(12) UK Patent Application (19) GB (11) 2529472 (13) A

(43) Date of A Publication 24.02.2016

(21) Application No: 1414942.1

(22) Date of Filing: 22.08.2014

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(51) INT CL:
A41D 7/00 (2006.01)

(56) Documents Cited:
DE 202008017430 U1 **DE 202006012273 U1**
FR 002594652 A1
http://mezzaluna.co.in/Swimwear/Mezzaluna-Mesh-Block-Panels-Maillot-Swimwear-id-319893.html

(58) Field of Search:
INT CL **A41D**
Other: **WPI, EPODOC, TXTE & Internet**

(54) Title of the Invention: **Swimming garments**
Abstract Title: **Swimsuit to help maintain good body position by having more sensitive and thinner fabric zones around specific muscle groups**

(57) A swimming garment formed from a stretchable elasticated fabric, where the garment has at least one sensitivity zone with the fabric thickness being less than the fabric thickness of the region of the garment surrounding it. Each sensitivity zone may be made of fewer layers of fabric than the surrounding area, preferably a single layer of fabric, and may be located in the region of the garment that covers the abdomen, 9 and 10. The garment may also include at least two tensions bands, 1-8, having a higher modulus of elasticity than the surrounding areas, preferably the bands are in the form of garment seams.

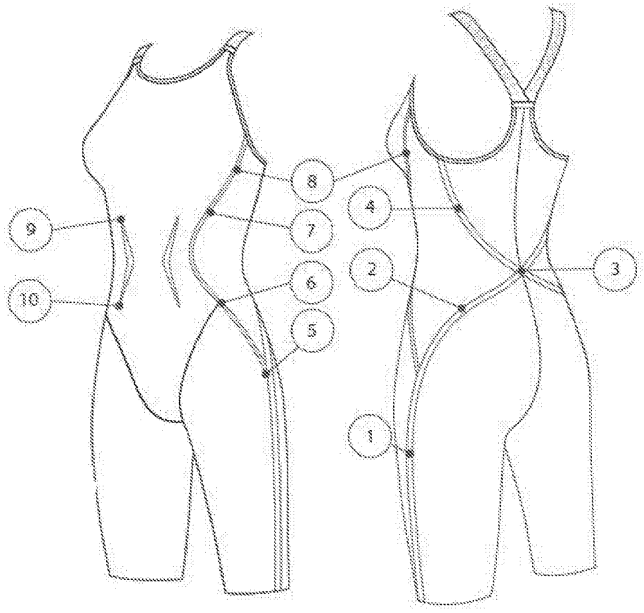

Figure 1

Figure 2

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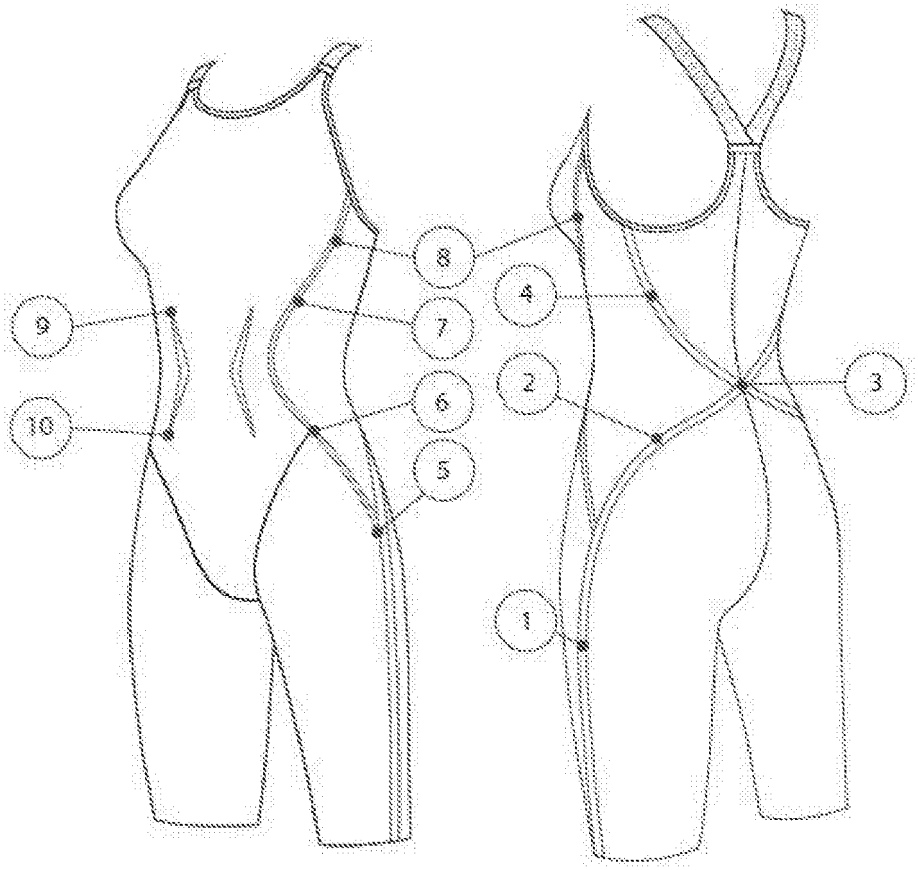

Figure 1

Figure 2

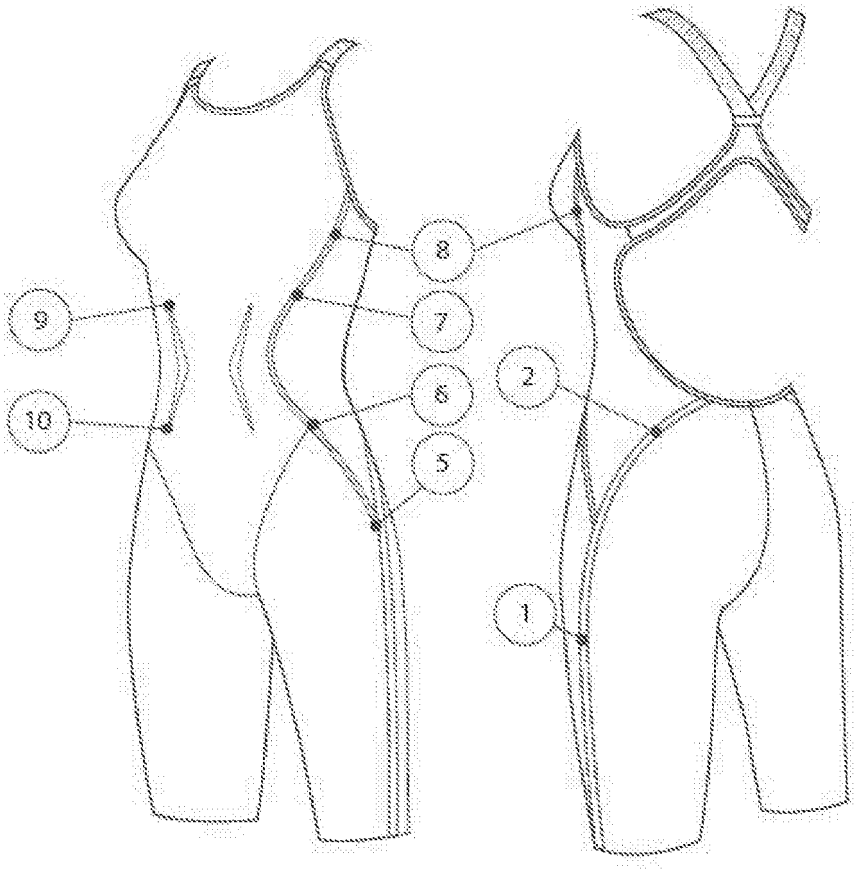

Figure 3

Figure 4

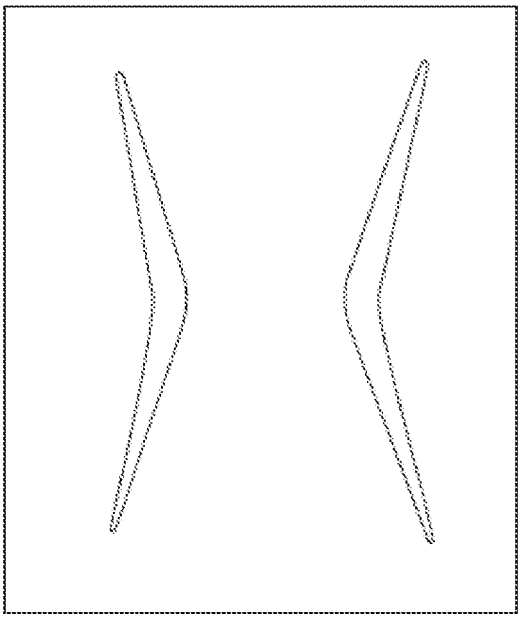

Figure 5

Swimming Garments

Technical field

The present invention relates generally to swimming garments, such as swimsuits, triathlon suits, waterpolo suits, wetsuits and other garments intended to be worn by a person when swimming. A preferred use is for swimsuits intended for competition swimmers.

Background

Swimmers typically wear tight fitting garments which help decrease air/water resistance, which is especially important in competitive events. If maximum performance is to be achieved then it is also very important the the swimmer maintains a correct body position when executing a swimming stroke in the water. This requires coordinated firing of specific muscle groups depending on the stroke. Such body position, including the coordinated firing of muscle groups, is generally only learned and maintained through hours of training in a pool.

Swimming garments have been proposed that support a swimmer's core to help them maintain good body position in the water. For example, EP1935266 (Speedo) describes a swimsuit having increased support for a swimmer's core, provided by a double layer of fabric in a torso region of the suit that surrounds the swimmers abdomen and lumbar region.

Summary of the Invention

It is a general aim of embodiments of the present invention to offer a swimming garment that better assists the swimmer to maintain a good body position, at least in part by encouraging activation of relevant muscle groups. In general terms, the approach proposed in embodiments of the invention is to provide a thinner fabric zone ('thinner' compared with adjacent regions of the garment) within the garment (for example a single layer fabric zone within a double fabric layer region of a garment) that, when the garment is worn, overlie muscle groups that it is wished to target. The thinner fabric zones result in a heightened sensation in the specific position of the body they register with, which in-turn

leads to a proprioceptive response that encourages activation of the muscle group under the thinner fabric zone.

The invention provides a swimming garment formed from a stretchable elasticated fabric, wherein the garment comprises at least one sensitivity zone in which the fabric thickness is less than the fabric thickness of the region of the garment surrounding the sensitivity zone.

Typically, the thicker fabric region within which the sensitivity zone is formed will surround the sensitivity zone on all sides.

Some embodiments may include a plurality of sensitivity zones, wherein the fabric thickenss in each sensitivity zone is less than the fabric thickness of the surrounding region of the garment.

In some embodiments, a region of the garment containing one or more sensitivity zones is formed from at least two layers of fabric and each sensitivity zone is formed with one (or more) fewer layers of fabric than the region of the garment surrounding it. For example, a single layer sensitivity zone may be formed in a double layer region of the garment.

In some embodiments, one or more of the sensitivity zones are formed in single layer fabric regions of the garment by a localised thinning of the fabric. This thinning may be achieved for example during initial manufacture of the fabric (e.g. by circular knitting) or by a post-manufacture processing step (e.g. laser etching).

In embodiments of the invention, sensitvity regions can be formed in any of a number of appropriate locations, determined by the muscle or muscle groups that it is desired to act on. For example, one or more sensitivity zones can be formed in a region of the garment that, when the garment is worn, covers the abdomen of the wearer. These zones, may, for example, extend to overlie the upper abdominals and/or the lower abdominals.

Some embodiments include a pair of sensitivity zones in a region of the garment that covers the abdomen, the zones being spaced apart on opposite sides of the mid-line of the garment.

Other possible locations for the sensitivity zones, either in addition to or as an alternative to the abdomen, include over the glutes, which may be especially beneficial for male swimmers in order to maintain alignment of the legs during kicking, and on the inside of the thigh, which may be especially beneficial when swimming breaststroke.

The sensitivity zones can give a heightened sensation in a specific position of the body, for example in the abdominals. The thinner fabric zone increases the sensation of water flow/temperature which in-turn leads to a proprioceptive response to activate the muscle group beneath the zone. Where this is the abdominals, for example, it helps to maintain a good relative anterior positioning between pelvis and ribcage, leading to a more neutral pelvis and lumber spine position.

Brief Description of the Drawings

Figure 1 shows a front perspective view of a swimsuit in accordance with an embodiment of the present invention;

Figure 2 shows a rear perspective view of the swimsuit of fig. 1;

Figure 3 shows a front perspective view of another swimsuit in accordance with an embodiment of the present invention;

Figure 4 shows a rear perspective view of the swimsuit of fig. 3; and

Figure 5 shows, on an enlarged scale, a feature that is seen on the front of the swimsuits of figs. 1 and 3.

Detailed Description

The invention will now be further described with reference to the following non-limiting Figures and Examples. Other embodiments of the invention will occur to those skilled in the art in the light of these.

Referring to figs. 1 and 2, a swimsuit in accordance with a first exemplary embodiment of the invention is described. The swimsuit is a female suit intended for competitive

swimming and is formed from a stretchable elasticated fabric of a type known for use in competition swimsuits.

In this example, the swimsuit is of a 'closed back kneeskin' type. As such, the suit includes left and right leg portions that extend down to the swimmer's knees and cover their thighs, a torso portion that covers the abdomen and the back (extending up to the bottom of the scapula) and a chest portion that covers the swimmer's chest. The suit has shoulder straps that extend from the top of the chest portion, at spaced apart points on each shoulder, over the shoulder to a central point at the top of the back portion, between the scapula. Arm openings are defined by the top edges of the chest and back portions in combination with the shoulder strap.

The swimsuit includes front and rear tension bands, which offer greater modulus (or resistance to stretch) along their length than the modulus of the basic stretchable elasticated fabric fabric of the suit. In this example, these tension bands are formed by bonded seams in the suit that join adjacent panels of the stretchable elasticated fabric fabric. The seams are taped on the inside of the suit.

More specifically, the rear tension bands are provided by crossed seam lines on the back of the suit that, when the suit is worn, follow the posterior oblique myofascial lines: the IT Band (1) into Glutes (2) on one side, across the Sacrum (3) to the opposite Latissimus dorsi (4) up into the shoulder on that opposite side. The two seam lines cross one another over the sacrum.

The front tension bands are provided by seam lines that, when viewed from the front, have a generally hour glass appearance to follow, when the suit is worn, skeletal landmarks and myofacial lines (muscle chains) to provide stability to the core region (upper and lower abdominals). These front seam lines connect to the rear seam lines at the greater trochanter (5), this being the point of rotation of the upper leg/thigh. The seam lines then run over the front of the pelvis at the anterior superior iliac spine (6) and then to the rib cage at the 5th / 6th rib (7). The seam then follows the line of the pectorialis major (8) up to the the armhole of the suit.

In this example, in accordance with an embodiment of the invention, two features (referred to in the following as 'sensitivity zones') are formed on the front of the suit over the abdomen. In general terms, these sensitivity zones are areas in the suit that have a

thinner fabric covering than surrounding areas of the suit to give a heightened sensation in a very specific position of the body, in this example the upper abdominals (9) and lower abdominals (10).

As seen in figs. 1 and 5, in this example there are two chevron-shaped sensitivity zones spaced apart one to either side of the midline of the front of the suit, with each pro hole extending from an upper region (9) of the abdominals to a lower region (10) of the abdominals.

In this example, the abdominal region of the suit is formed from two (or more) layers of fabric (e.g. two stretchable elasticated fabric fabric layers) and the sensitivity zones are created to provide the desired heightened sensation by removing one layer of fabric to increase the sensation of water flow/temperature which in-turn leads to a proprioceptive response in order to activate this muscle group and maintain a good relative anterior positioning between pelvis and ribcage. This leads to a more neutral pelvis and lumber spine position.

In other examples, to avoid using a double layer fabric region, the thinner areas of fabric to form the sensitivity zones can be produced by processing a fabric panel to produce localised thinning. For example, laser-etching of the surface layer of a fabric can create a localised thinner area within the fabric panel.

Alternatively, the fabric could be formed in the first instance with regions of differing thickness in order to provide the sensitivity zones. For example, a circular knitting process could be used to produce a 3D fabric panel (i.e. a panel with variation in thickness) or even a semi-complete suit. This production technique can produce a garment panel with thicker and thinner areas by design rather than using a secondary process to thin areas of the fabric.

The seam lines and sensitivity zones in the front of the suit are to give proprioceptive feedback to the lower abdominal region to initiate a more posterior pelvic tilt to help maintain a more neutral lumbar spine position (“flat lower back”) and avoid excessive anterior pelvic tilt which can cause lumbar lordosis (extension).The cross seam lines on the back of the suit aim to connect the Gluteals and posterior chain muscles with the muscles on the back of the opposite shoulder, following the lines of the posterior oblique

myofascial lines (IT Band into Glutes on one side, across the sacrum to the opposite Latissimus dorsi up into the shoulder on that side). This helps with proprioceptive feedback to fire the gluteal muscles to help maintain pelvic position (more posteriorly tilted into neutral and neutral lumbar spine) and also maintain good scapula position (slightly posteriorly rotated, retracted and depressed flat against the posterior chest wall) while initiating the scapula stabilising muscles (Serratus anterior, lower fibres trapezius mainly).

Thus it can be seen that in this example, the front and rear seams / sensitivity zones play slightly different roles. The seams in the front of the suit give purely proprioceptive feedback to the abdominal region to maintain a good pelvic position and a flat lower back. The crossed seams in the rear follow the posterior oblique myofascial lines to give proprioceptive feedback to connect this group of muscles. This then helps the glutes to fire and in turn maintain the good pelvic position (as with the front seams). By encouraging firing of the glutes in time with the opposite shoulder, the crossed seams on the back can also help with dynamic co-ordination and timing between upper and lower body (arms and legs).

Figs. 3 and 4, show a second exemplary swimsuit in accordance with an embodiment of the invention. The suit of this example is very similar to the suit of figs. 1 and 2, save that in this example, the swimsuit is of an 'open back kneeskin' type. As such, it has an open back region (i.e. a region free of fabric) above the top of the glutes. The rear of the shoulder straps has a cross-like form with strap portions extending laterally and downwardly from the centre of the back between the scapula to join with the side of the chest portion of the suit. Consequently, the seams forming the rear tension bands terminate at the top of the glutes where they meet the back opening.

In other respects the example of figs. 3 and 4 is identical to the example of figs. 1 and 2, including the sensitivity zones on the abdomen and similar proprioceptive effects are obtained, although in this suit there is not the same connection between the sacrum and the latimmus dorsi. There is, however, still a benefit in connecting the IT bands to the sacro-illiac joints.

The skilled person will appreciate that the swimsuits illustrated in the Figures and described above are examples embodying inventive concepts described herein and that many and various modifications can be made without departing from the invention. For

example, the same concepts can be applied to other types of swimming garment, such as triathlon suits, waterpolo suits and wetsuits for example. It is also possible to include ‘sensitivity zones’ and/or tension bands in alternative or additional positions on the garment to provide different or additional proprioceptive effects.

CLAIMS

1. A swimming garment formed from a stretchable elasticated fabric, wherein the garment comprises at least one sensitivity zone in which the fabric thickness is less than the fabric thickness of the region of the garment surrounding the sensitivity zone.

2. A swimming garment according to claim 1, comprising a plurality of sensitivity zones, wherein the fabric thickenss in each sensitivity zone is less than the fabric thickness of the surrounding region of the garment.

3. A swimming garment according to claim 1 or claim 2, wherein the or each region of the garment containing a sensitivity zone is formed from at least two layers of fabric and the or each sensitivity zone is formed with one or more fewer layers of fabric than the region of the garment surrounding it.

4. A swimming garment according to claim 3, wherein the or each region surrounding a sensitivity zone is formed from a double layer of fabric and the or each sensitivity zone has a single layer of fabric.

5. A swimming garment according to any one of the preceding claims, wherein at least one said sensitivity zone is formed in a region of the garment that, when the garment is worn, covers the abdomen of the wearer.

6. A swimming garment according to claim 5, wherein the sensitivity zone extends to overlie the upper abdominals and the lower abdominals.

7. A swimming garment according to claim 5 or claim 6, comprising a pair of said sensitivity zones in said region of the garment that covers the abdomen, spaced apart on opposite sides of the mid-line of the garment.

8. A swimming garment according to any one of the preceding claims wherein, in use, the stretchable elasticated fabric covers at least part of the wearer's thighs, hips and glutes, the garment including at least two tension bands that have a higher modulus of elasticity than adjacent regions of the stretchable elasticated fabric so that, in use, the tension bands offer greater resistance to stretch than the adjacent regions;

wherein a first one of said tension bands follows a path that extends along the outside of a left thigh region of the garment to a left hip region of the garment and inwardly from the left hip region across a left upper glute region of the garment towards a mid-line of the garment; and

a second one of said tension bands follows a path that extends along the outside of a right thigh region of the garment to a right hip region of the garment and inwardly from the right hip region across a right upper glute region of the garment towards a mid-line of the garment.

9. A swimming garment according to claim 8, wherein, in use, the stretchable elasticated fabric also covers at least part of the wearer's addomen, chest and back.

10. A swimming garment according to claim 9, wherein:

the path of the first tension band extends from the left upper glute region of the suit across the back of the suit and to a right rear shoulder region of the suit; and

the path of the second tension band extends from the right upper glute region of the suit across the back of the suit and to a left rear shoulder region of the suit;

wherein the first and second tension bands cross one another at the mid-line of the suit in a lower back region of the suit.

11. A swimming garment according to any one of claims 8 to 10, wherein the paths of the tension bands are such that when the suit is worn the first and second tension bands generally follow the posterior oblique myofascial lines of the wearer.

12. A swimming garment according to any any one of claims 8 to 11, wherein the tension bands comprise seams in the garment.

13. A swimming garment according to claim 12, wherein the seams join separate panels of the stretchable elasticated fabric from which the garment is formed.

14. A swimming garment according to claim 12 or claim 13, wherein the seams are stitched seams.

15. A swimming garment according to any one of claims 12 to 14, wherein the seams are bonded seams.

16. A swimming garment according to any one of claims 9 to 15, further comprising:

a third one of said tension bands that follows a path from a left hip region of the garment onto the front of the garment over an upper left pelvis region of the garment to a left rib-cage region of the garment and then across a left lateral chest region of the garment back towards the left side of the garment adjacent a left arm opening in the garment; and

a fourth one of said tension bands that follows a path from a right hip region of the garment onto the front of the garment over an upper right pelvis region of the garment to a right rib-cage region of the garment and then across a right lateral chest region of the garment back towards the right side of the garment adjacent a right arm opening in the garment.

17. A swimming garment according to claim 6, wherein the third tension band meets the first tension band at said left hip region and the fourth tension band meets the second tension band at said right hip region.

18. A swimming garment according to any one of claims 1 to 7, wherein the stretchable elasticated fabric, in use, covers at least part of the wearer's hips, glutes, addomen and chest, the garment including at least two tension bands that have a higher modulus of elasticity than adjacent regions of the stretchable elasticated fabric so that, in use, the tension bands offer greater resistance to stretch than the adjacent regions, wherein:

one of said tension bands follows a path from a left hip region of the garment onto the front of the garment over an upper left pelvis region of the garment to a left rib-cage region of the garment and then across a left lateral chest region of the garment back towards the left side of the garment adjacent a left arm opening in the garment; and

another of said tension bands follows a path from a right hip region of the garment onto the front of the garment over an upper right pelvis region of the garment to a right rib-cage region of the garment and then across a right lateral chest region of the garment back towards the right side of the garment adjacent a right arm opening in the garment.

Intellectual Property Office

Application No:	GB1414942.1	**Examiner:**	Mrs Nicola Payne
Claims searched:	1-18	**Date of search:**	19 February 2015

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1 and 2	DE202008017430 U1 (ALBERS) See especially figures and WPI abstract Accession No. 2010-E83399
X	1-6	FR2594652 A1 (MELKI) See especially figures and WPI abstract Accession No. 1987-315396
X	1, 2, 5 and 6	http://mezzaluna.co.in/Swimwear/Mezzaluna-Mesh-Block-Panels-Maillot-Swimwear-id-319893.html https://www.facebook.com/www.mezzaluna.co.in?ref=hl#!/www.mezzaluna.co.in/photos/pcb.773154082742292/773153832742317/?type=1&theater As advertised on Facebook 15/8/14
X	1, 2, 5 and 6	DE202006012273 U1 (LEVEE) See especially areas 5, 6, 6 ', 9, 9', 10, 10 ' and 11 in figures and WPI abstract Accession No. 2007-141390

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A41D

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, TXTE & Internet

International Classification:

Subclass	Subgroup	Valid From
A41D	0007/00	01/01/2006