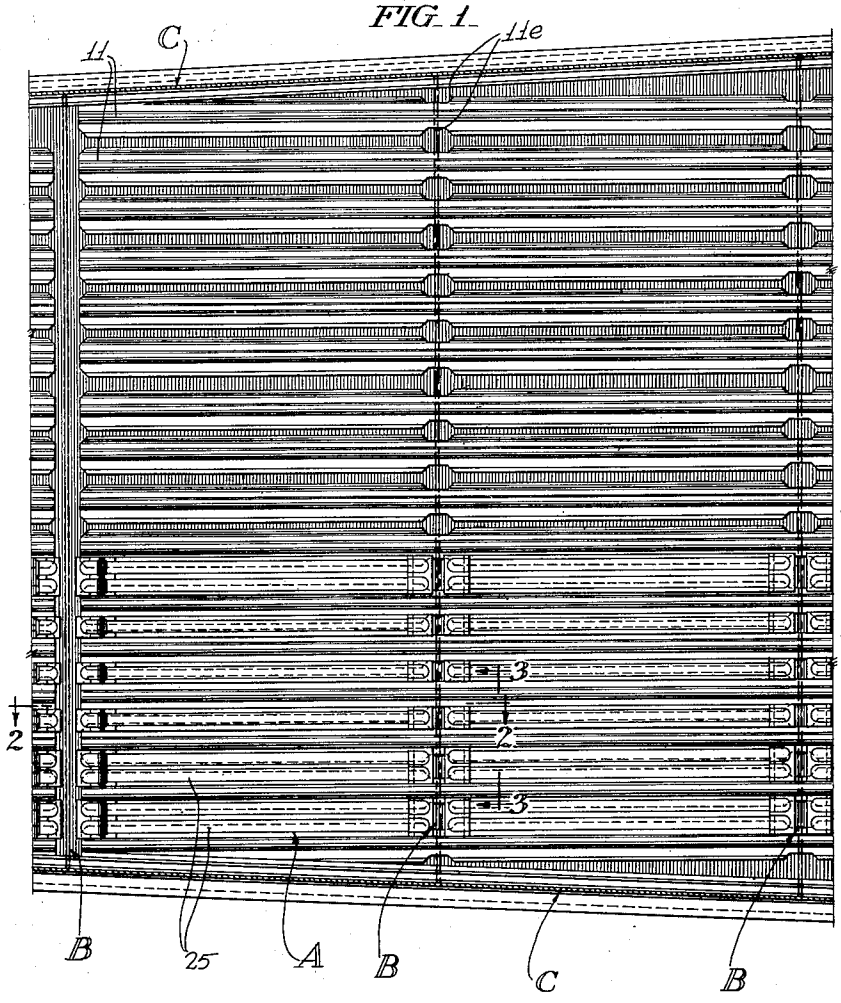
March 26, 1946. M. WATTER 2,397,450

FABRICATED STRUCTURE

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FIG. 1.



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FIG. 2.

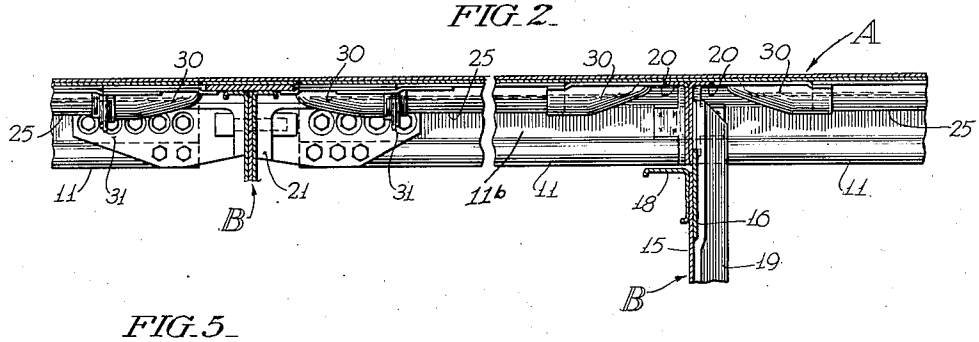


FIG. 5.

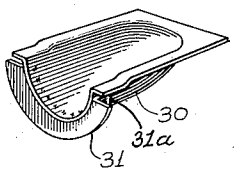


FIG. 3.

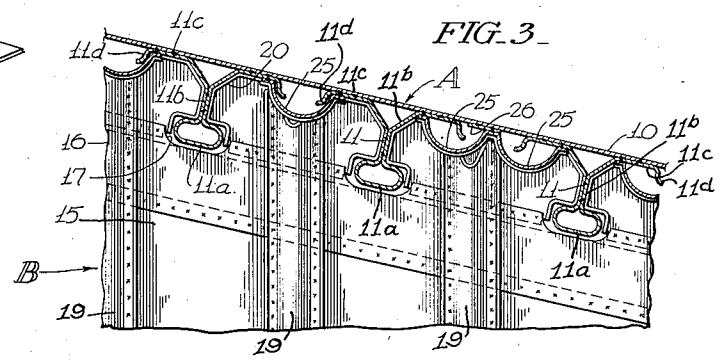


FIG. 7.

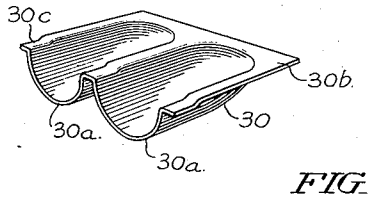


FIG. 6.

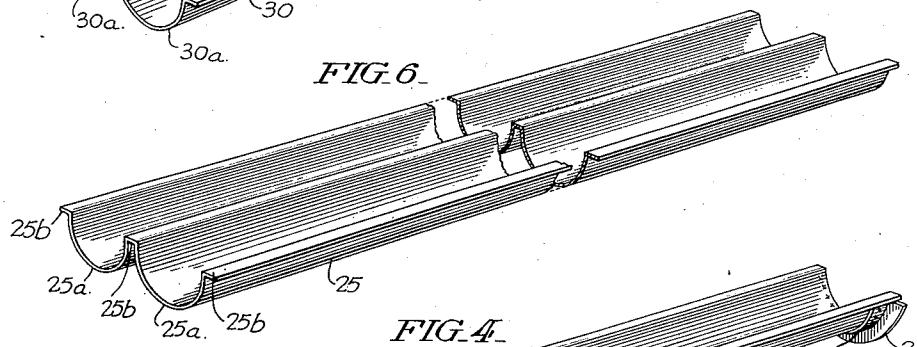
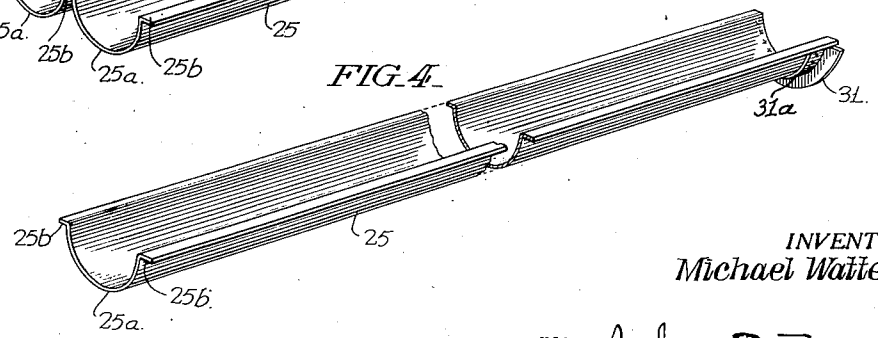


FIG. 4.



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UNITED STATES PATENT OFFICE

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FABRICATED STRUCTURE

Michael Watter, Philadelphia, Pa., assignor to Edward G. Budd Manufacturing Company, Philadelphia, Pa., a corporation of Pennsylvania

Application February 25, 1944, Serial No. 523,846

3 Claims. (Cl. 189—34)

This invention relates to fabricated structures, particularly metallic structures, such as airfoils, which include an interior framework and a covering sheet, and has for an object the provision of improvements in this art.

In order to secure the desired strength and light weight in an airfoil cover, it is customary to reinforce the thin metal cover sheet with stiffeners or stringers. The assembly of cover sheet or skin and stringers may be referred to as a skin blanket. The skin blanket must be secured to the framework and this may be accomplished by using attaching clips which are secured first to one assembly and then to the other. Whether the connection of blanket to frame is made by welding, riveting, or bolting, it is necessary to use tools of considerable size, hence as much free space as possible is desirable at the region of connection.

According to the present invention, the blanket is initially provided with relatively heavy stringers and is attached to the framework while there is ample space between the stringers to receive the tool elements needed to make the connection. With such a construction, it is easy to connect the clips either to the skin blanket or the framework. Preferably, the clips are first attached to the skin blanket and later attached to the framework. After the blanket is secured to the framework, it may be desirable to further stiffen or strengthen it and, according to the present invention, this is accomplished by attaching auxiliary stringers between the original stringers which were present when the blanket was connected to the frame. The original stringers are preferably run through the spaced frame elements, usually the ribs, and the auxiliary stringers are arranged as intercostals located wholly between the frame elements or ribs. In this manner, the blanket may be reinforced over the total area or over local areas by auxiliary stringers of any desired character and size, usually of a smaller size than the through-running stringers and conveniently of derby shape partly or wholly overlying the side flanges of the through-running stringers.

The objects and advantages of the invention will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

Fig. 1 is a plan view of a skin blanket, certain related inter-spar ribs being shown in broken lines;

Fig. 2 is a partial longitudinal section taken on the line 2—2 of Fig. 1;

Fig. 3 is a partial transverse section taken on the line 3—3 of Fig. 1;

Fig. 4 is a perspective view of one of the intercostal stringers;

Fig. 5 is a perspective view of a cap for the stringer shown in Fig. 4;

Fig. 6 is a perspective view of another one of the intercostal stringers; and

Fig. 7 is a perspective view of a cap for the stringer shown in Fig. 6.

Referring to the drawings, a skin blanket A is secured to a framework which includes spaced ribs B and spars C. The skin blanket includes a skin sheet 10 made up of as many adjoining pieces as necessary and a plurality of through-running stringers 11 which are connected to the skin before the blanket is secured to the frame. Herein the stringers 11 are shown to be made of a flanged Y-bulb shape with return out-curved flanges. The bulb portion is designated by the numeral 11*a*, the web by 11*b*, the main base flanges by 11*c*, and the return flanges by 11*d*.

The rib B, as shown, comprises a web plate 15, a web plate extension 16 formed with recesses 17 to receive the stringers, cap strips 18, and strut stringers 19. Cupped clips 20 connect the skin 10, stringers 11 and rib elements 16 together, the clips preferably being split to enable them to be easily inserted in the recessed sides of the stringers and being secured together by the strut stringers 19. As shown in Figures 2 and 3, the clips 20 have an end plate body portion aligned with the rib web plate 15 and side flanges which lie against and are secured to the web 11*b* and flange 11*c* of the stringers 11. The other edges of the clips are flat and lie against and are secured to the rib plate extension 16 and the strut stringer 19. In some instances, at certain rib stations the skin blanket is spliced through the rib by certain joint means generally indicated by the numeral 21 but it is not necessary to describe the details of this joint for an understanding of the present invention.

After the above-described assembly has been completed, with the exception possibly of the spars C, certain intercostal stringers 25 are inserted between the principal stringers 11. Conveniently, the intercostals 25 are formed as derby sections having rounded channels 25*a* and attaching flanges 25*b*. One side flange of the intercostal stringers is secured above a side flange 11*c* of the principal stringers 11 and where twin stringers are used the common central flange 25*b* may be elevated by a filler strip 26, as shown in Fig. 3.

Adjacent the ribs the return flanges 11*d* of the principal stringers are cut away at 11*e*, as best shown in Fig. 1, and here caps 30 are secured over the ends of the stringers. The caps are made to fit the stringers 25 and here comprise curved portions 30*a* with closed ends and flanges 30*b*. They may be joggled, as at 30*c*, where they drop off of the ends of the flanges of the principal stringers.

The caps 30 at one end of the stringers may be secured to the stringers before the stringers are attached to the skin sheets, and the caps at the other end also if the space for the full length of the stringers is not obstructed; but usually this space is obstructed and it is desired to secure the caps at the other end after the stringer elements have been brought into proper position relative to the skin blanket and rib assembly. Accordingly, the caps and stringers at one end are provided with outstanding transverse flanges 31 which can be secured together after insertion. The flanges 31 may be formed on separate parts which are provided with arcuate flanges 31*a* and through them secured to the curved stringers and caps. The parts carrying flanges 31, 31*a* are secured to the stringers and their caps before they are attached to the assembly. And, as stated, the caps with the flanges 31 are inserted after the stringer with its unflanged cap has been inserted. The flanges 31 of cap and stringer, being laterally outstanding, can be secured together, as by welding, after the parts have been inserted and secured to the assembly.

While various connecting means may be used for joining the structural elements, it is assumed for purposes of illustration that the means may be resistance welding, and in various places conventional weld indicia are shown in the drawings. Conveniently all or most of the welding on the skin blanket and ribs is done before the spars are attached, unless ample access openings are present as is sometimes the case.

It is thus seen that the invention provides an improved structure and an improved method of assembly which furnishes maximum strength and lightness and maximum access for assembling operations.

While one embodiment of the invention has been illustrated and described, it is to be understood that there may be various embodiments within the limits of the prior art and the scope of the subjoined claims.

What is claimed is:

1. A fabricated structure comprising in combination, a plurality of spaced ribs, a skin blanket, and clips securing the blanket to the ribs, said blanket including heavy rib-attached stringers and light flanged-derby stringers, some of the derby stringers being of double derby section with flanges on each side and in the middle, the side flanges being secured upon flanges of the heavy stringers and the middle flange being secured on a filler plate, said derby-section stringers terminating short of the ribs and having closed end caps.

2. A fabricated structure composed of spaced ribs, through-running stringers, intermediate stringers which end at the ribs, and a cover sheet, the first said stringers having base flanges secured to the skin, said flanges having return edges extending away from the skin, the edges being cut away at the ribs, and the intermediate stringers being concave and having base flanges mounted on the base flanges of the first stringers, the intermediate stringers also having closed cupped ends fitting over the ends of the side edges of the first stringers.

3. A fabricated structure comprising in combination, a plurality of spaced ribs, a skin blanket, and clips securing the blanket to the ribs, said blanket comprising parallel stringers including large through-running flanged Y-bulb members and small flanged-derby capped intercostals, the caps at one end of the derby stringers having lateral flange connections with these derby stringers.

MICHAEL WATTER.