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(54) Benævnelse: **VANDINGSMÅTTE TIL LEVERING AF VÆSKER TIL RODZONEN PÅ PLANTER OG VANDINGSSYSTEM**

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WATERING MAT FOR SUPPLYING FLUIDS FOR THE ROOT REGION OF PLANTS, AND WATERING SYSTEM

Description

The invention relates to a watering mat for supplying fluids for the root region of plants according to the preamble of claim 1 and a watering system with such a watering mat.

Watering is understood as meaning the supply of fluids, in particular water and/or nutrient solutions for plants.

For watering plants, water can be applied to the soil and plants from above. To minimise water loss, the water can be applied by sprayers or drippers close to each plant. Here, however, water is lost in particular through evaporation.

This disadvantage can be avoided by using watering systems laid underground in the soil under the plants. Such watering systems include watering mats fitted with watering tubes which are connected to a water supply device with valves and control devices.

Such a capillary watering system is known from DE 695 14 365 T2, which has a watering mat equipped with several perforated watering tubes. The watering mat consists of an upper layer of capillary material and a lower layer of capillary material, between which the watering tubes are arranged. The terms "above" and "below" refer to the alignment of the watering mat laid in the ground.

Pockets formed by folding the top layer are provided between the two layers of capillary fabric to accommodate the tubes. The preformed pockets are dimensioned so that the watering tubes can be inserted into these pockets. The two layers are connected to one another, for example by sewing, ultrasound or welding. These are seam-like connections that have the disadvantage that e.g. the sewing thread can tear and the connection points can open up. Laying such mats is then significantly more complex because of the slipping of the individual layers. Since such mats have edge lengths of 50m or more, not only is handling and laying the mats more difficult, but the tubes can also slip sideways and assume positions other than those intended. In this case, an even water distribution in the watering mat is no longer possible.

Such seam-like connections between two layers are known from DE 10 2007 036 018 A1, which discloses a watering mat for distributing water over a large area, with means for detecting the degree of moisture in the watering mat being provided. In addition, an absorption layer is provided between the upper and lower layer of the watering mat as absorbent fibre fill.

Such a watering mat and watering system is known from WO-A-02082888.

Another problem is the penetration of roots into the outlet openings of the perforated tubes. The root system penetrates through the layer of the mats from the outside in the area of the pockets and extends in particular to the water outlet openings, which become clogged and, in the worst case, can completely block the escape of water. This impairs the even distribution of water in the watering mats.

The object of the invention is to provide a watering mat and a watering system, wherein the watering mat should be easy to handle and the watering system should be characterised by a large fluid absorption capacity and quick and better distribution of the fluid.

This problem is solved by the features of claim 1.

The watering mat is characterised in that the upper layer made of a textile fabric and the lower layer made of a textile fabric are connected to one another over an area in at least one region outside the tunnels, preferably over the whole area.

Preferably at least 20%, in particular at least 50%, of the available area are preferably connected to one another.

A full-surface connection means that at least 90% of the available area is connected to one another.

The area available for the surface connection is formed by the contact area of the lower and upper layer. Where the two layers lie on top of each other outside of the tunnel, the two layers can be connected to one another over a large area.

According to the invention, the two layers are needled to one another.

Needling, which is also referred to as felting, allows a surface connection, in particular of fleece webs, in a simple manner, with special needling devices such as needle boards being used. When needling, both layers are pierced together. The fibres of the adjacent layers intertwine as a result of being pierced once or several times, so that the dividing line between the lower and upper layer is largely eliminated and the two layers as a whole form a uniform, largely homogeneous textile fabric.

The manufacturing process using needling has the further advantage that it is more cost-effective than, for example, sewing the individual layers to produce seam-like connections.

Surprisingly, it emerged that this needling process positively changes the fluid absorption and fluid distribution properties of the layers, particularly in the case of fleece webs. It was found that layers connected to one another in this way ensure faster and more uniform fluid distribution than is the case with textile fabrics connected only by seams.

Compared to seam-like connections, the flat needling also achieves a significantly more

stable connection between the layers, so that processing and laying, in particular of large-scale watering mats, is made easier. Since this connection of the layers does not come loose, the watering tubes also cannot slip between the layers, so that an even distribution of the fluid in the watering mat is ensured.

Another advantage of the flat needling is that, for example, no threads, which are used for the seam-like connection according to the prior art, can come loose and get caught in the cutting tools when the watering mats are cut to size.

Preferably, a tunnel in which the watering tube is located is formed by means of a fold of the lower layer and by means of a fold of the upper layer.

This embodiment has the advantage that upper and lower layers of the same size can be used for the production of the watering mat. This simplifies the manufacturing process.

The watering mat has a symmetrical structure with regard to the dividing plane between the lower and upper layer, so that when laying it you do not have to pay attention to which layer has to be on top or below, unless, for example, different materials are used for the lower and upper layer. This simplifies handling.

This symmetrical structure of the watering mat also has the advantage that the fluid is distributed more evenly between the upper and lower layers.

A textile fabric is understood to mean textiles that are permeable to fluids, such as woven fabrics, fleece fabrics, composites, geotextiles, geogrids or foils, which have the ability to distribute the fluid, preferably water, in particular by capillary action.

The textile fabric is preferably a fleece. A layer of fleece material preferably has a grammage of 100 to 1000 g/m^2. Preferred grammage ranges are 100 to 300 g/m^2. A grammage of at least 100 g/m^2 is required to ensure stable needling.

The textile fabric preferably consists of at least one layer of a polyester, in particular a polyester fleece.

At least the lower layer preferably consists of a textile fabric made of polyester, in particular of polyester fleece. Both layers can also be made of these materials, which simplifies production.

The fluid absorption capacity and the fluid distribution properties can be further improved if at least one layer, preferably the lower layer, consists of a hydrophilic or hydrophilised material.

Hydrophilic textile fabrics have the advantage that they can absorb the fluid, in particular water, better and in larger quantities and store it for longer, and can distribute the fluid better in the watering mat.

Polyester materials, such as the fibres of polyester fleeces, are inherently hydrophilic. In

order to further improve the properties with regard to fluid absorption and fluid distribution, this material can also be subjected to an additional hydrophilic treatment.

The watering mat preferably has an absorbent powder for storing the fluid. The absorbent powder increases the storage capacity of the watering mat without having to increase the grammage. The absorbent material swells and has the advantage that it does not release any fluid even under pressure. Only the roots have the ability to recover the fluid, particularly water, from the absorbent powder. The absorbent powder is able to absorb a multiple of its own weight in fluid, in particular water.

The watering mat preferably has a powder made of mycorrhizal fungi. The mycorrhizal fungi supply the plant with nutrient salts and water and, in turn, receive part of the assimilate produced by the plants' photosynthesis. Because of this symbiosis, the roots and the plant as a whole can be strengthened.

The powder, in particular the absorbent powder and the powder made of mycorrhizal fungi, is preferably introduced between the lower layer and the upper layer. The powder can be sprinkled onto the lower layer when manufacturing the watering mat. Due to the planar connection, in particular planar needling of both layers, the powder can be fixed between the layers.

The powder can also be incorporated into at least one layer. The powder is preferably incorporated during the manufacture of the textile fabric. In the production of fleece fabrics, the powder is preferably added to the starting material for the production of the fleece, which has the advantage that the powder is distributed evenly in the layer, in particular in the fleece. If the fleece is produced by means of a needling process, the powder is preferably sprinkled into the starting material before needling.

The watering mat preferably contains 5 to 40 g/m^2 absorbent powder and/or 10 to 50 g/m^2 powder made of mycorrhizal fungi. In particular, 10 to 30 g/m^2 absorbent powder, in particular 10 to 20 g/m^2 absorbent powder, are used. With respect to the powders made of mycorrhizal fungi, 20 to 40 g/m^2 is particularly preferred, particularly 20 to 30 g/m^2.

Preferably, the powders are incorporated into the lower layer. If such powders are sprinkled or incorporated into the layers, it is advantageous if the grammage of the significant layer is at least 300 g/m^2 to 1000 g/m^2.

The watering system according to the invention comprises a watering mat and at least one tube which has outlet openings. This tube or tubes are placed in the tunnels of the watering mat.

A tube is understood not only as a rigid tube but also, for example, as a hose-like tube. The term tube includes all lines that are suitable for conducting a fluid through the tunnel

of a watering mat. Such tubes are also referred to as perforated tubes, since they usually have a large number of outlet openings, which are usually arranged at defined intervals in the tube.

According to one embodiment, the tube can have a drip emitter in the region of at least one outlet opening.

Such drip emitters enable the amount of fluid released to be controlled in a targeted manner and are used in watering tubes that are laid directly in the ground. Tubes with drip emitters of this type are known for example from EP 2 248 414 A1. It has been shown that with tubes that have a drip emitter, the fluid can be discharged more evenly within the watering mat, so that overall a better fluid distribution over the entire watering mat is achieved.

The drip emitter is preferably equipped with a metallic component, in particular in the region of the outlet opening, which prevents plant roots from penetrating into the outlet opening of the drip emitter. The metallic component prevents the penetration of plant roots due to chemical reactions.

The metallic component is preferably made of copper or a copper alloy. Copper is not only a nutrient for plants, but also hinders root growth when copper ions in high concentration come into contact with the roots. The outlet opening is kept free of penetrating roots in a simple manner.

Tubes with drip emitters equipped in this way are known in principle from EP 2 248 414 A1. However, the advantageous use of such tubes in combination with watering mats according to the invention has not yet been recognized. The advantage of this combination of a surface needled watering mat and tubes with such drip emitters is that additional measures to prevent root systems from penetrating into the outlet openings of the tubes, such as encasing the tubes, can be dispensed with. The required tunnel volume is smaller than with jacketed tubes, so that the watering mat can be wound up more tightly and the transport volume of the wound up watering mat can be kept low.

The tube is preferably made of an elastic material. Tubes made of flexible material, preferably a flexible plastic material, have the advantage that the watering mats provided with these tubes can be wound up much tighter, i.e. with a smaller radius of curvature. This significantly reduces the transport volume of the coiled tubes.

Such soft tube materials have the further advantage that the watering mats fitted with the tubes can be cut to size without having to use different cutting tools for the watering mat on the one hand and the tubes on the other.

In order to prevent roots from penetrating into the outlet openings of the tubes, there is a

further preferred embodiment in addition to the use of a component made of copper.

According to one embodiment, the tube has a casing made of a textile fabric, in particular of one of the preferred fabrics described above. The textile fabric can also consist of a fleece. In order to affix the textile fabric to the tube, it is wound with at least one thread, preferably using the looped thread technique, which is also known as the Kemafil technique.

The cross section of the tunnel is preferably matched to the cross section of the tube in such a way that the lower layer and the upper layer rest at least partially flat against the outer surface of the tube. Preferably at least 20%, in particular at least 50% of the outer surface of the tube is in contact with the upper and lower layers of the watering mat. The watering mat can also have more than one upper and/or lower layer.

Exemplary embodiments of the invention will be explained below, with reference to the Figures.

Shown here:

Figure 1 a watering system with a watering mat with two tubes,

Figure 2 a plan view of a front section of the watering mat shown in Figure 1,

Figure 3 a perspective view of a tube according to the invention,

Figure 4 a perspective view of a drip emitter,

Figure 5 a section of a view of the end face of a watering mat according to a further embodiment, and

Figure 6 a perspective view of an encased tube according to the invention, and

Figures 7 and 8 two schematic representations of a cross section through a watering mat with powders.

Figure 1 shows a perspective view of a watering system 1 with a watering mat 10 and two tubes 40. The watering mat 10 has a lower layer 12 and an upper layer 14 made of a textile fabric. This textile fabric can consist of a fleece, with each layer having a grammage of 300 g/m^2.

When this watering system 1 is laid in the ground, the watering mat 10 is arranged in such a way that the top layer 14 faces the plants.

Both layers 12, 14 each have two folds 18 and 19, so that two straight-line tunnels 16 are formed between the lower layer 12 and the upper layer 14, in which the tubes 40 are arranged. The tunnels 16 extend over the entire breadth B of the watering mat 10. The folds 18, 19 are essentially the same size, so that the watering mat 10 is formed symmetrically with respect to the dividing plane E between the layers 12, 14.

If the two layers 12, 14 are identical, i.e. in particular consist of identical material, the watering mat 10 can also be laid in such a way that the lower layer 12 and the upper layer 14 are reversed.

The cross section of the tunnel 16 is matched to the cross section of the tubes 40 in such a way that the lower layer 12 and the upper layer 14 in the region of the folds 18, 19 rest predominantly flat against the outer surface 41 of the tubes 40. The smaller the cross section of the tunnel 16, the closer the edge 24 of the folds 18, 19 slides towards the tunnel 16 and the larger the region of the watering mat 10 available for needling.

The watering mat 10 has four edges 20a to 20d. A total of three regions 22a,b,c are formed between the edges 24 of the folds 18, 19 and the respective edges 20a to 20d, in which the lower and the upper layer 12, 14 are connected to one another by needling.

In the regions 22a,b,c, the lower layer 12 and the upper layer 14 are needled together over their entire surface, i.e. the entire area of the regions 22a,b,c was used for the needling. This is also shown in Figure 2, which shows a section of the end face of the watering mat 10 of Figure 1. The needled end face section 30 extends from the edge 20a to the edge 24 where the layers 12, 14 diverge to form the tunnel 16.

The entire available area is needled in the embodiment shown in Figures 1 and 2.

As a result of the needling, the fibres of the layers 12, 14 lying on top of one another are intertwined or matted with one another in such a way that the dividing line between the layers 12, 14 is largely eliminated. This is shown by the dashed line in Figure 2.

One or both layers 12, 14 can consist of a hydrophilic or hydrophilised material. Preferably, the lower layer 12 is made of such a material.

Furthermore, at least one layer can consist of polyester, in particular a polyester fleece. It is preferred that at least the lower layer 12 is made of a polyester material.

Figure 3 shows a perspective view of an embodiment of a tube 40. Inside the tube 40, in the region of the outlet openings 42, are drip emitters 44, which have an outlet opening 48.

Such a drip emitter 44 is enlarged and shown only schematically in Figure 4. The drip emitter 44 has a metallic component 46 made of copper or a copper alloy in the form of a cover plate in which the outlet opening 48 is provided. The copper part can also be arranged in the interior of the drip emitter 44.

A further embodiment of a watering system 1 is shown in Figure 5, in which the tube 40 is provided with a casing 50. The casing preferably consists of a fleece that is laid around the tube. The casing 50 is affixed to the tube 40 by means of at least one thread 52, which is wound around the casing 50 using the looped thread technique (see Figure 6).

Two sections of watering mats 10 according to further embodiments are shown in Figures 7 and 8.

As can be seen in Figure 7, an absorbent powder 60 and/or a powder 62 made from mycorrhizal fungi is incorporated into the lower layer 12. The amount of absorbent powder is preferably 15 g/m^2. The amount of mycorrhizal fungi powder is preferably 30 g/m^2.

Another embodiment is shown in Figure 8, in which the powder 60 and/or 62 has been sprinkled in during the manufacturing process of the watering mat 10. The powder is preferably sprinkled onto the lower layer 12 before the upper layer 14 is placed on top and needled to the lower layer 12. The needling causes the powder 60, 62 to be distributed largely uniformly in the contact region between the two layers 12, 14.

List of reference symbols

1	Watering system
10	Watering mat
12	Lower layer
14	Upper layer
16	Tunnels
18	Lower layer fold
19	Top layer fold
20a,b,c,d	Edge of the watering mat
22a,b,c	Connected regions of the layers
24	Edge of the fold
30	Needled end face section
40	Tube
41	Outer surface of the tube
42	Outlet opening
44	Drip emitters
46	Metallic component
48	Outlet opening
50	Casing of the tube
52	Threads
60	Absorbent powder
62	Mycorrhizal fungi powder
B	Breadth of the watering mat

E Dividing plane

VANDINGSMÅTTE TIL LEVERING AF VÆSKER TIL RODZONEN PÅ PLANTER OG VANDINGSSYSTEM

Patentkrav

1. Vandingsmåtte (10) til levering af væsker til rodzonen på planter med mindst ét nedre lag (12) og ét øvre lag (14) hver især af et tekstil, hvor der mellem det nedre (12) og det øvre lag (14) er udformet mindst én tunnel (16) til optagelse af mindst ét rør (40), der er forsynet med udløbsåbninger (42) til væsken, og hvor det nedre lag (12) og det øvre lag (14) er forbundet med hinanden i mindst ét område (22a, b, c) uden for den i det mindste ene tunnel (16), **kendetegnet ved,** at det nedre lag (12) og det øvre lag (14) er nålet fladt sammen i det i det mindste ene område (22a, b, c).

2. Vandingsmåtte ifølge krav 1, kendetegnet ved, at det nedre lag (12) og det øvre lag (14) er forbundet med hinanden over hele fladen i det i det mindste ene område (22a, b, c).

3. Vandingsmåtte ifølge krav 1 eller 2, kendetegnet ved, at den i det mindste ene tunnel (16) er dannet ved hjælp af en fold (18) i det nedre lag (12) og ved hjælp af en fold (19) i det øvre lag (14).

4. Vandingsmåtte ifølge et af kravene 1 til 3, kendetegnet ved, at tekstilet er et fibermateriale.

5. Vandingsmåtte ifølge et af kravene 1 til 4, kendetegnet ved, at tekstilet består af mindst ét lag (12, 14) af et polyestermateriale.

6. Vandingsmåtte ifølge et af kravene 1 til 5, kendetegnet ved, at tekstilet består af mindst ét lag (12) af et hydrofilt eller hydrofiliseret materiale.

7. Vandingsmåtte ifølge et af kravene 1 til 6, kendetegnet ved, at vandingsmåtten (10) indeholder et absorberende pulver (60) til lagring af væsken.

8. Vandingsmåtte ifølge et af kravene 1 til 7, kendetegnet ved, at vandingsmåtten (10) indeholder et pulver (62) af mykorrhiza-svampe.

9. Vandingsmåtte ifølge krav 7 eller 8, kendetegnet ved, at pulveret (60, 62) er indført mellem det nedre lag (12) og det øvre lag (14).

10. Vandingsmåtte ifølge et af kravene 7 til 9, kendetegnet ved, at pulveret (60, 62) er indarbejdet i mindst ét lag (12, 14).

11. Vandingsmåtte ifølge et af kravene 7 til 10, kendetegnet ved, at den indeholder 5 til 40 g/m^2 absorberende pulver (60) og/eller 10 til 50 g/m^2 pulver (62) af mykorrhiza-svampe.

12. Vandingssystem (1) med en vandingsmåtte (10) ifølge et af kravene 1 til 11 og med mindst ét rør (40), der er forsynet med udløbsåbninger (42).

13. Vandingssystem ifølge krav 12, kendetegnet ved, at røret (40) i området ved mindst én udløbsåbning (42) er forsynet med en dråbeemitter (44).

14. Vandingssystem ifølge krav 13. kendetegnet ved, at dråbeemitteren (44) har mindst én udløbsåbning (48), og at der i området ved udløbsåbningen (48) er placeret en metallisk komponent (46), der forhindrer, at planterødder trænger ind i udløbsåbningen (48).

15. Vandingssystem ifølge krav 14, kendetegnet ved, at den metalliske komponent (46) består af kobber eller en kobberlegering.

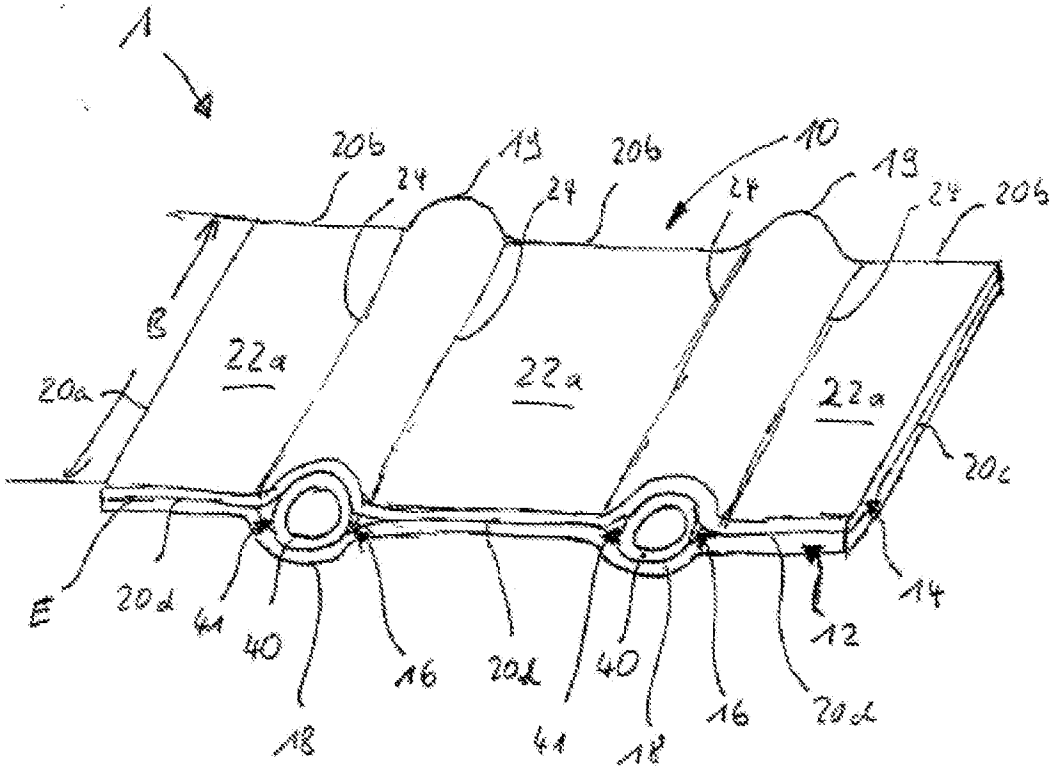
16. Vandingssystem ifølge et af kravene 12 til 15, kendetegnet ved, at røret (40) består af et elastisk materiale.

17. Vandingssystem ifølge et af kravene 12 til 16, kendetegnet ved, at røret (40) er forsynet med en kappe (50) af et tekstil.

18. Vandingssystem ifølge krav 17, kendetegnet ved, at kappen (50) er omviklet med mindst én tråd (52) med slyngtrådsteknik.

19. Vandingssystem ifølge et af kravene 12 til 18, kendetegnet ved, at tværsnittet af den

i det mindste ene tunnel (16) i vandingsmåtten (10) er tilpasset til rørets (40) tværsnit på en sådan måde, at det nedre lag (12) og det øvre lag (14) af vandingsmåtten (10) i det mindste delvist ligger fladt op til rørets (40) yderflade (41).


1
20b
24
18
24
20b
10
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18
24
20b
B
22a
22a
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20c
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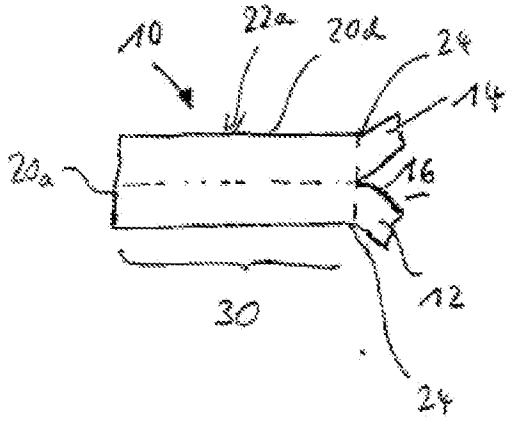
20d
44
40
16
20d
40
16
20d
12
14
18
44
18

Fig. 1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22a
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24
14
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24

Fig. 2

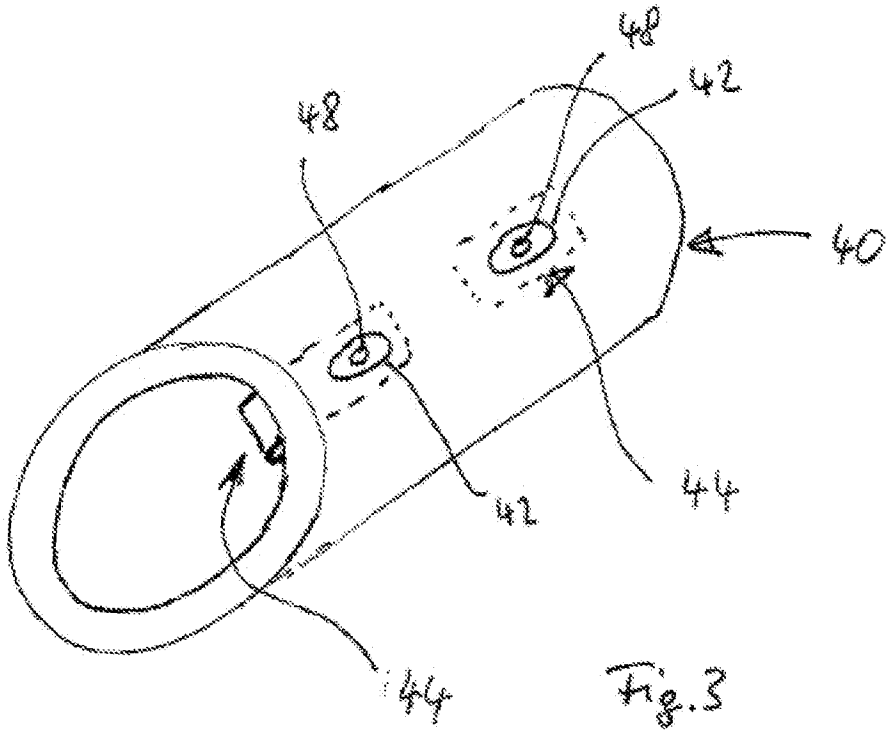

Fig.3

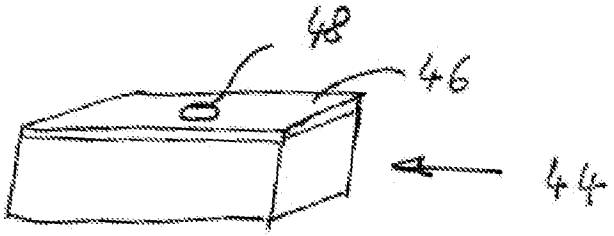

Fig 4

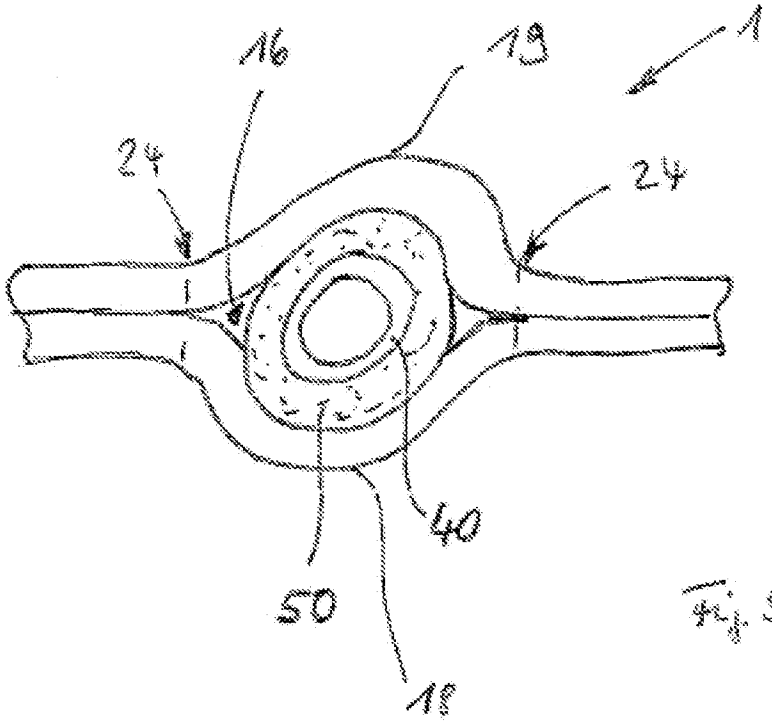

Fig. 5

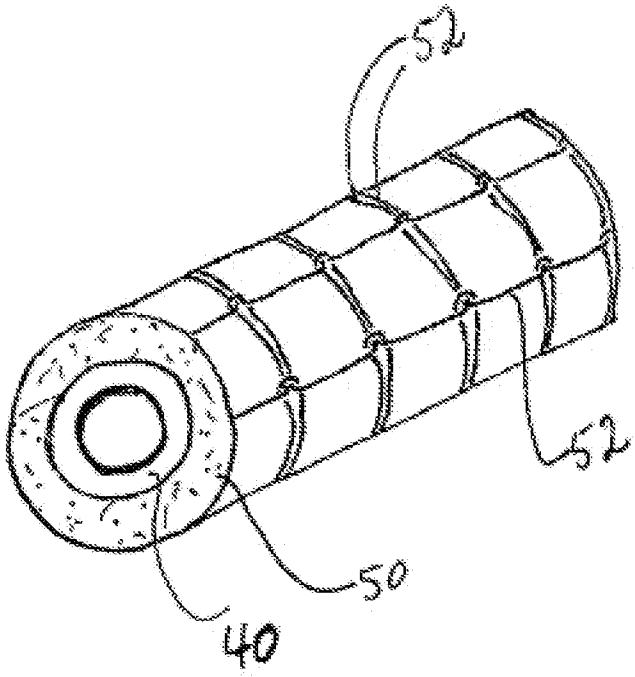

Fig. 6

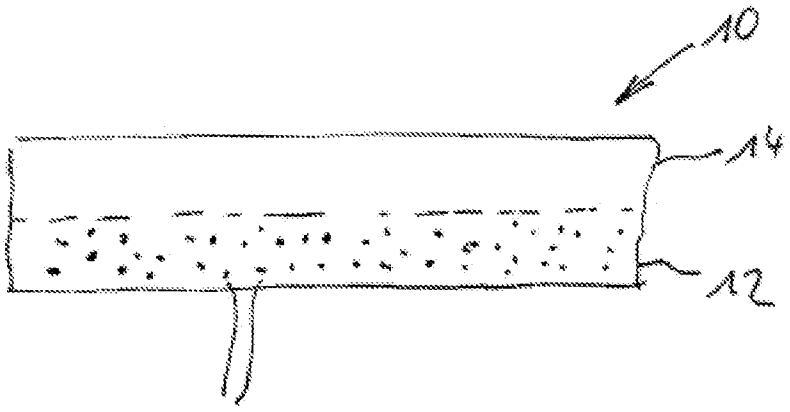

Fig. 7

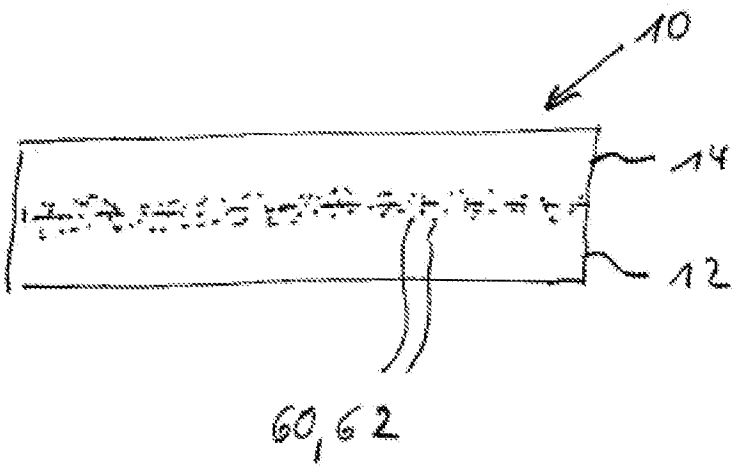

Fig. 8