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AIRCRAFT BEAM CHORD CONSTRUCTION

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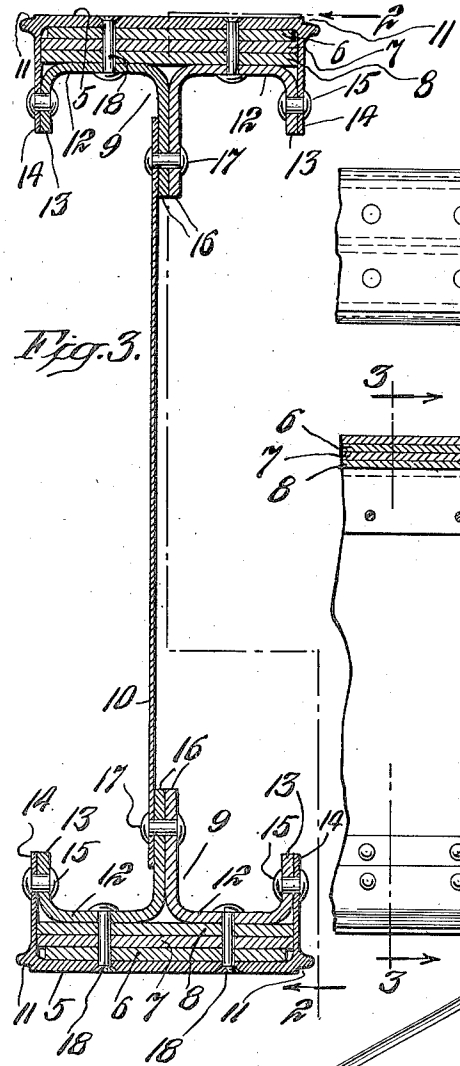


Fig. 3.

Fig. 2.

Fig. 1.

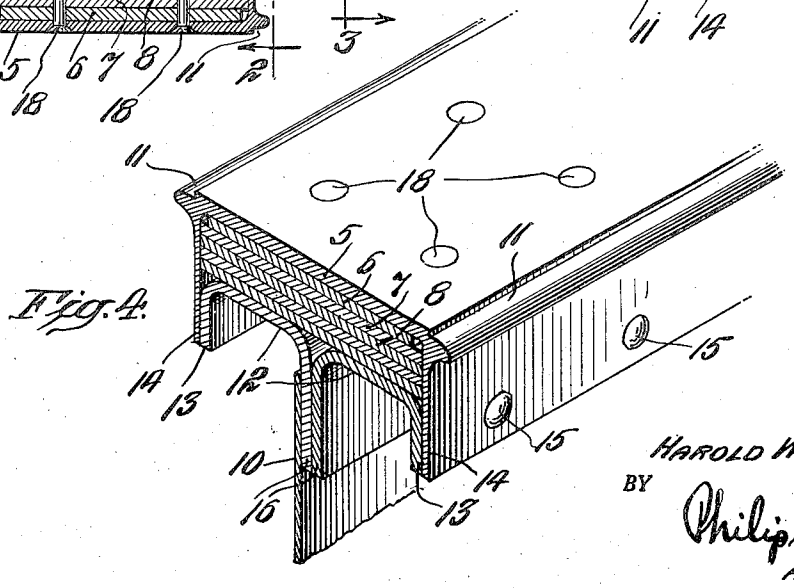


Fig. 4.

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AIRCRAFT BEAM CHORD CONSTRUCTION

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5 Claims. (Cl. 189—37)

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The invention herein disclosed relates to the construction of beams for airframes.

Objects of the invention are to distribute the material along the span of a beam in accordance with the bending moments at different points in the length of the beam and to accomplish this in a simple, practical way and with simple, easily fabricated materials.

Special objects are to enable the selection and use of simple, flat strip laminations for the strength localizing elements and to confine and restrain these from buckling by means contributing as well to the strength and formation of the chord.

Other desirable objects and the novel features of construction, combination and relation of parts by which the purposes of the invention are attained will appear or are set forth in the following specification.

The drawing accompanying and forming part of the specification illustrates a present practical embodiment of the invention. Structure, however, may be modified and changed in certain respects, all within the true intent and scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawing is a broken plan view of a form of beam chord constituting the invention;

Fig. 2 is a broken side elevation, partly in section as taken on the plane of line 2—2 of Fig. 3;

Fig. 3 is an enlarged vertical sectional view as on substantially the plane of line 3—3 of Fig. 2;

Fig. 4 is a perspective and broken vertical sectional detail of the beam.

The invention involves a special combination of structural members including opposed channel elements 5 for the top and bottom chords, flat laminations such as 6, 7, 8, seated within the channels and inner members 9, which may be of T-section for tying the parts together and to the web 10.

The outer members 5 may be formed or extruded channel sections and these serve as bonds to unite all the members into a single unit.

These channels may be further formed for attachment of other parts of the airframe. In the illustration they are shown as having smooth, flat, outer faces with inset shoulders 11 at opposite edges providing seats for edges of skin panels and pads or flanges to form hinge knuckles for attachment of other structural members, the latter feature disclosed more particularly in copending patent application Serial No. 565,713, filed November 29, 1944, now Patent No. 2,432,396, issued December 9, 1947.

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The inner, T-sections 9 are shown as made up each of two formed or extruded channel sections 12, with their outer edge flanges 13 set within and secured to the side flanges 14 of the outer channels by rivets and with their inner edge flanges 16 secured together coextensively and to the web 10 by rivets 17.

These inner members may be made up each as a single extruded or otherwise formed T-shaped section, and it is contemplated also that these inner members may be made up each as a single channel with opposite edge flanges secured within the opposite edge flanges of the outer channels, without special provision for attachment of the web. In this latter event one or two beam webs may be attached to either or both the legs or edge flanges of the outer channel section.

The laminations such as 6, 7 and 8, while usually and preferably of flat strips, may be formed in any suitable shape. These laminations are selected and disposed, according to number, to carry the loads to which the beam is subjected at different points.

Figs. 1 and 2 illustrate a length of beam to the right of the center or mid-section and showing the laminations of successively shorter length toward the mid-portion of the beam. These may be graded equally at top and bottom of the chord, as illustrated, or unequally at top and bottom, according to usual or special loading.

The outer channel sections, inner T-sections and laminations disposed therebetween are connected together and to each other by means of rivets 18, bolts, welds or other fastenings. In the illustration the rivets 18 extend through the outer channels, the laminations and the smaller channels forming the inner T-sections.

As indicated in Figs. 1 and 2, the channels 12 forming the heads of the T-sections may be stepped as indicated at 19, 20, 21, to seat the successively shorter laminations. At the extreme right in these views the T-section channel 12 is shown, in the absence of an interposed lamination, directly engaging and secured to the outer channel 5.

The outer channel sections and the inner T-sections being comparatively stiff against buckling failure, serve to provide buckling restraint for the flat laminations which make up the center portion of the beam chord and which in themselves may have little or less stiffness against buckling. The unit as a whole, therefore, has great stiffness and strength, in those portions where such qualities are required and without special contouring or tapering of parts.

Laminations may be eliminated or added at any points considered necessary or desirable, enabling a beam chord to be fabricated to provide at any given point only the cross sectional area required to carry loads existing in the beam chord at such points. The shapes of the inner and outer members may remain constant or substantially so throughout the length of the beam, the load carrying capacity of the beam being varied through elimination or addition of simple, flat strip laminations. This eliminates any need for expensive extrusions, forgings, etc., or expensive machining set-ups and operations heretofore required for varying the amount of material in beam chords of the solid type.

The combination and form of construction disclosed is particularly suitable for airplane construction involving less labor and material costs, loss in scrap and the like, existing in other modes of comparable construction.

What is claimed is:

1. A beam for aircraft comprising a pair of chords connected by a web, said chords comprising outer channels, T-sections having their heads secured in the channels and their flanges secured to the web and superposed laminations of different length secured in the channels in back of the heads of the T-sections.

2. A beam for aircraft comprising a pair of chords connected by a web, said chords comprising outer channels, T-sections having their heads secured in the channels and their flanges secured to the web and superposed laminations of different length secured in the channels in back of the heads of the T-sections, the heads of said T-sections having edge flanges secured to the sides of said channels.

3. A beam for aircraft comprising a pair of chords connected by a web, said chords comprising outer channels, T-sections having their heads secured in the channels and their flanges secured to the web and superposed laminations of different length secured in the channels in back of the heads of the T-sections, the T-sections being successively stepped to accommodate the different length laminations.

4. A beam for aircraft comprising a pair of chords connected by a web, said chords comprising outer channels, T-sections having their heads secured in the channels and their flanges secured to the web and superposed laminations of different length secured in the channels in back of the heads of the T-sections, the T-sections being successively stepped to accommodate the different length laminations and the channels being substantially straight to provide a beam of substantially uniform height.

5. A beam for aircraft comprising a pair of chords connected by a web, said cords comprising opposed top and bottom channels, laminations in superposed relation in said channels and of different lengths proportioned to the loads imposed on the beam at different points in the length of the same, said web being located between the channels and means securing the channels, laminations and web in the relation described, including inner channel members confining the laminations within said top and bottom channels and having side flanges secured inside the flanges of the top and bottom channels and provided with center flanges attached to the web.

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