relates to a method and device for transporting articles such as airplane wings and other airplane parts, which are of light weight and large size, and which are readily damaged by impact with surrounding objects, and particularly to a method and device for transporting articles of this character without the use of protecting boxing or crating.

It is common practice in the airplane industry, as in other industries, to fabricate some of the different parts of the completed product at separately located factories and ship them to a central plant for assembly. In shipping airplane parts, and particularly the wing panels, difficulties have been experienced in loading the parts in a manner such that they will be properly protected from damage in transit. Wing structures are of large size relative to their weight and are made of material which is readily dented or otherwise damaged upon contact with surrounding objects. The standard method of transporting wing structures has been within enclosing boxes or crates. One objection to this method is the relatively large volume of car space occupied per article shipped, and another objection is the difficulty of so securing the wing panels within the box that they will not become loosened in transit and be damaged by contact with the box walls and the securing devices within the box.

One object of this invention is to provide a method and device for transporting articles of the general character above set forth without the use of boxing or crating which shall protect the transported article from injury or damage.

Another object of the invention is to provide a means and method for transporting articles of the character described without boxing or crating, by which the article will be held immovable with respect to the transporting vehicle and out of contact with any part of the vehicle or with any other object.

It is another object of the invention to provide a device and method for transporting articles of the character described which will be economical of shipping space and will lend itself to the loading of a maximum number of articles in a transporting vehicle.

It is another object of the invention to provide a device and method for transporting articles of the character described by which the articles are supported in the transporting vehicle without contact of any kind with any object except at points on the article at which the article is particularly adapted to receive stresses without any resulting damage.

It is another object of the invention to provide a method and device for loading, transporting and unloading articles of the character described without the use of enclosed protective boxing or crating.

Another object of the invention is to provide a method and device for transporting a wing panel assembly which includes a nacelle body, without the use of enclosed protective boxing or crating and which is especially adapted to such an assembly.

Further objects and advantages of this invention will be brought out in the following description taken in connection with the accompanying drawings and appended claims. In the drawings, which are for illustrative purposes only:

Figure 1 is a perspective view showing a shipping structure embodying the invention and having mounted thereon an inboard wing panel assembly including a nacelle body, the panel being shown in phantom lines.

Figure 2 is a side elevational view of the shipping structure shown in Figure 1.

Figure 3 is a plan view of the shipping structure.

Figure 4 is a rear elevational view of the shipping structure.

Figure 5 is an enlarged sectional view taken as indicated by the line 5—5 in Figure 3.

Figure 6 is an enlarged sectional view taken as indicated by the line 6—6 of Figure 3.

In Figure 1 an inboard wing panel 12 of an airplane is shown supported upon a floor 10 of a transporting vehicle, such as a freight box car, by means of a shipping structure 11. The wing panel 12, as will appear hereinafter, is secured to the shipping structure 11 at only four reinforced contact areas of small size, and the structure is in turn secured to the car floor. The dimensions of the wing panel and of the shipping structure and their relative positions are such that no part of the wing panel contacts the floor, side walls or roof of the car, or any other object, except only the four above mentioned areas at which it is secured to the shipping structure. The wing panel is thus held both immovable under the shocks and vibrations to which it is subjected during transit, and out of contact with any surrounding objects, impact with which might dent or otherwise deform it.

The wing panel assembly 12 is carried with its leading edge 14 adjacent the floor, and its trailing edge 15 directed toward the roof, the body of the panel 13 being horizontally offset with respect to the shipping structure 11 and the nacelle

body 16 being vertically above the shipping structure with its lower rim 17 directed downward.

The base of the shipping structure 11 consists of four angle irons, welded together to form a rectangular frame having a front bar 24, side bars 25 and a rear bar 26. The angle irons forming the base are disposed with one flange lying horizontal in contact with the floor and the other flange standing vertically upward therefrom.

Two upright angle irons 27 are welded to the rectangular base at the two rear corners thereof, and two other shorter upright angle irons 28 are similarly welded to the rectangular base at the front corners thereof. Horizontal channel iron bars 30 extend from the upper end of the front uprights 28 to the rear uprights 27 respectively, being secured to these uprights by welding.

A front supporting bar 32 connects the upper ends of the front uprights 28 and a rear supporting bar 34 similarly connects the upper ends of the rear uprights 27.

The shipping structure is braced by crossed diagonal angle iron bars 40 and inclined angle iron bars 38, as shown. The brace bars 40 are reinforced, at their intersection, by a gusset 39 and the two end portions of each brace bar 38 are reinforced at their connections with the associated horizontal side bar 30 by a gusset 37. Each of the side bars 25 of the base of the shipping structure is formed with bolt holes 42 to receive bolts for fastening the shipping structure to the car floor.

The structure, constructed as above described, provides a relatively small, compact sturdy frame which may be solidly secured to the car floor and which will not have relative movement of its parts when subjected to the dynamic stresses applied to it by the weight of the wing panel assembly when the car is stopped or started or given sudden movements of acceleration or deceleration in transit.

The two points indicated by arrows 43 on the nacelle frame 16 and the two points indicated by arrows 44 on the front spar of the wing panel, to which the engine mount is secured when the plane is assembled, are utilized to secure the wing panel assembly 12 to the shipping structure. The points 43 are aligned with the ends of the rear supporting bar 34 and the points 44 with the ends of the front supporting bar 32 in mounting the wing panel for shipment. Two spacer sleeves 45 are disposed between the bar 34 and the points of attachment of the engine mount to the nacelle frame, with the bores of these sleeves 45 in registry with two bolt holes 52 at the respective ends of the supporting bar 34 (see Figure 6). Two spacer sleeves 50 are similarly disposed between the bar 32 and the points of attachment of the engine mount 44 to the front spar of the wing panel, with the bores of these sleeves in registry with two bolt holes at the ends respectively of the supporting bar 32. Bolts 46 are inserted from below through the bolt holes in these two supporting bars and in the spacing sleeves. Nuts threaded upon the upper ends of the bolts secure the wing panel assembly immovably to the shipping structure.

A pin 47 is welded to each spacer sleeve 45 and attached to the adjacent brace bar 40 by a chain 48 and fastener bracket 49 welded to the brace 40, to provide for securement of the spacer sleeves against misplacement or loss.

The spacer sleeves 50 are shown as welded to the supporting bar 32, although if desired they may be separable from the shipping structure and secured thereto in the same manner as spacer sleeves 45.

To facilitate loading and unloading the assembled wing panel and shipping structure and handling and storage operations about a factory or warehouse, the shipping structure is provided with a detachable wheel 77 at each of its four lower corners. Referring to Figure 5, the housing for each front wheel comprises an outside plate 60 and top plate 61 suitably secured to adjacent elements of the framework of the shipping structure. A cross angle iron bar 41 connecting the front uprights 28 at a level just above the top plate 61 of the front wheel housings provides additional means for mounting these housings upon the framework of the shipping structure.

To the inside face of the outside plate 60 and to the surface of the top plate 61 are secured respectively the guideway bars 62 and 63 providing guideways 64 within which slides a rectangular wheel supporting plate 75. The wheel 77 is rotatably mounted between wheel hangers 76 which are riveted at their upper edges to the wheel supporting plate 75. The top plate 61 of each front wheel housing is centrally apertured at 80 to align with a similar central aperture 81 in the wheel supporting plate 75. The wheel assembly is installed in the housing by sliding the plate 75 in the guideway 64 from the inner ends of the guideway, and, upon the apertures 80 and 81 coming into alignment, by inserting from above a fastening pin 78 in these apertures. To prevent misplacement of the fastening pin 78, it may be attached to the frame structure by a fastening chain, as shown in the drawings.

The rear wheel assemblies are identical with the front wheel assemblies. The rear wheel housings comprise an inner side plate 85, an outer side plate 84 and a top plate 83, welded at suitable points to the frame members of the shipping structure, as shown in the drawings. The rear wheel assemblies are installed and secured in the same manner as has already been set forth in describing the front wheel construction.

The horizontal flange of each side bar 25 of the rectangular base of the shipping structure is bent upwardly at 86 to provide a recess for inserting a crow bar or other tool for prying the shipping structure and wing panel upward from the floor a distance sufficient to permit the installation of the wheel assemblies.

In loading a freight car or other transporting vehicle the wing panel assembly is first bolted to a shipping structure with wheels in place. The wing panel assembly and shipping structure is then placed on a truck and delivered to the car door. The shipping structure with the wing panel assembly is rolled into the car and moved into position for securement to the car floor. A crow bar is inserted in one of the recesses 86 and operated to lift the shipping structure sufficiently to remove the wheel assemblies from place at one end of the shipping structure. By a similar operation the wheel assemblies are removed from the other end of the shipping structure. The shipping structure is then bolted to floor irons in the car by cap screws which pass through the bolt holes 42. When the car reaches its destination, by a reverse series of operations, the shipping structure with the wing panel assembly mounted thereon is removed from the car and delivered to a place of storage.

Preferably the wheel assemblies do not accompany the shipment in the freight car. A

proportionately small but adequate number of these wheel assemblies are kept on hand at each shipping, receiving or storage place for use in loading, unloading and moving the shipping structures with wing assemblies mounted thereon. Thus the cost of the equipment is less and the danger of loss and damage to the wheel assemblies in transit is eliminated.

The positions of securement of the mounted wing assemblies to the floor of the car are selected to place them close to each other and to the side walls of the car in such relative positions with respect to each other and to the car walls, as determined by their overall horizontal dimensions and shape, that as many articles as possible may be shipped in the car. The immovability of the wing assemblies, the absence of enclosing box or crate side walls and the position of the shipping structure vertically beneath a portion of the article are all factors contributing to the realization of this result.

While there have been described herein certain embodiments of this invention, the invention is not to be understood as confined to these particular embodiments, but is to be given the definition and scope expressed in the following claims.

We claim:

1. In a frame device for shipping without protective boxing, an article of extensive dimensions relative to said device and readily damaged by impact with surrounding objects, the combination of: base members having horizontal surfaces for contactual engagement with the floor of the transporting vehicle, and having bolt holes intersecting said surfaces for the accommodation of bolts to secure the device rigidly to the floor; a superstructure rigidly secured to said base members; supporting members carried by said superstructure at levels substantially above said base members and having surfaces for contact with surfaces on the article when said article is spaced out of contact with the floor, said surfaces being the only surfaces on said device disposed for contact with the article, and said supporting members having all told at least three bolt holes intersecting said surfaces of said supporting members for disposition therein of bolt means for reception within bolt holes in the article to rigidly secure the article to said device; bracing means on said superstructure for bracing it against stresses acting in every direction between the floor and article; at least three wheel mounts carried by said device, each mount including a horizontal apertured plate spaced substantially above said horizontal floor contacting surfaces and a pair of parallel horizontal guideway means proximately beneath said plate; a wheel assembly including a horizontal wheel hanger plate for laterally close-fitting, slidable, disposition in said guideway means, having an aperture registrable with said plate aperture; and a drop pin for engagement with said apertures to prevent relative movement of said plates.

2. A device for shipping a relatively long article having a flexible frame substantially covered by an imperforate skin comprising: base members adapted to rest on the floor of the transporting vehicle, said base members having passages therethrough for receiving bolts to secure the device rigidly to said floor; a unitary superstructure rigidly secured to said base members, said base members and superstructure constituting a compact openwork frame assembly of small size relative to the width and length of said article; supporting members carried by said superstructure at levels remotely above said base members and having surfaces adapted to contact the medial portion of said skin to support said article above said floor, said contacting surfaces being the only surfaces in contact with the article, and said supporting members having a plurality of bolt holes opening onto said contacting surfaces for receiving bolts to be inserted into bolt holes in said article to rigidly secure the article to said device; and bracing means on said superstructure for bracing the same against stresses whereby said article will be rigidly held by said supporting members.

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