G. M. BALL.

FABRIC STRUCTURE FOR PARACHUTES AND AEROSTATS AND METHOD OF CONSTRUCTING THE SAME.

APPLICATION FILED MAY 5, 1921.

1,427,772. Patented Sept. 5, 1922.

Fig. 1.

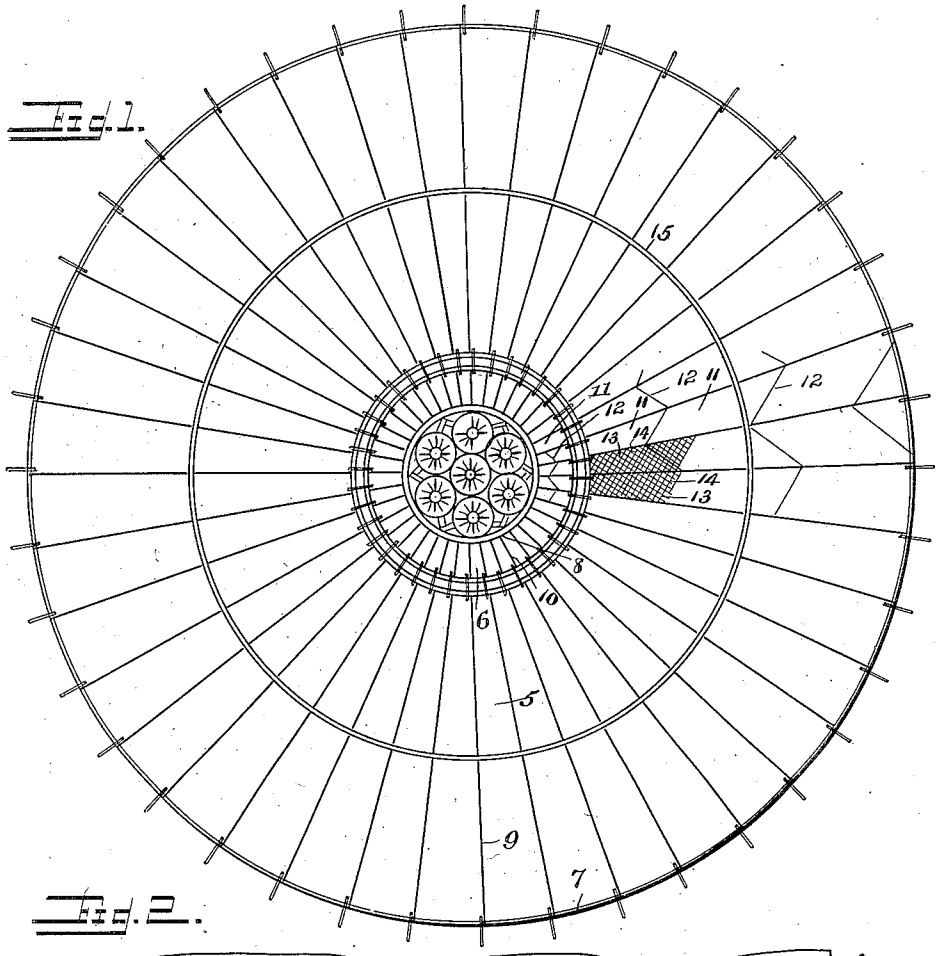
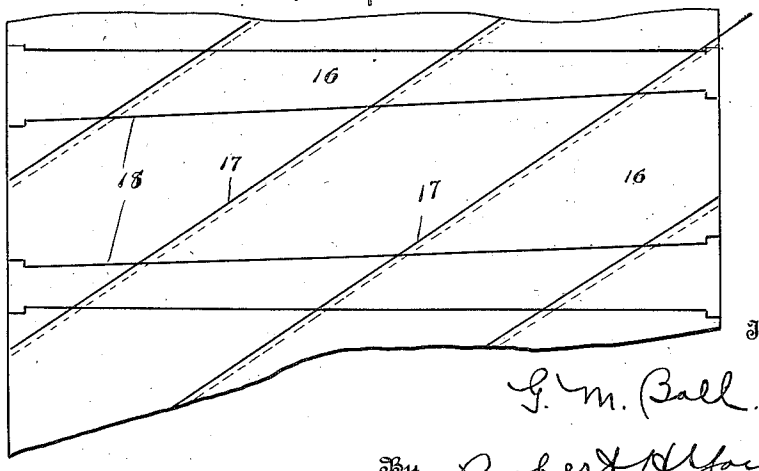


Fig. 2.



Inventor

G. M. Ball.

By Robert H. Young

Attorney

Patented Sept. 5, 1922. 1,427,772

UNITED STATES PATENT OFFICE.

GUY M. BALL, OF SPOKANE, WASHINGTON.

FABRIC STRUCTURE FOR PARACHUTES AND AEROSTATS AND METHOD OF CONSTRUCTING THE SAME.

Application filed May 5, 1921. Serial No. 467,128.

To all whom it may concern:

Be it known that I, GUY M. BALL, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented certain new and useful Improvements in Fabric Structure for Parachutes and Aerostats and Methods of Constructing the Same, of which the following is a specification.

My invention relates to the fabric structure of parachutes and the envelopes of aerostats, and to a method of constructing the same.

It is the primary object of the invention to provide a fabric structure which will be very strong, in which any ripping stress will be distributed over a large area, and in which such stress can only produce a rip of short extent. Heretofore, the only means relied upon to check ripping and limit its extent of action have been the seams between panels. The construction of the panels has been such that any stress applied to a seam was not absorbed but resulted generally in further ripping. I have discovered that the faulty feature has been the arrangement of the warp and weft threads of the fabric with one set of threads substantially at right angles to the seam between panels and the other set of threads parallel to the same. Any stress upon a seam between panels has communicated longitudinal stress to the threads which are perpendicular thereto and shearing stress to the parallel threads. As a result, instead of absorbing shock, the fabric structure of an affected panel has become torn. This failure to reinforce the same generally results in rupture of the seam, if that has not already occurred. Considering parachutes in particular, a radial rip is not so serious as a lateral rip extending through more than one panel. In practice it has been found that a single panel may rip from vent hem to skirt hem without increasing the speed of descent so materially as to result in a dangerous landing. Therefore, a fabric structure which will restrict ripping to the panel in which it starts is desired.

In addition to providing a fabric structure which will prevent lateral ripping when applied to parachute construction in particular, it is an object also to provide a structure which will tend to limit the extent of radial ripping. This has been accomplished in the past by the use of a series of lateral reinforcing bands which intersect the interpanel seams at relatively spaced points between vent and skirt.

A further object is to provide a fabric structure which will accomplish the objects just mentioned and which may be cut into panels for the construction of parachutes, balloon envelopes, and the like, with maximum economy of material.

Further objects and advantages may become apparent as the following specific description is read in connection with the accompanying drawing, in which:

Fig. 1 is a plan view of a parachute constructed in accordance with the present invention, some of the warp and weft threads being shown in detail in order to indicate their angular relation to adjoining seams; and

Fig. 2 is a plan view of a strip of the improved fabric structure made up for parachute construction, showing the manner in which standard strips of the desired material are united to form the wide composite strip, and also representing in dotted lines the manner of cutting out panels to economize material and prevent waste.

In the drawings, the invention is shown applied to parachute construction by way of example. It is to be understood, however, that its application may be extended to the envelopes of balloons, dirigibles, and other aerostats, or even to fabric devices which do not relate to the aeronautical art. For instance, tents, sails, awnings, and numerous other articles of manufacture which are subject to ripping stresses due to the effect of wind or other causes, may employ in their construction the principles of the present invention with a view to limiting the extent of rips which may occur. The scope of the invention is therefore not limited to the illustrative disclosure in the accompanying drawings.

Referring to Fig. 1 of the drawings first, it will be noted that the parachute therein disclosed consists essentially of a plurality of main panels 5 and vent panels 6 extending between the skirt hem 7 and the vent hem 8. The main panels are connected together at their adjacent edges by the usual interpanel seams 9 and the vent panels are similarly joined by interpanel seams 10. These are the general characteristics of a

well-known type of parachute. The present invention may obviously be applied to other types of parachutes as well. It will be observed that each panel is made up of a number of segments 11 which are separated by diagonal seams 12. It will be noticed also that the intersegmental seams 12 of each panel are parallel to each other. This feature results from the method of uniting standard strips of material in the construction of the composite strips from which the panels are cut and will be more clearly described later or in connection with Fig. 2 of the drawing. The important feature is the diagonal arrangement of these seams, regardless of their incidental parallelism.

Turning to that portion of Fig. 1 in which the warp and weft threads of the fabric are shown in detail, it will be seen that the warp threads 13 are parallel to the intersegmental seams in each panel, the weft threads 14 being consequently at right angles to these seams. The seams 12 are preferably disposed at 45° to the axis of each panel. This brings the warp and weft threads into oblique angular relation to adjacent interpanel seams. The functions performed by this relative arrangement of threads and seams will be described presently.

The intersegmental seams may be supplemented by the usual lateral bands 15 as shown, but the former will be more effective in limiting the extent of lateral rips that may occur.

The manner in which the relative arrangement of threads and seams functions will now be described. Assuming that some segment of a panel has become torn while the parachute is descending through the air, the rip will be directed in an oblique direction with respect to the panel axis rather than parallel to the axis. This is due to the oblique arrangement of the warp and weft threads. As a result, the rip will meet either an interpanel seam or an intersegmental seam, and will extend at an oblique angle to the interpanel seam, or at right angles to the intersegmental seam, as the case may be. If the rip meets an interpanel seam, it will be stopped thereby, due to the fact that additional stress brought to bear upon the seam will be absorbed by the fabric of the panel on the opposite side of the latter. The warp and weft threads of this last mentioned fabric are not disposed at right angles to the seam or parallel thereto, so the stress communicated to them will neither shear the parallel threads nor rupture the perpendicular threads by exerting excess endwise pull on them. The threads are on the contrary disposed at an oblique angle to the same and the lateral stress on the panel will tend to change the angular relation of warp to weft threads and thus to make the fabric more impervious. This is not a disadvantage when occurring only at one or two isolated points, so may be permitted. This distortion of the threads absorbs shock and distributes it over a considerable area without permitting rupture of the fabric. On the other hand, in the event that a rip encounters an intersegmental seam, the latter being very short as compared with an interpanel seam will exert lateral pull upon adjacent interpanel seams before being distorted to the breaking point. This latter stress upon interpanel seams will be distributed over the fabric of the two adjoining panels and will be absorbed in the manner just described. Therefore, the intersegmental seams will also serve to stop a rip. The effect of the whole arrangement is to restrict any ripping which starts to the extent of one of these small segments. One such rip, or even several, would not be dangerous. The parachute would still give sufficient support to the weight carried thereby to retard the speed of descent below the danger point.

In Fig. 2 the method of making up a wide strip from which a series of panels may be cut without waste of material is represented. A strip of the desired fabric material of standard width, as it comes from the mills, is cut into a series of short strips 16. Each short strip is in the form of a rhombus. This is accomplished by cutting the standard strips at 45° so there will be no wastage. When the strips 16 are joined in the manner shown, they will form wide composite strips and will extend at 45° to the longitudinal axis of the latter. The width of the composite strip depends upon the length of the panels that are to be cut therefrom. For the main panels of the parachute, for instance, the composite strip will be wider than it would be for the cutting out of vent panels. For the manufacture of parachutes of the specific type disclosed in Fig. 1, two composite strips will be required, whereas the number of strips of various widths required for the construction of balloon envelopes, and other devices, will depend upon the requirements in each particular case.

The short strips 16 may be joined together by means of seams 17 of suitable formation. The panels which are to be used in the final construction of the parachute or other device may be cut from this composite strip. In the present instance, the panels are trapezoidal in form and are cut along lines 18 with the long and short bases alternating in position so as to economize material and prevent any wastage. When the segments are joined in the usual manner by means of suitable interpanel seams, the desired relative arrangement of the threads and seams will result.

It is desired again to emphasize the

breadth of scope of this invention and to point out the fact that various modifications in the arrangement of parts or other structural details may be resorted to in practice without departing from the scope of the appended claims.

I claim:

1. A fabric covering for aerial devices comprising a plurality of panels of woven material secured together by seams at adjoining edges, each panel being made of a plurality of diagonally extending segments secured together by intersegmental seams at adjoining edges and said intersegmental seams of one panel being obliquely related to the intersegmental seams of adjacent panels.

2. A fabric covering for aerial devices comprising a plurality of panels of woven material secured together by seams at adjoining edges, each panel being made of a plurality of diagonally extending strips secured together by seams at adjoining edges and arranged with corresponding threads parallel, the strips of one panel being oblique to the strips of adjacent panels.

3. The method of making a fabric structure which consists in forming a wide strip of woven material by joining together a plurality of narrow strips in diagonal relation to the axis of the wide strip, cutting transverse panels from the wide strip, and securing a plurality of panels together in such manner as to form the completed fabric structure in which the narrow strips of one panel extend obliquely to the narrow strips of adjacent panels.

In testimony whereof I have affixed my signature.

GUY M. BALL.