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(54) **Thread**

(57) A stiffening thread (20) for use in increasing the durability of a crease (12) in a panel of fabric (10) comprises at least one ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the at least one thermofusible ply is a monofilament thermofusible ply.

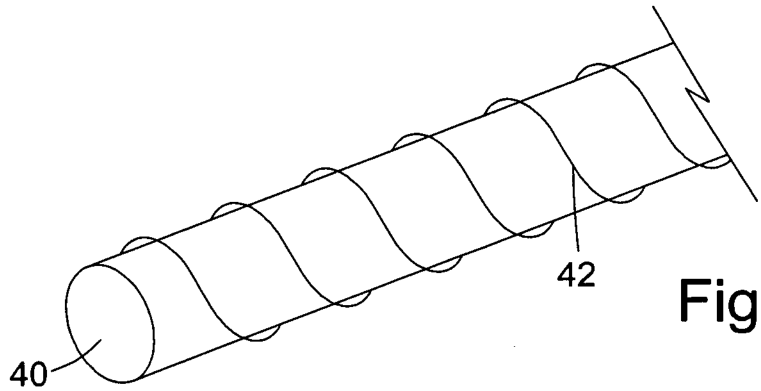

Fig. 4

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Description

[0001] The present invention relates to thread, typically of a kind that may be used in the manufacture of garments in which it is desired to construct durable creases.

[0002] Garments with such creases are known *per se*. One way in which durable creases are manufactured is by the provision of a substance in the region of the crease which acts to create a degree of rigidity in and mutual adherence between fibres of the fabric at the apex of and immediately adjacent the crease. The action of the substance on the fabric ensures that the crease remains present in the fabric for longer and in a more pronounced way.

[0003] Such a substance may have the form of a resin in the region of the crease applied in the region of the crease, which is then melted by heat. Such a manner of creating a durable crease is one used by Supercrease Ltd under the registered trade mark SUPERCREASE.

[0004] A first aspect of the present Invention relates to thread which may be used to achieve such creases and which comprises a thermo-fusible element. A further aspect of the present invention relates to a method of generating a crease in a panel of fabric using a thermofusible thread.

[0005] According to embodiments of the present invention, a durable crease is applied to a panel of fabric by laying a stiffening thread along a crease line of the fabric panel. The stiffening thread comprises one or more elements of thermofusible material. Once the stiffening thread has been correctly positioned, the fabric panel is the folded along the crease line and heat and pressure is applied to the fabric panel in the region of the crease. The application of heat causes the thermofusible material of the thread to melt. On melting the thermofusible material becomes mobile and flows to some degree through the fibres of the panel. The extent of this flow is amplified by the pressing action. The effect of the pressure is to force the hot, fluid thermofusible material to propagate through the fibres of the panel. Once the melted fusible material within the fabric has cooled and thus solidified once again, it acts to add rigidity to the fibres of the fabric and, additionally, by filling the spaces between them, to assist in retaining the relative configuration of those fibres. This, in turn, makes the fabric in the panel in the region of the crease line significantly more rigid which results in the crease itself having greater durability.

[0006] One embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising at least one ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the at least one thermofusible ply is a monofilament thermofusible ply.

[0007] A further embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising at least one ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the thread is of wrapped construction with the carrier ply providing a core and the thermofusible ply being wrapped around the carrier ply.

[0008] A further embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising a ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the carrier ply is of polyvinyl alcohol (PVA) and is soluble in water at temperatures of above 40°C.

[0009] Yet a further embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising a ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the thread is of braided construction.

[0010] Embodiments of the present invention will now be described, by way of example, and with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a panel of fabric in which a durable crease is to be created according to an embodiment of the present invention;
Fig. 2 shows constructions of stiffening thread according to an embodiment of the present invention;
Figs. 3 shows further constructions of stiffening thread according an embodiment of the present invention;
Fig. 4 shows yet a further construction of stiffening thread according an embodiment of the present invention;
Fig. 5 is a perspective view of a part of a method of manufacturing a panel with a durable crease according to an embodiment of the present invention;
Fig. 6 is a perspective view of a panel of fabric after fixing of the stiffening thread according to an embodiment of the present invention;
Fig 7 is a perspective view of an apparatus used in a first embodiment of method according to the present invention;
Fig. 8 is a side view of the apparatus of Fig. 7;
Fig. 9 is a view on IX-IX in Fig. 7;
Fig. 10 is a detail of Fig. 9; and
Figs. 11 to 14 are side views of apparatus used in a second embodiment of manufacture according to the present invention at various stages in the process of manufacture.

[0011] Referring now to Fig. 1, a panel 10 of fabric has a crease line 12 extending within it which then defines two sides 14A and B to the panel. According to one embodiment of the present invention the panel 10 is of a man-made material which may habitually washed in water, though this is not essential and natural fabrics, such as wool or linen may also be used. The crease line is typically created initially by pressing with a hot iron (or the industrial equivalent in the case of large scale manufacture of garments using such panels). A habitual problem with creases created in this way is that any garment in which such a crease is created will, inevitably during the course of being worn, be subjected to stresses and strains in the fabric which will act to degrade the integrity of the crease line, leaving it less sharply defined. This will, in turn, leave the garment in which the crease is created looking less smart.

[0012] According to an embodiment of the present invention, a stiffening thread 20 is laid along the crease line 12 of the fabric panel 10. The thread 20 comprises one or more elements of thermofusible material. The stiffening thread is then fixed to the panel by stitching. Preferably, the fixing stitch is a stitch configuration which can be readily unpicked, for example a stitch which is capable of being unpicked by simply pulling along its length once the stitch pattern has been broken at one point. In one preferred embodiment, the fixing stitch is a chainstitch. Once the thread 20 has been attached to the fabric panel 10, the panel is the folded along the crease line 12 and heat and pressure is applied to the fabric panel. This can be done by ironing or an equivalent industrial process such as by means of a heat press. The application of heat causes the thermofusible material of the threat to melt. On melting the thermofusible material becomes mobile and flows to some degree through the fibres of the panel 10. The extent of this flow is amplified by the pressing action. The effect of the pressure is to force the hot, fluid thermofusible material to propagate through the fibres of the panel 10. Once the melted fusible material within the fabric has cooled and thus solidified once again, it acts to add rigidity to the fibres of the fabric and, additionally, by filling the spaces between them, to assist in retaining the relative configuration of those fibres. This, in turn, makes the fabric in the panel 10 in the region of the crease line significantly more rigid which, in turn, causes the crease itself have greater durability.

[0013] The stiffening thread 20 comprises, as has been stated previously, at least an element which is made of thermofusible material. Thermofusible material is known *per se.* One example series of thermofusible threads manufactured by Grilon EMS of Switzerland, under the trade mark designation 'K', such as, for example, K85. The stiffening thread 20 may further include one or more elements which are not thermofusible. Examples of such combination threads are also manufactured by Grilon EMS of Switzerland, under the trade mark designation 'C', such as, for example, C85.

[0014] According to a preferred embodiment of the present invention a thread for use in generating a durable crease comprises a plurality of plied yarns, at least one of which comprises filaments which are thermofusible at a first temperature and at least a further one of which is a carrier ply providing structural integrity to the thermofusible ply.

[0015] Referring to Fig. 2, the plies of the thermofusible material may be plied in a traditional manner by twisting them around each other in an anti-clockwise direction (an S twist) or a clockwise direction (a Z twist). Where the individual plies are multfilament, the individual filaments of those plies are typically twisted in the opposite direction to the ply direction to counteract the torque and provide a plied thread which is torque neutral, or nearly torque neutral.

[0016] Referring to Fig. 3, according to an alternative embodiment of stiffening thread, where there are three plies, the or each carrier ply and the or each thermofusible ply are braided. One preferred embodiment comprises a single carrier ply and two thermofusible plies.

[0017] Referring to Fig. 4, in yet a further embodiment, the stiffening thread is of wrapped construction, having a core ply around which is wrapped one (in the illustrated embodiment) or more cover plies 42 which are typically of lower grist.

[0018] In one embodiment of stiffening thread according to the present invention, the stiffening thread comprises at least one thermofusible ply, having a melting point between 70 and 120 °C and of between 200 and 600 Denier and preferably 400 Denier; and at least one carrier ply which is not thermofusible and having a grist of between 100 and 400 Denier. In one preferred embodiment the carrier ply has a grist of 270 Denier. Preferably the carrier ply has a melting point above 120 °C. Preferably, the thermofusible ply is a monofilament ply though multifilament may also be used.

[0019] A preferred embodiment of stiffening thread comprises a 3 ply thread of wrapped construction. The core of the stiffening thread is the carrier ply, which is of polyvinyl alcohol (PVA) of 270 Denier. The thread further comprises two cover plies, wrapped around the core, each being monofilament yarns of polyamide having a melting point of 110°C, each of which is of grist 400 Denier. The PVA core is soluble in water at a temperature of 30°C.

[0020] In an alternative embodiment, the core of the stiffening thread is of polyester corespun or staple yarn having a grist 225 Denier.

[0021] In yet a further alternative, the or each thermofusible ply has a melting point of 85°C.

[0022] Further embodiments of stiffening thread, of whatever thread construction include

Two thermofusible plies having a grist of 200 Denier and a carrier ply of 120 Denier

Two thermofusible plies having a grist of 600 Denier and a carrier ply of 400 Denier

[0023] The application of the various modifications of any aspect of any embodiment (such as for example, thread construction) are not limited to the embodiments in connection with which they are first disclosed (such as for example, the grist value, melting point and construction of the individual plies) and each such modification is hereby explicitly disclosed in conjunction with each thread construction.

[0024] As mentioned above, once the garment is manufactured, including the insertion of the stiffening thread 20 running substantially parallel to the crease line 12, the garment is pressed and, as a result of the heat and pressure applied during the pressing process, a crease is created within the garment whose durability is increased. Use of one or more monofilament thermofusible plies have been found to provide improved durability of the resultant crease by comparison to the use of multifilament plies of thermofusible material. This is thought to be because of the smaller degree of propagation of the melted thermofusible material in the case of monofilament plies, which therefore provides a greater concentration and stiffness in the immediate region of the crease. Where a lower stiffness is required, for example in the case of a finer fabric in the garment providing greater fabric mobility, multifilament thermofusible plies or lower grist plies may be used.

[0025] After the pressing process is finished and the garment has cooled, the carrier ply of the stiffening thread has served its purpose. Where that carrier ply is of PVA typically, to reduce costs, a PVA ply of a single colour (typically white though not essentially so), is used rather than matching the colour of the carrier ply to the fabric colour. This means that the carrier ply will be visible unless the garment is of the same colour. However, because the carrier ply is of PVA, and PVA is water soluble, the carrier thread will, during a washing process, dissolve in the water used to wash the garment. It will, therefore, effectively, be washed out of the garment during the first and few subsequent washing operations, leaving only the now fused and distributed thermofusible thread which maintains the durability of the crease.

[0026] In an alternative embodiment of thread according to the present invention, the core of the wrapped thread is of polyester.

[0027] An embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising at least one ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the at least one thermofusible ply is a monofilament thermofusible ply. Preferably, the melting point of the thermofusible ply is between 80°C and 115°C.

[0028] Another embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising at least one ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the thread is of wrapped construction with the carrier ply providing a core and the thermofusible ply being wrapped around the carrier ply. Preferably, the thread comprises two thermofusible plies and one carrier ply.

[0029] Another embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising a ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the thread is of braided construction. Preferably, the thread comprises two thermofusible plies and one carrier ply.

[0030] Another embodiment of the present invention provides a stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising a ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, wherein the carrier ply is of polyvinyl alcohol (PVA) and is soluble in water at temperatures of above 40°C. Preferably the carrier ply is soluble in water at temperatures of above 30°C

[0031] Details of the manufacture of a crease with improved durability will now be described with reference to Figs 5 and 6. Referring now to Fig. 5, the panel 10 which is supported on a sewing table lies under the presser foot 50 of a sewing machine. A stiffening thread 20 is drawn from a reel or cone or other suitable thread carrier (not shown) under the panel 10. A guide 60 for the stiffening thread 20 comprises a plate 62 by which the guide is fixed in position on the table while the thread 20 passes through a semi-circular guide tube 64 which serves to fix the relative position of the panel 10 and the thread 20 as the thread is drawn under the presser foot 50. The needle 66 of the sewing machine then fixes the stiffening thread to the panel 10 by stitching a fixing stitch, formed from fixing thread 68. In the illustrated embodiment a lockstitch is shown, Preferably, the fixing stitch is of a configuration which can easily be unpicked once broken at one point along its length. In one embodiment the fixing stitch configuration is a chain stitch. According a further embodiment, the fixing stitch is stitch type 402, being a twin needle chainstitch which further requires a looper thread for fastening. Referring to Fig. 6 the stiffening thread 20 is shown, fixed to the panel 10 by the fixing stitch 70.

[0032] Once the stiffening thread has been fixed to the panel, the panel is then folded along the crease line 12 and pressed along the crease line (which in Fig 6 is then coincident with the fixed position of the stiffening thread 20). This is typically performed.using an open press or other suitable form of pressing equipment which applies both pressure and heat to the panel in a folded configuration. Typically, steam or another medium may be used additionally to conduct heat through the panel during the pressing process to assist in generating a crease and, additionally, to melting the thermofusible material. After formation of the crease and melting of the thermofusible material, the panel is then allowed to cool and the thermofusible material then sets in the manner and having the effect described above. In the illustrated embodiment the stiffening thread is coincident with the crease line; but laying the thread substantially coincident (for example offset to one or other side for example) is acceptable provided that an improved durability in the crease can be obtained.

[0033] When the panel has cooled and the thermofusible material has set, the fixing stitch has then served its purpose and is removed. Preferably, the fixing stitch has a configuration which is easily unpickable, such that breaking It at one point along its length then permits the thread 66 used for the stitch then simply to be pulled out in a single operation. One preferred embodiment of fixing stitch is a chainstitch.

[0034] Further embodiments of the present invention, will now be described in which the stiffening thread is positioned and the fabric panel creased along a line coincident with the location of the thread position, and heated. Referring now to Figs. 7 and 8, according to a first preferred embodiment, this is achieved by guiding the thread into the correct alignment with respect to the fabric panel (shown in Fig. 9) and then passing the guided thread through a sequence of mangling rollers whilst applying heat to the thread to cause the thermofusible elements of it to melt. In implementing various embodiments it has been found that it is not necessary to fix the stiffening thread to the fabric panel, for example by stitching, prior to folding, pressing and heating the panel to create the durable crease.

[0035] A suitable apparatus, shown without the fabric panel or stiffening thread, includes a planar bed 210 upon which the fabric panel in which a crease is to be created is laid and which supports that panel. The fabric panel may incorporate guide marks or other indicia indicating the desired location of the crease line, though this is not essential. A guide groove 212 extends along the bed 210. In use, an operator will align the fabric panel so that the guide groove 212 extends substantially coincident with the desired position of the crease line on the panel. Where the panel carries marks, the marks on the fabric panel may advantageously be aligned with the groove 212. A pair of motorised drive rollers 214A,B, journaled about a substantially vertical axis, pinch and grip a fabric panel and cause the panel to move in the direction of arrow A in Fig. 7. Further rollers 220, assist with this operation while heating the panel, the purpose and operation of which will be subsequently described.

[0036] Referring now additionally to Figs. 9 and 10, a pilot member whose function is to deform the panel of fabric to create a fold which will eventually become a durable crease is, in the present embodiment, provided by guide foot 216, mounted on an arm 218. The guide foot 216 urges the panel 226 into the groove 212 as the panel is drawn past the guide foot 216 by the action of the rollers and, in so doing, creates a fold 228 in the panel 226 at the desired position of the crease line.

[0037] Referring now additionally to Figs. 9 and 10, the base of the foot 216 has a groove 222, which is shaped so as to provide a guide along which the stiffening thread 224 can be drawn and retained. This ensures that once the fabric panel 226 has had a fold applied 228 to it, because the thread 224 is retained on the guide foot 216 which itself is creating the fold 228, the thread 224 is retained coincident with the fold 228 in the panel enters the rollers 214, 220 in the correct alignment with respect to the fold 228 in the panel 226 of fabric (as long as the fabric panel is correctly aligned with the groove 212). Thus, the fold 228, which is the precursor to the crease line, is formed coincident with the location of the stiffening thread 224 relative to the panel 226 prior to the panel being pinched by the drive rollers 214A,B.

[0038] After passing through the mangle provided by drive rollers 214A,B, the pinched (and therefore folded by virtue of the pinching) panel 226 is then fed through a pair of heating rollers 220A,B. Heat applied by the heating rollers causes the fusible component of the stiffening thread to melt with the consequence of producing a durable crease as discussed above. According to one preferred embodiment the heated rollers 220 are also motorised and rotate fractionally faster than the guide rollers 214 so as to stretch the fabric. This serves to avoid snagging and, additionally, provides better dispersion of the fusible components of the melted thread into the fibres of the fabric panel. In a modification, a single set of rollers providing drive and heating simultaneously is provided. In yet a further modification, the rollers 220 either serve merely for guidance or are omitted and hot air is passed through the fold in the panel to melt the fusible thread.

[0039] The stiffening thread 224 will typically be drawn off a reel containing a longer length and Is cut following passage of the panel through the rollers 214, 220 then subsequently trimmed if required.

[0040] The foregoing embodiment of the present invention provides a method of applying a durable crease to a panel of fabric (which may be used in a garment) comprising the steps of: placing a composite thread comprising at least one ply of thermofusible material upon the panel; applying a fold to the panel whilst locating the thread; and applying heat to the panel thereby to melt the at least one thermofusible ply. Preferably the panel and stiffening thread are fed into a folding mechanism simultaneously substantially along the direction of the crease. Preferably, the feeding of the panel and thread takes place by the action of mutually opposing rollers which grip the sides of the panel and draw the panel and thread with a mangling action.

[0041] The foregoing embodiment enables creases of any required length to be created as desired,

[0042] A further embodiment of manufacturing method will now be described by reference to Figs. 11 to 214. Referring to Fig. 11, a pivoting heated press includes two pressing plates 260A, B. The plates 260A,B each comprise a structural bed 262, typically of a conductor such as metal, upon which is coated a layer 264 of material of some resilience. The layers 264 provides some 'give' when the fabric panel is pressed between them. Pressing is performed by a pivoting action of the plates generally about a point or on a locus situated at their lower end. The precise nature of the pivoting action may vary in that there may be a strict pivoting of the plates 260A, B about a point in the region of their base or the apparatus may be constructed to provide a more arcuate pivoting path which, therefore, additionally involves some translation. A further element of the apparatus is the pilot member which, in this embodiment generates the fold in the fabric panel whilst locating the thread relative to the panel and, at the same time provides the motive force by means of which the panel is drawn into the space between the pressing plates 260. In the present embodiment the pilot member is provided by a shaping blade 270, which is mounted for translational projection and retraction between the plates. Projection of the blade 270 into the space between the plates 260A,B serves to position the fabric panel prior to closing of the plates 260A,B for a pressing operation. The blade is typically made of stainless steel and has a planar construction tapering at its lower edge 272. A retaining groove 274 in the lower edge holds the stiffening thread 280 relative to the blade 270 so that, when the blade 270 is projecting into the space between the plates 260A,B to draw in the fabric panel 290 prior to a pressing operation, the thread 280 is correctly located relative to the blade 270 and therefore, relative also to the fold which the drawing action of the blade 270 generates. The groove therefore ensures that the stiffening thread 80 remains in the proper position with respect to the fabric during pressing.

[0043] Referring now additionally to Fig. 12, a pressing operation commences with the fabric panel 290 being placed across the upper ends of the plates 260A, B when in the open position. The blade 270 is then moved downwards to project into the space between the plates 260 while, simultaneously, pivoting of the plates into the closed position then starts to occur. The projecting motion of the blade 270 causes a fold to be created in the fabric panel, the apex 296 of which is coincident with the position of the stiffening thread 280, and the fabric panel 290 to be drawn into the space between the closing plates 260A,B.

[0044] When full projection of the blade 270 has occurred, the panel 290 has then been fully drawn by the blade 270 into the press as shown in Fig. 12. Further closing of the plates then serves initially to grip the panel 290 and, as a result, locates the thread 280 relative to the panel 290 by the gripping action of the plates 260 by virtue of the friction between the panel 290 and the thread as shown in Fig. 13. The location of the thread 280, being substantially coincident with the apex 296 of the fold whose location was determined initially by the blade 270 and, upon gripping of the panel by the plates, is maintained by the friction between the panel 290 and thread 280 arising as a result of the gripping action. Subsequent to this, the blade 270 then starts to retract. The plates 260A,B continue to close fully around the panel as the blade is retracted further. The resilience of the covering layer 264 providing the necessary give to enable gripping of the apex 292 of the panel 290 and retaining the stiffening thread 280 within the panel 290 at the location where the crease is to be created and, simultaneously, full retraction of the blade 270 to occur whilst the panel 290 retains the stiffening thread 280 in the correct place under the pressing action of the plates 260. This is shown in Fig. 14. The pressing and heating action of the plates 260A,B then cause the creation of the crease and, simultaneously, melting of the thermofusible element or elements of the stiffening thread 280.

[0045] Typically, the thread may be drawn into and along the retraining groove 274 from a reel (not shown) prior to pressing and is then, once full projection of the blade 270 and gripping of the panel 290 by the plates 260A,B has occurred, is cut from the reel.

[0046] The foregoing embodiment provides a method of applying a durable crease to a panel of fabric (which may be used in a garment) comprising the steps of: placing a composite thread comprising at least one ply of thermofusible material upon the panel; applying a fold to the panel whilst locating the thread; and applying heat to the panel thereby to melt the at least one thermofusible ply. Preferably, the panel is drawn into a space between a pair of pressing plates by a blade in a direction substantially perpendicular to the direction of the crease.

[0047] The foregoing embodiment enables creases of significant depth with regard to the size of the fabric panel to be created.

[0048] The various modifications to the embodiments disclosed herein are not limited in their application to the embodiments in connection with which they are first described and all modifications can be applied to all embodiments as the context permits.

Claims

1. A stiffening thread for use in increasing the durability of a crease in a panel of fabric, the thread comprising at least one ply of thermofusible material having a melting point between 75°C and 125°C and at least one carrier ply of material which is not thermofusible, having a melting point above 125°C, the thread further comprising at least one characteristic selected from the group consisting of:

a) the at least one thermofusible ply is a monofilament thermofusible ply
b) the thread is of wrapped construction with the carrier ply providing a core and the thermofusible ply being wrapped around the carrier ply
c) the carrier ply is of polyvinyl alcohol (PVA) and is soluble in water at temperatures of above 40°C

d) the thread is of braided construction.

2. A thread according to claim 1 comprising at least two thermofusible plies.

3. A thread according to claim 1 or claim 2 wherein the melting point of the thermofusible material is between 80°C and 125°C.

4. A thread according to claim 3 wherein the melting point of the thermofusible material is 85°C.

5. A thread according to claim 3 wherein the melting point of the thermofusible material is 110°C.

6. A thread according to any one of the preceding claims wherein each thermofusible ply has a grist of between 100 and 600 Denier.

7. A thread according to any one of the preceding claims wherein each carrier ply has grist of between 75 and 400 Denier.

8. A thread according to claim 6 or claim 7 having a carrier ply of grist between 220 and 280 Denier and a thermofusible ply of between 400 and 500 Denier.

9. A thread according to any one of the preceding claims wherein the thermofusible ply is of monofilament construction.

10. A thread according to any one of the preceding claims wherein the thread is of braided construction.

11. A thread according to any one of the preceding claims wherein the thread is of wrapped construction with the carrier ply providing a core and the thermofusible ply being wrapped around the carrier ply.

14. A thread according to any one of the preceding claims wherein the carrier ply is of PVA and is soluble in water at temperatures of above 40°C.

15. A thread according to claim 14 wherein the PVA is soluble in water at temperatures above 30°C.

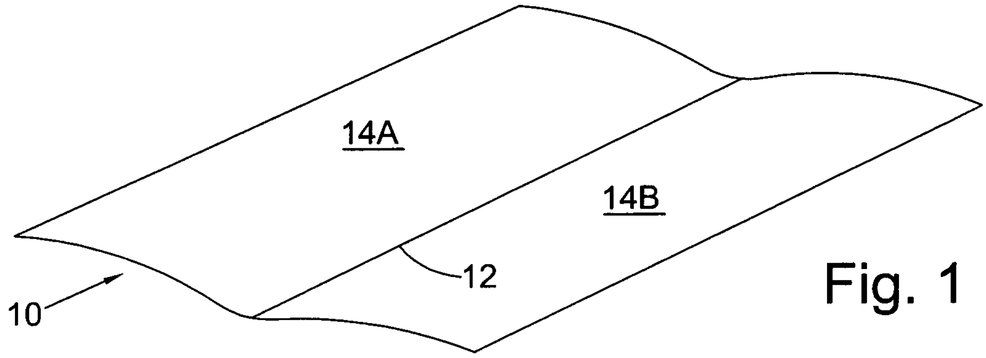

Fig. 1

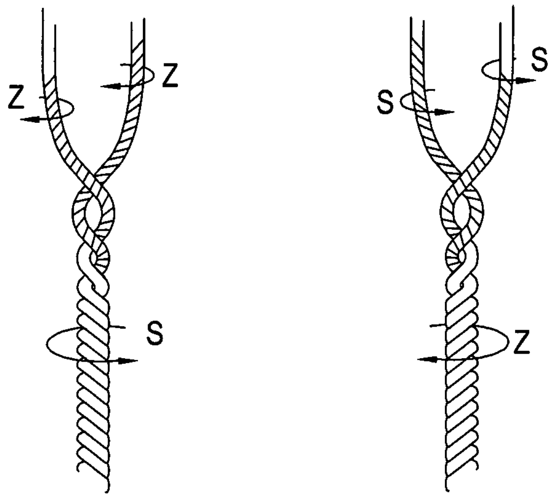

Fig. 2

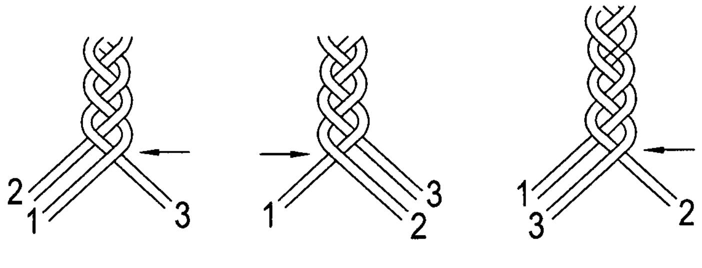

Fig. 3

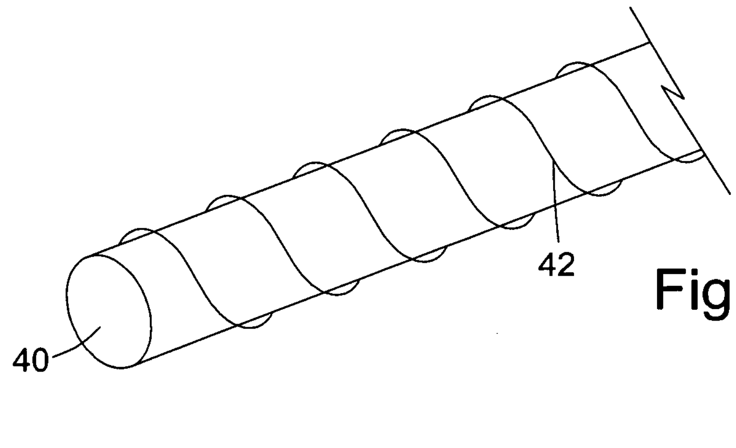

Fig. 4

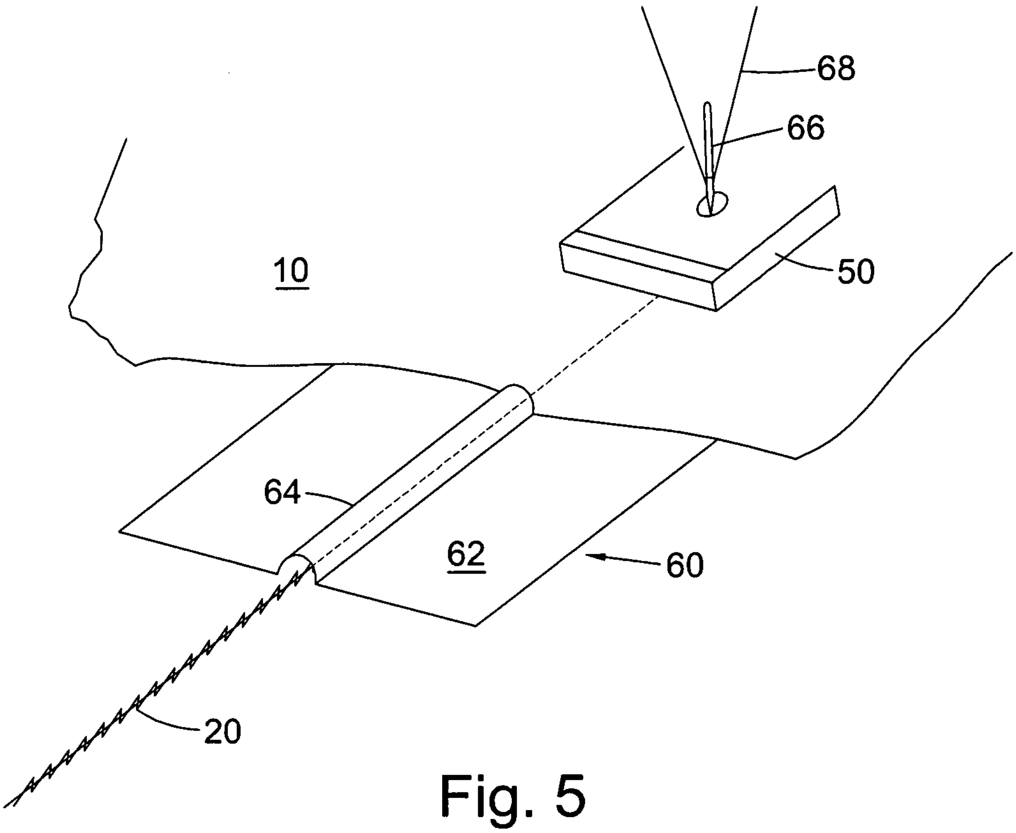

Fig. 5

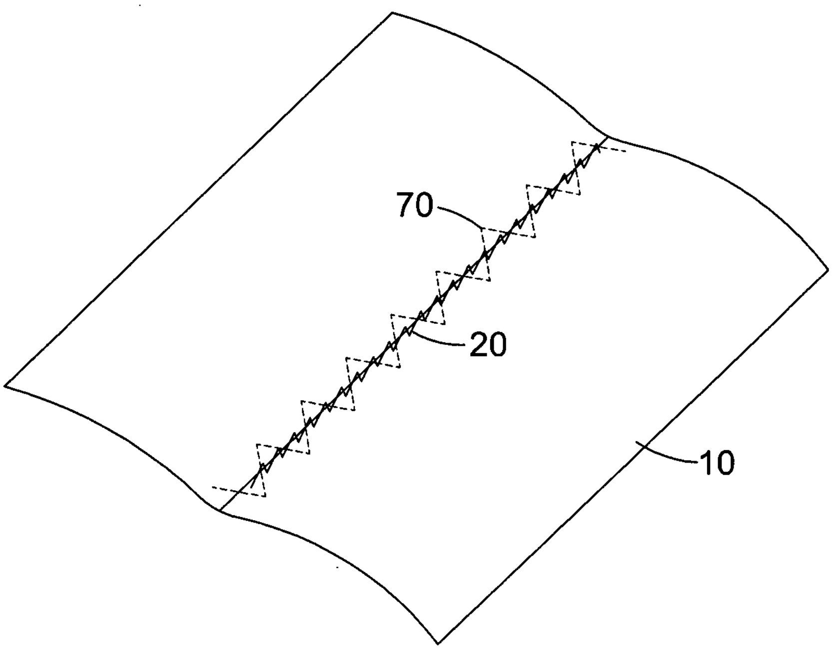

Fig. 6

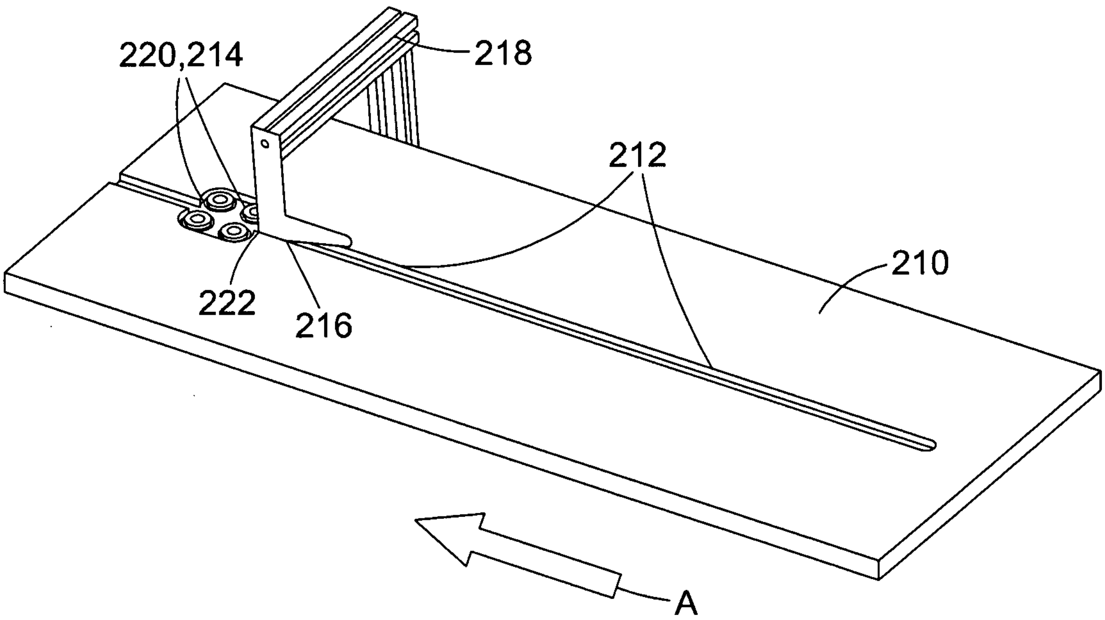

Fig. 7

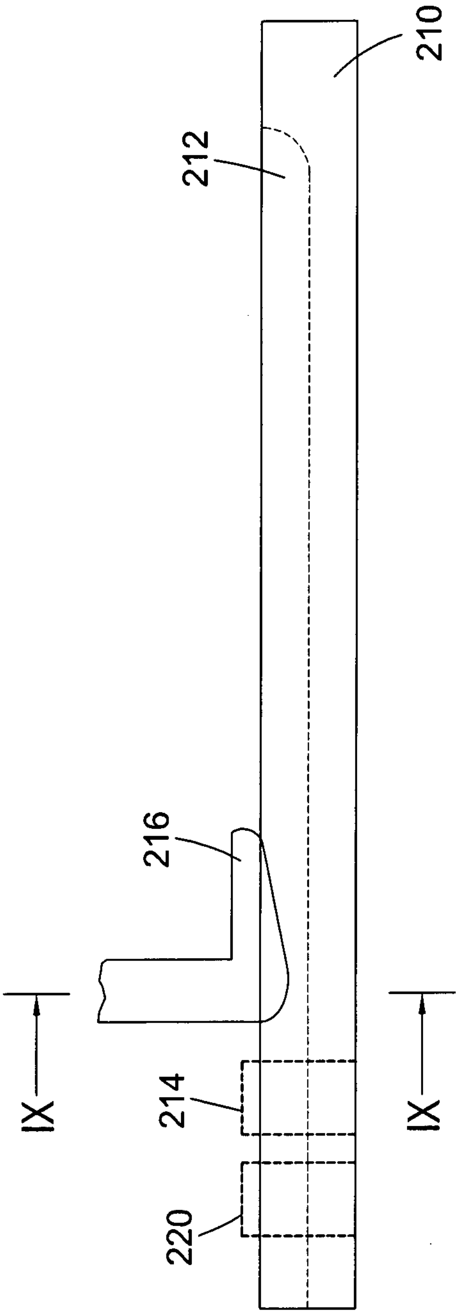

Fig. 8

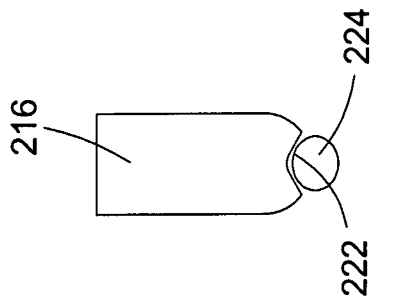

Fig. 10

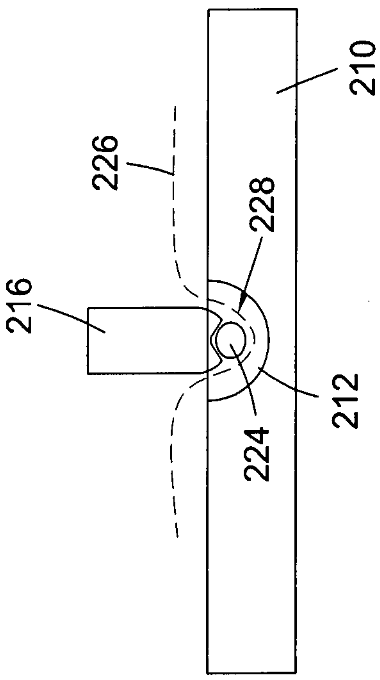

Fig. 9

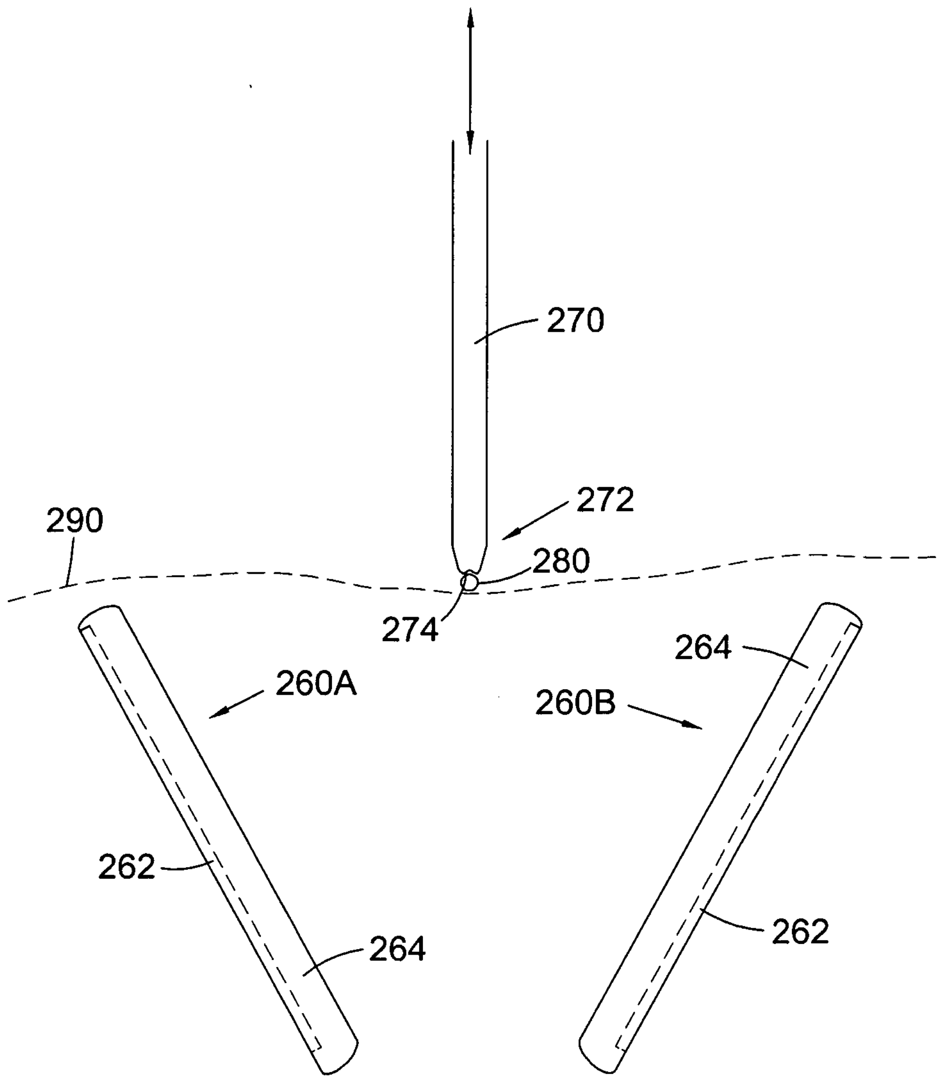

Fig. 11

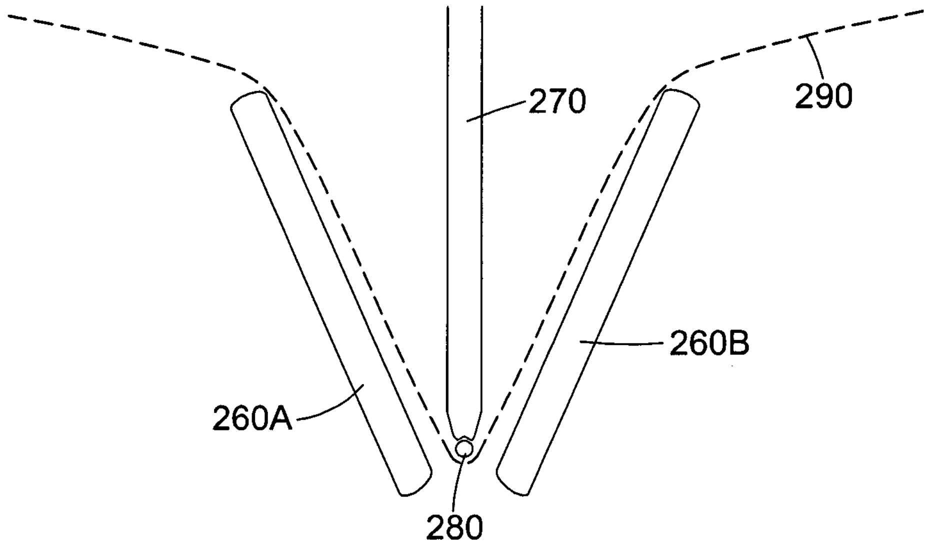

Fig. 12

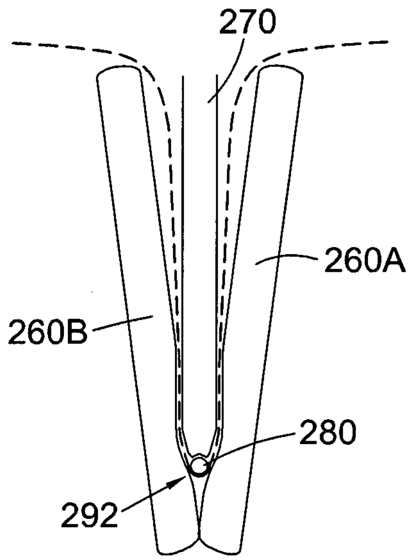

Fig. 13

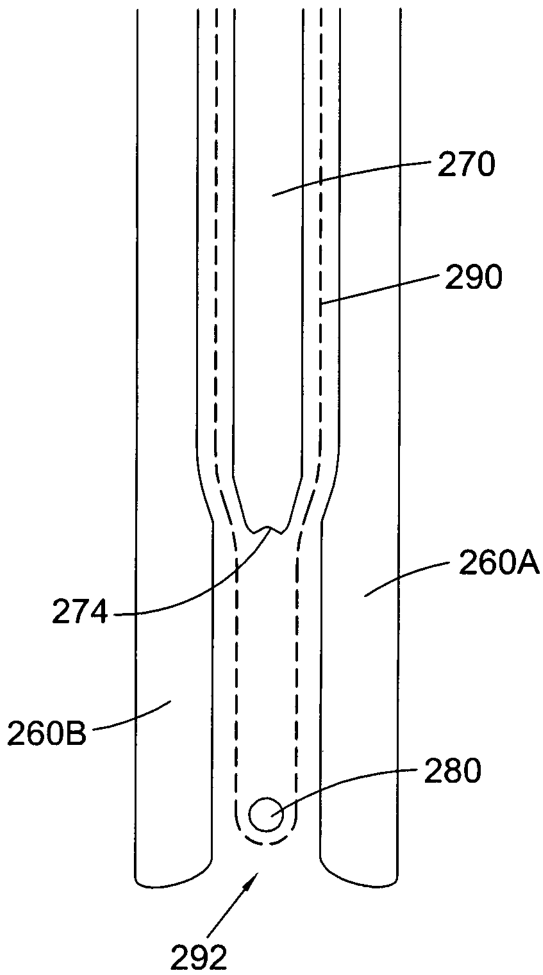

Fig. 14