Jan. 20, 1970 W. W. BIRD 3,490,184

TAPED TENSION WEB-SKIN JOINT FOR AIR INFLATED STRUCTURES

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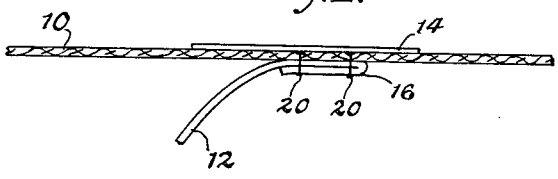
PRIOR ART

Fig. 1.



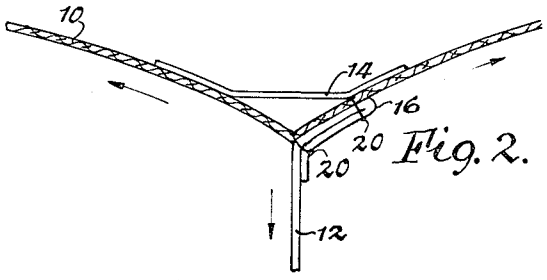
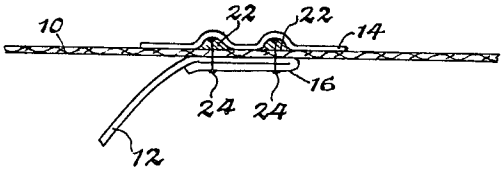


Fig. 2.

Fig. 3.



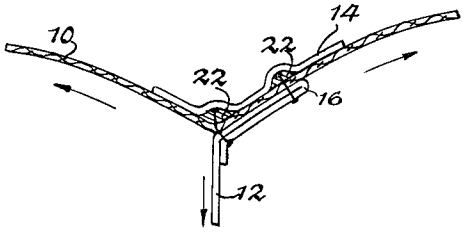


Fig. 4.

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TAPED TENSION WEB-SKIN JOINT FOR AIR INFLATED STRUCTURES

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U.S. Cl. 52—2 9 Claims

ABSTRACT OF THE DISCLOSURE

A joint construction between a tension web member and a flexible fabric fluid-pressure retaining envelope skin member disposed generally normal to the web member, in an air inflated structure such as shown in my earlier U.S. Patent No. 3,247,627, the junction is effected by stitching an edge flange of the web member to the skin member while providing thereat an externally projecting protuberance overlying the stitch seam; then adhesively mounting a flexible tape against the outer face of the envelope to extend lengthwise of the seam while bridging the latter and permanently gripping the protuberance material and the skin material at opposite sides of the seam. The tape member compresses the protuberance material in fluid-sealing condition against the seam while at the same time providing a flexible anchorage platform for the mid-section of the tape; thereby permitting flexure accommodation of the tape to envelope-inflation distortions of the skin material at opposite sides of the seam, while avoiding stresses on the tape such as would otherwise tend to cause it to bridge the seam and/or separate from the skin material.

DESCRIPTION OF THE INVENTION

The invention relates to an improvement in structures as disclosed in my aforesaid referenced patent, and wherever inflated envelope skin members are supported at intervals by tension web devices, thereby providing a skin configuration of "valleyed" form. It has been found that such inflation distortions of the envelope skin members translate into stresses tending to cause the adhesively applied seam-covering tapes to "bridge" the valleys and to separate from the envelope skin material, thereby disrupting the seam-seal effect and/or resulting in peeling of the tape away from the envelope. The object of the present invention is to provide, by simple and inexpensive means, a solution to the above stated problem and disadvantages of prior web-envelope stitched-joint constructions, in air-inflated structures.

By way of example and to illustrate the features of the present invention the accompanying drawing is furnished, wherein:

FIG. 1 is a fragmentary sectional view taken through an envelope skin member having a tension web attached thereto and seam-taped in accordance with a typical prior art construction; the structure being shown as when it is under relaxed, non-inflated condition;

FIG. 2 corresponds to FIG. 1 but illustrates the disposition of the construction and stress results thereon when it is under inflation-distortion conditions;

FIG. 3 is a view corresponding to FIG. 1 but illustrates the construction of the present invention in contradistinction thereto; and

FIG. 4 corresponds to FIG. 3 but illustrates the construction of the present invention when operating under envelope-inflated conditions.

The invention is applicable to any situation wherein an envelope subject to air inflation is arranged to have a skin member thereof positionally restrained at intervals therealong by means of tension webs pulling in directions substantially normal to the general plane of the skin member.

Therefore, although the device is particularly useful for example in a construction as shown in my U.S. Patent No. 3,247,627, in order to simplify the illustration herein only one skin member and one associated tension web member are shown. The skin member is designated generally at **10**, and the web member is designated generally at **12**. The seam-sealing tape member is indicated generally at **14**.

FIGS. 1 and 2 illustrate how in accordance with one form of prior art construction the web member **12** is backfolded along its edge, as indicated at **16**, and then double stitched to the skin member **10** as indicated at **20—20**. A straight stitching technique is typically employed, whereby the outer surface of the skin member **10** remains substantially smooth and uninterrupted except for the perforations therethrough due to the stitching operation. Thus, during the envelope fabrication process of the skin member and web members are with ease and facility layered flatwise and machine-sewn together, and then seam-taped as illustrated at FIG. 1 to air-seal the joint. However, it has been found that joints so made are propense to early deterioration because of the stresses imposed thereon, due to the fact that when the envelope is inflated the skin member **10** balloons out from opposite sides of the joint seam into the bowed sectional form shown at FIG. 2. Incidental to such inflation the fabric of the skin member stretches somewhat, and therefore elongates transversely as viewed in the drawing herewith.

As a result, the cemented connection between the envelope skin and the sealing tape member **14** is subject to severe shear loads, and these stresses are relieved by separation of the adhesive connection either partially or totally throughout the width of the tape. Such separation occurs initially in the region of the apex of the valley formation in the envelope skin due to envelope inflation; whereby the tape **14** pulls partially away from the "bridges" the seam as illustrated at FIG. 2. Obviously, the seam-sealing effect is thereby disrupted and the tape tends to peel away from the joint, thereby exposing the joint to further adverse stress and weather deterioration effects.

As distinguished from the above, in the case of the present invention the junction between the envelope skin member and the tension web member is supplemented along the seam line so as to include a substantial external protuberance as indicated at **22** (FIGS. 3, 4). This protuberance may be provided by using a "chain stitch" sewing technique or the like, as indicated at **24**; or by otherwise providing an outwardly extending bead or ridge running the full length of the seam. For example, a welt or cord may be stitched along the outer surface of the seam to provide the desired protuberance. A sealing tape **14** is thereupon cemented in place as shown in the drawing herewith. It has been found that by virtue of such construction the tape member **14** embodies sufficient lateral expansion leeway to accommodate the previously described envelope skin distortion effects while avoiding tape separation stresses. It appears that the sinuous sectional form of the tape when so applied, provides a "reservoir" of the tape material allowing for ample transverse elongation without strain, while the material of the protuberance device **22** provides a flexible platform for carrying the tape during such flexural movements, without separation therefrom.

Whereas in the drawing and specification hereinabove the invention is illustrated and described in connection with only a single envelope skin member and a single tension web member, it is to be understood that the invention may be employed in a variety of situations involving the same problems; such as for example in a dual-walled air inflated structure as shown in my earlier Patent No. 3,247,627. Also, it is to be understood that whereas the drawing herewith illustrates the juncture between the skin and web members to have been performed

by use of a double-folded flange and double stitching technique, the features of the invention may be provided in connection with a single thickness flange and/or a single stitch.

What I claim as my invention is:

1. In an air-inflated envelope structure including, in combination, an envelope skin member and a tension web member disposed generally normal thereto, said skin member being formed of an extensible material, an improved joint connection therebetween comprising:

an edge flange portion of said web member being disposed in flatwise lapped relation against the inner surface portion of said skin member and fixed thereto by an interconnecting stitched thread member defining a seam, said skin member being extensible transversely of said seam upon inflation of said envelope,

a protuberance of substantial proportions extending lengthwise of said seam, said protuberance being positioned on the outer surface portion of said skin member by said thread member;

and a sealing tape member fixed to said outer surface portion of said skin member in overlying relation to said protuberance and thread member and extending lengthwise of said seam,

the opposite edge portions of said tape member being fixed to said skin member at opposite sides of said seam and the mid-portion of said tape member being fixed to said protuberance and conforming to the sinuous sectional profile thereof,

said protuberance being flexible whereby to provide for said mid-portion of said tape member a flexible platform holding the latter in connected relation thereon throughout flexures of said skin member upon inflation of said envelope,

said mid-portion when fixed to said protuberance as aforesaid providing a reservoir of tape material allowing for elongation without strain of said tape member transversely of said seam when said skin member is extended transversely of said seam upon inflation of said envelope.

2. In an air inflated enevelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 1, wherein said sealing tape member is adhesively fixed to the outer surface of said skin member and to said protuberance.

3. In an air inflated envelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 2, wherein said envelope skin and tension web and tape members are all formed of flexible fabric material.

4. In an air inflated envelope structure including an

envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 2, wherein said protuberance is a flexible bead device and said thread member passes through said bead device.

5. In an air inflated envelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 1, wherein said protuberance is formed by portions of said thread member projecting outwardly from said outer surface of said skin member.

6. In an air inflated envelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 1, wherein there is provided a pair of thread members and a pair of parallel protuberances extending lengthwise of said seam, and the mid-portion of said sealing tape member is fixed to each said protuberance and to said outer surface portion of said skin member disposed therebetween.

7. In an air inflated envelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 6, wherein said sealing tape member is adhesively affixed to said outer surface of said skin member and to said protuberances.

8. In an air inflated envelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 6, wherein said protuberances are formed by portions of said thread member projecting outwardly from said outer surface of said skin member.

9. In an air inflated envelope structure including an envelope skin member and a tension web member, an improved joint connection therebetween as set forth in claim 6, wherein said protuberances are flexible bead devices and said thread members pass through said bead devices.

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U.S. Cl. X.R.

52—62, 222; 112—418