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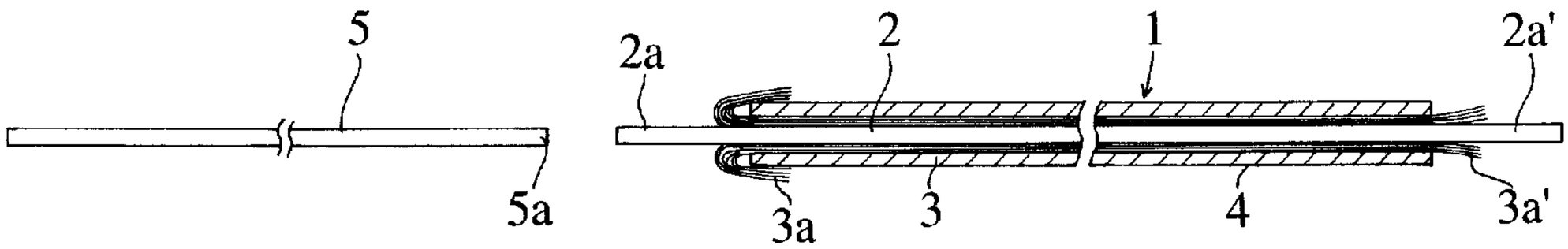
(54) **Titre : METHODE DE PRODUCTION D'UNE FIBRE OPTIQUE ET D'UN FAISCEAU DE FIBRES OPTIQUES**
(54) **Title: METHOD FOR PRODUCING AN OPTICAL FIBER AND AN OPTICAL FIBER BUNDLE**



(57) **Abrégé/Abstract**:
A method for producing an optical fiber, or an optical fiber bundle, comprising the steps of placing a replaceable line at the center, arranging resilient fibers around its periphery, and covering the assembly with a jacket to produce a dummy fiber; exposing, at both ends of the dummy fiber, the ends of replaceable line and of resilient fibers from the ends of jacket; connecting one exposed end of replaceable line with an optical fiber core line or a unit core line of an optical fiber bundle; and replacing the replaceable line in the dummy fiber with the optical core line or unit core line. The method has the advantage that it can be used with both small and large diameter optical fibers.

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ABSTRACT OF THE DISCLOSURE

A method for producing an optical fiber, or an optical fiber bundle, comprising the steps of placing a replaceable line at the center, arranging resilient fibers around its periphery, and covering the assembly with a jacket to produce a dummy fiber; exposing, at both ends of the dummy fiber, the ends of replaceable line and of resilient fibers from the ends of jacket; connecting one exposed end of replaceable line with an optical fiber core line or a unit core line of an optical fiber bundle; and replacing the replaceable line in the dummy fiber with the optical core line or unit core line. The method has the advantage that it can be used with both small and large diameter optical fibers.

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METHOD FOR PRODUCING AN OPTICAL FIBER AND AN OPTICAL FIBER BUNDLE

Field of the Invention

This invention relates to a method for producing an optical fiber cord or an optical fiber bundle, particularly to a method for producing a small-bore optical fiber or an optical fiber bundle useful for the manufacture of a highly dense, optics-related apparatus and its components.

Background of the Invention

Conventionally, an optical fiber is obtained by applying a resin coat over an optical fiber element line to turn it into an optical fiber core line, and then applying around the periphery of the optical fiber core line a protective vapour coat with resilient fibers such as aramid fiber, glass fiber, copper wire, PBO fiber, etc., inserted in between.

The optical fiber having the constitution as described above is produced as follows.

Firstly, a nylon tube (a) having a bore of a desired size is prepared as shown in FIG. 3(A), and resilient fibers (b) as described above are arranged longitudinally around the periphery of the nylon tube (a). Next, the nylon tube (a) having the resilient fibers (b) arranged around its periphery is inserted into a tubular PVC cover (c) as shown in FIG. 3(B). Then, an optical fiber element line (d) is inserted into the nylon tube (a) to produce thereby an optical fiber core line (e) as shown in FIG. 3(C), and the whole assembly is made into an optical fiber cord A.

However, with the conventional method, all procedures necessary for the production of an optical fiber are practised manually. Therefore, while it is comparatively easy to produce an optical fiber having a large bore size, production of a small bore fiber requires extra labor and time for completion because then it is often difficult to pass a nylon tube with resilient fibers arranged longitudinally around its periphery smoothly through a tubular protective vapour coat cover having a comparatively small size. Accordingly, development of a method whereby it is possible to efficiently produce a small-bore optical fiber or small-bore optical fiber bundle is urgently demanded, because nowadays optics-related apparatuses and their components are increasingly more compact and densely packed.

Summary of the Invention

This invention seeks to provide a method for producing an optical fiber, or an optical fiber bundle, which consists of preparing a dummy fiber incorporating a replaceable line and resilient fibers, connecting the replaceable line of the dummy fiber to an optical fiber core line, and replacing the replaceable line with the optical fiber core line, thereby making it possible to efficiently produce an optical fiber or optical fiber bundle whether their bore is large or small, without significant degradation of the quality of the product.

The method according to this invention for producing an optical fiber or an optical fiber bundle comprises:

- placing a replaceable line at the center, and covering it with a jacket with resilient fibers disposed around its periphery inserted in between, to produce a dummy fiber;

- exposing, at both ends of the dummy fiber, the ends of the replaceable line and the resilient fibers from the ends of the jacket;

- connecting one exposed end of the replaceable line with an optical fiber core line or with a unit core line of the optical fiber bundle; and

- replacing the replaceable line in the dummy fiber with the optical core line or with the unit core line.

Brief Description of the Drawings

The invention will now be described with reference to the drawings in which:

FIGS. 1(A), 1(B), 1(C) and 1(D) are the longitudinal sections of an optical fiber to illustrate the production processes observed for a first embodiment of this invention;

FIGS. 2(A), 2(B), 2(C) and 2(D) are the longitudinal sections of an optical fiber bundle to illustrate the production processes observed for a second embodiment of this invention; and

FIG. 3 shows the cross-sections of an optical fiber to illustrate the production processes of a conventional method.

Detailed Description of the Drawings

In Figure 1, a dummy fiber 1 is configured as follows: a replaceable line 2 is placed at the center; the replaceable line 2 has resilient fibers 3 arranged around its periphery; and the whole assembly is covered with a jacket 4. The replaceable line 2 may be made of any material such as an optical fiber core line, electroconductive wire, piano wire, copper wire, nylon thread, vinyl on thread, etc., as long as it is sufficiently resilient and has a smooth surface.

The resilient fibers 3 are preferably made of light fibers having a diameter of 20-50 pm such as aramid fiber, glass fiber, copper wire, PBO fiber, etc., but may be made of fibers other than above. The jacket 4 is preferably made of a thermoplastic resins, thermosetting resin, UV hardening resin, etc. which is used for the outer covering of a conventional optical fiber.

An equal length of jacket 4 is removed from each end of the dummy fiber 1; a considerably long end of replaceable line 2 with resilient fibers 3 disposed around it is exposed from each cut end of jacket 4; and the ends 2a and 2a' of replaceable line 2 and the ends 3a and 3a' of resilient fibers 3 each having specified lengths with respect to the cut ends of jacket 4 are prepared on both ends of dummy fiber 1.

An optical fiber core line is shown in Figure 1. The optical fiber core line 5 has a diameter substantially the same as that of the replaceable line 2 within dummy fiber 1.

One end 5a of optical fiber core line 5 is placed opposite to one end 2a of the replaceable line 2 of dummy fiber 1 as shown in Fig. 1(A); the two ends 2a and 5a are connected by fusion as shown in Fig. 1(B); and the opposite end 2a' of replaceable line 2 is pulled towards the direction indicated by the arrow of the figure. Then, the replaceable line 2 slides through the interior of jacket 4 until it is expelled out of jacket 4; at this moment the optical fiber core line 5 has been inserted into jacket 4 to replace the replaceable line 2 as shown in Fig. 1(C). The end 5a of optical fiber core line 5 is separated from the replaceable line 2 by cutting; and then an optical fiber A is obtained as shown in Fig. 1(D).

The fusion-connected section between the end 2a of replaceable line 2 and the end 5a of optical fiber core line 5 is represented by a numeral 6 in Fig. 1(B). The connection may be achieved by adhesion based on an instantaneous adhesive instead of fusion. When the replaceable line 2 is completely replaced with the optical fiber core line 5, the replaceable line 2 is preferably cut off close to the connection section towards the cut-end of jacket 4 as shown in Fig. 1(C). The ends 3a of resilient fibers 3 are preferably folded back towards the cut-end of jacket 4 as shown in the figures, to facilitate the replacement of replaceable line 2 with optical fiber core line 5.

Next, the production processes of an optical fiber tape in another embodiment as shown in Fig. 2 will be described.

The fibers 1 in Fig. 2 represent dummy fibers. Each of these dummy fibers 1 has the same configuration as the dummy fiber of Fig. 1: a replaceable line 2 is placed at the center; the replaceable line 2 has resilient fibers 3 arranged around its periphery; and the whole assembly is covered with a jacket 4.

In this embodiment, however, a plurality of dummy fibers 1 (four in this particular embodiment) are prepared as desired to form an optical fiber bundle.

In Fig. 2 an optical fiber bundle is divided midway into individual unit core lines 8 (four in this particular embodiment). The unit core line 8 has an external diameter substantially the same as that of a replaceable line 2 passing through a dummy fiber 1. The numeral 9 in the figures represents the division section of the optical fiber bundle 7, while the numeral 10 represents a sheath movably placed over the optical fiber bundle 7.

One end 2a of each replaceable line 2 passing through the dummy fiber 1 is placed opposite to an end 8a of each unit core line 8 constituting the optical fiber bundle 7 as shown in Fig. 2(A); and the two ends 2a and 8a are connected by fusion as shown in Fig. 2(B). This operation is repeated for all the pairs of replaceable lines 2 and unit core lines 8. The opposite ends 2a' of the thus connected replaceable lines 2 are pulled towards the direction as shown by the arrow in the figure; and the replaceable lines 2 slide through jackets 4 until they are expelled out of the jackets 4. At this instant, the

replaceable lines 2 previously in the jackets 4 have been completely replaced with the connected unit core lines 8. The ends 8a of unit core lines 8 are separated by cutting; and then an optical fiber bundle B is obtained as shown in Fig. 2(D).

The fusion-connected sections between the ends 2a of replaceable lines 2 and the ends 8a of unit core lines 8 are represented by numerals 11 in the figures. The connection may be achieved by adhesion based on an instantaneous adhesive instead of fusion as in the above embodiment. When the replaceable lines 2 are completely replaced with the unit core lines 8, the former are preferably cut close to the connection sections towards the cut-ends of jackets 4 as shown in Fig. 2(C) similarly to the first embodiment. The ends 3a of resilient fibers 3 are preferably folded back towards the cut-ends of jackets 4 as shown in the figures, similarly to the first embodiment.

Then, the sheath 10 placed over the optical fiber bundle 7 is moved to the division section 9 such that it contains, in an extra cavity, the folded-back ends 3a of resilient fibers 3 which are then fixed in that cavity with a bonding agent (not shown). The fixation may be achieved by a mechanical means such as clamping, pressure bonding, etc., instead of bonding based on a bonding agent.

The method of this invention is put into practice as described above. Briefly, a dummy fiber containing a replaceable line at its center with resilient fibers around the dummy fiber is prepared; the replaceable line of dummy fiber is connected with an optical fiber core line, or with

a unit core line of an optical fiber bundle; and the end of replaceable line opposite to the connected end thereof is pulled until the replaceable line cord is completely withdrawn from the dummy fiber, and replaced with the optical fiber core line or the unit core line. According to this method, even if it is applied for the manufacture of a small-bore optical fiber or a small-bore optical fiber bundle (including a branched fiber or fiber bundle), or a large-bore optical fiber or a large-bore optical fiber bundle, it is possible to easily and rapidly produce the fiber or bundle without causing any displacements or distortions of resilient fibers in a narrow space between the core line and the jacket. Thus, mass production of optical fibers and optical fiber bundles by the method of this invention will be greatly improved in its efficiency.

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What is claimed is:

1. Method for producing an optical fiber or an optical fiber bundle comprising:

- placing a replaceable line at the center, and covering it with a jacket with resilient fibers disposed around its periphery inserted in between, to produce a dummy fiber;

- exposing, at both ends of the dummy fiber, the ends of the replaceable line and the resilient fibers from the ends of the jacket;

- connecting one exposed end of the replaceable line with an optical fiber core line or with a unit core line of the optical fiber bundle; and

- replacing the replaceable line in the dummy fiber with the optical core line or with the unit core line.

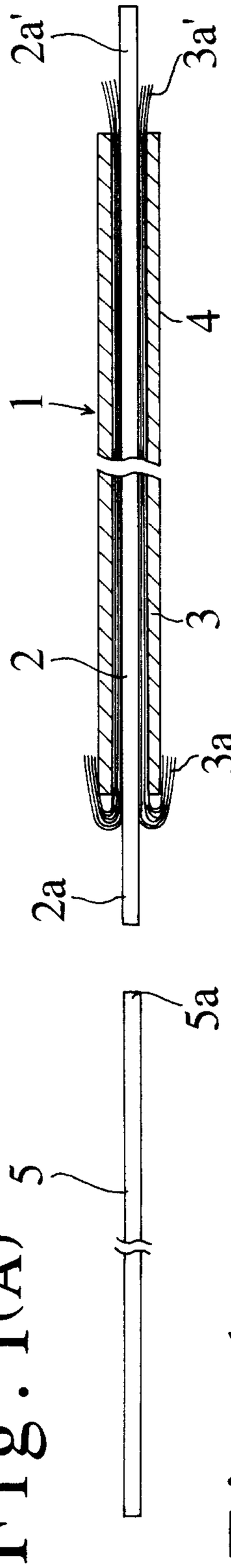


Fig. 1(A)

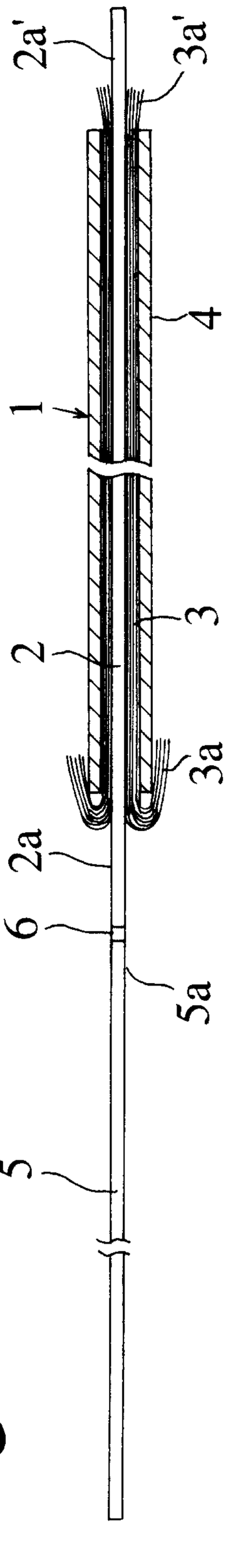


Fig. 1(B)

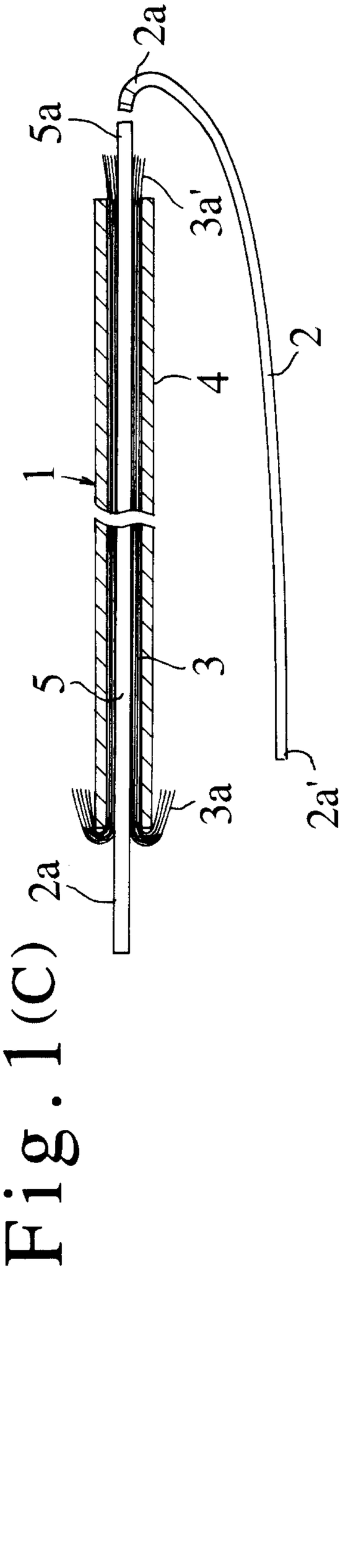


Fig. 1(C)

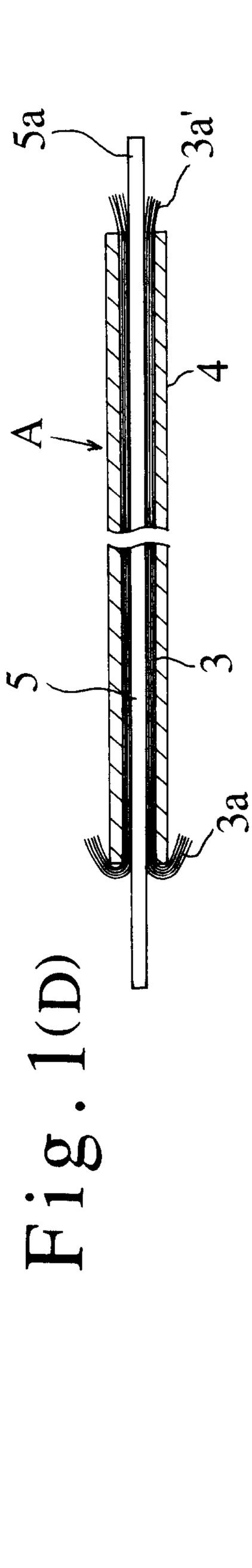
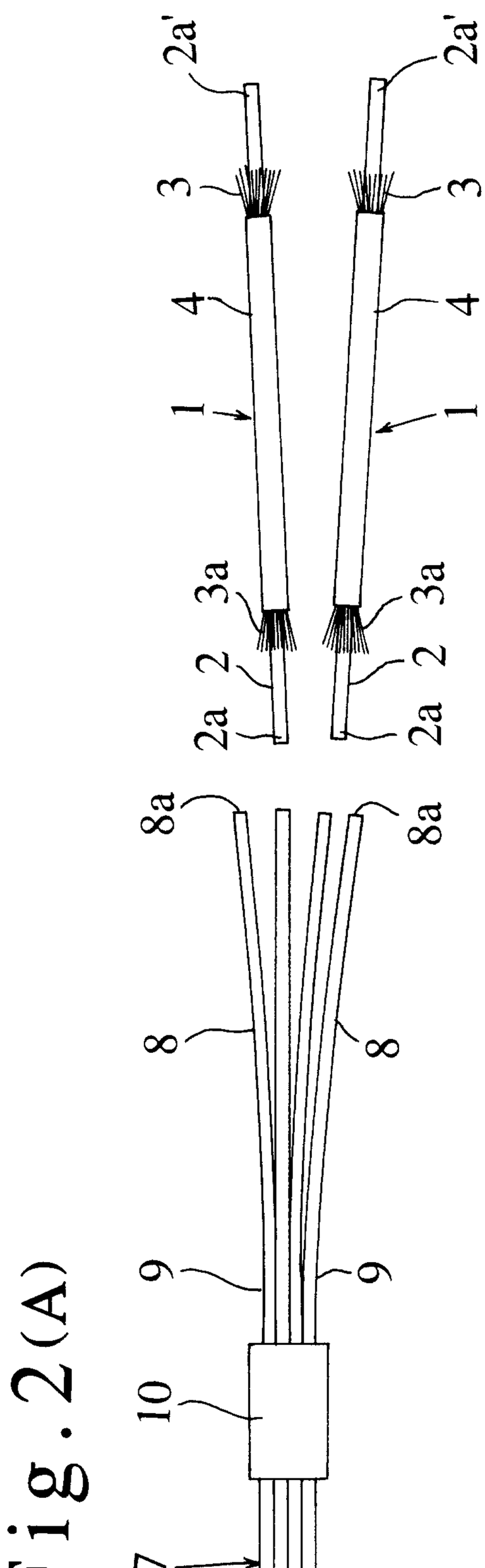


Fig. 1(D)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3a
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2a
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9
9
10
7

Fig. 2(A)

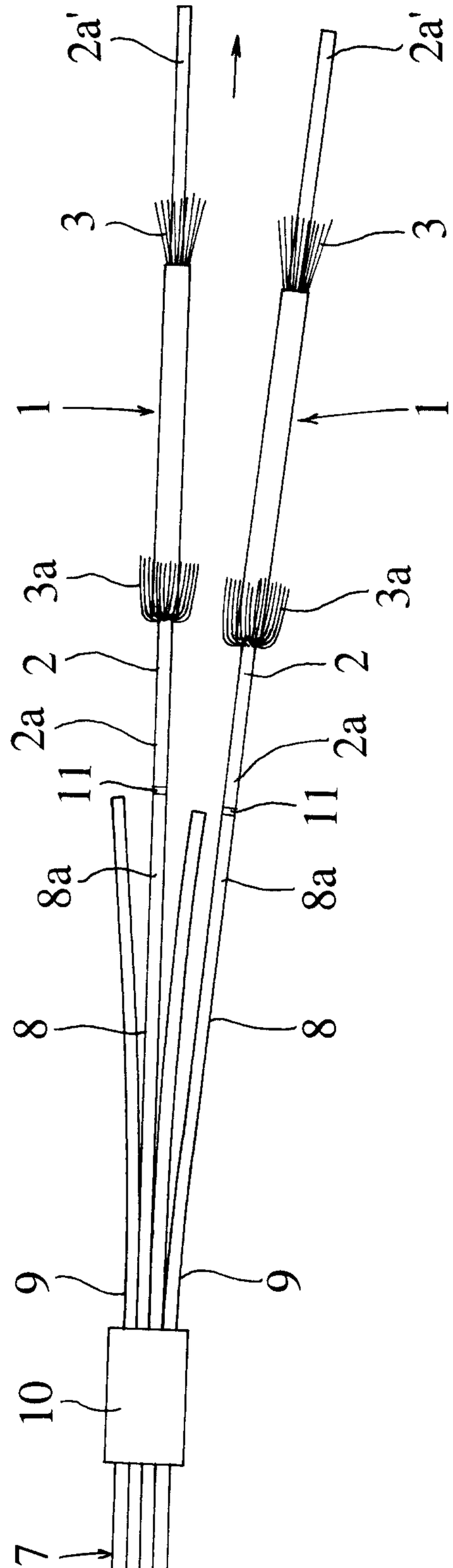
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Fig. 2(B)

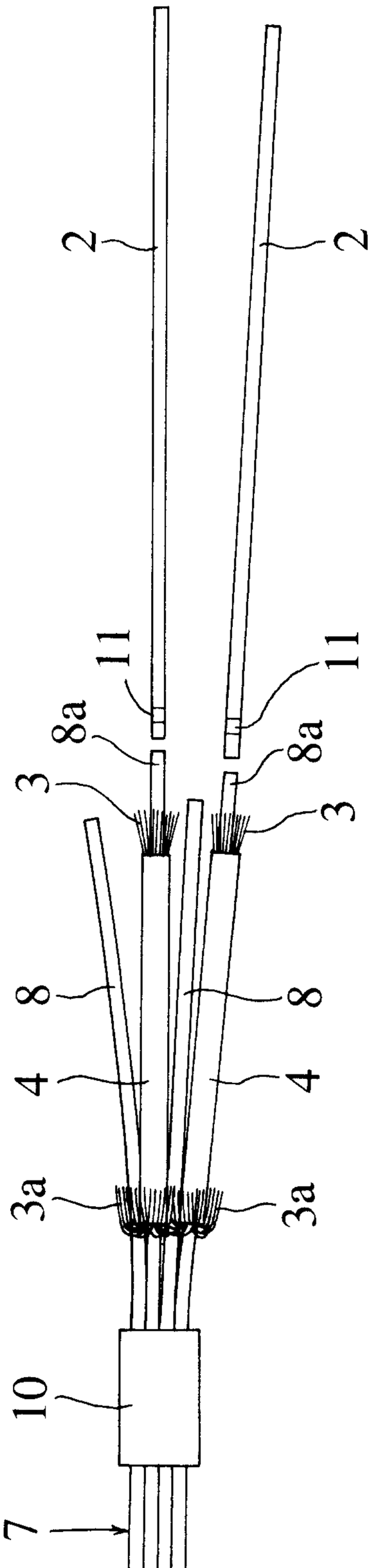


Fig. 2(C)

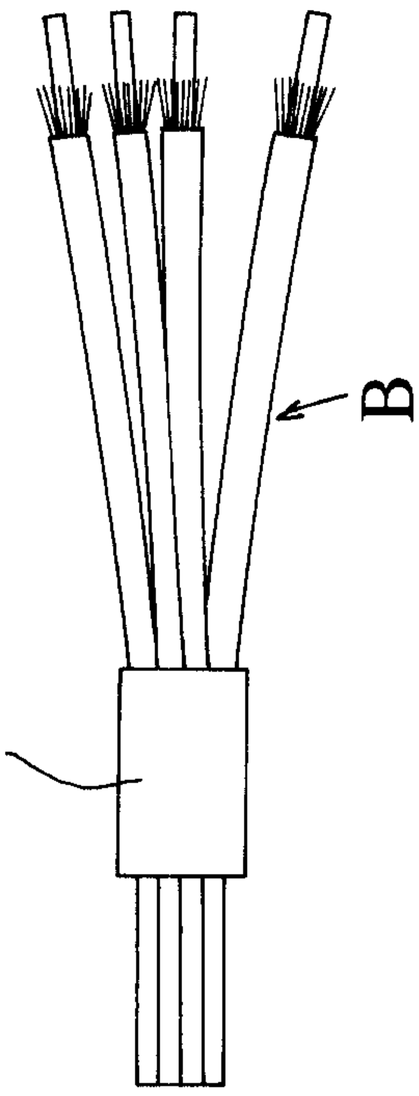


Fig. 2(D)

Fig.3(A)

PRIOR ART

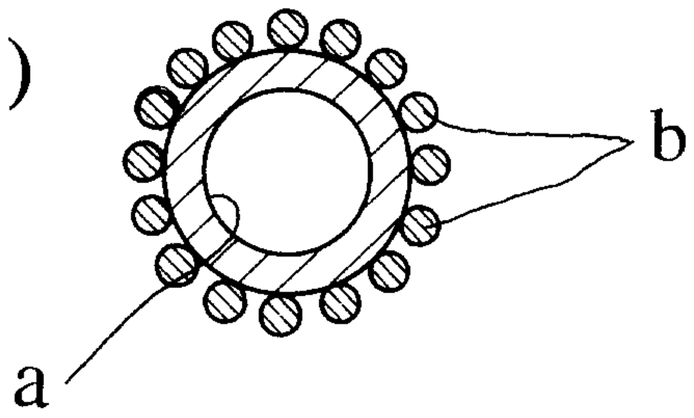


Fig.3(B)

PRIOR ART

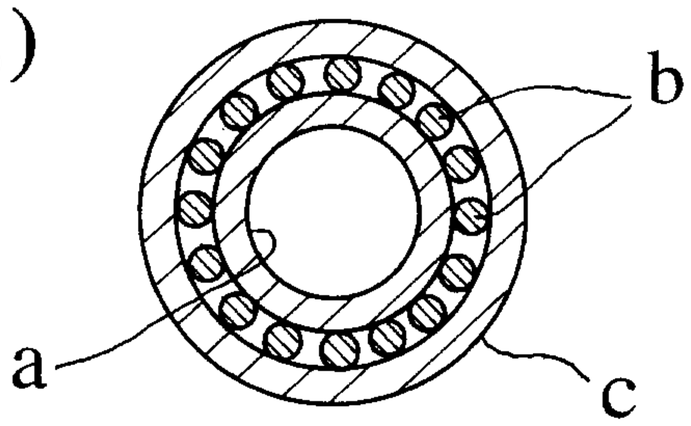
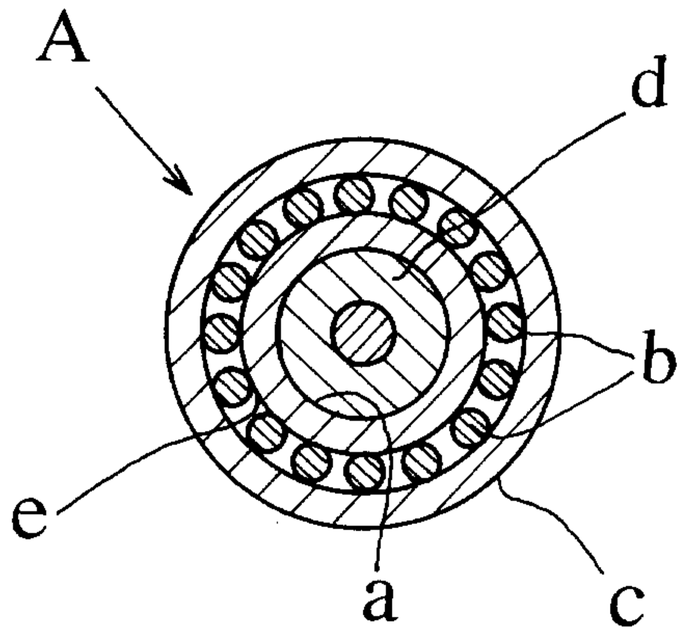
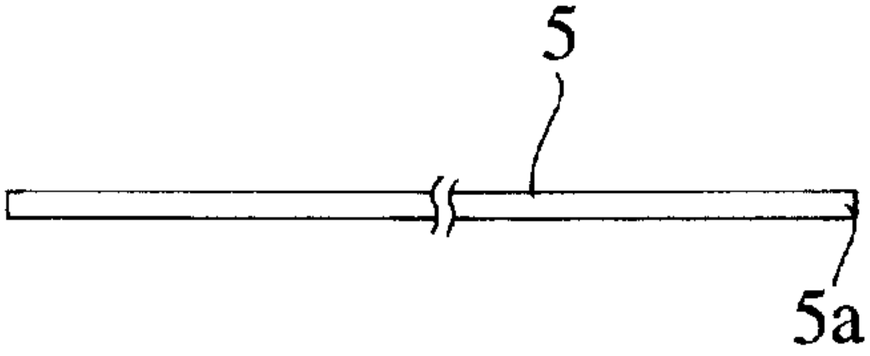
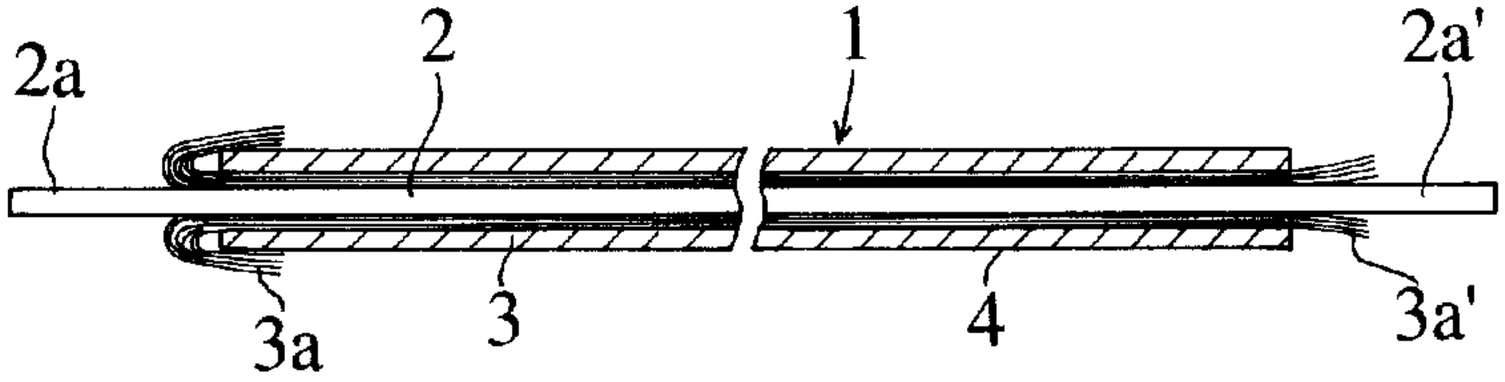


Fig.3(C)

PRIOR ART




5
5a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3a'