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(12) # EUROPEAN PATENT APPLICATION

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(54) **Sewing thread with thermoplastic material; sewing method and sewn product.**

(57) A sewing thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, said plurality of yarns being twisted such that said at least one yarn of a thermoplastic material is exposed to the outside of the thread in accordance with the twisting pattern, the thermoplastic material being maintained in a substantially non-adhesive state prior to sewing.

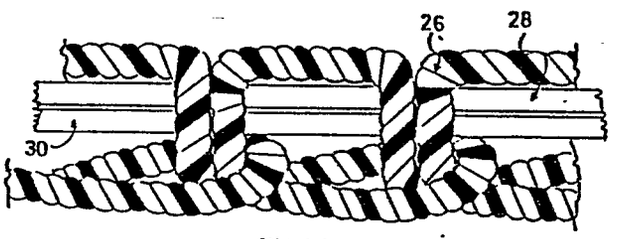

FIG 5A

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NEW YARNS AND THREADS AND THEIR USE IN THE FABRICATION OF TEXTILE PRODUCTS

The present invention relates to textiles generally and more particularly to sewing threads, techniques of sewing with such threads,and sewn products produced thereby.

In the textile industry a wide variety of stitches are employed. A lock stitch is conventionally employed when it is sought to prevent the unravelling of a chain of stitches when the thread is broken at a given location therealong. Lock stitches have the inherent disadvantage that they can only be produced by sewing machines which employ a bobbin. Since bobbins are limited to a relatively short length of thread, they require frequent replacement, which presently requires the attention of an operator. Thus lock stitching is not suitable for automated operations wherein it is sought to dispense with frequent operator attention.

An alternative to lock stitching which has the advantage that a bobbin need not be employed, is chain stitching. This type of stitching is eminently suitable for automated operations but has the inherent disadvantage that it is subject to unravelling upon breakage of one or more threads.

There is described in German Offenlegungsschrift

DE 3142507 a thread comprising a bundle of yarns which are held together by an adhesive material which is prevented from escape to the outside of the thread.

The invention aims at solving the problem of unravelling that occurs frequently in conventional chain stitched textile products.

There is thus provided in accordance with an embodiment of the present invention, a sewing thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, said plurality of yarns being twisted such that said at least one yarn of a thermoplastic material is exposed to the outside of the thread in accordance with the twisting pattern, the thermoplastic material being maintained in a substantially non-adhesive state prior to sewing.

Further in accordance with an embodiment of the present invention, the yarn formed of a thermoplastic material may comprise a monofilament.

Additionally in accordance with an embodiment of the present invention, the yarn formed of a thermoplastic material may comprise a yarn including adhesive fibers.

According to an alternative embodiment of the present invention, the yarn formed of a thermoplastic material

may comprise a multifilament yarn.

Additionally in accordance with an embodiment of the present invention there is provided a method of sewing comprising the steps of sewing a textile material with a thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, the plurality of yarns being twisted such that the yarn or yarns formed of a thermoplastic material is exposed to the outside of the thread and applying heat to the sewn textile material at the location of thread engagement therewith sufficient to cause the thermoplastic material to assume an adhesive state, thereby to bond the sewn thread at points of intersection thereof in the sewn material.

Further in accordance with the above method, the sewing step may include sewing in a chain stitch.

Additionally in accordance with an embodiment of the present invention, there is provided a product including sewn portions employing a sewing thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, said plurality of yarns being twisted such that said at least one yarn of a thermoplastic

material is exposed to the outside of the thread in accordance with the twisting pattern, the thermoplastic material being maintained in a substantially non-adhesive state prior to sewing.

Additionally in accordance with an embodiment of the present invention, there is provided a product having sewn portions formed by the steps of sewing a textile material with a thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, the plurality of yarns being twisted such that the yarn or yarns formed of a thermoplastic material is exposed to the outside of the thread and applying heat to the sewn textile material at the location of thread engagement therewith sufficient to cause the thermoplastic material to assume an adhesive state, thereby to bond the sewn thread at points of their intersection in the sewn material.

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

Fig. 1 shows a single thread chain stitch;

Fig. 2 shows a two-thread chain stitch;

Fig. 3 shows a lock stitch;

Fig. 4 is a side view illustration of the sewing thread of the present invention;

Figs. 5A and 5B illustrate in enlarged form a chain stitch formed of sewing thread according to the present invention prior to heat treatment in respective side and bottom view illustrations;

Fig. 5C illustrates, in a bottom view illustration, the chain stitch of Fig. 5B after heat treatment;

Fig. 6 illustrates, in perspective view, a stitched seam in accordance with an embodiment of the invention;

Fig. 7 illustrates, in perspective view, a blind stitched hem in accordance with an embodiment of the present invention;

Fig. 8 illustrates, in a side view sectional illustration, a button attached to fabric in accordance with an embodiment of the present invention.

Reference is now made to Fig. 1 which illustrates a conventional chain stitch. The chain stitch shown in Fig. 1 corresponds to the so-called "Federal Stitch Type 101". Such a stitch is formed with one thread drawn from what may be a large spool or cone normally mounted above the sewing machine. The needle pushes a loop of thread through the cloth and also through the previous loop which for this purpose is held by a "looper" and in this way a chain of interlocking loops is formed. In Fig. 1,

1 and 2 are respectively the top and bottom moieties (faces) of the stitch. The bottom face 2 comprises a plurality of loops 3 each of which is engaged by the one on the left-hand side and engages the one on the right-hand side and in this way the chain stitch is formed.

Chain stitches have the advantage that all threads are supplied from above where the thread source may be easily observed so that timely replacement of an exhausted spool or cone can be undertaken. Furthermore, the thread supply is usually from large cones or spools holding very substantial supplies of thread.

Chain stitches have however the disadvantage that the stitches are readily unravelled so that a seam is completely opened in cases where the thread is broken only in one spot. For example, if the thread is cut at line 4 this frees the loop at 5 and if the thread is pulled at 6 the loops in each stitch will successively free the stitches one after the other until the whole seam is open.

Another important variation of the chain stitch is the Two Thread Chain Stitch and an example thereof known as Federal Stitch Type 401 is shown in Fig. 2. In this case two threads are fed from large cones above the machine. One thread is pushed through the cloth by

the needle from above making loops below the cloth and the second thread is fed to a "looper" below the cloth and this looper thrusts loops of the looper thread through the needle loops to retain the stitch. In Fig. 2, 7 and 8 are respectively the top and bottom faces of the two-thread chain stitch. The first thread is shown at 9 and the second at 10.

This stitch also has the same drawback as that according to Fig. 1 in that it may be unravelled. Thus, for example, if the second threads are cut at lines 11 and 12, loop 13 is freed and a pull at 14 will unravel the entire seam.

It should be noted that there are numerous variations of the chain stitch which may employ a multiplicity of threads, needles and loopers. These variations have specific functions in sewing such as affixing buttons, blind stitching hems, overcasting edges, and attaching pieces of cloth with cover stitching. However, the basic principles discussed above are characteristic of such variations.

A typical lock stitch is shown in Fig. 3. As shown, this again is a two-thread system in which the top face 15 is made of a first thread 16 and the bottom face 18 is made of a second thread 17, the said faces interlocking through vertical loops 19. To produce such a stitch

the needle thread is fed from a large spool or cone above the machine and a second bobbin thread is supplied from a very small spool - the bobbin - which is located within the sewing medium underneath the cloth.

Lock stitches are more secure than chain stitches since each stitch is locked and if the thread is cut the seam will only open a stitch or two. However, the lock stitch requires a bobbin thread which is a significant disadvantage. Thus the bobbin thread is expended frequently and must be replenished which causes considerable interruptions as both replacing and winding a new one are time consuming operations. Moreover, the bobbin thread which is hidden from the operator, may run out at random in the seam. Thus the seam may require special treatment and resewing when this occurs in the middle of a seam. These problems, apart from being of considerable nuisance to sewing machine operators, also constitute a serious interference with automatic machinery.

Thus, to sum up the prior art in terms of this one factor, chain stitches are of great advantage as regards the manufacturing technique but have the disadvantage of being readily unravelled, while lock stitches are more secure against unravelling but the technique is tedious. Hitherto these problems have not been resolved and it is left to the manufacturer to choose between what, under

the circumstances, would appear to be the lesser of two evils.

Similar problems are also encountered in button sewing, button hole sewing and blind stitching and it is therefore quite generally the object of the present invention to provide novel yarns and threads for sewing and stitching, adapted to overcome the problem of unravelling.

In the following description and claims the operations of sewing and stitching will be referred to collectively as "manufacture and processing of textiles".

The adhesive material may be applied to the elongated structure in various ways. Thus, in accordance with one embodiment, one or more filaments of an adhesive material is included in the twisting process together with conventional filaments or staple yarn to produce a structure according to the invention.

In accordance with another embodiment, fibers of thermoplastic are blended into the basic yarn fibers during the spinning process, yielding a conventional type yarn with adhesive fibers included among the basic fibers of the yarn.

In accordance with yet another embodiment, yarns of adhesive fibers are combined with conventional yarns in a doubling process. For example, it is possible in

this way to make a thread composed of three yarns twisted together, two of which are normal and one made of adhesive fibers. Such a thread is illustrated in Fig. 4. Here it is seen clearly that the adhesive yarn 20 is twisted with two conventional non-adhesive yarns 22 and 24 and the adhesive yarn is exposed to the outside of the thread.

Figs. 5A and 5B illustrate generally how the thread 26 of the present invention (Fig. 4) appears in a chain stitch, joining two portions of fabric 28 and 30, prior to heat treatment and activation of the adhesive. For the sake of accuracy it is pointed out that the illustrations appearing in Figs. 5A, 5B and 5C are merely intended to represent the thread and do not purport to show the actual appearance of the thread as it would be seen under a microscope. In fact, due to the fact that there are a great number of free individual fibers ends which are attached to the thread, the appearance of the stitch in reality, particularly at curved portions thereof, is much less clear than that shown.

The invention also comprises a method of manufacture and processing of textiles to make a textile article, using a thread as described and illustrated hereinabove and subjecting the resulting textile article to heat treatment. Fig. 5C illustrates the chain stitch of Fig. 5B after heat treatment. The cross-hatching

indicates a smear of adhesive from the adhesive yarn 20. It can be assumed that the portions of adhesive yarn 20 adhere to each other where adjacent, such as at reference numerals 30 and that the adhesive yarn may or may not adhere to non-adhesive portions of the thread or of the fabric joined thereby, depending, of course, on the composition thereof.

It may be appreciated that during heat treatment, adjacent interlocking, interlacing or intersecting portions of monofilaments, yarns and thread are fused together at points of contact whereby subsequent unravelling is prevented, even if a yarn or thread is broken at one or several places.

Many thermoplastic and thermosetting materials can be used for the purposes of the present invention, provided they are compatible with textile materials and that their softening points are at a temperature at which the textile is not damaged. Merely by way of example there may be mentioned copolyamides and copolyesters. A preferred embodiment of the invention employs K115 melt bonding multifilament manufactured and sold by Grilon of Ems, Switzerland.

The invention is illustrated by the following examples to which it is not limited.

EXAMPLE A: TWO THREAD CHAIN STITCH FOR JOINING TWO PIECES.

A thread was made of polyester yarns twisted together with heat curable fibers made from a low melting point nylon. Seams were made using the two-thread chain stitch - F.S.T. 401 - with this thread in the looper and with a conventional sewing thread in the needle. The seam strength of the experimental thread was stronger than comparable seams sewn with conventional thread. Moreover the normal seam could be unravelled by a force of only 10 grams pulling the thread. The seam sewn with the adhesive thread could not be unravelled. When attempts were made to unravel the seam a load of 1090 grams was reached at which point the thread broke.

EXAMPLE B: WATERPROOF STITCHING OF WATERPROOF PRODUCTS

A common problem encountered when fabric structures, such as raincoats, tents and tarpaulins are exposed to rain or water is the penetration of water through the sewn seams.

The ability of cloth and seams to resist water penetration is evaluated in a "Hydrostatic Head Test for Resistance to Water Penetration" described in the British Standards Handbook Volume 11, 1974, Method of Test for Textiles, British Standards Institute, 1974, Section 4, 2823, 1968, "Resistance of [redacted] to Penetration

by Water".

In the above test, a hydrostatic head of water is applied to one side of a sewn seam, for example. The head of water is increased until water begins to penetrate the seam, and the head of water at this point is considered a measure of the seam's resistance to water penetration.

As illustrated in Fig. 6, a heavy canvas tenting 40 was joined in a conventional lap seam with a 401 stitch 42 made from a conventional 70/2 cotton thread as needle thread and a looper thread made of two 100 dtex polyester yarns twisted together with one 110 dtex yarn of adhesive multifilament.

After sewing, the seam was heated with a conventional pressing iron to activate the adhesive and tested to determine the hydrostatic head at which water penetrated the seam.

It was found that a seam sewn with the thread containing adhesive withstood a hydrostatic head of 305 mm whereas a seam sewn with conventional thread withstood a head of but 200 mm. This 52% improvement was due to the melted adhesive filling the interstices between the thread, its loops and the cloth.

EXAMPLE C: BLIND STITCHED HEMS

The blind stitch is essentially a single thread

chain stitch sewn from the back side of the cloth with the needle penetrating only half way through the cloth. (Federal stitch type 103). The stitching thus appears only on the back of the cloth and the stitches are therefore not seen on the front of the garment. Such blind stitching has the great advantage of being invisible on the face of the garment. According to conventional techniques, however, such blind stitched seams are chain stitched, and therefore the seams frequently unravel.

In the example illustrated in Fig. 7, a hem 50 was sewn with a ticket no 180 210 dtex thread 52 composed of one 100 dtex polyester yarn twisted together with one 110 dtex yarn made of adhesive multifilament.

After sewing, the adhesive was activated by the heat of normal pressing. Whereas the equivalent seam sewn with normal thread readily unravelled, the adhesive thread blind stitching could not be unravelled.

EXAMPLE D: AFFIXING BUTTONS WITH SINGLE THREAD CHAIN STITCH

Conventionally, buttons sewn to fabric with a chain stitch frequently fall from the garment due to the unravelling of the chain of stitches. As illustrated in Fig. 8, buttons 60 were chain stitched to various fabrics 62 with a thread 64 made from 2 100 dtex

polyester yarns plus one 110 dtex adhesive multifilament yarn twisted together into a thread.

After sewing, the adhesive was activated by heat and it was impossible to unravel the stitching. Similar buttons, chain stitched in an identical manner but with conventional thread, were readily removed by unravelling the stitches.

CLAIMS:

1. A sewing thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, said plurality of yarns being twisted such that said at least one yarn of a thermoplastic material is exposed to the outside of the thread in accordance with the twisting pattern, the thermoplastic material being maintained in a substantially non-adhesive state prior to sewing.

2. A sewing thread according to claim 1 wherein said yarn formed of a thermoplastic material comprises a monofilament.

3. A sewing thread according to claim 1 or claim 2 and wherein said yarn formed of a thermoplastic material comprises a yarn including adhesive fibers.

4. A sewing thread according to claim 1 and wherein said yarn formed of a thermoplastic material comprises a multifilament yarn.

5. A method of sewing comprising the steps of sewing a textile material with a thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, the plurality of yarns being twisted such that the yarn or

yarns formed of a thermoplastic material is exposed to the outside of the thread and applying heat to the sewn textile material at the location of thread engagement therewith sufficient to cause the thermoplastic material to assume an adhesive state, thereby to bond the sewn thread at points of intersection thereof in the sewn material.

6. A method of sewing according to claim 5 and wherein said sewing step includes sewing in a chain stitch.

7. A sewn product including sewn portions employing a sewing thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, said plurality of yarns being twisted such that said at least one yarn of a thermoplastic material is exposed to the outside of the thread in accordance with the twisting pattern, the thermoplastic material being maintained in a substantially non-adhesive state prior to sewing.

8. A sewn product having sewn portions formed by the steps of sewing a textile material with a thread formed of a plurality of yarns twisted together, wherein at least one of the plurality of yarns is formed of a thermoplastic material which becomes adhesive upon heat treatment thereof, the plurality of yarns being twisted such that the yarn or

yarns formed of a thermoplastic material is exposed to the outside of the thread and applying heat to the sewn textile material at the location of thread engagement therewith sufficient to cause the thermoplastic material to assume an adhesive state, thereby to bond the sewn thread at points of intersection thereof in the sewn material.

9. A sewn product according to either of claims 7 and 8 and wherein said thermoplastic material when melted by heat treatment fills the interstices between the thread, its loops and the cloth.

10. A sewn product according to either of claims 7 and 8 and wherein said sewn portions include a blind stitch seam.

11. A sewn product according to either of claims 7 and 8 and wherein said sewn portions include a chain stitched button.

12. A sewn product according to either of claims 7 and 8 and wherein said sewn portion is chain stitched.

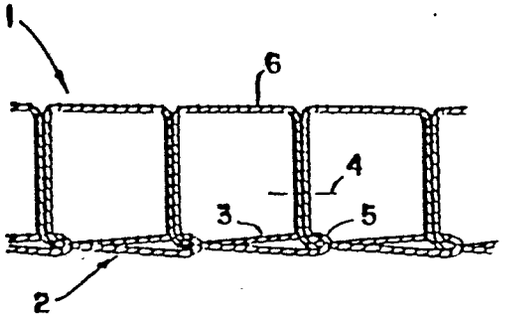

Fig.1

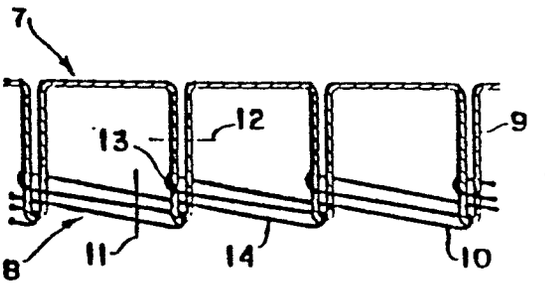

Fig.2

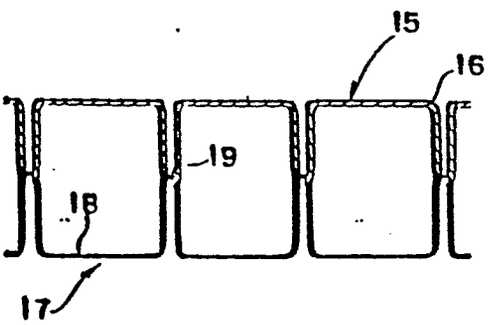

Fig.3

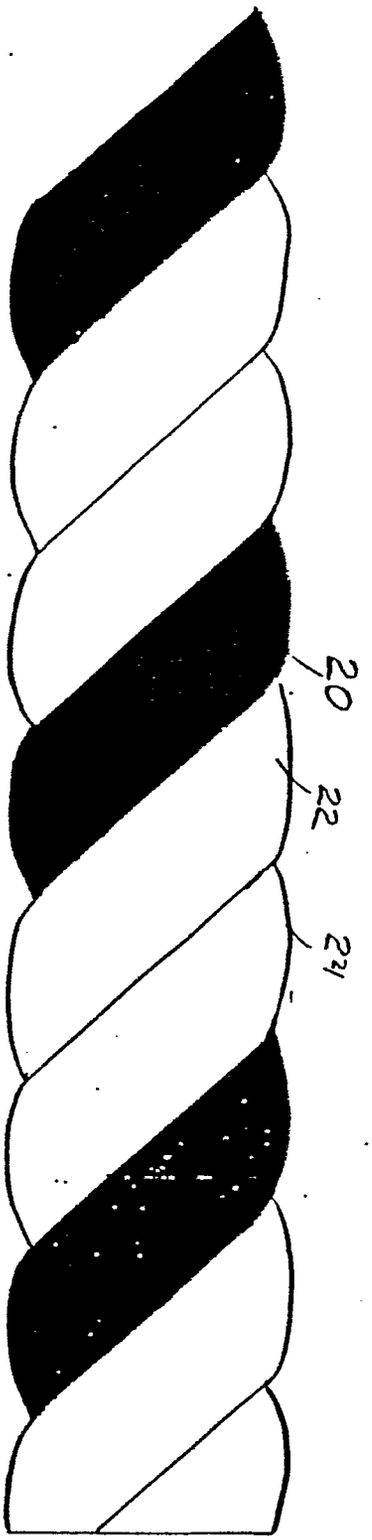

Fig 4

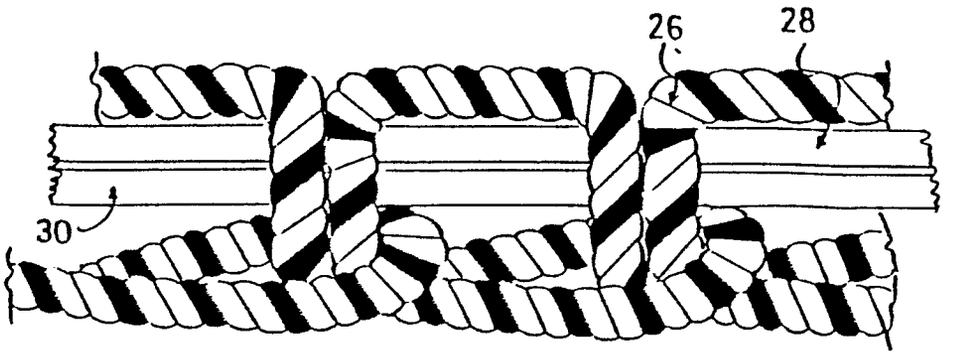

FIG 5A

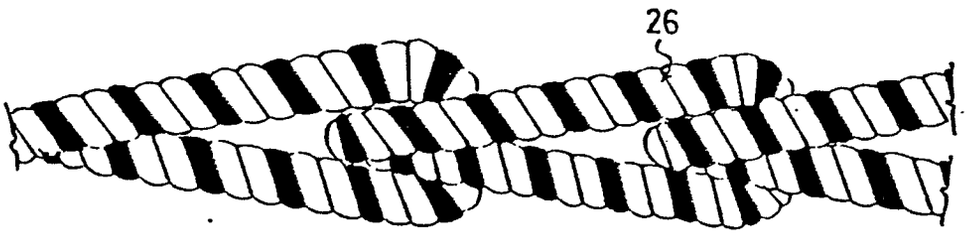

FIG 5B

FIG 5C

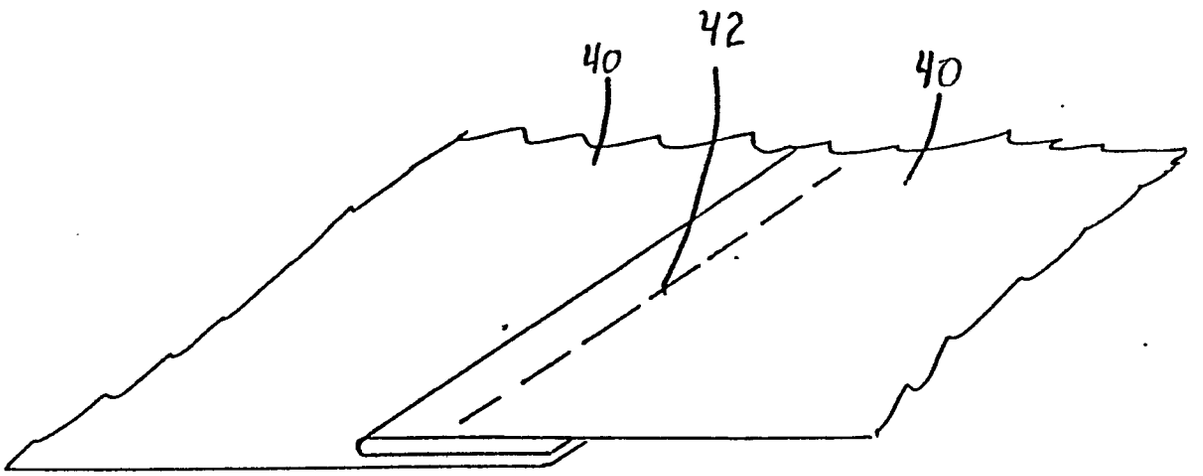

FIG 6

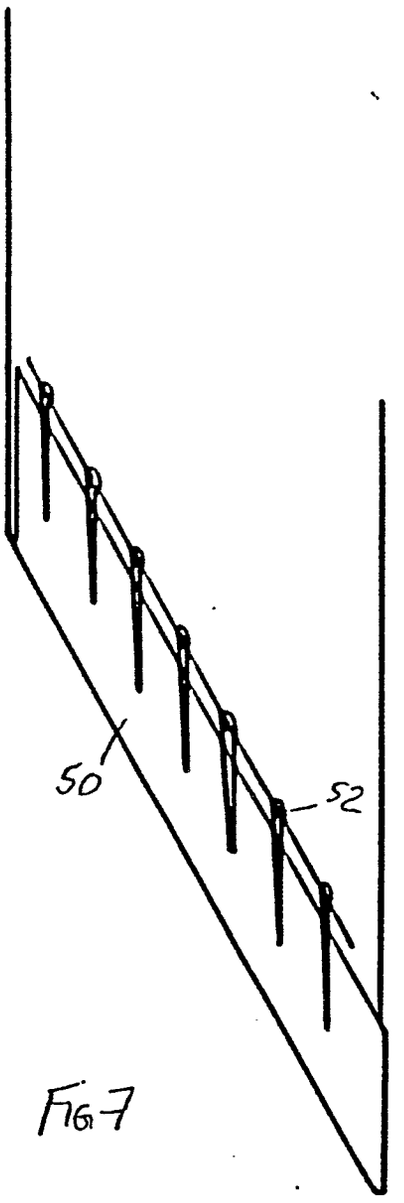

Fig 7

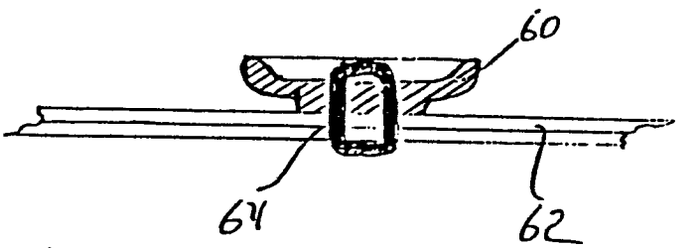

FIG 8

European Patent Office

EUROPEAN SEARCH REPORT

0156503
Application number

EP 85 30 1153

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-3 649 399 (HROSHI NAKANISHI) * The whole content *	1-9	D 02 G 3/46 A 41 D 27/24
A	DE-A-2 049 543 (KANEGAFUCHI) * Page 20, example 20; page 80, example 23 *	1,5,7	
A	FR-A-2 314 958 (PAYEN) * The whole content *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D 02 G
A 41 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-05-1985	DEPRUN M.

CATEGORY OF CITED DOCUMENTS

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