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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

REPLY TO ATTN OF: GP

TO: USI/Scientific & Technical Information Division
Attention: Miss Winnie M. Morgan

FROM: GP/Office of Assistant General Counsel for Patent Matters

SUBJECT: Announcement of NASA-Owned U. S. Patents in STAR

In accordance with the procedures agreed upon by Code GP and Code USI, the attached NASA-owned U. S. Patent is being forwarded for abstracting and announcement in NASA STAR.

The following information is provided:

U. S. Patent No. : 3,563,198

Government or Corporate Employee : U.S. Government

Supplementary Corporate Source (if applicable) : N/A

NASA Patent Case No. : MSC-12109

NOTE - If this patent covers an invention made by a corporate employee of a NASA Contractor, the following is applicable:

Yes ☐ No ☒

Pursuant to Section 305(a) of the National Aeronautics and Space Act, the name of the Administrator of NASA appears on the first page of the patent; however, the name of the actual inventor (author) appears at the heading of Column No. 1 of the Specification, following the words ". . . with respect to an invention of . . . "

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Enclosure
Copy of Patent cited above

United States Patent

[11] 3,563,198

[72] Inventor Richard S. Johnston
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[73] Assignee The United States of America as represented by the Administrator of the National Aeronautics and Space Administration

[54] FABRIC FOR MICROMETEOROID PROTECTION GARMENT

3 Claims, 2 Drawing Figs.

[52] U.S. Cl. 112/402, 2/275, 2/81
[51] Int. Cl. D05b 93/00
[50] Field of Search 112/402, 432, 434, 440, 262; 2/272, 274, 275, 243, 81, 82, 2, 2.1; 161/50

[56] References Cited

UNITED STATES PATENTS

1,306,518	6/1919	Briones	112/420
2,353,984	7/1944	Barone	2/275X
2,831,198	4/1958	Datlof	112/420X
3,090,047	5/1963	DeGrazia	2/82X
3,303,515	2/1967	Lash	2/275X
3,449,764	6/1969	DeFazio et al.	2/82X

FOREIGN PATENTS

1,262,014	4/1961	France	2/2
902,468	8/1962	Great Britain	112/420

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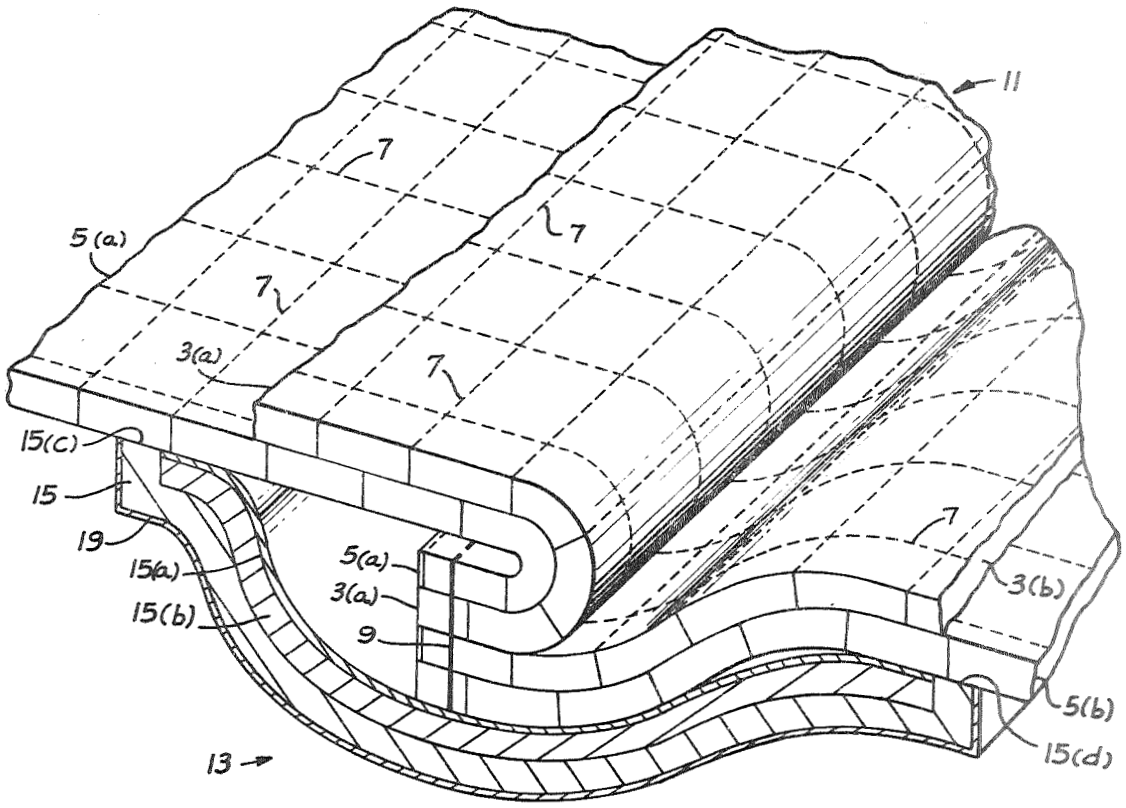
ABSTRACT: A structure of fabric layers is arranged so as to eliminate heat shorts therethrough and comprises a plurality of individually grouped layers, each layer consisting of stacked fabrics. Each of the layers of stacked fabrics is stitched together in quiltlike fashion to form a unitary or integral body. The layers are laid one upon another in offset stitch manner, that is, with the stitch lines of each fabric being disposed intermediate the stitch line of the adjacent fabric so as to avoid a common heat transfer avenue through all layers.



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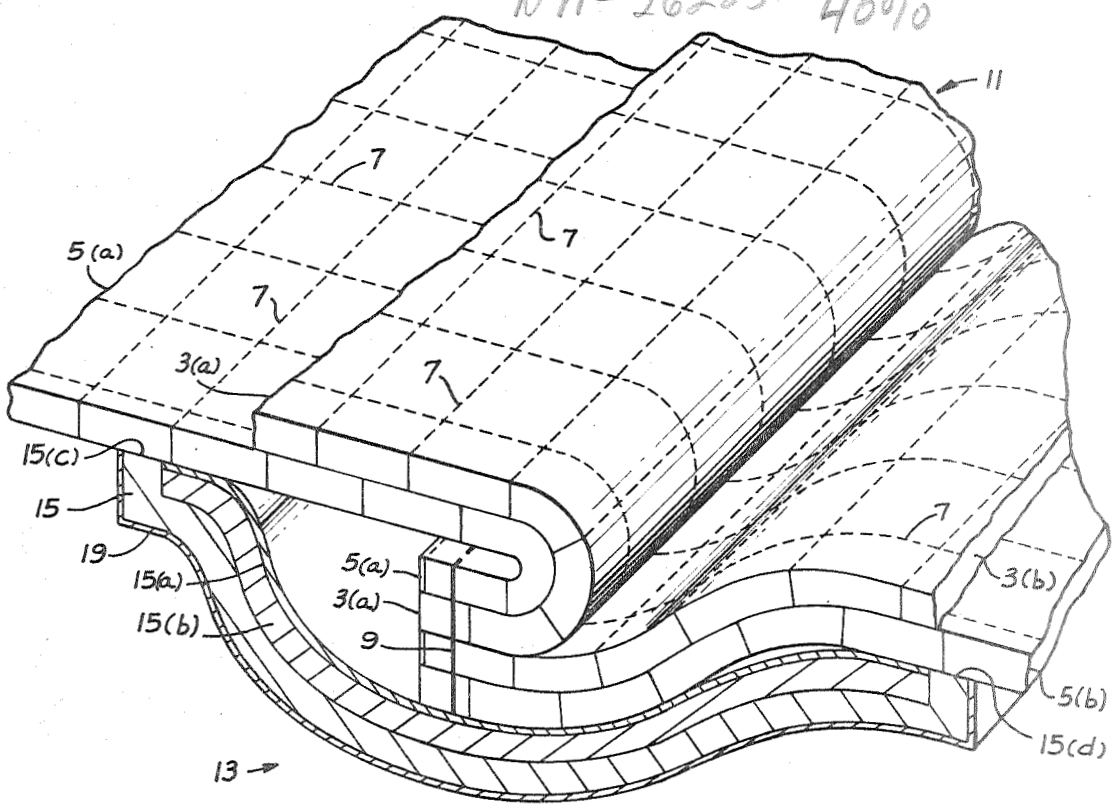

Fig 2

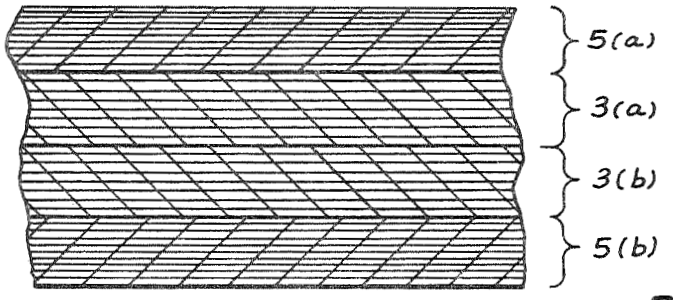

Fig 1

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FABRIC FOR MICROMETEOROID PROTECTION GARMENT

The invention described herein was made by an employee of the United States Government and may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The present invention relates to improvements in fabric seam construction, and more particularly pertains to the production of multilayered materials for use in thermal protection garments. The utilization of protective clothing for persons operating in hostile environments frequently requires multilayer fabrics of various materials since individual or single layer fabrics cannot adequately protect the wearer. Thus it is common to find, in fire fighters' garments for example, multiple layer fabrics and multiple course stitching. The layers in such garments are commonly affixed to one another at a common point or at predetermined points in order to render shape to the garment. Otherwise inner or intermediate layers would slide away from one another making the garment difficult to draw on and sometimes cumbersome to work in. A most significant disadvantage of this prior art multilayer-single stitch construction technique, particularly in heat protective garments, is that it produces compression of the garment layers along the stitching line. Such compression reduces substantially the necessary spacing between layers which normally enhances the thermal insulating properties. Compression of the layers at the stitch area therefore produces a heat-short in the thermal insulating structure. Also, unitary seaming of all the layers produces increased tensile loads on the individual seams since they carry greater loads, and results in exposure of the unitary structural seam to potential abrasion, corrosion from heat or wear and hence possible failure, the result of which would be separation of all layers of the garment.

SUMMARY OF THE INVENTION

The instant invention obviates all of the aforementioned disadvantages disclosed in the prior art by providing an inexpensive method and structure which will effectively seal off temperature shorts that develop at tacking points, stitches, and seams in protective garments. The concept and structure described hereinafter for this purpose is exemplified by the use of materials which makes the resultant structure particularly adaptable for use by an astronaut operating in an environment requiring not only thermal insulation but also micrometeoroid protection. It should be readily apparent, however, that the stitching and structural concept herein may be applied to materials other than those mentioned. Fire fighters' garments represent but one of such other uses.

Briefly, the invention obviates the common heat short inherent in prior art garments by eliminating the stitch which is common to all layers and by removing external exposure of any stitch to the hostile environment. This is done first by stitching the laminae of component layers and by tacking said layers to one another with the stitches of each offset or staggered with respect to its adjacent layer. Additionally a unique overlap arrangement of the surface layer then eliminates the exposure of the tacking stitch. As a result no single stitch or tack goes through the whole assembly, thereby effectively eliminating heat shorts in the garment in which it is used. These and numerous other features and advantages of the present invention become readily apparent upon a reading of the following detailed description, claims and drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view showing layup order of the various laminae.

FIG. 2 illustrates a perspective cross section through a typical fabric layup and stitching arrangement embodying the invention.

DETAILED DESCRIPTION

With reference now to the drawings there is shown a material assembly for a thermal micrometeoroid protection garment embodying the invention and which serves as both a heat and micrometeoroid barrier for astronauts' space suits. It will be recognized that the illustrated construction constitutes but one of numerous identical sections through an entire garment. The thermal and micrometeoroid protection garment consists of a first layer group 3(*a*) and a second layer group 3(*b*) each of such groups being composed of identical multilaminae of materials which are chosen for their particular insulating and protective characteristics. It is not unusual, for example, for each of the layers to have as many as eight or more individual material laminae. As best shown in FIG. 1, the layers 3(*a*), 3(*b*) are disposed in intermediate manner between the upper and lower surface layers 5(*a*) and 5(*b*), respectively. The layers 5(*a*), 5(*b*) are likewise composed of a plurality of materials or laminae chosen for their particular insulative or protective characteristics. The laminae in each of the layers are physically connected to one another by means of tacking stitches 7. The stitches in each layer unitize the laminae to form the layer by being arranged to form a quiltlike pattern of stitching throughout. When each of the layers is unitized in this manner a completed piece of surface layer 5(*b*) is disposed on a table and inner layer 3(*b*) positioned thereover so that the stitch lines of the one layer are offset with respect to the stitch lines of the other layer. It is suggested that the stitches of one layer be disposed approximately intermediate the stitch pattern of the adjacent layer so as to thereby substantially preclude transfer of heat through the stitches themselves from one layer to the next. Inner layer 3(*a*) is then laid upon layer 3(*b*) in similar offset relationship so that the quilted laminae of one layer are arranged and staggered with respect to the tacking stitches of its adjacent layer, this being accomplished in both longitudinal and lateral directions as shown in FIG. 2. Layer 5(*b*) is then similarly positioned. After the layers 5(*a*), 3(*a*), 3(*b*), and 5(*b*) have been laid one upon the other as shown in FIG. 1, a stitching seam 9 is run entirely through the structure in order to integrally connect the layers to one another. The seam 9 thus constitutes the sole structural connection between the layers. In order to remove the seam 9 from exposure to the hostile and/or heated environment 11, the upper layer 5(*a*) and inner layer 3(*a*) are unfolded from layers 3(*b*) and 5(*b*) as shown in FIG. 2. In this way it is seen that although each of the laminae are connected to form respective layers, the stitching thereof precludes a heat short from the hostile environment 11 to the protected environment 13. At the same time the laminae themselves are nevertheless connected and arranged in such manner as to remove the connection (9) from exposure to the hostile environment.

In order to still further insure against a heat short through the stitch 9, the under side of the stitch or seam joint is covered with a strip of material 15 which consists of seven layers of Kapton and seven layers of marquisette. Kapton, a DuPont trade name, is a polyimide characterized by its nonflammability in air and its minimally flammable nature in oxygen. The interior surface of the strip 15 is characterized by an aluminized or reflective coating 15(*a*). The marquisette material 15(*b*) is positioned on the external side of the insulative strip or tape 15(*a*). The marquisette preferably consists of a weave of Fiberglas threads which are adapted to serve primarily as spacers for the materials on either side thereof. The entire strip 15 is preferably cemented to the under side of layer 5(*b*) at the points 15(*c*) and 15(*d*). Still further protection is acquired by use of a bladder layer 19 which is disposed over strip 15 and similarly cemented along its terminal edges to the layers 5(*a*) and 5(*b*). The primary function of such bladder layer is merely to protect the strip 15 from abrasion and/or tearing.

It is obvious that many modifications and variations of the present invention are possible in light of the above teachings. For instance, the seam structure may be used for many things besides garments wherein the number of laminae per layer

may be changed without variation in the invention. Still further, it is clear that the surface area sizes of the layers between the connecting seams 9 may be varied in accordance with the particular type of garment and/or the area on the garment at which the seam occurs. It is therefore to be understood that the spirit of the invention may be practiced otherwise than as specifically described without departing from the scope of the appended claims.

I claim:

1. The method of assembling a plurality of layers of thermally insulative materials so as to prepare a wearable garment therefrom having substantially no heat leaks at the seams thereof comprising:

laying out a first stack of laminae so as to form a first layer,

tacking together the laminae of said stack so as to unitize said layer,

positioning and tacking additional stacks of laminae so as to form additional unitized layers,

positioning said layers, one on top of another with the tacking of each layer disposed in offset relation with respect to the taking of adjacent layers,

sewing all said layers together with a common stitch,

separating at least the uppermost layer and folding it over said common stitch so as to cover the outer exposed surface of the stitch, and

covering the inner surface of the stitch with a heat insulating strip of material.

2. An article of manufacture for effectively precluding heat shorts therethrough comprising:

a plurality of layers of protective material disposed in surface adjacent relation to one another and secured together by first seam means along a common edge portion thereof to form a layered component of the article having first and second face sides,

each of said layers comprising a series of fabric laminae connected together by tacking stitches sewn through each layer at points regularly distributed over the surface thereof so that each of said layers becomes a unitary component of the article,

adjacent layers of said layered component being selectively positioned whereby the tacking stitches of one layer is laterally offset relative to the tacking stitches of an adjacent layer so as to thereby obstruct the conductive transfer of heat by said tacking stitches through said layered component,

at least one surface layer of said layered component first face side being folded up and over said seam means so as to constitute a layer for a substantially identical layered component and connected thereto by a second seam means thereby concealing said first seam means from said first face side, and

elongate strip means having one longitudinal edge secured to the second face side layer of said layered component and the other longitudinal edge secured to the second face side of said folded over layer thereby covering the second face side of said seam means to insulate same from the conductive transfer of heat through said seam between said first and second face side.

3. The article of claim 2 wherein said elongate strip has a reflective coating thereon.