

1 • Figure 4 is front view of the first flexible member prior to forming the
2 center portion into a loop illustrating the distribution of filamentary material
3 therein.

4
5 Figure 5 is a partial is view of the attachment fitting shown in Figure
6 3, illustrating the addition of reinforcements to the sides of the loop and
7 the installation of a metal attachment tube within the loop.

8
9 Figure 6 is a partial is view of the attachment fitting shown in Figure
10 2, illustrating a center loop portion as formed without reinforcements or
11 the installation of an attachment fitting therein.

12
13 **DESCRIPTION OF THE PREFERRED EMBODIMENT**

14
15 Illustrated in Figure 1 is a non-ridged lighter-than-air vehicle,
16 generally indicated by numeral 10. The vehicle 10 includes a flexible gas
17 bag 12 having a gondola 14 suspended from the bottom thereof and
18 thrust producing assemblies 16 attached to the gondola. The vehicle
19 further includes a plurality of fins 17 mounted on the rear thereof
20 supported by bracing wires 18. The vehicle 10 is shown docked on a
21 platform 18, secured thereto at its nose to a tower 20 and by a plurality of
22 mooring lines 22 along its length directly to the platform. These mooring
23 lines 22, as well as the bracing wires 18 are attached directly to the gas
24 bag by the subject attachment fittings, indicated by numeral 24. It is
25 important to note that the example application is for purposes of
26 illustration only and the attachment fitting can be used on any flexible wall
27 structure; however, it is most useful on pressurized flexible structures,
28 such as the gas bag illustrated above.

29
30 Referring now to figures 2 and 3, it can be seen that the wall 30 of
31 the gas bag 12 has an inner side 32 and outer side 34 with an elongated

1 slot 36 extending therethrough. The slot 36 has circular cut outs 38A and
2 38B at either end thereof that act as rip "stoppers". By having such a
3 cutout at the end of the slot 36 there is far less tendency to tear under
4 load. Of course other cutout shapes can be used as long as they have
5 the effect of distributing stress loads over a wide area. A first flexible
6 member 40, that acts as the primary attach point, includes a center
7 portion 42 in the form of a loop having sides 42A and 42B having a width
8 generally equal to the width of the slot 36. The loop extends through the
9 slot 36 from the inner side 32 and beyond the outer side 34. The first
10 flexible member 40 also includes fan shaped outer portions 44A and 44B
11 on either end thereof that are bonded to the inner side 32 of the wall 30
12 adjacent to the slot 36.

13
14 Figure 4 is a view of the first flexible member 40 prior to the forming
15 of the center portion 42 into a loop. The member 40 is made of strands of
16 unidirectional filamentary material 48 embedded in a flexible resin matrix
17 material 49. The filamentary material 48 is closely packed in the center
18 portion 42 (indicated by numeral 48A) and uniformly spread out into the
19 fan shaped outer portions 44A and 44B (indicated by numeral 48B). The
20 filamentary material can be selected from any of the high strength
21 structural fibers, such as KEVLAR™, DACRON™, VECTRAN™ graphite,
22 fiberglass, etc. The member 40 can also be made in any number of
23 ways. For example, the filamentary material could be laid up in a mold
24 having the shape of the member with a plurality of pins equally spaced
25 about the peripheral ends of the fan shaped end portions. The
26 filamentary material could be laid up in the mold with the ends tied off in
27 tension about the pins. The unidirectional filamentary material could
28 incorporated harness weaving to maintain filament spacing. Thereafter a
29 resin could be injected into the mold. A suitable resin is thermoplastic
30 urethane. This would allow bonding to the inner side 32 of the wall 30 by

CLAIMS

- 1 1. An attachment fitting for supporting a tension load applied to flexible
2 wall of a structure, the flexible wall being pressurized from a first side and
3 the tension load applied form the second side, said fitting comprising:
4 a slot in the wall of the structure;
5 a first flexible member having a center portion folded in half forming
6 a loop extending from the first side of the wall through said slot and out
7 from the second side, and outer fan shaped portions on each end of said
8 center portion bonded to the first side of the wall of the structure adjacent
9 to said slot, said first flexible member comprising a plurality unidirectional
10 reinforcing filaments in a matrix material with the filaments being parallel
11 to each other in the center portion and fanning out from each other in
12 each of said outer portions; and
13 a second flexible member completely covering said outer portions
14 of said first flexible member and said slot in the wall, said second flexible
15 member having a periphery extending about said slot and said outer
16 portions of said first flexible member, said second flexible member
17 bonded to said outer portions of said first flexible member and to the first
18 side of the flexible wall of the structure extending about the periphery of
19 said outer portions of said first flexible member such that said slot is
20 sealed off between the first and second sides of the wall and said first
21 flexible member is reinforced.
- 1 2. The attachment fitting as set forth in Claim 1 comprising:
2 said slot in said wall is elongated; and
3 said center portion of said first flexible member has a width
4 generally equal to said width of said slot.

1 3. The attachment fitting as set forth in Claim 2 further comprising
2 stress concentration reducing cutouts on either end of said slot and said
3 second flexible member extends beyond and about said cutouts.

1 4. The attachment fitting as set forth in Claim 3 wherein said stress
2 concentration reducing cutouts are circular shaped.

1 5. The attachment fitting as set forth in Claim 1, or 2, or 3, or 4
2 wherein a portion of the loop extending from a point in proximity to the
3 second side of the wall toward the free end of the loop are joined
4 together.

1 6. The attachment fitting as set forth in Claim 5 wherein reinforcing
2 members are joined to said joined portions of the sides of said loop.

1 7. The attachment fitting as set forth in Claim 6 wherein said
2 reinforcing members are flexible.

1 8. The attachment fitting as set forth in Claim 7 wherein a load
2 distributing member is mounted in the un-joined portion of said loop.

Note: Claims 3 to 8
are the re-numbering of
original claims 2 to 7.