

(19)



(11)

EP 3 216 360 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.09.2017 Bulletin 2017/37

(51) Int Cl.:
A41C 3/14 (2006.01)

(21) Application number: **16159832.1**

(22) Date of filing: **11.03.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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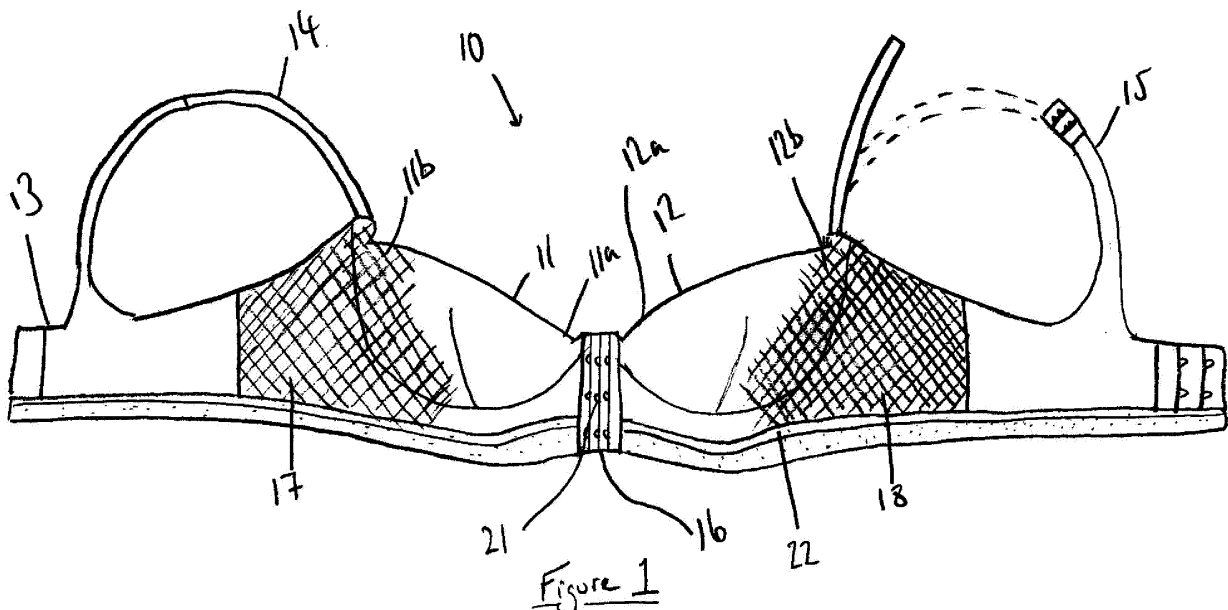
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(54) **AN IMPROVED BRA**

(57) A post-operative bra (10) for cardiac surgery patients, the bra (10) comprising two cups (11,12) for supporting both breasts of a patient, and at least one strap (13) for attaching the bra to the patient's body; wherein the or both cups (11,12) comprises an inner portion (11a,12a) which is, in use, proximal to the patient's sternum, and an outer portion (11b,12b) which is proximal

the patient's armpit; a central portion (16) being located between said inner and outer portions; wherein the outer portion (11b,12b) of at least one cup (11,12) incorporates a region of reinforcement (17,18) which, in use, minimises or prevents movement of the patient's breast towards their armpit, when the patient is in the supine position.



EP 3 216 360 A1

Description

Field of the Invention

[0001] The invention relates generally to bras and more specifically to bras for post-operative cardiac surgery patients.

Background to the Invention

[0002] Wearing a support, in particular a bra, following cardiac surgery is proven to have a positive impact in women, particularly in reducing surgical infection rates. Wearing an appropriate support has been shown to reduce lateral tension on a wound, because the weight of a woman's breasts is well supported, which prevents mechanical disruption of the new wound bed. A support also tends to reduce skin on skin contact under a woman's bust, to minimise the risk of bacterial growth. However, at least in the United Kingdom, current supports are typically not suitable for larger-sized women, i.e. those with breasts that are >D cup and/or >50cm chest size (band). Current supports provided in the United States are also unsuitable.

[0003] The closest prior art known to the applicant comprises a front fastening bra incorporating adjustable straps which is typically provided following an operation. However, whilst these bras have been used and have proven successful with a large number of women, these bras are not suitable for those with larger breasts, resulting in discomfort to the patient and minimal or non-effective support of the breasts. Moreover, existing bras cannot be straightforwardly up-scaled to fit larger women because of the increase in weight of breasts compared to smaller-sized women and because of the implications this would have on access to the wound, e.g. for drainage at or near the sternum. Therefore, a large number of female patients are not provided with suitable peri-post operative support-wear. The incorrect or non-existent support is disadvantageous for a number of reasons, including increasing the risk of infection and improper wound healing, and an increase in wound-healing time.

[0004] Given that female patients undergoing cardiac surgery often gain fluid weight post operatively and have breasts that increase in size to >D cup and/or >50cm chest size because of this gained fluid, there is a real need to provide a bra which is more suitable for a larger sized woman to ensure that the risks noted above are minimised. Effective post-operative supports would also improve, long term, the financial costs of cardiac surgery because a patient who does not develop a bacterial infection and who heals effectively will be less likely to require further treatment.

[0005] An object of the current invention is to provide a bra which seeks to alleviate at least the problems noted above.

Summary of the Invention

[0006] In a first broad independent aspect the invention provides a post-operative bra for cardiac surgery patients, the bra comprising two cups for supporting both breasts of a patient, and at least one strap for attaching the bra to the patient's body; wherein the or both cups comprise an inner portion which is, in use, proximal to the patient's sternum, and an outer portion which is proximal the patient's armpit; wherein the outer portion of at least one cup incorporates a region of reinforcement which, in use, minimises or prevents movement of the patient's breast towards their armpit, when the patient is in the supine position.

[0007] This configuration is particularly advantageous because it provides a post-operative bra with a cup and band or strap size suitable for women having large breasts or backs, e.g. larger than D cup and/or 50cm chest size. The region of reinforcement supports the patient's breasts from the side to prevent or at least minimise the movement of the breasts away from the sternum. Cardiac surgery often requires the opening of the chest cavity through the sternum. Preventing or minimising movement of the breasts away from the sternum therefore minimises the risk that a wound will re-open once an operation has been completed. The risk of infection at the wound is therefore also minimised, as there are other issues associated with lateral tension on a wound.

[0008] Preferably, the or each region of reinforcement comprises a pocket; wherein the pocket incorporates a supporting insert for reinforcing said cup. The pocket and supporting insert reinforce the outer portion of the or both cups to prevent or minimise movement of a patient's breasts away from the sternum, thus reducing the risk of wound opening following surgery. This configuration is also advantageous because the supporting insert can be comprised of a more rigid material than the remainder of the bra and can be manufactured separately and then placed inside the pocket. If the pocket is not sealed and a separate insert is provided, the pocket and insert configuration also allows the bra to be washed separately from the insert. More preferably, the pocket is sealed and the insert is not removable from the pocket.

[0009] Preferably, the pocket of the or both cups is sized and located such that, in use, the said pocket extends alongside a patient's breast, from the front of the breast to the side of the ribcage and is so shaped as to cup the side of the patient's breast. Extending the pocket alongside the breast from the front of the breast to the side of the chest ensures that each breast is adequately supported and prevented from moving outwards.

[0010] Optionally, the pocket of the or both cups comprise an opening and the supporting insert is removable from the pocket. The removability from the pocket allows replacement of the supporting insert. This is advantageous for cleaning/sanitising the bra effectively and for modifying the bra for each patient, i.e. for different sized

breasts.

[0011] Optionally, the or both cups comprises an inner surface and an outer surface, wherein the pocket is located between said inner and outer surfaces at the outer portion. Locating the pocket between the inner and outer surfaces minimises the overall size of the bra and therefore improves the comfort and practicality of the bra to the patient.

[0012] Optionally, the or both cups comprise an inner surface, an outer surface and a spacer layer; and wherein the pocket is located between said outer surface and said spacer layer. This configuration is particularly advantageous because it improves the strength and therefore lifespan of the bra. The spacer layer also provides additional padding to a patient so that the bra does not become uncomfortable.

[0013] Optionally, the or both cups comprise an inner surface, an outer surface and a spacer layer; and wherein the pocket is located between said inner surface and said spacer layer. This configuration is also particularly advantageous because it improves the strength and therefore lifespan of the bra. The spacer layer also provides additional padding to a patient so that the bra does not become uncomfortable.

[0014] Preferably, said supporting insert comprises a flexible material. A flexible supporting insert can conform to the individual shape of a patient whilst still providing the support necessary for protecting a wound. Optionally, the insert comprises a fabric, washable in a standard washing machine, which is advantageous for patients who have left hospital.

[0015] Preferably, the bra comprises at least one band which is connected to a bottom edge of the or both cups and extends laterally around the chest of the patient; wherein the width of a portion of the band proximal to said inner portion of the or both cups is reduced compared to the remainder of said band. A reduced width in the vicinity of the sternum allows for drains to be straightforwardly employed at a wound. The greater width of the remaining portion of the band improves the strength of the band and prevents the rolling up of the band, which would be uncomfortable for the wearer.

[0016] Preferably, said band comprises one or more fasteners; wherein at least one of said fasteners is located at the front of the bra. Locating fasteners at the front of the bra allows the bra to be straightforwardly fitted to a patient by another person following cardiac surgery and/or when the patient is supine and/or has restricted movement. A front fastener also allows a patient to put the bra on without reaching behind their back, which would increase the lateral tension on a wound, and without turning the bra across an incision made during surgery, which would aggravate the wound.

[0017] Preferably, said band comprises three or more fasteners located at the front of the bra. The Applicant has found that providing three or more fasteners, which are arranged either vertically or horizontally, is advantageous because the use of three or more fasteners im-

proves the fit of the bra (one or more of the fasteners can be left undone without compromising the attachment of bra parts). Preferably, the fasteners are arranged vertically. Three fasteners is optimum because this configuration improves the fit of the bra compared to the use of one or two fasteners. This configuration also allows for negative pressure therapy and dressings to be more straightforwardly applied. The use of three or more fasteners also reduces the risk of disturbing the healing of a wound because the force is spread across all three fasteners. Also, one or two of the button hooks could be left undone if it is located above a particularly sensitive part of a wound, without impairing the efficacy of the bra.

[0018] Preferably, the bra comprises one or more straps, the or each strap extending over the shoulder of the patient between one of said cups and said band; wherein at least one of the straps comprises means for adjusting the fit of the bra. The adjusting means allows the bra to be modified for different sized patients.

[0019] Preferably, said means for adjusting the fit of the bra comprises a series of hook and eye fastenings. Hook and eye fastenings provide a straightforward means for adjusting the length of the straps.

[0020] Preferably, said one or more straps comprise an elasticated material. Providing elasticated straps improves the fit and comfort of the bra and minimises the risk that the straps will dig in and cause discomfort or harm to the patient. Elasticated material also makes it easier for a healthcare professional to fit the bra to a patient following surgery, particularly if the patient is lying on their back. An elasticated material also allows for fluid gain. During the post-operative period, it is normal for patients to gain weight, especially if they have had valves or required certain medications. Weight gain typically ranges between 5 to 10 kilograms but it is not uncommon for patients to gain 15 kilograms. The elasticated material allows the bra to accommodate these weight fluctuations.

[0021] Preferably, the bra is constructed such that all seams are formed on an outer surface of the bra. Providing all seams on an outer surface of the bra minimises the risk of discomfort to the patient through rubbing.

[0022] Preferably, the bra is constructed such that any seam which is formed between two joined parts of the bra is formed along one of said cups. Locating seams vertically over or along the cups of the bra avoids aggravating the wound at the sternum and/or rubbing the breast or nipple of the patient, or putting pressure on the patient's skin. This configuration also minimises any discomfort to a patient, which might occur if the seams are located along a strap or other part of the bra. Even more preferably, all seams are flat seams to reduce rubbing and aggravation to the patient.

Brief Description of the Drawings

[0023] In the drawings:

Figure 1 shows a front view of a bra of a preferred

embodiment.

- Figure 2 shows a perspective front three-quarter view of a bra of a preferred embodiment.
- Figure 3 shows a view from the right hand side of a bra of a preferred embodiment.
- Figure 4 shows a view of the outer surface of an open bra of a preferred embodiment.
- Figure 5 shows a view from the side of a section of a bra of a preferred embodiment.

Detailed Description of the Embodiments

[0024] A preferred embodiment of a post-operative bra, suitable for use with cardiac surgery patients (typically those with median sternotomy wounds), is shown in Figure 1 and is referenced generally as 10. The bra 10 comprises two cups 11, 12 for supporting the, either or both breasts of a patient (not shown). The bra 10 further comprises at least one band 13 for fitting the bra 10 around the patient's body. In the preferred embodiment of Figure 1 the bra comprises two cups 11, 12 and band 13, and two straps 14, 15; wherein the band 13 extends laterally around the chest of a patient and which is joined to each of the cups 11, 12 and two straps 14, 15 which extend one from each cup, over the shoulder of the patient, to the band 13. In alternative embodiments, a lesser or greater number of straps or bands is provided, and even more preferably the cups 11, 12 are configured to be removably attached to several straps so that the bra 10 can be customised for different patients.

[0025] Each cup 11, 12 comprises an inner portion 11a, 12a which is located proximal to a central part 16 of the bra and which is, in use, proximal to a patient's sternum and an outer portion 11b, 12b which, in use, is located proximal a patient's armpit. The two cups 11, 12 are joined to one another via the central part 16 which lies next to or over the sternum of a patient in use. In a preferred embodiment, the bra 10 opens and closes at the front, wherein the central part 16 comprises one or more fasteners 21. In this preferred embodiment, the band 13, which extends around the chest of the patient in use, is continuous and does not comprise any fasteners. In an alternative embodiment, the band 13 comprises a fastener 21 which is located to one side of at least one of the cups 11, 12. In another alternative embodiment, fasteners are provided at both the central part 16 and band 13 to allow a patient or health care professional to fit the bra to the patient in the easiest way possible, depending on the size and shape of the patient and their position. For example, if the patient is lying down in a bed following cardiac surgery, it is most straightforward to provide a bra with an opening at the central part 16 so that the bra can be slipped underneath the patient's back, brought around their chest, and fastened at the front above the

sternum. The central part 16 incorporating the fastener 21 is preferably approximately 5cm in width and comprises ten hook and eye fastenings. In one embodiment, ten triplets of eyes are provided on the central part 16.

[0026] In a most preferred embodiment, the fastener 21 of the central part 16 comprises one or more hook and eye fastenings. Most preferably, the fastener 21 comprises a triplet of hook and eye fastenings to allow the bra to be sufficiently modified for comfort and best results with each patient. In alternative embodiments, the fastener 21 of the central part 16 comprises Velcro (RTM), buttons and slits, or any other type of fastening, such as poppers, which are known to the skilled person. However, fastenings which comprise Velcro (RTM), buttons or poppers are no preferred due to the possible infection risk and strength of these fastenings in relation to the preferred hook and eye fastening.

[0027] An outer portion 11b, 12b of each cup is located, in use, proximal to the patient's armpit, i.e. each of the outer portions is located over the outer side of each of the patient's breasts and faces outwards, away from each side of the patient. The outer portion 11b, 12b of each cup 11, 12 incorporates a region of reinforcement 17, 18 which minimises or prevents altogether the lateral movement of the patient's breasts away from their sternum, i.e. towards their armpits. The regions of reinforcement 17, 18 therefore minimise the risk that a closed wound at the sternum will reopen or that the wound will breakdown because of lateral pull or spread of the breasts, which could bring about a number of disadvantages as discussed above.

[0028] The region of reinforcement 17, 18 of each cup may comprise a stiffened section of material, as shown by the hashed lines in Figure 1, which is either integrally formed with the rest of the bra or is stitched, glued or otherwise fixed to the rest of the bra. In a preferred embodiment, each region of reinforcement is formed of a buckwheat fabric for superior support and contouring. In a preferred embodiment, which is shown best by the dashed lines in Figure 2 at 'X', each region of reinforcement comprises a pocket, such as 20. Each pocket incorporates one or more supporting inserts (not shown) formed of a stiffened or otherwise strengthened material for minimising sideward movement of the patient's breasts. The (or each) insert preferably comprises a fabric so that the insert can be washed with the rest of the bra, but the insert may also comprise a plastic, metal or other material, or a combination of the above, which provides suitable reinforcement to the side of a patient's breast. In a further preferred embodiment, the or each insert comprises Buckram, which is made from 100% woven cotton and is a single stiffened panel. In another embodiment, the or each insert comprises a buckwheat fabric. Varying sizes of insert may be incorporated to customise the bra for each patient. Varying cup sizes, strap lengths and insert sizes can be combined to maximise the comfort and reinforcement that the bra provides for each patient.

[0029] The regions of reinforcement may comprise part of the band 13 and may extend to the front of each cup. In a preferred embodiment, each region of reinforcement extends from the front of a respective cup 11, 12 to a location which is, in use, under a patient's armpit so that each breast is effectively cupped and thus supported by a region of reinforcement. The regions of reinforcement also preferably extend upwards on a patient's breast to cup, at least partially, the top and bottom of the breasts. Where the regions of reinforcement each comprises a pocket 20 and one or more supporting inserts, the pocket and the (or each) supporting insert preferably both extend from the front of the cup to under the patient's armpit.

[0030] In a preferred embodiment, each supporting insert is sealed within a respective pocket. However, in an alternative embodiment, each pocket 20 comprises a closable opening (not shown) so that the supporting inserts can be removed from each pocket for washing or replacement with a new or better-fitting insert. The opening may be closed with Velcro (RTM) or any other fastening which ensures that the or each supporting insert remains in the pocket 20 and which does not irritate the patient's skin. In an alternative embodiment, the pocket comprises two overlapping sections of material which can be arranged to keep the insert inside the pocket.

[0031] In one embodiment, each cup 11, 12 comprises an inner surface (which contacts the patient's breast) and an outer surface and the pocket 20 is provided between the inner and outer surfaces of the cup. However, in alternative embodiments, a spacer layer (not shown) is provided, and the pocket 20 is located between either the inner surface and the spacer layer or the spacer layer and the outer surface of each cup. In further alternative embodiments, each cup may comprise a multiplicity of layers and linings between the inner and outer surfaces, and the pocket is provided between or spans across any number of those layers or linings.

[0032] In a preferred embodiment, the width of the band 13, which extends around the chest of a patient in use, is reduced at a portion which is proximal to the inner portion of the or each cup compared to the width of the remainder of the band 13. Reducing the width of the band 13 at the front of the bra, i.e. proximal to the sternum, improves ease of access for a healthcare professional for draining of a wound at or near the sternum because the reduced width provides sufficient space for draining apparatus. Cardiac drains are typically left in place following surgery for a couple of days. Temporary pacing wires may also be present. A reduced width of the band 13 at this location minimises the risk that damage will be caused to the wound or to the drains and pacing wires that are in place, and will minimise discomfort of the patient. The thickness of the band 13 proximal the sternum may also be reduced compared to the remainder of the band 13. The remainder of the band 13 is preferably wider to prevent or minimise the risk of roll up of the band 13 which would be uncomfortable for the wearer.

[0033] In a preferred embodiment the bra 10 further

comprises a section of 'breathable' material 22 which is located between each cup 11, 12 and the band 13. The section 22 of 'breathable' material which, in use, is located under the patient's bust, reduces the warmth and humidity under the bust because of the prevention of skin on skin contact, which could lead to moisture build up which is attractive to bacteria. In a preferred embodiment, the bra 10 is completely devoid of any underwiring to minimise the risk of discomfort to the patient or of aggravation of the wound. Underwire can also reduce perfusion to the area and healing wounds need a good supply of oxygen.

[0034] In a preferable embodiment, two straps 14, 15 are provided which extend, one from each cup, over the shoulder of the patient to the band 13. Preferably one or both of these straps 14, 15 comprises a fastener or means for adjusting the length of the or both straps 14, 15, to modify the fit of the bra 10. In one embodiment, which is shown in Figures 3 and 4, the means for adjusting the fit of the bra comprises one or more hook and eye fastenings. However, in alternative embodiments, any type of known suitable fastening means of adjusting means may be provided.

[0035] The shoulder straps are removable. This allows placement of the bra when the patient is in a supine or seated position. The strap(s) may be removed completely, for occasions when a pacing device is placed following cardiac surgery, to prevent rub on the new wound/pacing device.

[0036] In one embodiment, the straps 14, 15 are comprised of an elasticated material to improve the overall fit of the bra 10 and also to improve the ease of use of the bra 10. The band 13 preferably comprises an elasticated material. In the embodiment of Figure 4, at least one of the straps 14 comprises two, initially separated ends - a long end and a short end. The long end preferably comprises an elasticated material and is approximately 21cm including the length of a fastener, and approximately 3cm wide. The short end comprises a cooperating part of the fastener which is located on the long end. The short end is preferably approximately 6cm at its widest point and rests, in use, over the collar bone of the patient. The strap 15 may have the same configuration or may be a continuous strap, which is preferably comprised of an elasticated material. The back of the bra has a racer style to provide additional support to the bust. The number of straps or bands is also reduced to minimise the risk of rubbing or pressure points.

[0037] In a preferred embodiment, the bra 10 is constructed such that any seams formed between two joined parts of the bra are located over one or both of the cups 11, 12 to minimise discomfort (e.g. from rubbing) to the patient. In one embodiment, all of the seams are provided on the outer surface of the bra to prevent or minimise the risk of rubbing. The seams are also preferably flat, i.e. as flush as possible to the remainder of the bra's material, to improve comfort. In an embodiment where seams are provided on the inner surface of the bra, the seams are

flat to prevent rubbing or pressure which would cause discomfort.

[0038] Figure 5 shows a side view of a preferred embodiment, where the bra 10 comprises a fastener 21 comprising three sets of eyes which are connectable to a set of hooks on the opposite side of the central portion 16 (not shown in Figure 5). The cup 11 comprises three seams 23 which are all located on the outer surface of the cup 11 to minimise or eliminate the risk of discomfort to the patient. Each of the seams comprises a flat stitch to further reduce the risk of discomfort. Section 'A' comprises breathable material to reduce the amount of moisture which might otherwise collect under the patient's bust.

[0039] The bra 10 is preferably comprised of a circular knitted fabric with a composition of (approximately) 85% Polyamide Meryl, 4% Polyamide and 11% Lycra. The width of the bra when fully open and laid flat is preferably 150cm and has a weight of approximately $215\text{g/m}^2 \pm 15\text{g/m}^2$, a Zwick stretch (30N) of max. Warp 85% and max. Weft 95%. In a preferred embodiment, the bra 10 has a washing shrinkage of max. Warp 10% and max. Weft 6%.

[0040] In another embodiment, the bra 10 is comprised of a dream fit, soft Weftloc-quality material of machine gauge E28 and a preferable composition of 59% Polyamide and 41% Elastane. In this embodiment the width of the bra 10 when opened and laid flat is preferably a minimum of approximately 175cm with a weight of 250g/m^2 , a weight tolerance of $235\text{--}265\text{g/m}^2$, a Wales/10cm of 260 and Courses 10/cm of 661. In this embodiment the bra 10 preferably has a Zwick stretch at 60N of between 150 and 180% but preferably 165% and a Weft of between 160 and 200% and preferably 180%. The shrinkage of the bra is preferably max. Warp 5% and max. Weft 5%.

[0041] The bra 10 may also comprise a combination of circular knitted fabric and dram fit, soft Weftloc-quality material.

Claims

1. A post-operative bra for cardiac surgery patients, the bra comprising two cups for supporting both breasts of a patient, and at least one strap for attaching the bra to the patient's body; wherein the or both cups comprise an inner portion which is, in use, proximal to the patient's sternum, and an outer portion which is proximal the patient's armpit; wherein the outer portion of at least one cup incorporates a region of reinforcement which, in use, minimises or prevents movement of the patient's breast towards their armpit, when the patient is in the supine position.
2. A bra according to claim 1, wherein the or each region of reinforcement comprises a pocket; wherein the pocket incorporates a supporting insert for reinforcing said cup.

3. A bra according to claim 2, wherein the pocket of the or both cups is sized and located such that, in use, the said pocket extends alongside a patient's breast, from the front of the breast to the side of the ribcage and is so shaped as to cup the side of the patient's breast.
4. A bra according to either claim 2 or claim 3, wherein the pocket of the or both cups comprises an opening and the supporting insert is removable from the pocket.
5. A bra according to any of claims 2 to 4, wherein the or both cups comprises an inner surface and an outer surface, wherein the pocket is located between said inner and outer surfaces at the outer portion.
6. A bra according to any of claims 2 to 4, wherein the or both cups comprises an inner surface, an outer surface and a spacer layer; and wherein the pocket is located between said outer surface and said spacer layer.
7. A bra according to any of claims 2 to 4, wherein the or both cups comprises an inner surface, an outer surface and a spacer layer; and wherein the pocket is located between said inner surface and said spacer layer.
8. A bra according to any of claims 2 to 7, wherein said supporting insert comprises a flexible material.
9. A bra according to any of the preceding claims, wherein the bra comprises at least one band which is connected to a bottom edge of the or both cups and extends laterally around the chest of the patient; wherein the width of a portion of the band proximal to said inner portion of the or each cup is reduced compared to the remainder of said band.
10. A bra according to any of the preceding claims, wherein said band comprises one or more fasteners; wherein at least one of said fasteners is located at the front of the bra.
11. A bra according to any of the preceding claims, wherein said band comprises three or more fasteners located at the front of the bra.
12. A bra according to any of the preceding claims, wherein the bra comprises one or more straps, the or each strap extending over the shoulder of the patient between one of said cups and said band; wherein at least one of the straps comprises means for adjusting the fit of the bra; preferably wherein said means for adjusting the fit of the bra comprises a series of hook and eye fastenings.

13. A bra according to claim 12, wherein said one or more straps comprise an elasticated material.
14. A bra according to any of the preceding claims, wherein the bra is constructed such that all seams are formed on an outer surface of the bra. 5
15. A bra according to any of the preceding claims, wherein the bra is constructed such that any seam which is formed between two joined parts of the bra is formed along one of said cups. 10

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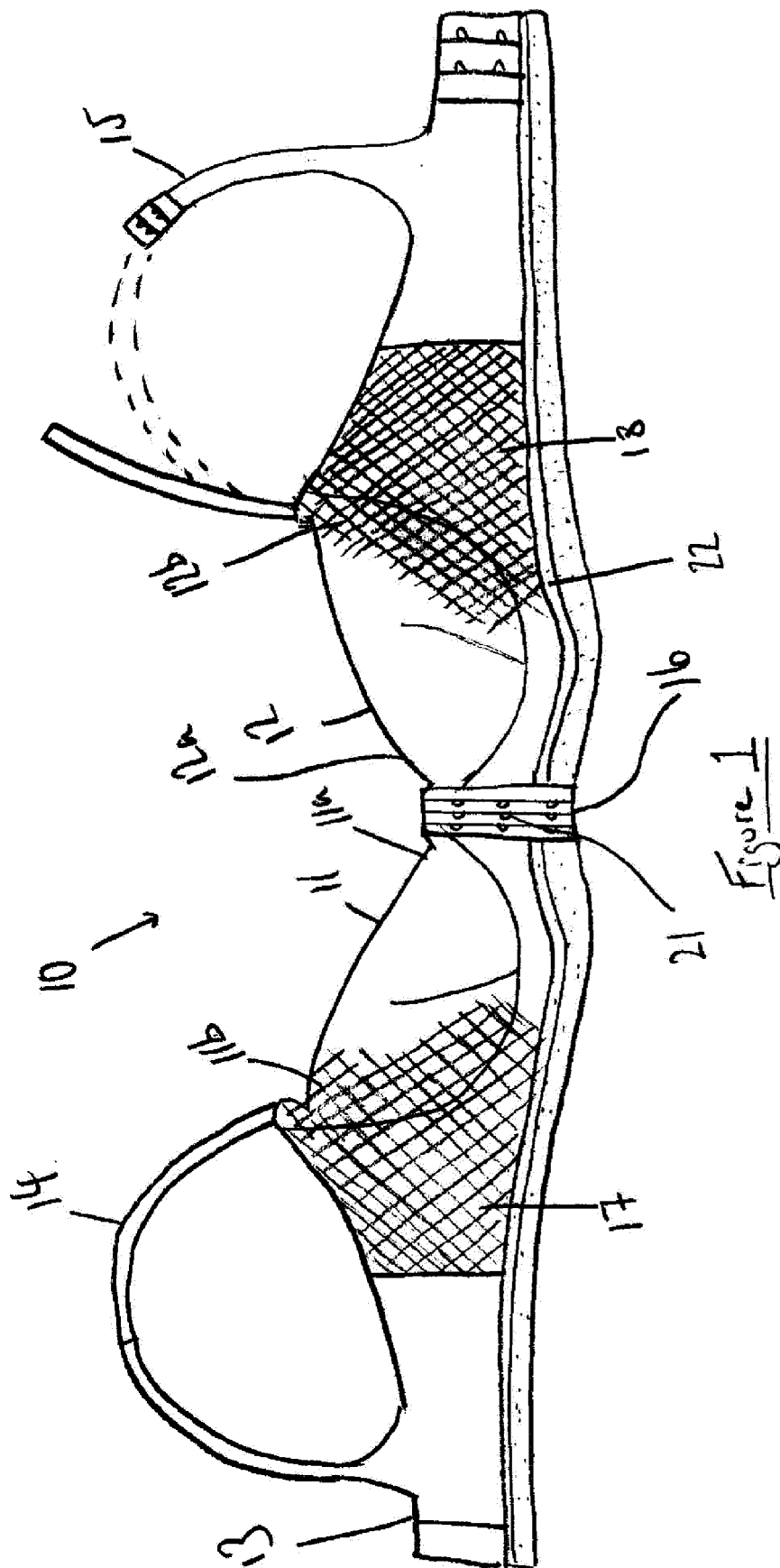
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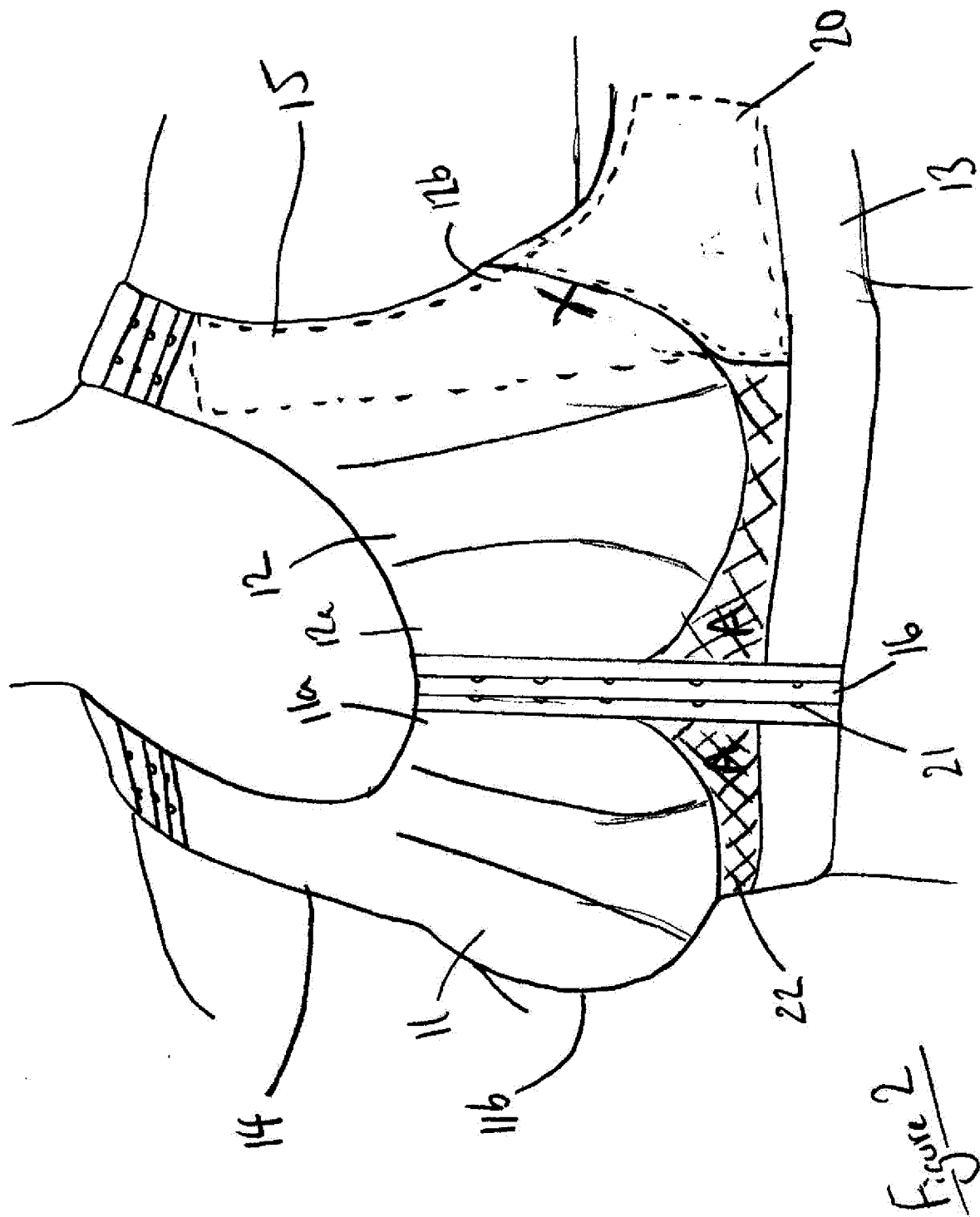
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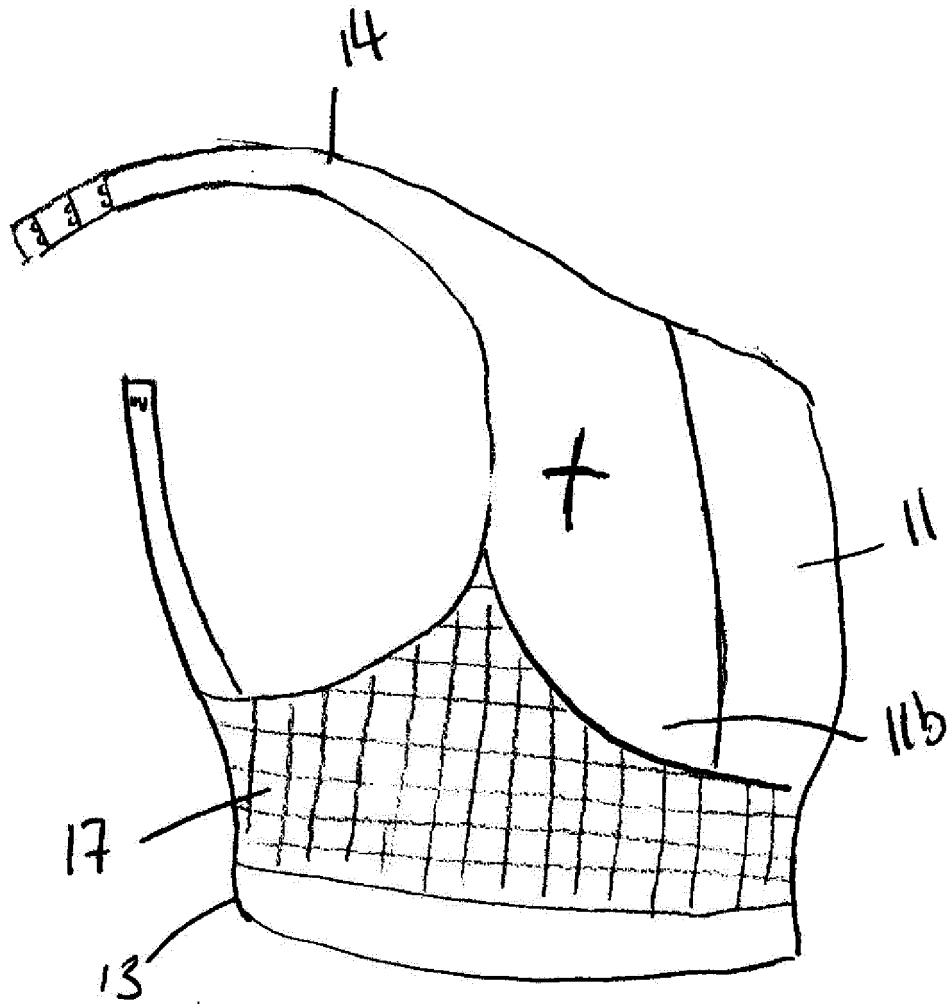


Figure 3

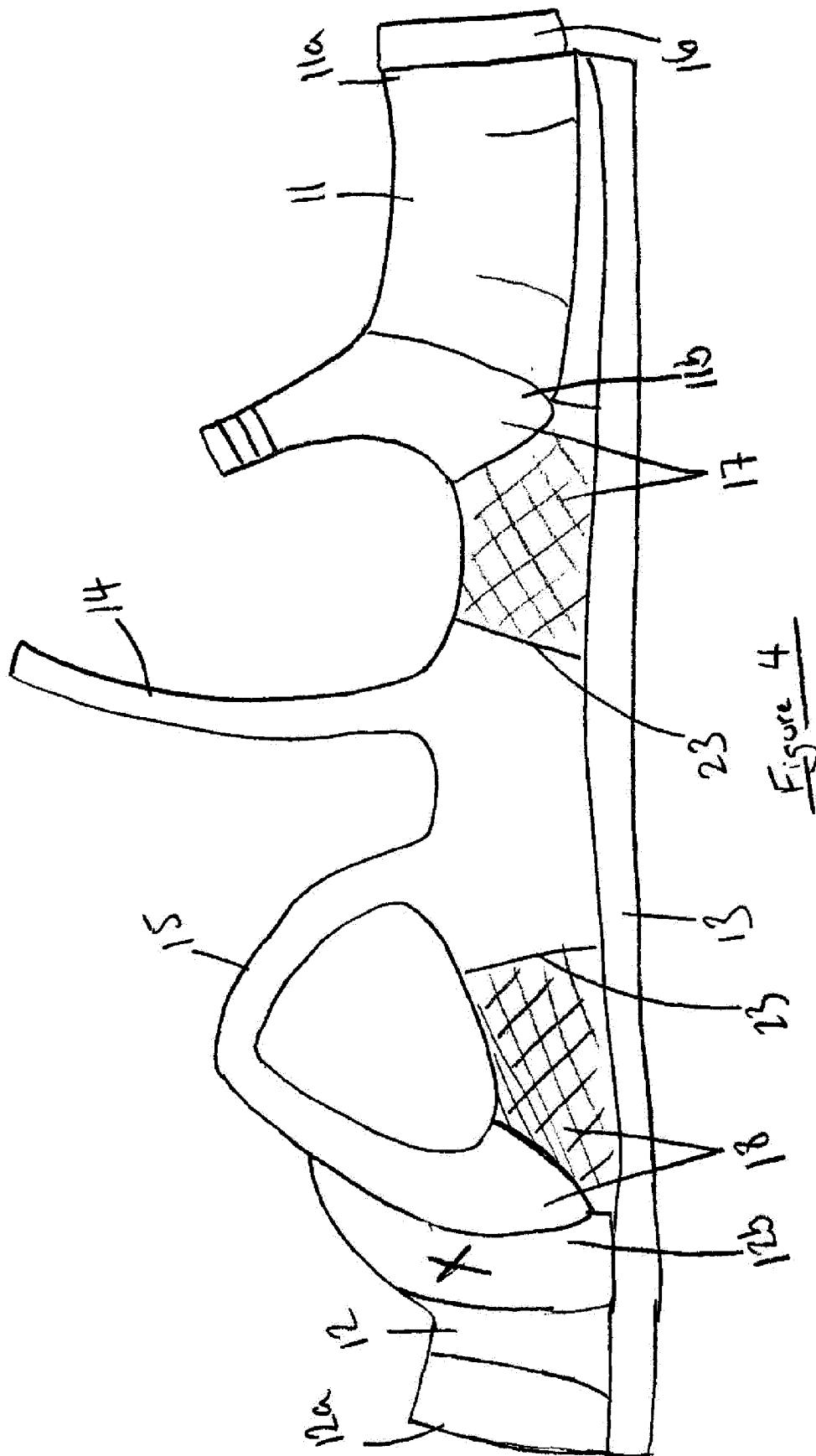
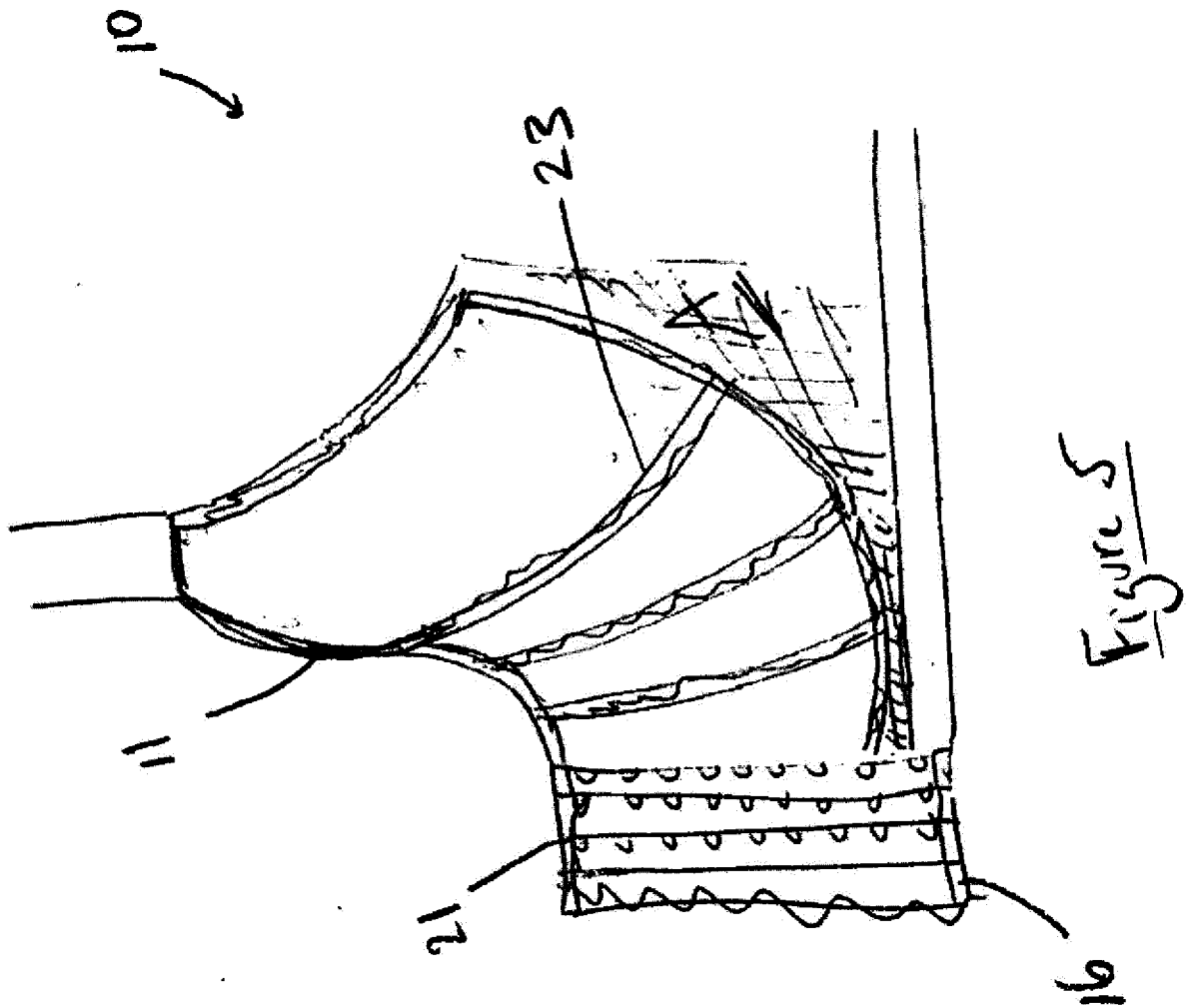


Figure 4





EUROPEAN SEARCH REPORT

Application Number
EP 16 15 9832

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 September 2016	Examiner Krüger, Sophia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 15 9832

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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