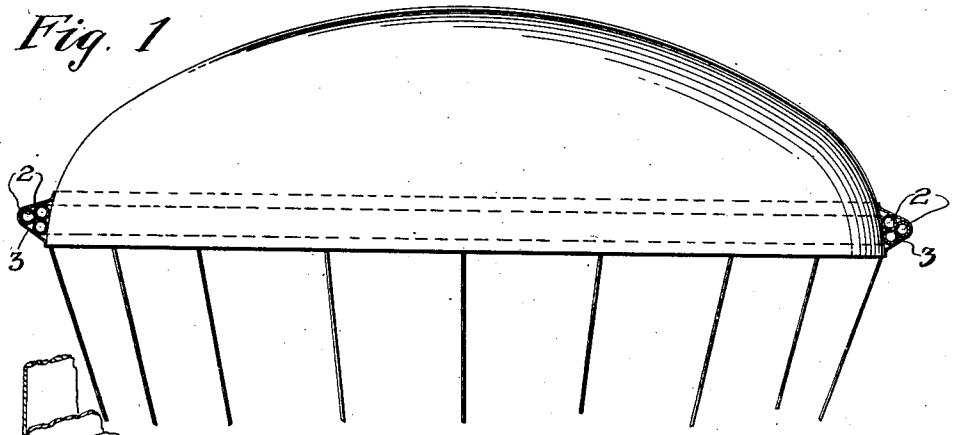
N. B. WALES.

PNEUMATICALLY REINFORCED CASING FOR AERONAUTIC CARRIERS.

APPLICATION FILED JAN. 24, 1919. RENEWED NOV. 29, 1920.

1,364,596. Patented Jan. 4, 1921.

Fig. 1



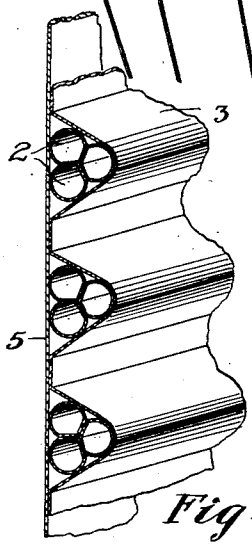


Fig 4

Fig. 2

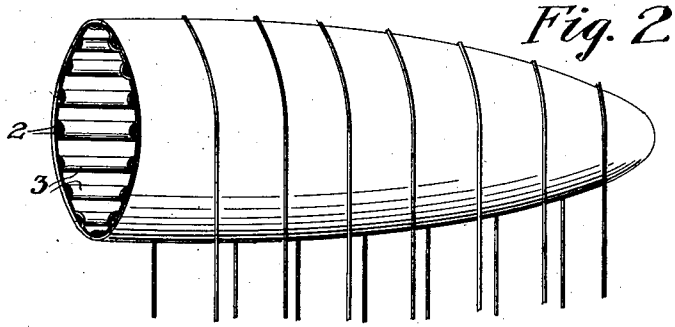
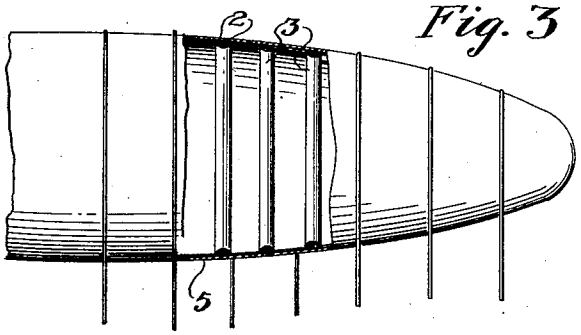


Fig. 3



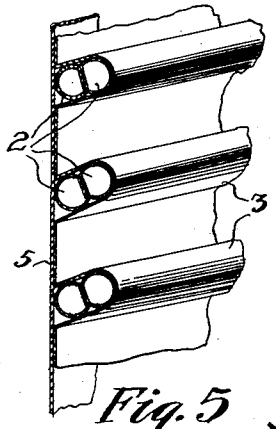


Fig. 5

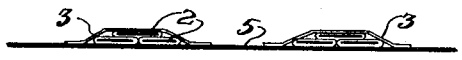


Fig. 7



Fig 6

Witness

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PNEUMATICALLY-REINFORCED CASING FOR AERONAUTIC CARRIERS.

1,364,596. Specification of Letters Patent. Patented Jan. 4, 1921.

Application filed January 24, 1919, Serial No. 272,840. Renewed November 29, 1920. Serial No. 427,212.

To all whom it may concern:

Be it known that I, NATHANIEL B. WALES, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Pneumatically-Reinforced Casings for Aeronautic Carriers, of which the following is a specification.

This invention relates to envelops or casings especially adapted for aeronautic bodies, such as balloons, air ships or parachutes, though applicable to other uses.

The main purpose of my invention is to provide pneumatic means of reinforcing the casings or covering of aeronautic carriers which will afford great rigidity and strength when inflated, but without materially adding to the weight of the fabric, and permitting it to be collapsed or folded into compact form for storage or transportation.

Various devices for stiffening the bodies of balloons, air ships, and parachutes have been proposed, consisting usually of a frame or skeleton of wood, metal or other material possessing the requisite inherent strength and rigidity, but these are objectionable among other reasons on account of their weight and bulk, difficulty in construction and because they cannot be collapsed into compact form.

It has also been proposed to construct a framework of tubes which may be inflated and to which the covering may be attached, or to construct the casing with double walls which may be inflated as a whole or in separate sections. Both of these constructions require an excessive amount of gas for inflation and do not afford the proper truss construction which is requisite to withstand the stresses to which aeronautic carriers are subjected.

I have overcome the difficulties encountered and the inherent defects in such prior constructions by incorporating a multi-cellular pneumatic reinforcement in the fabric of the covering or casing. I have found that a far more rigid construction may be obtained by sub-dividing each reinforcing element into a multi-cellular structure, the combined strength and resistance to bending of the compound element being much greater than the same number of individual pneumatic strands would afford. This increased strength and rigidity of the compound multi-cellular reinforcing element is the resultant effect of a number of causes which will be apparent to engineers. Each individual pneumatic strand or component tends to maintain its form and resists lateral bending stresses, this resistance being greater in proportion to its diameter than the reduction in size, or in other words, if the reinforcing element is composed for instance, of three pneumatic tubular strands, each strand possesses more than one-third the rigidity of a single tube having a cross-sectional area equal to that of the entire element. Again, a greater pneumatic pressure may be maintained in the multi-cellular element than could be employed in a single tubular element of the same size with the same stress upon the material. It is obvious therefore, that I am enabled to obtain a far greater rigidity and strength by employing multi-cellular reinforcing elements and with a smaller total pneumatic capacity.

For the purpose of clearly disclosing my invention, I shall refer in the following description to the accompanying drawings, in which—Figure 1 is a diagrammatic illustration of the upper portion of a parachute provided with a multi-cellular reinforcing element shown in section which embodies my invention; Figs. 2 and 3 are fragmentary side elevations showing my invention applied to dirigible balloons; and Figs. 4, 5, 6 and 7 are detail views of my multi-cellular pneumatic reinforcing element.

As previously stated, I have found that the casing or covering for aeronautic bodies or carriers may be reinforced most effectively by incorporating the stiffening elements with the fabric as integral portions thereof. I have also found that I can secure the requisite rigidity and strength necessary to resist the enormous stresses and strains to which aeronautic carriers are subjected by providing reinforcing elements constituting integral ribs, which are multi-cellular in structure. Each of these pneumatic reinforcing elements or rib members is composed of two or more small tubes 2, 2, formed of a suitable fabric material preferably a rubberized fabric; and these small

tubes which are adapted to be inflated to constitute pneumatic strands of the reinforcing element or rib member are preferably united where they abut by a vulcanized joint, so that the plurality of tubes constitute an integral structure. They are then attached to the fabric constituting the covering or casing by being vulcanized thereto in any suitable manner. I prefer to employ an enveloping strip of fabric 3, which is secured upon either longitudinal edge to the fabric sheet 5, preferably by vulcanization. In some cases the envelop 3, for a series of reinforcing elements may be made from a continuous sheet of material vulcanized to the main fabric sheet between the ribs.

I have previously pointed out certain of the peculiar and great advantages which I obtain by constructing the pneumatic reinforcing elements of a plurality of longitudinal cells of small diameter and wherein this construction possesses far greater strength and rigidity than a single tube having the same cross-sectional area as the multi-cellular element. It is to be noted also that greater lateral rigidity and strength is afforded in planes passing diametrically through two of the pneumatic strands. Thus in the arrangement shown in Fig. 5, I obtain the greatest rigidity in planes perpendicular to the fabric 5. In the arrangement illustrated in Fig. 4, in which the three pneumatic strands are symmetrically arranged, great rigidity is afforded in the two planes at an angle to the fabric and which are parallel to the inclined sides of the envelop 3 and also in a plane parallel with the fabric 5.

When this multi-cellular reinforcing element is applied to the casing or covering of a parachute the multi-cellular reinforcing element may be secured to or incorporated with the fabric in the manner illustrated in Fig. 1 forming an annular rib around the base of the parachute cover or at its largest diameter. The channels of the small tubes 2 of the pneumatic multi-cellular reinforcing element are connected in any suitable manner, as by a flexible tube to a tank of compressed non-inflammable gas which is controlled by a valve, in the manner well understood, so that when the aviator is to make his descent by means of the parachute, which is usually carried in a bag or pocket attached to the aviators jacket, or in any other suitable manner, the parachute will be instantly opened outwardly into its distended shape as soon as the compressed gas is permitted to pass into the multi-cellular reinforcing element.

The fabric covering of air-ships or dirigible balloons, may be reinforced in the same manner by means of my multi-cellular pneumatic reinforcing elements and these reinforcements may constitute ribs extending either longitudinally, as illustrated in Fig. 2 or transversely as illustrated in Fig. 3.

When these multi-cellular elements are deflated they may be pressed down against the fabric backing so that they are nearly flat as illustrated in Fig. 7. The rubberized fabric of which the cells of my pneumatic reinforcing elements are formed is very thin and flexible so that the casing may be folded and packed away with substantially the same facility as it could be if the multi-cellular reinforcements were not present.

I have described in detail the particular construction illustrated in the accompanying drawings for the purpose of clearly disclosing an embodiment of my invention, but it will be understood by engineers that various changes and modifications may be made without departing from my invention and that there are other applications and uses for this multi-cellular pneumatic reinforcing element besides those which I have particularly specified herein.

I claim:—

1. An aeronautic carrier, such as a parachute, comprising a fabric covering or casing, and a reinforcing element or rib united thereto having a plurality of longitudinally extending tubular cells incorporated into a multi-cellular structure having the cell channels continuous throughout the extent of said element and adapted to be connected to a source of pneumatic pressure.

2. A fabric covering material adapted for the casings of aeronautic bodies, comprising a rubberized fabric, and a multi-cellular pneumatic reinforcing element secured thereto having a plurality of tubular cells extending longitudinally thereof throughout the extent of the element and adapted to be inflated by connection to a source of pneu-pneumatic pressure.

3. A pneumatic reinforcing element for the fabric casing or covering of aeronautic carriers, such as parachutes, comprising a plurality of tubular cells of flexible fabric incorporated into a multi-cellular structure, said cells extending longitudinally throughout the extent of the element and adapted to be united to the covering material.

In testimony whereof I affix my signature.

NATHANIEL B. WALES.