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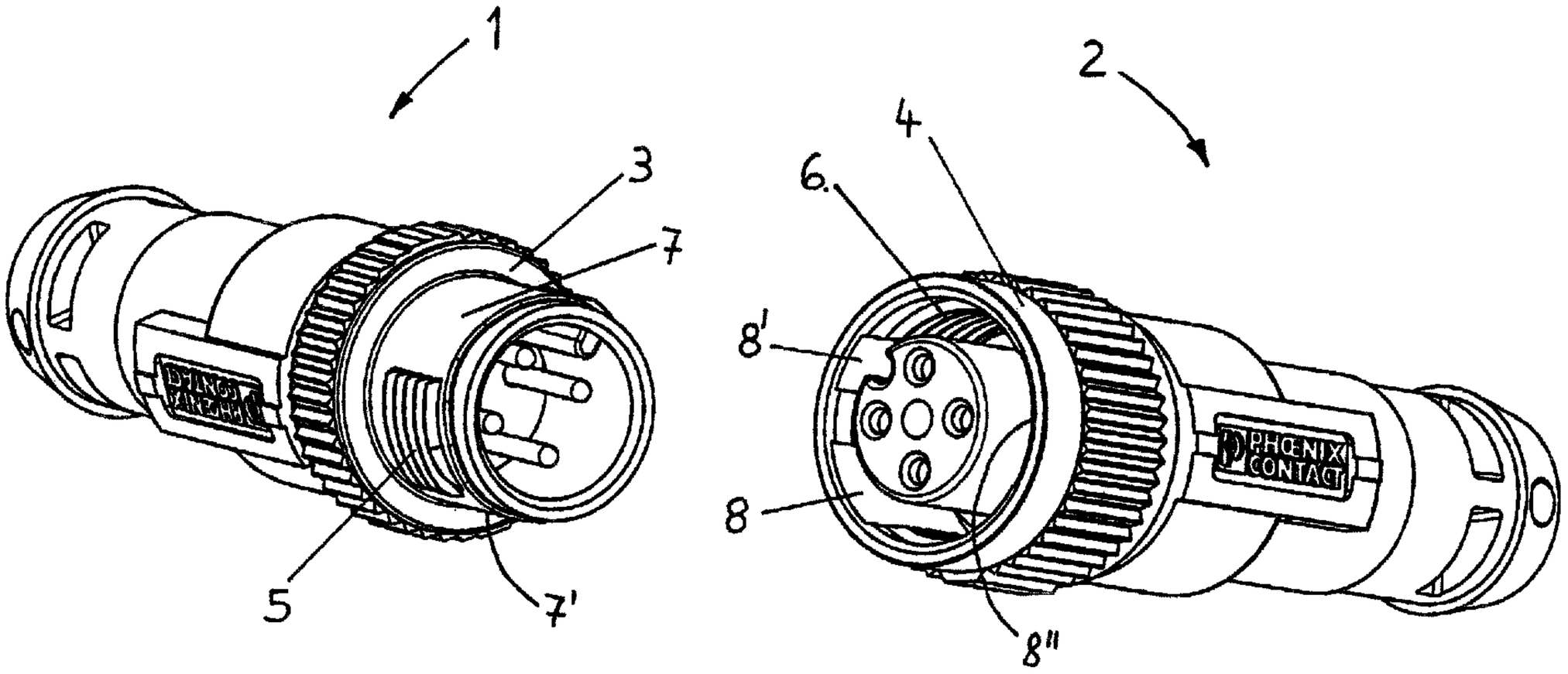

(57) Abrégé/Abstract:
The invention relates to an electrical connector having a plug part forming a threaded bushing for screwing on a coupling nut or for screwing into a fixed housing part of an electronic device, in which the outer thread of the threaded bushing has at least one threadless region provided in the plugging direction into which an inner thread of a coupling nut or of a housing corresponding to the threadless region and accordingly adapted may be almost completely inserted during assembly such that the screwed connection is able to be tightened in a half or a maximum of one revolution. The construction also allows the use of fully threaded screws and, as such, combination with standard connectors of the same commercially available size and connection type.

ABSTRACT

The invention relates to an electrical connector having a plug part forming a threaded bushing for screwing on a coupling nut or for screwing into a fixed housing part of an electronic device, in which the outer thread of the threaded bushing has at least one threadless region provided in the plugging direction into which an inner thread of a coupling nut or of a housing corresponding to the threadless region and accordingly adapted may be almost completely inserted during assembly such that the screwed connection is able to be tightened in a half or a maximum of one revolution. The construction also allows the use of fully threaded screws and, as such, combination with standard connectors of the same commercially available size and connection type.

DESCRIPTION

ELECTRICAL CONNECTOR

The present invention relates to an electrical connector having a connecting element forming a threaded bushing for screwing on a coupling nut of a mating connector that may be plugged into the electrical connector.

In connectors of such kind, it is known that the male connecting element and the female connecting element are protected against inadvertent disconnection from one another with a coupling nut. To this end, the coupling nut is typically screwed and tightened onto the opposing external thread of the connecting element until it is axially locked against the connecting element, which is often sealed axially by an O-ring or equivalent so that the screwed connection cannot become loose.

A disadvantage in these known connectors is the time required for fastening or loosening such a connector in the event of damage, when the connector must be released and the damaged part replaced quickly.

From German Patent No. DE 100 03 924 A1, it is known that a plug connector may be detachably connected to a plug socket via a bayonet fitting. For this purpose, corresponding slotted connections are provided on the outer surfaces of the guide bushings and of the plug connector's receiver and use correspondingly positioned guide pins to ensure a force fit of the connection when

the guide bushing is joined and rotated. This type of connection is not used for the axial connection of plug connectors having a small pin layout because of the mechanical stress on the guide pins and the corresponding slotted connection.

A coaxial HF plug connector is known from German Patent No. DE 30 22 102 C1 in which at least one of the plug connectors is configured as a threaded bushing having an outer thread, and in which both a screwed connector element and a connector element with bayonet fitting may be twisted on and secured with a twisting locking operation. However, in the case of this plug connector, the attaching and detaching forces that arise during manipulation when establishing and releasing the connection are not very significant because the seals are usually not present in this case so that only minimal stress is placed on the locking lugs.

An electrical connector in which the corresponding socket part may be fastened to a plug part via a coupling nut is known from German Patent No. DE 296 18 581 U1. In this context, the coupling nut is furnished with both and inner thread for engaging with a plug part having an outer thread as well as profiled cutouts for engaging with a plug part having external pins, for example, a bayonet connection. The drawback in this this case is that the external pins can withstand minimal stress in respect of the occurring attaching and detaching forces. When the screwed connection is used, quick assembly of the plug connection is not possible since the entire screwed attachment path must be traversed by the coupling nut.

An electrical connector with bayonet locking is known from European Patent No. EP 0 431 408 A2. In this case, quick assembly is achieved in that a guide groove for receiving a guide ridge has a steep pitch. However, the nearly constant steepness of the pitch does not fulfill the various requirements with regard to the force fit.

An electrical connector is known from US. Patent No. U.S. 6,099,329 in which the threaded bushing includes only two sections. Since the threaded bushing no longer has a closed cylindrical form, such a connector is unstable and does not provide a connection that is reliable in the long term. Attachment, detachment, and turning forces can easily result in damage to the sections of the threaded bushing during the plugging operation.

The industrial use of connectors provided for machines, sensors, and electronic devices distributing signals or voltage are subject to stringent requirements in terms of robustness and insulation. In this context, the use of gaskets for insulation has become the standard in harsh industrial use. In addition, in the event of machinery malfunctions and the associated replacement of failed components, sensors, or electronic devices, the connecting cables must be quickly disconnected from these devices so that the components may be removed. As a result, the currently used connectors entail significant time expenditure in loosening the respective screwed connection of the connector. The present invention differs from the related art in that it describes a robust fastening type that minimises the

current significant time expenditure and also assures the connection of standard commercial connectors.

The suggested construction is limited to exclusive use of a screw thread for this type of connector, in which the screwing operation causes a seal that is to protect the contacts from the commonly harsh environmental influences to be compressed just in front of the axial joining limit.

An electrical connector having a plug part forming a threaded bushing on which a coupling nut may be screwed or for screwing into a fixed housing part of an electronic device is therefore proposed in which the outer thread of the threaded bushing has at least one threadless region provided in the plugging direction, into which an internal thread that is provided on a coupling nut or housing and that is adapted to correspond to this threadless region may be inserted almost entirely during connection, such that the screwed connection is tightened within a half or no more than one revolution. The construction further allows the use of complete screw threads and thus also use in combination with standard plug connectors of the same commercially available size and connection type.

In the drawing:

Figure 1 shows two connectors of the type of the species having a threaded bushing with outer thread and a coupling nut with an inner thread

Figure 2 shows a threaded bushing having an outer thread present in partial regions and threadless regions between these thread regions.

Figure 3 shows a coupling nut having an inner thread present in partial regions and threadless regions between these inner thread regions

Figure 4 shows a threaded bushing screwed together with a coupling nut and having an arrangement of insulating parts accommodating contacts and flexibly sealing the contact region via an O-ring seal

Figure 5 shows a threaded bushing having an outer thread, in which the thread regions are separated by threadless regions such that the threadless region extends at an angle to the plugging and joining direction

The overall construction of connectors 1, 2 according to Figure 1 differs from that of standard commercial connector components, for a sensor or valve connection for example, only in the use of novel screwed connections in the form of a threaded bushing 3 and a coupling nut 4. The outer contours of screwed connection parts 3 and 4 are compatible with commercially available connectors of this type. Compatibility is also a requirement, so that standard commercial connectors and connectors 1, 2 according to Figure 1 having the features of a quick connection may

be able to be combined with one another without disadvantage.

Accordinngly, an outer thread is provided on threaded bushing 3 according to Figure 1 but is only present in partial regions 5 of the periphery of threaded bushing 3. Positioning these thread regions 5 yields threadless regions 7, 7', that are able to receive an inner thread region 6 of a coupling nut. On the other hand, threaded plug part 2 has a coupling nut 4, which is furnished with an inner thread 6 and which has threadless regions 8, 8', 8" opposite the joining position, and regions with a thread 6.

Figure 2 is a perspective representation of this threaded bushing 3 with the knurl required for handling in order to twist threaded bushing 3, and from which the regions having threads 5, 5', 5" and their arrangement are evident. Although Figure 2 shows an asymmetrical distribution of thread regions 5, 5', 5" on the periphery of threaded bushing 3, a symmetrical arrangement is also possible in a simpler form. However, the asymmetrical arrangement has the advantage that joining is only possible in one position during turning, which is advantageous for fastening connector 1 when a seal 14 according to Figure 4 and having high flexibility is used so that a greater twisting angle of threaded bushing 3 of almost a complete revolution the is necessary due to the thread pitch.

In Figure 3, correspondingly with threaded bushing 3, coupling nut 4 is furnished with internal threadless region 8, 8', 8" in the areas opposite thereto when the

two parts are connected. In this way, radially protruding thread regions 5, 5', 5" of threaded bushing 3, which are adjusted in their peripheral expansion to the free regions of coupling nut 4, engage with one another until seal 14 prevents further telescoping in joining direction X-X according to Figure 4. With a symmetrical arrangement of thread pieces 5, 5', 5", 6, 6', 6" on the periphery of both components, threadless regions 7, 7', 7", 8, 8', 8" are arranged in the same peripheral position and size on the respective mating counterpart so that the largest possible area of the bearing thread is covered. In particular, for simple locating of the joining position of the pin layout by turning in the peripheral direction, outer markings 17, 18 are supplied on the knurl outer side, such that when the positions of these two markings coincide, advantageously producing a striking visual point by colour coding or, as shown in Figures 2 and 3, by a surface without knurling, the insertion of threaded bushing 3 and coupling nut 4 into one another is facilitated.

Figure 4 shows the arrangement in which threaded bushing 3 and coupling nut 4 are screwed together. In this case, a ring-shaped seal 14, which is configured as a commercially available O-ring, is compressed between the components and their axially aligned seating surfaces 13 and 15 on the two connectors 1 and 2 in joining direction Y so that the contacts positioned in isolation in the connector are protected from often adverse environmental influences.

An advantageous embodiment of the alignment of the threadless regions is shown in Figure 5. The alignment of the threadless region on the surface of threaded bushing 3 and correspondingly on coupling nut 4 already allows the respective screwed component to be turned easily during handling. At the same time, the overall alignment of threadless region 7, 7', 7" on threaded bushing 3, or correspondingly of threadless region 8, 8', 8" on coupling nut 4, is arranged at an angle alpha that is equal for both components so that thread regions 5, 5', 5", 6, 6', 6", corresponding to these threadless regions, must be positioned at the same angle. In this case, it is important for the position of these regions to also correspond in the peripheral direction.

Of course, the thread before and after a threadless region 7, 7', 7" lies in a groove required for the mating thread so that it is possible for coupling nut 4 to be screwed on. As a result, commercially available connectors 1, 2 having a complete thread may also be used for both plug types. When combining connectors having differing pin layouts, for example a symmetrical arrangement of the threadless regions or an asymmetrical arrangement of these regions, these connectors act with respect to another connector in the same way as commercially available connectors having a complete thread, in which the screwed parts may be fastened to one another in the conventional, time-intensive manner.

In a further embodiment (not shown), a fixed housing part of a device having a thread receiving part adapted

according to the coupling nut is conceivable instead of a threaded plug part 2 having a coupling nut 4. If the design of the inner thread of a device connection is adapted to the requirements of inner thread 6, 6', 6" of coupling nut 4 according to the present invention, the time-intensive manipulation associated with fastening connector 1 is minimiszed also in direct device connection.

LEGEND

1 Plug part with threaded bushing
2 Threaded plug part with coupling nut
3 Threaded bushing
4 Coupling nut
5 Outer thread
6 Inner thread
7 Threadless region on threaded bushing
8 Threadless region on the coupling nut
9 Thread chamfer in screwing-on direction of the threaded bushing
10 Thread chamfer in screwing-on direction on the coupling nut
11 Sharp-edged thread end of the threaded bushing
12 Sharp-edged thread end in the coupling nut
13 End face of the threaded bushing
14 Sealing ring
15 Axial seating surface of the coupling nut
16 Angled course of the threadless region on the threaded bushing
17 Outer marking on the knurl of the threaded bushing
18 Outer marking on the knurl of the coupling nut

CLAIMS:

1. An electrical connector comprising:

a plug part including a threaded bushing, the threaded bushing including an outer thread having a plurality of threadless areas; and

a threaded plug part connectable to the plug part and including a coupling nut, the coupling nut including an inner thread configured for threaded engagement with the outer thread of the plug part;

wherein the inner thread of the coupling nut is configured to be received by the at least one threadless area and tightened onto the outer thread; and

the inner thread includes a plurality of threaded areas matching the threadless areas.

2. The electrical connector as claimed in claim 1 wherein the threadless areas and the matching threaded areas are disposed at a respective same angle relative to a respective axial connector axis of the plug part and the threaded plug part.

3. The electrical connector as claimed in claim 1 or claim 2 wherein the threaded areas are disposed in an even distribution at a circumference of the threaded bushing.

4. The electrical connector as claimed in claim 1 or claim 2 wherein the threadless areas and the matching threaded areas are disposed in an uneven distribution at a respective circumference of the threaded bushing and the coupling nut.

5. The electrical connector as claimed in claim 3 or claim 4 wherein the threadless areas and the matching threaded areas have a respective different length in a circumferential direction so that a full revolution is required for disengaging a connection of the plug part and threaded plug part.

6. An electrical connector comprising:

a plug part with threaded bushing, the threaded bushing including an outer thread having at least one threadless area; and

a threaded plug part connectable to the plug part and including a coupling nut, the coupling nut including an inner thread configured for threaded engagement with the outer thread of the plug part;

wherein the inner thread of the coupling nut is configured to be received by the at least one threadless area and tightened onto the outer thread;

the outer thread includes a respective individual first thread on each side of the at least one threadless area, the individual first threads being aligned with each other;

the inner thread includes respective individual second threads; and

the individual first and second threads each have a respective chamfer at a start of the respective thread so as to enable an easier insertion of a counterthread area when tightening the inner thread onto the outer thread.

7. An electrical connector comprising:

a plug part with threaded bushing, the threaded bushing including an outer thread having at least one threadless area; and

a threaded plug part connectable to the plug part and including a coupling nut, the coupling nut including an inner thread configured for threaded engagement with the outer thread of the plug part;

wherein the inner thread of the coupling nut is configured to be received by the at least one threadless area and tightened onto the outer thread;

the outer thread includes a respective individual first thread on each side of the at least one threadless area, the individual first threads being aligned with each other;

the inner thread includes respective individual second threads; and

the individual first and second threads each include a respective sharp edge at an end of the respective thread so as to prevent turning past a tangential removal position when unscrewing the inner thread from the outer thread.

8. The electrical connector as claimed in claim 7 wherein the plug part and the threaded plug part are configured so that an O-ring seal disposed between the plug part and the threaded plug part causes at least one of the plug part and the threaded plug part to be lifted slightly out of a respective flight of the internal or outer thread so as to prevent a turning of the internal or the outer thread past a tangential removal position.

9. An electrical connector comprising:

a plug part including a threaded sleeve, the threaded sleeve including an outer thread without a threadless area; and

a threaded plug part connectable to the plug part and including a coupling nut, the coupling nut including an inner thread configured for threaded engagement with the outer thread of the plug part, the inner thread having at least one threadless area.

10. An electrical connector comprising:

a plug part with threaded bushing, the threaded bushing including an outer thread having a plurality of threadless areas; and

a threaded plug part disposed in a stationary housing component and connectable to the plug part, the threaded plug part including an inner thread configured for threaded engagement with the outer thread of the plug part;

wherein the inner thread of the threaded plug part includes a plurality of threaded areas matching and configured to receive the threadless areas for tightening the outer thread onto the inner thread.

11. The electrical connector as claimed in claim 10 wherein the threadless areas and the matching threaded areas are disposed at a respective same angle relative to a respective axial connector axis of the plug part and the threaded plug part.

12. An electrical connector comprising:

a plug part with threaded bushing, the threaded bushing including an outer thread having at least one threadless area; and a threaded plug part connectable to the plug part and including a coupling nut, the coupling nut including an inner thread configured for threaded engagement with the outer thread of the plug part;

wherein the inner thread of the coupling nut includes at least one threaded area matching the at least one threadless area and configured to be received by the at least one threadless area and tightened onto the outer thread.

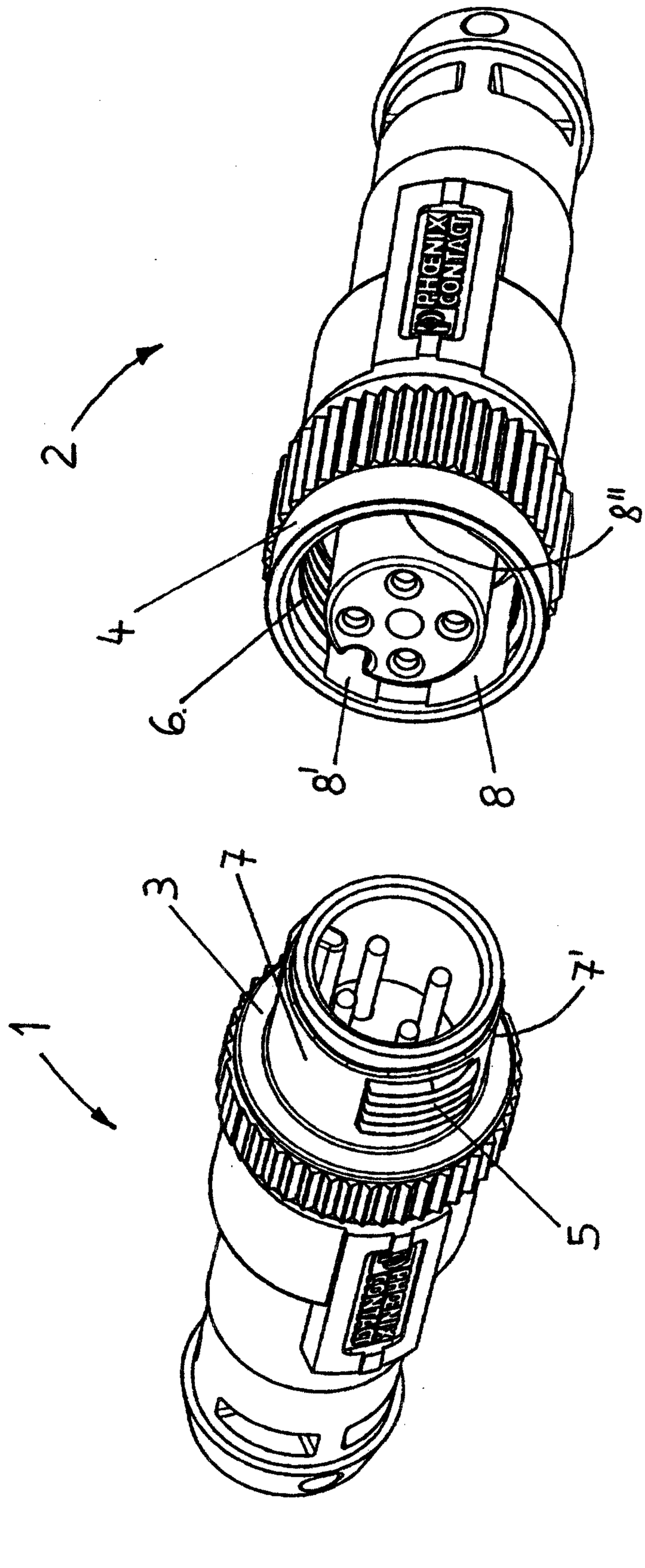

Fig. 1

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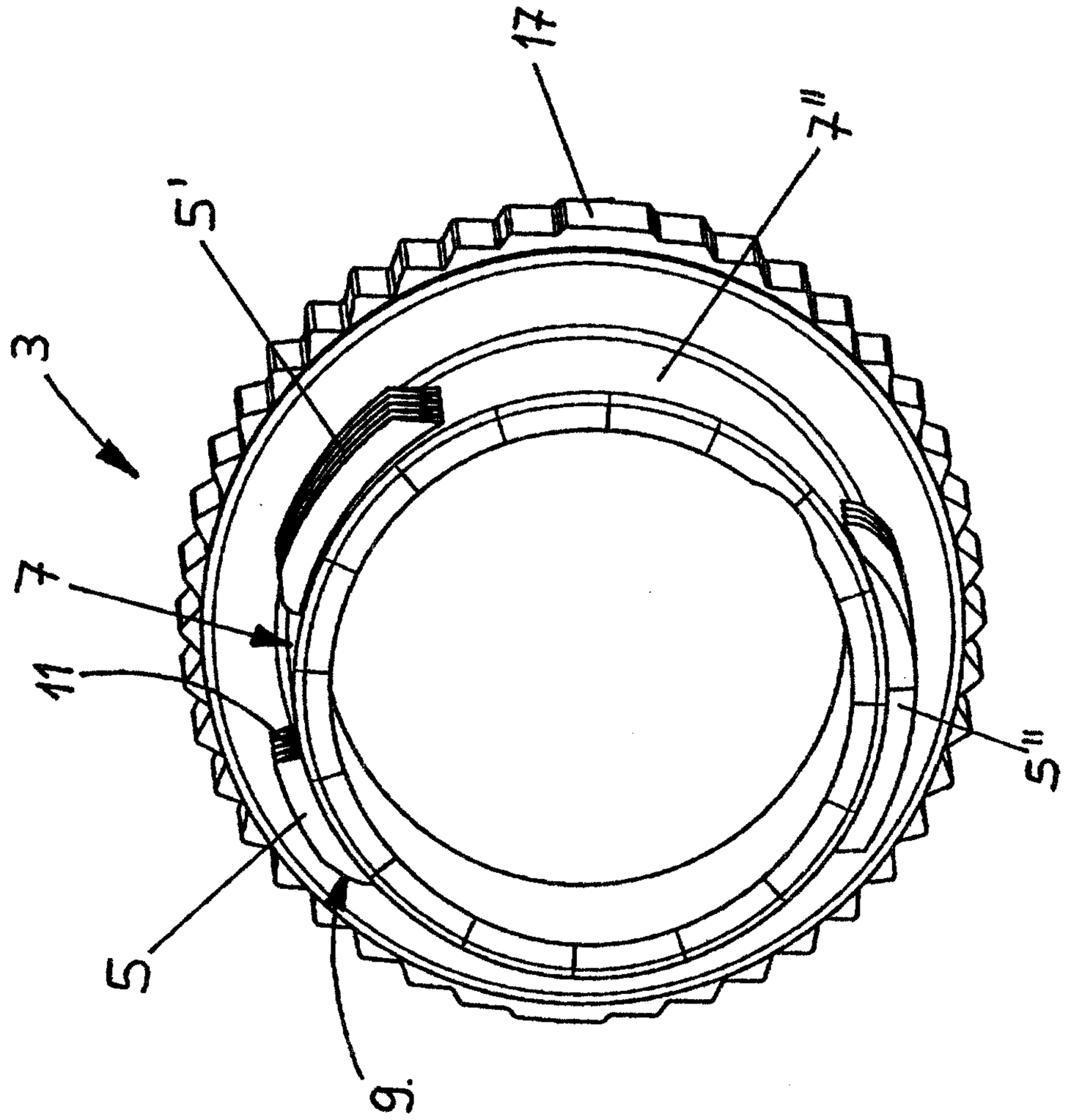

Fig.2

Fig.3

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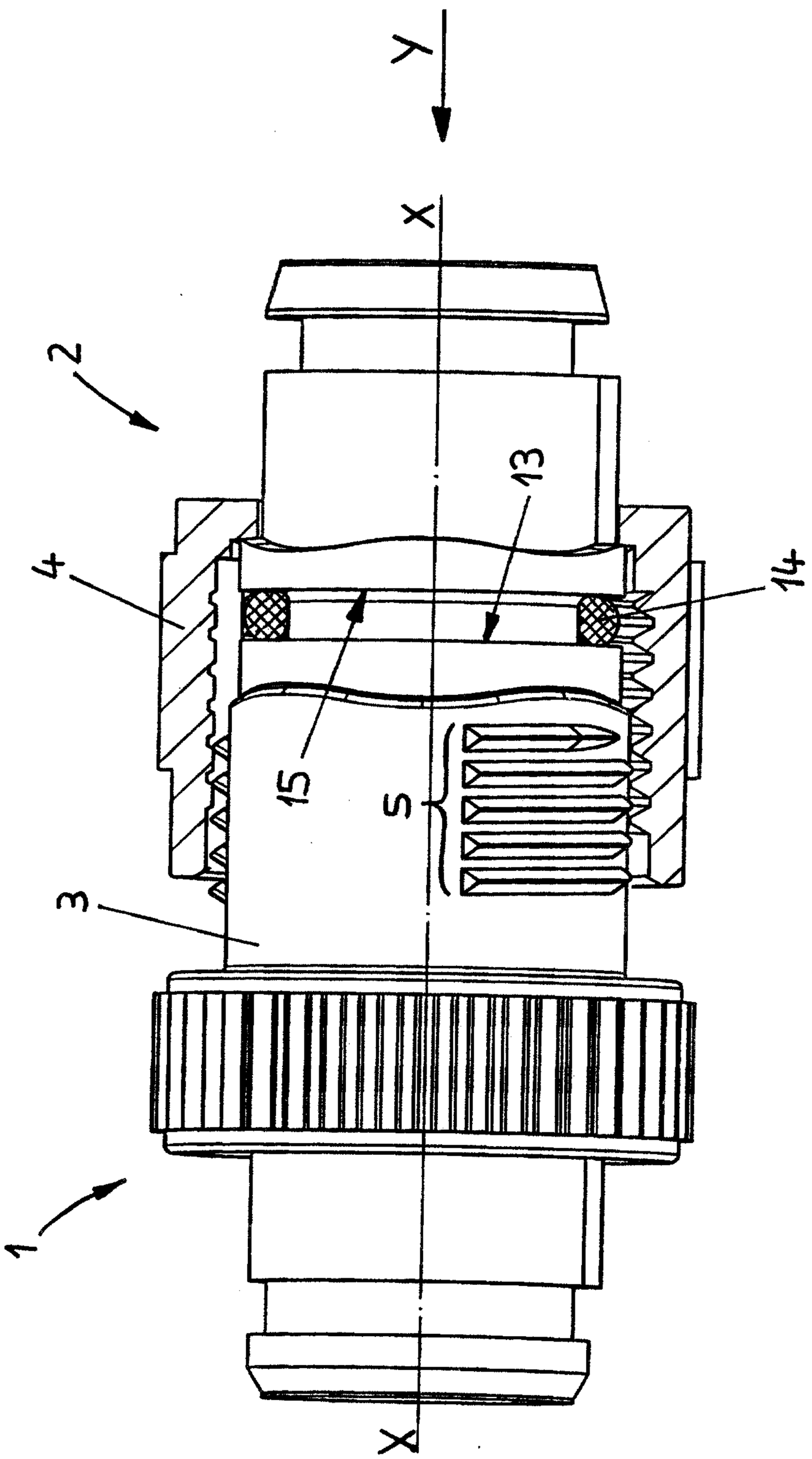


Fig. 4

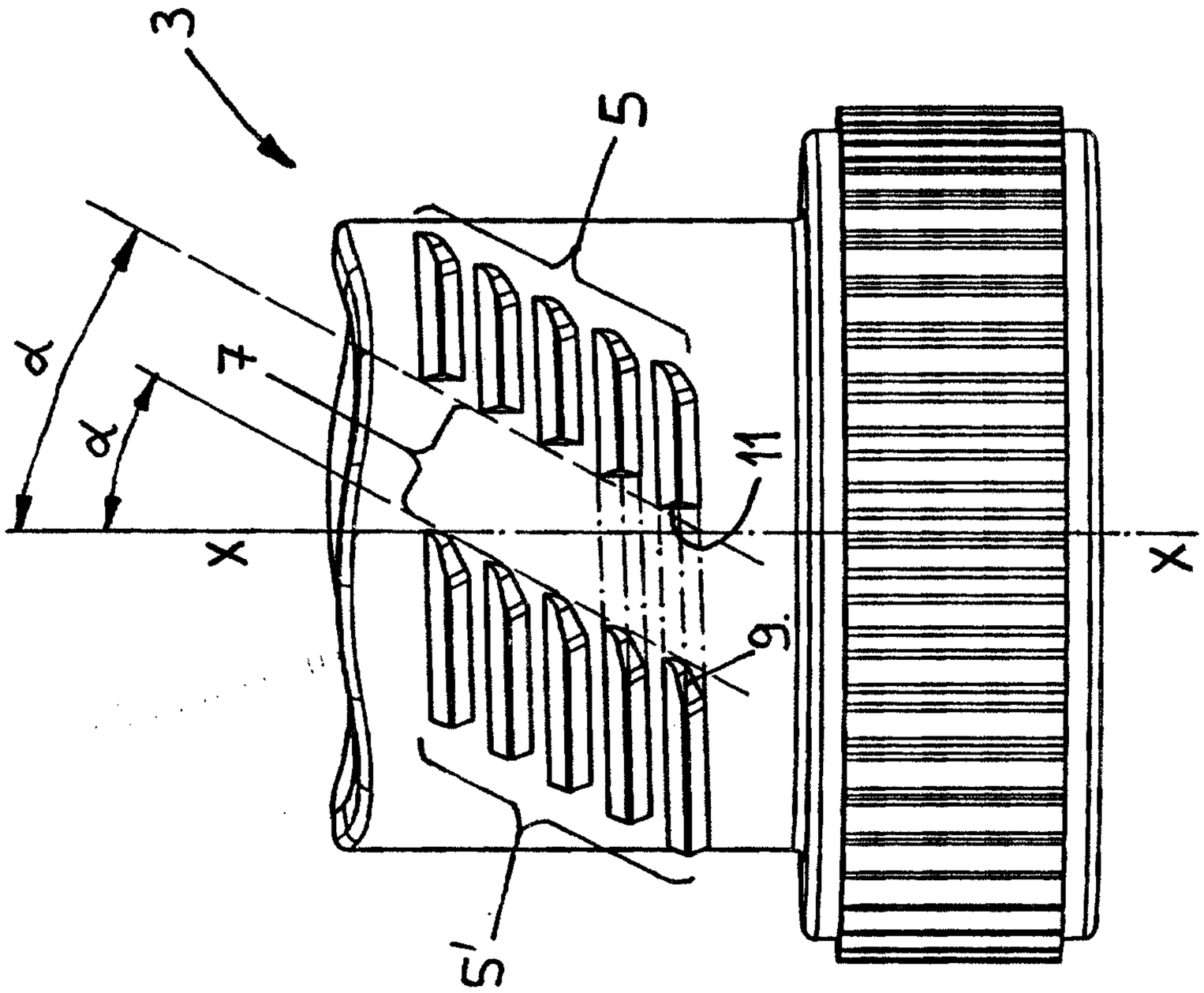
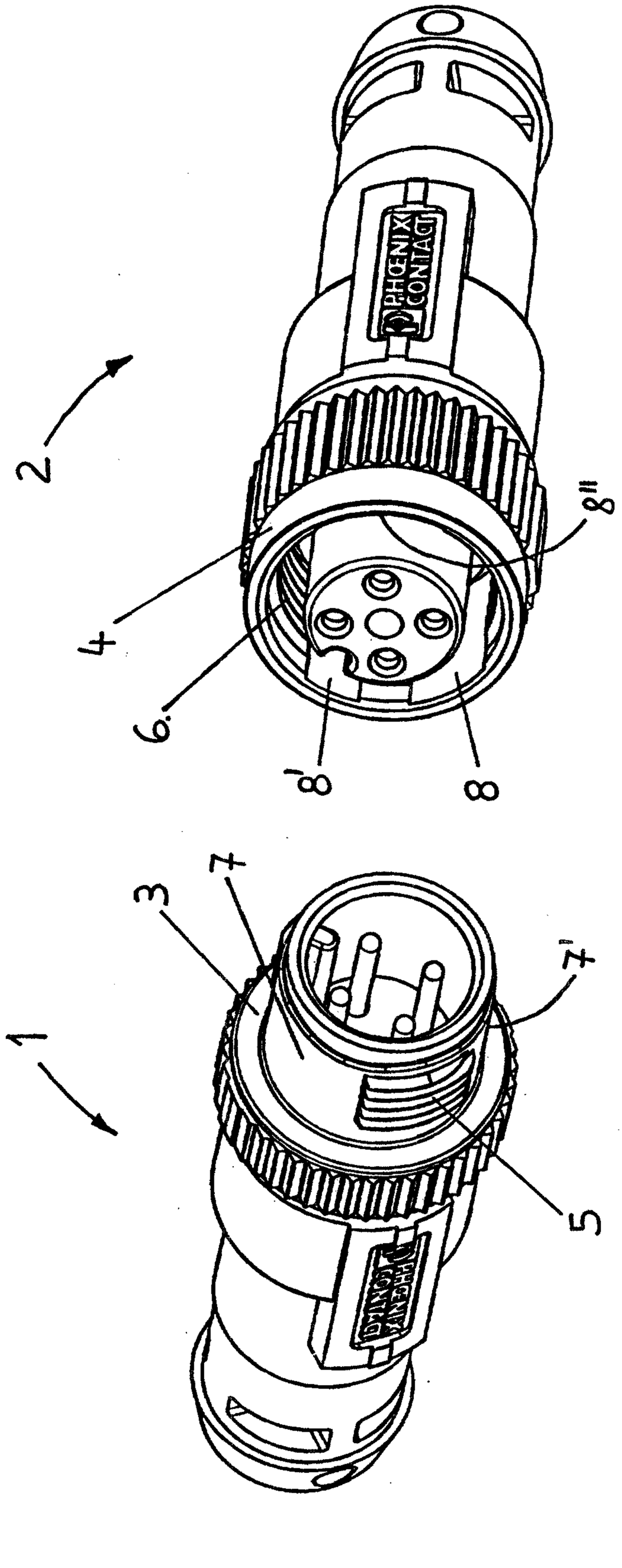


Fig. 5



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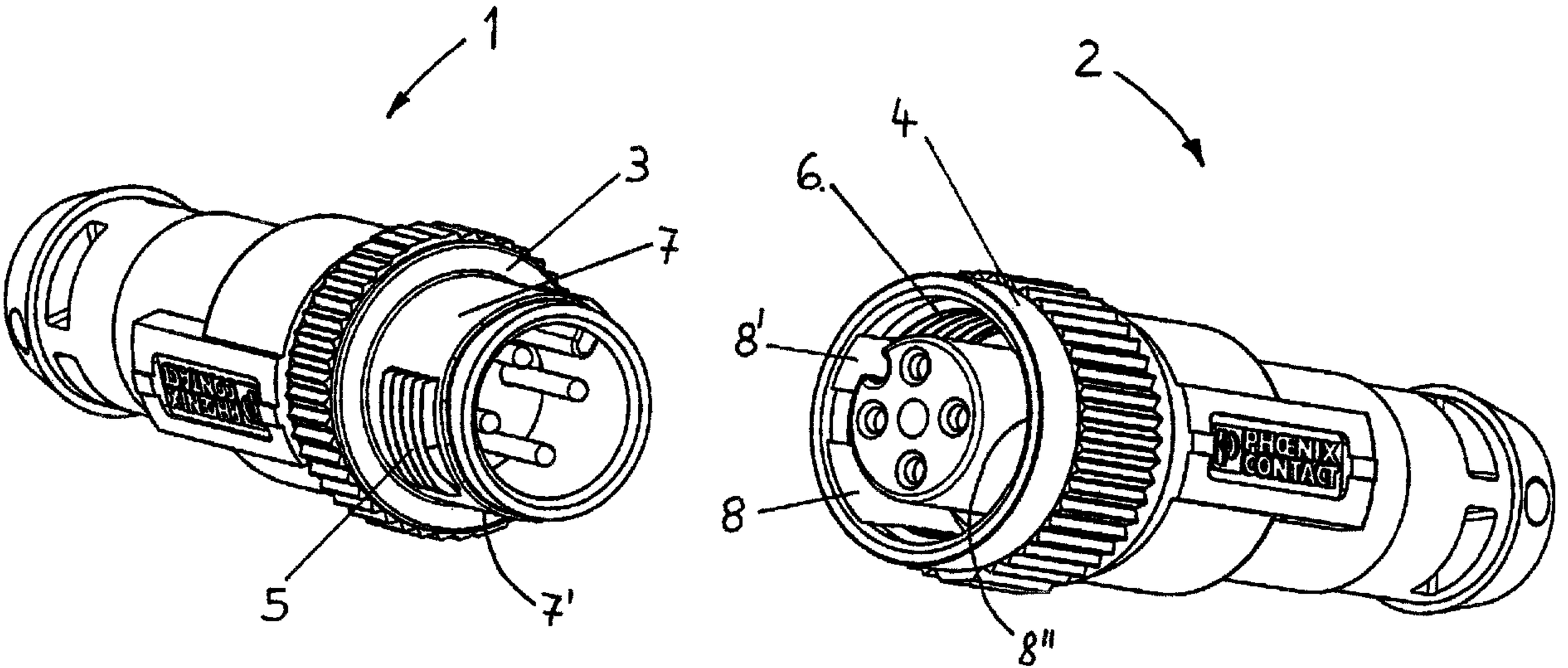
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