

March 7, 1944.

P. W. MILBURN ET AL

2,343,844

SHIPPING STRUCTURE

Filed Nov. 3, 1942

3 Sheets-Sheet 1

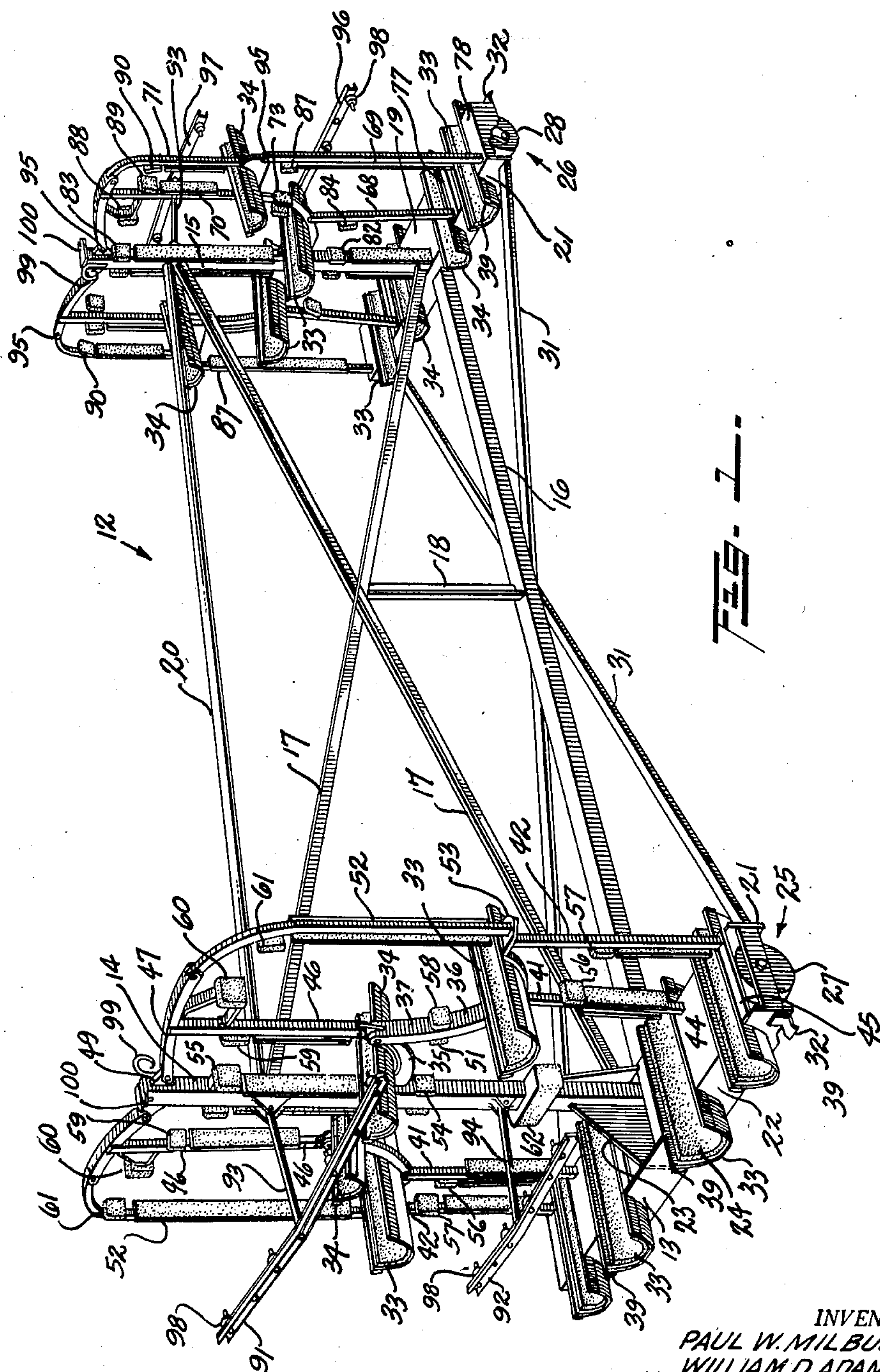


FIG. 1

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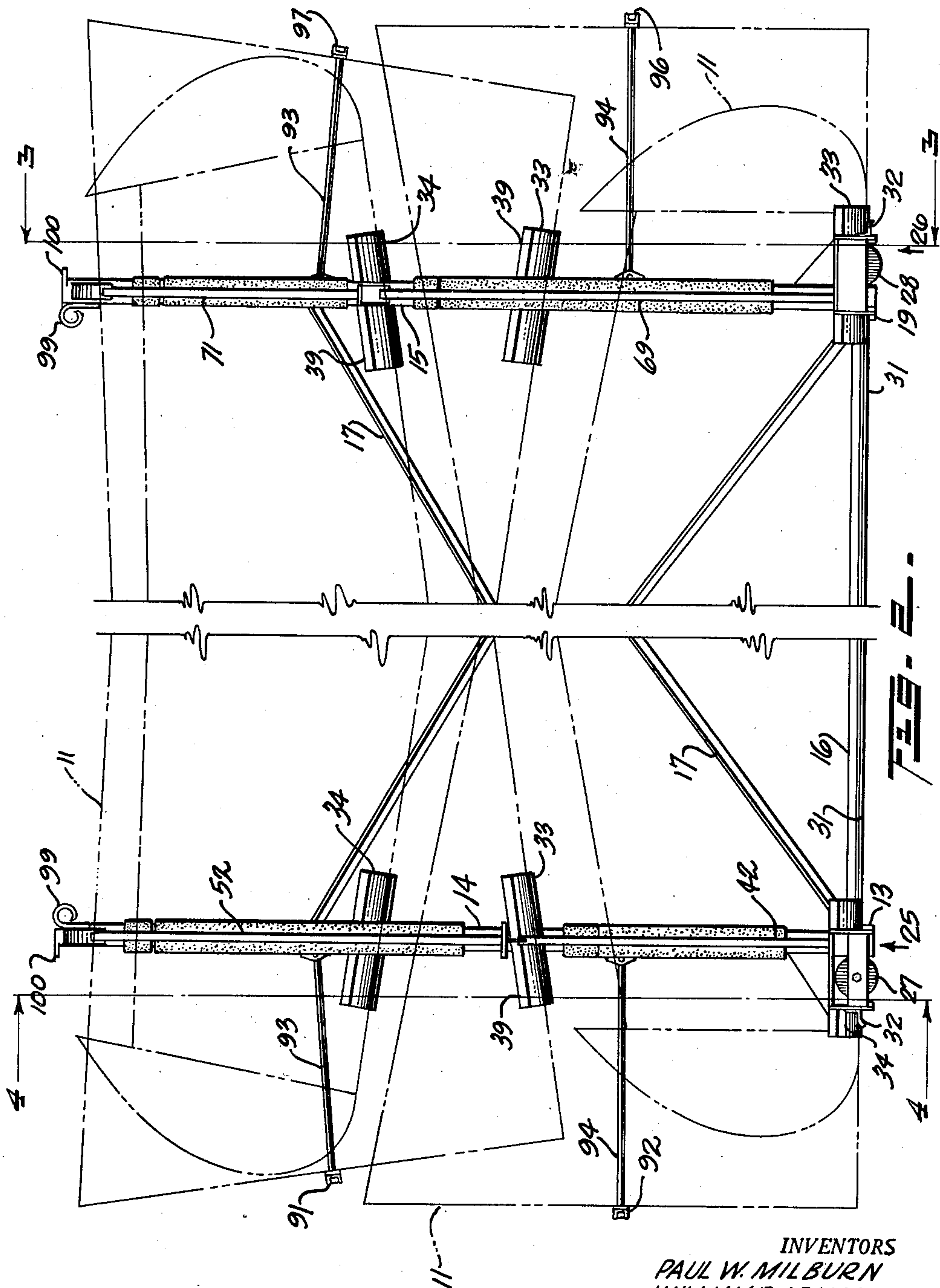
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

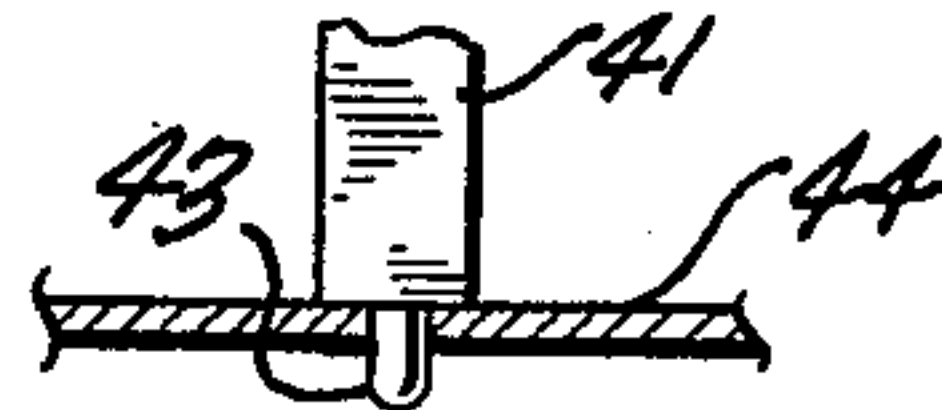
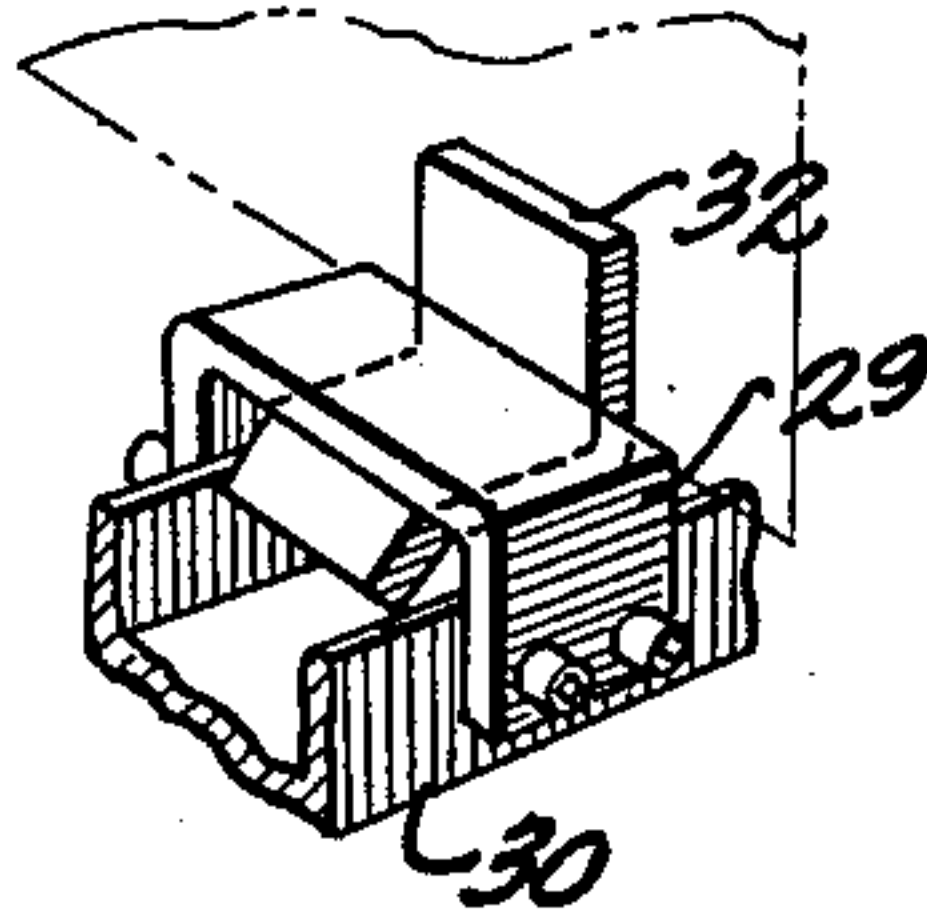
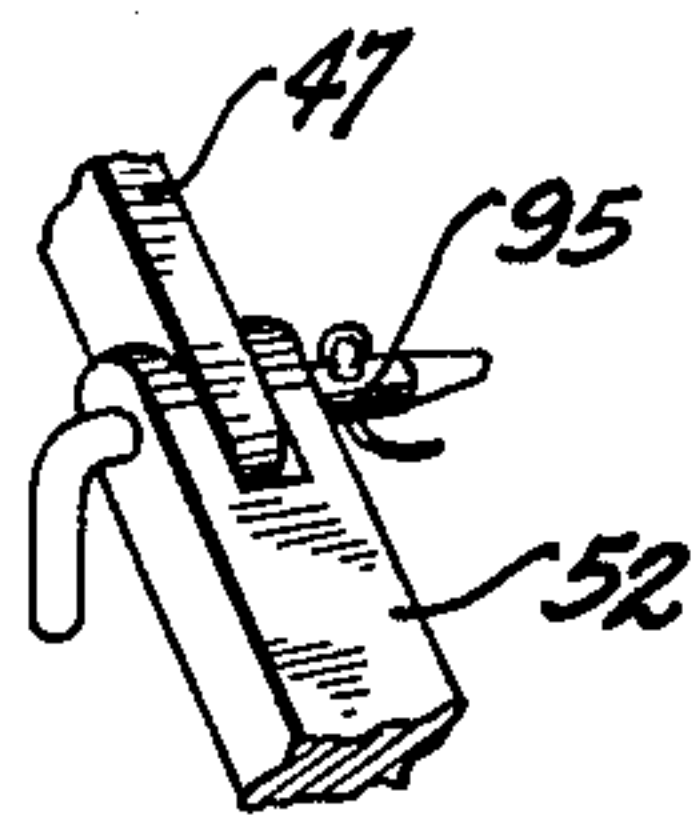
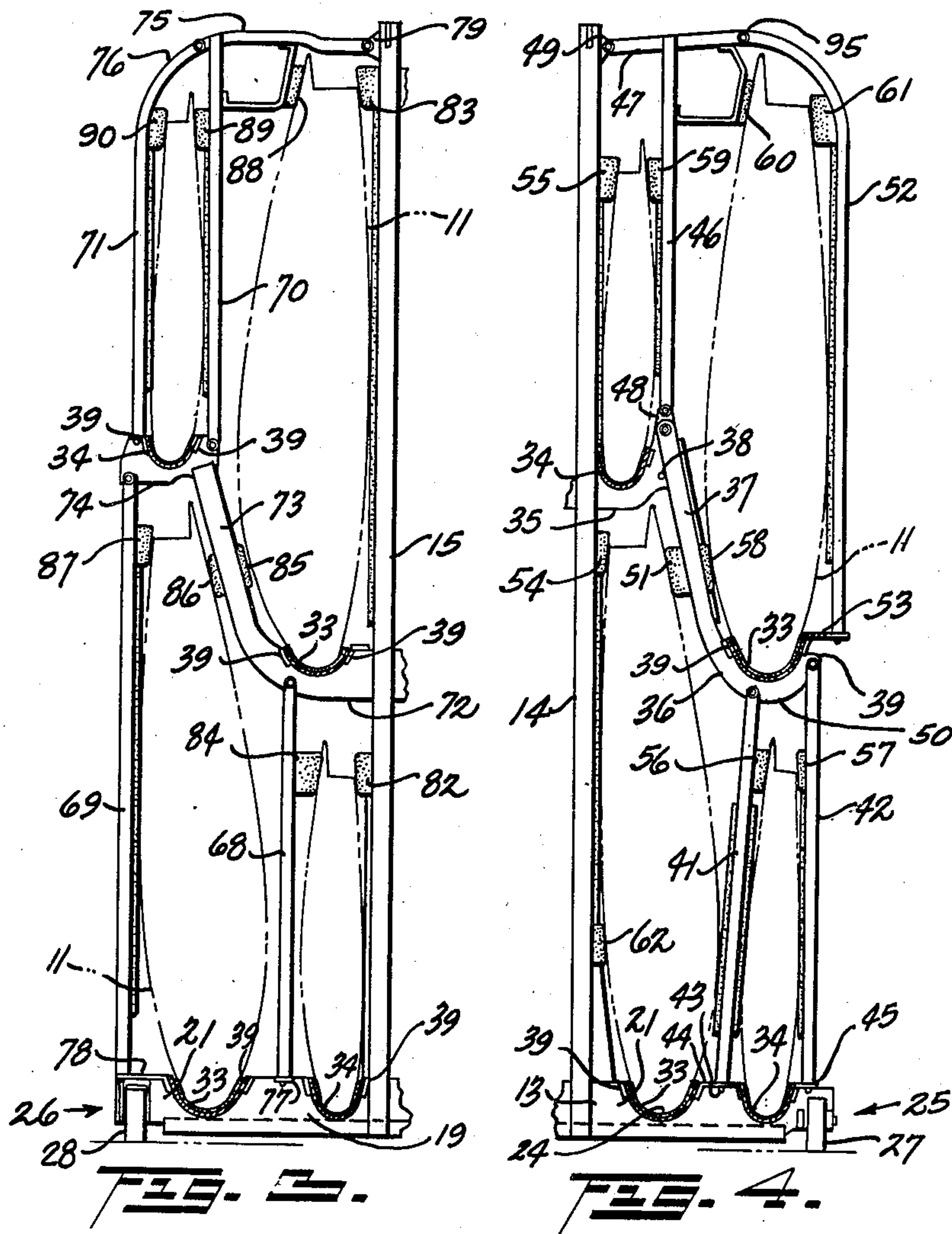


FIG. 6.

FIG. 5.

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SHIPPING STRUCTURE

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Application November 3, 1942, Serial No. 464,414

13 Claims. (Cl. 211—60)

This invention relates to a 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 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 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 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 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 for loading, transporting and unloading articles of the character described without the use of enclosed protective boxing or crating.

It is a further object of this invention to provide a shipping structure for transporting a group of right and left wing panels otherwise of identical shape and size in which the several panels are arranged relatively to each other to occupy

a minimum space and in which the space occupied by the loaded shipping structure is of a shape to so conform to the spaces occupied by other similar shipping structures and to the shape of the transporting vehicle that a maximum number of shipping structures may be placed in the vehicle. Other 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 of the shipping structure.

Figure 2 is an elevational view of the shipping structure, showing in phantom lines wing panels in loaded position thereon.

Figure 3 is a vertical sectional view taken as indicated by the line 3—3 of Figure 2.

Figure 4 is a vertical sectional view taken as indicated by the line 4—4 of Figure 2. The arms 93 and 94 are omitted from Figures 3 and 4 for the sake of clarity.

Figure 5 is an enlarged perspective view of the rail clamp on the wheel supports of the shipping structure and the floor rail which it engages.

Figures 6 and 7 are enlarged views showing the connections between the clamping bars and the members to which they are secured.

In Figure 1, there is shown as an embodiment of the invention a shipping structure which is capable of being loaded with eight outboard wing panels 11 (Figure 2) of an aircraft four of which are right wing panels and four of which are left wing panels. The frame of the shipping structure comprises a vertically disposed longitudinal trussed frame 12 and two transversely disposed base frames 13 and 19 at the two ends respectively of the vertical frame 12.

The vertical frame 12 comprises standards 14 and 15, one at each end of the structure, a horizontal longitudinal connecting bar 16, an upper tie bar 20, diagonal braces 17 and a vertical brace 18. Each of the transverse base frames 13 and 19 comprises a transverse vertical plate 21 extending in each direction from the foot of the corresponding standard, a second transverse plate 22 welded to the outer end of a gusset 23 which is in turn welded to the foot of the corresponding standard. At the outer ends of the transverse plates 21 and 22 and suitably secured thereto are the wheel housings 25 at one end of the structure and wheel housings 26 at the other end of the structure. The two wheel housings 25 are

the means for mounting the wheels 27 and the wheel housings 26 are the means for mounting the caster wheels 28.

The transverse base frames 13 and 19 are cross-braced by horizontal brace bars 31. Four short lengths 32 of angle iron are secured in horizontal position to the outer side faces of the transverse plates 22, constituting stops to prevent moving of the shipping structure in either direction on rails 30 on the car floor. (See Figure 5.) One of these stops is positioned at each end of each transverse plate 22 in longitudinal alignment with one of the rails engaged by the wheels of the shipping structure. The outer edge of the horizontal flange of each stop is curved downwardly to have frictional engagement with a correspondingly inclined underface of a cooperating stop 29 securable to the rail 30.

Upon the upper face of the transverse base frame 13 at the foot of the standard 14 are mounted adjacent to the standard and upon either side thereof a relatively large saddle 33 shaped cross-sectionally to receive the inboard end portion of the leading edge of a left hand wing panel, the inner side wall of the saddle being in a relatively upright position to conform to the under surface of the wing panel which faces inwardly when loaded on the shipping structure. This saddle is a piece of sheet metal in the shape of a trough and is supported by longitudinal frame bars 39 which are in turn supported by the transversely disposed plates 21 and 22. The saddle is provided with a cushioning pad 24 to protect the wing panel from becoming dented or otherwise deformed in transit. Two other relatively small saddles 34 of a similar character, and similarly shaped and mounted, are disposed on the transverse base frame 13 outside of the relatively large saddles 33 respectively to similarly receive the outboard end portions of the leading edge of right hand wing panels.

Four other saddles of a similar character and similar mounting are disposed on the transverse base frame 19 adjacent the standard 15, the smaller saddles 34 at this end being placed adjacent the standard and the larger saddles 33 being placed in the position more remote from the standard 15 to receive the other ends of the panels supported in the saddles on transverse frame 13. The outside saddles at each end of the structure are arranged with their outer side walls in a relatively upright position to conform to the under surfaces of the wing panels carried by these saddles which face outwardly in the shipping structure. The saddles are also arranged on the base frames with their axes at a slight inclination toward the longitudinal lines of the shipping structure, the saddles adjacent standard 14 being inclined centrally and inwardly and the saddles adjacent standards 15 being inclined centrally and outwardly.

A bracket plate 35 is welded to each side of the standard 14 at a level intermediate its upper and lower ends and somewhat above the vertically median point of the standard. This bracket carries a small saddle 34. A saddle supporting frame bar 36 is pivoted on a horizontal longitudinal axis to the outer end of the bracket 35. This frame bar 36 comprises an inclined arm 37 and a saddle support 50. The arm 37 is held at its proper angle of inclination by a stop pin 38 on the bracket 35. On the saddle support 50 is mounted one of the large saddles 33.

A lower inner upright clamping bar 41 is pivotally connected at its upper end to the saddle

support 50 and is formed at its lower end with a dowel pin 43 which is seated in an aperture in a plate 44 of the transverse base frame 13. A lower outer upright clamping bar 42 is similarly pivoted to the outer end of the saddle supporting frame bar 36, and is similarly seated in a bracket plate 45 of the transverse base frame 23. An upper inner upright clamping bar 46 having a cross bar 47 at its upper end is pivoted at the inner end of the cross bar 47 to a bracket 49 at the upper end of the standard 14 and is pivotally connected at its lower end to an inner upper extension 48 of the bracket 35. An upper outer upright clamping bar 52 is pivotally connected at its upper end to the outer end of the cross bar 47 and is provided at its lower end with a dowel pin which engages an aperture in a bracket 53 secured to the outer end of the saddle supporting frame bar 36.

The several pivotal connections between the clamping bars 41, 42, 46, and 52 are each arranged on a longitudinal horizontal axis and comprise a pin 95 (see Figure 6) bent at one end and provided with a hole at the other end to receive a cotter pin or other retaining means. In unloading the structure, the pin at the upper pivotal connection of each clamping bar is first removed and the bar swung downwardly and outwardly to permit removal of the wing panel which it has served to hold in shipping position.

The standards, clamping bars, and inclined arm 37, which are disposed at the end of the frame adjacent the standard 14, as well as similar parts described below as disposed at the other end of the frame, are provided with padded lugs for engagement with the surfaces of the wing panels to hold them firmly in their proper position out of contact with each other and with any other portion of the frame than the saddle or one of the padded lugs. Each of the lower inner panels 11 is laterally supported adjacent its upper trailing edge by a lug 54 on the standard 14 and by a lug 51 on the inside of the arm 37 and near its lower leading edge by a lug 62 on the standard 14. By reason of the upward convergence of the upper and lower surfaces of the wing panel, the lugs 54 and 51 prevent upward movement of the wing panel from the saddle 33 in addition to fixing the lateral position of the wing. Each one of the other seven wing panels is similarly provided with lateral supporting lugs which wedge the panel against upward movement.

The lower outer wing panel is laterally supported by lugs 56 and 57 on the outside of bar 41 and inside of bar 42 respectively. The upper inner wing panel is laterally supported by lugs 55 and 59 on the standard 14 and on the inside of bar 46 respectively. The upper outer wing panel is laterally supported by lugs 60 and 61 on the outside of bar 46 and inside of bar 52 respectively and by a lug 58 on the outside of arm 37. The clamping bars, saddles and lugs are relatively disposed to carry the inner panels with their nether surfaces facing the standard 14 and to carry the outer panels with their upper surfaces facing outwardly to conserve space on the shipping structure and present an approximately smoothly contoured assemblage of panel portions and shipping structure parts in an outside approximately vertical plane, conserving space in assembling the loaded structures in a transporting vehicle. The clamping bars, saddles and lugs at the other end of the shipping

structure described below, are relatively positioned to effect the same result.

Standard 15 at the other end of the shipping structure from standard 14 has welded to it on each side and at a level substantially below that of bracket 35 on standard 14, a bracket 72 formed with an upwardly and outwardly inclined arm 73 and a bracket end plate 74. The lower end of bracket 72 has secured to it by means of two of the frame bars 39 a large saddle 33. The bracket end plate 74 similarly supports a small saddle 34.

The eight upper saddles are designed to support right hand wings in the positions as stated above.

A lower inner upright clamping bar 68 is pivotally pinned at its upper end to the lower end of each bracket 72 and is dowel pinned at its lower end in a plate bar 77 welded across the upper edges of plates 21 and 22. A lower outer upright clamping bar 69 is pivotally pinned at its upper end to the outer end of each bracket plate 74 and is dowel pinned at its lower end in a plate bar 78 connecting the upper edges of plates 21 and 22.

An upper inner upright clamping bar 70 having an inwardly turned horizontal upper arm 75 is pivotally pinned at the inner end of arm 75 to each of two brackets 79, one attached to each side of the upper end of standard 15 and is pivotally pinned at its lower end to the inner upper corner of bracket end plate 74. An upper outer upright clamping bar 71 having an upper in-turned arm 76 is pivoted at the inner end of arm 76 to the upper end of clamping bar 70 and dowel pinned at its lower end to the outer end of bracket plate 74.

The clamping bars, brackets and standard 15 at that end of the shipping structure are provided with padded lateral supporting lugs as follows: Lug 82 on the standard 15 and lug 84 on the inside of clamping bar 68 for the trailing edge of each lower inner wing panel; lug 86 on the outside of arm 73 and lug 87 on the inside of clamping arm 69 for the trailing edge of each lower outer wing panel; lug 83 on standard 15 and lug 88 on the inside of clamping bar 70 for the trailing edge and lug 85 on the inside of arm 73 for the upper surface of each upper inner wing panel; and lug 89 on the outside of clamping bar 70 and lug 90 on the inside of clamping bar 71 for each upper outer wing panel.

The wing panels are held against movement longitudinally in their supporting saddles by the upper swinging cross bars 91 and 97 and lower swinging cross bars 92 and 96, each upper cross bar being secured to one of the standards 14 and 15 at an upper level by an arm 93 which is transversely pivoted to the outer end face of the standard and each lower cross bar being secured to one of the standards 14 and 15 at a lower level by an arm 94 which is somewhat longer than arm 93 and which is transversely pivoted to the outer end face of the standard. Each bar has spaced along it on each side of the arm 93 or 94 two bolting assemblies 98 with suitable rubber cushioning washers for securing the bar to the frame structure of the two wing panels the inboard ends of which are directed toward the bar, the bolting assemblies on bars 91 and 96 being further removed from the vertical frame 12 than the bolting assemblies on bars 92 and 97 to conform to the relative positions of the inboard ends of the panels to which they

are bolted, the bars 91 and 96 being longer than bars 92 and 97 for this purpose.

A horn hook 99 at the top of each of the standards is provided for lifting the shipping structure in the course of loading and unloading operations. A claw 100 projects horizontally and longitudinally out from each standard for the reception of a vertically disposed fixture (not shown) projecting downwardly from the vehicle roof for preventing lateral swaying of the shipping structure on its base.

In loading the shipping structure, each side is prepared for loading by first removing the end cross bars 91, 92, 96 and 97, the frame bar 36, and then all of the clamping bars, wing panels and structure parts are placed in position in the following order: lower inner wing panel, frame bar 36, clamping bar 41, clamping bar 68, lower outer wing panel, clamping bar 42, clamping bar 69, upper inner wing panel, clamping bar 46, clamping bar 70, upper outer wing panel, clamping bar 52, clamping bar 71, end cross bars 91, 92, 96 and 97 and finally the bolting assemblies are employed to connect the inboard ends of the wing panels to the cross bars 91, 92, 96 and 97. The loaded structure is then hoisted by hooks 99 onto a platform at car floor level at the end of a car, rolled onto the track runways in the car and clamped against rolling movement by adjusting stops 29 to engage stops 32 which fix the structure in a position where it is secured against swaying by engagement of the ceiling fixtures of the car with the claws 100. The unloading operation comprises these same steps in reverse order.

We claim:

1. In a shipping structure, the combination of: a frame; a first large saddle for the leading edge of the inboard end portion of a first airplane wing panel, said saddle being mounted at a lower first level on the frame adjacent the longitudinal center line thereof; a first small saddle for the leading edge of the outboard end portion of a second similar airplane wing panel mounted at said first level laterally beyond said first saddle; a second small saddle similar to said first small saddle mounted at a higher second level adjacent the said center line; a second large saddle similar to said first large saddle mounted at a level intermediate said first and second levels and laterally beyond said second small saddle, said first four saddles being mounted in substantial transverse alignment at a first end of the frame and on a first side of said center line with their axes parallel to said center line and in upwardly opening position; four other saddles similarly sized and disposed and mounted on the other side of said center line at said first end of the frame in a transverse pattern symmetrical with the pattern of said first four saddles; and eight additional saddles mounted at the second end of the frame, four of said saddles being large and four of said saddles being small, said additional eight saddles being arranged in a transverse pattern similar to that of said first eight saddles excepting for a transposition of the large and small saddles relative to said center line and a transposition of said upper and intermediate levels relative to said center line.

2. In a shipping structure for airplane wing panels, the combination of: a frame structure comprising a trussed, vertically disposed, laterally thin frame and a transversely extending frame adjacent the bottom of said vertically disposed frame and on each side thereof for supporting said frame in vertical position; and means on

said frame structure for supporting on each side of said vertical frame at a lower level and parallel to said vertical frame two wing panels laterally of each other, leading edge downward, with inboard and outboard ends in reverse juxtaposition; and means on said frame structure for supporting on each side of said frame at a higher level and parallel to said vertical frame two wing panels laterally of each other, leading edge downward, with inboard and outboard ends in reverse juxtaposition with each other and with the first wing panels vertically beneath them at the lower level respectively.

3. The combination defined in claim 2 in which said supporting means are shaped and disposed to support the four wing panels adjacent said vertical frame with their lower surfaces facing said vertical frame and to support the four wing panels laterally more remote from said vertical frame with their upper surfaces facing said vertical frame, the four of said wing panels at one level being right hand panels and the four of said wing panels at the other level being left hand panels.

4. In a shipping structure for airplane wing panels, the combination of: first and second standards; frame members tying together said standards in horizontally spaced relation; a transverse base centered at the lower end of each standard for supporting it in upright position; two laterally extending, symmetrically related first frame structures on the two sides respectively of said standards, each of said frame structures being arranged for supporting by means of suitably arranged interiorly padded saddles, laterally padded lateral supports and longitudinal fasteners, at a lower level, the inboard end of a first wing panel, with lower surface inward and adjacent said first standard, and the outboard end of a second wing panel, with upper surface inward and laterally beyond said first wing panel, and at an upper level, the outboard end of a third wing panel, with lower surface inward and adjacent said first standard and the inboard end of a fourth wing panel, with upper surface inward and laterally beyond said third wing panel, said third and fourth wing panel ends being substantially vertically aligned with said first and second wing panel ends respectively and the leading edges of all panels being arranged downward; to dispose said wing panels generally parallel to each other and to the vertical plane of said standards, with right hand wing panels at one level and left hand wing panels at the other level.

5. The combination defined in claim 4 in which each of said first frame structures comprises a removable saddle for the inboard end of said fourth wing panel and each of said first and second frame structures comprises a removable, upright, supporting bar proximately on the outside of each of said wing panel ends, for laterally supporting the wing panels adjacent thereto.

6. The combination defined in claim 4 in which said saddles and lateral supports are arranged to support the leading edges of said wing panels of the lower-level in substantially horizontal position and the leading edges of said wing panels of the upper level in a position of downward inclination from inboard end to outboard end, disposing each upper-level leading edge substantially parallel to the trailing edge of the wing panel beneath it and disposing the eight upper-level trailing edges substantially horizontal and substantially in lateral registry.

7. In a shipping structure for airplane wing panels, the combination of: first and second

standards; frame members tying together said standards in horizontally spaced relation; a transverse base centered at the lower end of each standard for supporting it in upright position; two first large saddles mounted on a first one of said bases adjacently on the two sides respectively of said first standard for the leading edges of the inboard ends of a first two wing panels respectively; two second small saddles mounted on said first base laterally beyond said first saddles respectively for the leading edges of the outboard ends of a second two wing panels respectively; two rigidly secured brackets extending laterally from the two sides respectively of said first standard intermediate its ends; two small third saddles mounted on said brackets respectively for the leading edges of the outboard ends of a third two wing panels respectively; two saddle supports including rigid outwardly and downwardly inclined arms detachably secured to said brackets at their upper ends; two large fourth saddles for the leading edges of the inboard ends of a fourth two wing panels respectively mounted on the lower ends respectively of said saddle supports; two lower inner upright laterally acting, wing-clamping bars detachably connected at their upper ends to said saddle supports respectively and at their lower ends to said bases respectively between said first and second saddles and disposed between the shipping positions of said first and second wing panels; two lower outer upright laterally acting, wing-clamping bars detachably connected at their upper ends to the outer ends of said saddle supports respectively and at their lower ends to said bases respectively beyond said second saddles; two upper inner upright laterally acting, wing-clamping bars detachably connected at their upper ends to the top of and on the two sides of said standard respectively and at their lower ends to the outer ends of said brackets respectively; and two upper outer upright laterally acting, wing-clamping bars, detachably connected at their upper ends to the top and on the two sides of said standard respectively and at their lower ends to the outer ends of said saddle supports respectively; and a combination of four saddles, two brackets, two saddle supports and four clamping bars on the second base and standard, in which the large and small saddles are, with respect to the combination on the first standard and base, laterally transposed, the two brackets are fixedly secured to the second standard at the level of the fourth saddles on the first standard, the inclined arms are directed upwardly and outwardly and are rigidly secured at their lower ends to the brackets at the level of the third saddles on the first standard, the lower inner clamping bars are detachably connected at their upper ends to the brackets and the upper inner clamping bars are detachably connected to the upper ends of the inclined arms, said combination being otherwise like the corresponding combination first recited.

8. The combination defined in claim 7 in which the detachable connections at the lower ends of the lower clamping bars and the lower ends of the upper outer clamping bars are uprightly disposed pin and socket connections and the remaining detachable connections are pivotal connections on a horizontal axis longitudinally of the shipping structure.

9. The combination defined in claim 7 in which the detachable connections at the lower ends of the lower clamping bars and the lower ends

of the upper outer clamping bars are uprightly disposed pin and socket connections and the remaining detachable connections are pivotal connections on a horizontal axis longitudinally of the shipping structure and in which each upper inner clamping bar has an inwardly turned upper end portion which is connected to the upper end of the standard and each upper outer clamping bar has an inwardly turned upper end which is connected to the upper end portion of an upper inner clamping bar.

10. The combination defined in claim 7, and in addition thereto; lateral supporting lugs disposed one on each side of each standard adjacently below said brackets and one on each side of each standard adjacent the upper end thereof, one on the inside and one on the outside of each upper inner clamping bar, adjacent the upper end thereof, one on the inside of each lower inner clamping bar associated with the second standard, and each outer clamping bar adjacent the upper ends thereof, and one on the outside of each lower inner clamping bar associated with the first standard, adjacent the upper end thereof and one on the inside and one on the outside of each inclined arm.

11. The combination defined in claim 2, and in addition thereto; an outwardly disposable end tie bar horizontally transversely pivoted to each end of said vertical frame at a lower level and a horizontal cross arm at the free end of each of said tie bars for securement at each end thereof to the frame structure of the two lower wing panels presenting their inboard ends at said end of said vertical frame to prevent longitudinal movement of said panels in their saddles and two

similar tie bars and cross arms at each end of said frame at an upper level for similar securement to the four upper wing panels.

12. The combination defined in claim 2, and in addition thereto; means securable to the inboard end of each wing panel for preventing longitudinal movement of said wing panel with respect to the frame.

13. In a shipping structure for airplane wing panels the combination of: a plurality of standards; frame members tying together said standards in horizontally spaced relation; a base at the lower end of each standard for supporting it in upright position; means extending at upper and lower levels laterally from said standards, padded saddles mounted on said laterally extending means to support the leading edges of four airplane wing panels arranged with leading edges downward, the lower lateral extending means acting to support the saddles mounted thereon substantially at one level, the upper laterally extending means being formed to support the saddles mounted thereon at different levels, the wing panels being arranged so that at one level an inboard end of a panel is adjacent to the standards and an outboard end of a panel is carried on the outside of said inboard end, while at another level the outboard end of a panel is adjacent the standards and an inboard end is carried on the outside of said outboard end; and means engaging with said laterally extending means and acting to securely retain the wing panels against lateral movement.

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