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NASA TECH BRIEF

Improved Heat-Resistant Garments

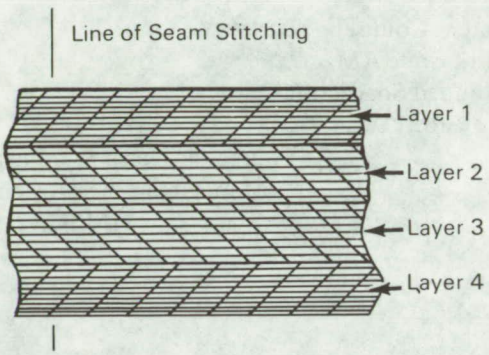

Figure 1. Four Layers Before Seaming

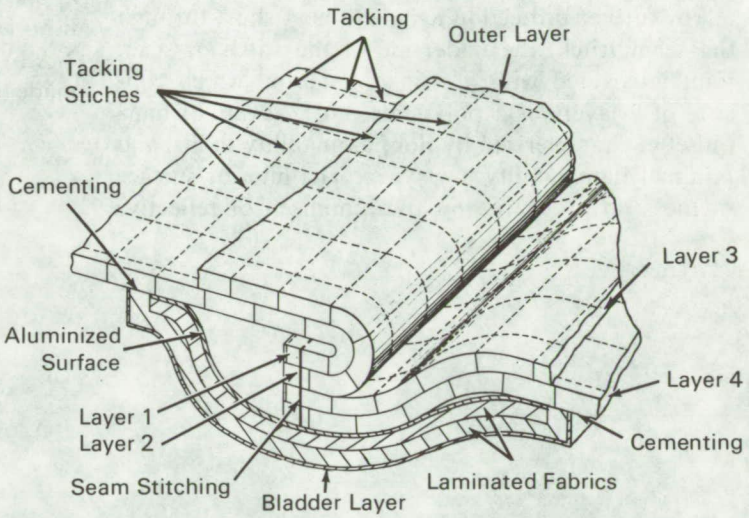

Figure 2. Finished and Covered Seam

Improved fabric seam construction in multilayered materials has resulted in more effective, inexpensive clothing for firefighters and personnel working in difficult or dangerous environments. The problem with protective clothing has been that multilayer-stitch construction compresses the garment layers along the stitching line. The spacing required between layers to enhance thermal insulation is reduced, and often produces a heat-short in the thermal insulating structure. Also, unitary seaming of all the layers causes increased tensile loads on individual seams which could result in greater abrasion, corrosion from heat or wear, or separation of the layers of the garment.

The new method of fabrication eliminates the common heat-short by avoiding the stitch which is common to all layers, and preventing external exposure of any stitch to the outer environment. By first stitching the laminae of component layers and tacking these layers to one another, the stitches of each layer are staggered with respect to its adjacent layer. A unique overlap arrangement of the surface layer covers the tacking stitch; no single stitch or tack goes through the entire assembly.

Figure 1 shows how layers 2 and 3 are sandwiched between layers 1 and 4 respectively. All layers are composed of laminae selected for their specific insulative and protective characteristics. The laminae in each layer are physically connected to one another by tacking stitches which are unitized, and form the layer into a quilt-like pattern of stitching throughout. When each of the layers is unitized, layer 4 and layer 3 are positioned so that the stitch lines of one layer are offset with respect to the stitch lines of the other layer. The stitching should be approximately inter-

(continued overleaf)

mediate the stitch pattern of the adjacent layer to preclude transfer of heat through the stitches themselves from one layer to the next. Layer 2 is then placed upon layer 3 in like manner, so that the quilted laminae of one layer are arranged and staggered with respect to the tacking stitches of its adjacent layer. This stitching is accomplished in both longitudinal and lateral directions, as shown in Figure 2. Layer 4 is then similarly positioned. After layers 1, 2, 3 and 4 have been placed one upon the other as shown in Figure 1, a stitching seam is run through the entire structure to connect the layers integrally. The seam thus constitutes the sole structural connection between the layers. To remove the seam from exposure to heat or dangerous environment, layers 1 and 2 are unfolded from layers 3 and 4.

For further protection against a heat-short through the seam stitch, the underside of the stitch or seam joint is covered with a strip of material which consists of 7 layers of a polyimide and 7 layers of marquisette, characterized by nonflammability in air, and minimal flammability in oxygen. The interior surface of the strip is covered by an aluminized or reflective coating. The marquisette consists of a weave of Fiberglas threads adapted to serve as spacers for the materials on either side. The entire strip is cemented to the underside of layer 4. Further protection from abrasion and/or tearing is acquired by use of a bladder layer which covers the aluminum strip and is cemented along its terminal edges to layers 1 and 4.

Note:

Requests for further information may be directed to:

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Reference: TSP70-10544

Patent status:

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