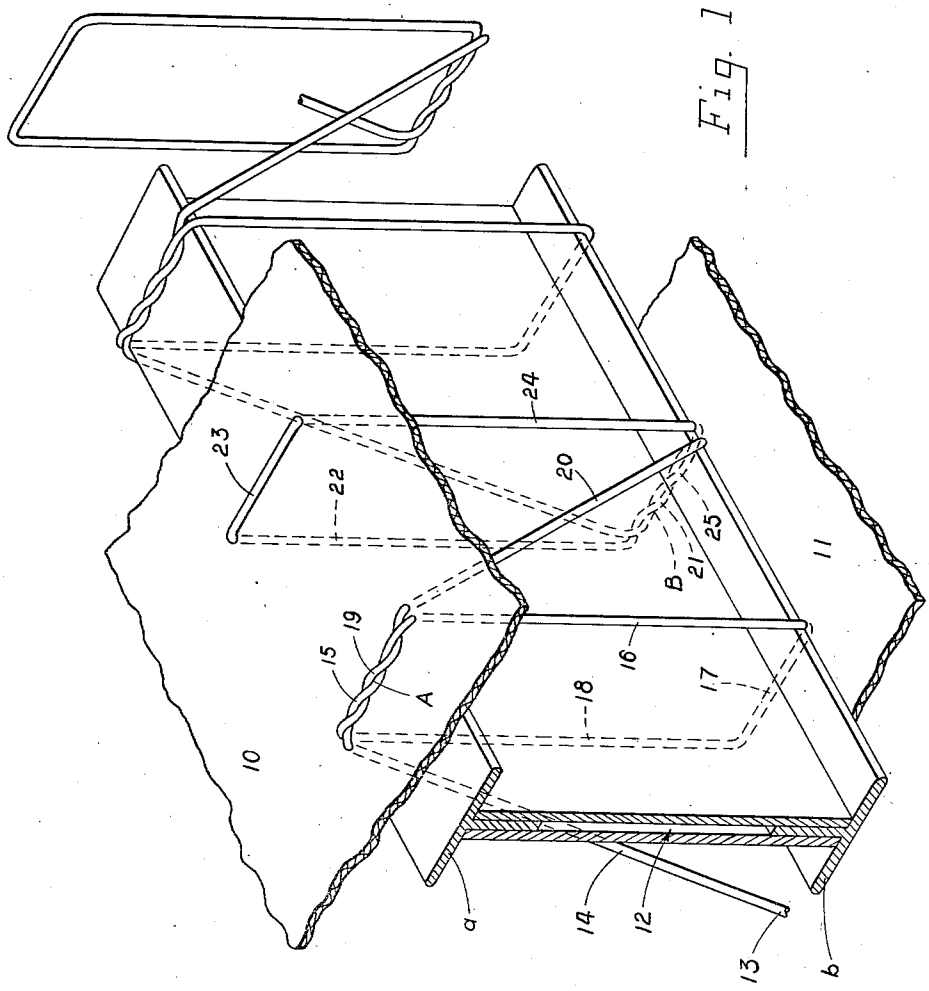
Aug. 1, 1939. K. SCHMIDT 2,167,687

LACING ATTACHMENT FOR AIRPLANE COVER FABRIC

Filed March 9, 1938 2 Sheets-Sheet 1

Fig. 1



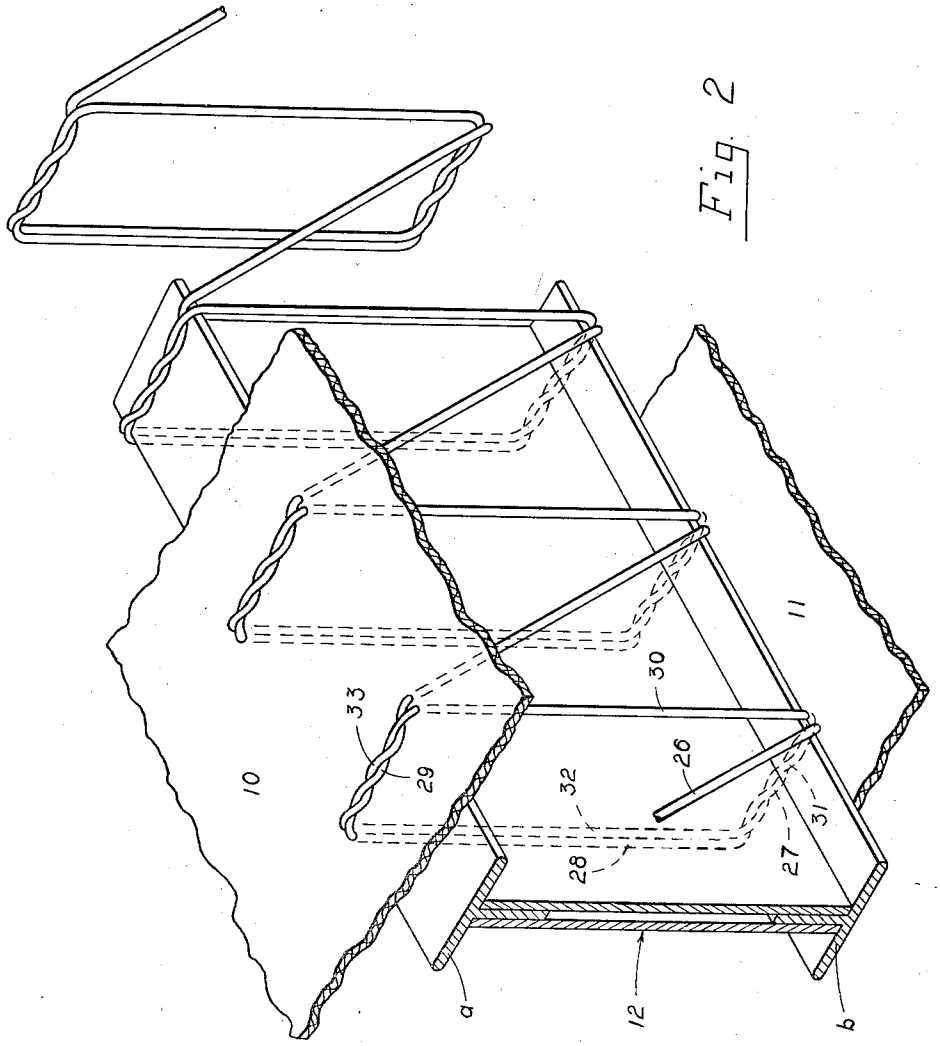
INVENTOR
KARL SCHMIDT
BY
Ramon K. Davis
ATTORNEY

Aug. 1, 1939. K. SCHMIDT 2,167,687

LACING ATTACHMENT FOR AIRPLANE COVER FABRIC

Filed March 9, 1938 2 Sheets-Sheet 2

Fig. 2



INVENTOR
KARL SCHMIDT
BY Ransom N. Davis
ATTORNEY

Patented Aug. 1, 1939

2,167,687

UNITED STATES PATENT OFFICE

2,167,687

LACING ATTACHMENT FOR AIRPLANE COVER FABRIC

Karl Schmidt, United States Navy

Application March 9, 1938, Serial No. 194,888

4 Claims. (Cl. 244—132)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The present invention relates to airplane fabric attaching means and it has a particular relation to the attachment of the fabric to the wings and fuselage of an airplane by means of a lacing cord.

Airplane fabric cover failures may usually be subscribed to two causes, first, to the failure of the lacing cord itself, and second, to the tearing of the fabric as a result of a concentration of the load at the points of its attachment to the wing rib or other supporting frame member. The first cause may result from the stretching of the lacing cord under load and its consequent abrasive action against the edges of the capstrip to which the fabric covering is attached. Cord failure may also result at a load value far below the full cord strength, due to the cord axis being deflected so that the component threads or strands of the cord are non-uniformly stressed. For example, if all of the component threads of the cord are equally stressed, such as would be the case where the cord is subjected to a pull exerted in a rectilinear direction, the ultimate cord strength developed may be considered as 100 percent. If now, two cords are overlapped so that each cord is bent at an angle of 90° at the point of overlap or engagement, and if each cord is subjected to equal strain, the breaking strength will be approximately 45 percent of the full cord strength. If, however, the cords are overlapped at an angle of 90° or so that the interengaging cords are bent upon themselves to extend parallel to one another and are subjected to equal strain, the breaking strength of each cord at the point of bend will be approximately 35 percent of full cord strength. This reduction in the strength of a lacing cord manifests itself particularly at points where the cord is tied or knotted. From this it will be apparent that the strength of the cord decreases with the angle of bend and that if maximum strength is to be obtained the cord should be subjected, as nearly as possible, to strains exerted rectilinearly of its length.

One of the objects of the invention is the provision of a method of lacing a fabric covering to the capstrip of an airplane rib or the like in which the cord is not tied off or knotted at intervals along the length of the capstrip, thus not only increasing the tensile strength of the cord but obtaining a smooth cover surface which is highly desirable to improve the aerodynamic efficiency of the airfoil and the airplane as a whole.

Another object of the invention is the provision of a lacing attachment for airplane wing fabric such as will prevent the top and bottom coverings of the wing in the region of the propeller slipstream from slapping against the capstrips of the ribs, which action causes excessive wear and early failure in the present type of cover attachment.

With these and other objects in view, as well as other advantages that may be incident to the use of the improvements, the invention consists in the parts and combinations thereof hereinafter set forth and claimed, and with the understanding that the several necessary elements constituting the same may be varied in proportion and arrangement without departing from the nature and scope of the invention, as defined in the appended claims.

In order to make the invention more clearly understood, there are shown in the accompanying drawings, means for carrying the invention into practical use, without limiting the improvements in their useful application to the particular construction, which, for the purpose of explanation, have been made the subject of illustration.

In the accompanying drawings:

Fig. 1 is a diagrammatic perspective view of a fragment of an airplane wing in which the fabric covering is secured at intervals to the rib by a lacing attachment embodying the invention; and

Fig. 2 is a similar view of another form of cover attachment embodying the invention.

Referring to the drawings, and particularly to Fig. 1 thereof, the upper and lower fabric coverings 10 and 11 respectively, of an airplane wing is shown as being secured to the upper and lower capstrips "a" and "b" of a rib member, a portion of which is indicated at 12, by means of a cord lacing 13. This cord extends upwardly and diagonally along one side of the rib, as at 14, thence through the fabric 10 and transversely across the rib at right angles to its longitudinal axis, as at 15 and downwardly through the fabric 10. From this point the cord extends downwardly across the side of the rib, as at 16, and through the fabric 11, thence beneath the rib, as at 17, thence upwardly across the opposite side of the rib, as at 18, and again through the fabric 10 at or adjacent to the point where it first passed therethrough. From here the cord is passed several times around the portion 15 thereof, as at 19, to form an interlock A. At this point it is important that the cord be tightly drawn up, thus introducing and securing initial tension in the finished loop. The cord then is passed downwardly through the fabric 10, or at near the point where the portion 14 was passed. The cord is next extended downwardly and diagonally across the side of the rib opposite to the diagonal portion 14 of the cord, as at 20, and through the lower fabric covering 11, thence beneath the rib at right angles thereto, as at 21, thence upwardly through the lower fabric covering 11 and across the side of the rib opposite to the portion 20, as at 22, and through the upper fabric covering

10, thence across the upper edge of the rib, as at 23, and downwardly through the upper fabric 10, thence downwardly along the side of the rib, as at 24, and through the lower fabric covering 11 at or adjacent to the point where the portion 20 previously passed. From here the cord is passed several times around the lower portion 21 of the cord, as at 25, to form an interlock B, and upwardly through the lower fabric covering 11. From here on the described lacing steps are repeated, each loop being drawn up tightly before starting the next one. It will be noted that the upper and lower coverings 10 and 11 are thus secured by spaced loops extending at right angles to the rib and that the loops are all connected by diagonally extending portions of the same lacing cord. Also, it will be noted, that by this method of lacing, the upper and lower coverings are held in position by alternate portions of single and double cord strength, the cords of the latter being twisted together and later united by the finishing dope.

In Fig. 2 there is illustrated another method of lacing cord attachment embodying the invention in which the lacing cord is first passed diagonally downward through the lower fabric covering 11, as at 26, thence beneath the rib, as at 27, thence upwardly through the lower fabric 11 and upwardly across the far side of the rib, as at 28, thence through the upper fabric covering 10 and across the upper surface of the rib, as at 29, thence downwardly through the fabric 10 and across the near side of the rib, as at 30, and thence through the lower fabric covering 11 at or near the point where the diagonal portion 26 of the cord passed therethrough. From here the cord is passed several times around the lower portion 27 of the cord, as at 31, and upwardly through the lower fabric 11, at or near the point where the portion 27 passed, thence upwardly across the far side of the rib parallel to the portion 28, as at 32, and through the upper fabric, at or near where the portion 28 passed. The cord is then passed several times around the upper portion 29 thereof, as at 33, and downwardly through the upper fabric 10. From here on the above described lacing steps are repeated. This form of lacing differs from that described in connection with Fig. 1 in that the transverse portions of the cord which are disposed in contact with the upper and lower coverings are all of double cord strength.

From the foregoing it will be apparent that by means of the present form of lacing a fabric covering may be secured to a wing rib or other frame structure without the use of knots or sharp bends in the cord, thus utilizing nearly the full tensile strength of the cord. The portions of the cord where they are twisted together, as at A and B, greatly increase the resistance to slippage and elongation of the cord, especially when dope impregnated. Also, as has been hereinbefore pointed out, the elimination of the many knots, previously employed in this type of lacing, results in a smooth wing surface of low wind drag.

The method of lacing herein described may be further modified in its application by those skilled in the art without departing from the nature and scope of the invention as defined in the appended claims.

The invention described herein may be manufactured and/or used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. An airplane wing construction comprising a rib member having upper and lower capstrips connected together; upper and lower fabric coverings supported by said rib; and a lacing cord for securing said coverings to said capstrips; said lacing cord passing continuously around said capstrips and through said upper and lower coverings in a series of spaced loops, the portions of said cord connecting said loops being twisted around certain of the transverse portions of said loops to form an elongated interlock for and between adjacent loops, whereby slippage and elongation of the cord is reduced and friction between the interlocking portions of said cord and between said cord and said coverings is distributed throughout the width of said capstrip.

2. An airplane wing construction comprising a rib member having upper and lower capstrips connected together; upper and lower fabric coverings supported by said rib; and a lacing cord for securing said coverings to said capstrips; said lacing cord passing continuously around said capstrips and through said upper and lower coverings is a series of spaced loops, the portions of said cord connecting said loops being twisted around certain of the transverse portions of alternate loops to form an elongated interlock for and between adjacent loops, whereby slippage and elongation of the cord is reduced and friction between the interlocking portions of said cord and between said cord and said coverings is distributed throughout the width of said capstrip.

3. An airplane wing construction comprising a rib member having upper and lower capstrips connected together; upper and lower fabric coverings supported by said rib; and a lacing cord for securing said coverings to said capstrip; said lacing cord passing continuously around said capstrips and through said upper and lower coverings in a series of spaced loops, the portions of said cord connecting said loops being twisted around certain of the inner and outer transverse portions of each of said loops to form an elongated interlock for and between adjacent loops, whereby slippage and elongation of the cord is reduced and friction between the interlocking portions of said cord and between said cord and said coverings is distributed throughout the width of said capstrip.

4. An airplane wing construction comprising a rib member having upper and lower capstrips connected together; upper and lower fabric coverings supported by said rib; and a lacing cord for securing said coverings to said capstrip; said lacing cord passing continuously around said capstrips and through said upper and lower coverings in a series of spaced loops, the portions of said cord connecting said loops extending diagonally across the sides of said capstrips and twisted around certain of the transverse portions of said loops to form an elongated interlock for and between adjacent loops, whereby slippage and elongation of the cord is reduced and friction between the interlocking portions of said cord and between said cord and said coverings is distributed throughout the width of said capstrip.

KARL SCHMIDT.