March 21, 1933. G. M. BELLANCA 1,901,864

AEROPLANE WING CONSTRUCTION

Filed June 30, 1931

Fig. 1

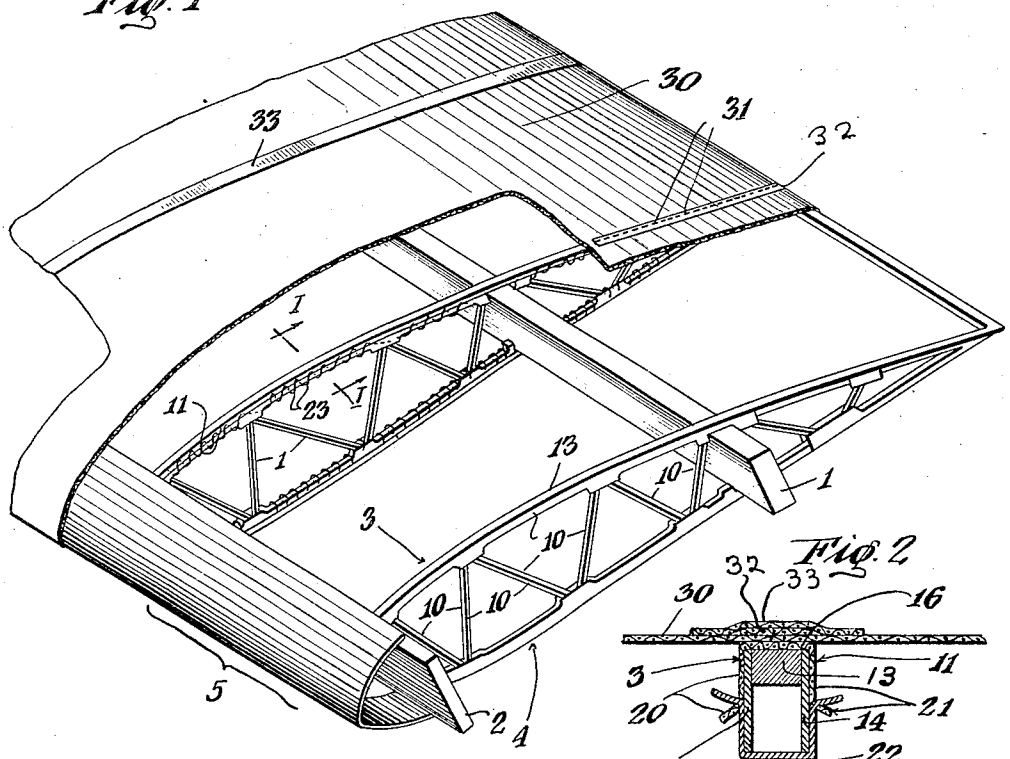
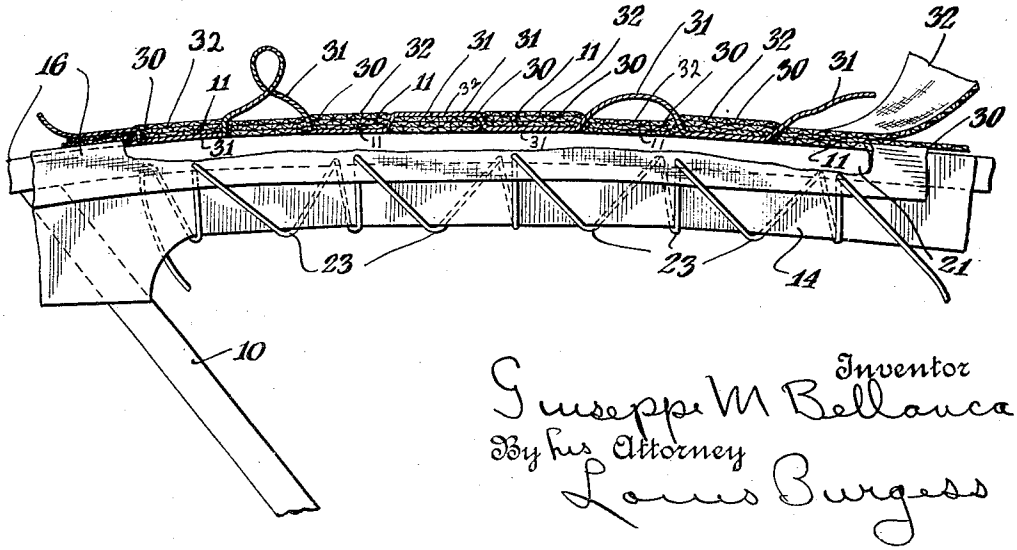


Fig. 2

Fig. 3



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AEROPLANE WING CONSTRUCTION

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The invention will be fully understood from the following specification read in conjunction with the drawing, in which,

Fig. 1 is a perspective view of part of an aeroplane wing showing the construction which I have invented.

Fig. 2 is a cross-section through part of Fig. 1 on the plane I—I, and

Fig. 3 is a detailed side view with parts in section of part of the construction shown in Fig. 1.

An aeroplane wing ordinarily comprises a number of longitudinal spars such as 1 and 2 (Fig. 1). These spars in turn carry transverse ribs to which the skin of the wing is attached. The term "rib" shall be hereinafter employed to denote the member transverse to the longitudinal spars which carries the fabric and which defines the upper and/or lower surfaces of the wing. For example, the members 3 and 4 in Fig. 1 are upper and lower ribs in the wing 5. The ribs are ordinarily stiffened by means of bracing members, such as 10. The ribs may take a variety of forms; they may, for example, consist simply of a wood strip, appropriately shaped to define the contour of the airfoil surface; or of a simple strip, appropriately grooved to receive the extremities of the diagonal bracing members 10. Where the ribs 3 and 4 are constructed of wood or similar material, I find it advantageous to provide a fabric tape 11 extending longitudinally with respect to the outer surface of the said rib. The tape is wider than the outer surface of the rib, and the excess width is folded over to over-lay and embrace at least in part the sides of the rib. The fabric tape is firmly secured to the rib in any suitable way, and may for example be cemented thereto. While the combination of the fabric tape with the rib of wood or similar material is only a subordinate part of my invention in its entirety, it is intrinsically valuable for the reason that it imparts additional strength to the rib, and, inter alia, prevents incipient cracks or defects from developing or extending under the strain and vibration incident to use. The fabric tape may be combined with any type of rib, although I prefer to apply it to the form shown in Fig. 2. In this case, the rib 3 is built up of a number of pieces. It includes the strip 13 flush with the outer surface of the rib, to which there are secured side pieces 14 and 15. The pieces 13, 14 and 15 may be cemented together in the relationship shown in Fig. 2, thereby forming a channel beam of wood or similar material of exceptional strength and lightness. The part 16 of the tape (Fig. 2) fits snugly against the outer surface of the rib, while the sides 20 and 21 of the tape 11 over-lay the side pieces 14 and 15 of the rib. As hereinabove stated, the tape may be secured to the rib in any way, but I have found it preferable to secure the same by means of strong linen thread 22, passing through one side 20 of the tape, across the inner surface of the rib, and through the side 21 of the tape on the opposite side of the rib. The thread 22 is also carried longitudinally along the rib to form a series of sutures 23, as shown in Fig. 3. The thread is knotted at intervals so that in case the same is broken or severed at any point no considerable length of the seam will be released or loosened.

One of the principal advantages of the fabric tape construction, hereinabove described, inheres in the ease and efficiency by which the fabric surface or skin of the wing may be secured in position. In this aspect of the invention, the material of which the rib is constructed is not controlling, and the invention may with advantage be employed with a rib of wood, metal, or any similar material. It is, moreover, immaterial in this aspect of the invention whether the rib is formed of one or a number of pieces, and the rib, if desired, be formed entirely or principally in one piece. If desired, the rib together with the bracing members may also be formed in a single piece. The rib may take the form of a flange or over-turned bead, and the flange or bead may be formed integral with the web; for example by stamping the entire rib and bracing members from a single sheet of metal.

The skin 30 is secured directly to the tape

11 by means of the stitching 31. A relatively narrow reinforcing tape 32 is preferably laid over the fabric airfoil surface, and the stitching 31 is carried through the tape 11 through the fabric airfoil surface 30 and the reinforcing tape 32. This form of construction is characterized by greater strength than the mode of attachment previously employed in the art, particularly in connection with wood ribs, and in addition eliminates completely the long threads extending between the upper and lower surfaces which obstruct vision and render extremely difficult a complete inspection of the wing interior.

When the stitching has been finished and the fabric airfoil surface properly secured, I preferably over-lay the stitching 31 and reinforcing tape 32 with a cover strip 33 which is cemented or doped in position for the purpose of protecting the stitching and providing the airfoil surface with a uniformly smooth exterior.

In Fig. 3, the rib and the superimposed layers of fabric have been shown in longitudinal section for the purpose of clearly illustrating their relationship. To simplify the illustration the cover strip 33 has been omitted.

The foregoing specific description is intended by way of illustration and not of limitation. It is therefore my intention that the invention be limited only by the appended claims or their equivalents in which I have endeavored to claim broadly all inherent novelty.

I claim:

1. In an aeroplane wing structure of the type including a fabric airfoil surface carried by wood ribs, which ribs contain strips and stiffening members of greater depth than said strips secured to the sides of said strips, thereby forming built up channel beam ribs defining the upper and lower surfaces of said wing, a fabric tape extending longitudinally of a rib, embracing the outer surface and sides of said rib, and secured to the said rib.

2. In an aeroplane wing structure of the type including a fabric airfoil surface carried by wood ribs, which ribs contain strips and stiffening members of greater depth than said strips secured to the sides of said strips, thereby forming built up channel beam ribs defining the upper and lower surfaces of said wing, a fabric tape extending longitudinally of a rib, embracing the outer surface and sides of said rib, secured to the said rib, and stitching securing the said airfoil surface to said fabric tape.

3. In an aeroplane wing structure of the type including a fabric airfoil surface carried by ribs, defining the upper and lower surfaces of said wing, a fabric tape extending longitudinally of a rib, embracing the outer surface and sides of said rib, secured to the said rib, stitching securing said fabric airfoil surface to said tape, and a fabric tape reinforcing element for said stitching external to said airfoil surface.

4. In an aeroplane wing structure of the type including a fabric airfoil surface carried by wood ribs, which ribs contain strips and stiffening members of greater depth than said strips secured to the sides of said strips, thereby forming built up channel beam ribs defining the upper and lower surfaces of said wing, a fabric tape extending longitudinally of a rib, embracing the outer surface and sides of said rib, secured to the said rib, stitching securing said fabric airfoil surface to said fabric tape, and a fabric tape reinforcing element for said stitching external to said airfoil surface.

5. An aeroplane wing, comprising spars, rib sections transverse to said spars, a fabric airfoil covering surrounding said spars and rib sections, each of said rib sections including an upper transverse member bearing against and supporting the upper part of said airfoil covering, a lower opposed transverse member spaced apart from said upper transverse member bearing against and supporting the lower part of said airfoil covering, bracing means intermediate said upper and lower transverse members, a tape overlaying the entire outer surface of one of said transverse members and laying intermediate the said transverse member and the said airfoil covering, means passing around and in contact with the sides and inside surface of said transverse member but not around the opposed transverse member, securing said tape to said transverse member, and stitching securing the said airfoil covering to the said tape.

6. A wing according to claim 5, comprising in addition a fabric tape reinforcing element for said stitching external to said airfoil surface.

7. An aeroplane wing, comprising spars, rib sections transverse to said spars, a fabric airfoil covering surrounding said spars and rib sections, each of said rib sections including an upper transverse member bearing against and supporting the upper part of said airfoil covering, a lower opposed transverse member spaced apart from the said upper transverse member bearing against and supporting the lower part of said airfoil covering, bracing means intermediate said upper and lower transverse members, a tape extending longitudinally along and overlaying the entire outer surface of one of said transverse members, and laying between the outer surface of said transverse member and the said airfoil covering, the said tape being wider than the outer surface of said transverse member and the excess width laying longitudinally in contact with the sides of

said transverse member, a series of stitches extending from the edges of said tape around and in contact with the inside surface of said transverse member but not around the opposed transverse member, securing said tape to said transverse member, and stitching securing said airfoil covering to the said tape.

8. A wing according to claim 7, comprising in addition a fabric tape reinforcing element for said stitching external to said airfoil surface.

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