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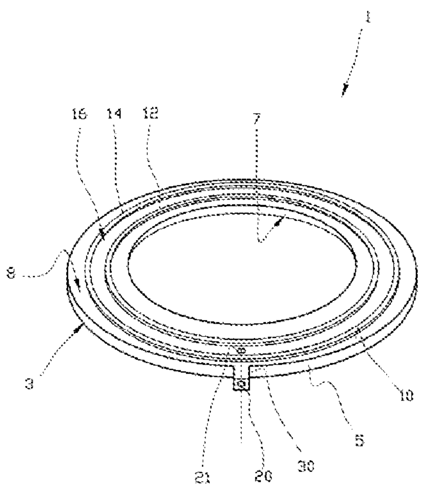
(54) Title **Insulation Test Gasket**

(57) Abstract

An insulation gasket (1) for electrically insulating a connection between two flanges in a pipe connection, comprising: a first gasket face (8) and a second gasket face (9); - a dielectric material (10) for preventing any current from passing between the first gasket face and the second gasket face; - a first endless seal (12) and a second endless seal (14) arranged radially spaced apart from the first endless seal, at least the first endless seal protrudes from an indentation (12′) in each of the faces (8, 9) so that in a position of use, a chamber (16) is defined by the endless seals and a face of each flange of the pipe connection; - a fluid channel (20, 21) for communicating a pressurized test fluid into said chambers (16) to test the integrity of the gasket, wherein the first endless seal is a double acting seal.



INSULATION TEST GASKET

The present disclosure is related to a gasket for facilitating testing of a seal between two flanges in a pipe connection. More specifically, the disclosure is related to a gasket for facilitating testing a seal between two flanges in a pipe connection, the gasket comprises a core having an inner face, an outer face defining a perimeter, and a first surface and a second surface opposite the first surface for facing the flanges of the pipes.

Publication WO 03/027561 discloses a gasket for monitoring and/or testing of potential leakage at jointing flanges in a piping system. Each face of the gasket is provided with radially spaced-apart seals for providing an annular space communicating with a leakage indicator for indicating a leakage from the piping system into the annular space. The annular space may also be filled with a pressurized gas monitored by a manometer so that any pressure drop during a certain time-period indicates a leakage in the joint. The gasket disclosed in WO 03/027561 comprises a packing body consisting of a circular disc body of constant thickness, wherein spaced-apart seals abut against the disc body of constant thickness.

A drawback of the gasket disclosed in WO 03/027561 is that at least portions of the radially innermost seal is prone to displacement when subject to a pressure from the fluid within a pipeline, in particular to a pressure surge that may arise in particular situations.

There is a need for a gasket capable of withstanding pressure surges while at the same time being electrically insulating so that any electric current is prevented from passing through the gasket.

The invention has for its object to remedy or to reduce at least one of the drawbacks of the prior art, or at least provide a useful alternative to prior art.

The object is achieved through features, which are specified in the description below and in the claims that follow.

The invention is defined by the independent patent claim. The dependent claims define advantageous embodiments of the invention.

In a first aspect the invention there is provided [claim 1] an insulation gasket for electrically insulating a connection between two flanges in a pipe connection, the insulation gasket comprising:
- a first gasket face and a second gasket face opposite the first gasket face;
- a dielectric material for preventing any current from passing between the first gasket face and the second gasket face;
- a first endless seal and a second endless seal arranged radially spaced apart from the first endless seal, at least the first endless seal protrudes from an indentation in each of the first face and the second face so that, in a position of use, a chamber is defined by the first endless seal, the second endless seal and a face of each flange of the pipe connection;
- a fluid channel for communicating a pressurized test fluid from a perimeter of the gasket and into said chambers to test the integrity of the gasket,
wherein the first endless seal is arranged closer to a radial center of the gasket than the second endless seal, and the first endless seal is a double acting seal.

A double acting seal, commonly known as DAS, is a seal that is bidirectional in the sense that it can seal dynamic pressure from both sides so that the seal will function regardless of a direction of pressure. A double acting seal is known from double acting cylinders and is considered to provide the best sealing capacity for sealing dynamic pressure from both sides.

The inventor has surprisingly found that using a double acting seal as a first endless seal has great advantages for testing an integrity of a gasket that has been inserted between flanges in a pipe system. By using a double acting seal, the integrity of the connection can be tested prior to opening for fluid flow within the pipeline comprising the gasket. Thus, the integrity of the gasket can be tested without testing the pipeline itself, i.e., without filling the pipeline itself with a pressurized test fluid. A volume of the test fluid for testing the integrity of the gasket according to the invention is therefore extremely small as compared with an internal volume of a pipeline and is therefore advantageous with respect to an economical point of view and with respect to time needed for performing the integrity test. Further, tests have shown that a double acting seal has proven to be very reliable with regards to pressure surges that may arise in a pipeline.

The pressurized fluid for testing the integrity of the gasket, is preferably a nonconductive fluid, such as a gas. The gas may typically be nitrogen or air. Alternatively, the test fluid may be a liquid such as an oil or any other suitable liquid. Preferably, the test liquid is nonconductive. An advantage of using a nonconductive test fluid is that the test fluid may remain within the test chamber of the gasket after the testing has been completed. When using an electrically conductive test fluid, the fluid must be drained prior to setting the pipeline comprising the gasket, in operation.

The test fluid is typically communicated into the test chamber from a test assembly configured for providing and monitoring a fluid pressure. Such a test assembly is commercially available in the marked and will therefore not be further discussed herein.

An advantage of using a gas as a test medium is that the test may be carried out with a low pressure since it is only required to monitor whether the pressure remains constant during the test period.

Preferably, the test fluid is communicated from the test assembly and into the fluid channel of the gasket via a test nipple. In an embodiment wherein the gasket comprises a core of metal, the test nipple may be secured to the radial perimeter of the gasket by means of a weld so that the test nipple is permanently secured to the gasket. When welding the test nipple to the gasket, the temperature will rise.

[Claim 2] To achieve the desired electrically insulation properties in an embodiment wherein the gasket comprises a metal core, the dielectric material is a dielectric cover provided on at least one of the first gasket face and the second gasket face.

Such a dielectric cover may be damaged if the temperature exceeds a certain level during the welding of the test nipple to the radial perimeter of the gasket. To at least reduce a risk of damaging the dielectric cover during said welding, it is an advantage if [claim 3] the metal core is provided with a radial protrusion having an aperture forming part of the fluid channel, the protrusion being configured for receiving the nipple for communicating with a test assembly.

In one embodiment, the protrusion may [claim 4] be an integral part of the core of the gasket. By integral part is meant that the protrusion and the core itself are cut from the same piece of material, typically in one cutting operation. Such a cutting operation may be executed for example by means of a water jet cutting tool.

The fluid channel for communicating the pressurized fluid into the chamber, is provided by a drilling machine provided with a bit. However, due to a thickness of the core typically being 1-1,5 % of an outer diameter of the core, the bit itself must be slim. As an example, a core having an outer diameter of about 398 mm, may typically have a thickness of about 5 mm. A fluid channel in such core should not exceed 1-2 mm. A bit for providing such a fluid channel has a limited capacity with respect to an axial length of the channel to be provided. From experience, the inventor has found that a bit having a diameter of 1-2 mm has a capacity of drilling a fluid channel of about 10-15 mm.

Especially, but not exclusively, when the core is provided with a protrusion being an integral part of the core as discussed above, it is advantage if [claim 5] the fluid channel is provided in a portion of the core having a reduced radial distance between a radial center portion of the gasket and a perimeter face of the gasket, as compared with the rest of the core. In one embodiment said portion is provided by means of cutting a segment off the gasket. In such an embodiment the protrusion extends from a chordal surface of the gasket as will be discussed below.

As an alternative to providing the protrusion as an integral portion of the core of the gasket, the protrusion may [claim 6] be provided by means of a sleeve projection threadedly engaged with an aperture forming part of the fluid channel. To prevent the projection from unthreading from the core, the projection is preferably secured to the core by a locking means preventing the projection from rotation with respect to the core. The locking means may typically be a spot weld, or even a suitable adhesive.

The dielectric cover may [claim 7] be made from an epoxy material, such as glass-reinforced epoxy grade G10 or grade G11. Alternatively, the dielectric cover may be made from polytetrafluoroethylene (PTFE) or any other suitable material.

At least the first endless seal may [claim 8] be a spring energized seal. A spring energized seal is a seal provided with a core of steel, typically as spring steel. The effect of providing at least the first endless seal in the form of a spring energized seal is that the seal is capable of withstanding higher pressure than for example an O-ring seal made from rubber. Further, a spring energized seal is, due to its “reinforcement” far better with respect to maintaining its intended form, as compared with a seal solely made of for example rubber or silicone.

In a preferred embodiment, also the second endless seal is provided by means of a spring energized seal.

Preferably, at least one of the pairs of first and second endless seals protruding from each of the first gasket face and the second gasket face may [claim 9] comprise a dielectric material. Thus, the endless seals arranged on at least one of the first gasket face and the second gasket face may comprise a dielectric material, i.e., one of the pairs of the endless seals protruding from one of the faces of the gasket may comprise a dielectric material, while the other pair of endless seals protruding from the other face of gasket may not, but can, be provided with a dielectric material. The dielectric material may be in the form of a jacket made from for example polytetrafluoroethylene, alternatively another suitable dielectric material having elastic properties. However, if the core of the gasket itself has dielectric properties, or each of the endless seals are arranged protruding from a groove or indentation provided with dielectric material, the endless seals do not have to be dielectric.

In some applications, there are requirements of providing a gasket configured for withstanding an increased temperature having a duration of a certain time. Such an increased temperature may typically occur during a fire.

The first gasket face and the second gasket face may [claim 10] be provided with a fire-resistant seal.

In one embodiment, [claim 11] the fire-resistant seal may be provided by means of a third endless seal configured for resisting fire, the third endless seal being arranged closer to an external perimeter of the core than the second endless seal. In such an embodiment, the third endless seal protects also the second endless seal against fire.

As an alternative to providing the gasket with a third endless seal having fire-protecting properties, each of the second endless seals may [claim 12] have fire-protecting properties. An advantage of this embodiment is that the gasket may comprise only two endless seals protruding from each of the first gasket face and the second gasket face but still achieves the fire protecting properties. Thus, the gasket is simpler to manufacture. Another advantage is that, in an embodiment wherein a segment has been cut from the core as discussed above, no area outside the second endless seal is required for receiving any third endless seal.

In still another embodiment, the gasket may comprise a second endless seal having fire-protecting properties, and an additional third endless seal also having fire-protecting properties, thereby providing a double fire protection of the first endless seal.

In the following is described examples of preferred embodiments illustrated in the accompanying drawings, wherein:

Fig. 1a shows a view in perspective of a first embodiment of the gasket according to the invention;

Fig. 1b shows a view in perspective of a second embodiment of the gasket according to the invention;

Fig. 2a shows a cut of sector of the gasket shown in fig. 1a, wherein the gasket comprises a test nipple secured to a protrusion extending from a perimeter face of a core of the gasket;

Fig. 2b shows a cut of sector of the gasket shown in fig. 1b, wherein the gasket comprises a test nipple threadedly secured to a core of the gasket;

Figs. 3a shows in a smaller scale a view of a second embodiment of the gasket wherein a secant has been cut off the core of the gasket;

Figs. 3b shows a cut through A-A in fig. 3a; and

Fig. 3c shows in larger scale a cut of sector of the gasket having similarities with the gasket shown in fig. 3a.

Any positional specifications refer to the positions that are shown in the figures.

In the figures, same or corresponding elements are indicated by same reference numerals. For clarity, some elements may in some of the figures be without reference numerals.

For illustrative reasons, the relative proportions of some of the elements may be somewhat distorted.

In the figures, the reference numeral 1 indicates an insulation gasket for use between two flanges (not shown) in a pipeline (not shown). The gasket 1 is disc-shaped and comprises a core 3 having an outer perimeter defined by a perimeter face 5 and an inner face 7 defined by an opening. The opening is typically adapted to an inner diameter of a pipeline into which the gasket 1 shall be used.

In the embodiments shown, the core 3 is made of metal. The gasket 1 has a first face 8 and a second face 9 (see fig. 3b) opposite the first face 8, the faces 8, 9 being defined by the perimeter face 5 and the inner face 7.

To prevent electric current from passing opposing flanges between which the gasket 1 in a position of use, is clamped by means of bolts (not shown), the first face 8 and the second face 9 of the gasket 1 are provided with a dielectric cover 10 as best seen in figures 2a, 2b, 3b and 3c. However, to prevent electric current from passing between the flanges that in a position of use abut against the gasket 1, it is sufficient that only one of the first face 8 and the second face 9 is provided the dielectric cover 10. The bolts (not shown) of the flanges are prevented from passing electric current between the flanges by means of insulating sleeves and insulating washers, as will be appreciated by a person skilled in the art.

In the embodiments shown, the faces 8, 9 for abutting against flanges of the pipeline, are provided with a first endless, annular seal 12 and a second, endless annular seal 14 arranged radially spaced apart from the first annular seal 12. The annular seals protrude from each of the first and second faces 8, 9 so that in a position of use, a chamber 16 is defined by the first annular seal 12, the second annular seal 14 and a face of each flange (not shown).

As best seen in figures 2a and 2b, each of the annular seals 12, 14 is arranged in an indentation or groove 12' and 14', respectively.

The gasket is further provided with a fluid channel 20 for communicating a pressurized fluid from the perimeter face 5 of the gasket 1 via a transversal fluid channel 21 and into said chambers 16 to test the integrity of the gasket 1.

The first annular seal 12 is arranged closer to a radial center of the gasket 1 than the second annular seal 14, and the first annular seal 12 is a double acting seal, i.e., a so-called DAS (Double Acting Seal) commonly used in double acting hydraulic cylinders.

The inventor has found that using a double acting first annular seal 12, which is bidirectional in the sense that it can seal dynamic pressure from both sides so that the seal will function regardless of a direction of pressure, has proven to be very reliable with respect to keeping the integrity of the gasket 1 both during testing of the gasket 1 and during a subsequent operation of the pipeline comprising the gasket 1, even in the event of any pressure surge in the fluid within the pipeline.

In figures 1a, 2a, and 3a - 3c, the core 3 is made of metal and provided with a radial protrusion 30 having an aperture forming part of the fluid channel 20 so that the fluid channel extends from a perimeter face of the protrusion 30 to a transverse fluid channel 21 being in fluid communication with the chamber 16. The protrusion 30 is configured for receiving a nipple 40 for communicating with a test assembly (not shown) known *per se.*

In the embodiment shown in figures 2a – 3c, the nipple 40 comprises a nipple pipe 41 being in fluid communication with a screw-coupling 42 having a seal 44 at its end portion for connecting to the test assembly in a sealing manner. Normally, the test nipple 40 remains in place so that one or more subsequent integrity test can be performed throughout the lifetime of the gasket 1. In figures 2a and 3a – 3c, the test nipple 40 is secured to the protrusion by means of a weld 34.

In the embodiment shown in fig. 2b the test nipple 40 is threadedly secured to the core 3 of the gasket 1. A portion of the nipple pipe 41 is provided with external threads 47 mating with threads of a bore 4 extending inwardly form the perimeter face 5 of the core 3. To reduce a possibility of unscrewing the nipple pipe 41, and thus the test nipple 40, caused for example by vibrations in the pipeline comprising the gasket 1, it is an advantage if the threaded connection is provided with an adhesive, for example an adhesive sold under the brand Loctite®. Alternatively, or additionally to use an adhesive, the nipple pipe 41 may be secured against unwinding by means of a weld, typically a spot weld.

An area of the core 3 of the gasket 1 and its faces 8, 9 being defined between the perimeter face 5 and a portion of the second annular seal 14 being closest to the perimeter face 5, is known as a guiding portion 15. The guiding portion 15 has a purpose of guiding the gasket 1 into a correct position by abutting against the bolts connecting the flanges and glamping the gasket 1 therebetween. Thus, the guiding portion 15 may be regarded as superfluous with respect to sealing properties of the gasket 1.

In the embodiment shown in figures 3a – 3c, the inventor has found that this superfluity of the guiding portion may be utilized when providing the fluid channel 20.

The fluid channel 20 for communicating a pressurized fluid from the perimeter face 5 of the gasket 1 and into the test chamber 16, may have a relatively small cross-sectional area. To reduce the distance between perimeter face 5 and the transversal fluid channel 21 communicating the fluid into the chambers 16 at either of the first face 8 and the second face 9, the gasket 1 is provided with a portion having a reduced distance between a radial center portion of the gasket to the perimeter face 5. This reduced distance is provided by cutting a secant of the perimeter face 5 at either side of the protrusion 30, as shown in figures 3a and 3c wherein the protrusion 30 extends outwardly from a chord 5’ providing a “cutting line” of the removed secant.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Claims

1. An insulation gasket (1) for electrically insulating a connection between two flanges in a pipe connection, the insulation gasket (1) comprising:
a first gasket face (8) and a second gasket face (9) opposite the first gasket face;
- a dielectric material (10) for preventing any current from passing between the first gasket face (8) and the second gasket face (9);
- a first endless seal (12) and a second endless seal (14) arranged radially spaced apart from the first endless seal (12), at least the first endless seal protrudes from an indentation (12’) in each of the first face (8) and the second face (9) so that in a position of use, a chamber (16) is defined by the first endless seal (12), the second endless seal (14) and a face of each flange of the pipe connection;
- a fluid channel (20, 21) for communicating a pressurized test fluid from a perimeter (5) of the gasket (1) and into said chambers (16) to test the integrity of the gasket,
wherein the first endless seal (12) is arranged closer to a radial center of the gasket (1) than the second endless seal (14), and the first endless seal (12) is a double acting seal.

2. The insulation gasket (1) according to claim 1, wherein the gasket (1) comprises a metal core (3), and the dielectric material (10) is a dielectric cover provided on at least one of the first gasket face (8) and the second gasket face (9).

3. The insulation gasket (1) according to claim 2, wherein the metal core (3) is provided with a radial protrusion (30) having an aperture forming part of the fluid channel (20), the protrusion (30) being configured for receiving a nipple (40) for communicating with a test assembly.

4. The insulation gasket (1) according to claim 3, wherein the protrusion (30) is an integral part of the core (3) of the gasket (1).

5. The insulation gasket (1) according to any one of the preceding claims, wherein the fluid channel (20) is provided in a portion of the core (3) having a reduced

radial distance between a radial center portion of the gasket (1) and a perimeter face of the gasket (1).

6. The insulation gasket (1) according to claim 3, wherein the protrusion (30) is a sleeve- projection threadedly engaged with the aperture forming part of the fluid channel (20).

7. The insulation gasket (1) according to any one of claims 2-6, wherein the dielectric cover (10) is made of glass reinforced epoxy or PTFE.

8. The insulation gasket (1) according to any one of the preceding claims, wherein at least the first endless seal (12) is a spring energised seal.

9. The insulation gasket (1) according to any one of the preceding claims, wherein the endless seals (12, 14) arranged on at least one of the first gasket face (8) and the second gasket face (9) comprise a dielectric material.

10. The insulation gasket (1) according to any one of the preceding claims, wherein the first gasket face (8) and the second gasket face (9) are further provided with a fire-resistant seal.

11. The insulation gasket (1) according to claim 10, wherein the fire-resistant seal is provided by means of a third endless seal configured for resisting fire, the third endless seal being arranged closer to an external perimeter (5) of the core (3) than the second endless seal (14).

12. The insulation gasket (1) according to claim 10 or 11, wherein each of the second endless seals (14) has fire-protecting properties.

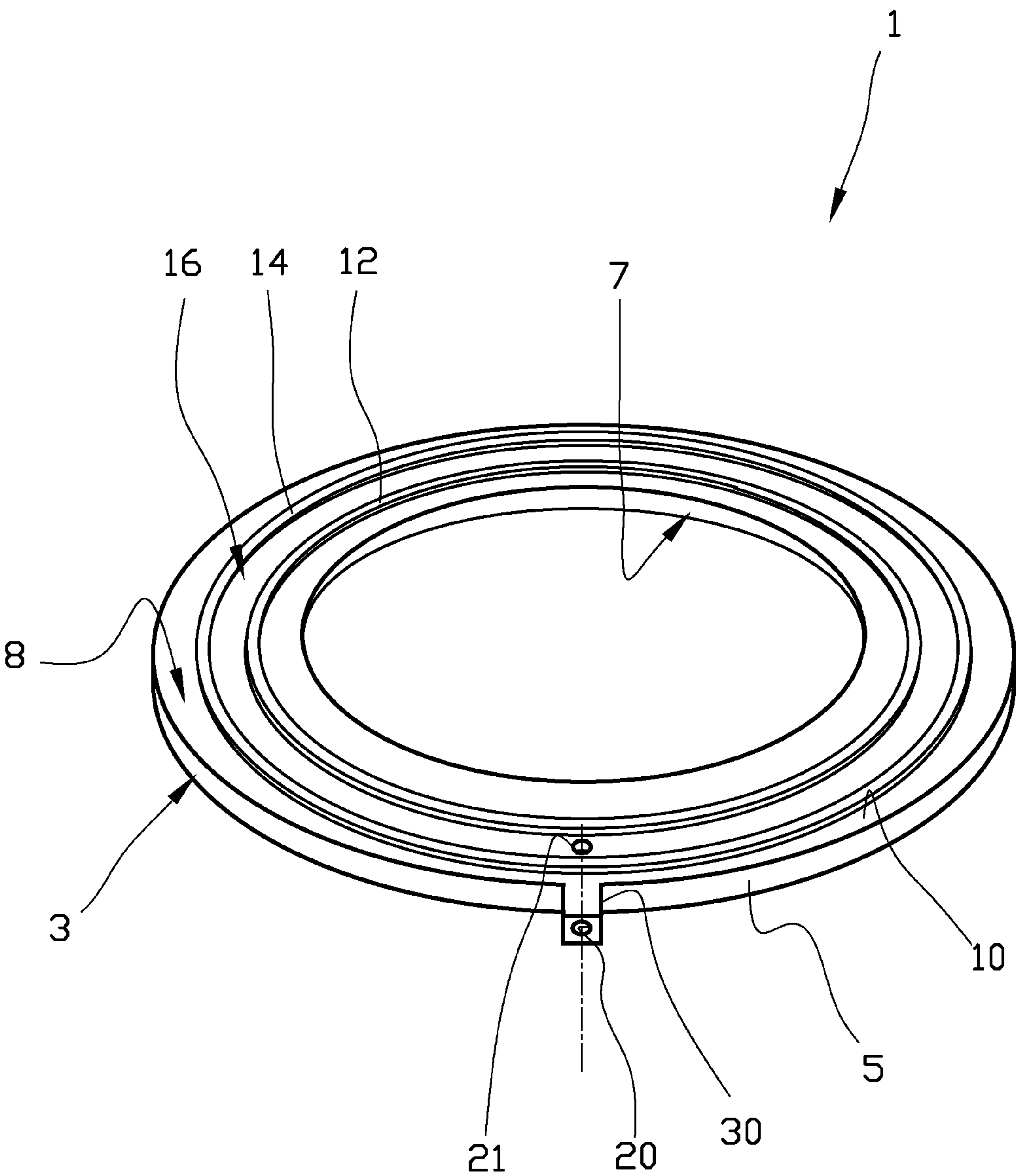


Fig. 1a

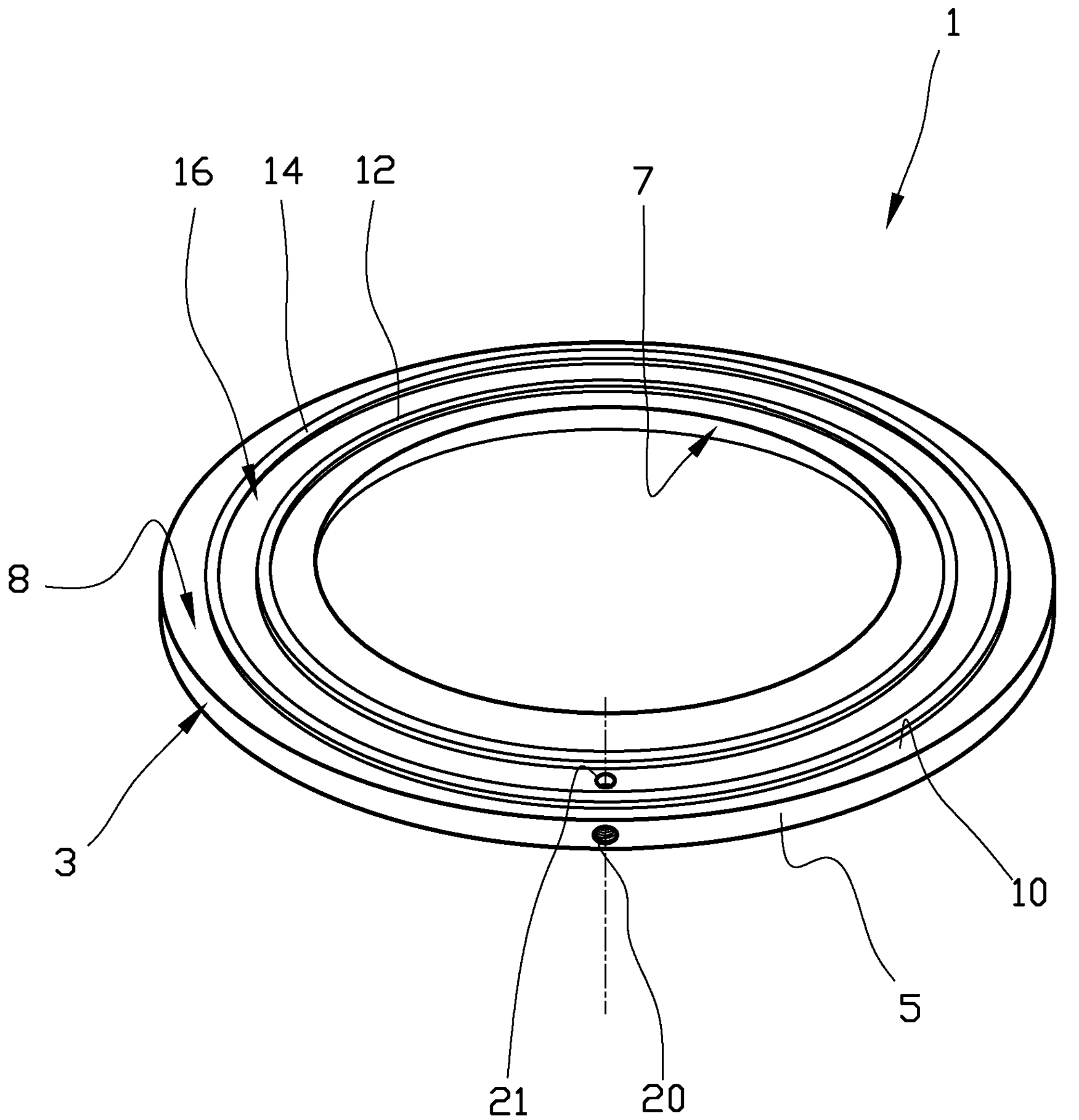


Fig. 1b

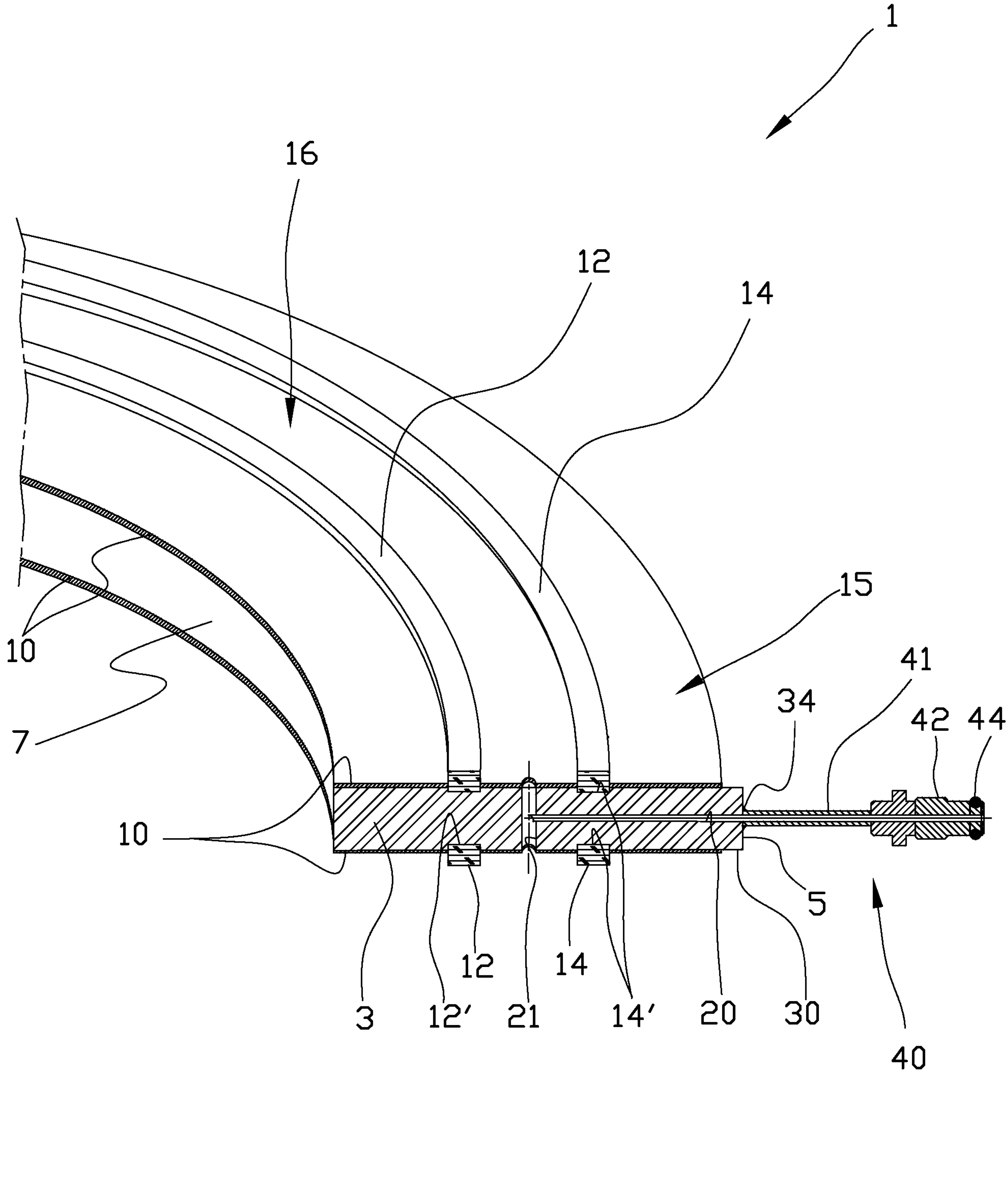


Fig. 2a

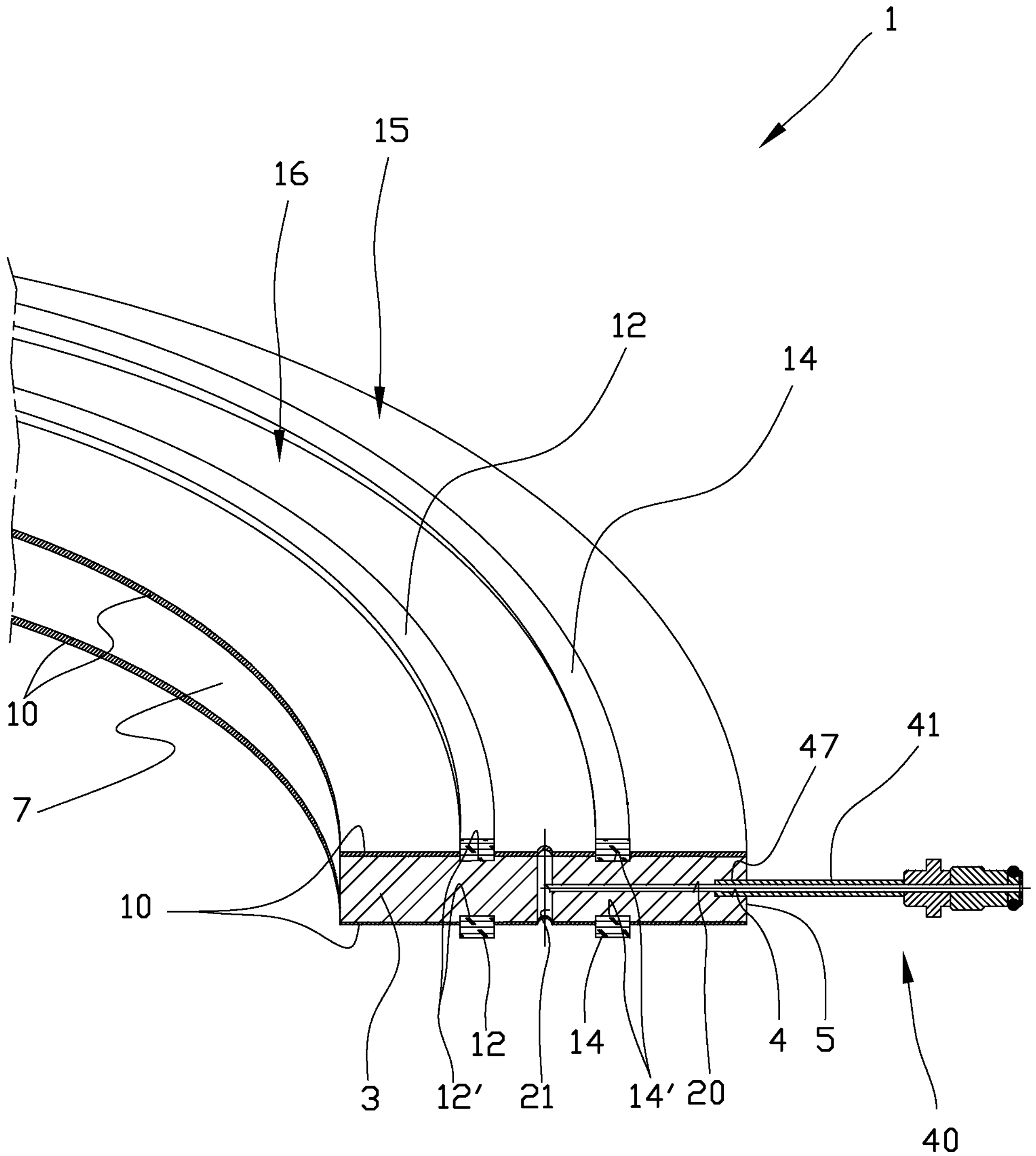


Fig. 2b

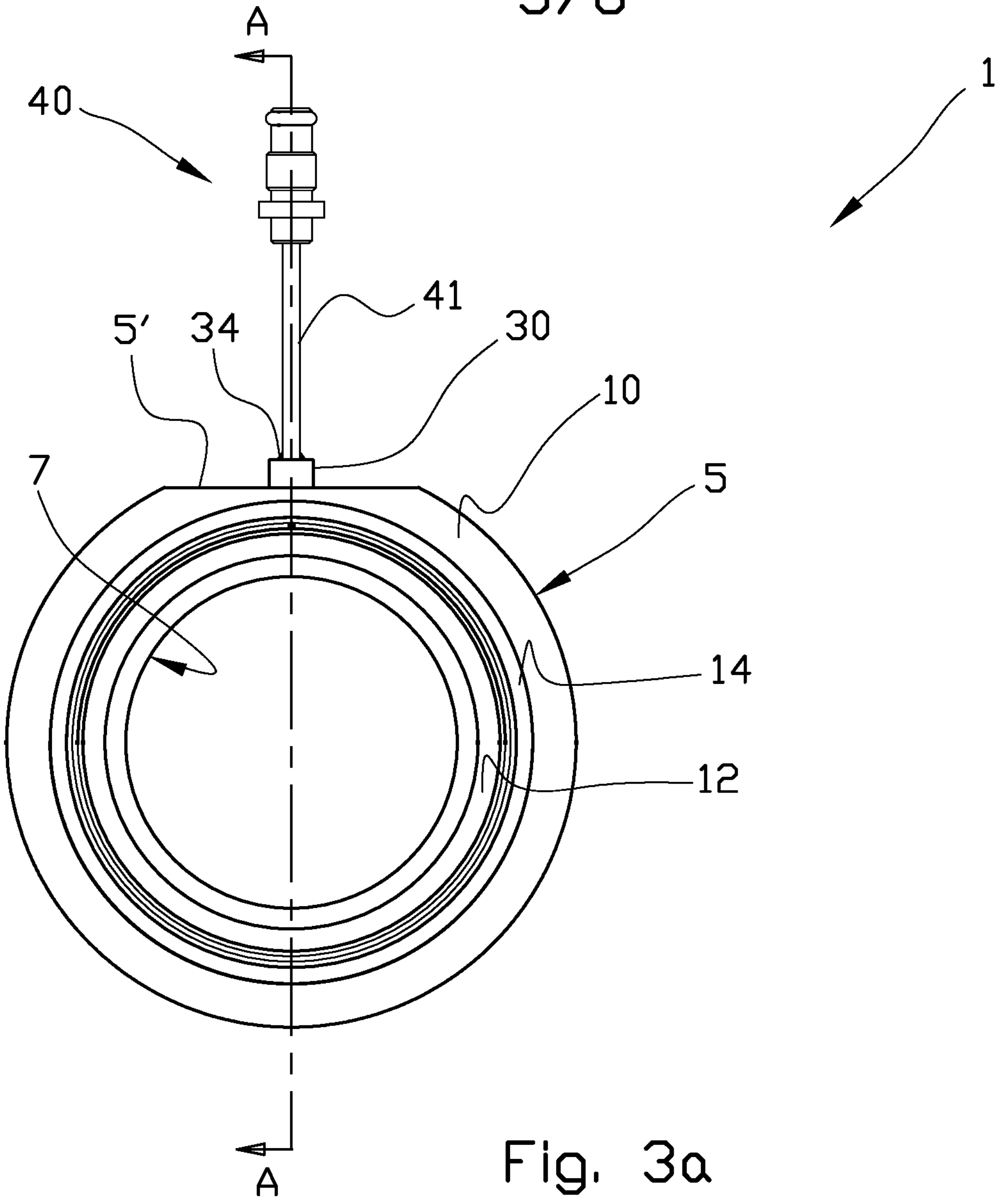

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Fig. 3a

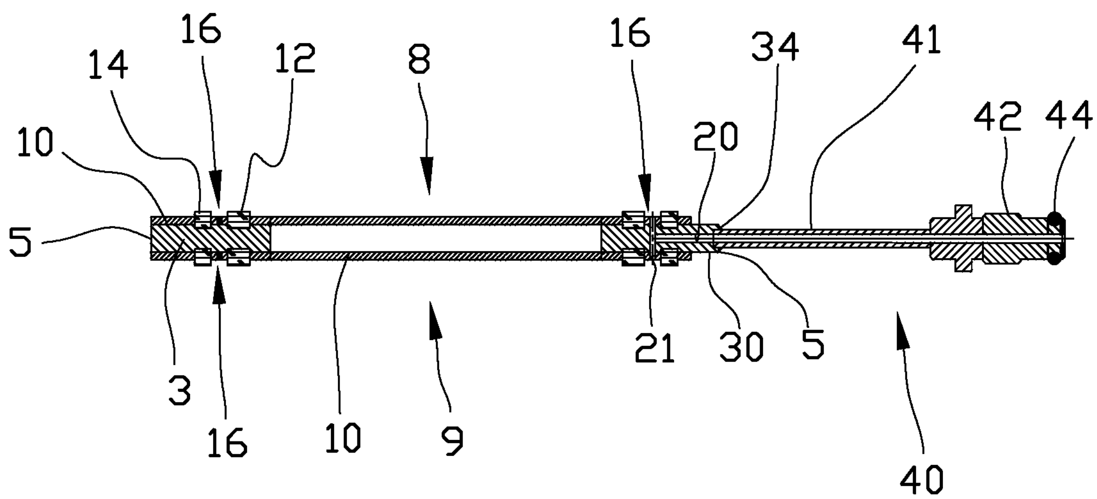
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Fig. 3b

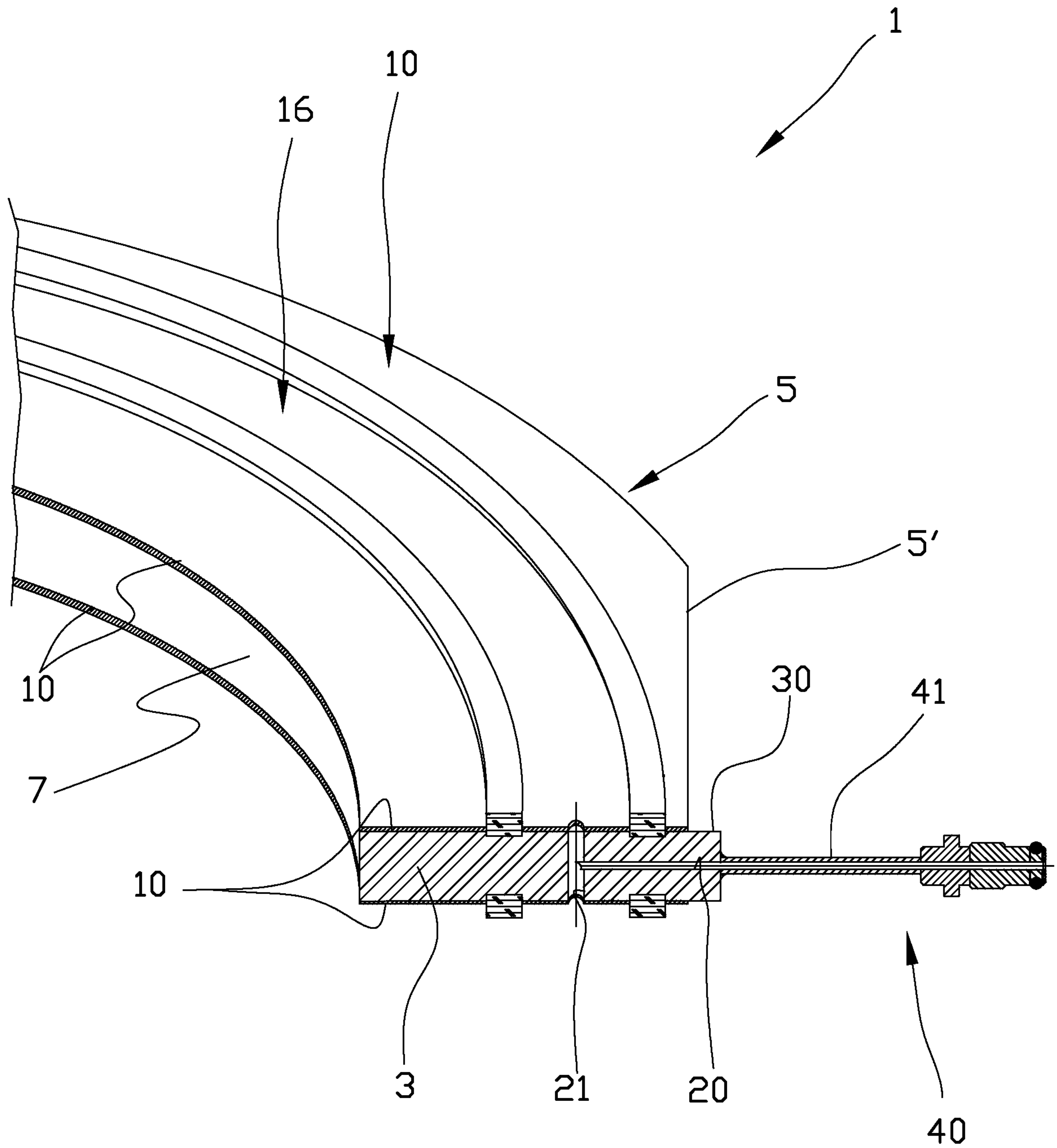

Fig. 3c