(12) UK Patent Application (19) GB (11) 2489947 (13) A

(43) Date of A Publication 17.10.2012

(21) Application No: 1106124.9

(22) Date of Filing: 11.04.2011

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(51) INT CL:
A61F 13/00 (2006.01) ***A61F 13/02*** (2006.01)
A61F 13/537 (2006.01)

(56) Documents Cited:
EP 0531096 A2 **EP 0151018 A2**
WO 2007/085884 A1 **WO 2000/018343 A1**
US 5433987 A **US 20080167593 A1**

(58) Field of Search:
INT CL **A61F, D04H**
Other: **EPODOC, WPI**

(54) Title of the Invention: **Wound dressing**
Abstract Title: **Wound dressing formed by needling two non-woven layers together**

(57) A wound dressing comprises at least two absorbent non-woven layers comprised of entangled fibres and being in an opposed relationship to each other. One of the layers is a wound facing layer. The said layers are held in spaced apart relationship from each other by a plurality of spacer wicks that are spaced apart from each other. The spacer wicks are formed by entanglement (e.g. by needling) of fibres from at least one of said layers into the adjacent layer, such that the fibres at the ends of the wicks are entangled with the fibres of the respective adjacent layers to hold the layers together in the spaced apart relationship.

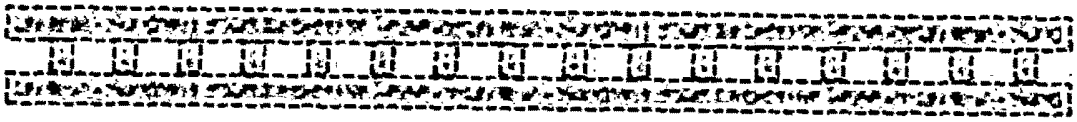

Figure 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 2007.

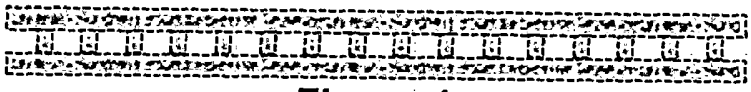

Figure 1

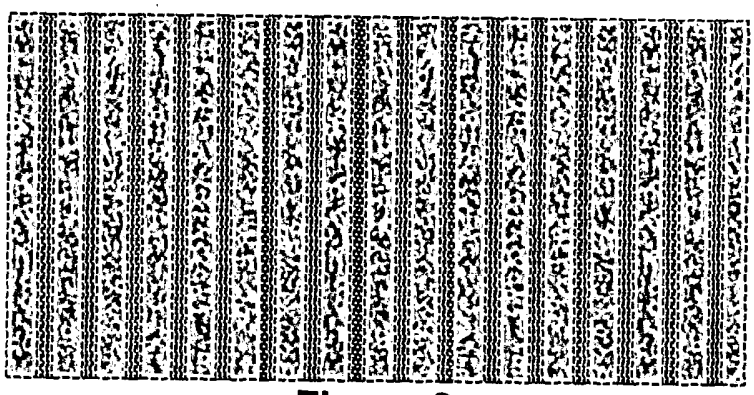

Figure 2

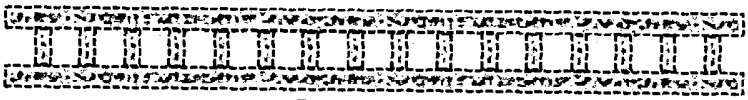

Figure 3

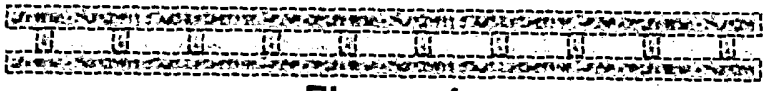

Figure 4

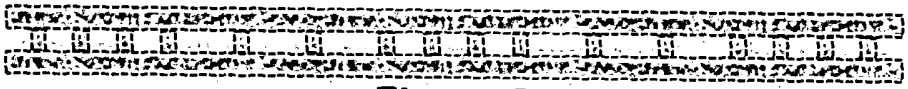

Figure 5

Wound Dressing

The present invention relates to a wound dressing comprised of absorbent fibres whereby the dressing is able to absorb exudate from a wound.

Various types of non-woven wound dressings comprise of entangled absorbent fibres are known, e.g. in the form of felts. Non-woven felts may be used as primary wound dressings. Such felts typically have a basis weight in the range of 80-140 g m^{-2}. The felt may be the wound contact layer and the absorbent fibres may be such as to gel as wound exudate is absorbed, thus allowing easy removal of the dressing. The gelling fibres may for example be alginate and/or carboxymethylcellulose fibres. In other cases, the felt may be associated with a wound contact layer (for location between the wound and the felt) in which case the fibres may be of other absorbent materials/blends. In all cases, the wound dressing may comprise a backing layer.

Non-woven felts for use in wound dressings may be manufactured by the following steps:

1. Opening – This is the first stage in separating clumps of fibres into individual fibres and is a coarse combing action. Fibres can be blended together at this stage.

2. Carding – This is a finer combing action to separate all the fibres and create a coherent, lightweight web. The fibres are largely orientated in the length direction (machine direction of the produced web).

3. Crosslapping – This lays down over lapping layers of the lightweight, carded web to build up the overall weight to the required level. This action turns the process flow through 90 degrees, and the fibres are now orientated across the width of the felt.

4. Needling – Numerous barbed needles penetrate the fibres, taking fibres from the surface into the middle, thereby entangling the fibres to create the felt. The needles only take fibres in one direction; the barbs of the needles have no effect on the way out. The quantity and type of

needles, the speed of needling and the penetration depth control the felt properties. The needling action can be carried out in more than stage, and from one or both sides of the fibres.

The absorbent properties of the felt are dependent of the fibre type, weight of the felt and the degree of needling.

As the felt weight is increased, the overall absorbency does not go up in proportion, e.g. a 200g/m² felt will not absorb twice as much as a 100g m² felt.

Also, as thickness increases, it is more difficult for exudate to penetrate the felt, and fully utilise its absorbent capacity. This is because that even after needling there are a large number of fibres still in the horizontal plane, and few in the vertical plane.

For very highly exuding wounds such as burns, those as a result of lymphoedema, or carcinomas; multiple dressings are sometimes used. This can lead to very expensive dressing changes, as several pouches have to be opened.

It is an object of the present invention to obviate or mitigate the above mentioned disadvantages.

According to the present invention there is provided a wound dressing comprising at least two absorbent non-woven layers comprised of entangled fibres and being in an opposed relationship to each other, one of said layers being a wound facing layer wherein said layers are held in spaced apart relationship from each other by a plurality of spacer wicks that are spaced apart from each other and formed by entanglement (e.g. by needling) of fibres from at least one of said layers into the adjacent layer such that the fibres at the ends of the wicks are entangled with the fibres of the respective adjacent layers to hold said layers together in said spaced apart relationship.

In the context of the present invention, the wound facing layer is that non-woven layer which is closest to the wound when the dressing is applied.

Wound dressings in accordance with the invention may be produced from pre-prepared non-woven layers (e.g. felts) which comprise entangled fibres. These fibres may, for example, have a length of 50 to 100mm. Techniques for producing such non-woven materials have been described above. The non-woven materials may then be further needled together in such a way that the spacer wicks formed of absorbent fibres are produced. These spacer wicks are, in effect, bridges that allow for exudate transport from one non-woven layer to adjacent layer going in a direction away from the wound facing layer. The total number of spacer wicks provides sufficient structural integrity so that the two non-woven layers are held in spaced apart relationship. A further feature is that the fibres forming the spacer wicks are, at the axial ends of the wicks, entangled with the fibres in the two non-woven layers thus retaining the layers together in spaced apart relationship.

Wound dressings in accordance with the invention may be produced from pre-prepared, absorbent non-woven layers (e.g. felts), using for example Laroche Napco process, 3D Web Linker ®. This machine can be set to produce the desired spacing for the layers, spacing of the wicks and cross-sectional size of the wicks. The machine "joins" the non-woven layers together by means of bridges (i.e. the support wicks) by entanglement of fibres from at least one of the non-woven layers into the adjacent layer such that the fibres at the ends of the wicks are entangled with the fibres of the respective adjacent layers to hold these layers together in spaced apart relationship.

Therefore the wound dressings of the invention comprise at least two non-woven layers held in spaced apart relationship by the plurality of spacer wicks (produced as described), between which there are channels extending between adjacent faces of the two layers. In use of the dressing, exudate is initially absorbed by the wound facing layer and is then transferred by the spacer wicks to the adjacent layer of non-woven material. This arrangement has the advantage that it allows more of the absorption capacity of the two non-woven layers to be used than would be the case if the two layers were in contacting relationship.

The spacer wicks will generally extend substantially perpendicularly between the opposed faces of the two layers and will generally be such as to provide a spacing of at least 3mm and generally a maximum of 10mm (typically 3 to 5mm) between these adjacent faces. However the length of the wicks (and therefore the spacing between

opposed faces of the non-woven layers) will be dependent on the weight of the two layers (each of which will typically be in the range of 80 to 140 g m^{-2}) and how much fibre (in the original non-woven materials) is available to create the spacer wicks. Typically the spacer wicks are located a distance of 4 to 12 mm (preferably 4 to 8mm) from each other in the two directions perpendicular the axes of the spacer wicks. The spacer wicks may be uniformly or non-uniformly spaced from each other. Alternatively or additionally the spacer wicks may be located at the intersections of a notional square or rectangular grid.

In some embodiments of the invention, certain of the spacer wicks ("a first set") may be spaced from each other by the same distance and other spacer wicks in the dressing ("the second set") may be spaced by the same distance from each other but with this distance being different from that by which the wicks of the first set are spaced from each other. The spacing of the wicks in the second set may, for example, be an integral multiple of the spacing of the wicks in the first set. By way of example, the wicks in the first set may be spaced by 4mm and the wicks in the second set by 8mm or 12mm.

It will be appreciated that the spacing between the wicks has an effect on both the total absorbency of the dressing as well as on the structural integrity thereof. A relatively narrow spacing between the spacer wicks provides more transport capacity for exudate to pass from one of the layers to the next. However this will increase the overall level of needling and result in a lower absorbency. A wider spacing will give less structural rigidity, effectively allowing the non-woven layers to collapse and form one thick layer resulting in poor wicking from one layer to the next.

It is possible to take advantage of the fact that a narrow spacing of the vertical bridges provides more opportunity for exudate transport from one layer to the next by designing the wound dressing such that there is a greater number of spacing wicks per unit area in a central region of the dressing than in an outer region thereof. Thus when such a dressing is applied to a wound the central region is able to provide greater transport of exudate where it is required.

The level of needling to create the spacer wicks can be varied by speed and penetration depth of the needles. More needling increases the number of fibres in the

spacer wicks, giving greater overall strength and hence more resistance to collapse. However this may tend to reduce the overall absorbency.

Although the invention has thus far been described with particular reference to a dressing comprising two layers held in spaced apart relationship from each other by the spacer wicks, it is possible for the dressing to comprise more than two such layers with any two adjacent layers being held in spaced relationship from each other by a plurality of further spacer wicks formed as generally described above.

The non-woven layers employed in the invention are absorbent but may be comprised of fibres that are not necessarily absorbent *per se*. Absorption can occur by take-up of exudate into interstices in the layers. Exudate can be supported by capillary action along the wicks. However in preferred embodiments of the invention at least some of the fibres in at least some of the non-woven layers will be absorbent fibres. It will be appreciated that, in this case, the spacer wicks may also incorporate absorbent fibres, e.g. any of the particular types listed below.

The fibres used in the dressings may be those typically employed for wound dressings applications where absorption capability is required. Thus, for example, the absorbent fibres may be gelling fibres, for which a particular examples are alginate and carboxymethylcellulose fibres. Such fibres may be located in any layer of the dressing and may be the predominate fibre component in any layer in which they are located. Generally such fibres will be located in at least the wound facing layer of the dressing since it will generally be preferred that the wound facing layer has a greater gelling capacity than the other non-woven layers.

A further possibility is that the dressing comprises superabsorbent fibres, e.g. based on polyacrylic acid fibres admixed with viscose and/or polyester fibres. Once again, such fibres may be provided in any or all of the non-woven layers and may be the predominate fibrous component in any layer in which they are provided. It will however generally be preferred that the superabsorbent fibres are provided in a layer other than the wound facing layer. In this way the superabsorbent fibres have a drawing effect and "pull" exudate from the wound contact layer into another layer of the dressing. Such an arrangement can be used to mimic the effect of vacuum therapies.

A further possibility is for one or more of the non-woven layers to comprise a blend of absorbent fibres and (possibly non-absorbent) synthetic fibres that resist compression of the wound dressing to improve absorbency when the dressing is to e used in conjunction with a bandage system applied over the top of the dressing.

There are various other options for improving the strength characteristics of the dressing. For example, the dressing could be manufactured by interposing a layer of foam between any two adjacent non-woven layers and then effecting a needling action to form the spacer wicks in the manner described. The needling action would serve to consolidate the foam in the wicks, leaving the areas therebetween filled with less-consolidated ("soft") foam. Instead of using foam, a spun-laid non-woven or a net could be used to provide strengthening and reinforcement.

If desired, the wound dressing may be provided with a wound contact layer so that the wound facing layer does not come into direct contact with the wound. Such a wound contact layer may, for example, be a perforated material (to allow exudate transport through the perforations), a net or a fibrous layer.

Furthermore, the dressing may be provided with a backing layer providing additional characteristics for the dressing, e.g. to control moisture loss from a wound or to act as a bacterial barrier. Depending on the function required, such a backing layer may be a semi-permeable film, a discrete non-woven layer (i.e. not one attached to an adjacent non-woven layer by spacer wicks), a foam etc. Examples of such materials are well known to persons skilled in the art.

The dressing may incorporate additives, particular such additives as are beneficial to wound healing. The additives may be provided in the dressing in a number of ways.

One possibility is for the additives to be incorporated in the fibres that are to be used to make the non-woven material. A further possibility is for the additive to be sprayed, coated etc on to the non-woven material before the dressing is formed.

A further possibility is to incorporate the additive in the interstitial spaces between the spacer wicks. Such additives may be incorporated as, or in, viscous

liquids (e.g. gels) or fine particulate materials that can be pumped through small diameter pipes into the interstitial spaces.

Examples of additives that may be used include:

(a) Antimicrobials (e.g. iodine, polyhexamethylene biguanide, chlorohexidine and groups of antibiotics: Aminoglycosides Ansamycins, Carbacephem, Carbapenems, Cephalosporins, Lincosamides, Macrolides, Monobactams, Nitrofurans, Penicllins, Polypeptides, Quniolones, Sulfonamides, Tetracyclines, Quaternary Ammonium compounds),

(b) Antibiofilm agents (e.g. polyphosphates, Delmopinol),

(c) Matrix Metallo Protease (MMP) binding (e.g. zinc oxide, polyphosphates, EDTA),

(d) Haemostatic agents (Calcium alginate, Kaolin),

(e) Odour absorbing (e.g. activated carbon),

(f) Superabsorbent materials (e.g. Technical Absorbent Ltd Oasis fibre blends).

In the event that any additives to be incorporated in the dressing should desirably not come into contact with the wound then such additive can be provided in a layer other than the wound contact layer. Thus, for example, a number of actives such as antimicrobials have been shown to have cytotoxic effects and if used inappropriately can slow down wound healing. These risks may be reduced by ensuring that such additives are non present within the wound contact layer.

It will be appreciated that the combination of the two non-woven layers (held in spaced apart relationship by the spacer wicks) may be used as a "stand alone" dressing for application to the wound. Alternatively the combination may be used to form part of an island dressing, in which case the combination is located in the centre of an adhesive film or substrate. In either case, a wound contact layer may be applied to the wound facing layer.

Wound dressings in accordance with the invention are particularly useful for very highly exuding wounds such as burns, those as a result of lymphoedema or carcinomas.

It will be appreciated that wound dressings in accordance with the invention may be sterilised in accordance with standard techniques and supplied for use in sterile packaging.

The invention is further described by reference to Figs 1-5 of the accompanying drawings which incorporate self-explanatory annotations.

Non-woven materials for use in the invention may, for example, be produced with fibres having a length of 2.5 to 200mm e.g. 50 to 150mm.

CLAIMS:

1. A wound dressing comprising at least two absorbent non-woven layers comprised of entangled fibres and being in an opposed relationship to each other, one of said layers being a wound facing layer wherein said layers are held in spaced apart relationship from each other by a plurality of spacer wicks that are spaced apart from each other and formed by entanglement (e.g. by needling) of fibres from at least one of said layers into the adjacent layer such that the fibres at the ends of the wicks are entangled with the fibres of the respective adjacent layers to hold said layers together in said spaced apart relationship.

2. A wound dressing as claimed in claim 1 wherein said first and second layers are felts.

3. A wound dressing as claimed in claim 1 or 2 wherein said spacer wicks are comprised of fibres of one of the layers.

4. A wound dressing as claimed in any one of claims 1 to 3 wherein said spacer wicks extend substantially perpendicularly between the opposed faces of the layers.

5. A wound dressing as claimed in any one of claims 1 to 4 wherein the spacer wicks hold the opposed faces of the layers at least 3 mm apart, and preferably a maximum of 10mm apart.

6. A wound dressing as claimed in any one of claims 1 to 5 wherein the spacer wicks are located a distance of 4 to 12mm, preferably 4 to 8mm, from each other in the two directions perpendicular to the axes of the spacer wicks.

7. A wound dressing as claimed in any one of claims 1 to 6 wherein the spacer wicks are uniformly spaced from each other.

8. A wound dressing as claimed in claim 6 wherein the spacer wicks are located at the intersections of a notional square or rectangular grid.

9. A wound dressing as claimed in any one of claims 1 to 6 wherein there is a greater number of spacer wicks per unit area in a central region of the dressing than in an outer region thereof.

10. A wound dressing as claimed in any one of claims 1 to 9 wherein the wound facing layer is of lesser area than the other layer and is located within the boundaries thereof whereby said dressing is an island dressing.

11. A wound dressing as claimed in any one of claims 1 to 10 comprising at least one further non-woven (e.g. absorbent) layer comprised of fibres and held in spaced relationship from one of the other layers of the dressing by a plurality of further spacer wicks formed of fibres which at the ends of said further wicks are entangled with the fibres of the respective adjacent layers.

12. A wound dressing as claimed in any one of claims 1 to 11 wherein at least some of the fibres of at least some of the non-woven layers are absorbent fibres.

13. A wound dressing as claimed in any one of claims 1 to 12 wherein the spacer wicks between at least two of the layers include absorbent fibres.

14. A wound dressing as claimed in any one of claims 1 to 13 wherein at least one of said layers comprises alginate fibres.

15. A wound dressing as claimed in claim 14 wherein said at least one layer is comprised predominantly of alginate fibres.

16. A wound dressing as claimed in claim 14 or 15 wherein the wound facing layer comprises said alginate fibres.

17. A wound dressing as claimed in any one of claims 1 to 13 wherein at least one of said layers comprises superabsorbent fibres.

18. A wound dressing as claimed in claim 17 wherein said at least one layer is comprised predominantly of superabsorbent fibres.

19. A wound dressing as claimed in claim 18 wherein the wound facing layer comprises said superabsorbent fibres are provided other than in the wound contact layer..

20. A wound dressing as claimed in any one of claims 1 to 13 wherein at least one of said layers comprises gelling fibres.

21. A wound dressing as claimed in claim 20 wherein said at least one layer is comprised predominantly of gelling fibres.

22. A wound dressing as claimed in claim 21 wherein the wound facing layer comprises said gelling fibres.

23. A wound dressing as claimed in any one of claims 1 to 22 wherein each of said layers has a basis weight in the range of 80 to 200 g m^{-2}, preferably 80 to 140 g m^{-2}.

24. A wound dressing as claimed in any one of claims 1 to 23 wherein at least one of the layers incorporates synthetic fibres that resist compression of the wound dressing.

25. A wound dressing as claimed in any one of claims 1 to 24 additionally comprising foam material between at least two of said layers, said foam material being consolidated within the spacer wicks between those layers and being less consolidated in the spacer between these wicks.

26. A wound dressing as claimed in any one of claims 1 to 25 additionally comprising a wound contacting layer in the form of a perforated layer or a fibrous layer.

27. A wound dressing as claimed in any one of claims 1 to 26 wherein at least one of the layers incorporates an additive beneficial to the wound healing process.

28. A wound dressing as claimed in claim 27 wherein the additive has antimicrobial, antibiofilm MMP-binding, haemostatic or odour-absorbing properties.

29. A wound dressing as claimed in claim 27 or 28 wherein the additive is provided other than in the wound facing layer.

30. A wound dressing as claimed in any one of claims 1 to 29 wherein additives are provided between two of the layers in the channels formed between the wicks.

31. A wound dressing as claimed in claim 30 wherein the additives in the channels are in the form of viscous liquids, gels or powders.

32. A wound dressing as claimed in claim 30 or 31 wherein the additives are beneficial to the wound healing process.

33. A wound dressing as claimed in claim 32 wherein the additives have antimicrobial, antibiofilm, MMP-binding, haemostatic, odour absorbing or super absorbent properties.

34. A wound dressing as claimed in any one of claims 1 to 33 in a sterile condition.

35. A sterile package incorporating a wound dressing as claimed in claim 34.

36. A method of treating a wound on a patient comprising applying to the wound a dressing as claimed in any one of claims 1 to 34.

Application No: GB1106124.9 **Examiner:** Gabrielle Cowcill

Claims searched: 1-36 **Date of search:** 11 July 2012

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	1-28, 32-36	WO 00/18343 A1 (MOUTON) See page 4, line 17, to page 5, line 3, and figure 1 at least
X	1-28, 32-36	WO 2007/085884 A1 (MOUTON) See page 6, line 3, to page 7, line 15, and figure 1 and 2 in particular
X	1-28, 32-36	EP 0151018 A2 (JOHNSON & JOHNSON) See pages 9-12 and figures 2 and 3 in particular
A	-	US 5433987 A (PETERSON et al) See the whole document
A	-	EP 0531096 A2 (McNEIL-PPC, INC) See column 6, lines 16-56, and figures 1-2 in particular
A	-	US 2008/167593 A1 (FLEISCHMANN) See paragraphs 33-35 and figure 1 at least

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

A61F; D04H

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

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
A61F	0013/00	01/01/2006
A61F	0013/02	01/01/2006
A61F	0013/537	01/01/2006