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(71) Applicant: **Polus, Marian**
31-215 Kraków (PL)

(72) Inventor: **Polus, Marian**
31-215 Kraków (PL)

(74) Representative: **Malcherek, Piotr**
Rzecznicy Patentowi INVENT Sp. z o.o.
ul. Gen. Ch. de Gaulle'a 8
43-100 Tychy (PL)

(54) DEVICE FOR COMPOSITE MESH BRAIDING

(57) The device (1) for composite mesh braiding is designed to be loaded with longitudinal composite fibers (A) and transverse ties (B). In a load-bearing structure (2) of the device (1), there is a seated beam (3) with guiding sleeves (4) provided for continuous guiding of longitudinal composite fibers (A). Behind the beam (3), there is a set of braiding heads (5), in which neighboring braiding heads (5) have opposite directions of rotation. Each single braiding head (5) has at least two brackets (14) equipped with ring elements (8) to guide longitudinal composite fibers (A) and they are situated in the direct contact with a laying mechanism (9) for transverse ties (B) with the inner surface similar to a conical surface, while the purpose of the laying mechanism (9) is to insert the transverse tie (B) in the direction from the base to the apex of the cone. An Axis (O_1) of that conical surface is perpendicular to an axis (O_2) of the braiding heads (5) and in this axis (O_1) there is a pass-through hole (10) of the laying mechanism (9) for insertion of the transverse tie (B). In the side surface of the laying mechanism (9) there is a longitudinal pass-through gap (11) for guiding the transverse tie (B) out to be braided, whereby gaps (11) of the laying mechanisms (9) of the whole set of braiding heads (5) constitute one common plane that passes through the axis (O_1) of the conical surface of the laying mechanism (9).

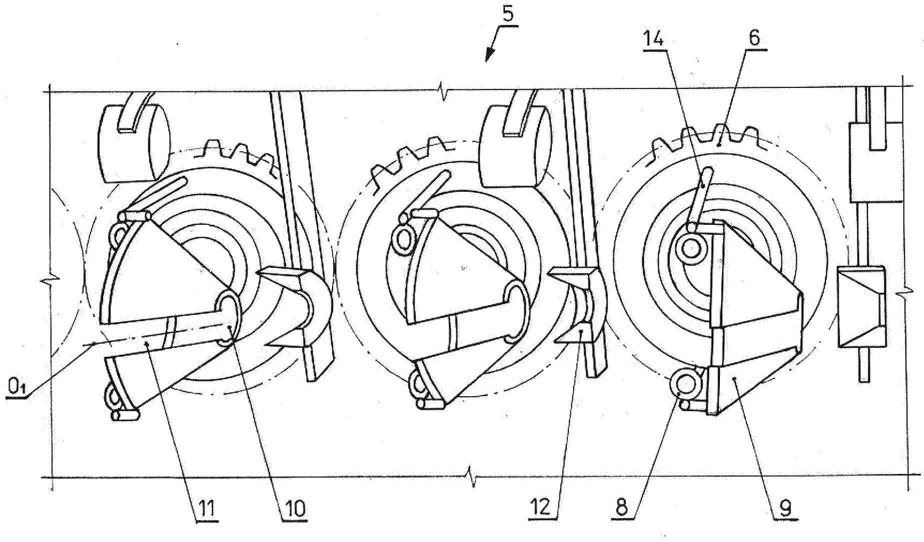

Fig.3

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Description

[0001] The subject of the invention is a composite mesh braiding device, particularly for mesh used in mining and construction industries, the longitudinal fibers of which are braided in transverse ties in a way that individual longitudinal fibers, over the length of openings formed between two neighboring transverse ties, have mutually opposite directions of twisting of the threads.

[0002] Polish description of invention PL418525A1 regarding the method of production of composite mesh partially discloses the construction of a device to be used to manufacture such mesh, where such a device contains rotary heads, situated next to each other in one line, for braiding of longitudinal fibers, whereby neighboring rotary heads have opposite directions of rotation.

[0003] On the other hand, description FR 2183336 discloses a twisting device for braiding of two elements of yarn. Several pairs of spindles are seated in the frame of the device. Each spindle has a yarn guide bar and two yarn strings go through it, whereby elements of yarn are twisted together when the spindle is rotating. The spindles of each pair have gearwheels that are connected to the common drive unit. Each guide bar have transverse plate with cut-out on the each side of this place, which is designed for introducing appropriate component of the yarn.

[0004] The invention concerns a device for composite mesh braiding, into which longitudinal composite fibers and transverse ties are inserted in order to connect them together. The device comprises a load-bearing structure with a beam with sleeves that is seated in that structure to constantly guide longitudinal composite fibers. Behind the beam, there is a set of many braiding heads, whereby neighboring braiding heads have opposite directions of rotation. The essence of the invention is that each single braiding head has mounted at least two brackets equipped with ring elements for guiding the longitudinal composite fibers, situated in direct contact with a laying mechanism for transverse ties, with the inner surface similar to conical surface, intended for guiding the transverse tie in the direction from the base to the apex of the cone. In the axis of this conical surface, which is perpendicular to the axes of braiding heads, there is a pass-through hole of the laying mechanism for inserting of the transverse tie. In the side surface of the laying mechanism, there is a longitudinal, pass-through gap to guide the transverse tie out for braiding, whereby gaps of the laying mechanisms in the whole set of braiding heads constitute one, common plane that goes through the axis of the conical surface of the laying mechanism.

[0005] Preferably the outer surface of the laying mechanism is also a conical surface corresponding to the inner surface.

[0006] It is desirable when a single braiding head, in its axis of rotation, has a guiding pass-through hole for longitudinal composite fibers.

[0007] To enhance the operation of the device, there are jointly-propelled push rods between neighboring braiding heads to guide the transverse tie out from the laying mechanism.

[0008] It is also desirable when each braiding head is rigidly coupled with a gearwheel, whereby the gearwheels of neighboring rotation heads are in gear with each other, while one of them is connected with a drive.

[0009] In such embodiment, it is advantageous when the gearwheel is driven by a stepping motor started for an adjusted number of rotations.

[0010] Then, it is best when the stepping motor is started by a transverse tie insertion sensor located behind the outmost braiding head.

[0011] In the most advantageous embodiment, the device has a set of ten braiding heads with two brackets each, while the diameter of the guiding hole in the braiding head is bigger than the formed braid and the pass-through gap of the laying mechanism is wider than the width of the transverse tie for which it has been intended.

[0012] The device for composite mesh braiding allows for automated manufacture of composite meshes, especially in the case of meshes in which the longitudinal fibers are braided in transverse ties in a way that individual longitudinal fibers, over the length of openings formed between two neighboring transverse ties, have mutually opposite directions of twisting of the threads. The device is easy-to-use and reliable, allowing simple adjustments of the length and width of composite meshes, according to the needs. Moreover, thanks to the fact that the set of rotary heads is mounted on a simple load-bearing structure, it is possible to incorporate the composite mesh braiding device into technological lines with tooling for insertion of longitudinal composite fibers and transverse ties and with equipment for processing of composite materials, which consequently results in the possibility of manufacturing composite mesh in one technological process. The reliability of the device is in particular thanks to the laying mechanism of transverse ties that allows stable guiding of the transverse tie, securing it against being caught by longitudinal composite fibers. Additionally, thanks to the inner, tapered conical surfaces of the laying mechanism, it is possible to eliminate eventual shakes of the transverse tie caused by the device for inserting it or to significantly simplify the manual insertion of the transverse tie between longitudinal composite fibers.

[0013] What is more, thanks to the fact that the longitudinal composite fibers are guided through the pass-through holes in the rotation axis of each braiding head, the reliability of the device is greatly increased, since in the case of using agents to process composite materials before the process of braiding, it is possible to prevent such agents from getting to movable parts of the set of braiding heads. The eventual excess of agents for processing of composite materials is accumulated in the pass-through hole of the rotation axis of the braiding head, where it can be easily removed.

[0014] The invention has been presented in the embodiment described below and in the drawing, in which:

fig. 1 presents the schematic perspective view of the device according to the invention,

fig. 2 - the beam, in perspective view, with guiding sleeves;

fig. 3 - set of braiding heads in perspective view;

fig. 4 - a partial longitudinal cross-section through the device with visible head, guiding sleeve, longitudinal fiber, and transverse tie;

fig. 5 - the device in another longitudinal cross-section.

[0015] Device 1 for composite mesh braiding has a load-bearing structure 2 consisting of vertical and horizontal load-bearing beams that can connect various elements and allows to attach them at different levels. Such construction of the load-bearing structure 2 allows to use the device 1 for composite mesh braiding in technological lines that provide tools for insertion of longitudinal composite fibers A and transverse ties B to the device 1 for composite mesh braiding. What is more, technological lines incorporating the device 1 for composite mesh braiding can include necessary equipment for the processing, especially chemical processing, of longitudinal composite fibers and transverse ties before the mesh is braided or after that operation. As a result, the device 1 for composite mesh braiding is adjusted to use longitudinal composite fibers A that are, for example, strings consisting of many strands of glass-fiber or carbon-fiber.

[0016] In the load-bearing structure 2 of the device 1 for composite mesh braiding, there is a beam 3 equipped with guiding sleeves 4 intended for continuous guiding of longitudinal composite fibers A. The number of guiding sleeves 4 is selected according to the number of used composite fibers A, which prevents tangling. Guiding sleeves 4 are mounted in the beam 3 by known methods. In the present embodiment, the beam 3 includes holes open from the top, in which twenty guiding sleeves 4 are seated.

[0017] In the load-bearing structure 2, there is a linear set of ten braiding heads 5 fixed behind the beam 3, where neighboring braiding heads 5 have opposite directions of rotation. Two guiding sleeves 4 has been assigned to each braiding head 5. The number of braiding heads 5, their mutual arrangement or fact of using all of them or just a part of them depend on the production needs and are selected to match the size of the composite mesh. Each braiding head 5 is made as a rotating element seated in a fixing element of the load-bearing structure 2 and rigidly coupled with a gearwheel 6, whereby in the whole set of braiding heads 5, the gearwheels 6 are in gear, which allows achieving opposite directions of rotation for neighboring braiding heads 5. Also, in the case of the whole set of the braiding heads 5, the gearwheel 6 of only one selected braiding head 5 is connected with a drive implemented by a stepping motor 7. The stepping motor 7 itself is programmed and started for a selected number of rotations - it is directly reflected in the number of rotations of braiding heads 5, which enables adjusting the number of braids of longitudinal composite fibers A and the size of an opening of the manufactured composite mesh. The stepping motor 7 can be started by a single sensor or a set of sensors, which will be described further on.

[0018] Each single braiding head 5 has two evenly arranged brackets 14 equipped with ring elements 8 to guide longitudinal composite fibers A. Also, each braiding head 5, in its rotation axis O_2, has a guiding pass-through hole for longitudinal composite fibers A that go through that hole between assigned guiding sleeves 4 and the ring elements 8. Thus, the pass-through hole of braiding head 5 has a diameter that is bigger than the total diameter of longitudinal composite fibers A that go through it and of braids formed by those fibers.

[0019] The ring elements 8 are located in the direct contact with a laying mechanism 9 for transverse ties B. The inner surface of the laying mechanism 9 is in a shape similar to a cone. An axis O_1 of that conical surface is perpendicular to a rotation axis O_2 of braiding heads 5 and, moreover, in axis O_1 of the cone, there is a pass-through hole 10 for insertion of the transverse tie B. While in the side surface of the laying mechanism 9, there is a longitudinal pass-through gap 11 to guide the transverse tie B out for braiding. The Gap 11 is wider than the width of the used transverse tie B for which it has been intended. Gaps 11 of each laying mechanism 9 in the whole set of braiding heads 5 constitute one, common plane that goes through the axis O_1 of the conical surface of the laying mechanism 9. Transverse tie B is inserted to the device 1 for composite mesh braiding transversally to longitudinal composite fibers A. This transverse tie B is inserted into the laying mechanism 9 in the direction from the base of the cone to its apex. Thus, the transverse tie B is guided through the tapered surfaces of the inner cone directly to the pass-through hole 10. The inner shape of the laying mechanism 9 greatly improves the process, since, for instance, it can compensate shakes or imprecision of the device that feeds the transverse tie B, or facilitate work of the operator who inserts the transverse tie B manually.

[0020] Behind the outmost braiding head 5 and the laying mechanism 9 assigned to it on the load-bearing structure 2, there is mounted a sensor 13 that reacts when the transverse tie B is being inserted. If the transverse tie B is inserted correctly, the sensor 13 will start the stepping motor 7.

[0021] At the same time, between neighboring braiding heads 5, there are push rods 12 that support guiding the transverse tie B out for braiding. Ends of the push rods 12 have a recess in a shape that is adjusted to the shape of the transverse ties B. The Push rods 12 are driven by one mutual drive and are connected with it through a transmission.

[0022] In the embodiment, the outer surface of the laying mechanism 9 is also a conical surface that corresponds to the inner surface.

[0023] Longitudinal composite fibers A and transverse ties B are inserted into the device 1 for composite mesh braiding. First, longitudinal composite fibers A go through the guiding sleeves 4, where they are organized and then go into axial holes in the braiding heads 5. After that, they go to the ring elements 8 and are led through them. Transverse tie B, which is guided through the laying mechanisms 9 and their holes 10 of consecutive braiding heads 5, is inserted into the hole formed by longitudinal composite fibers A led through the ring elements 8. After transverse tie B is inserted in the device 1 for composite mesh braiding, the process of the technological line that incorporates the device 1 for composite mesh braiding is launched. Transverse tie B is pushed out from the laying mechanism 9 by the push rod 12 through the gap 11 and pressed against longitudinal composite fibers that have been already braided. Placement of transverse tie B does not only cause its pushing out later on, but also starts the braiding heads that braid longitudinal composite fibers A behind transverse tie B. Thus, in front and behind the transverse tie B, there are braided composite fibers A that form individual openings of the mesh.

Claims

1. A device for composite mesh braiding, being loaded with longitudinal composite fibers and transverse ties, having a load-bearing structure with a seated beam with guiding sleeves provided for continuous guiding of longitudinal composite fibers, while behind that beam there is a set of many braiding heads, in which neighboring braiding heads have opposite directions of rotation, while each single braiding head has at least two evenly arranged guiding elements for longitudinal composite fibers, **characterized in that** a single braiding head (5) has at least two brackets (14) fixed equipped with ring elements (8) to guide longitudinal composite fibers (A), situated in the direct contact with a laying mechanism (9) for transverse ties (B) with an inner surface similar to conical surface, provided for inserting the transverse tie (B) in the direction from the base to the apex of the cone, whereby an axis (O_1) of that surface is perpendicular to an axis (O_2) of the braiding heads (5) and in this axis (O_1) there is the a pass-through hole (10) of the laying mechanism (9) to insert the transverse tie (B), while in the side surface of the laying mechanism (9) there is a longitudinal pass-through gap (11) for guiding the transverse tie (B) out to be braided, whereby gaps (11) of the laying mechanisms (9) of the whole set of braiding heads (5) constitute one common plane that goes through the axis (O_1) of the conical surface of the laying mechanism (9).

2. The device according to claim 1, **characterized in that**, the outer surface of the laying mechanism (9) is also a conical surface that corresponds to the inner surface.

3. The device according to claim 1 or 2, **characterized in that**, a single braiding head (5) has a pass-through hole in its rotation axis for longitudinal composite fibers (A).

4. The device according to one of the claims 1 to 3, **characterized in that**, between neighboring braiding heads (5), there are jointly-propelled push rods (12) for guiding the transverse tie (B) out from the laying mechanism.

5. The device according to one of the claims 1 to 4, **characterized in that**, each braiding head (5) is rigidly coupled with a gearwheel (6), whereby gearwheels (6) of neighboring rotation heads (5) are in gear with each other, while one of them is connected with a drive.

6. The device according to claim 5, **characterized in that**, the gearwheel is driven by a stepping motor (7) started for a selected number of rotations.

7. The device according to claim 6, **characterized in that**, the stepping motor (7) is started by a sensor (13) located behind the outmost braiding head (5) and reacting to insertion of the transverse tie (B).

8. The device according to one of claims 1 to 7, **characterized in that**, it has a set of ten braiding heads (5) with two brackets (14) each, while the guiding hole in the braiding head (5) has a diameter bigger than the diameter of the formed braid and the pass-through gap (11) of the laying mechanism (9) is wider than the width of the transverse tie (B) for which it has been intended.

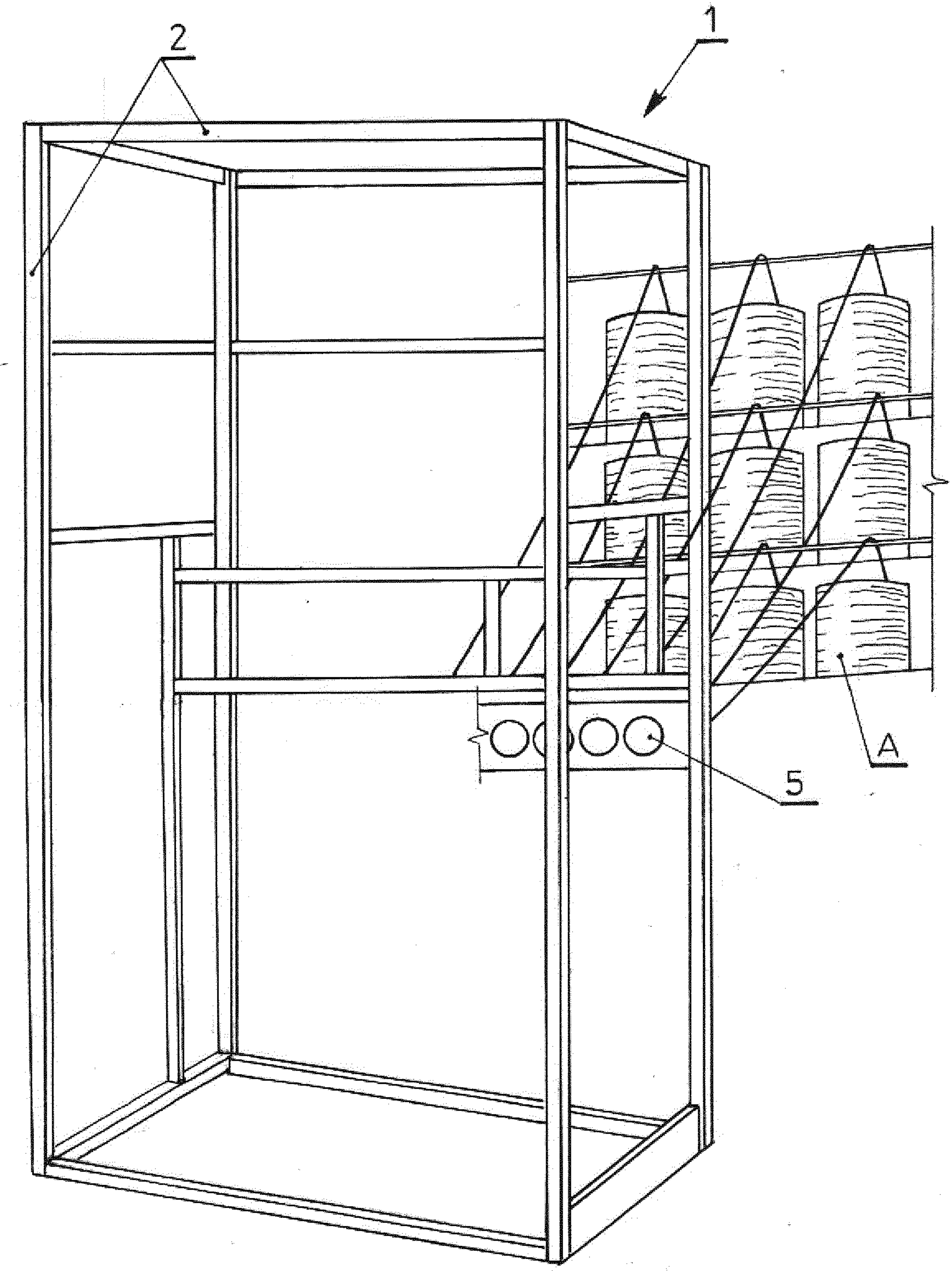

Fig.1

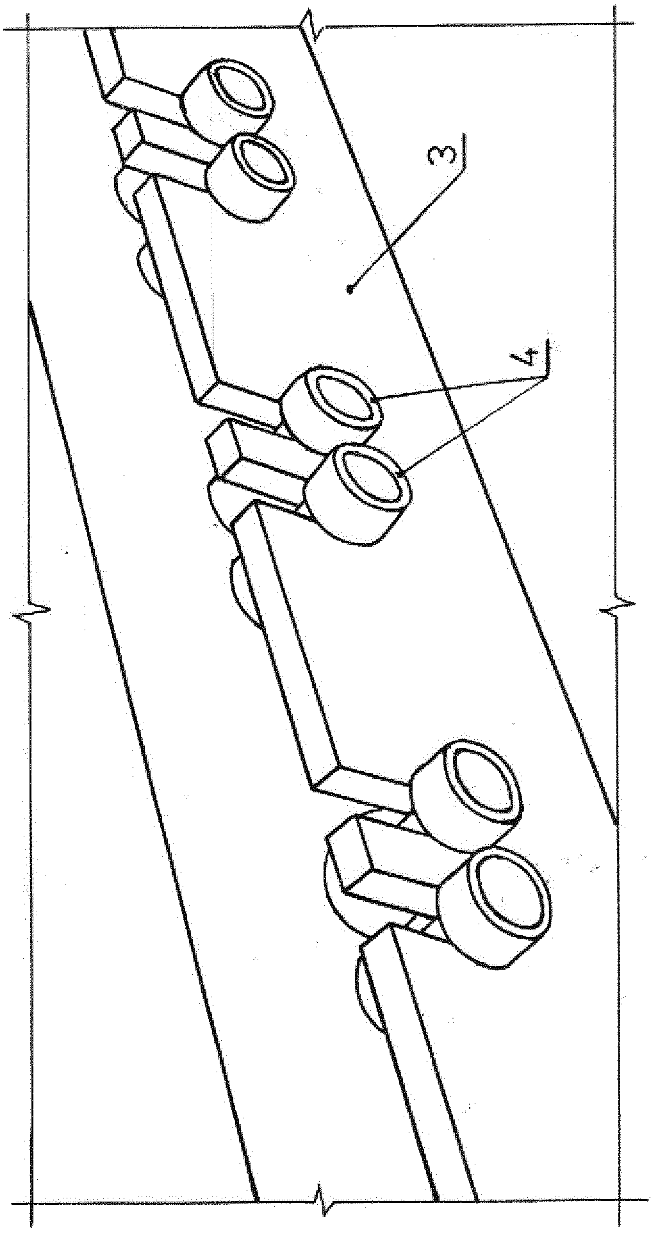

Fig. 2

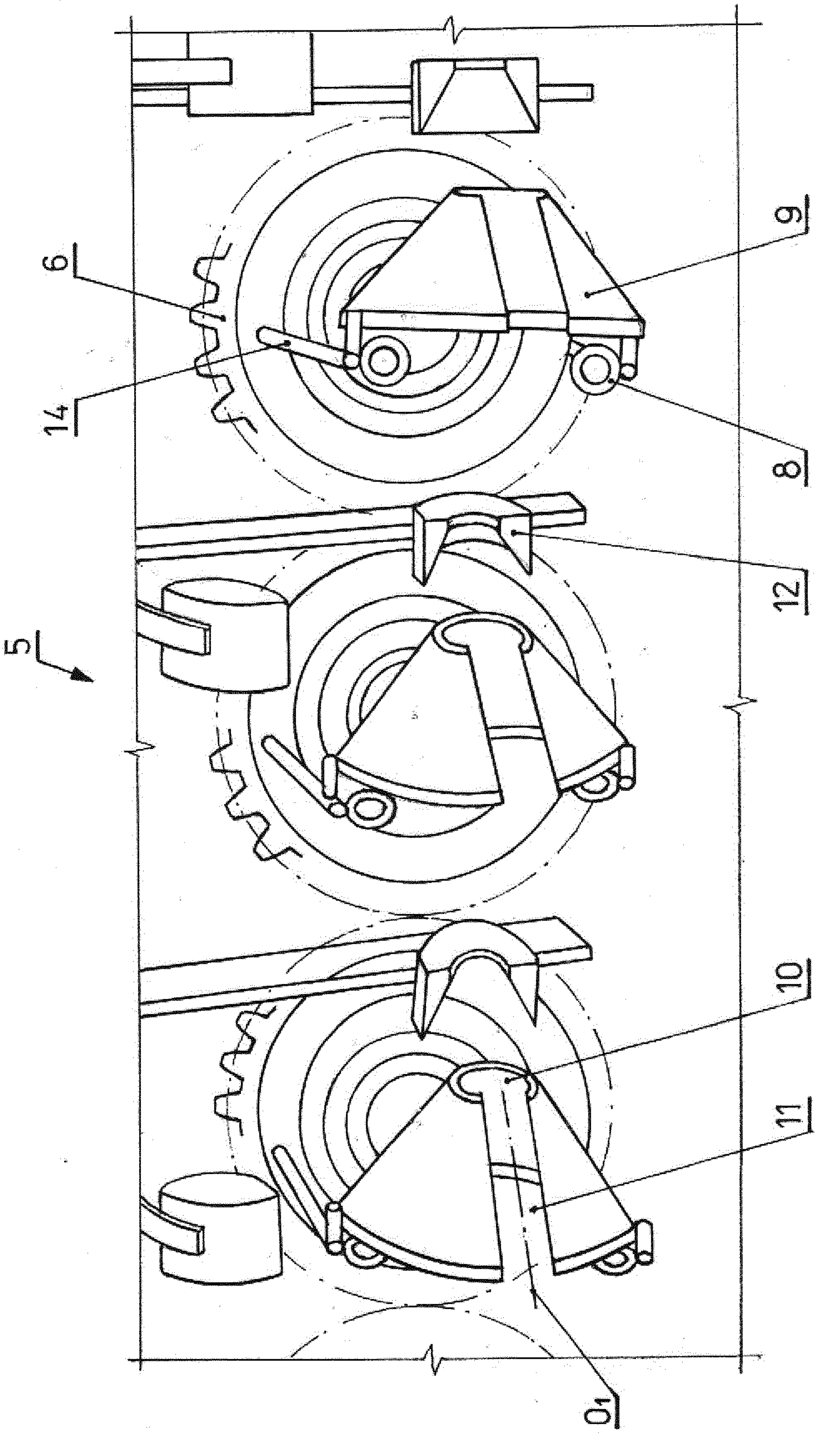

Fig.3

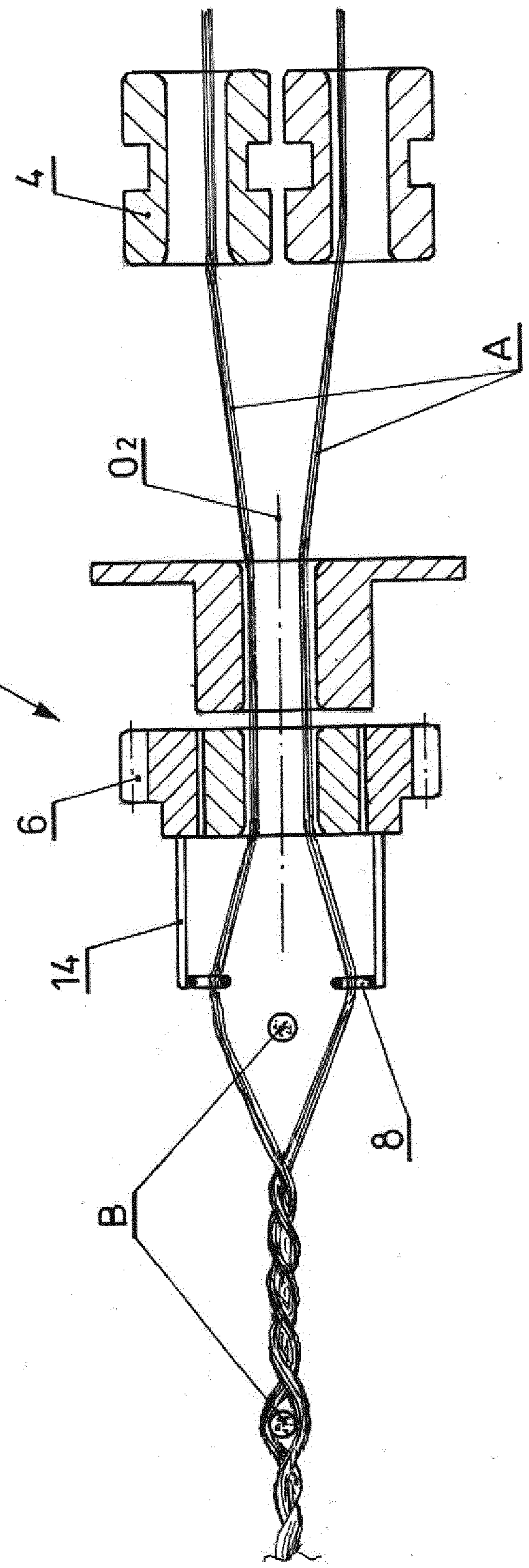

Fig. 4

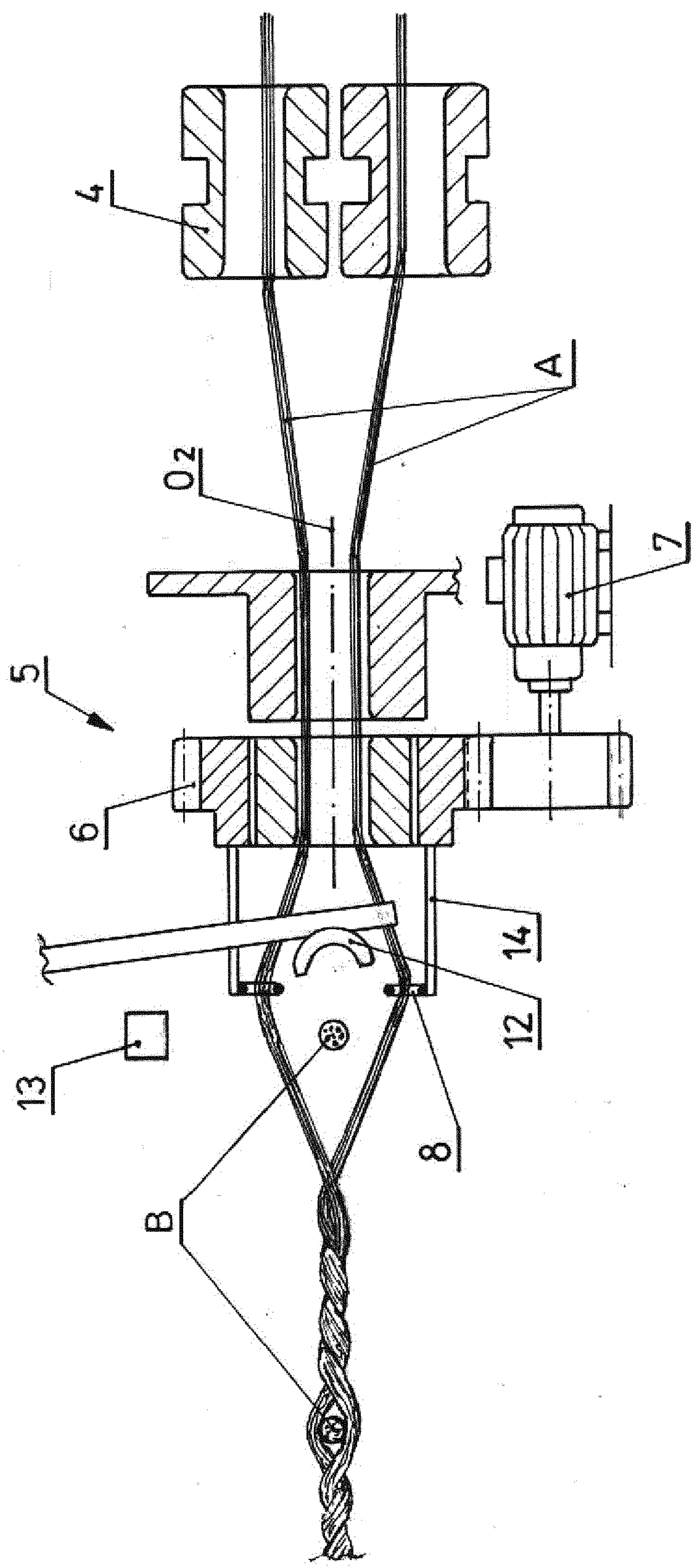

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 0113

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 1 025 307 A (RAYMOND GEORGE A [US]) 7 May 1912 (1912-05-07) * page 2, lines 44-93; figures 1-15 *	1-8	INV. D03C7/08 B21F27/06 D04C1/08
A	GB 331 770 A (HAIDEKKER SANDOR R T) 10 July 1930 (1930-07-10) * page 2, lines 17-50; figures 1-7 *	1-8	
A	US 2008/276564 A1 (OFFERSEN KURT [DK] ET AL) 13 November 2008 (2008-11-13) * paragraphs [0022] - [0035]; figures 1-3 *	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

D03C
B21L
B21F
D04C
D03D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	11 December 2018	Louter, Petrus

CATEGORY OF CITED DOCUMENTS

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11-12-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- PL 418525 A1 **[0002]**
- FR 2183336 **[0003]**