Nov. 20, 1956 J. J. RYAN 2,771,256

BALLOON WITH LOAD SUPPORTING TAPES

Filed Oct. 29, 1953

Fig 1

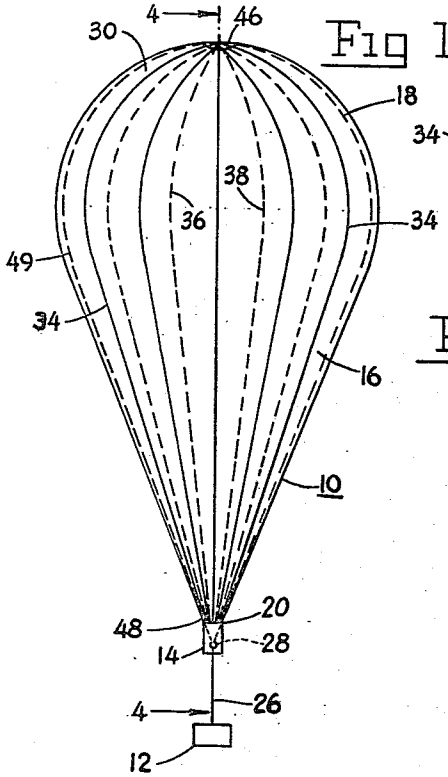


Fig 2

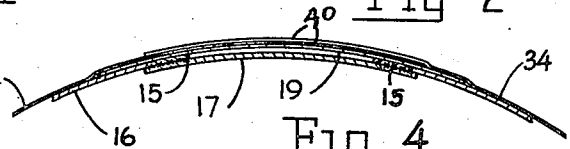


Fig 3

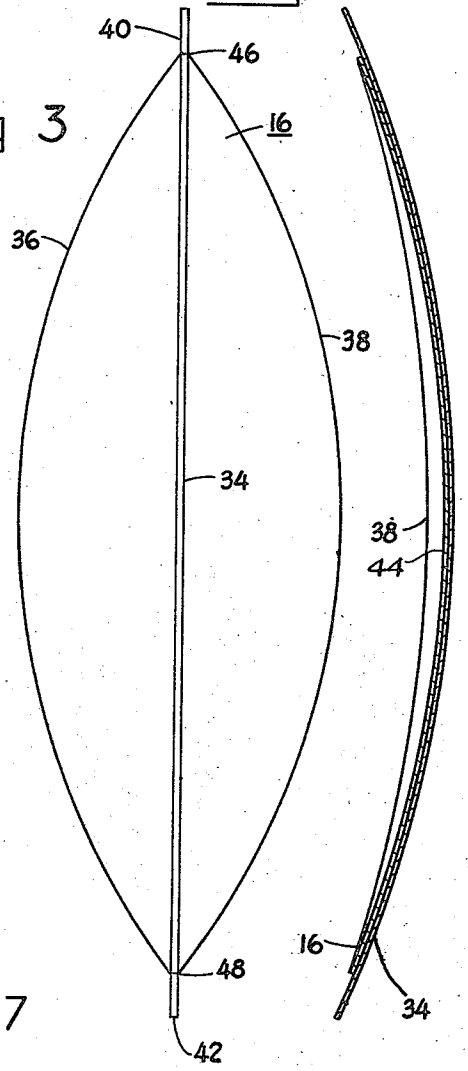


Fig 4

Fig 5

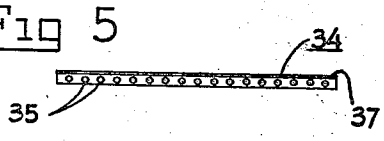


Fig 6

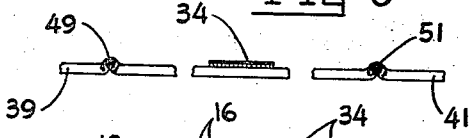
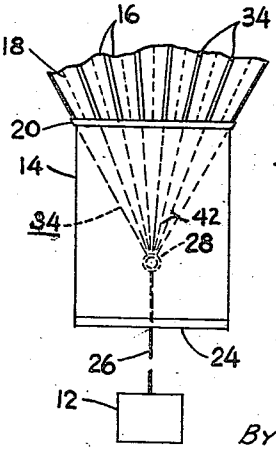


Fig 7



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BALLOON WITH LOAD SUPPORTING TAPES

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7 Claims. (Cl. 244—31)

This invention relates to improvements in balloons and more specifically to an improved balloon having tapes for supporting a load.

Balloons have been developed which are capable of carrying heavy loads high into the stratosphere. These balloons achieve superior performance because they use very thin, very light weight materials which are non-porous to gas. These materials are capable of containing a large quantity of lifting gas with a small leakage but because of the thinness cannot endure a concentration of high stress.

The loads which are to be carried by these balloons are relatively heavy and some means must be provided to attach them to the balloon material without creating points of concentrated stress.

Heretofore, one method of carrying the payload and distributing its weight over the upper lifting surface of the balloon has been to form a harness over the balloon by attaching adhesive backed tapes over the seams between the gores. The tapes carry the load and distribute it over the upper surface of the balloon and also strengthen the seams over which they lie. Balloons of large sizes cannot be practically manufactured from one piece of material. These ballons are made of a plurality of gores extending the length of the balloon and joined to each other at seams. Since the seams generally do not achieve the strength of the original material it was heretofore thought advisable to reinforce the seams as by placing an adhesive backed strengthening tape over them.

Although this method of strengthening the seams and attaching the load is excellent for many purposes, the present invention proposes certain improvements over this method and the achievement of an improved load supporting balloon structure.

Accordingly an object of the invention is to provide a balloon structure having a balloon envelope formed of very light weight material and formed of gores attached to each other along vertical seams with a load supporting harness formed of tapes extending from the top of the balloon to the load line with the tapes positioned between the seams.

One advantage to positioning the load-bearing tapes between the edges of the gores is that the tapes may be attached to the gores before the gores have been joined to form the balloon which greatly simplifies the assemblage of the ballon.

Another advantage to attaching the tapes in the central portion of the gores prior to joining them into a ballon is that this portion will be reinforced to withstand stresses and strains placed on it such as the stretching of this portion when the balloon is inflated. The part of the tape attached to the gores will be the same length as the gores and may also be composed of relatively strong materials as compared to the gore material.

A still further advantage to positioning the tapes so that they are non-contiguous to the seams is that the load carried by the ballons will pull down on the tapes and have a tendency to draw them inwardly toward the center of the balloon and thus minimize again any stretching of the central portion of the balloon gores.

Other objects and advantages will become more apparent in the following specification taken in connection with the appended drawings in which:

Figure 1 is an elevational view of the balloon illustrating the preferred embodiment as it appears in flight;

Fig. 2 is a plan view illustrating the details of the structure at the top of the balloon;

Fig. 3 is a plan view showing one of the balloon gores;

Fig. 4 is a sectional view taken along line 4—4 of Fig. 1 and illustrating the shape of one of the balloon gores in the inflated balloon;

Fig. 5 is a detailed perspective view illustrating the form of tape which may be used;

Fig. 6 is a sectional view taken through the balloon gores illustrating the relative position of the tape and the seams; and

Fig. 7 is a detailed view of the lower end of the balloon showing the load supporting lines.

In Fig.. 1 the balloon **10**, shown illustrating the preferred embodiment of the invention, carries a load **12** which may contain meterological instruments, ballast, and the like. The balloon has an appendix **14** for relieving excess gas pressure as the balloon ascends, since the relative pressure inside the balloon increases when the balloon reaches high altitudes.

The balloon envelope **10** is formed of a plurality of gores **16** which are secured to each other along seams **18**. The balloon material may be light weight material such as plastic and may be a thermoplastic such as polyethylene with the seams being heat sealed.

A typical balloon gore is shown in Fig. 3, although the width of this gore has been exaggerated for purposes of illustration.

The gore has a wider central portion and tapers toward narrower end portions being somewhat elliptical in shape.

As the lower end of the balloon, Fig. 7, the gores may terminate and have their lower edge covered by a band **20**. Also attached along this band of tape is the appendix **14** which may be the "Bronx cheer" type of appendix known to the balloon art. This has a skirt portion which descends downwardly and which is flattened at its lower edge **24** to permit the gas to escape when it reaches a higher pressure than the atmosphere but seals again to prevent the air from entering the balloon.

The load **12** is attached to a load line **26** which is secured to a load carrying ring **28**, Figs. 1 and 7. To transmit the weight of this load to the ballon envelope, which contains the lifting gas, the series of load tapes **34** are attached to the load ring **28**. These tapes extend up over the top of the balloon where they meet and are attached to form a harness over the balloon envelope. In this manner the weight of the load **12** is transmitted to the tapes and is distributed evenly over the upper surface **30** of the balloon which exerts the upward lift when inflated with a lifting gas.

The junction of the gores at their intersection at the upper end of the gores is sealed gas tight by heat sealing the gores at **15** to a flat disc of material **17** to form the balloon cap as shown in detail in Fig. 2. Another flat disc **19** is positioned loosely over the first disc **17** and the extension straps **40** of the tapes **34** are layed over this cap and thereby overlap each other. Since they are adhesive backed they adhere and form a strong balloon top.

The detail of a single balloon gore **16** before assemblage is shown in Fig. 3. The gore has been cut to the shape shown from a sheet of thermoplastic such as polyethylene. The load bearing tape **34** is laid over the gore midway between its edges **36** and **38**. The tape extends beyond the ends of the gores to form a top extension **40** and a bottom extension **42** which may also be called

straps. The top extension 40 is secured to other top extension straps at the top of the balloon as is shown in Fig. 2. The bottom extension strap 42 is attached to the load ring as shown in Fig. 7.

The tape 34 is shown in detail in Fig. 5. It is a flat strip of material having substantial tensile strength along its longitudinal axis so that it will be capable of supporting the load. This strength may be obtained by embedding a series of threads or strands 35 of cotton, nylon, linen or the like in the material. Woven material could also be embedded in the tape. The strengthening material should of course be light in weight, having a high strength to weight ratio so that as little weight as possible is added by the tapes. The tape has a coating of adhesive 37 on its surface for attaching to the ballon although if the balloon is of thermoplastic the tape may be also and be heat sealed to the gore.

It is to be noted that the tape extends down the center of the gore and not over the seam as has heretofore been the practice. As is shown in Fig. 3, the tape may be applied to the gore before the gores are assembled, instead of necessitating waiting for the assemblage of the gores in order to place the tapes over the seams. This will in many cases result in a saving of time and effort since a large balloon is unweildy and applying the tapes is difficult and may damage the balloon if not done with exceeding care.

In the present invention the tapes may be applied to the single gore which is relatively easy to handle, and once the large balloon is fabricated it need not be handled again for applying tape.

The location of the tape 34 relative to the adjoining gores 39 and 41 is shown in the flattened balloon section of Fig. 6. The tape lies midway between the seams 49 and 51 and in this position leans against the balloon envelope to carry the load.

It will be noted from Fig. 4 that, when the balloon is inflated, the center of the balloon gore, i. e., the area along the central axis 44, must bow outwardly as is shown in Fig. 4. In order to achieve this roundness the central portion must actually stretch in length.

Referring to Fig. 1, the distance from the point 46 at the top of the balloon to the point 48 at the lower end of the balloon is equal to the length of the seam 49. If the balloon is evenly rounded the length of the centerline 34 of the gore is the same length. Yet in Fig. 3 the curved edges 36 and 38 of the balloon are much longer than the center line 34. Therefore, since there is much more material available along the edges 36 and 38 the material along center line 34 must stretch to where it is at least as long as the material along the line 36 or 38 shown in Fig. 3. It follows that since this center line of the gore will stretch a considerable distance, it is subject to a greater strain than the edges of the gore. Also, because of the weight of the load additional stress is placed on the balloon in a vertical direction. Failure of the balloon is therefore likely to occur midway between the seams where the greatest stress is present.

The present balloon, in remedy to this situation, utilizes a tape which passes down along the longitudinal center axis of the gore and gives strength to the midpoint of the gore. Thus the tape has been placed over the area of greatest stress achieving a stronger balloon and with this additional strength balloon failures are less likely to occur. It follows that in a balloon of the present design the enhanced strength enables using a lighter weight balloon material reducing the balloon weight and consequently enables carrying a larger load.

It will be seen that the present invention has provided a new and improved balloon structure which utilizes a load supporting harness formed of tapes positioned midway between the seams of the gore balloons. By this structure a balloon of superior strength and one which is easier to fabricate has been achieved. While maximum advantages are obtained by placing the tape exactly along the centerline of the gore, substantial benefits can also be obtained with the tape displaced from this axis, as long as the tape is generally parallel to the axis and located within the central portion of the gore.

It also may be seen that the present invention allows placing of tapes on the portion of the plastic that increases in size, thus the tapes are always stretched tight and form a snug harness for the ballon walls. Thus, even without effective adhesive on the tapes at high altitude when fully inflated, the tapes would securely hold the plastic balloon as in a basket. This would not be true if the tapes were placed on the longer seams, which tend to wrinkle on inflation and allow the tapes to be loose. This wrinkling is due to the gore assuming the length of its center which, as above explained, is shorter than the seam. The gore center will of course stretch slightly but the seam will usually have a greater length than is necessary and will wrinkle instead of stretching taut.

I have, in the drawings and specification, presented a detailed disclosure of the preferred embodiment of my invention. It is to be understood that the invention is susceptible of modifications, structural changes and various applications of use within the spirit and scope of the invention and I do not intend to limit the invention to the specific form disclosed but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by my invention.

I claim:

1. A load carrying balloon comprising a balloon envelope formed of a plurality of elongated gores attached to each other to form vertical seams, load supporting tapes attached to the central portion of the outer surface of the gores between the seams and extending from the top of the balloon to the lower end, and means for supporting a load from the balloon being attached to said tapes.

2. A load carrying balloon comprising a balloon envelope formed of elongated symmetrical balloon gores attached to each other along seams which extend vertically from the top to the bottom of the balloon, load bearing tapes attached to the balloon surface midway between the balloon seams, and means for supporting a load from the balloon during flight and being attached to the load bearing tapes to transmit the load through the tapes uniformly to the upper balloon surface.

3. A load carrying balloon comprising a balloon envelope for containing a lifting gas formed of a light weight non-porous plastic arranged in elongated gores attached to each other along seams extending vertically along the balloon, load supporting tapes formed of a material having a greater tensile strength than the plastic and having an adhesive coating on one face, the tapes being attached to the balloon gores midway between the seams and extending from the top of the balloon to the lower end to form a harness for supporting a load in flight, and means for attaching the load to the harness.

4. In a balloon for supporting a load which has a gas containing envelope formed of a plurality of gores joined to each other along seams, the gores comprising an elongated sheet of light weight balloon material shaped to extend from a broad center portion to narrower ends, and a load supporting tape adhered to the surface of balloon gore extending from the ends and located between the two edges of the gore which are to be seamed to the adjoining gore to form the balloon envelope, both of which edges extend laterally beyond said tape.

5. In a load carrying balloon having a gas containing balloon envelope formed of a plurality of gores seamed to each other, the gore comprising an elongated sheet of balloon material tapered from a broad center to narrower ends, and a load supporting tape adhered to the central portion of the balloon gore between the gore edges and extending parallel to the axis of the gore along the length

of the gore and also extending a distance beyond the gore end, one end adapted to meet the tapes of the adjoining gores and the other end to be attached to a device for supporting the load.

6. The method of making a load carrying balloon which comprises forming a plurality of elongated elliptically shaped gores extending from a broad center to narrow ends, attaching an elongated load supporting tape to the central portion of the gore extending parallel to its axis and beyond each end thereof, and securing the gores to each other along a seam to form a completed continuous balloon envelope.

7. The method of making a load carrying balloon which comprises forming a plurality of elliptically shaped gores having a wide center portion curved to tapered narrow

end portions, attaching a load carrying tape to the central portion of the gore and extending beyond the ends thereof, securing the gores to each other along their edges to form seams, overlapping and attaching the extension of the tapes at the top end of the balloon, and affixing an extension of the tape at the lower end to a load supporting device.

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