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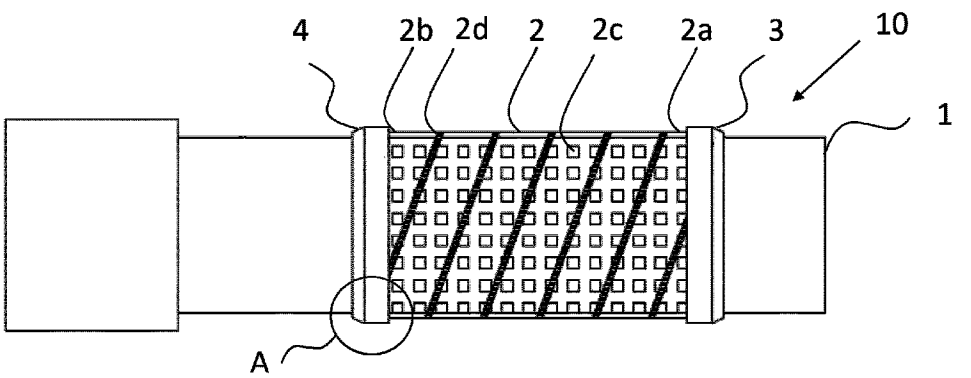
(54) **Titre : APPAREIL DE COMMANDE DE SABLE ET METHODES DE FABRICATION**
(54) **Title: SAND CONTROL APPARATUS AND METHODS FOR MANUFACTURING**



(57) **Abrégé/Abstract:**
There is provided an apparatus and method for controlling sand production in a wellbore. The apparatus comprises a base pipe having a middle section with perforations for allowing the flow of fluid between an exterior and interior of the base pipe; a helically wound filter directly wrapped around the exterior of the base pipe middle section, the filter having openings for allowing fluid flow while preventing sand flow through the openings; and a first and second end ring connecting a first and second end of the filter, respectively, and the base pipe. The apparatus is formed by helically wrapping a metal plate having openings around the middle section of the base pipe to form the filter; welding abutting edges of the filter together to form helical seams; and connecting the filter to the base pipe by welding the first and second end rings to the filter and the base pipe.

ABSTRACT

There is provided an apparatus and method for controlling sand production in a wellbore. The apparatus comprises a base pipe having a middle section with perforations for allowing the flow of fluid between an exterior and interior of the base pipe; a helically wound filter directly wrapped around the exterior of the base pipe middle section, the filter having openings for allowing fluid flow while preventing sand flow through the openings; and a first and second end ring connecting a first and second end of the filter, respectively, and the base pipe. The apparatus is formed by helically wrapping a metal plate having openings around the middle section of the base pipe to form the filter; welding abutting edges of the filter together to form helical seams; and connecting the filter to the base pipe by welding the first and second end rings to the filter and the base pipe.

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SAND CONTROL APPARATUS AND METHODS FOR MANUFACTURING

TECHNICAL FIELD

[0001] The invention relates generally to sand control in wellbores, and more specifically to sand control in oil and gas wells.

BACKGROUND

[0002] In the field of oil and gas production, it is necessary to prevent or minimize sand from the formation from entering the wellbore as fluids are brought into the wellbore and recovered to the surface. Often industrial filters are used downhole to effectively filter fluids, including oil, gas and water, that enter the wellbore. Such filters are often referred to as sand control screens.

[0003] Most materials used in sand control screens are expensive multi-layer products. One common material is multi-layered sintered metal mesh, where several layers of woven or perforated stainless steel wire mesh are overlapped together and then sintered in a vacuum sintering furnace to form a porous filter material. Some drawbacks to sintered metal mesh filters is that they are expensive to manufacture, have low productivity, and are limited in size by the vacuum sintering equipment.

[0004] When single-layer or multi-layer metal mesh, including sintered metal mesh, is used as a filter in oil and gas production, it is generally fixed by manual or mechanical fixing methods onto a support pipe. Some problems with industrial filter screens manufactured by this method is that it can be difficult to control the porosity of the mesh, thus they have low reliability, low production efficiency, and aren't suitable for large-scale production and quality control.

SUMMARY

[0005] In accordance with the present disclosure, there are provided apparatuses for controlling sand production within a wellbore and methods for manufacturing such apparatuses.

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[0006] In accordance with some embodiments, there is provided an apparatus for controlling sand production within a wellbore comprising: a base pipe having a middle section with perforations for allowing the flow of fluid between an exterior and interior of the base pipe; a helically wound filter directly wrapped around the exterior of the base pipe middle section, the filter having openings for allowing fluid flow while preventing sand flow through the openings; a first end ring connecting a first end of the filter and the base pipe; and a second end ring connecting a second end of the filter and the base pipe.

[0007] The first and second end ring may be welded to the base pipe and to the filter. The filter may comprise a perforated metal plate. The filter may comprise a metal mesh covering the perforations on the metal plate. Abutting edges of the helically wound filter may be welded to form helical seams. An inner surface of the filter may contact an outer surface of the base pipe middle section.

[0008] In accordance with some embodiments, there is provided a method for forming an apparatus for controlling sand production within a wellbore comprising the steps:

a. providing a metal plate and forming openings in the metal plate to create a filter;

b. providing a base pipe and forming perforations in a middle section of the base pipe;

c. inserting a first end ring on the base pipe;

d. directly wrapping the filter in a helical manner around the base pipe middle section;

e. welding abutting edges of the wrapped filter together to form helical seams;

f. inserting a second end ring on the base pipe; and

g. connecting the filter to the base pipe by welding the first end ring to a first end of the filter and to the base pipe, and welding the second end ring to a second end of the filter and to the base pipe.

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[0009] In step a), the openings may be formed by punching or stamping the metal plate. In step a), the openings may be covered with a metal mesh. The filter may be wrapped around the base pipe such that an inner surface of the filter contacts an outer surface of the base pipe middle section.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] In the Detailed Description section below, one or more embodiments of the present technology are described in relation to the attached figures. These embodiments are intended to provide a better understanding of the invention, how the invention may be put into practice, and to demonstrate some of the advantages of the invention. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of various embodiments of the invention. Similar reference numerals indicate similar components.

FIG. 1 is a side view of one embodiment of the apparatus for controlling sand production within a wellbore comprising a perforated base pipe with a direct wrap helically wound filter.

FIG. 2 is a side view of the perforated base pipe of the apparatus of **FIG. 1**, without the helically wound filter installed.

FIG. 3 is a sectional side view of the apparatus of **FIG. 1** showing a section of the perforated base pipe without the helically wound filter, and a section of the perforated base pipe with the helically wound filter.

FIG. 4 is a top perspective view of one embodiment of the structure of the sand control filter when it is not wound around the base pipe, the sand control filter having punched slots on a metal plate.

FIG. 5 is a top perspective view of one embodiment of the sand control filter when it is not wound around the base pipe, the sand control filter having a metal woven mesh combined with a perforated metal plate.

FIG. 6 is an enlarged cross-sectional view of area **A** from **FIG. 1** illustrating the second metal ring that connects the helically wound filter to the base pipe.

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DETAILED DESCRIPTION

[0011] Various aspects of the invention will now be described with reference to the figures. For the purposes of illustration, components depicted in the figures are not necessarily drawn to scale. Instead, emphasis is placed on highlighting the various contributions of the components to the functionality of various aspects of the invention. A number of possible alternative features are introduced during the course of this description. It is to be understood that, according to the knowledge and judgment of persons skilled in the art, such alternative features may be substituted in various combinations to arrive at different embodiments of the present invention.

Apparatuses for Controlling Sand Production in a Wellbore

[0012] **FIG. 1** illustrates an apparatus **10** for controlling sand production in a wellbore. The apparatus comprises a base pipe **1** with a filter **2** directly wrapped in a helical manner around the base pipe, the filter having a plurality of holes **2c** and spiral seams **2d**. The directly wrapped filter **2** has a first end **2a** and second end **2b** that are attached to the base pipe via a first ring **3** and a second ring **4**.

[0013] **FIG. 2** illustrates the base pipe **1** without the helically wound filter. The base pipe has a middle section **1a** comprising a plurality of perforations **1b** that allow fluid flow between an exterior and interior of the base pipe. The filter **2** is directly wound around the middle section **1a** of the base pipe, as shown in **FIG. 3** which illustrates a first section **10a** of the apparatus **10** without the filter, and a second section **10b** of the apparatus with the filter, for comparison purposes.

[0014] In some embodiments, including the example shown in **FIG. 4**, the filter **2** is comprised of a metal plate having a plurality of holes **2c** for filtering sand particles. In this example, the holes are indents in the metal plate with slits **2f** in the lateral walls that allow fluid flow but prevent larger particles, such as sand, from flowing through the holes. When the filter strip **2** is directly wound around the base pipe, the edges **2e** of the strip abut and are welded together to form helical seams **2d**, shown in **FIGS. 1** and **3**.

[0015] In some embodiments, including the example shown in **FIG. 5**, the filter comprises a metal plate with holes **2c** and a mesh layer **2g** adjacent to the holes. The mesh layer allows fluid flow through the holes but prevents larger particles, such as sand, from flowing through the holes. The mesh layer may be a woven metal mesh.

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[0016] **FIG. 6** illustrates an enlarged cross-section from **FIG. 1**, showing the second ring **4** connected to the base pipe **1** and the filter **2**. The second ring **4** has an inner cavity **4a** into which the second end **2b** of the helically wound filter **2** is inserted. The inner cavity **4a** has a certain taper, and the gap between the base pipe **1** and the second end ring **4** is calculated according to the metal linear expansion coefficient to give a specific value, which is the same as that of the base pipe **1**.

[0017] The base pipe may be a well casing or tubing.

[0018] The base pipe **1**, filter **2**, first end ring **3**, and second end ring **4** may be stainless steel, and preferably corrosion resistant stainless steel. Alternative suitable materials may be used.

Methods of Manufacture

[0019] The apparatus **10** for controlling sand production in a wellbore is formed by the following steps. Note that in some embodiments, there may be modifications to the order of the steps.

[0020] Step 1: Provide a single-layer metal plate and form holes in it that are sized and shaped to prevent sand particles from moving through the holes to form a filter. The holes may be formed by punching or stamping the metal plate. The holes may be in the shape of slits or another suitable size and shape.

[0021] Step 2: Drill a plurality of openings in a middle section of a base pipe to establish fluid communication between the inside and outside of the base pipe.

[0022] Step 3: Insert the first end ring on the base pipe.

[0023] Step 4: Directly wind the filter in a helical manner around the base pipe middle section. The filter is wound tightly such that inner surfaces of the filter abut the outer surface of the base pipe.

[0024] Step 5: Weld the abutting edges of the helically wound filter together to form helical seams.

[0025] Step 6: Cut the second end of the filter strip to the desired length at the second end of the base pipe middle section.

[0026] Step 7: Insert the second end ring on the base pipe.

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[0027] Step 8: Weld the first end of the filter to the first end ring, and the second end of the filter to the second end ring.

[0028] Step 9: Weld the first end ring and the second end ring to the base pipe.

[0029] Alternatively, in Step 1, the filter may be formed by providing a metal plate and forming holes in it, for example by punching or stamping. Then, a wire mesh may be connected to the metal plate to cover the holes and prevent particles of a certain size, e.g. sand particles, from flowing through the holes. The wire mesh may be connected to the metal plate via welding.

Advantages

[0030] The apparatus and method for manufacturing it described and illustrated herein have several advantages over the prior art sand control filters. By directly wrapping the filter comprising a metal plate around the base pipe, the base pipe supports the filter without a continuous gap between the filter and the base pipe. This provides greater strength and integrity to the apparatus, with the filter friction fit on the base pipe. This is particularly important when the apparatus is entering a well, since there is often contact between the outside of the apparatus (i.e. the outside of the filter) and the well wall. In this case, the contact will not cause axial slippage of the filter with respect to the base pipe since the filter is tightly wrapped around the base pipe and secured in place. This is not always the case in prior art systems where a filter sleeve is inserted onto a base pipe and requires a gap between the filter sleeve and the base pipe to allow for installation of the filter sleeve. When there is a gap, there is more likely to be slippage of the filter sleeve with respect to the base pipe during well insertion. In addition, the gap causes the outer diameter of the apparatus to be larger compared to the subject apparatus described herein.

[0031] The method described herein provides for a versatile sand control apparatus in which the length and diameter of the filter can be easily made according to the desired specifications. The manufacturing process is efficient, reliable, and reduces manufacturing cost, while providing a high-quality product

[0032] Although the present invention has been described and illustrated with respect to preferred embodiments and preferred uses thereof, it is not to be so limited since

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modifications and changes can be made therein which are within the full, intended scope of the invention as understood by those skilled in the art.

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CLAIMS

1. An apparatus for controlling sand production within a wellbore comprising:

a base pipe having a middle section with perforations for allowing the flow of fluid between an exterior and interior of the base pipe;

a helically wound filter directly wrapped around the exterior of the base pipe middle section, the filter having openings for allowing fluid flow while preventing sand flow through the openings;

a first end ring connecting a first end of the filter and the base pipe; and

a second end ring connecting a second end of the filter and the base pipe.

2. The apparatus of claim 1, wherein the first and second end ring are welded to the base pipe and to the filter.

3. The apparatus of claim 1 or 2, wherein the filter comprises a perforated metal plate.

4. The apparatus of claim 3, wherein the filter comprises a metal mesh covering the perforations on the metal plate.

5. The apparatus of any one of claims 1-4, wherein abutting edges of the helically wound filter are welded to form helical seams.

6. The apparatus of any one of claims 1-5, wherein an inner surface of the filter contacts an outer surface of the base pipe middle section.

7. A method for forming an apparatus for controlling sand production within a wellbore comprising the steps:

a) providing a metal plate and forming openings in the metal plate to create a filter;

b) providing a base pipe and forming perforations in a middle section of the base pipe;

c) inserting a first end ring on the base pipe;

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d) directly wrapping the filter in a helical manner around the base pipe middle section;

e) welding abutting edges of the wrapped filter together to form helical seams;

f) inserting a second end ring on the base pipe; and

g) connecting the filter to the base pipe by welding the first end ring to a first end of the filter and to the base pipe, and welding the second end ring to a second end of the filter and to the base pipe.

8. The method of claim 7, wherein in step a), the openings are formed by punching or stamping the metal plate.

9. The method of claim 7 or 8, wherein in step a), the openings are covered with a metal mesh.

10. The method of any one of claims 7-9, wherein the filter is wrapped around the base pipe such that an inner surface of the filter contacts an outer surface of the base pipe middle section.

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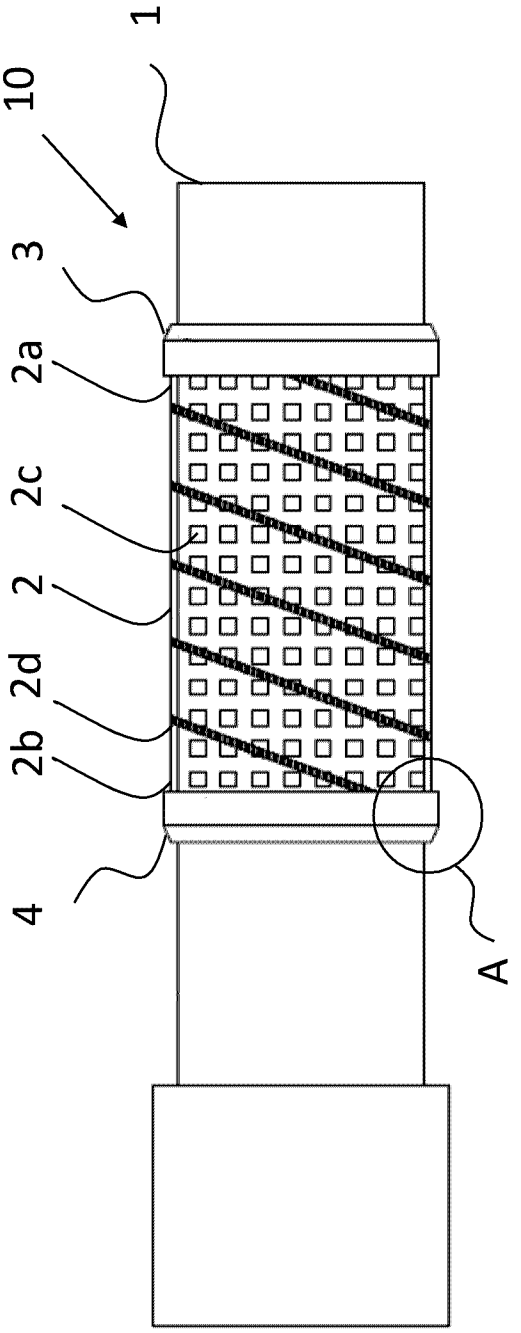

FIG. 1

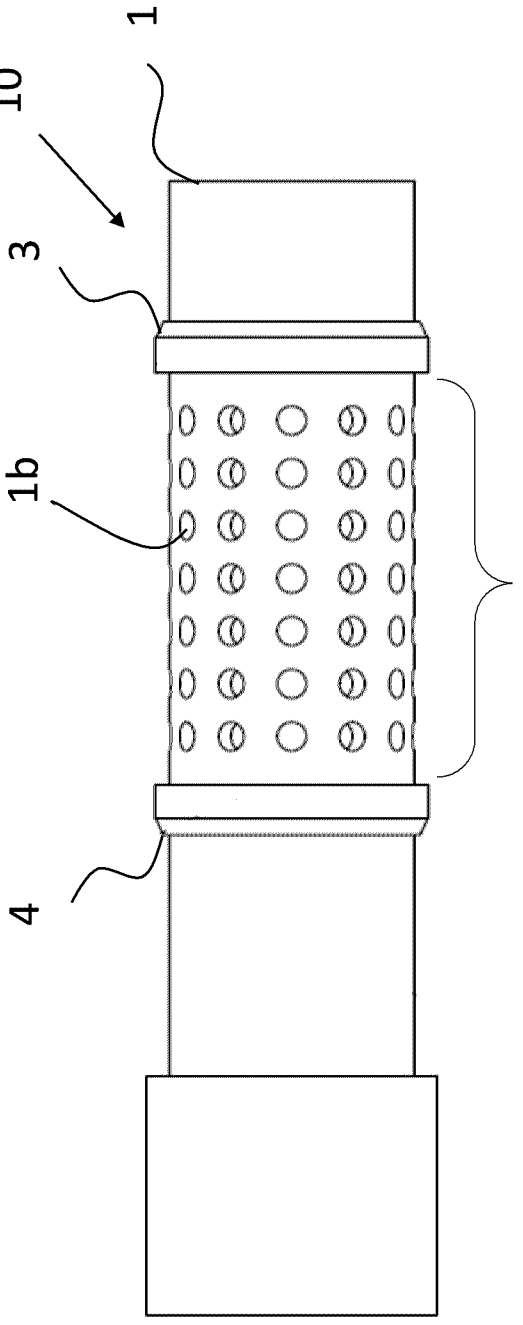

FIG. 2

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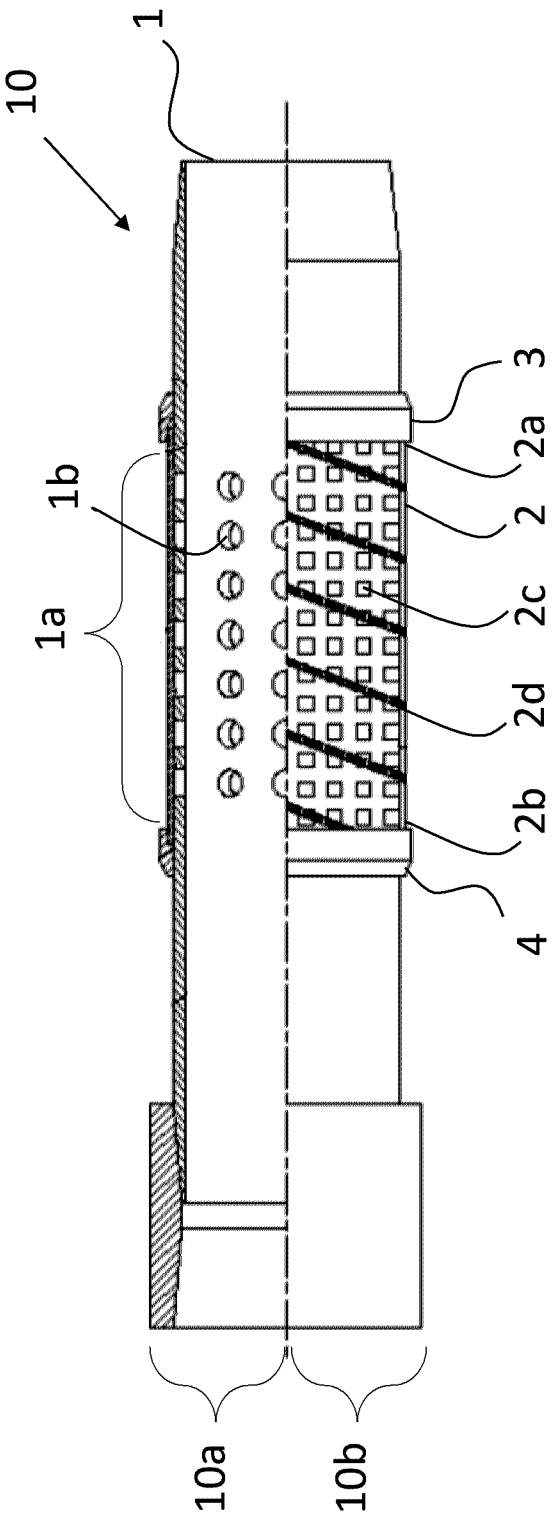

FIG. 3

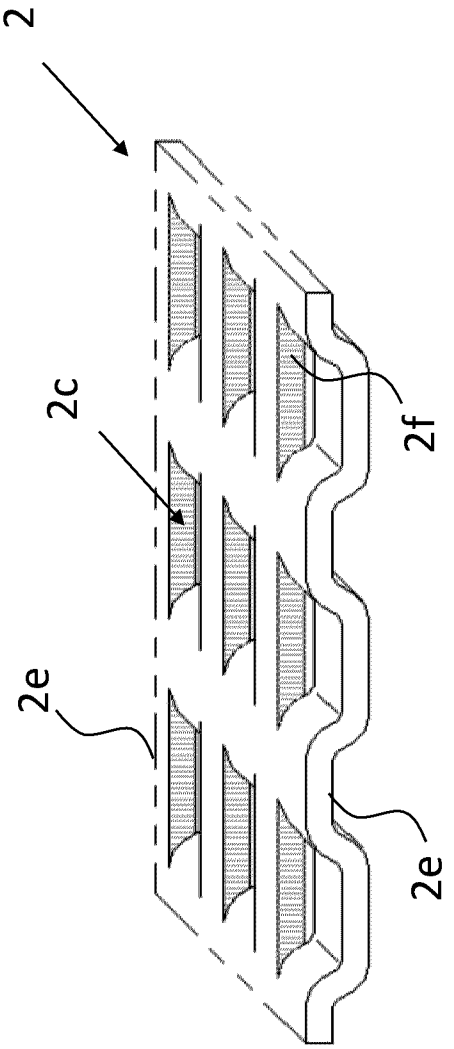

FIG. 4

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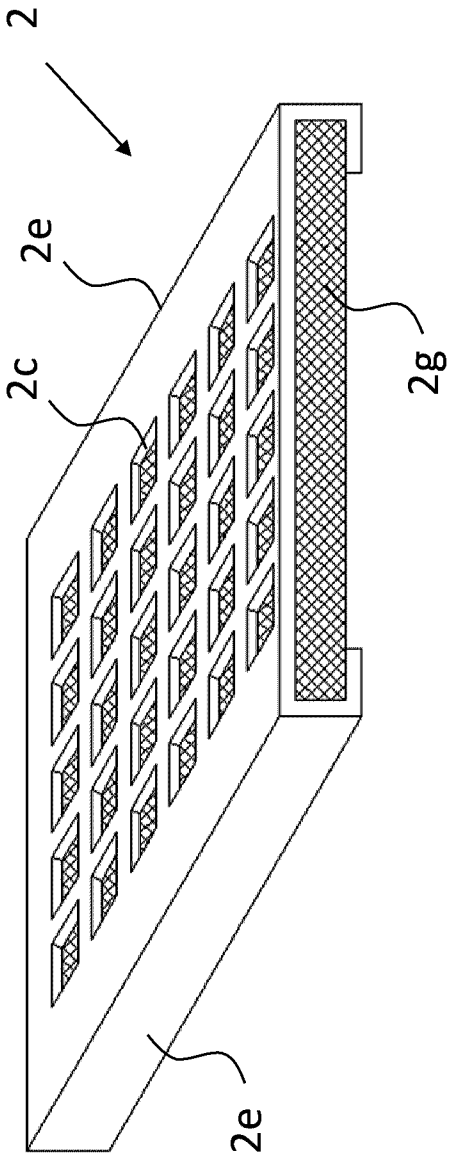

FIG. 5

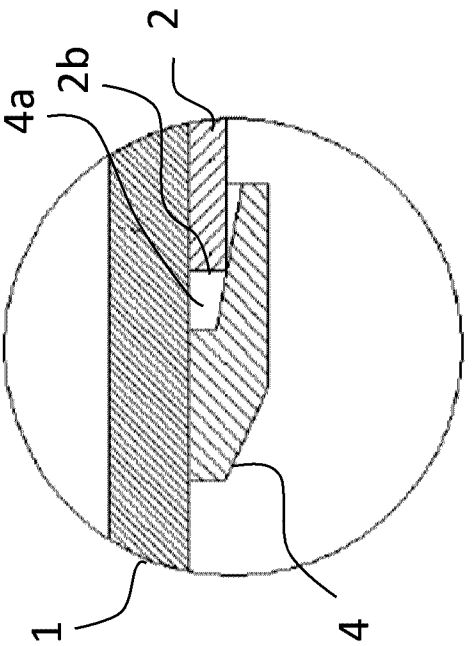

FIG. 6

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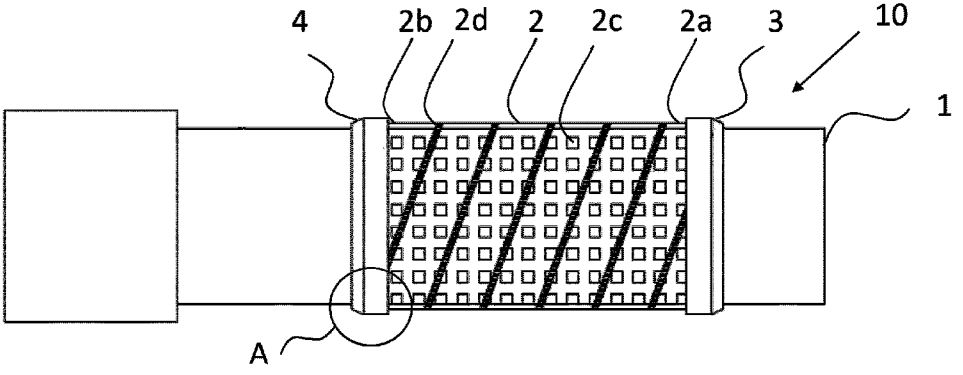
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