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(71) Applicant: **AESCULAP AG** [DE/DE]; Am Aesculap-Platz, 78532 Tuttlingen (DE).

(72) Inventors: **MERCKLE, Christof**; Steubenstr. 60, 68199 Mannheim (DE). **ODERMATT, Erich**; Fernsichtstraße 7a, CH-8200 Schaffhausen (CH).

(74) Agent: **PATENTANWÄLTE RUFF, WILHELM, BEIER, DAUSTER & PARTNER**; Kronenstraße 30, 70174 Stuttgart (DE).

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(54) Title: TISSUE FUSION AGENT

(57) Abstract: The invention relates to a tissue fusion agent comprising a particulate and/or fibrous flock material. The invention further relates to a discharge device containing the tissue fusion agent. Lastly, the invention relates to a surgical system comprising the tissue fusion agent or the discharge device and a tissue fusion instrument.

Tissue Fusion Agent

Description

Field of application and prior art

The invention relates to a tissue fusion agent, to a discharge device and to a surgical system.

Tissue fusion (tissue connection), especially in the form of anastomoses and ligations (ligatures), can be carried out by means of various techniques, for example suturing techniques and stapling techniques.

Newer tissue fusion techniques provide for the use of ultrasound, laser irradiation, or heat. Although carrying out said techniques brings about tissue fusion which is reliable and safe from a medical point of view, the disadvantage is that part of the tissue in the fusion region always also becomes degenerated because of the energy input. In some circumstances, this can have an adverse effect on the strength and tightness of the fused tissue.

WO 2011/138347 A2 discloses a surgical system for electrosurgical tissue fusion, comprising not only a surgical instrument having two high-frequency current electrodes (HF electrodes) but also a medically compatible material supporting the tissue connection. The material can be, in particular, a collagen disc.

The use of a biocompatible material layer as intermediate layer between body tissue surfaces to be fused is known from DE 10 2009 002 768 A1.

A fundamental disadvantage of the tissue fusion materials known from the prior art is the application thereof into a tissue region to be fused, said application being very complicated in some cases.

A further difficulty is that of achieving a most uniform distribution of the materials in a tissue region to be fused.

Moreover, a possible result of inhomogeneities with regard to the material thickness is that the material contracts with great variation upon input of energy, and so there is the risk of there being insufficient material provided for strong and tight tissue fusion.

Problem and solution

Against this background, the problem addressed by the present invention is therefore that of providing a technical solution which adequately addresses the disadvantages discussed above.

This problem is solved by a tissue fusion agent having the features of independent Claim 1, by a discharge device having the features of Claim 17 and by a surgical system having the features of Claim 18. Preferred embodiments of the tissue fusion agent are defined in dependent Claims 2 to 16. The wording of all the claims is hereby made content of the description by express reference. Apart from that, the problem addressed by the invention is solved by further subjects of the invention which are dealt with exclusively in the description.

In a first aspect, the invention proposes a tissue fusion agent, i.e. an agent for use in the fusion or connection or the closure of tissue, generally body tissue.

The tissue fusion agent is notable in particular for the fact that it comprises a particulate and/or fibrous flock material.

Alternatively, the tissue fusion agent can comprise a solution, dispersion, suspension or paste which contains the particulate and/or fibrous flock material or is produced using the particulate and/or fibrous flock material.

The invention is based on the surprising finding that particulate and/or fibrous flock material can be used to some extent as fusion particles and/or fusion fibres for carrying out tissue fusion and/or for producing medical solutions, dispersions, suspensions or pastes for likewise carrying out tissue fusion.

The tissue fusion agent according to the invention has the following advantages:

» Owing to the particulate and/or fibrous design of the flock material, the tissue fusion agent has an enlarged surface area, making it possible to establish improved contact with a tissue region to be fused, said contact being improved in terms of strength and tightness with regard to the fusion to be achieved.

» A further advantage associated with the enlarged surface area of the flock material is that generally relatively low amounts of the tissue fusion agent need to be applied into a

tissue region to be fused in order to achieve strong and, in particular, tight, compact and penetrative tissue fusion.

» A further advantage of the tissue fusion agent arising from the particulate and/or fibrous design of the flock material is that the tissue fusion agent can be uniformly or homogeneously distributed in a tissue region to be fused, ensuring that there is always sufficient provision of material for strong and, in particular, tight, compact and penetrative tissue fusion.

Any visible inhomogeneities in the distribution of the tissue fusion agent can be easily compensated for by “re-application” of the tissue fusion agent before or during the fusion process.

» In addition, it is advantageous that, owing to the particulate and/or fibrous design of the flock material, the tissue fusion agent allows complete coverage of a tissue region to be fused, without complicated adaptations of the tissue fusion agent to the proportions of the tissue region to be fused being required before or during the tissue fusion process.

Apart from that, complete coverage of a tissue region to be fused can ensure, with particular advantage, that the fused tissue parts in a layer arising from the tissue fusion agent after the tissue fusion find sufficient space or pores for cells to grow into.

» Also advantageous is the fact that, owing to the particulate and/or fibrous design of the flock material, the tissue fusion agent can be applied in a targeted manner to a tissue region to be fused.

» Owing to the particulate and/or fibrous design of the flock material and the associated surface area enlargement, it is additionally possible to more easily and, in particular, more rapidly apply the tissue fusion agent into a tissue region to be fused. Depending on the form of the tissue fusion agent, the latter can be applied as, for example, a dispersion or suspension by means of spraying (or optionally by means of spreading) or a paste by means of brushing to a tissue region to be fused. This likewise contributes to facilitating the performance of tissue fusion.

» As a result, the tissue fusion agent can also be applied without relatively great difficulties into poorly accessible treatment areas.

» A further advantage is that, owing to the particulate and/or fibrous design of the flock material, the tissue fusion agent can be applied into a tissue region to be fused in reproducible and, in particular, definable amounts, making it altogether possible to carry out the tissue fusion process under reproducible and, in particular, definable conditions.

» Through the specific selection of materials and/or additives for the flock material, it is additionally possible to specifically influence or adjust the fusion properties thereof such as, for example, melting ability, adhesiveness and/or conductive or impedance behaviour and also resorption properties. This allows not only fusion process-specific but also indication-specific adaptation of the tissue fusion agent. Depending on the material selected, the tissue fusion following performance of the fusion process can be based on a sealing and/or covering film arising from the tissue fusion agent.

» The aspects listed above contribute, with particular advantage, to shortening the fusion process and thus to shortening possible energy input (if the newer tissue fusion techniques mentioned at the start are used), and so the tissue fusion agent altogether also allows the performance of fusion which is more gentle to tissue.

» Lastly, one advantage is that the flock material and thus the tissue fusion agent can be produced in a cost-effective manner. For instance, the flock material can, for example, be extruded and transferred to a particulate and/or fibrous form, for example by means of trimming to length, more particularly cutting, or milling.

In the context of the present invention, the term “fibrous flock material” or “flock fibres” is to be understood to mean fibres having a defined fibre length (preferred fibre lengths will be mentioned below). The fibrous flock material is usually produced by trimming to length, more particularly cutting, or milling of single fibres (such as, for example, extrusion fibres), more particularly so-called continuous fibres.

In a preferred embodiment, the fibrous flock material is flock fibres, more particularly monofilament flock fibres.

Particularly preferably, the fibrous flock material is present in the form of single flock fibres. In other words, it is particularly preferred according to the invention when the fibrous flock material is not connected, especially not via an adhesive layer, to a substrate, more particularly an implant body and/or a supporting element, or assembled to form a planar structure such as, for

example, a non-woven fabric, non-woven scrim, loop-drawingly knitted fabric, loop-formingly knitted fabric or the like.

The fibrous flock material can, in principle, have a fibre length of from 40 µm to 15 mm, more particularly from 50 µm to 10 mm, preferably from 100 µm to 5.0 mm. The fibrous flock material can, in particular, have a fibre length of from 10 µm to 5 mm, more particularly from 40 µm to 4 mm, preferably from 50 µm to 3 mm, more preferably from 100 µm to 2 mm. The fibrous flock material can, with particular preference, have a fibre length of from 100 µm to 3 mm, preferably from 200 µm to 2 mm.

Furthermore, the fibrous flock material can have a fibre thickness or diameter of from 10 µm to 900 µm, more particularly from 20 µm to 900 µm, preferably from 70 µm to 600 µm, more preferably from 100 µm to 400 µm.

In addition, the fibrous flock material can have a linear density of from 0.01 dtex to 1000 dtex, more particularly from 0.1 dtex to 500 dtex, preferably from 0.3 dtex to 200 dtex. The fibrous flock material can, in particular, have a linear density of from 0.01 dtex to 100 dtex, preferably from 0.1 dtex to 80 dtex, more preferably from 0.3 dtex to 40 dtex. The dimension “dtex” (decitex) means a linear density of 1 g per 10 000 m length of the fibrous flock material.

In a further embodiment, the fibrous flock material can be textured or non-textured.

Furthermore, the fibrous flock material can have a circular cross section or a non-circular cross section, more particularly an oval, ellipsoidal, polygonal, for example triangular, rectangular, square, rhomboidal, pentagonal, hexagonal and/or star-shaped, cross section.

In a further embodiment, the particulate and/or fibrous flock material can be present in milled form.

More particularly, the particulate and/or fibrous flock material can be milled fibres, more particularly milled flock fibres.

The particulate flock material can be present in the form of a powder or granules.

The particulate flock material can, in particular, have a particle size or particle diameter of from 0.05 µm to 5 mm, more particularly from 0.1 µm to 3 mm, preferably from 10 µm to 2 mm.

In a useful embodiment, the flock material comprises a coagulative and/or hot-melt adhesive material or is formed from such a material.

More particularly, the flock material comprises a material which is meltable under the influence of high-frequency alternating current (HF current), heat, ultrasound and/or laser radiation or is formed from such a material.

Preferably, the flock material comprises a meltable material or is formed from such a material which can have a melting point in the range of 40°C to 120°C, preferably 50°C to 100°C, depending on the target tissue.

Preferably, the flock material comprises a material which is meltable under the influence of an alternating current having a frequency of from 200 kHz to 4000 kHz, more particularly from 100 kHz to 600 kHz, preferably from 250 kHz to 500 kHz, or is formed from such a material.

Particularly preferably, the flock material comprises a resorbable material or is formed from such a material. The surface area enlargement associated with the particulate and/or fibrous design of the flock material favours, with particular advantage, rapid resorption of the tissue fusion agent after tissue fusion has been performed. Moreover, gradual resorption of the tissue fusion agent (after the tissue fusion) ensures that cells, extracellular matrix or tissue completely grow through fused tissue parts. Preferably, fused tissue regions exhibit, as a result of a melting process within the first three to four days after completion of the fusion process, a higher “fusion strength” than in the case of performing tissue fusion in the absence of the tissue fusion agent according to the invention.

In a further embodiment, the material described in the preceding embodiments for the flock material can be of synthetic, biological and/or recombinant origin.

More particularly, the material for the flock material can be of animal and/or plant origin.

As an alternative or in addition, the material for the flock material can be of natural or native origin. The material can, in particular, be of xenogeneic origin, preferably porcine, bovine and/or equine origin. As an alternative or in addition, the material for the flock material can be of human origin. Preferably, the flock material is present as milled flock material in the embodiments described in this paragraph.

In a preferred embodiment, the material for the flock material is a polymer, selected in particular from the group comprising synthetic polymer, recombinant polymer, naturally occurring polymer or biopolymer and mixtures, more particularly blends, thereof. Furthermore, the polymer can be a copolymer. In the context of the present invention, the expression “copolymer” is to be understood to mean a polymer composed of at least two different monomer units. Thus, the expression “copolymer” encompasses not only copolymers in the narrower sense, i.e. so-called bipolymers (polymers composed of two different monomer units), but also terpolymers, tetrapolymers, etc. The copolymer can additionally be selected from the group comprising random copolymer, alternating copolymer, block copolymer or segmented copolymer, graft copolymer and mixtures, more particularly blends, thereof.

Preferably, the flock material comprises a resorbable material or is formed from such a material which is selected from the group comprising polyhydroxyalkanoates, proteins, extracellular proteins, serum proteins, polysaccharides, mucopolysaccharides, carboxyl group-bearing polysaccharides, amino group-bearing polysaccharides, aldehyde group-bearing polysaccharides, copolymers thereof, salts thereof, stereoisomers, more particularly diastereomers, thereof and mixtures, more particularly blends, thereof.

More particularly, the flock material can comprise a resorbable material or can be formed from such a material which is selected from the group comprising polyglycolide or polyglycolic acid, polylactide or polylactic acid, polydioxanone, poly-3-hydroxybutyrate or poly-3-hydroxybutyric acid, poly-4-hydroxybutyrate or poly-4-hydroxybutyric acid, polytrimethylene carbonate, poly-ε-caprolactone, polyvinyl alcohol, cotton, cellulose, cellulose derivatives such as, for example, alkylcelluloses, methylcellulose, hydroxyalkylcelluloses, hydroxymethylcellulose, hydroxyethylcellulose, hydroxypropylcellulose, carboxyalkylcelluloses, carboxymethylcellulose, starch, amylose, amylopectin, dextran, dextrin, chitin, chitosan, hyaluronic acid, dextran sulphate, heparin, heparan sulphate, chondroitin sulphate, dermatan sulphate, collagen, gelatin, elastin, reticulin, fibronectin, laminin, fibrin, fibrinogen, albumin, copolymers thereof, salts thereof, stereoisomers, more particularly diastereomers, thereof and mixtures, more particularly blends, thereof.

In a further embodiment, the flock material comprises a polyethylene glycol or is formed from a polyethylene glycol.

In a further embodiment, the flock material can comprise a material having a melting point below 100 °C, in particular having a melting point from 70 °C to 90 °C, or can be formed of such a material.

In advantageous embodiments, the flock material can be additized, i.e. comprise one or optionally more additives.

To achieve an increase in conductivity or decrease in impedance, it can be provided that the flock material comprises a conductivity-increasing or impedance-decreasing additive, preferably in the form of a salt.

The conductivity-increasing or impedance-decreasing additive is preferably selected from the group comprising alkali metal halide, alkaline earth metal halide, phosphate, alkali metal phosphate, alkaline earth metal phosphate, mixed phosphates thereof and mixtures thereof.

For example, the conductivity-increasing or impedance-decreasing additive can be selected from the group comprising sodium chloride, potassium chloride, barium chloride, magnesium chloride, calcium chloride, sodium phosphate, potassium phosphate, barium phosphate, magnesium phosphate, calcium phosphate, mixed phosphates thereof and mixtures thereof.

In a further embodiment, the conductivity-increasing or impedance-decreasing additive can comprise a proportion of from 0.1% by weight to 25% by weight, more particularly from 0.5% by weight to 20% by weight, preferably from 0.8% by weight to 10% by weight, based on the total weight of the flock material.

In an alternative embodiment, the flock material comprises a conductivity-decreasing additive, preferably in the form of a metal, for example selected from the group comprising aluminum, iron, silver, zinc, magnesium and mixtures, more particularly alloys, thereof.

To achieve a biological, pharmaceutical and/or medical effect, it can be provided in an alternative or additional embodiment that the flock material comprises an active ingredient selected from the group comprising biological active ingredient, pharmaceutical active ingredient, medical active ingredient and mixtures thereof.

More particularly, the flock material can comprise an active ingredient selected from the group comprising antimicrobial, more particularly antibiotic, active ingredient, wound healing-promoting active ingredient, disinfecting active ingredient, anti-inflammatory active ingredient, blood coagulation-promoting active ingredient, growth factors, cell-differentiating factors, cell-adhesive factors, cell-recruiting factors, cell receptors, cell-binding factors, cytokines, peptides, structural proteins, extracellular proteins such as, for example, collagen, serum proteins such as, for example, albumin, polysaccharides such as, for example, hyaluronic acid, oligonucleo-

tides, polynucleotides, DNA, RNA, salts thereof, stereoisomers, more particularly diastereomers, thereof and mixtures thereof.

For example, the flock material can comprise an active ingredient selected from the group comprising biguanides, polyhexamethylene biguanide (PHMB), triclosan, chlorhexidine, gentamicin, vitamins, copper, zinc, silver, gold, salts thereof, stereoisomers, more particularly diastereomers, and mixtures thereof.

To increase the stability of the flock material, it can be provided in a further embodiment that the flock material is present in crosslinked form. The flock material can be physically and/or chemically crosslinked. Physical crosslinking of the flock material can be achieved, for example, by means of appropriate irradiation techniques. Chemical crosslinking can generally be realized by means of appropriate chemical crosslinkers.

For example, the flock material can be crosslinked with a chemical crosslinker selected from the group comprising aldehydes such as, for example, formaldehyde, dialdehydes such as, for example, glutaraldehyde, polyaldehydes such as, for example, dextran aldehyde, carbodiimides, diisocyanates such as, for example, hexamethylene diisocyanate, salts thereof and mixtures thereof.

According to the invention, it can be further provided that the tissue fusion agent comprises a mixture of different particulate and/or fibrous flock materials. In this case, the flock materials can differ from one another with regard to at least one parameter preferably selected from the group comprising particle size (in the case of a particulate flock material), fibre length (in the case of a fibrous flock material), thickness or diameter, linear density (in the case of a fibrous flock material), material and mixtures thereof. With regard to the parameters listed in this paragraph, full reference is made to the description so far.

In a particularly preferred embodiment, the tissue fusion agent is present in the form of the particulate and/or fibrous flock material or in the form of a mixture of different particulate and/or fibrous flock materials. In other words, in a particularly preferred embodiment, the tissue fusion agent consists of the particulate and/or fibrous flock material or a mixture of different particulate and/or fibrous flock materials. With regard to further features and advantages of the flock material(s), full reference is made to the description so far.

In an advantageous embodiment, the tissue fusion agent is present in a sprayable form.

In useful embodiments, the solution, dispersion, suspension or paste referred to at the start in connection with the tissue fusion agent according to the invention additionally comprises a biocompatible solution agent, dispersion agent, or suspension agent, generally water or an aqueous mixture, and/or a biocompatible carrier substance such as, for example, fats, oils, glycerol or the like.

If the tissue fusion agent comprises a suspension comprising the particulate and/or fibrous flock material or produced using the particulate and/or fibrous flock material, it can be provided that the suspension has a flock material content of from 1% by weight to 20% by weight, more particularly from 3% by weight to 15% by weight, preferably from 5% by weight to 10% by weight, based on the total weight of the suspension.

In preferred embodiments, the tissue fusion agent can be present in the form of a solution, dispersion, suspension or paste containing the particulate and/or fibrous flock material. Alternatively, the tissue fusion agent can be present in the form of a solution, dispersion, suspension or paste produced using the particulate and/or fibrous flock material. With regard to further features and advantages of the flock material, full reference is made to the description so far.

Furthermore, the tissue fusion agent can be present in aerosolizable form. For example, it can be provided according to the invention for the tissue fusion agent together with a propellant to be applied as an aerosol. A suitable propellant can be selected from the group comprising perfluorinated ethers (such as, for example, Desfluran®), fluorinated hydrocarbons, more particularly fluorinated hydrocarbons of medium chain length (chain length having from two to five carbon atoms) such as, for example, tetrafluoroethane, hexafluoropropane, heptafluoropropane, decafluorobutane, octafluorocyclobutane, noble gases, nitrogen, oxygen, carbon dioxide, dinitrogen oxide and mixtures thereof.

The tissue fusion agent according to the invention is preferably a surgical tissue fusion agent.

The tissue fusion agent is generally suited to closing, occluding or sealing biological tissue, more particularly human and/or animal tissue. Thus, the tissue fusion agent according to the invention can in particular act as an occlusion agent.

In a particularly preferred embodiment, the tissue fusion agent is intended for use in carrying out anastomoses and/or ligations (ligatures). The anastomoses can be, in particular, end-to-end anastomoses, side-to-end anastomoses, end-to-side anastomoses and side-to-side anastomoses. Furthermore, the anastomoses can be selected from the group comprising vascular anas-

tomoses, more particularly blood vessel and/or lymphatic vessel anastomoses, intestinal anastomoses, and nerve anastomoses.

Furthermore, the tissue fusion agent can be intended for closing tissue or for sealing tissue after resections, more particularly after partial resections, for example in the case of organs.

A further preferred application area concerns the use of the tissue fusion agent in carrying out electrosurgical fusion of body tissue.

In useful embodiments, the tissue fusion agent is present in sterile and, in particular, off-the-shelf form. Sterilization of the tissue fusion agent can, for example, be achieved using ethylene oxide and/or gamma irradiation.

In a second aspect, the invention provides a discharge device containing the tissue fusion agent according to the invention.

The discharge device is preferably designed as a spray device. It is advantageous when the discharge device can be used with the aid of trocars, for example by extension of the spray head.

The discharge device can, in particular, be intended for discharging an aerosol. In this case, it may be useful for the discharge device to contain a suitable propellant in addition to the tissue fusion agent.

With regard to further features and advantages of the discharge device, especially the tissue fusion agent and/or a possible propellant, full reference is made to the description so far.

Lastly, the invention provides a surgical system comprising the tissue fusion agent according to the invention or the discharge device according to the invention and a tissue fusion instrument. The tissue fusion instrument preferably comprises at least two electrodes for releasing or taking up current, more particularly high-frequency current (HF current). Alternatively, the tissue fusion instrument can be a laser instrument or an instrument for generating ultrasonic waves.

However, the surgical system is preferably an electrosurgical system comprising the tissue fusion agent according to the invention or the discharge device according to the invention and at least two electrodes for releasing or taking up current, more particularly high-frequency current (HF current). Preferably, the two electrodes are component of a surgical instrument having two

tool elements which are movable relative to one another and which each comprise one of the two electrodes, which, preferably in a convergence position of the tool elements, define a minimum distance from one another, lie opposite one another and face one another. With regard to such a surgical instrument, reference is made to WO 2011/138347 A2, which was cited at the start and the full disclosure content of which is, in this respect, made content of the present description.

With regard to further features and advantages of the surgical system, especially the tissue fusion agent and/or the discharge device, full reference is made to the description so far.

Further features and advantages of the invention are revealed by the following description of preferred embodiments in the form of examples. Individual features can, in each case, be realized on their own or in combination with one another. The preferred embodiments serve solely to further elucidate the invention and to provide a better understanding of the invention, without restricting the invention thereto.

Example section

1. Production of flock fibres composed of poly(ε-caprolactone-co-trimethylene carbonate)

An extrusion device was used to extrude fibres composed of poly(ε-caprolactone-co-trimethylene carbonate). Said fibres were subsequently trimmed to flock fibres of 100 µm in length using a precision cutting device. After ethylene oxide sterilization and subsequent drying, the flock fibres composed of poly(ε-caprolactone-co-trimethylene carbonate) thus produced were transferred to a spray device. In this form, the flock fibres were used in a sterile environment.

2. Production of particulate flock material composed of collagen

Starting from bovine skin, collagen-containing granules were produced and subsequently finely ground. This gave rise to a collagen-containing flock material having a particle size in the range of 10 µm to 80 µm, depending on the milling operation.

3. Reinforcing a colorectal end-to-end anastomosis

The distal and proximal intestinal region of a porcine intestinal section to be anastomized was attached in each case to a circular HF instrument (high-frequency current instrument) by means

of a so-called tobacco-pouch suture. Both the distal and the proximal tobacco-pouch suture were subsequently sprayed with the flock fibres produced in 1. and composed of poly(ε-caprolactone-co-trimethylene carbonate). Thereafter, the two intestinal regions to be anastomized were joined by moving the two surfaces of the HF instrument to one another and triggering the HF generator.

After completion of the fusion process, the tobacco-pouch suture in the interior of the anastomized intestinal sections was cut and the HF instrument was removed from a proximal longitudinal cut. The fused circular intestinal wall with the cut-out of the tobacco-pouch suture was visible.

4. Sealing and reinforcing a side-to-side anastomosis

The distal and proximal end of a porcine small-intestine section to be anastomized was flocked in each case using the collagen-containing flock material produced in 2. and then fused using a linear HF instrument. This led to the surface-applied flock material forming a sealing matrix. Subsequently, the fused small-intestine region was cut.

Through a lateral incision of both small-intestine parts, the two intestinal parts were introduced into the linear arms of the HF instrument, the two arms having been sprayed and covered with the collagen-containing flock material.

To achieve side-to-side anastomosis, the two arms of the HF instrument were brought together and the latter was activated by application of a high-frequency alternating current. The small-intestine tissue fused in this way was visible as a white colour. Also visible was flock material which was unmelted in some cases.

The incisions required for the arms of the linear HF instrument were sealed using a lateral HF instrument. To close these incisions, the collagen-containing flock material was likewise used.

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Claims

1. Tissue fusion agent comprising a particulate and/or fibrous flock material.

2. Tissue fusion agent according to Claim 1, characterized in that the fibrous flock material is in the form of monofilament flock fibres.

3. Tissue fusion agent according to Claim 1 or 2, characterized in that the fibrous flock material has a fibre length of from 100 µm to 3 mm, preferably from 200 µm to 2 mm.

4. Tissue fusion agent according to any of the preceding claims, characterized in that the fibrous flock material has a linear density of from 0.01 dtex to 100 dtex, more particularly from 0.1 dtex to 80 dtex, preferably from 0.3 dtex to 40 dtex.

5. Tissue fusion agent according to Claim 1, characterized in that the particulate flock material is present in the form of a powder or granules.

6. Tissue fusion agent according to any of the preceding claims, characterized in that the flock material comprises a resorbable material or is formed from such a material.

7. Tissue fusion agent according to Claim 6, characterized in that the material is selected from the group comprising polyhydroxyalkanoates, polyvinyl alcohol, proteins, extracellular proteins, serum proteins, polysaccharides, mucopolysaccharides, carboxyl group-bearing polysaccharides, amino group-bearing polysaccharides, aldehyde group-bearing polysaccharides, copolymers thereof, salts thereof, stereoisomers, more particularly diastereomers, thereof and mixtures, more particularly blends, thereof.

8. Tissue fusion agent according to any of the preceding claims, characterized in that the flock material comprises a conductivity-increasing or impedance-decreasing additive, preferably in the form of a salt.

9. Tissue fusion agent according to Claim 8, characterized in that the additive or salt is selected from the group comprising alkali metal halide, alkaline earth metal halide, phosphate, alkali metal phosphate, alkaline earth metal phosphate, mixed phosphates and mixtures thereof.

10. Tissue fusion agent according to any of Claims 1 to 7, characterized in that the flock material comprises a conductivity-decreasing additive, preferably in the form of a metal.

11. Tissue fusion agent according to any of the preceding claims, characterized in that the flock material comprises an active ingredient selected from the group comprising biological active ingredient, pharmaceutical active ingredient, medical active ingredient and mixtures thereof.

12. Tissue fusion agent according to any of the preceding claims, characterized in that the tissue fusion agent is present in the form of the particulate and/or fibrous flock material.

13. Tissue fusion agent according to any of Claims 1 to 11, characterized in that the tissue fusion agent is present in the form of a suspension or paste.

14. Tissue fusion agent according to any of the preceding claims as a surgical tissue fusion agent, preferably for use in carrying out anastomoses and/or ligations and/or for closing tissue after resections, more particularly partial resections, for example in the case of organs.

15. Tissue fusion agent according to any of the preceding claims for use in carrying out electrosurgical fusion of body tissue.

16. Tissue fusion agent according to any of the preceding claims, characterized in that it is present in sterile and, in particular, off-the-shelf form.

17. Discharge device containing a tissue fusion agent according to any of the preceding claims.

18. Surgical system comprising a tissue fusion agent according to any of Claims 1 to 16 or a discharge device according to Claim 17 and a tissue fusion instrument, the instrument preferably comprising at least two electrodes for releasing or taking up current, more particularly high-frequency current (HF current).

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/054225

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61L31/14 A61L31/16 A61L24/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61L A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, COMPENDEX, EMBASE, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2005/129733 A1 (MILBOCKER MICHAEL T [US] ET AL) 16 June 2005 (2005-06-16) paragraph [0002] paragraph [0036] paragraph [0079] - paragraph [0080] paragraph [0104] - paragraph [0105] example 14 -----	1-4,11, 13,14 15
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 April 2014	17/04/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Zalfen, Alina

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INTERNATIONAL SEARCH REPORT

International application No
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