E. B. CARNS.

AIRCRAFT.

APPLICATION FILED NOV. 25, 1918.

1,343,707. Patented June 15, 1920.

2 SHEETS—SHEET 1.

Fig. 1

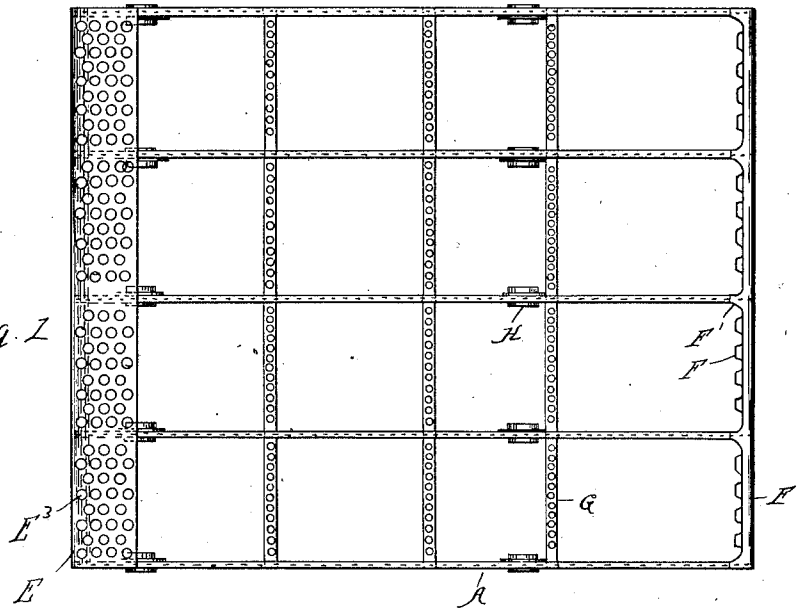


Fig. 6

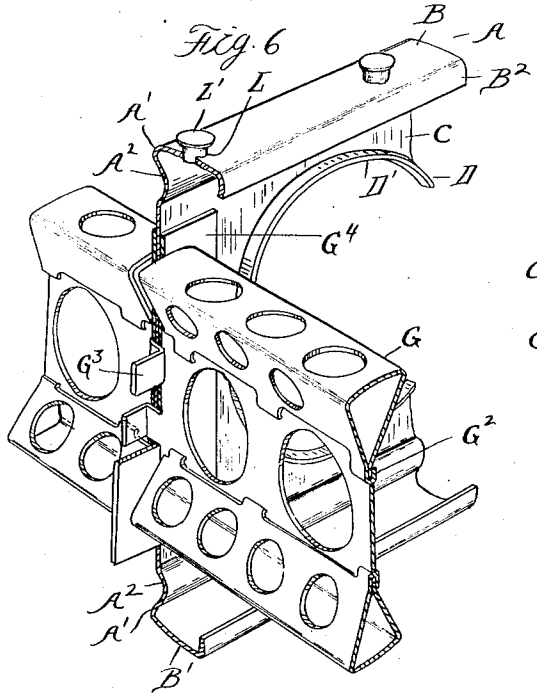
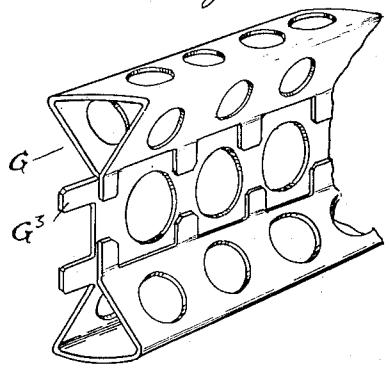


Fig. 11



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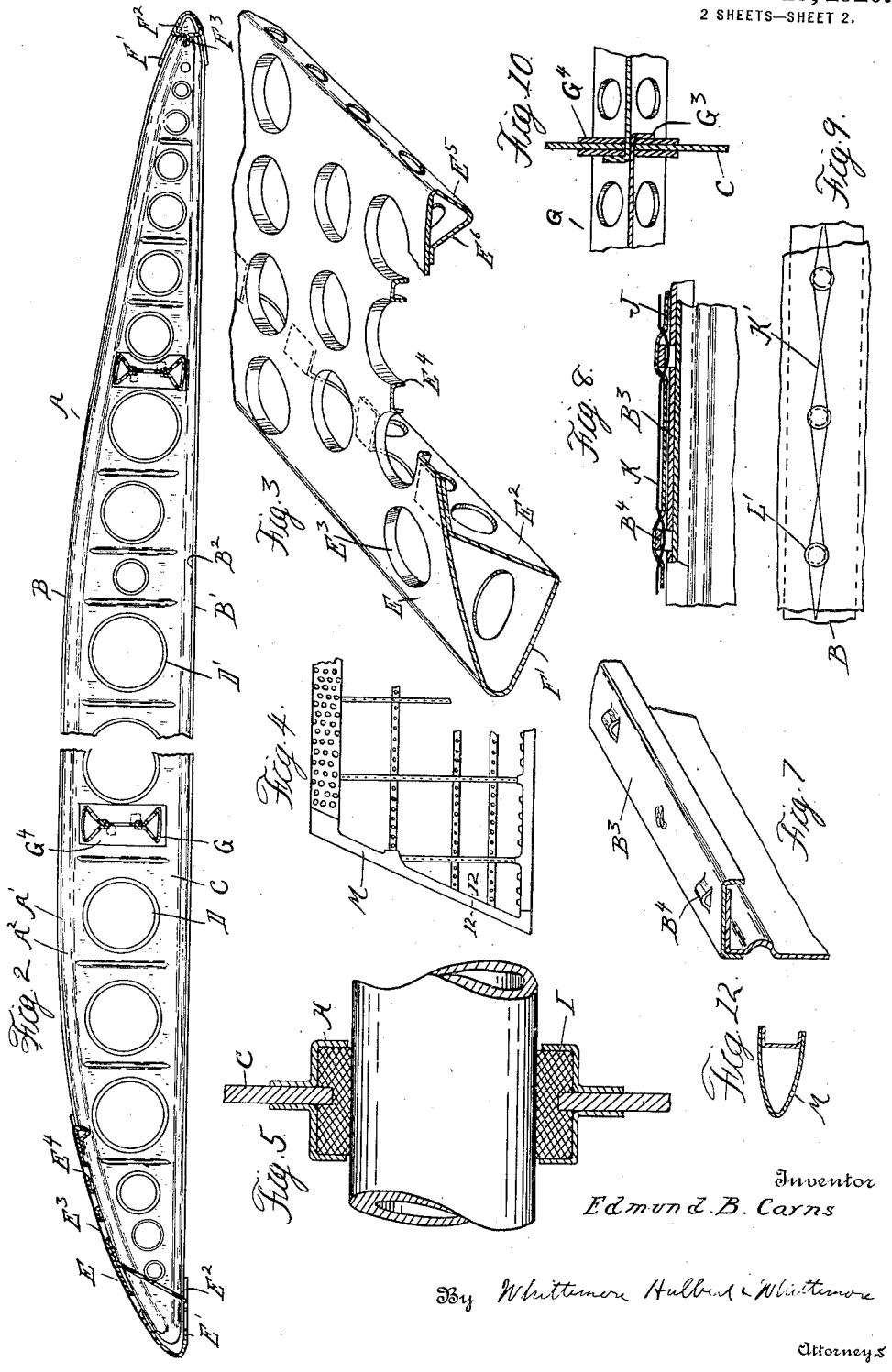
2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

EDMUND B. CARNS, OF DETROIT, MICHIGAN.

AIRCRAFT.

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Application filed November 25, 1918. Serial No. 264,007.

To all whom it may concern:

Be it known that I, EDMUND B. CARNS, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Aircraft, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to aircraft construction and has more particular reference to the structural frame for wind-exposed surfaces.

It is the object of the invention to construct the frame of metal and to secure a maximum of strength with a minimum of weight. It is a further object to more accurately maintain the desired contour, particularly of the edge portions of the surfaces. It is also an object to effectually cushion the frame upon the spars or other members which attach it to coöperating portions of the machine.

In the drawings:

Figure 1 is a plan view of a frame member;

Fig. 2 is a cross-section thereof;

Fig. 3 is a sectional perspective view of a portion of the contour edge strip for the forward edge of the plane;

Fig. 4 is a view similar to Fig. 1 showing a modified construction;

Fig. 5 is a cross-section through one of the contour ribs, showing the means of cushioning the same upon the spar;

Fig. 6 is a perspective view of adjoining strut and rib members;

Fig. 7 is a perspective view of a modified construction of rib member;

Fig. 8 is a section showing the manner of securing the fabric;

Fig. 9 is a plan view of a modified construction;

Fig. 10 is a horizontal section through adjoining strut and rib members.

Fig. 11 is a perspective view of a modified form of strut.

Fig. 12 is a section on the line 12—12 of Fig. 4.

My improved frame construction is preferably formed from sheet metal members fashioned by pressing or stamping and lightened by perforations. These members include contour ribs which are fashioned to the desired cross sectional contour of the wing or other wind-exposed surface; also edge strips, which impart the desired form to the edge portions of the surface, and struts or brace members intermediate the ribs. The ribs A are preferably pressed to form top and bottom flanges B and B′ with a connecting web C, which is perforated or cut away, as indicated at D, to lighten the structure. The forward edge strip E is also formed of sheet metal, return bent at E′ to form the forward edge or nose, with the return-bent flange re-bent to form a cross strut or brace E^2 by which the desired angular relation is maintained. To lighten this strip it is perforated, as at E^3, the perforations being preferably arranged in staggered rows, and to stiffen the structure, annular flanges E^4 surrounding the perforations are struck inward, producing a trussing effect. The rear edge of the strip is reinforced by a bent flange E^5 which is re-bent at E^6 and is secured to the main portion by spot-welding or other suitable means. The portion E^2 is also secured to the main portion of the strip in a similar manner.

The rear edge of the plane is provided with an edge strip F which also is return-bent to form a channel section. At the point of attachment to the ribs the strip F is provided with forwardly projecting portions F′ which are rounded to produce in effect gusset connections with the ribs. Intermediate these gusset portions the strip is inwardly flanged, as indicated at F^2, and at intervals these flanges abut and are spot-welded or otherwise secured to each other at F^3. The ribs A are suitably spaced, and to hold them in proper relation a series of cross struts are arranged therebetween. The struts G are preferably formed up from perforated sheet metal into an I-beam with triangular head portions G′ formed by re-bent flanges. These re-bent flanges are suitably secured to the web of the beam, preferably by tongues G^2 on the flanges engaging slits in the web and bent over or clenched. The struts are arranged in alinement with each other on opposite sides of the ribs, to which they are secured by tongues G^3 engaging slits in the web. The tongues G^3 of the adjacent strut members project through the slits oppositely and are secured by clenching. There are also preferably arranged bearing members G^4 of soft sheet metal which are arranged on opposite sides of the web of the rib and are slitted in alinement with the slits in said web.

Thus the tongues G^3 securely attach the strut members to the rib members and also fasten in position the bearing members G^4, which, being of softer material, prevent the ends of the struts from cutting into the web.

The frame, composed of the rib members A, strut members G and edge strips E and F secured to each other as described, is mounted upon spar members by passing the latter through alined apertures in the webs of the rib members. Surrounding these apertures in the webs are annular members H which together form a groove for receiving a bushing I of felt or other cushioning material. Thus instead of having a metallic contact bearing on the spars the frame is supported through the medium of these resilient yieldable cushions.

The ribs A are strengthened by pressing therein rounded bead portions A′ and A^2 extending longitudinally adjacent to the flanges B and B′. These flanges are also provided with inturned portions B^2 to form a section with a rounded edge, which avoids cutting of the fabric stretched thereover. The re-bent portion B^2 can be formed integral with the rib, as illustrated in Fig. 6, or it may be formed of a separate channel shaped member, as illustrated at B^3 Fig. 7. Where the latter construction is employed the channel strip may be secured to the flange B by spot-welding or other suitable means, and by striking up loop portions B^4 in this channel strip securing means is provided for a binding wire which secures the fabric to the rib. Thus, as shown in Fig. 8, the fabric J after being stretched over the frame is secured to each of the ribs by binding wires K threaded through the loops B^4.

The modified construction of securing means for the fabric is shown in Figs. 6 and 9, in which studs L are secured to project from the flanges B, said studs having flanged heads L′. The fabric J is then stretched over the frame and binding wires K′ are laced up the studs.

As has been stated, the web portions C of the ribs A are cut away to lighten the structure, and to further stiffen these ribs annular flanges D′ are turned adjacent to the apertures, forming reinforcements similar to those used in the edge strips E.

The frame formed as described may be used in wing construction either by forming each wing of a single unit or by a plurality of units mounted on the same spars. The end portion of the wing is given the desired contour by an end strip M which also is of a return-bent form in cross-section, and longitudinally is of a predetermined contour, as shown in Fig. 4.

In use the frame being covered with fabric, the latter is held in form first by the edge strips which are of sufficient strength to hold their shape under the maximum stresses. Intermediate these edge strips the fabric is fashioned by the form of the ribs, and as the whole frame is substantially rigid no objectionable distortion can take place. On the other hand, there is sufficient flexibility in the metallic elements of the frame to distribute the stresses and to resiliently yield to a slight extent. However, as soon as relieved from stress the frame assumes its original form and is unaffected by atmospheric conditions.

What I claim as my invention is:—

1. In aircraft construction, a frame comprising contour ribs, cross struts and edge strips formed of sheet metal, a spar member passing through alined apertures in said contour ribs, annular bearings surrounding the apertures for said spar member, and cushioning material in said annular bearings.

2. In aircraft construction, a wing frame comprising contour ribs and cross struts formed of pressed sheet metal, and an edge strip at adjacent ends of said contour ribs comprising a portion passing on one side of said ribs, a return bent portion passing on the other side thereof and a re-bent flange between the latter and the former portions.

3. In aircraft construction, a wing frame having a nose or edge strip formed of perforated sheet metal, the forward edge of said strip being return-bent with an angular bent flange extending between the return-bent portions and forming a strut, and an inwardly turned flange on the rear edge of said strip for bracing the same.

4. In aircraft construction, a wing frame having a forward edge or nose strip formed of perforated sheet metal, the forward edge of said strip being returned-bent and having an angularly bent flange between the return-bent portions and the rear edge of said strip having an inturned flange and a re-bent flange forming a hollow bead.

5. In aircraft construction, the combination with parallelly arranged contour ribs, of strut members between the ribs formed of perforated sheet metal having their opposite edges bent into a triangular cross section and secured to the central web portion thereof.

6. In aircraft construction, a frame comprising parallelly arranged ribs of pressed sheet metal and of a channel cross section, edge strips at the opposite ends of said ribs connecting the same, the forward or nose strip being formed of perforated sheet metal having a return-bent portion, and the rear strip being of a channel cross section with forwardly projecting portions connected to said ribs and curved gusset connections.

7. In aircraft construction, the combination with a contour rib formed of sheet metal and having a web portion and flanged

edge portion, of a strut member also formed of sheet metal having its end abutting against said web portion and provided with a tongue passing through a slit in said web and clenched to form a securing means.

8. In aircraft construction, the combination with a contour rib formed of sheet metal, of strut members also formed of sheet metal arranged to abut against opposite sides of said web portion in alinement with each other, said strut members being provided with projecting tongues extending through a slit in said web portion and clenched to secure said strut members to the rib.

9. In aircraft construction, the combination with a contour rib formed of sheet metal, of a strut member also formed of sheet metal with return-bent edge portions and a projecting tongue at the end thereof for passing through a slit in the web of said rib, and a sheet metal bearing member interposed between the end of the strut member and said web, said bearing member being also slitted for the passage of said tongue.

10. In aircraft construction, a sheet metal frame member having a re-bent edge portion and a tongue projecting from the re-bent portion passing through a slit in the adjacent sheet metal and clenched thereto.

11. In aircraft construction, a frame member formed of sheet metal having an edge portion re-bent into substantially triangular cross-section, and a tongue projecting from the re-bent edge passing through a slit in the adjacent sheet metal and clenched thereto.

12. In aircraft construction, the combination with a contour rib formed of sheet metal and having a flanged edge portion, of a channel shaped reinforcement engaging said flanged edge portion and secured thereto, said reinforcement having a flange engaging said contour rib adjacent to its flanged edge portion, an eyelet struck out from said channel shaped member and a securing strip for the fabric engaging said eyelet.

In testimony whereof I affix my signature.

EDMUND B. CARNS.