

Jan. 2, 1945.

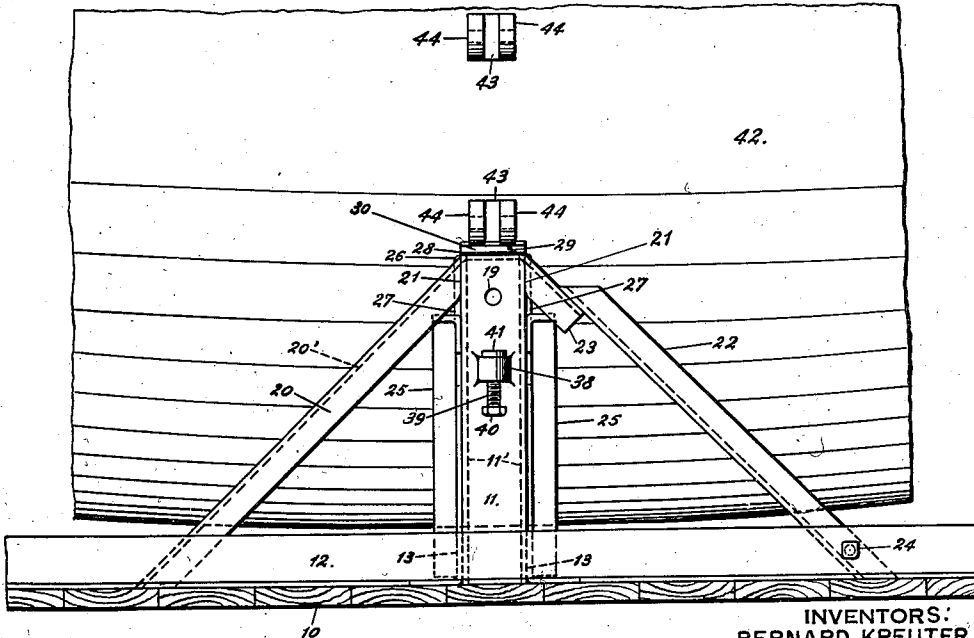
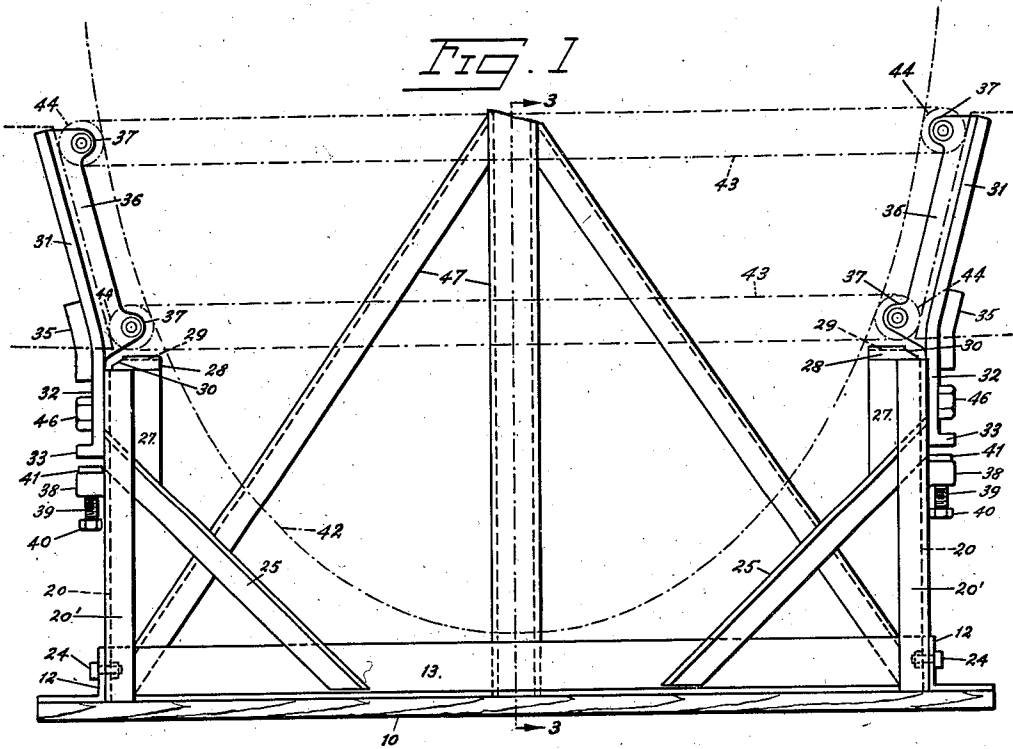
B. KREUTER ET AL

2,366,337

SHIPPING CRADLE AND ASSEMBLY SUPPORT

Filed July 21, 1943

2 Sheets-Sheet 1



INVENTORS:
BERNARD KREUTER &
DAVID G. DURYEA;
BY *Robert C. Basche*
ATTORNEY

Jan. 2, 1945.

B. KREUTER ET AL

2,366,337

SHIPPING CRADLE AND ASSEMBLY SUPPORT

Filed July 21, 1943

2 Sheets-Sheet 2

FIG. 3

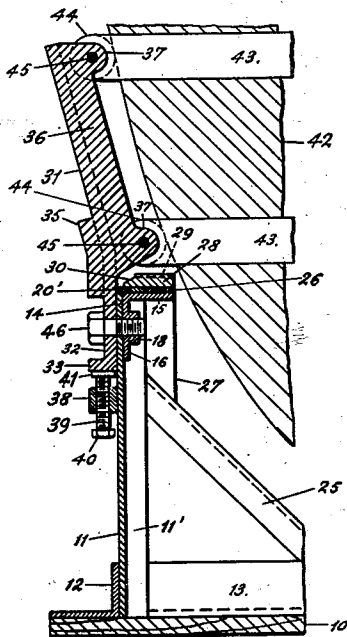
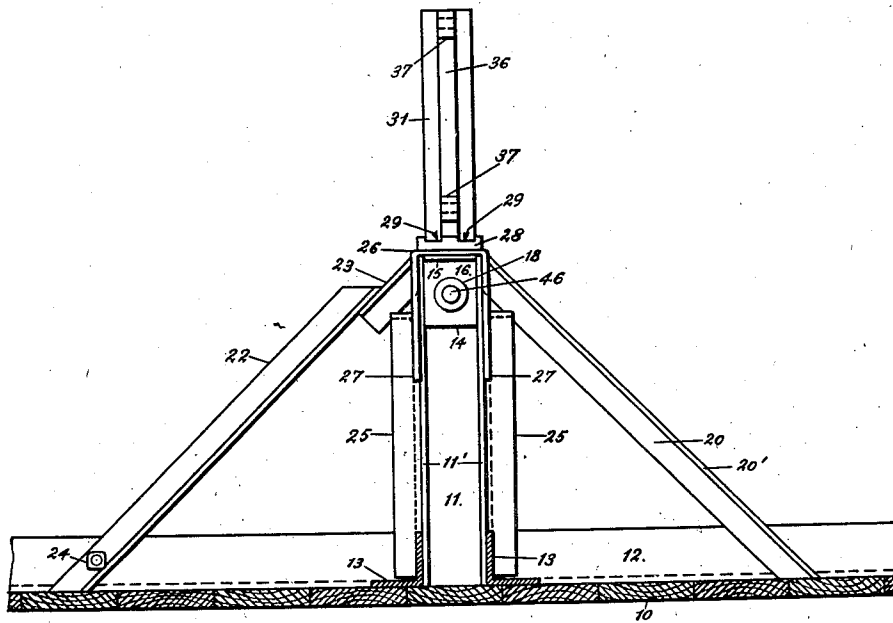


FIG. 4

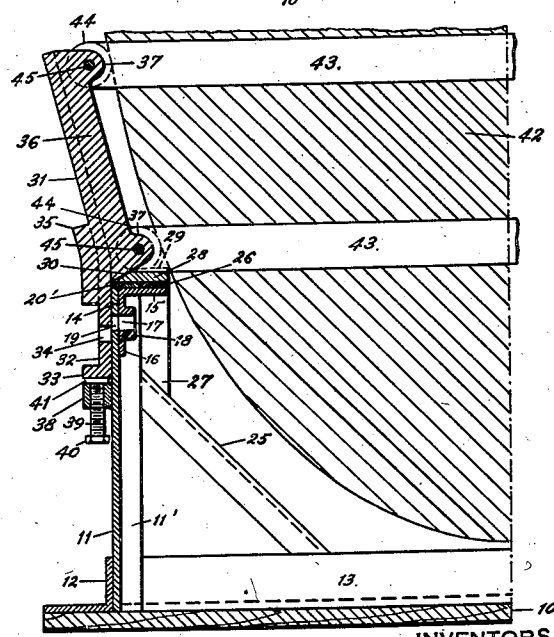


FIG. 5

INVENTORS:
BERNARD KREUTER &
DAVID G. DURYEA;
BY *Robert C. Rasche,*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,366,337

SHIPPING CRADLE AND ASSEMBLY
SUPPORT

Bernard Kreuter, Farmingdale, and David G. Duryea, New York, N. Y., assignors to Republic Aviation Corporation, a corporation of Delaware

Application July 21, 1943, Serial No. 495,670

21 Claims. (Cl. 248—119)

This invention relates to cradles for the support in shipment, as well as during any subsequent assembly and adjustment, of mechanical structures or articles in such manner that the structure or article when crated or encased is firmly and rigidly supported out of contact with, or even close proximity to, any of the parts, walls or surfaces of the enclosing container. This cradle is intended to continue the proper support of the structure or article after the surrounding container has been removed so that additional or cooperating parts may be attached to or assembled with the supported structure or article or so that any adjustments or inspections may be made. In short, the combining of the present cradle with a container not only creates a package wherein the enclosed structure or article is supported out of contact with any of the walls or elements of the container, but also one which encompasses within its confines all of the necessary elements of an assembly jig and work support.

While the present invention may be used and applied to the shipment and subsequent assembly and adjustment of mechanical structures or articles in general it is primarily intended for the crating and shipping of airplane fuselages and for the proper support of the fuselage when the crate is removed from around it and during the assembly therewith of the engine, empennage and wings and while adjustments thereof are being made.

With the above and other objects in view, as will be apparent, this invention consists in the construction, combination and arrangement of parts, all as hereinafter more fully described, claimed and illustrated in the accompanying drawings wherein:

Fig. 1 is an end elevation of the bottom of a container with the present cradle attached to inner face thereof, a fuselage, pertinent fuselage parts and wing roots being shown in broken lines to indicate the cooperation between the cradle and the fuselage:

Fig. 2 is an exterior side elevation of one of the cradle uprights and associated parts illustrating its position relative to the wing hinge fitting on one side of the fuselage:

Fig. 3 is a vertical section taken along line 3—3 of Fig. 1 and in effect comprises an interior side elevation of one of the uprights of the cradle taken in a direction opposed to that of Fig. 2:

Fig. 4 is a central vertical section through one of the uprights of the cradle showing its elements

in the upper of their two predetermined positions; and

Fig. 5 is a like view illustrating the elements of the upright in the opposite or lower of their two predetermined positions.

A proper understanding of the present invention and its utility on reaching the destination can be derived from a consideration of the field assembly of airplanes. Prior to shipment, the plane is separated into its component parts, viz.: fuselage, wings, or wing sections, empennage and engine and these parts are cased or crated and shipped to the field where they must be assembled into a complete plane. Sometimes this field assembly is done at points remote from shops, hangars, cranes and hoists, and in any event, it is desirable to accomplish it with the least possible equipment and labor. The present invention in addition to supporting and holding the fuselage within the container during shipment continues such support after the container has been removed from around the fuselage and during the subsequent assembly of the plane and adjustments thereof. In this sense the present invention acts as an assembly jig and work support thereby eliminating the use or necessity of cranes, hoists and other assembly equipment regardless of where or under what conditions the assembly and adjustment takes place.

Reference now being had more particularly to the drawings, 10 designates the bottom of any standard shipping container. The usual sides, ends and top (not shown) can be associated with this bottom 10 to create a complete shipping container.

To the inner surface of the bottom 10 is attached the cradle forming the subject matter of the present invention and designed and intended to support the fuselage or other structure or article out of all contact with surrounding container elements during shipment and to continue this support, in either of two predetermined positions, after the sides, ends and top of the container have been disassociated with the bottom 10.

This cradle consists of a pair of vertical uprights 11, each being a channel bar, spaced one from the other and aligned one with the other transversely of the bottom 10, the side webs 11' thereof extending inwardly of the side edges of the bottom. At their lower ends the uprights 11 are braced by and attached to the base angle bar 12, one side of which is welded or otherwise attached to the lower end of the outer face of the upright 11 while its other arm is attached,

in any suitable manner, to the inner face of the bottom 10. Interposed between the two uprights 11 are a pair of spacing members 13, each in the form of an angle bar, having one of its arms flush against and welded to the adjoining webs 11' of the uprights 11 and its other arm resting on the inner surface of the bottom 10, where it may be secured if desired. The terminals of these spacing members 13 are also welded or otherwise attached to vertical sides of the base bars 12. Thus the uprights 11, the base bars 12 and the spacing members 13 are combined into a unitary frame structure with the uprights spaced one from the other transversely of the bottom 10 and firmly held in their vertical positions.

An angle 14 is welded or otherwise permanently secured to the inner face of each upright 11 and is so positioned between the side webs 11' thereof adjoining the upper extremity of the upright that the outer surface of the horizontal arm 15 of the angle rests coplanar with the upper end of the upright. The vertical arm 16 of the angle 14 is flush against the inner surface of the upright 11 and for all intents and purposes is integral therewith. An opening 17 is centrally formed with the vertical arm 16 of the angle 14 and is aligned with the threaded passage of a nut 18 welded to or integral with the outer surface of the arm 16. A similar opening 19 is formed in the upright 11 in registration with the opening 17 and the threaded passage of the nut 18. It is manifest that the angle 14, nut 18 and upright 11 may be made in a single piece and that when constructed as herein shown and described, these elements are, in effect, a single unitary, integral structure.

To brace each upright 11 longitudinally of the bottom 10, a longitudinal brace 20 cooperates with the upright 11 between its upper end and the base bar 12 and comprises a single section of angle iron 20 extending from the base bar 12 on one side of the upright and terminating in a relatively short stub 23 on the opposite side of the upright. An extension or continuation brace member 22 is lightly welded to this stub 23 at one end and is bolted, as at 24, to the vertical side of the base bar 12 at its other end. Intermediate of its ends the horizontal side 20' of this brace 20 passes over and rests flush against the upper face of the horizontal arm 15 of the angle 14. The vertical side of the brace 20 is cut away to accommodate the upright 11 and to permit the necessary bending of the brace, the edges 21 of this cutaway portion abutting the webs 11' of the upright 11 where they are welded or otherwise permanently secured. The end of this longitudinal brace 20 opposed to the stub 23 is located to the rear of and is attached to the vertical side of the base bar 12 by any practical means.

Thus when the cradle is functioning as a jig or work support during assembly and adjustments after shipment, as will be more fully referred to hereinafter, the extension brace member 22 may be displaced by removing the bolt or bolts 24 and breaking the weld connecting it to the stub 23. This allows greater access to the fuselage during assembly and adjustment without materially weakening the cradle structure when serving as a jig or work support. It is apparent that the stub 23 and the extension or continuation brace 22 may be of a single piece so that the construction of the longitudinal brace on one side of the upright 11 is an exact duplicate

of that on the other side of the upright. This can be accomplished by extending the stub 23 to terminate adjoining the base bar 12 where it is secured exactly as is the opposite end of the longitudinal brace.

For the purpose of reinforcing the upright transversely of the bottom 10, lateral braces 25 extend from the upper end of each upright 11 inwardly and downwardly to the spacing members 13. The outer end of each lateral brace rests against the outer face of one of the webs 11' of the upright while its inner end rests against the outer face of the vertical side of one of the spacing members 13. The ends of each brace are welded or otherwise secured to the coacting elements. Two braces 25 are provided for each upright 11, one extending between each web 11' of the upright and the corresponding vertical side of one of the spacing members 13.

Thus a cradle frame is created for mounting on the inner face of the bottom 10 and constituting a pair of uprights 11 spaced one from the other transversely of the bottom 10 and rigidly held in their respective positions by braces that counteract all strains and stresses on the uprights either during shipment or subsequent assembly and adjustment operations. The positioning of the uprights 11, spacing members 13, and base bars 12 creates a substantially U-shaped cradle frame while the interconnections between these elements and between them and the braces 20 and 25 results in a unitary frame structure which may, if desired, be placed on or removed from the bottom 10, or erected and assembled independently of said bottom, if that be desired.

A continuation of that portion of the horizontal side 20' of the longitudinal brace 20 that passes over and rests flush on the horizontal arm 15 of the angle 14 is provided in the base of the U-shaped plate 26 which rests upon the upper or outer surface of the horizontal arm 15 of the angle 14 in the same plane as the portion of the horizontal side 20' of the brace 20 coacting with the arm 15. The sides 27 of this U-plate 26 extend downwardly to points adjacent to lateral braces 25 to which they may be secured by welding or otherwise. This U-plate 26 in forming a continuation of the portion 20' of the longitudinal brace 20 creates an enlarged bearing surface at the upper extremity of the upright 11 (the utility of which will be apparent), that is thoroughly braced and supported by the upright 11, the longitudinal brace 20 and the lateral brace 25. If desired or found to be more practical the U-plate 26, or at least the base thereof, can be made integral with the longitudinal brace 20.

Resting upon the combined outer surfaces of the longitudinal brace 20 and U-plate 26 and above the horizontal arm 15 of the angle 14 is a pillow block 28 secured to or mounted upon the members 20 and 26 in any suitable manner. This block 28 if desired, may be removably mounted by any of a number of well known mechanical expedients but for the present purposes it is preferred to have it permanently secured in its operative position and to that end it is welded to its supporting elements. For the reception and seating of the wing hinge fittings of a fuselage, as will be hereinafter more specifically described, the upper surface of the block 28 is provided with one or more parallel grooves 29, one constituting a seat for each projecting and coacting part of the hinge fitting. That end of the pillow block 28 in approximate alignment with the upright 11 is beveled, as at 30, to provide a supporting

surface for the lower end of the elevator bracket 31.

An elevator plate 32 is positioned flush against the outer surface of the upright 11 adjoining its upper end and is capable of movement relative to said upright between two predetermined positions. The lower terminal of this plate 32 is provided with an outstanding abutment member or flange 33. An opening 34 pierces the body of the plate 32 to register with the openings 17 and 19 and with the nut 18 when the plate is in one (the upper) of its predetermined positions.

The elevator bracket 31 is carried at the upper end of the elevator plate 32 and is formed integrally therewith. It may, of course, form a direct continuation of the plate 32 by lying in the plane thereof, or it may, as illustrated, lie at an angle to the plane of the plate 32 to accommodate any bulge or outward flare of the structure or article to be supported. To strengthen the plate 32 and the bracket 31 and especially the junction between the two, an outwardly projecting rib or fin 35 is created on the outer surfaces thereof spanning their junction medially of the width thereof.

On its inner face the bracket 31 has formed an integral, projecting, longitudinal relatively heavy rib 36 with an apertured ear 37 at each end. These members 36 and 37 in combination provide the means whereby the fuselage is secured to and mounted between the brackets 31.

A bearing or stud 38 is formed on the outer surface of the upright 11 below the lower extremity of the elevator plate 32 and has a threaded opening therein. Operating in this threaded opening is a threaded rod 39 having a faced head 40 at its outer or lower end and a contact plate 41 at its upper end to contact with the abutment flange 33 of the elevator plate 32. Thus the rotation of the rod 39 in one direction moves the elevator plate 32 and bracket 31 in one direction while the reverse movement of the rod 39 permits these elements to move in a reverse direction. As will be seen this movement is for the purpose of positioning the bracket 31 and plate 32 in either of two predetermined positions, viz.: an upper position and a lower position.

The functions, purposes and operation of the present invention will be described in conjunction with the fuselage of an airplane though it is manifest that it can readily be applied to other structures and articles, where it is desired to support them out of all contact with the surrounding container and to perform assembly and adjustment operations after shipment, without departing from the spirit and scope thereof.

In the drawings 42 denotes the fuselage of an airplane having the transverse spars 43 spanning the fuselage and each terminating at its ends in the parallel apertured wing hinge fittings 44 on the exterior of the fuselage. The bracket 31 of the present cradle coacts with the fittings 44 by the insertion of one of the ears 37 between each pair of fittings 44 and the placing of a suitable hinge pin 45 through the registering openings of the fittings 44 and ears 37. Thus an elevator bracket 31 is removably affixed to each side of the fuselage 42. The angle the brackets 31 occupy with respect to their individual plates 32 corresponds generally to the outward flare or bulge of the fuselage and tends to situate the plates 32 approximately flush against the outer surfaces of the two uprights 11 with the abutments 33 thereof above and preferably in engagement with the contact plates 41 of the

threaded rods 39. The rods 39 may then be rotated to move in an upward direction until the openings 34 of elevator plates 32 align with the registered openings 17 and 19 of the arm 15 of the angle 14 and the upright 11 respectively and of necessity with that of the nut 18. The registration of these openings on each side of the cradle permits the master bolts 46 to be inserted therein and threaded home into the nuts 18. In this manner, the fuselage is suspended between the elevator brackets 31 not only out of contact with the pillow blocks 28 but also out of contact with bottom 10 of the container and with the sides, ends and top of the container that may be associated with the bottom 10.

While the cradle and associated elements will satisfactorily hold the fuselage 42 during shipment, a tripod 47 can, if desired, be interposed between and fixed to the tail of the fuselage and the bottom 10. This, among other things, will eliminate or overcome any tendency on the part of the fuselage to create a torque on hinge fittings 44 of the fuselage and the ears 37 of the elevator brackets 31, thereby adding to the security of the mounting.

After the sides, ends and top of the container have been removed from around the fuselage 42, the tripod 47 is removed and while the fuselage is still supported or suspended between the elevator brackets 31 the engine and empennage may be put in place and such adjustments made as are desirable.

The master bolts 46 may thereupon be removed and the rods 39 rotated to move in a downward direction permitting the brackets 31 and plates 32 to lower under the weight of the fuselage until the projecting ends or wing hinge fittings 44 of the spars 43 seat in the grooves 29 of the pillow blocks 28. The hinge pins 45 and associated parts passing through the apertures of the ears 37 of the elevator brackets 31 and the co-operating wing hinge fittings 44 are then removed which permits the complete removal of the elevator parts from cooperation with the fuselage and allows the wings to be attached to the fuselage while it remains supported by the uprights 11 and on the pillow blocks 28.

At the time the sides, ends and top of the container are disassociated from the bottom 10 and before any assembly or adjustment takes place, the extension brace members 22 may be removed as above described thereby providing additional clearances and greater access to the fuselage 42.

From the foregoing it is manifest that the present cradle embodies an elevating and supporting structure which will occupy either of two predetermined positions: the first or upper for the support of the fuselage in shipment independently of the sides, ends and top of the container and during partial assembly after shipment; and the other or lower for the support of the fuselage during the completion of the assembly and adjustment. It is apparent that this assembly and adjustment is accomplished without the use of the usual shop equipment such as stands, hoists, cranes, etc. Furthermore the present cradle rigidly and firmly supports the fuselage out of contact with all parts of the container in which it is shipped and permits the same to be erected about the fuselage in association with the bottom 10 without injury to the fuselage or to be disassociated from the bottom 10 without affecting the support of the fuselage.

What is claimed is:

1. A supporting cradle comprising a pair of uprights, transverse spacing members interposed between and secured to said uprights, brackets at the upper ends of said uprights embodying means for suspending a fuselage between and upon the upper ends of said uprights, and elevating and lowering means cooperating with said brackets for positioning them and the suspended fuselage in either of two predetermined positions.

2. A supporting cradle comprising a pair of uprights, transverse spacing members interposed between and secured to said uprights, brackets associated with the extremities of said uprights embodying means for engaging a fuselage therebetween and suspending it between the uprights, elevating and lowering means associated with said brackets for positioning them and the engaged fuselage in either of two predetermined positions, and means for entirely supporting the fuselage independently of said brackets in one of said predetermined positions.

3. A supporting cradle comprising a pair of uprights, spacing members interposed between and secured to said uprights, brackets associated with said uprights embodying means for engaging a fuselage therebetween and means coacting with said brackets for positioning them and the engaged fuselage in either of two predetermined positions.

4. A supporting cradle comprising a pair of uprights, spacing members interposed between and secured to said uprights, brackets associated with said uprights, embodying means for engaging a fuselage therebetween, means coacting with said brackets and said uprights for positioning them and the engaged fuselage in either of two predetermined positions, and means for supporting the said fuselage entirely on said uprights in one of said predetermined positions thereby permitting the complete disengagement of the brackets from the fuselage.

5. A supporting cradle comprising a pair of uprights, transverse spacing members interposed between and secured by said uprights, brackets associated with said uprights embodying means for engaging a fuselage therebetween, means coacting with said brackets for positioning them and the fuselage engaged thereby in either of two predetermined positions, locks to fix the brackets in one of these predetermined positions, and means for supporting the fuselage entirely on the uprights in the other of said positions thereby permitting the complete disengagement of the brackets from the fuselage.

6. A supporting cradle comprising a pair of uprights spacing members interposed between and secured to said uprights, brackets associated with said uprights and embodying means for engaging a fuselage therebetween, an elevating plate cooperating with each of said brackets and its upright, and means coacting with each plate for positioning it and its bracket in either of two predetermined positions.

7. A supporting cradle comprising a pair of uprights, spacing members interposed between and secured to said uprights, brackets associated with said uprights and embodying means for engaging a fuselage therebetween, an elevating plate cooperating with each of said brackets and its upright, means coacting with each plate for positioning it and its associated bracket in either of two predetermined positions, and a lock for

fixing said plate and bracket in one of said positions.

8. A supporting cradle comprising a pair of uprights, spacing members interposed between and secured to said uprights, a bracket associated with each of said uprights embodying means for engagement with a fuselage, an elevating plate individual to each bracket and its upright, means coacting with each plate for positioning it and its bracket in either of two predetermined positions, a releasable lock for fixing each plate and its bracket in one of said positions, and means whereby the fuselage may be entirely supported on said uprights in the other of said positions thereby permitting disengagement thereof by the brackets aforesaid.

9. The combination with a pair of spaced uprights, of a bracket associated with each of said uprights having means for engaging one side of an article, and means coacting with each bracket for positioning it in either of two predetermined positions, whereby the article is supported entirely by the bracket in one of such positions and by its upright in the other of said positions.

10. The combination with a pair of spaced uprights, of a bracket associated with each of said uprights and embodying means for engaging one side of a fuselage, means coacting with each bracket for positioning it and the engaged fuselage in either of two predetermined positions, whereby the fuselage is supported entirely between the brackets in one of said positions and directly upon the uprights in the other of said positions, and means whereby the fuselage may be entirely disengaged from the brackets in the last of said two positions.

11. The combination with a pair of spaced uprights, of a bracket associated with and lying generally above the extremity of each upright and including means to engage one side of a fuselage, a plate coacting with one end of each bracket and resting flush against the cooperating upright for movement relative thereto, said plate and upright having registerable openings therein, a fixed nut on the face of the upright opposed to the plate with its threaded passage in alignment with the opening in the upright, a supporting member extending at right angles to the upper extremity of each upright, a stud on the face of the upright coacting with the plate, means operating in said stud capable of abutment with said plate for positioning it and its associated bracket with respect to said upright, and means to be inserted in the registered openings aforesaid for threaded engagement with the aligned nut to secure the plate and its bracket in one position on said upright.

12. The combination with a pair of spaced uprights, of a bracket associated with and lying generally above the extremity of each upright and including means of engagement for one side of a fuselage, a plate coacting with one end of each bracket and resting flush against the cooperating upright for movement relative thereto, said plate and upright having registerable openings therein, a nut fixed on the face of the upright opposite that cooperating with the plate—the passage of the nut being aligned with the opening in the upright, an abutment at the lower end of the plate, a stud on said upright below said plate having a screw threaded through it for contact with the abutment, whereby the plate, bracket and engaged fuselage may be moved to an upper position with aforesaid openings and nut in registration or moved to a lower position, a bolt for

passing through the aligned openings aforesaid for engagement with said nut when the elements are in their upper position, and a support disposed angularly to the upper extremity of the upright to lie under and support one side of the fuselage when the bracket and associated plate are in their lower position.

13. The combination with a pair of spaced uprights, a bracket associated with and generally above the extremity of each upright including means of engagement for one side of a fuselage, a plate coacting with one end of each bracket and resting flush against the cooperating upright for movement relative thereto, said plate and upright having registerable openings therein, a nut fixed on the face of the upright opposite that cooperating with the plate the passage of the nut being in alignment with the opening of the upright, an abutment at the lower end of the plate, a stud on said upright below said plate, having a screw threaded through it for contact with the abutment, whereby the plate, bracket and engaged fuselage may be moved to an upper position with aforesaid openings and nut in registration or moved to a lower position, a bolt to pass through the aligned openings aforesaid for engagement with said nut when the elements are in their upper position, a support disposed at right angles to the upper extremity of each upright on the opposite side thereof to the plate and bracket, and a pillow block on each support upon which the fuselage rests when the plates and brackets are in their lower position, thereby permitting the disengagement and removal of the brackets.

14. The combination with a fixed upright, of a bracket associated with one end of said upright, means whereby said bracket may engage and support an article, a plate secured to said bracket and mounted for movement relative to said upright, means to move said plate and bracket to occupy either of two predetermined positions with respect to said upright, and means whereby the article may be entirely supported independently of the bracket in one of said positions.

15. A cradle, comprising: a pair of spaced uprights, spacing members interposed between and secured to the lower ends of said uprights, base members transverse to said spacing members at the lower ends of said uprights and secured to said uprights and spacing members, longitudinal braces between the upper ends of the uprights and the base members, means whereby a section of the longitudinal braces associated with each upright may be removed and lateral braces between the upper ends of the uprights and the spacing members.

16. A cradle, comprising: a pair of spaced uprights, spacing members interposed between said uprights, parallel base members at the lower ends of the uprights transverse to said spacing members, longitudinal braces between the upper ends of said uprights and said base members, lateral

braces between the upper ends of said uprights and said spacing members, means for supporting an article at the upper ends of said uprights, and means whereby a section of the longitudinal braces associated with each upright may be removed without affecting the support of the article by the uprights.

17. A supporting cradle comprising a plurality of uprights, a frame structure bracing and spacing said uprights, means coacting with said uprights for supporting an article therebetween, and means whereby said supporting means may occupy either of two positions with respect to said uprights.

18. A supporting cradle comprising a plurality of uprights, brackets associated with said uprights embodying means for engaging and supporting a fuselage therebetween, means whereby said brackets and supported fuselage may be moved to either of two positions with respect to said uprights, and means for supporting said fuselage independently of said brackets in one of said positions.

19. The combination with a platform, of a cradle fixed to said platform to constitute a shipping support and an assembly jig comprising spaced uprights, supporting means cooperating with said uprights to coact with the wing hinge fittings of an aircraft fuselage, means for positioning said supporting means in one of two predetermined positions relative to the uprights for supporting said fuselage from the wing hinge fittings during shipment and preliminary assembly after shipment, and means for moving said supporting means to the other of said predetermined positions to support the fuselage from the wing hinge fittings during the attachment of the wings thereto.

20. The combination with the bottom of a shipping case, of a cradle fixed to the inner face of said bottom to constitute a shipping support and an assembly jig comprising a pair of spaced uprights, supporting means coacting with said uprights to engage the wing hinge fittings of an aircraft fuselage to support it during shipment and preliminary assembly, means embodied in said cradle and cooperating with said supporting means for supporting the fuselage after disengagement of the wing hinge fittings from the aforesaid supporting means during the attachment of wings to the wing hinge fittings.

21. A unitary supporting cradle comprising a pair of uprights, transverse members spacing and securing said uprights one to the other, thereby creating a U-shaped frame structure with the space between the uprights substantially unobstructed, and brackets at the upper ends of said uprights each embodying means for cooperation with one side of an aircraft fuselage thereby supporting the fuselage at the upper ends of and between said uprights.

BERNARD KREUTER.
DAVID G. DURYEA.