Dec. 16, 1924. 1,519,772

L. DÜRR

OUTER COVER FOR RIGID AIRSHIPS AND METHOD OF FASTENING THE SAME

Filed Sept. 13, 1924 3 Sheets-Sheet 1

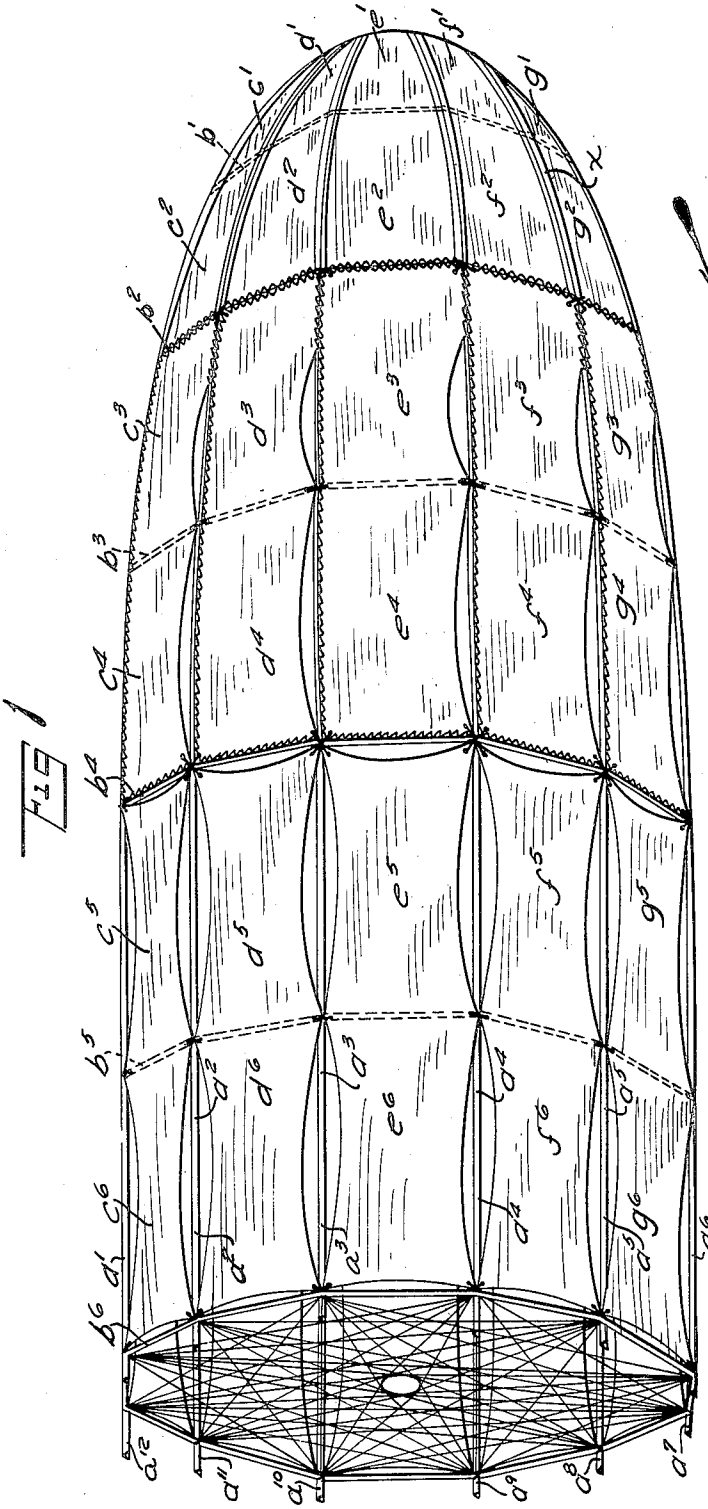


Fig 1



Fig 2

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FIG 2

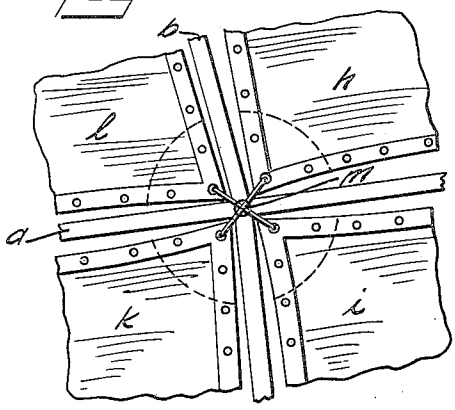


FIG 4

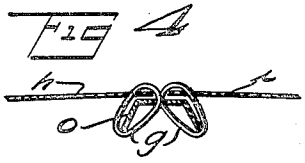


FIG 5

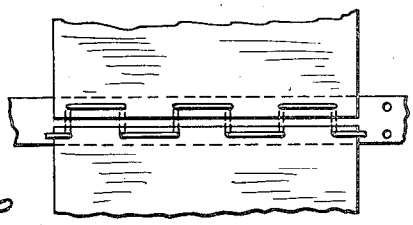


FIG 3

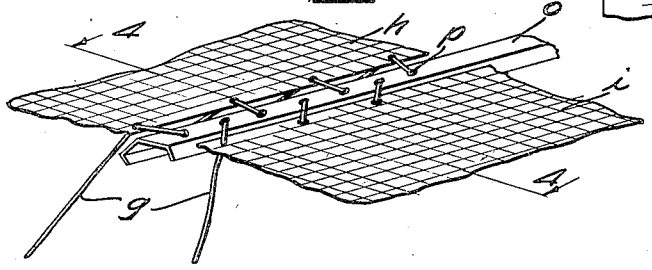


FIG 8

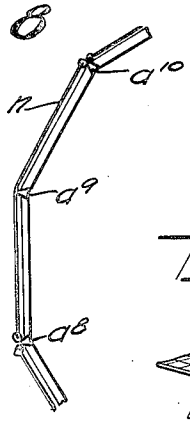


FIG 9



FIG 7

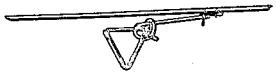
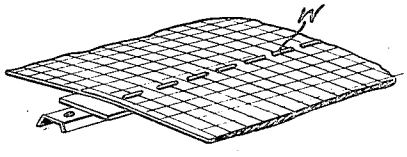


FIG 10



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OUTER COVER FOR RIGID AIRSHIPS AND METHOD OF FASTENING THE SAME

Filed Sept. 13, 1924 3 Sheets-Sheet 3

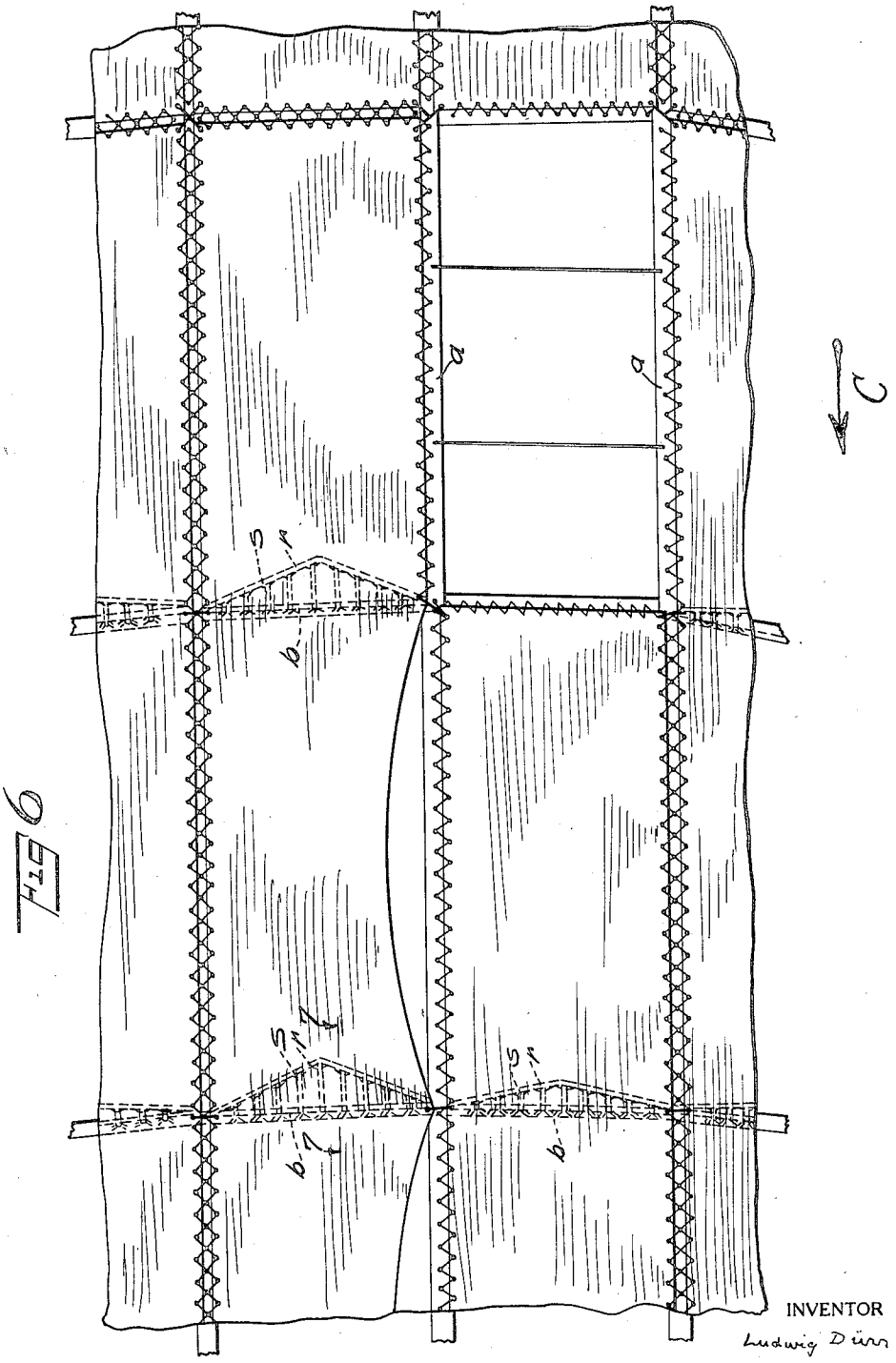


Fig 6

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Patented Dec. 16, 1924. 1,519,772

UNITED STATES PATENT OFFICE.

LUDWIG DÜRR, OF FRIEDRICHSHAFEN, GERMANY, ASSIGNOR TO LUFTSCHIFFBAU ZEPPELIN GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, OF FRIEDRICHSHAFEN, GERMANY.

OUTER COVER FOR RIGID AIRSHIPS AND METHOD OF FASTENING THE SAME.

Application filed September 13, 1924. Serial No. 737,592.

To all whom it may concern:

Be it known that I, LUDWIG DÜRR, a citizen of Germany, and a resident of Friedrichshafen, Bodensee, Germany, have invented certain new and useful Improvements in Outer Covers for Rigid Airships and Methods of Fastening the Same, of which the following is a specification.

My invention relates to rigid air ships, the hulls of which are covered by an outer cover made of fabric, and particularly to the method of putting the cover upon and fastening it to the hull of the airship.

The hull of a rigid airship is generally made up of longitudinal members and cross members—the latter called rings. Such framework after having been assembled and braced by wires is covered with fabric so as to have a smooth surface. Up to now such fabric cover was cut and sewn to form individual pieces which would surround a cylindrical or tapered section of the hull with a main ring member at each end, thus covering one so-called compartment. This way of forming the individual pieces demanded a special arrangement for joining the pieces at every main ring. It consisted in lacing both pieces over the ship's circumference to the ring member and to each other, and in applying an adhesive tape of more or less width over the seam.

According to my invention I do not use individual pieces each covering an entire compartment of the hull but I have the pieces cut and sewn so that they will extend much further in the ship's longitudinal direction (for example passing over two or more compartments)-but their width is sufficient to reach over a portion of the circumference.

The use of pieces of the outer cover made in accordance with my invention decreases the number of circumferential seams necessary over the length of the ship, and this results in a gain in speed because there is less air resistance. Of course the number of longitudinal seams—preferably located on longitudinal girders—is increased, but longitudinal seams will not influence the speed as much as cross seams do.

Special care has to be taken when putting the cover on to the hull and fastening to it such longitudinal pieces. It is particularly necessary to avoid considerable stresses on longitudinal and cross members. The following method will show a way in which this may be done.

I prefer to have the longitudinal pieces cut in such a way that those that have to cover portions of the same compartments are of equal length, so that the cross seams will be situated all around the same cross member, or ring. Such pieces are first fastened to the hull at the ring corners or points of intersection of longitudinal members and ring members. This is done first around one individual ring at one end of the pieces of the cover and preferably at the same time over the entire circumference of this ring. Then the respective parts of the pieces are fastened to the corners of the next ring and so on until the other ends of the longitudinal pieces are fastened in the same way to the corners of the last ring, which they touch.

The longitudinal seams are then made by fastening the pieces along their edges to the respective longitudinal girders and to one another. This work is again accomplished in such a way that the fastening along one approximate circumferential line is always done at the same time, progress being made in the ship's longitudinal direction.

If desired, after having fastened the pieces to the ring corners, they may first be fastened only along one longitudinal edge to the corresponding longitudinal girder and later the second edge may be fastened, but as before the work is done at one time over a single circumferential line and progress is made in the ship's longitudinal direction. It is not necessary to fasten the pieces to the intermediate longitudinal girders over which they pass in their width, but I prefer to do so.

For the purpose of obtaining a good surface and an equal distribution of stresses it is desirable to provide means for pulling the middle part of the fabric towards the cross members, preferably before the pieces are fastened all around their edges. Such means may for example be small strips of fabric or ribbon sewn to the inside of the pieces over their width in such a way as to form blunt arrows pointing in the direction opposite to the progress of fastening. Such ribbons may be sewn to the fabric at places just off the line of intersection with the cross member, and laces may be provided

fastened to such ribbons which allow one to pull the ribbons towards the cross member and to fasten them to the same.

If for any reason it is desired not to cover the hull all over its surface at once but to leave open certain parts for the purpose of having easier access, then it is best to substitute the missing parts of the outer cover by tension members such as wires or the like, thereby bracing the respective longitudinal girders. After completion of the inner construction of the ship the missing pieces may easily be put on and fastened in accordance with my method, when the auxiliary bracing may be removed.

When all the pieces have been fastened their edges or seams are covered with adhesive tape for the purpose of reducing the air resistance.

The drawing represents an example embodying my invention and demonstrating my method.

Fig. 1 is a perspective view of the ship's bow;

Fig. 2 gives a plan view of a ring corner where four pieces of outer cover meet;

Fig. 3 shows the connection of the edges of two longitudinal pieces to the outer chord of a longitudinal truss girder;

Fig. 4 is a cross section taken on line 4—4 of Fig. 3;

Fig. 5 gives another example of fastening the edges of the pieces;

Fig. 6 shows substantially two pieces of the cover in different stages of fastening;

Fig. 7 is a cross section taken on line 7—7 of Fig. 6;

Fig. 8 is a diagrammatical cross section through part of the ship at right angles to its longitudinal axis, the width of the piece shown reaching over two sides of the polygon;

Fig. 9 shows the way of fastening the piece of fabric to the intermediate longitudinal girder;

Fig. 10 gives a perspective view of the same.

The ship's bow shown in Fig. 1 consists of longitudinal members a^1 to a^{12} and of cross members or rings b^1 to b^6. Separate longitudinal pieces of fabric are covering the panels c^3 and c^4, d^3 and d^4, e^3 and e^4, f^3 and f^4, g^3 and g^4 respectively. The direction of progress in fastening the edges all at the same time over one approximate circumference is shown by the arrow C. The cover has already been fastened as far as ring b^2. Between ring b^2 and ring b^4 the fastening is in progress, while between ring b^4 and ring b^6 the pieces of the cover have just been fastened to the ring corners. In other words this latter compartment represents the first stage of the fastening of the outer cover. The pieces of fabric shown on compartments 3 and 4 after being fastened to the ring corners, in the same way as shown on compartments 5 and 6, have at first been fastened along their upper edges to the corresponding longitudinal girders; and at the stage shown they are just being fastened along their lower edges—at the same time along one approximately circumferential line and progressing in the direction given by arrow C.

Fig. 2 shows how the fastening of the corners of the pieces of the cover should be done. The letter a designates a longitudinal girder and b a ring girder; h, i, k, and l are the corners of fabric pieces.

The longitudinal girder a has an eyelet m through which the laces n pass.

In Figs. 3 and 4 the way of fastening the edges of the fabric pieces h and i to the outer chord o of a longitudinal girder is shown. Through the eyelets p in this chord o the laces q are passed.

Instead of passing these laces q in the manner represented in Fig. 3 they may as well be passed in the way shown in Fig. 5, thereby causing a decrease in air resistance as the laces are running in longitudinal direction outside of the cover.

For the purpose of obtaining a good distribution of stresses ribbons r are provided inside of the cover with laces s, as may be seen from Figs. 6 and 7. These ribbons and laces serve for pulling the fabric in the direction of arrow C toward the cross members b and for fastening them to the same. This causes the warp and the woof of the fabric to run substantially parallel with the longitudinal and cross girders and avoids their possible distortion. In Fig. 6 an open panel also is shown, the longitudinal girders a of which are braced by tension members t.

It will simplify the putting on and fastening of the outer cover if the width of its pieces is such that they will extend over several sides of the cross sectional polygon, as shown in Fig. 8. Here a piece of fabric n extends from longitudinal girder a^8 to longitudinal girder a^{10}, passing over girder a^9. It will be advisable to fasten the piece of cover not only by its edges to the girders a^8 and a^{10}, but also on a median line to girder a^9. As may be seen from Figs. 9 and 10, in such cases it is useful to provide a reinforcing strip or ribbon v between the fabric and the outer chord of girder a^9. Laces w serve for fastening the fabric to the girder a^9.

I want it understood that I do not limit myself to the exact details described or given in the drawings, as many variations will occur to persons skilled in the art.

Claims:

1. A rigid airship comprising a hull made up of longitudinal members and cross members, and an outer cover on said hull, the circumference of said outer cover con-

sisting of several pieces of fabric having four edges each, two of said edges being fastened to cross members and the other two edges to longitudinal members of said hull, said pieces in their longitudinal direction passing over intermediate cross members.

2. The method of fastening longitudinal pieces of an outer cover to the hull of a rigid airship which consists in first fastening the corners of said pieces of cover to the ring corners of the hull and afterwards fastening the longitudinal edges of said pieces of cover to the corresponding longitudinal girders, but doing this at the same time along approximately one circumferential line and progressing in the direction of the ship's longitudinal axis.

3. A rigid airship comprising a hull made up of longitudinal members and cross members, an outer cover on said hull, the circumference of said outer cover consisting of several pieces of fabric having four edges each, two of said edges being fastened to cross members and the other two edges to longitudinal members of said hull, said pieces in their longitudinal direction passing over intermediate cross members and being provided with reinforcing layers next to the lines of intersection with said intermediate cross members and laces or the like fastened to said reinforcing layers for the purpose of fastening said layers to said intermediate cross members.

LUDWIG DÜRR.