May 18, 1943 H. T. H. ANDRESEN 2,319,286

SHEET ARRANGEMENT FOR THE STRETCHING OF SURFACES

Filed Oct. 4, 1940

Fig. 1

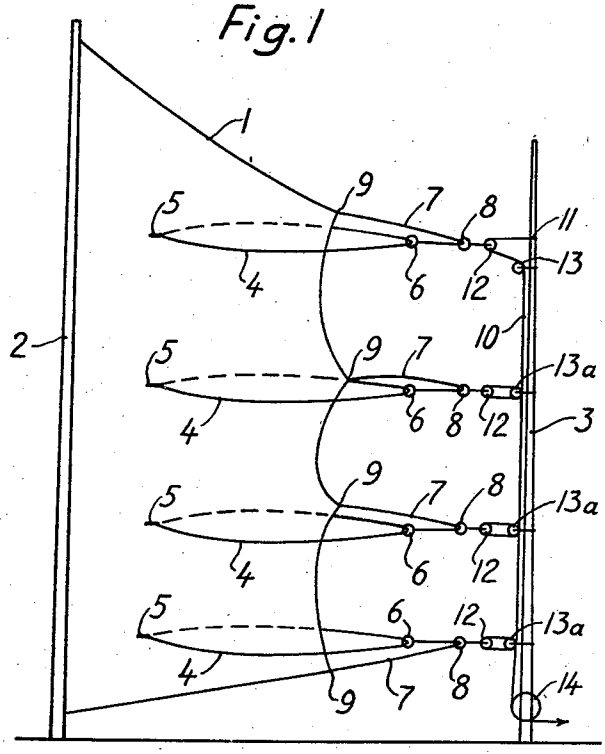


Fig. 2

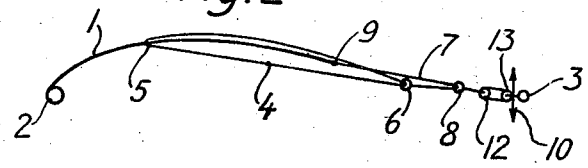
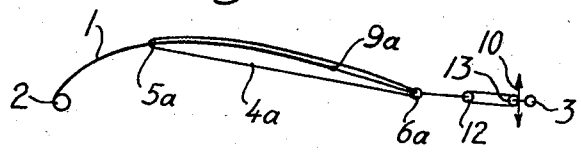


Fig. 3



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SHEET ARRANGEMENT FOR THE STRETCHING OF SURFACES

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Application October 4, 1940, Serial No. 359,788
In Norway October 9, 1939

3 Claims. (Cl. 114—102)

The present invention relates to sheet arrangements for the stretching of flexible airfoils which are supported at their forward edge and stretched so as to be subjected to reactions of an air flow. The invention especially is concerned with sheet arrangements for sails, but the principles of the invention may also be applied to other airfoils of cloth, fabric, leather and the like, such as windmill wings or carrying wings for gliders and the like, in which the satisfactory action of the airfoil depends upon a correct setting thereof against the reaction of the air flow.

Flexible airfoils which are supported at their forward edge, for instance by means of a mast, a foresail stay or the like will, due to the reactions of the air flow, which appear as pressure on the wind side of the airfoil and partly as suction on the lee side, assume a curved form. In ordinary sails this form is not the most favorable in respect of obtaining a high efficiency over the entire sail area. Usually, sails are made with a certain concavity or "tailoring" in order to obtain a favorable form at least over a certain portion of the sail area. This tailoring is, however, gradually changed by the stretching or tightening forces from a boom or from corners in the sail, with the result that the sail form will be in the main unfavorable.

According to known aerodynamic principles, the most favorable surface form is a curved one in which the greatest convexity is near to the fixed forward edge, where also the greatest reactions of the air flow appear.

The present invention relates to new and useful improvements in sheet arrangements of the type described in my copending application Serial No. 250,051, now U. S. Patent No. 2,240,878, issued May 6, 1941, comprising a main sheet, a plurality of lines distributing the stretching force of the main sheet among spaced points distributed along the aft edge of the sail as well as forward of the same, and a system of blocks and pulleys so connecting the said lines to the said main sheet that each individual line of the said plurality of lines may adopt a setting corresponding to the reaction forces on that portion of the surface which the line controls. The improvement in accordance with the present invention consists in providing a line transmitting a portion of the stretching force of the main sheet to a point forward of the aft edge of the surface, said line being in the form of a loop passing from the said point around the said aft edge through a block of the said system of blocks and pulleys, the said block being secured to the free end of a further line which is carried through a second block of the said system to a point at the aft edge of the sail, the said second block being connected to further blocks through which the main sheet is carried.

The sheet arrangement in accordance with the invention is comparatively simple and secures a favorable setting of the sail or other airfoil by the stretching of the same. The arrangement in accordance with the invention is especially adapted for use in connection with sails of great height in combination with a mast abaft of the sail to which mast the stretching forces may be transmitted, in which case a plurality of the lines above mentioned may be distributed along the height of the sail. All of these lines may be stretched by one and the same main sheet or the lines may be combined in groups, each group of lines being stretched by one main sheet. Sails of greater height may be subdivided into two or more separate parts, one arranged above the other and preferably in such a manner that adjacent edges of the parts overlap one another.

The accompanying drawing illustrates some embodiments of the invention.

Figure 1 shows an embodiment of the invention as applied to a sail in side elevation and Figure 2 a sectional view of the same. Figure 3 is a sectional view of another embodiment.

In the drawing 1 designates the sail, the forward leech of which is supported by a mast 2 and which is stretched by means of a sheet arrangement in connection with a mast 3 abaft of the sail 1.

The sheet arrangement shown consists of a plurality of individual lines 4, distributed along the height of the sail, each secured to the sail at a point 5 forward of the aft edge of the sail and extending rearwardly on both sides of the sail so as to form a loop around the aft edge of the same. The lines 4 may also be carried continuously through a ring or the like sewed into the sail. Each line 4 is carried through a ring or block 6, connected to a line 7 which is carried through a ring or block 8 and secured to the sail at a point 9 in the aft edge of the same. The stretching of the sheet arrangement described is effected by means of a line or main sheet 10 which is secured at 11 to the mast 3 and carried downwards along the mast 3 through a top block 12 connected to the top block 8, through the block 13 connected to the mast 3, over one disc of the two-disc block 13a, through a further block 12, over the second disc of the block 13a and so on

through further blocks 12 and 13a connected to individual lower blocks 8 and to a winch or other pulling means 14.

In the embodiment shown in Fig. 3, the line 4a is carried in a loop from a block or ring 6a, through the ring 5a in the sail 1 and back through the block or ring 6a to a point 9a in the aft edge of the sail. The stretching of the sheet arrangement is effected in the same manner as in the embodiment shown in Figures 1 and 2, by means of a line or main sheet 10 secured at one end to the mast 3 and carried through blocks 12 and 13 of which the first are connected to further blocks 6a and the latter to the mast 3.

What I claim is:

1. An air flow device comprising a flexible airfoil supported at its forward edge and spread so as to react to air flow, in combination with stretching means connected thereto, said stretching means comprising a plurality of lines connected with said airfoil at spaced points forward of the after edge thereof and extending rearwardly on both sides of said airfoil, rings carried on said lines and disposed rearwardly of the after edge of said airfoil, means connecting said rings with the after edge of said airfoil, a main sheet, and means connecting said rings to said main sheet.

2. An air flow device comprising a flexible airfoil supported at its forward edge and spread so as to react to air flow, in combination with stretching means connected thereto, said stretching means comprising a plurality of lines connected with said airfoil at spaced points forward of the after edge thereof and extending rearwardly on both sides of said airfoil, rings carried on said lines and disposed rearwardly of the after edge of said airfoil, one end of each said line being secured to said associated ring and the other end of said line extending through said ring and being connected to the after edge of said airfoil, a main sheet, and means connecting said rings to said main sheet.

3. An air flow device comprising a flexible airfoil supported at its forward edge and spread so as to react to air flow, in combination with stretching means connected thereto, said stretching means comprising a plurality of lines connected with said airfoil at spaced points forward of the after edge thereof and running in loops from the said points around the said after edge, rings threaded on said lines, a main sheet, secondary lines running from points spaced along the after edge of the airfoil to said rings threaded upon the first said lines, rings threaded on said secondary lines, and means connecting said last-mentioned rings with the main sheet.

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