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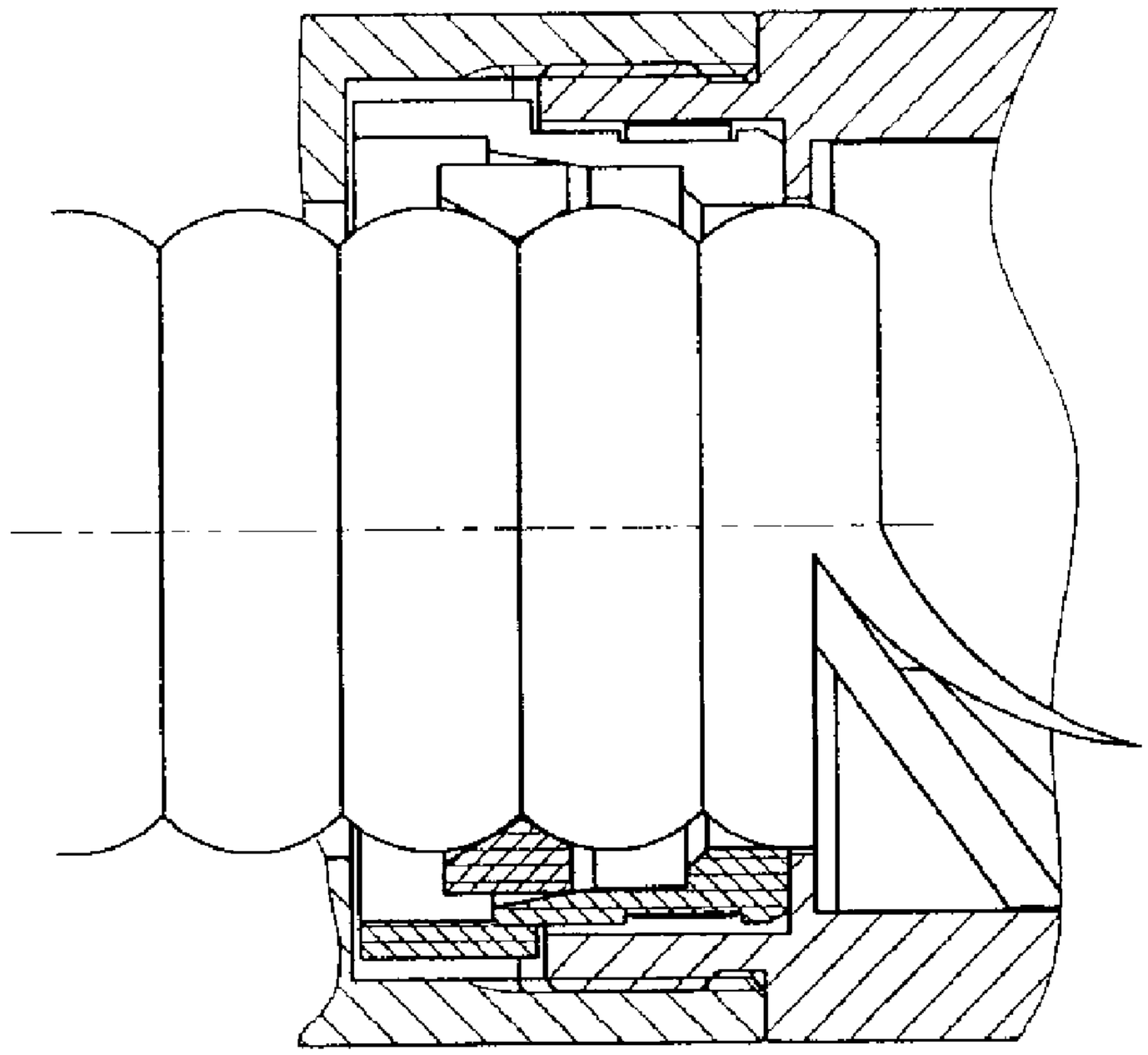
(54) Titre : METHODE DE PREPARATION DE CABLES COAXIAUX AVEC UN CONDUCTEUR EXTERIEUR ANNELE, ET OUTIL A CET EFFET

(54) Title: METHOD FOR PREPARING COAXIAL CABLES WITH AN EXTERNAL RINGED CONDUCTOR, AND TOOL THEREFOR



(57) Abrégé/Abstract:
The invention relates to a method for preparing coaxial cables by cutting the outer conductor, the dielectric and the central conductor to length, the cable being first cut perpendicularly to its axis, and then treated by means of a tool with a blade allowing to

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shear the sheath off, while a guide comes to rest on the central conductor and, under the action of a positioning and abutment device, one or more supplementary blades, respectively, cut the outer conductor, the dielectric and the inner conductor, and possibly the outer conductor is treated by means of a flaring tool. The invention also relates to a special tool for this coaxial cable preparing method, which comprises a blade allowing to shear the sheath off; a guide which may rest on the central conductor; a positioning and abutment tool; one or more supplementary blades, respectively, allowing to cut the outer conductor, the dielectric and the inner conductor.

ABSTRACT

The invention relates to a method for preparing coaxial cables by cutting the outer conductor, the dielectric and the central conductor to length, the cable being first cut perpendicularly to its axis, and then treated by means of a tool with a blade allowing to shear the sheath off, while a guide comes to rest on the central conductor and, under the action of a positioning and abutment device, one or more supplementary blades, respectively, cut the outer conductor, the dielectric and the inner conductor, and possibly the outer conductor is treated by means of a flaring tool. The invention also relates to a special tool for this coaxial cable preparing method, which comprises a blade allowing to shear the sheath off; a guide which may rest on the central conductor; a positioning and abutment tool; one or more supplementary blades, respectively, allowing to cut the outer conductor, the dielectric and the inner conductor.

METHOD FOR PREPARING COAXIAL CABLES WITH AN EXTERNAL RINGED CONDUCTOR, AND TOOL THEREFOR

BACKGROUND

A tool for preparing coaxial cables with a ringlike outer conductor, can only ensure a fast, reproducible and high quality assembly of connectors, if it meets a number of requirements:

- Cutting the central conductor, the dielectric, the outer conductor and the sheath of the cable, in accordance with the requirements of the connector to be fitted thereon.

- Cutting cable conductors with no burrs or filings. A thin burr, or filings, inside the outer conductor may generate intermodulations (generally known as PIM, the acronym of Passive Intermodulations).

- Automatically ensuring preparation accuracy in relation to a reference (a crest or a groove of the outer conductor), regardless of the accuracy wherewith the cable is sawed.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1.1 is a side elevation view of a tool for preparing coaxial cables having a sheath according to an embodiment of the present invention;

Fig. 1.2 is a top view of the tool of Fig. 1.1;

Fig. 1.3 is a sectional view of the tool taken along A-A in Fig. 1.1;

Fig. 1.4 is a sectional view of the tool taken along B-B in Fig. 1.1;

Fig. 2 is a section, in use, of a peeling knife;

Figs. 3.1 to 3.6 are side sectional views of the tool illustrating the working of the method and tool;

Fig. 4 is a side and end view of one embodiment of a blade holder;

Fig. 5 is a side and end view of another embodiment of a blade holder;

Fig. 6.1a is a side view of one embodiment of a flaring tool;

Fig. 6.1b is an end view of the flaring tool of Fig. 6.1a;

Fig. 6.2a is a side view of another embodiment of a flaring tool;

Fig. 6.2b is an end view of the flaring tool of Fig. 6.2a;

Figs. 7.1 to 7.9 illustrate several embodiments of cable ends prepared in accordance with the present invention; and

Figs. 8.1a, 8.1b, 8.2a and 8.2b schematically represent the principle of the blade holder operation in accordance with the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

The invention particularly pertains to a tool meeting all the aforesaid requirements. Figs. 1.1 to 1.4 show a tool for such kind of cables having a hollow central conductor. The tool is composed of a cable sheath peeling knife (1), which holds the blade (3) fastened by the screw (11). In this case, the peeling knife (1) is screwed on the guide (2) of the blade holder (4). The blade holder (4) is fastened by the screw (13) and holds the blade (5) and the axle (6) about which the inner guide (7) may rotate, secured by the screw (12). Depending on different sizes and requirements, the blade holder and the blade may be made from one piece.

The split rings (8) and (9) are housed between the guide (1) and

the guide (2) and may rotate freely relative to each other and to the spring (10) and open apart while being held in a coaxial position with respect to their housing by a zigzag or polygonal flat spring. In the illustrated case, the flat spring (10) has a pentagonal shape.

In order to use the tool, the cable has to be sawed perpendicularly to its axis and approximately in a groove of the outer conductor.

First, the tool is disposed with the guide of the peeling knife (1) at the end of the cable. With the help of a handle or of a drilling machine, secured at the end (41) of the blade holder (1), the tool has to be turned clockwise, while it is slightly pushed towards the cable. The blade (3) is fastened to form an angle of about 6° with respect to a plane perpendicular to the axis of the tool, which allows it to move in a helical path, as the tool rotates and advances. The blade (3) penetrates the cable sheath and lifts it in the plane (31). Then the sheath is sheared off between the cutting edges formed by the surfaces (31) and (32) in the passage plane between the guide (1) and the blade (3). The sheath chip comes out of the tool through the aperture (34), as shown in fig. 2. As the tool progresses, the inner guide (7) penetrates the central conductor of the cable and retains it. While the tool rotates, the guide (7) performs a rolling movement on the inner surface of the central conductor of the cable, which allows to avoid the formation of small filings and reduces the effort required to drive the tool. The preparation sequence is shown in figs. 3.1 to 3.6. The outer conductor of the cable, now bare, penetrates below the ring (8), opens it apart, and the latter opens apart the ring (9). The elasticity of the rings (8) and (9), in combination with the action of the spring (10) forces them to follow the outline of the outer conductor the cable. When the blade (5) contacts the front plane of the cable, it cuts the two conductors and the dielectric. The chips are cleared by the blade (5) and the surfaces (42) and (43) of the blade holder (4)

and, when the tool stops, a clean filingless surface is obtained, as shown in figs. 3.5 and 3.6.Fig. 3.4 shows that the ring (9) is opened apart by a crest, while the ring (8) remains closed up in a groove of the outer conductor. Then, the ring (8), dragged by the cable slides below the ring (9), as shown in fig. 3.5. When the ring (8) abuts against the shoulder (91) inside the ring (9), the tool automatically stops on the cable. Once the tool is removed after said preparation, the ring (8) moves back below the ring (9) up to its starting position and opens apart with the ring (9), thereby releasing the cable. The set of parts (8), (9) and (10) moves back to its starting position and the tool is ready for a new preparation.

Cable preparation, which is manufacturer-dependent, may be effected with selected sizes and configurations of the tool.

Figs. 7.1 through 7.6 show preparation variants for cables having a hollow central conductor.

The sheath displacement length (bare outer conductor) is determined by the dimension (x) of the tool, as shown in fig. 1.

The length through which the outer conductor, the dielectric and the central conductor will be cut (displacement length to obtain a clean cut) is determined by the dimension (y) of the tool, as shown in fig. 3.4.

The conductors and the dielectric are cut in the same plane, at a groove, as shown in fig. 7.1 or at a crest, as shown in fig. 7.3, as determined by the dimension (z) of the tool, as shown in fig. 3.6.

By replacing the blade holder (4) and the blade (5) with the ones shown in fig. 4, having two blades (14) and (15), the central conductor of the cable may be cut to be shifted from the cutting plane of the dielectric and of the outer conductor, as shown in figs. 7.2 and 7.4. Said shift is determined by the dimension (t) of the tool, as shown in fig. 4.

In order to obtain the preparations shown in figs. 7.5 and 7.6 a

blade holder with three blades may be used. If the dielectric is not to be touched, since the outside diameter thereof is greater below a crest of the outer conductor than the outside diameter of the outer conductor in a groove, a tool complement has to be used - a flaring tool as shown in Figs. 6.1(a + b).

The flaring tool is composed of the body (16), the inner guide (19) and the blade (17) fastened by the screw (18) in the aperture (20). The dimension (v) is greater than the greatest radius of the dielectric and smaller than the greatest inside radius of the outer conductor.

The flaring tool is disposed on the cable prepared according to Figs. 7.1 and 7.2, and slightly pushed while being rotated clockwise. The inner guide (19) is engaged in the central conductor and the tip (170) of the blade (17) penetrates the outer conductor. The cutting edge (171) cuts the outer conductor while flaring it, whereas the cutting edge (172) breaks the front portion of the conductor which passes on the inclined plane (173) and is cleared through the aperture (20). Since this cut is executed from the inside outwards, no flaring tool is required after said cut and the inner surface of the outer conductor, which comes into contact with the connector body is clean, with no filings or burrs. The length through which the outer conductor is displaced by the flaring tool (bare dielectric) is determined by the dimension (u), as shown in Figs. 6.1 (a + b).

When using a blade holder like the one shown in Fig. 5, having one or more blades according to the above principle and an axial hole (22), cables with a solid central conductor may be prepared. These preparations are shown in Figs. 7.7 and 7.8. In order to obtain the preparation shown in Fig. 7.9, the flaring tool as shown in Figs. 6.2 (a + b) has to be used as described above, on the cable prepared according to Fig. 7.7. This time the flaring tool is guided by the bore (21) on the outer conductor and by the bore (22) on the central conductor of the cable.

The drawbacks of the existing tools consist in positioning with

respect to the profile of the outer conductor of the cable and cutting the conductors, which generates burrs. They use either cutter blades which cut from the outside inwards or blades with a radial cutting edge. Due to wear of the cutting portion of the tool, burrs become more and more important.

In the first case, the tool clamps the outer conductor and forms burrs on the inner part of the two conductors. In order to flare the outer conductor, a conical part is used which follows a motion of revolution and is pushed between the outer conductor and the dielectric. This part draws the outer conductor apart, but the tip of the cone scratches it and produces filings, hits the dielectric and at the same time removes the burr by wedging it between the dielectric and the outer conductor on the surface for contact with the connector body. In order to deburr the hollow central conductor, a conical cutting tool has to be used which produces filings to be accommodated within the dielectric.

In the second case, positioning of the preparation with respect to the profile of the outer conductor, depends on the accuracy wherewith the cable has been sawed and the burrs produced by the cut are formed inside and outside each conductor, generating the same problems.

In the tool which forms the subject of the present invention, blades are used which have the cutting edge parallel to a radius and a particular chip clearing system, which provides that burrs generated when the outer conductor is cut are formed on the side opposite to the contact surface, which makes deburring unnecessary.

This system allows burr removal for the hollow central conductor.

Fig. 8.1 shows a blade which is made of one piece with the blade holder. The cutting edge of the blade is shifted through (δ) from the radius. The operation thereof will be understood with reference to

a simplified model of resolution of the force exerted by the cutting edge of the blade in a plane perpendicular to the axis. By rotating the tool clockwise, the force Fc acting on the wall of the tube which forms the outer conductor of the cable is resolved into Ft, which follows a tangential direction cutting the tube and Fr, which follows the direction of the radius pushing the chip from the inside outwards. The burr generated by the cut is only formed on the outer edge of the tube and is not produced in the inside contact area.

The burrless cut for the hollow central conductor is shown in fig. 8.2. The same simplified model is used for the resolution of the force exerted by the cutting edge of the blade. This time, the cutting edge is shifted through (-δ) from the radius. The force Fc is resolved into Ft, which cuts the tube and into Fr which pushes the chip from outside inward. As the chip is generated, it rolls up and rests on the clearing surface (43) of the blade. The force Fd exerted by the surface (43) pushes the chip outwards, and the latter, due to its being more rigid than the outer conductor, flares the cut portion of the tube. Thanks to the force exerted by the cutting edge, which has a component directed from the outside inwards, and to the flaring force exerted by the clearing surface in the cutting area, the tube is cut in a substantially burrless manner. The result is that, by properly selecting the shift between the cutting edge of the blade and the radius, it is possible to choose on which side of the wall of the tube burrs will be generated or, in some cases, to remove them.

The invention provides the above advantages:

- Highly accurate reproducible preparation, which is independent of the cable sawing accuracy.

- Automatic positioning of the preparation with respect to the profile of the outer conductor of the cable.

- Positioning independent of the variation of the profile of the outer conductor, depending on the cable manufacturer.

- Burrless cut.

- When burrs may only be removed on one side of the wall of the conductor, the tool allows to choose the contact side as a burrless side.

- Possibility to use the same principle for several different preparations.

CLAIMS

1. A method for preparing coaxial cables which have a sheath, a corrugated outer conductor, a central conductor and a dielectric separating the outer conductor from the central conductor, by cutting the outer conductor, the dielectric and the central conductor to length, wherein the cable is cut perpendicularly to its axis, in a position determined in relation to a groove of the outer conductor; characterized in that, with the help of a tool with a blade, the sheath is sheared off by rotation in a helical motion, while a guide of the tool comes to rest on the central conductor that, under the action of a positioning and abutment device of the tool, the cable is positioned automatically with respect to one or more supplementary blades of the tool such that a cutting plane of said one or more supplementary blades as in a pre-determined position in relation to a profile of the outer conductor, that the outer conductor, the dielectric and the central conductor are all cut by means of said one or more supplementary blades and that possibly the outer conductor is treated by means of a flaring tool.

2. A tool for preparing coaxial cables which have a sheath, a corrugated outer conductor, a central conductor and a dielectric separating the outer conductor from the central conductor, the tool comprising:

a blade for shearing the sheath off the blade being positioned in a cutting plane substantially tangential with respect to a surface of the sheath such that the blade moves in a helical path around the sheath;

a guide which rests on or penetrates inside the central conductor;

one or more supplementary blades, each of which cuts at least one of the outer conductor, the dielectric and the central conductor, such that the central conductor, the dielectric, and the outer conductor are all cut; and

a positioning and abutment tool provided to automatically position the cable with respect to said one or more supplementary blades such that a cutting

plane of said one or more supplementary blades is in a pre-determined position in relation to a profile of the outer conductor.

3. A tool for preparing coaxial cables as claimed in claim 2, wherein the tool is provided with a flaring tool for treating the outer conductor.

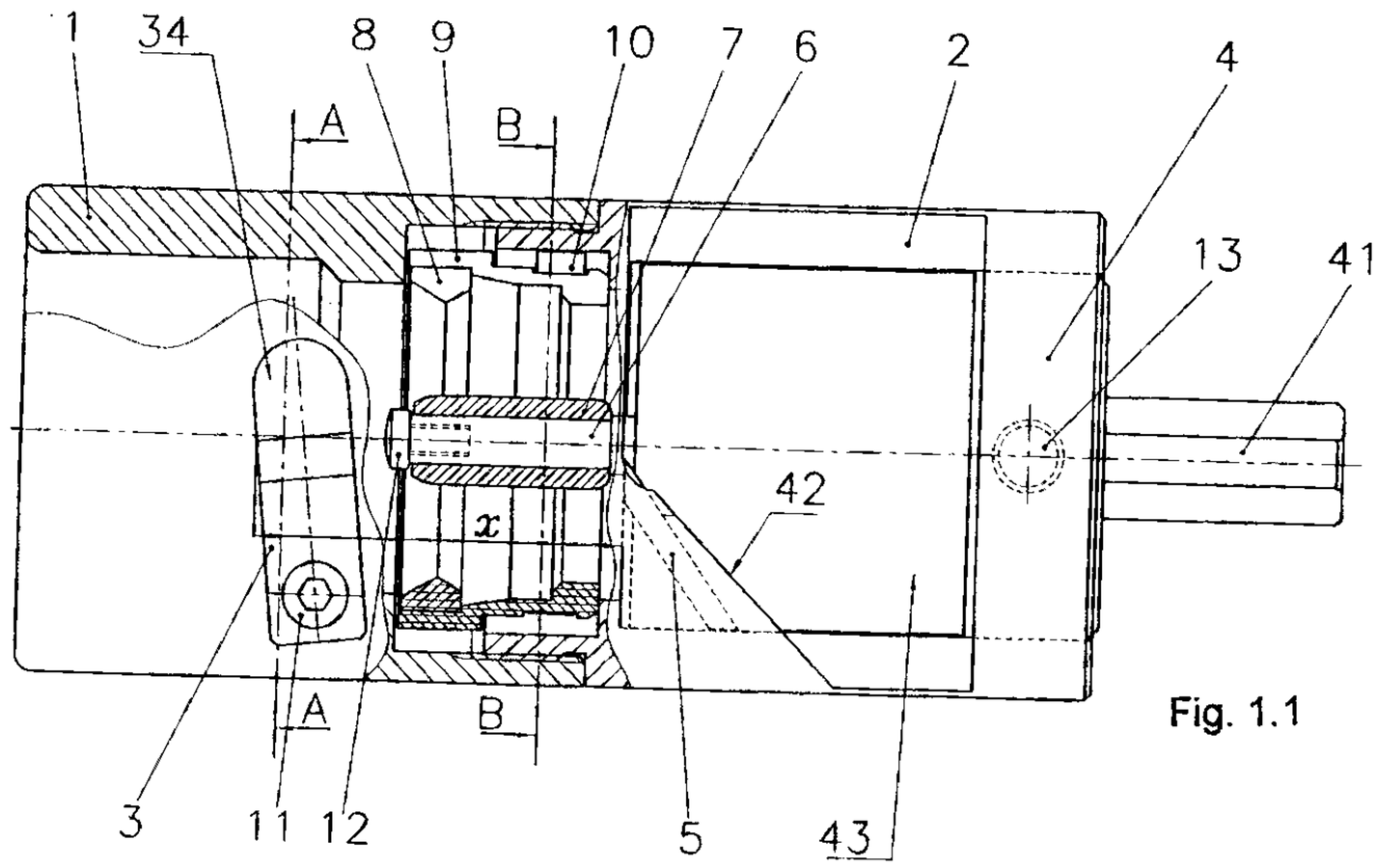


Fig. 1.1

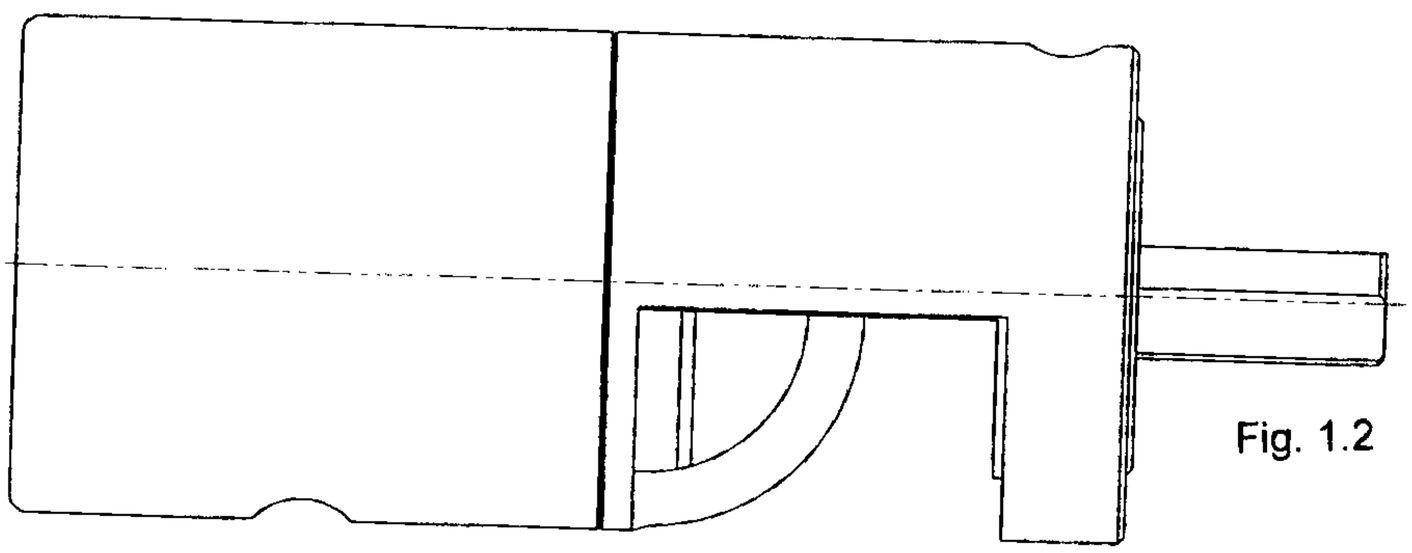


Fig. 1.2

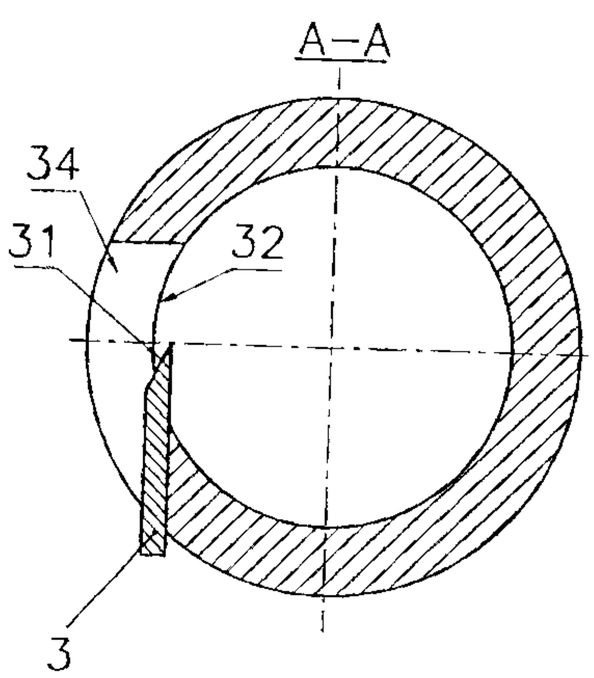


Fig. 1.3

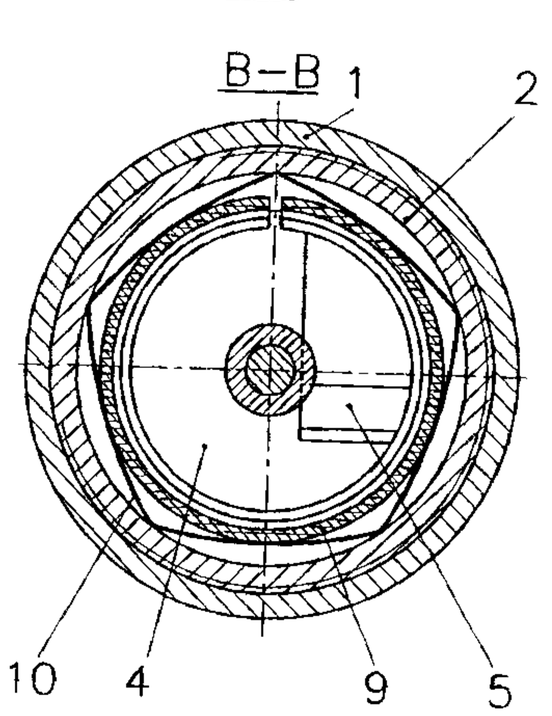


Fig. 1.4

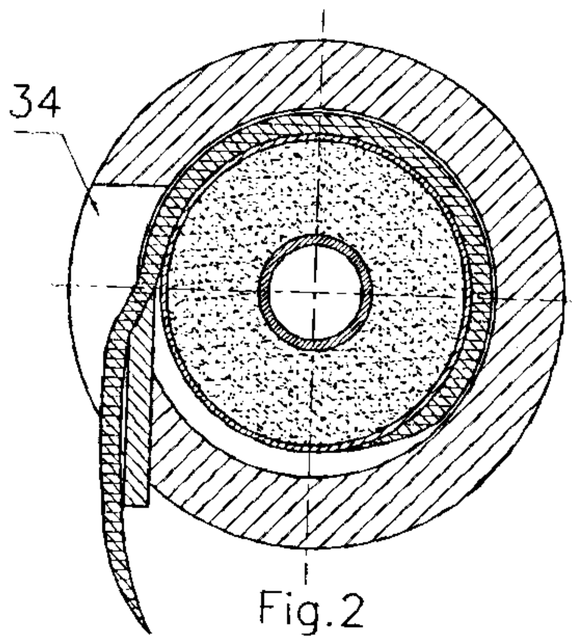


Fig.2

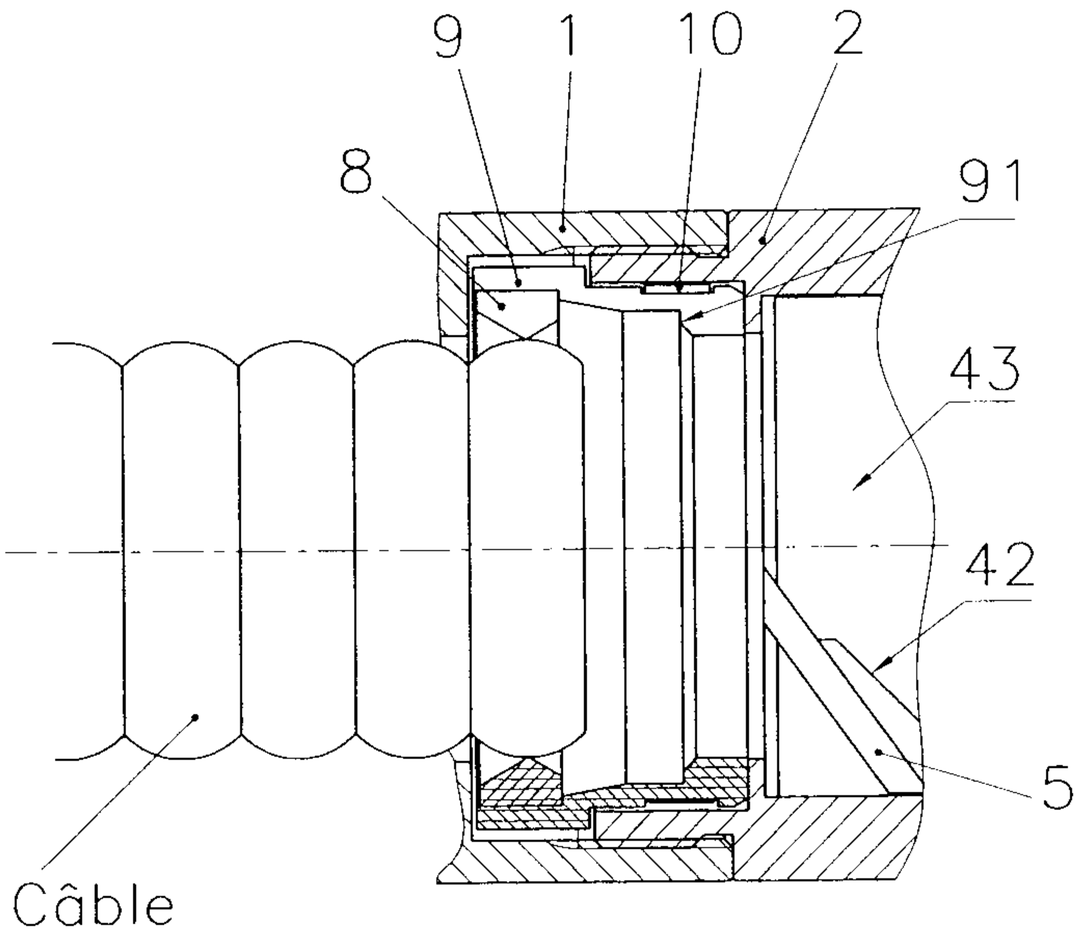


Fig.3.1

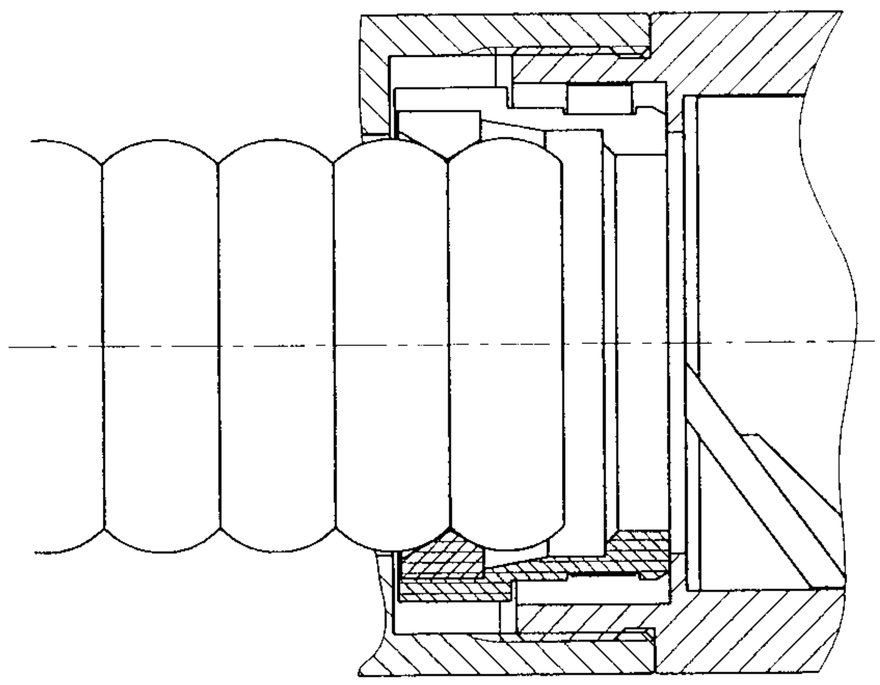


Fig.3.2

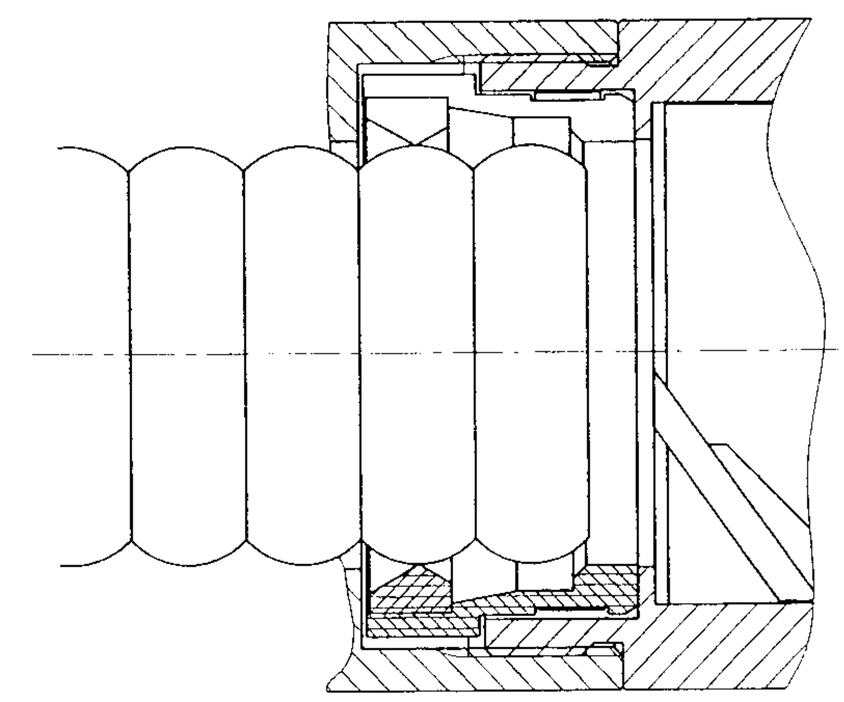


Fig.3.3

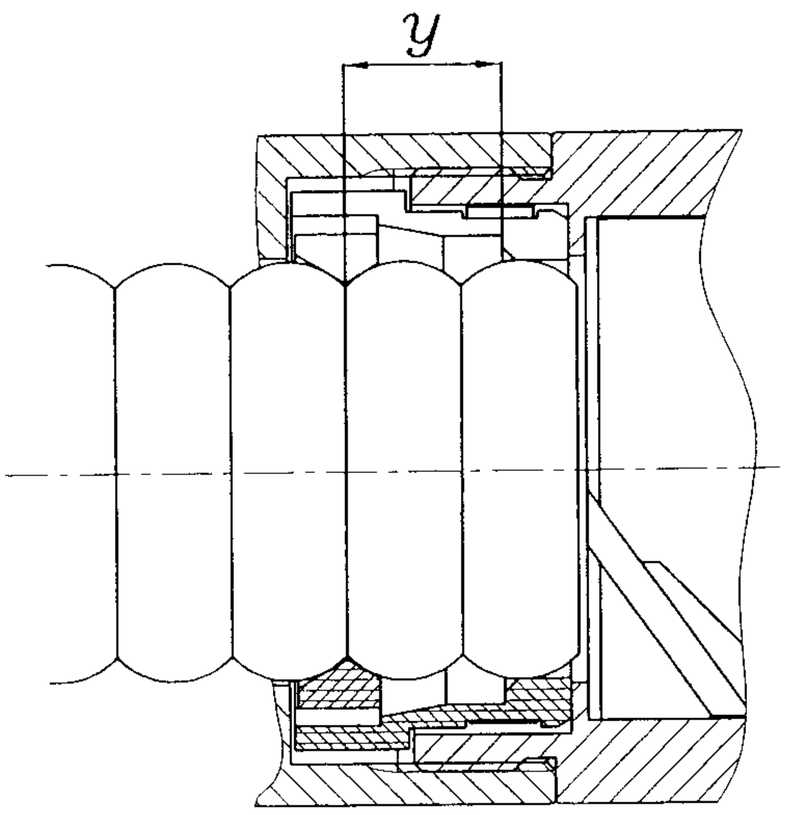


Fig.3.4

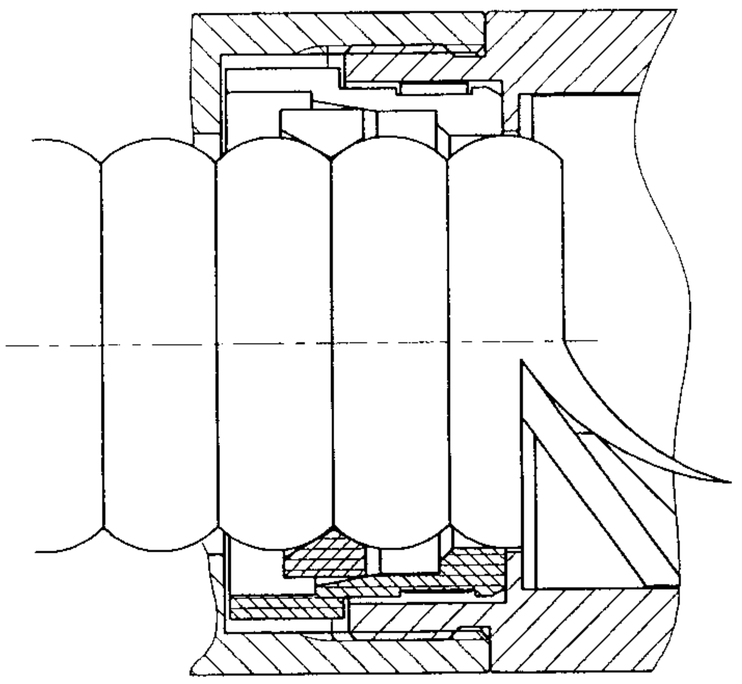


Fig.3.5

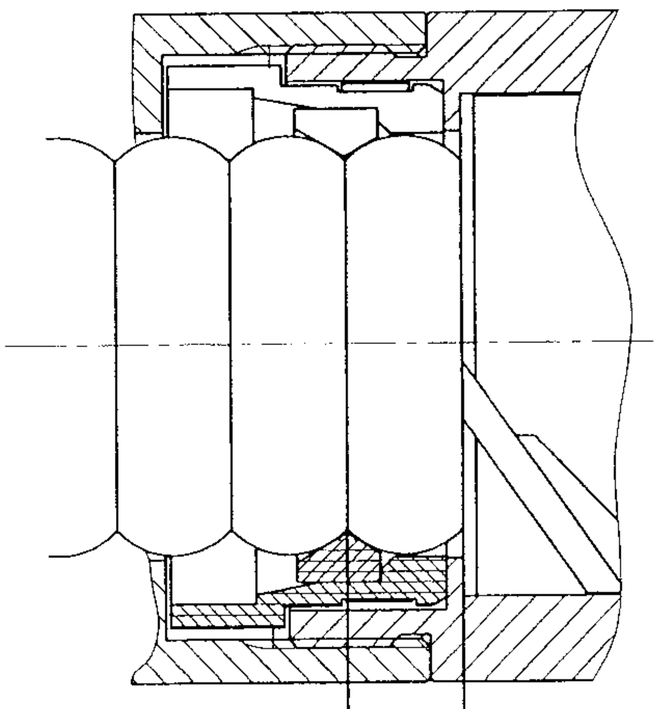


Fig.3.6

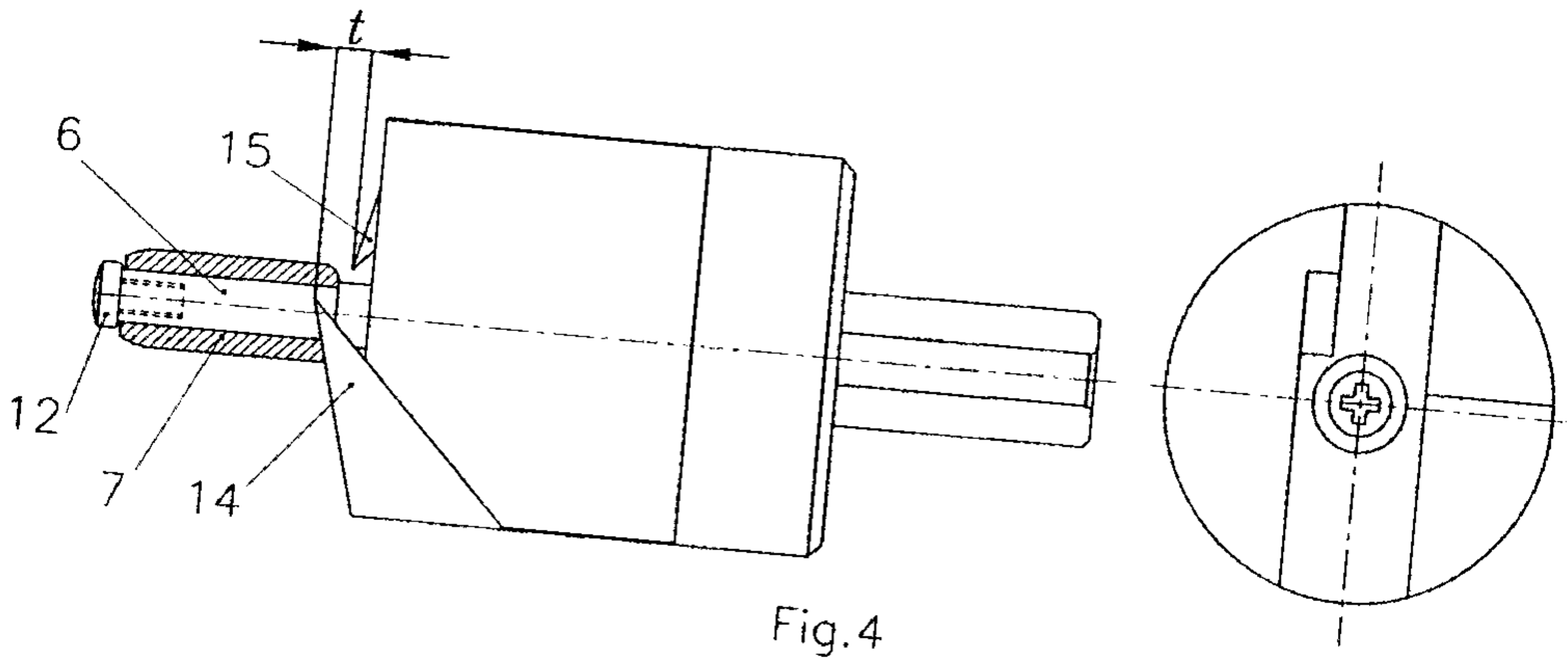


Fig.4

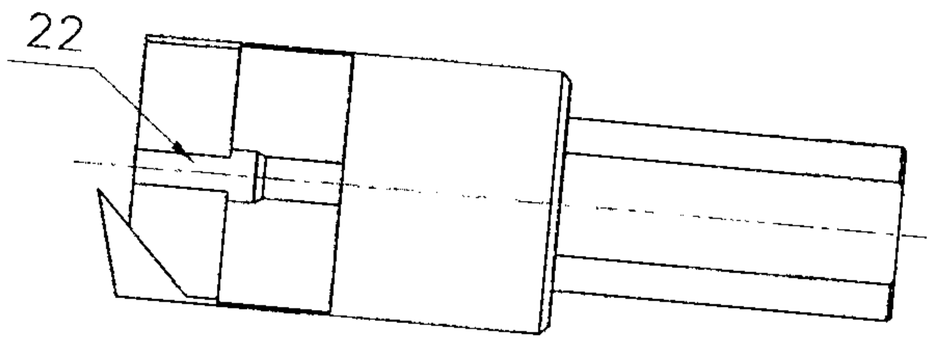


Fig.5

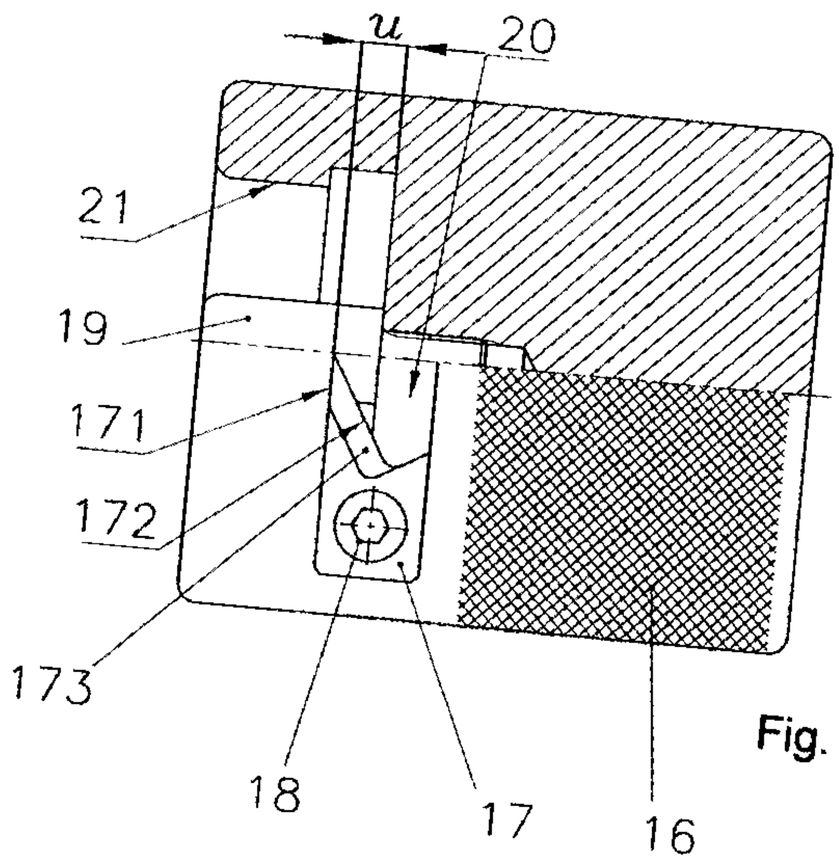


Fig. 6.1a

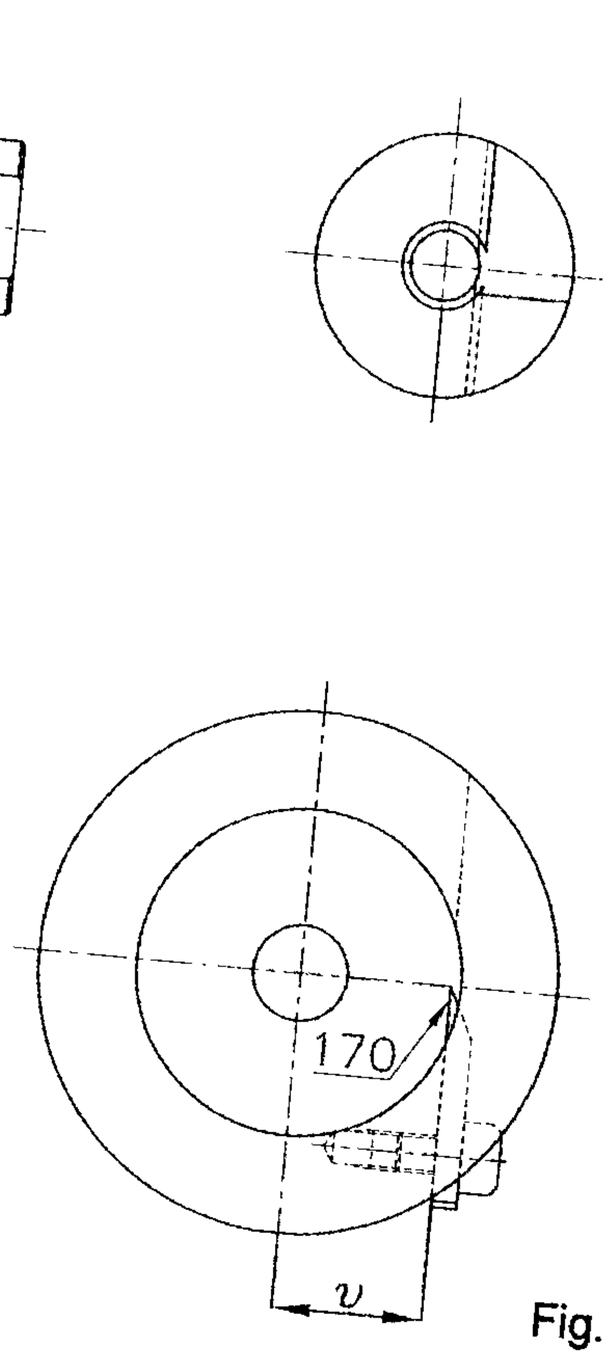


Fig. 6.1b

Fig. 6.2a

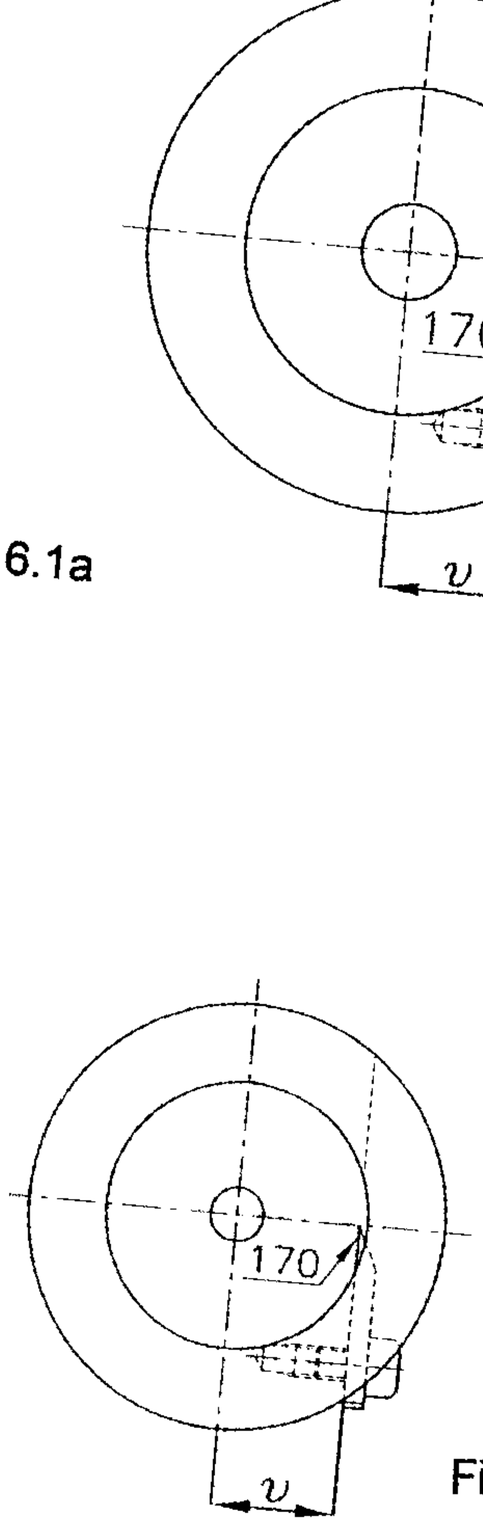


Fig. 6.2b

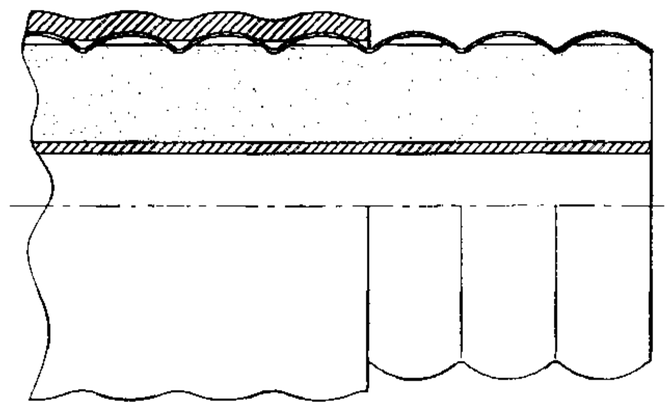


Fig.7.1

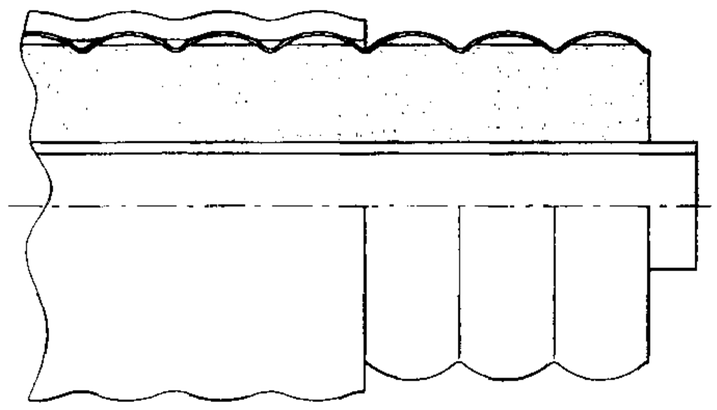


Fig.7.2

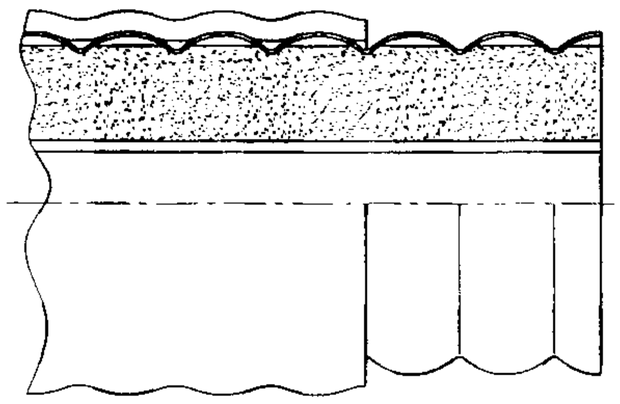


Fig.7.3

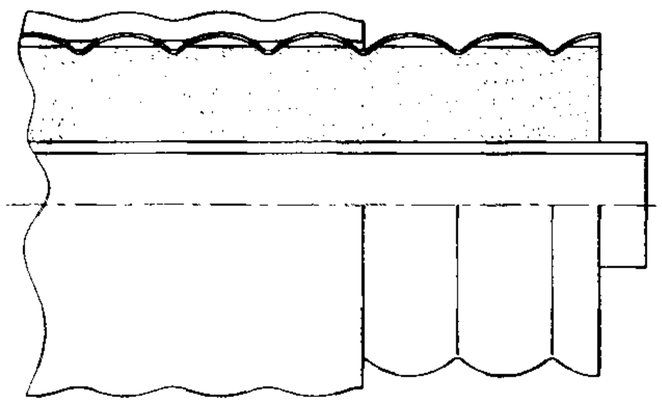


Fig.7.4

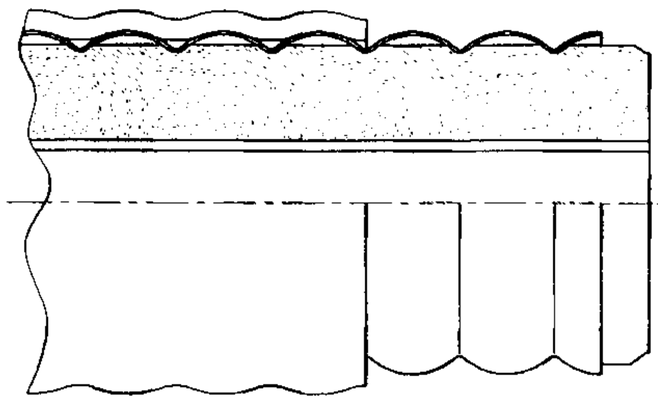
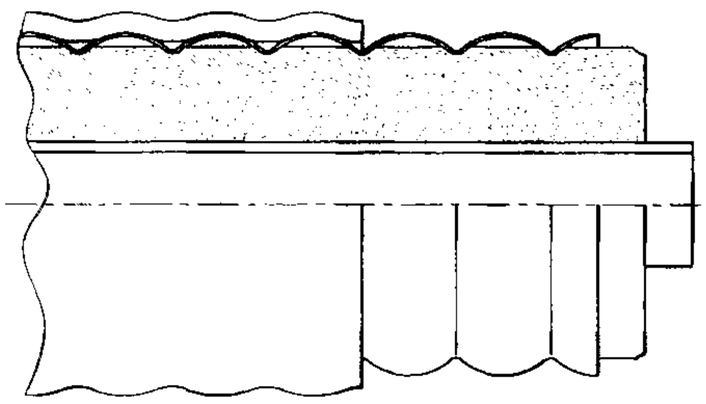


Fig.7.5



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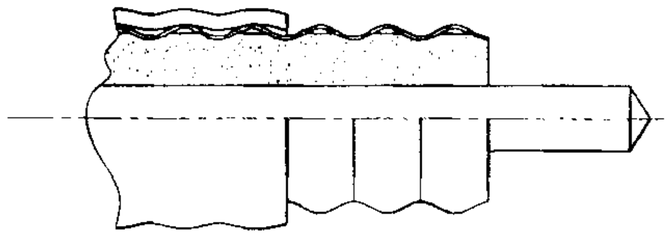

Fig.7.7

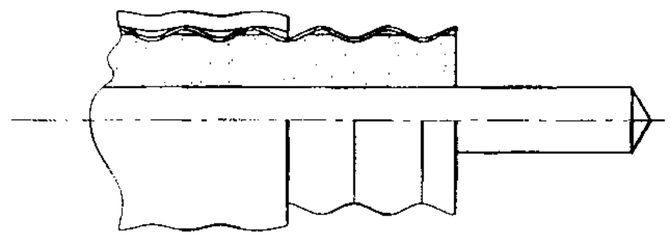

Fig.7.8

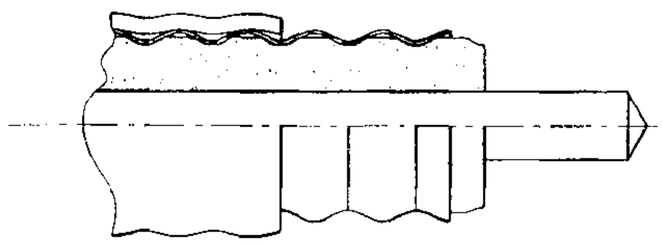

Fig.7.9

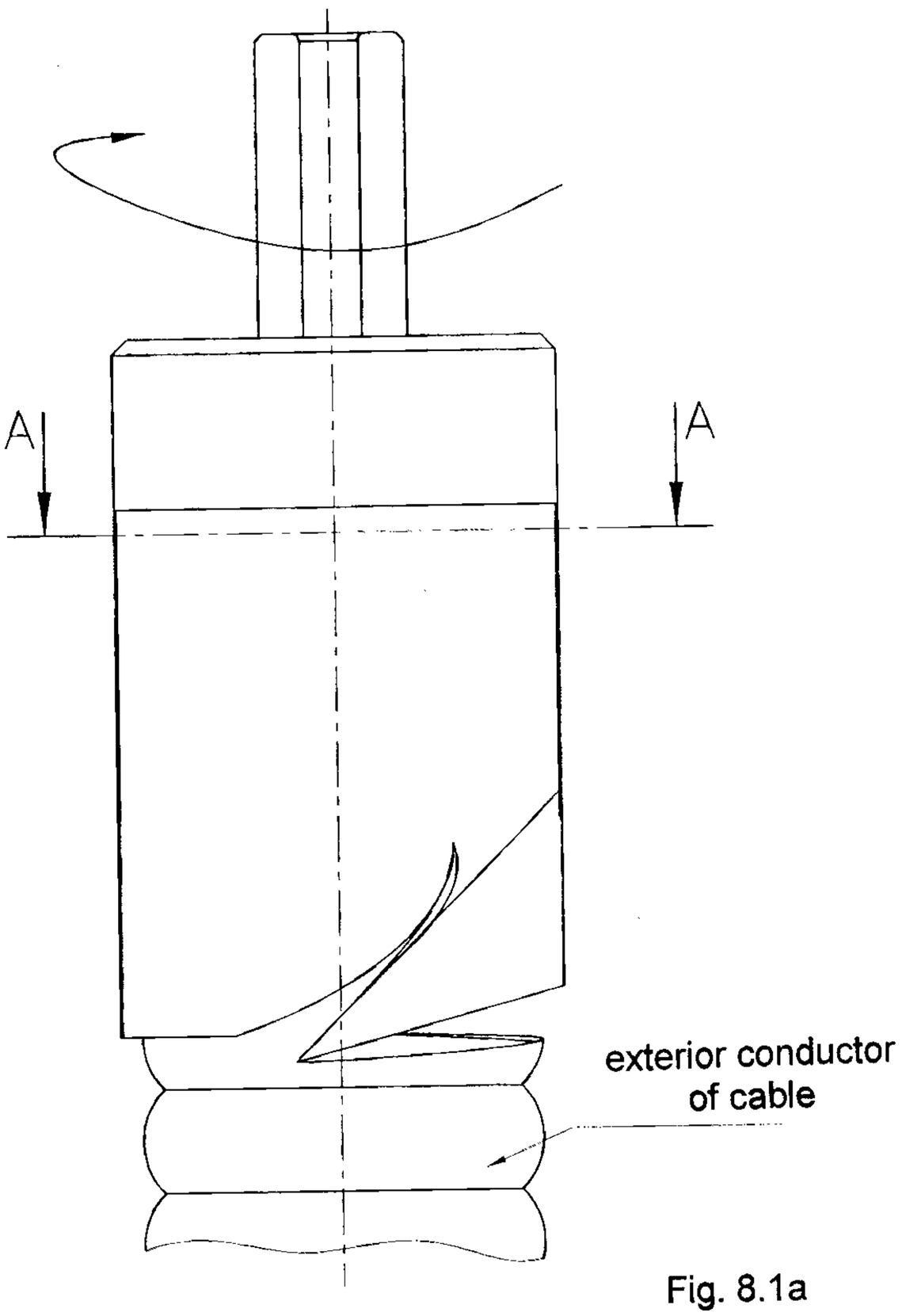

Fig. 8.1a

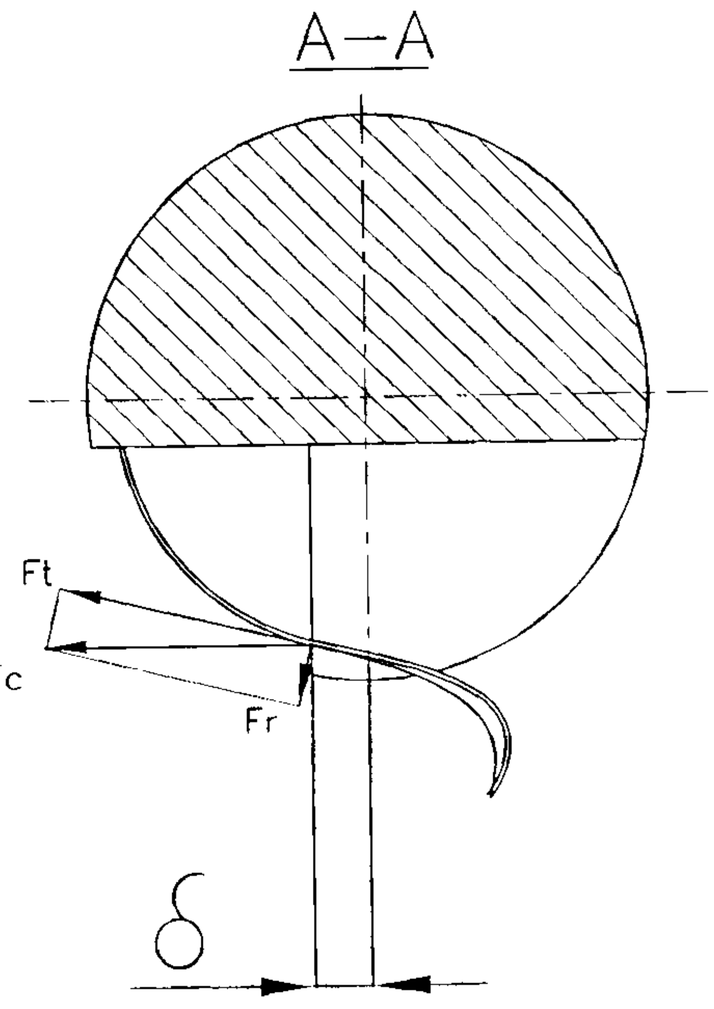

Fig. 8.1b

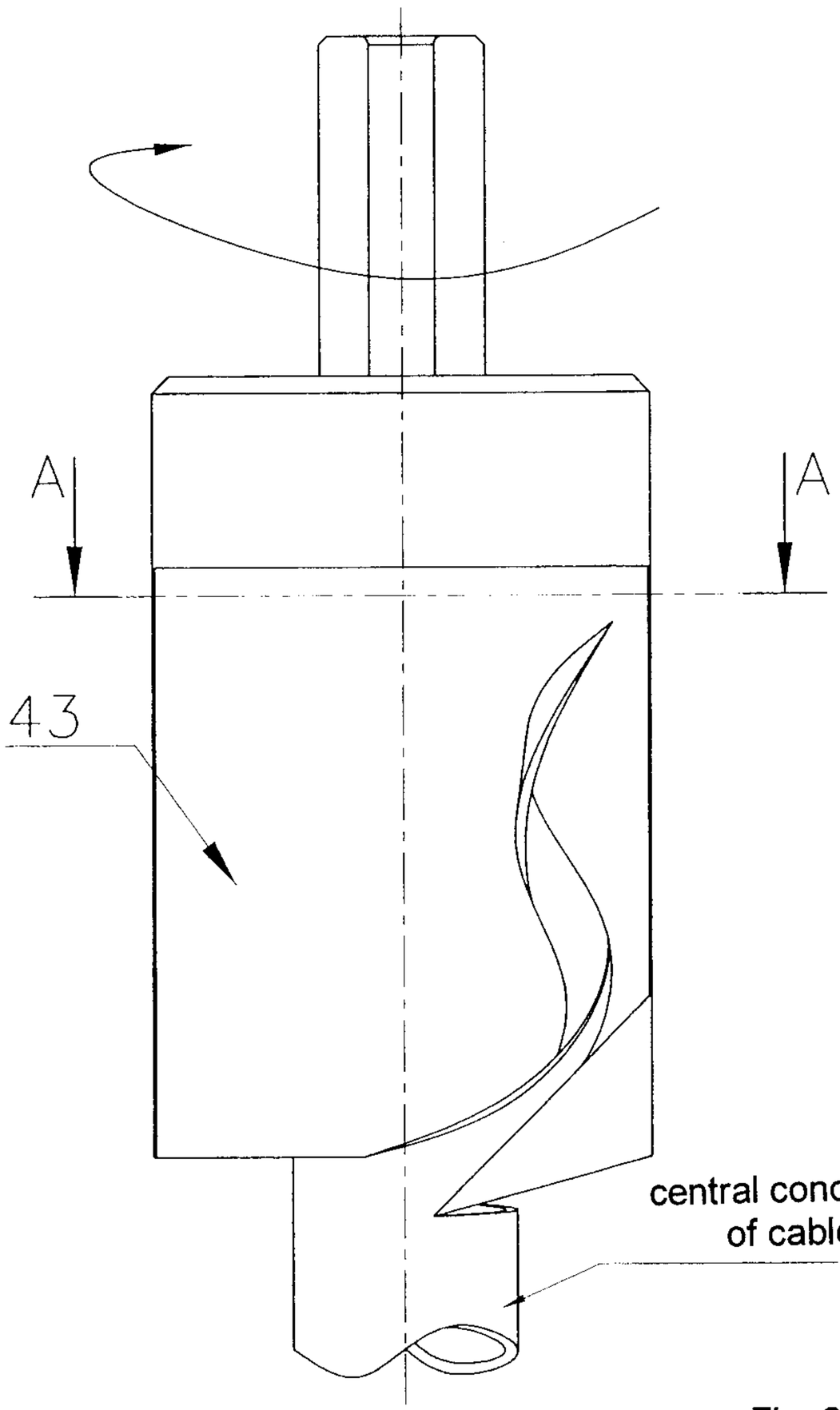

Fig. 8.2a

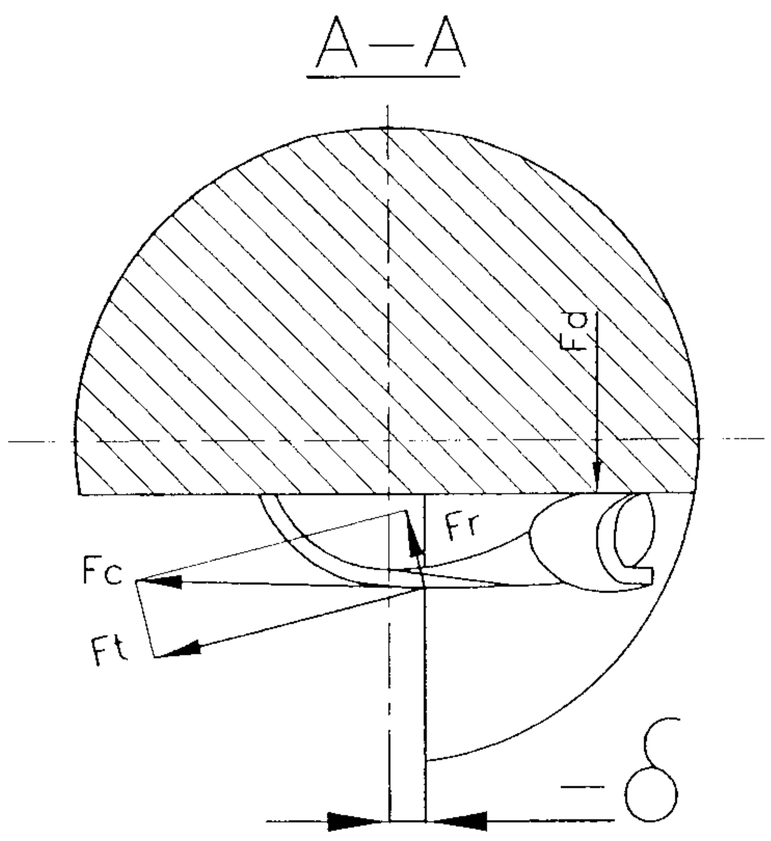

Fig. 8.2b