G. RIFFLARD.

JIG SYSTEM FOR AEROPLANE MANUFACTURE.

APPLICATION FILED NOV. 13, 1918.

1,303,596.

Patented May 13, 1919.

3 SHEETS—SHEET 1.

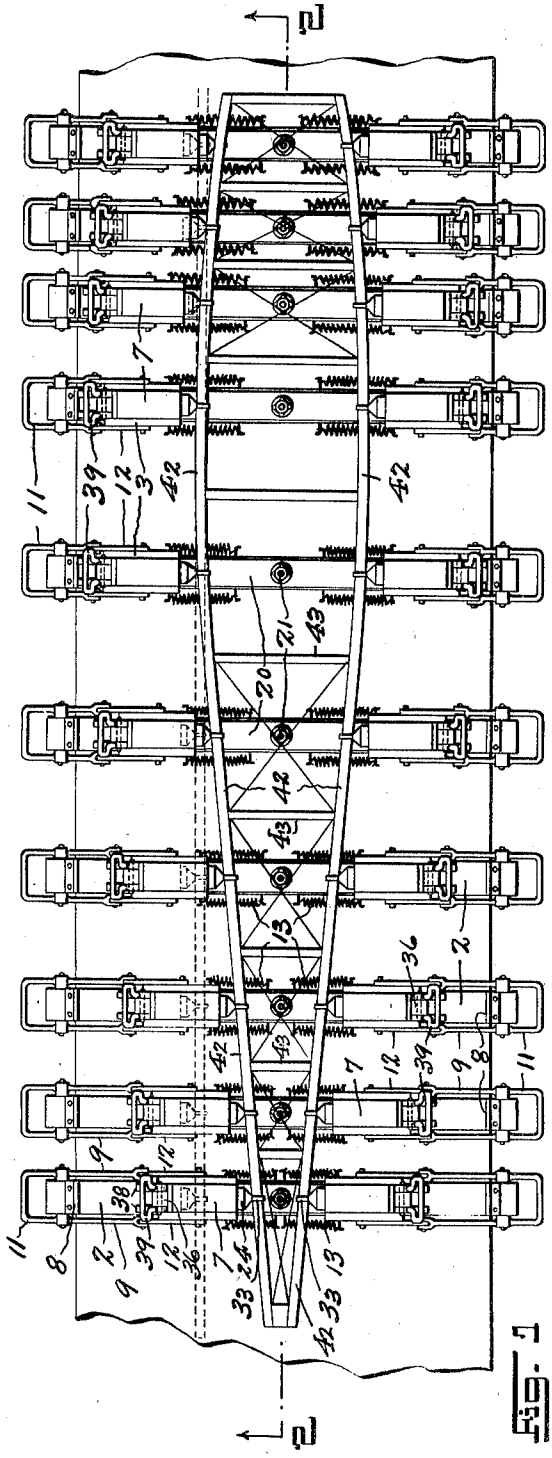


Fig. 1

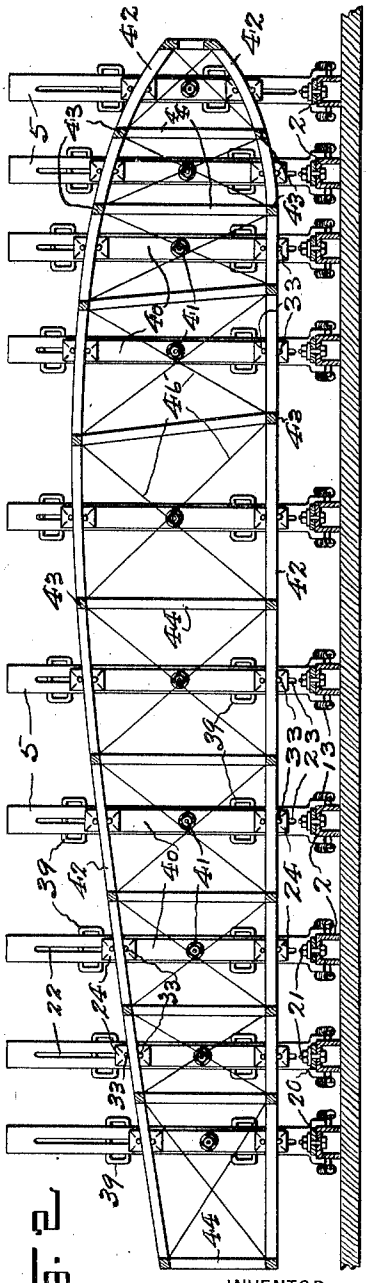


Fig. 2

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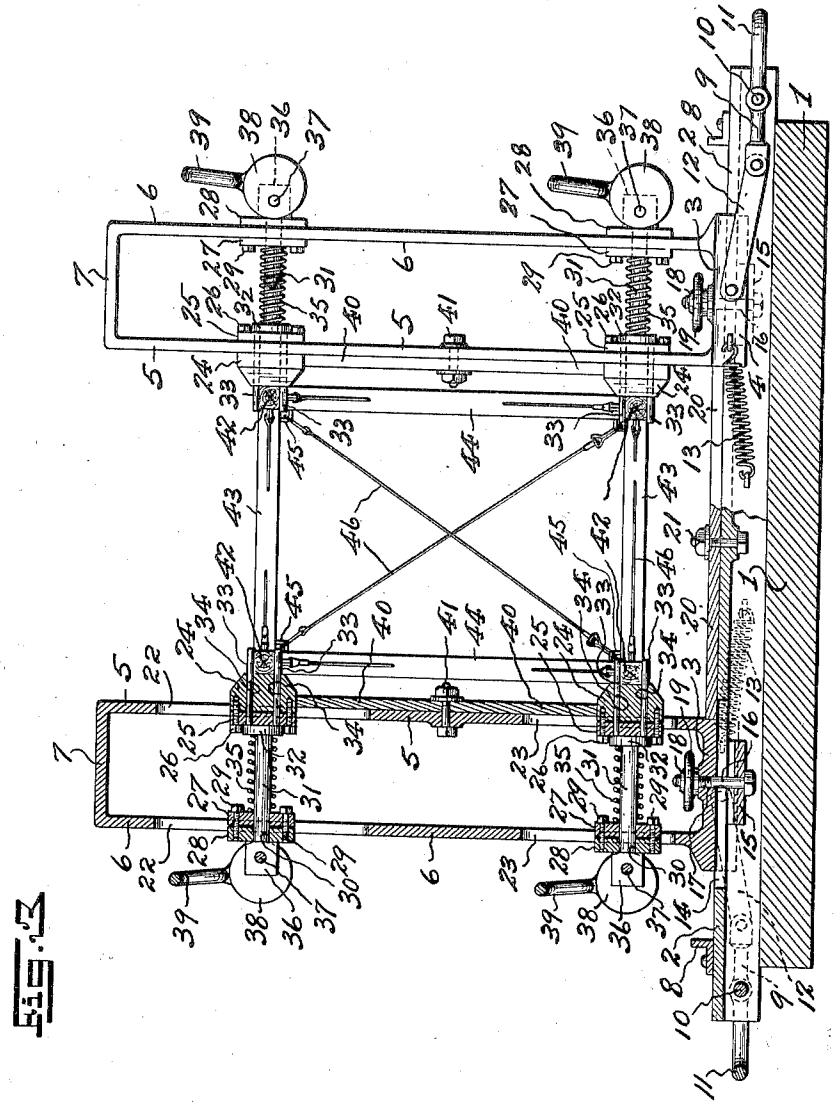


Fig. 3.

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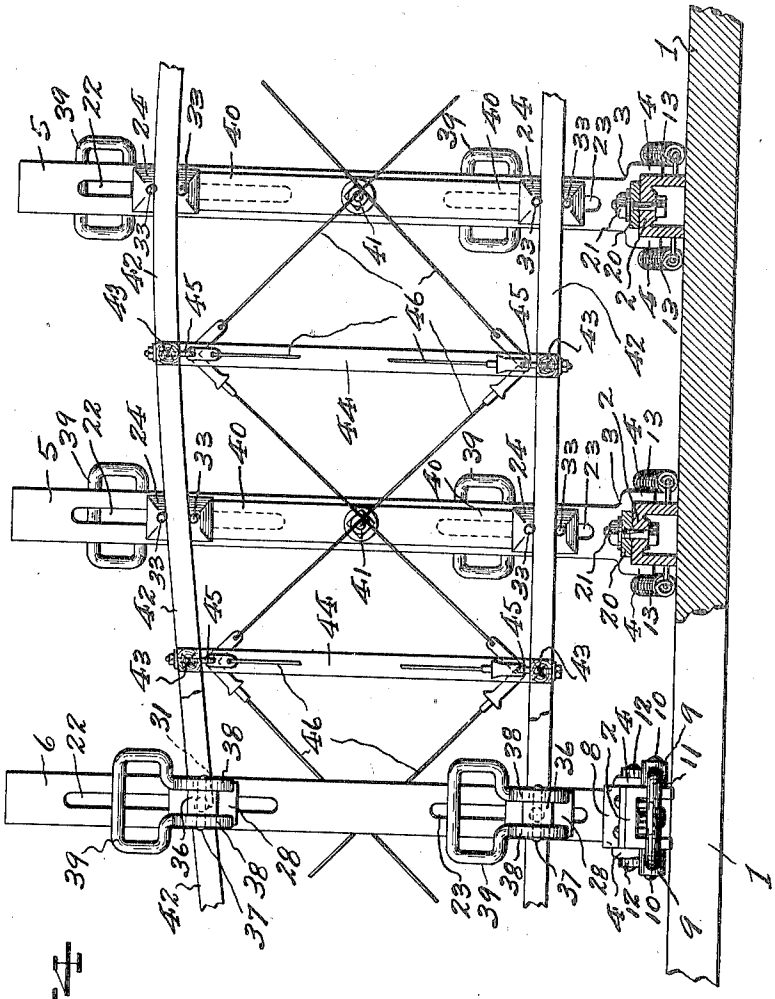


Fig. 4.

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UNITED STATES PATENT OFFICE.

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JIG SYSTEM FOR AEROPLANE MANUFACTURE.

1,303,596. Specification of Letters Patent. Patented May 13, 1919.

Application filed November 13, 1918. Serial No. 262,290.

To all whom it may concern:

Be it known that I, GEORGES RIFFLARD, a citizen of the Republic of France, residing at New York, in the county of Bronx and State of New York, have invented certain new and useful Improvements in Jig Systems for Aeroplane Manufacture; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

The present invention relates, generally, to mechanism for use in the manufacture and construction of body frames or fuselages for aeroplanes; and the invention has reference, more particularly, to a novel construction and system of jigs for forming and assembling the elements of a body frame or fuselage of an aeroplane.

The invention has for its principal object to provide a novel construction and arrangement of jigs, adapted to be mounted upon a suitable work-bench, and which are operatable to bend the longitudinal chords of the aeroplane frame-work or fuselage into proper shape, and then correlate the same with each other so that the stanchions and stretchers may be properly assembled therewith ready for the attachment of the wire ties or truss members which are adapted to secure the elements of the frame-work or fuselage in assembled relation. The use of the novel construction of jigs results in a great saving of time and labor in the consummation of the work of assembling an aeroplane body frame-work or fuselage, and also permits of the employment of unskilled labor for such work in place of the heretofore necessary highly skilled labor.

Other objects of the present invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

With the various objects of the present invention in view, the same consists, primarily, in the novel arrangement and construction of jigs, for the purposes above mentioned, hereinafter set forth; and, the invention consists, furthermore, in the novel arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same, all of which will be more fully described in the following specification, and then finally embodied in the claims appended thereto.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a top or plan view of my novel construction and system of jigs, illustrating how the same are employed in assembling the elements of an aeroplane frame-work or fuselage.

Fig. 2 is a vertical longitudinal section through the same, taken on line 2—2 in said Fig. 1.

Fig. 3 is a transverse or cross-section, drawn on an enlarged scale, and showing a jig element on one side in vertical section, while the opposite jig element is shown in side elevation.

Fig. 4 is a detail view showing in part side elevation and in part longitudinal vertical section a portion of the system of novel jig elements, said view being also drawn on an enlarged scale.

Similar characters of reference are employed in all of the hereinabove described views to indicate corresponding parts.

Referring now to the said drawings, the reference character 1 indicates a suitable bench or work-table upon which the novel construction and arrangement of jig elements are mounted. The said jigs are mounted or arranged in transversely disposed sets, longitudinally spaced apart at proper intervals. Each jig set comprises a transverse rail 2, preferably constructed of channel iron, fixed with its channeled side downward to extend across the bench or table 1, with its ends projecting slightly beyond the side marginal edges of said bench or table. Mounted upon said rail, for slidable movement thereon, are a pair of opposed jig standards or frames, each comprising a base-portion 3 having side flanges 4 adapted to embrace said rail 2, and upright members 5 and 6 extending upwardly from said base-portion in suitably spaced relation one to the other, the same being connected together at their upper ends by means of a horizontal portion 7. Secured upon said rail 2 in the rear of each jig standard or frame, are stop-devices 8 against which the jig standards or frames are brought to rest, when retracted, to determine their normal initial positions. The means for imparting the sliding movement of said jig standards or frames upon said rail comprise lever means

9 pivoted to each end of said rail by means of the transverse shafts 10 extending through the latter. Said lever means 9 are provided with hand-grasps or operating handles 11 which are yoke-shaped so as to extend around the ends of the rail. Interconnecting the free ends of said lever means 9 with the base-portions of said jig-standards or frames are connecting-links 12. Pull spring means 13 are provided for assisting the forward operative sliding movement of said jig standards or frames on said rail, the same being anchored by one of their ends to an intermediate portion of said rail and by the opposite ends to the base-portions of said jig standards or frames.

In order to lock said jig standards or frames in their forwardly moved operative position, there is provided in said rail 2 beneath each base-portion 3 of each jig standard or frame a longitudinally extending slot 14. Arranged in the channel of said rail 2, beneath each jig standard or frame, is a clamp plate 15, through which extends a bolt 16, the shank of which projects upwardly through said slot 14, and thence through an opening 17 provided in the base-portion 3 of each jig-standard or frame. The upper end of said bolt shank is threaded to receive a lock-nut element 18 provided with the hand-wheel flange 19 for manipulating the same. By screwing down the lock-nut element 18 the clamp-plate 15 is drawn upwardly and the base-portion 3 of the jig-standard or frame is forced downwardly into frictionally bound or clamped relation to said rail 2, thereby locking the jig-standard or frame immovably to and upon said rail.

In order to determine the proper amount of inward or forward movement of the jig standards or frames, when sliding the same to operative position, there is provided in connection with said rail 2, intermediate the opposed jig standards or frames, a templet member or stop-plate 20, the same being secured in fixed relation to the rail 2 by means of a nut and bolt 21, or any other suitable fastening means.

The uprights 5 and 6 of each jig standard or frame are provided with upper vertical slots 22 and lower vertical slots 23. The upper slots 22 of the respective uprights are alined opposite to each other, and in the same manner the lower slots 23 are likewise alined opposite to each other. Arranged in connection with said upright 5 of each jig standard or frame, in association with the upper slot 22 thereof, for vertical adjustment relative to the jig standard or frame, is a guide-block comprising two members 24 and 25, which are secured together by clamp screws 26 for clamping said two members together in proper adjusted position relative to the upright 5. In like manner, arranged in connection with said upright 6 of each jig standard or frame, in association with the upper slot 22 thereof, for vertical adjustment relative to the jig standard or frame, is a guide-block comprising two members 27 and 28, which are secured together by clamp-screws 29 for clamping said two members together in proper adjusted position relative to the upright 6. The respective guide-blocks comprised by the parts 24 and 25 and 27 and 28 are adjusted and arranged in relative horizontal alinement one with the other. Said guide-block comprised by the parts 27 and 28 is provided with an opening 30 in which is slidably mounted a stem or shank 31, provided at one end with an annular collar or flange 32 from which project outwardly a pair of fork-arms 33 slidably disposed in openings 34 provided in the guide-block comprised by the parts 24 and 25. A compression spring 35 arranged about said stem or shank 31 between the guide-block comprised by the parts 27 and 28 and the collar or flange 32 tends to normally force said stem or shank forward to project said fork-arms 33 normally outward from the outer face of said guide-block comprised by the parts 24 and 25. Connected with the rearward end of said stem or shank 31 is a head 36 which normally rests against the outer face of said guide-block comprised by the parts 27 and 28. Extending transversely through said head 36 is a wrist-pin 37. Pivoted on each end of said wrist pin 37, so as to be disposed one on each side of said head 36 are a pair of eccentric cams 38. Said cams are interconnected together, for simultaneous operation, by means of a lever loop 39 whereby the cams are operated. The said cams bear with their peripheries against the outer face of said guide-block comprised by the parts 27 and 28, against which they thrust to impart a retracting movement to said stem or shank 31 which serves to retract said fork-arms 33 from their normal outwardly projecting position relative to said guide-block comprised by the parts 24 and 25.

Arranged in connection with said uprights 5 and 6, in association with the respective lower slots 23 thereof, is a mechanism similar to that immediately above described, as will be apparent from an inspection of the drawings, wherein similar characters of reference are employed to indicate the same detail structure of said mechanism.

For convenience the above mentioned mechanisms may be respectively referred to, generally, hereinafter by the terms "upper fork mechanism" and "lower fork mechanism".

In order to normally determine and fix the positions of said upper fork mechanism and lower fork mechanism relative to each other and to the jig standards or frames

upon which they are mounted, there is provided in connection with each upright 5, of each jig standard or frame, a templet member or stop plate 40, which is fixed upon said upright 5 intermediate the respective upper fork mechanism and lower fork mechanism by means of a nut and bolt 41, or by any other suitable fastening means.

The above description defines the detail structure of one jig set. In practice a plurality of such jig sets are utilized all constructed in like manner.

The jig sets are mounted on the bench 1 in a spaced relation one to the other adapted to best position the same to produce, when operated, the desired curved contour in horizontal plane desired to be produced in the longitudinal chords of an aeroplane body-frame or fuselage. The respective upper fork mechanism and lower fork mechanism of each jig standard or frame, are normally fixed in vertically adjusted position relative to each other adapted to best position the same to produce, when operated, the desired curved contour in vertical plane desired to be produced in the longitudinal chords of an aeroplane body-frame or fuselage.

In operation, the jig sets, thus arranged, are employed in the following manner:—

When operations are begun, the jig standards or frames of each set, are retracted to normal initial positions against their respective stops 8. This results in positioning the jig standards or frames on each side of the sets thereof in relative straight alinement one with the other in a vertical plane, as shown by the dotted representation of portions of said parts illustrated in Fig. 1 of the drawings.

The templet members or stop plates 40 of each jig standard or frame are of predetermined size or length so as to position the upper fork mechanisms of each jig set relative to the upper fork mechanisms of the other jig sets to produce the vertical plane curvature desired to be imparted to certain of the longitudinal chords of the aeroplane body frame or fuselage, and in like manner, the templet members or stop-plates 40 provide a positioning guide for determining the position of the lower fork mechanisms of each jig set relative to the lower fork mechanisms of the other jig sets to produce the vertical plane curvature desired to be imparted to certain of the other longitudinal chords of the aeroplane body-frame or fuselage. The respective upper and lower fork mechanisms of each jig set are adjusted on the jig standards or frames in stepped relation to said templet members or stop-plates 40, and are then immovably fixed in such positions by clamping the guide-blocks comprised by the parts 24 and 25 and 27 and 28 upon the respective uprights 5 and 6 in such positions.

When thus positioned the eccentric cams 38 are manipulated to retract the stem or shank 31 to withdraw the fork arms 33 from projection beyond the face of the guide-blocks comprised by the parts 24 and 25.

The workmen, preferably two upon each side of the bench and jig sets, now take a length of straight material from which a longitudinal chord 42 for the aeroplane body-frame or fuselage is to be formed, and positioning the same relative to the inner faces of the jig standards or frames, begin to apply the same to the jigs. Preferably, the workmen begin the work at the intermediate jig set which determines the highest point of the curve to be formed, and operate the upper fork mechanism of said jig set to project the fork arms 33 to embrace the chord material at such point. Each workman now proceeds to work toward the respective free ends of the chord material, and by bearing down on the latter registers or alines the same with the upper fork mechanism of the next adjacent jig set, thus beginning the curvature desired to be imparted to the chord material. When the chord material is thus positioned and alined opposite the upper fork mechanism of the next adjacent jig set, the workman operates the eccentric cam mechanism 38 to release the stem or shank 31 from retracted position, so that the spring 35 may move the same forward to project the fork arms 33 to embrace the chord material and thus hold the same to the curvature to which it has thus been forced. Thus the workmen proceed from jig set to jig set until the ends of the chord material are reached, and it will thus be seen, that the desired curvature in vertical plane is imparted to the chord material. In the same manner, the workman operating with the lower fork mechanisms of the several jig sets impart to or set up another length of chord material in the desired curvature in vertical plane, and thus all four chord members 42 are shaped to the required curves in vertical plane.

This having been accomplished the jig sets are now operated to move the chord members into proper assembled position relative to each other, and at the same time producing therein the desired curvature in horizontal plane to which they are necessarily to be shaped. This operation is effected by placing between horizontally opposite chords 42, at an intermediate point between their ends, the stretcher members 43, then by operating the levers 9 of opposite jig standards or frames of intermediate jig sets, such jig standards or frames are carried slightly forward so as to engage the chords 42 with the ends of the stretchers 43, and stanchions 44 are engaged between the vertically opposite chords 42 at the same points ready to

have yoke-bolts 45 associated therewith for securing the parts together. The workmen now, as may be convenient, slide forward the jig standards or frames against the positioning templet members or stop-plates 20, at the same time placing in position the several stretchers 43, and stanchions 44 until the chords 42 are finally curved in horizontal plane to the shape required. It will be apparent that the throw or movement of the several jig standards or frames varies in each jig set to conform to the amount of curve at the location of each jig set, and that such throw or movement is determined by the templet member or stop-plate 20 of each jig set, said templet members or stop plates being of predetermined lengths requisite to the result required.

It will be apparent that the chord material does not have to be shaped prior to use, thus avoiding much labor heretofore required under the hand built system of fabricating aeroplane frame bodies or fuselages.

It will also be apparent that by the use of the jigs much time and labor may be saved, and also that comparatively unskilled labor may be employed in place of skilled labor.

When the chords 42, stretchers 43 and stanchions 44 have been assembled together in the jigs, as above described, the stay-wires or trusses 46 are secured in interconnecting relation with the said parts in the usual way, and after the completion of this work the jig standards or frames may be retracted on the rails 2 to normal initial position, thus releasing the completed body-frame for removal from the jigs.

I am aware that some changes may be made in the several arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same without departing from the scope of my present invention as set forth in the foregoing specification and as defined in the appended claims. Hence, I do not limit my invention to the exact arrangements and combinations of the several devices and parts as described in the foregoing specification, nor do I confine myself to the exact details of the construction of the said parts as illustrated in the accompanying drawings.

I claim:—

1. A system of jigs for assembling the elements of an aeroplane body-frame or the like comprising, a plurality of jig sets mounted in suitably spaced relation to each other, each jig set comprising a fixed rail, opposed jig standards slidable upon said rails, each jig standard having upper fork mechanisms and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body-frame in a desired produced curvature in vertical plane, and means for sliding said jig standards forwardly on said rails for producing a desired curvature of said longitudinal chords in horizontal plane and thus positioning a plurality of said longitudinal chords relative to each other for securing thereto in assembled relation therewith the stretchers, stanchions and trusses of the aeroplane body-frame.

2. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of transversely disposed jigs sets mounted in suitable longitudinally spaced relation to each other, each jig set comprising a fixed transverse rail, a pair of transversely opposed jig standards slidably mounted on said rail for movement toward each other, stop means for determining the normal retracted position of said jig standards, lever mechanism pivoted to the ends of said rail and interconnected with said jig standards for imparting movement thereto, a templet-member secured to said rail intermediate of said opposed jig standards for determining the inward sliding movement of the latter, and each jig standard having upper fork mechanisms and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body frame in a desired produced curvature in vertical plane.

3. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of transversely disposed jig sets mounted in suitable longitudinally spaced relation to each other, each jig set comprising a fixed transverse rail, a pair of transversely opposed jig standards slidably mounted on said rail for movement toward each other, stop means for determining the normal retracted position of said jig standards, lever mechanism pivoted to the ends of said rail and interconnected with said jig standards for imparting movement thereto, a templet-member secured to said rail intermediate of said opposed jig standards for determining the inward sliding movement of the latter, and each jig standard having upper fork mechanisms and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body frame in a desired produced curvature in vertical plane, each fork mechanism comprising vertically adjustable forward and rear guide-blocks in horizontal alinement, means for clamping said guide-blocks to said jig standards, a stem slidable through said rear guide-block having an annular shoulder at its forward end to abut against said forward guide-block, vertically alined fork arms slidable through said forward guide-block for projection from the outer face thereof, an eccentric cam mechanism connected with the rearward end of said stem to coöperate with said rear guide-block for retracting said

stem to withdraw said fork arms from projected position relative to said forward guide-block, and templet members fixed upon said jig standards intermediate said upper and lower fork mechanisms for determining the operative position of said fork mechanisms relative to each other and to the fork mechanisms of associated jig sets.

4. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of transversely disposed jig sets mounted in suitable longitudinally spaced relation to each other, each jig set comprising a fixed transverse rail, a pair of transversely opposed jig standards slidably mounted on said rail for movement toward each other, stop means for determining the normal retracted position of said jig standards, lever mechanisms pivoted to the ends of said rail and interconnected with said jig standards for imparting movement thereto, spring means for assisting the forward movement of each jig standard, locking mechanism for clamping said jig standards in their forwardly moved positions, a templet member secured to said rail intermediate of said opposed jig standards for determining the limits of the forward movement of said standards, each jig standard having upper and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body-frame in a desired produced curvature in vertical plane.

5. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of transversely disposed jig sets mounted in suitable longitudinally spaced relation to each other, each jig set comprising a fixed transverse rail, a pair of transversely opposed jig standards slidably mounted on said rail for movement toward each other, stop means for determining the normal retracted position of said jig standards, lever mechanisms pivoted to the ends of said rail and interconnected with said jig standards for imparting movement thereto, spring means for assisting the forward movement of each jig standard, locking mechanism for clamping said jig standards in their forwardly moved positions, a templet member secured to said rail intermediate of said opposed jig standards for determining the limits of forward movement of said standards, each jig standard having upper and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body-frame in a desired produced curvature in vertical plane, each fork mechanism comprising a horizontally movable stem having fork-arms for projection beyond the inner face of each jig standard, means for slidably supporting said stem and its fork-arms, and an eccentric cam mechanism for imparting desired movement to said stem and its fork-arms.

6. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of transversely disposed jig sets mounted in suitable longitudinally spaced relation to each other, each jig set comprising a fixed transverse rail, a pair of transversely opposed jig standards slidably mounted on said rail for movement toward each other, stop means for determining the normal retracted position of said jig standards, lever mechanism pivoted to the ends of said rail and interconnected with said jig standards for imparting movement thereto, a templet-member secured to said rail intermediate of said opposed jig standards for determining the inward sliding movement of the latter, each jig standard having upper fork mechanisms and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body frame in a desired produced curvature in vertical plane, each fork mechanism comprising a horizontally movable stem having fork-arms for projection beyond the inner face of each jig standard, means for slidably supporting said stem and its fork-arms, and an eccentric cam mechanism for imparting desired movement to said stem and its fork arms.

7. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of transversely disposed jig sets mounted in suitable longitudinally spaced relation to each other, each jig set comprising a fixed transverse rail, a pair of transversely opposed jig standards slidably mounted on said rail for movement toward each other, stop means for determining the normal retracted position of said jig standards, lever mechanisms pivoted to the ends of said rail and interconnected with said jig standards for imparting movement thereto, spring means for assisting the forward movement of each jig standard, locking mechanism for clamping said jig standards in their forwardly moved positions, a templet-member secured to said rail intermediate of said opposed jig standards for determining the limits of the forward movement of said standards, each jig standard having upper and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body-frame in a desired produced curvature in vertical plane, each fork mechanism comprising vertically adjustable forward and rear guide-blocks in horizontal alinement, means for clamping said guide-blocks to said jig standards, a stem slidable through said rear guide-block having an annular shoulder at its forward end to abut against said forward guide-block, vertically alined fork-arms slidable through said forward guide block for pro-

jection from the outer face thereof, a spring means arranged between said rear guide-block and said shoulder of said stem for imparting a forward thrust to the latter, an eccentric cam mechanism connected with the rearward end of said stem to coöperate with said rear guide-block for retracting said stem to withdraw said fork arms from projected position relative to said forward guide-block, and templet members fixed upon said jig standards intermediate said upper and lower fork mechanisms for determining the operative position of said fork mechanisms relative to each other and to the fork mechanisms of associated jig sets.

8. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of normally alined and parallel jig standards, each jig standard having upper and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body-frame in a desired produced curvature in vertical plane, and means for moving said jig standards inwardly in relative varying degrees to produce a desired curvature of said chords in horizontal plane.

9. A system of jigs for assembling the elements of an aeroplane body-frame, or the like, comprising a plurality of normally alined and parallel jig standards, each jig standard having upper and lower fork mechanisms for embracing and holding the longitudinal chords of an aeroplane body-frame in a desired produced curvature in vertical plane, means for moving said jig standards inwardly in relative varying degrees to produce a desired curvature of said chords in horizontal plane, stop means for determining the inward movement of each jig standard, and means for locking each jig standard in its inwardly moved position.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 8th day of November, 1918.

GEORGES RIFFLARD.

Witnesses:
GEORGE D. RICHARDS,
MARION M. BANTA.