METHOD FOR WEAVING CONTOURED THREAD CONNECTED DUAL WALL INFLATABLE FABRIC
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FIG. 1

FIG. 2

FIG. 3

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METHOD FOR WEAVING CONTOURED THREAD CONNECTED DUAL WALL INFLATABLE FABRIC

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This invention relates to a method for weaving contoured thread-connected dual wall inflatable fabric, and more particularly to a method for weaving double spaced fabrics with extended drop yarns therebetween so that when the fabrics are moved apart after weaving, a desired contour is attained between the fabrics because of the extended lengths of the drop yarns.

Thread-connected dual wall inflatable fabric is manufactured and sold by Goodyear Aerospace Corporation of Akron, Ohio, under the trademark "Airmat" registered in the U.S. Patent Office.

Another object of the invention is to provide a method highly accurate, extremely effective, and which is low in cost for weaving contoured inflatable fabric which is simple, easy to operate.

The aforesaid objects of the invention and other objects which will become apparent as the description proceeds are achieved by providing a method to weave contoured inflatable fabric which comprises the steps of weaving a top and bottom fabric of wire yarn in substantially parallel spaced relationship, maintaining the woven fabrics in substantially the same spaced relationship while moving them away from the weaving edge, weaving a plurality of drop yarns longitudinally into each fabric, crossing the drop yarns over from one fabric to the other, extending the crossed over drop yarns from the top fabric a pre-determined length between the fabrics while spacing them from the lower fabric, and extending the crossed over drop yarns from the bottom fabric a pre-determined length between the fabrics while spacing them from the top fabric.

For a better understanding of the invention reference should be had to the accompanying drawings, wherein:

FIGURE 1 is a schematic line diagram of one embodiment of the method of the invention;

FIGURE 2 is a schematic line diagram of a slightly altered version of the embodiment of FIGURE 1, and

FIGURE 3 is a schematic line diagram of another embodiment of the method of the invention which extends the drop yarns outside the fabrics.

With reference to FIGURE 1 of the drawings, the numeral 1 indicates a top fabric and numeral 2 represents a bottom fabric. The top fabric 1 is woven from a plurality of warp yarns 3 and 4 which define a top shed 5. Likewise the bottom fabric 2 is woven from a plurality of warp yarns 6 and 7 which define a bottom shed 8. Weft yarns 9 and 10 are received in the sheds 3 and 8 and are beaten up into weaving edges 11 and 12 usually by means of a reed mechanism (not shown). The woven fabrics 1 and 2 are taken away from the weaving edges in substantially straight, parallel spaced relationship to allow the extention method described hereinafter.

A plurality of drop yarns 13 and 14 are woven longitudinally into the fabrics 1 and 2 in substantially parallel spaced relationship to the warp yarns, with the drop yarns 13 and 14 being crossed over from one fabric to the other between about every two and about every twenty picks of the weft yarns 9 and 10. It should be understood that substantially conventional dobby or jacquard mechanism will be used to control the positioning of all the yarns during the weaving. FIGURE 1 illustrates the drop yarns 13 and 14 having been crossed over to form a cross over point 15. However, before the drop yarns 13 and 14 are rewoven back into their respective fabrics 1 and 2, they are extended, as will be described hereinafter. Thus, it is seen that the fabrics 1 and 2 comprise longitudinally running warp yarns, transversely running weft yarns, and longitudinally running drop yarns crossing over between fabrics. The invention contemplates that the yarns shall be metallic having diameters between about .0015 and about .005 inch. However, the yarns may be nylon, rayon, or natural or synthetic materials which will give the desired strength to weight ratios.

The important feature of the invention is to provide extension of the drop yarns 13 and 14 to pre-determined lengths before they are rewoven into the fabrics 1 and 2 so that when the fabrics 1 and 2 are made air impervious and the sides enclosed the structure is inflated allowing the drop yarns to extend and provide desired contours between the fabrics 1 and 2. Therefore, in order to achieve the extension of the drop yarns 13 and 14, a stationary central rod 16 and 17 is provided to support the inside of the fabrics 1 and 2 may be provided.
The stationary rod 16 is positioned so that it is between the cross over point 15 and the weaving edges 11 and 12. The movible rods 17 and 18 are positioned inside and adjacent the fabrics 1 and 2 and behind the respective cross over points 13 and 14. Therefore, when the movible rods 17 and 18 are moved forwardly substantially parallel to and between the fabrics 1 and 2 to a position indicated by dotted lines 19 and 20, the drop yarns 13 and 14 are extended to the dotted line positions 21 and 22. Thus, it is seen that the drop yarns 13 and 14 are extended individually to a length accurately determined by a distance X, indicated by numeral 23, which defines the distance from the stationary bar 16 to the extended positions of the movible bars 17 and 18. Also, it should be noted that each extended drop yarn is spaced by the stationary bar 16 from the other fabric and the other drop yarns to prevent tangling. Of course, the movible bars 17 and 18 could be moved pre-determined variable distances to provide variable extension of the drop yarns to achieve the desired contour between the fabrics 1 and 2.

FIGURE 2 illustrates a modified version of the method utilized in FIGURE 1 where everything is essentially the same except that the stationary bar 16 is moved up so that it is substantially in line with the weaving edges 11 and 12. In this manner the drop yarns 13 and 14 may be crossed over and beaten up to the weaving edges 11 and 12 so that they are essentially perpendicular thereto as indicated by the single line 24. After the drop yarns are beaten up into position the movible bars 17 and 18 may then move between the fabric layers 1 and 2 to the positions indicated by dotted lines 19a and 20a which extends the drop yarns 13 and 14 to the positions indicated by the dotted lines 21a and 22a. In this instance the extension of the drop yarns 13 and 14 is even more accurately controlled because the distance of extension X, indicated by numeral 25 is exactly equal on both sides of the movible bars 17 and 18, and further since both bars 17 and 18 are behind the drop yarns indicated by the straight line 24 both the drop yarns 13 and 14 are extended by each movible bar so that the total distance moved is equal to substantially four X. Thus, it is seen that simply by controlling the positioning of the rods 17 and 18 either behind only one drop yarn as shown in FIGURE 1, or behind both drop yarns, as shown in FIGURE 2, one can quickly and easily control the amount of extension to the drop yarns.

In the embodiments of the invention shown in FIGURES 1 and 2 it is contemplated that the drop yarns will be woven back into their respective fabrics after extension to hold them in position. The invention further contemplates that the extended drop yarns may be held in the extended position until the completion of weaving to prevent tangling thereof.

FIGURE 3 represents a method of extending the drop yarns outside the fabric layers. In this case a pair of substantially parallel spaced fabric layers 30 and 31 are made up from warp yarns 32, 33, 34, and 35. The warp yarns 32 and 33 describe a shed 36 while the warp yarns 34 and 35 describe a shed 37. Weft yarns 38 and 39 are received in the sheds 36 and 37, respectively. A plurality of drop yarns 40 and 41 are crossed over from the weaving edges 42 and 43 to provide a cross over point 44. In order to provide the extension of the drop yarns 40 and 41 a pair of movible rods 45 and 46 are provided. The rods 45 and 46 are placed behind the drop yarns 40 and 41 and outside the outer warp yarns 32 and 35. In this position the movible rods 45 and 46 can move forwardly towards the fabrics 30 and 31 in substantially parallel relation on the outside thereof to the position indicated by the dotted lines 47 and 48 which provides an extension of the drop yarns 40 and 41 to the position indicated by the dotted lines 49 and 50. This extension will move the drop yarns 40 and 41 to a position perpendicular to the weaving edges 42 and 43 which is indicated by the dotted line 51. The extension in this case is indicated by the distance X, as identified by numeral 52. Thus, it is seen that each individual drop yarn is extended a distance 2X by the movible rods 45 and 46 with the extension taking place outside the fabrics 30 and 31. With this method the extension of the drop yarns is extended beyond the woven fabrics 30 and 31 while the drop yarns are rewoven back into their respective fabrics and then pulled down to their extended length when the fabric layers 30 and 31 are made air impervious and covered and inflated to provide the desired contours.

It is contemplated that the drop yarn cross overs will be made between about two and about twenty picks of the weft yarns with the drop yarns extended before they are rewoven back into the fabrics. A method of internal extension of each individual drop yarn, and a method of internal extension of both drop yarns together, and a method of external extension of the individual drop yarns have been illustrated and described in detail.

However, it is to be understood that while in accordance with the patent statutes only one embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto to thereby, but that the inventive concept is defined in the appended claims.

What is claimed is:

1. A method to weave deep piled contoured inflatable fabric which comprises the steps of weaving a top and bottom fabric of wire yarn having a diameter of between about .0015 and about .005 inch, said fabric composed of longitudinally running warp yarns and transversely running weft yarns, said fabrics being in substantially parallel spaced relationship, taking the fabrics away from the weaving edge in substantially straight and parallel spaced relationship, weaving a plurality of drop yarns longitudinally into each fabric in substantially parallel relationship to the warp yarns, crossing said drop yarns over from one fabric to the other between about every two and about twenty picks of the weft yarn, positioning an extension bar in front of the crossed over drop yarns from the top fabric, moving said bar into the spaced opening between fabrics thereby extending the crossed over drop yarns from the top fabric a predetermined length inbetween the fabrics while spacing them from the lower fabric, positioning an extension bar in front of the crossed over drop yarns from the bottom fabric, moving said bar into the spaced opening between fabrics thereby extending the crossed over drop yarns from the bottom fabric a predetermined length inbetween the fabrics while spacing them from the top fabric, and weaving the crossed over and extended drop yarns into their respective fabrics.

2. A method to weave deep piled contoured inflatable fabric which comprises the steps of weaving a top and bottom fabric of wire yarn, taking the fabrics away from the weaving edge in spaced relationship for a considerable distance, weaving a plurality of drop yarns into each fabric, crossing said drop yarns over from one fabric to the other, positioning restraining means behind the crossed over drop yarns parallel to the weaving edge between the fabrics, positioning an extension bar in front of the drop yarns from the top fabric and moving it between the top fabric thereby extending the crossed over drop yarns from the top fabric a pre-determined length inbetween the fabrics while the restraining means spaces them from the lower fabric, and positioning an extension bar in front of the drop yarns from the lower fabric and moving it between the
restraining means and the lower fabric thereby extending the crossed over drop yarns from the bottom fabric a pre-determined length in between the fabrics while the restraining means spaces them from the top fabric.

3. A method to weave deep piled contoured inflatable fabric which comprises the steps of weaving two fabrics in substantially parallel spaced relationship, said fabrics comprising longitudinally extending warp yarns and transversely extending weft yarns, taking the fabrics away from the weaving edge a substantial distance in substantially straight and parallel spaced relationship, weaving a plurality of drop yarns longitudinally into each fabric in substantially parallel relationship to the warp yarns, crossing said drop yarns over from one fabric to the other, beating the crossed over drop yarns up to the weaving edges, positioning a restraining means behind the crossed over drop yarns substantially between and parallel to the weaving edges of the fabrics, positioning extension means in front of the crossed over drop yarns and moving said extension means into the space between the fabrics on each side of the restraining means thereby extending the crossed over drop yarns together pre-determined lengths between the fabrics while the restraining means effects spacing the extended end from the fabrics, and weaving the extended drop yarns into their respective fabrics.

4. A method to weave contoured inflatable fabric which comprises the steps of weaving a top and bottom fabric of wire yarn so that the fabrics are in substantially parallel spaced relationship, said fabrics composed of longitudinally extending warp yarn and transversely extending weft yarn, moving the fabrics away from the weaving edge a considerable distance in spaced relationship, weaving a plurality of drop yarns into each fabric, crossing said drop yarns over from one fabric to the other, beating the crossed over drop yarns up to the weaving edge, positioning an extension bar on the outside of each fabric substantially parallel to the weaving edge thereof in front of the crossed over drop yarns and moving the bars outside the fabrics parallel thereto along the fabrics away from the weaving edges thereby extending the crossed over drop yarns individually outside the fabrics to pre-determined length, and weaving the extended drop yarns into their respective fabrics.

5. A method to weave deep piled contoured inflatable fabric according to claim 4 which includes holding each drop yarn in spaced relation from every other drop yarn and the fabrics during movement by said extension bars.

References Cited by the Examiner

UNITED STATES PATENTS

1,976,793 10/1934 Mangold.
2,025,866 12/1935 Holmes ********** 139—20
2,046,039 6/1936 Schaaf ********** 139—384
2,317,518 4/1943 Brindle ********** 139—20
2,356,456 8/1944 Garner ********** 139—397 X
2,637,480 3/1953 MacIntyre ********** 139—410
2,657,716 11/1953 Ford ********** 139—410
2,743,510 5/1956 Mauney et al. 139—410 X
2,848,018 8/1958 Nielsen ********** 139—410
3,008,213 11/1961 Foster et al. 139—410 X
3,048,198 8/1962 Koppelman et al. ** 139—410 X

FOREIGN PATENTS

69,100 12/1951 Netherlands.

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