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(54) Title: A CIRCULAR LOOM FITTED WITH SHED FORMING WARP END GUIDE

(57) Abstract: The invention discloses circular loom to make plain weave woven fabric which is provided with reduced-friction warp guide elements to achieve high speed weaving. The circular loom is fitted with shed forming warp end guide (3) provided with an upper end portion (3A), a lower end portion (3B), and a middle portion (3C). The middle portion (3C) is provided with a thread eye (4). One key aspect of the invention is that the thread eye (4) has an internal profile curved to receive a reduced-friction thread eye insert (5). The side gap (7) and the end gap (8) between said thread eye insert (5) and the internal profile of said thread eye (4) are filled with adhesive. The advantage of this is that the thread eye assembly is desirably flexible/elastic but at the same time tough to a required degree.

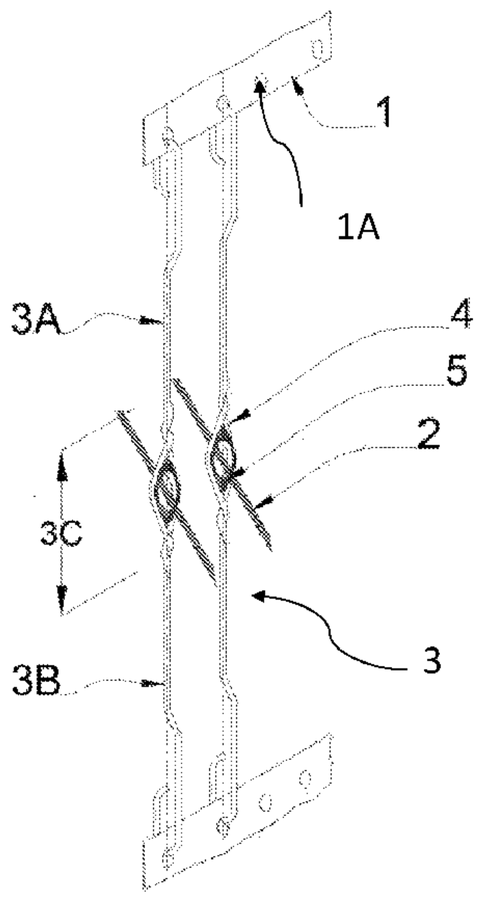

Figure 3

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A CIRCULAR LOOM FITTED WITH SHED FORMING WARP END GUIDE

Field of Invention:

The invention relates to a circular loom to make woven fabric. In particular it relates to woven fabric circular looms provided with reduced-friction warp guide elements to achieve high speed weaving.

Background of Invention:

In general, the most common warp guide element for shed forming used in circular weaving looms consists of a relatively thin flat strip of metal, such as steel, which has an opening or eye intermediate. It is known state of art that a single warp thread or yarn passes through the eye of the warp guide element for shed forming. The plurality of warp guide elements for shed forming is typically mounted on an endless belt or slide bar on the loom circumference. The warp ends are passed through the eyes provided on these warp guide elements such that the width of the warp end is substantially in horizontal plane while passing through the eye. The eye of the warp guide element for shed forming is typically rectangular with fully rounded ends or squared ends with small corner radii to minimize abrasion of the warp yarn passing through the eye. It is also known that the edges and corners of the eye should be well polished to avoid damaging or impeding the movement of the warp thread.

In an ideal configuration, the eye of the warp guide element for shed forming should not bind or chafe the warp thread passing there through nor crowd or contact the adjacent warp threads controlled by warp guide elements for shed forming bounded in adjacent harness belts in the set. This is particularly so during the shed-change reciprocating and opposite up/down movements of the harness belts and warp guide elements used for shed forming. However, conventional warp guide elements for shed forming are found not to deliver the expected ideal outcome.

Further, with an increasing trend towards the lighter weight fabric, the thinner warp slit film tapes are been used. As the thickness of the warp slit film tapes reduces, the chances of their getting damaged during the operation increase. Also, there is increase in demand for higher production rate with minimal downtime. However, with the conventional warp guide element for shed forming, wherein with metallic eye, with the warp slit film tape/yarn passing through the metallic eye, is subjected to binding abrasion in the eye itself.

The warp guide elements are typically hung at their both ends into receptor holes provided in the continuous belt. While the warp guide elements are secured into the belt sufficiently for the purpose of weaving, they are not secured tightly. As a result, the lane of the eye assembly is not parallel to the lane of belt – it is typically at an angle to the plane of belt. Therefore, the eye does not provide a straight passage for the warp tape/yarn end that passes through it. Since the warp tape is often made from polyolefin material with filler content which has very high abrasive nature, it tends to bind the eye itself. Thus, the conventional warp guide elements for shed forming have not been able to eliminate friction and interference both within the eye and with adjacent warp ends, posing higher problem for increase in production speed or increasing the wear life of thread eye.

Present invention addresses these deficiencies in the conventional warp guide element for shed forming and makes a significant improvement in the art.

Objective of Invention:

The main objective of this invention is to provide a circular loom fitted with shed forming warp end guiding elements for rapid shed forming on high speed circular weaving loom.

Another objective is to provide a circular loom fitted with shed forming warp end guiding elements which are even suitable for processing of light denier polyolefin slit film tapes.

Further objective is that the shed forming warp end guiding element has comparatively longer wear resistance/service life over the conventional guiding element.

Also, there is an objective to make low cost, light weight shed forming warp end guiding element for circular loom.

Brief Description of Figures:

FIG. 1 shows preferred warp guide element (B) for shed forming and its embodiments (A and C)

FIG. 2 shows the ceramic insert of the invention and a sectional view of it once it is fitted in the warp guide element for shed forming

Figure 3 shows the warp guide elements for shed forming held together with belt

List of parts:

1. Belt, 1A - receiver or receptor hole
2. Warp or warp end or warp thread or tape;
3. Warp end guide or warp end guide element or warp guide element; 3A – upper end portion; 3B – lower end portion; 3C – middle portion; 3D – legs of the middle portion; 3E – hook; 3F connector hole; 3G - leg
4. Thread eye or the eye or the loop
5. Insert or the thread eye insert
6. Strip
7. Side Gap
8. End gap

Summary Of Invention:

The invention relates to a circular loom to make woven fabric. In particular it relates to woven fabric circular looms provided with reduced-friction warp guide elements to achieve high speed weaving. The invention discloses a circular loom fitted with a plurality of shed forming warp end guides (3). The warp end guide comprises an upper end portion (3A), a lower end portion (3B), and a middle portion (3C), where the middle portion (3C) is provided with a thread eye (4). One key aspect of the invention is that the thread eye (4) has an internal profile curved to receive a reduced-friction thread eye insert (5). However, after fitting the insert into the thread eye (4), there are side gap (7) and the end gap (8) between said thread eye insert (5) and the internal profile of said thread eye (4). In another key aspect of the invention is that these gaps are filled with adhesive. The advantage of this is that the thread eye assembly is desirably flexible/elastic but at the same time tough to a required degree.

Detail Description Of Invention:

A circular loom provided with a plurality of warp thread guide elements (3) is disclosed, said warp guide elements (3) held together by a continuous belt (1) and designed for shed forming on circular weaving machines (not shown). Warp guide elements (3) for shed forming of this type have a thread eye (4), also referred to as a loop, and are used in weaving machines in order to raise and lower warp threads (2). Each warp thread (2) passes through a thread eye provided on each warp guide element (3), for the purpose of forming the shed. A typical warp guide element (3) for shed forming of this type conventionally has a split middle portion which merges into a longitudinal portion on each of the two sides, the metallic thread eye being soldered/inserted in the middle portion.

Conventional warp guide element for shed forming with a metallic thread eye have the major disadvantage that they are relatively costly to produce and are relatively heavy.

The objectives are achieved, in particular, by means of inventive shed forming warp guide element (3) which comprises at least one metallic wire or a bar or strip or a plate, which has in its middle portion (3C) a thread eye (4) that is fitted with a substantially friction-free insert (5). After fitting the insert (5), there are side gaps (7) between the insert and the legs (3G) of the warp guide element (3), and also end gaps (8) between the insert and upper and lower ends of the middle portion (3C) itself (see Figure 1 – part B and also Figure 2). The key aspect of the invention is that these gaps are filled with a suitable adhesive.

Figure 3 shows the belt (1) that holds together the warp end guides (3) of the invention. The warp guide elements (3) are hung at their both ends into receptor holes (1A) provided in the continuous belt (1). While the warp guide elements (3) are secured into the belt (1) sufficiently for the purpose of weaving, they are not secured tightly. As a result, the plane of the thread eye (4) is not parallel to the plane of belt (1) – it is typically at an angle to the plane of belt (1). Therefore, the eye (4) does not provide a straight passage for the warp tape/yarn end (2) that passes through it.

A warp guide element (3) disclosed here for shed forming is typically exposed to jolts and tremor during operation. The thread eye (4) fastened to the warp guide element (3) for shed forming therefore preferably has, to some extent, elastic properties and also some toughness. In order to ensure a permanent bond between the warp guide element (3) for shed forming and the thread eye (4), one aspect of the invention uses an adhesive which has some elastic properties or appropriate toughness. Moreover, the adhesive should be insensitivity to shocks/jerks. Once the insert (5) is fitted into the thread eye (4) and the gaps between the two are filled with the adhesive, the combined assembly has the desirable properties of flexibility/elasticity as well as toughness, thereby rendering it durable.

In an advantageous embodiment, the entire warp guide element (3) or at least the faces coming directly into contact with the warp threads (2), has a hardened surface with, for example, a surface treated with nitriding to a depth of 5 to 50 micrometers.

The warp thread guide element (3) according to the invention for circular loom is described in detail with reference to an exemplary embodiment of a smooth-edged wire warp guide element for shed forming.

The referred embodiment of warp guide element (3) for shed forming is illustrated in Figure 1. In its simplest form, it comprises two metallic wires or strips which in their middle portion are formed so that they form a loop (4). The strips/wires are affixed to each other in their upper end portion (3A) and the lower end portion (3B). Thus the warp guide element (3) has a middle portion (3C) flanked by two end portions – an upper end portion (3A) and a lower end portion (3B). The loop serves as the thread eye (4) into which a ceramic insert is secured by adhesive such that all side gaps (7) and the end gaps (8) between the ceramic insert and the loop (4) are filled by the adhesive. This is in contrast with the existing warp guide elements where at least the end gaps (8) are filled up using soldering, thereby making the thread eyes (4) of the conventional warp guide elements undesirably stiff. The internal surface of the ceramic insert (5) is preferably curved and polished.

The interspaces formed between the leg parts (3G) and the thread eye (4) are filled with adhesive, care being taken, in particular, to ensure that the surface of the adhesive between the respective legs (3G) and the thread eye insert (5) runs uniformly, so that the entire surface of the middle portion (3C), together with the glued-in thread eye insert (5), has, if possible, no edges. This design of the surface makes it possible for a warp thread running through the thread eye insert (5) to be guided with great care. The thread eye (4) could also have other cross-sectional

shapes. The adhesive is preferably always applied in such a way that a continuously running surface, which has no edges, is obtained between the leg parts (8) and the thread eye (4).

The ends of the warp guide elements (3) may be designed in widely varying ways, for example even as hooks; the warp guide element (3) thus has hooks (3E) at its extremities for securing themselves in the belt (1) which is provided with receivers (1A), which are holes or slits.

As shown in Figure 2 and the sectional view shown therein, the insert (5) is filled in the thread eye (4) of the warp end guide (4). The gap (7) between the ceramic eye and the thread eye is filled with adhesive. The insert (5) with the curved shape or profile that comes into contact with the warp (2) that passes through the thread eye (4) is fastened to the warp guide element (3) for shed forming by adhesive bonding, which decreases the overall weight. As the result, the circular weaving loom (not shown), comprising a plurality of individual warp guide elements (3) for shed forming, likewise has a lower weight and therefore, for example, can be operated at a higher rotational speed (up to 30% higher than conventional speed) or requires less energy (up to 20% saving over conventional energy requirement) to operate it.

The insert (5) can be made from ceramic or by ceramic coating. This allows more cost-effective production and, moreover, is ecologically preferable to the existing thread eye construction. Further, the outer contact surface of the thread eye being produced by ceramic or ceramic coating is relatively hard compared to the conventional metallic eye which ultimately reduces the risk that the guided warp threads of polyolefin material would cut into this outermost surface.

The ceramic insert (5) thus has a hardened surface; it also has a low heat conducting property compared to the conventional metallic eye inserts, which

consequently reduces the heat generated by warp ends rubbing on the surface of the thread eye/insert.

As shown in Figure 2 (sectional view) the adhesive used for securing the insert (5) in the thread eye (4) is chosen for its stronger binding ability, thus resulting in the warp guide element for shed forming having a longer service life. Further, the assembling of the insert (5) into the thread eye (4) with the help of adhesive is a much faster process of creating the thread eye assembly compared with the conventional methods of manufacturing warp guide elements with thread eyes. Quick-acting adhesives which have a short curing time due to chemical or physical influences are suitable. An adhesive of this type may, for example, be produced on the base of polymeric urethane acrylate.

Another advantage of the method according to the invention is that a thread eye insert (5) which is made from ceramic coatings that are more wear-resistant than conventional metallic eyes, for example Plasma ceramic layers applied using plasma ceramic coating process, does not require any external fastening element and are rust-proof.

In an embodiment (Figure 1 – part A), the warp guide element (3) for shed forming can also be designed as a single-piece flat steel warp guide element in the form of a strip (6), with a perforation in the middle portion. The perforation itself serves as a thread eye (4). The strip is provided with holes near its extremities where links to connect it to the belt (1) may be provided. Alternatively, it also may be provided with hooks at its extremities. In this embodiment, instead of providing a separate insert (5), the edges and any other surfaces of the thread eye (4) that are likely to come in contact with the warp end (2) are coated with ceramic material. The thread eye (4) is designed preferably as arch/curve shape guide element for ease of passing warp end without abrasion.

In a further embodiment (Figure 1 – part C), the warp guide element (3) for shed forming can also be designed as a single piece solid or hollow bar, and pressed/forged in its middle portion to form a flat and wide area with a perforation cut out in the middle portion. The perforation itself serves as a thread eye (4). The bars may be pressed at their upper and lower ends to provide a hole near its extremities where links to connect it to the belt (1) may be provided. Alternatively, it also may be provided with hooks (3E) at its extremities. In this embodiment too, instead of providing a separate insert (5), the edges and any other surfaces of the thread eye (4) that are likely to come in contact with the warp end (2) are coated with ceramic material. In this embodiment too, the thread eye element (3) is designed preferably as arch/curve shaped guide element for ease of passing warp end without abrasion.

While the above description contains much specificity, these should not be construed as limitation in the scope of the invention, but rather as an exemplification of the preferred embodiments thereof. It must be realized that modifications and variations are possible based on the disclosure given above without departing from the spirit and scope of the invention. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the appended claims and their legal equivalents.

Claims:

1. A circular loom fitted with a plurality of shed forming warp end guide (3), said warp end guide comprising an upper end portion (3A), a lower end portion (3B), and a middle portion (3C), said middle portion (3C) provided with an thread eye (4), characterised in that said thread eye (4) has an internal profile curved to receive a reduced-friction thread eye insert (5), and wherein the side gap (7) and the end gap (8) between said thread eye insert (5) and said internal profile of said thread eye (4) is filled with adhesive.

2. The circular loom as claimed in claim 1, wherein said thread eye insert (5) is made of ceramic material.

3. The circular loom as claimed in claim 2, wherein the internal surface of said insert (5) is curved and polished.

4. The circular loom as claimed in claims 1 to 3, wherein said upper end portion, said middle portion, and said lower end portion are made integrally with each other without any joint.

5. The circular loom as claimed in claims 1 to 3, wherein said guide (3) is made from two wires and wherein said middle portion is formed by twisting the two wires together on either side of said middle portion and in the middle portion the two wires are separated from each other to form a thread eye.

6. The circular loom as claimed in claims 1 to 4, wherein said warp end guide is made from a strip of metal, and wherein a hole is made in its middle zone to serve as the thread eye (4).

7. The circular loom as claimed in claims 1 to 6, wherein said adhesive has a base of polymeric urethane acrylate.

8. The circular loom as claimed in claim 1, wherein instead of providing an insert (5), said internal profile of said thread eye (4) is coated with ceramic coating.

9. The circular loom as claimed in claim 8, wherein said ceramic coating is done by plasma ceramic coating process.

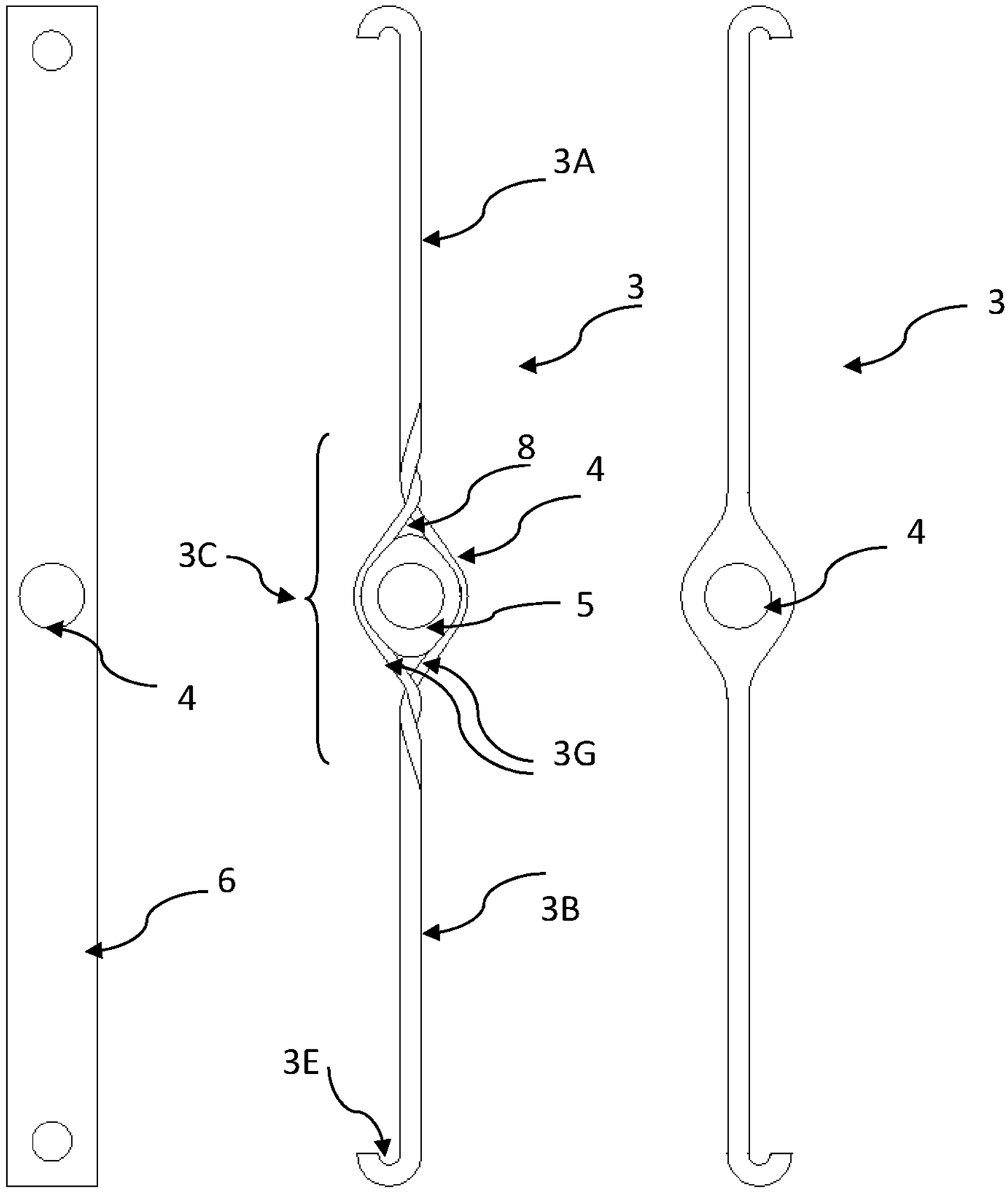

Figure 1

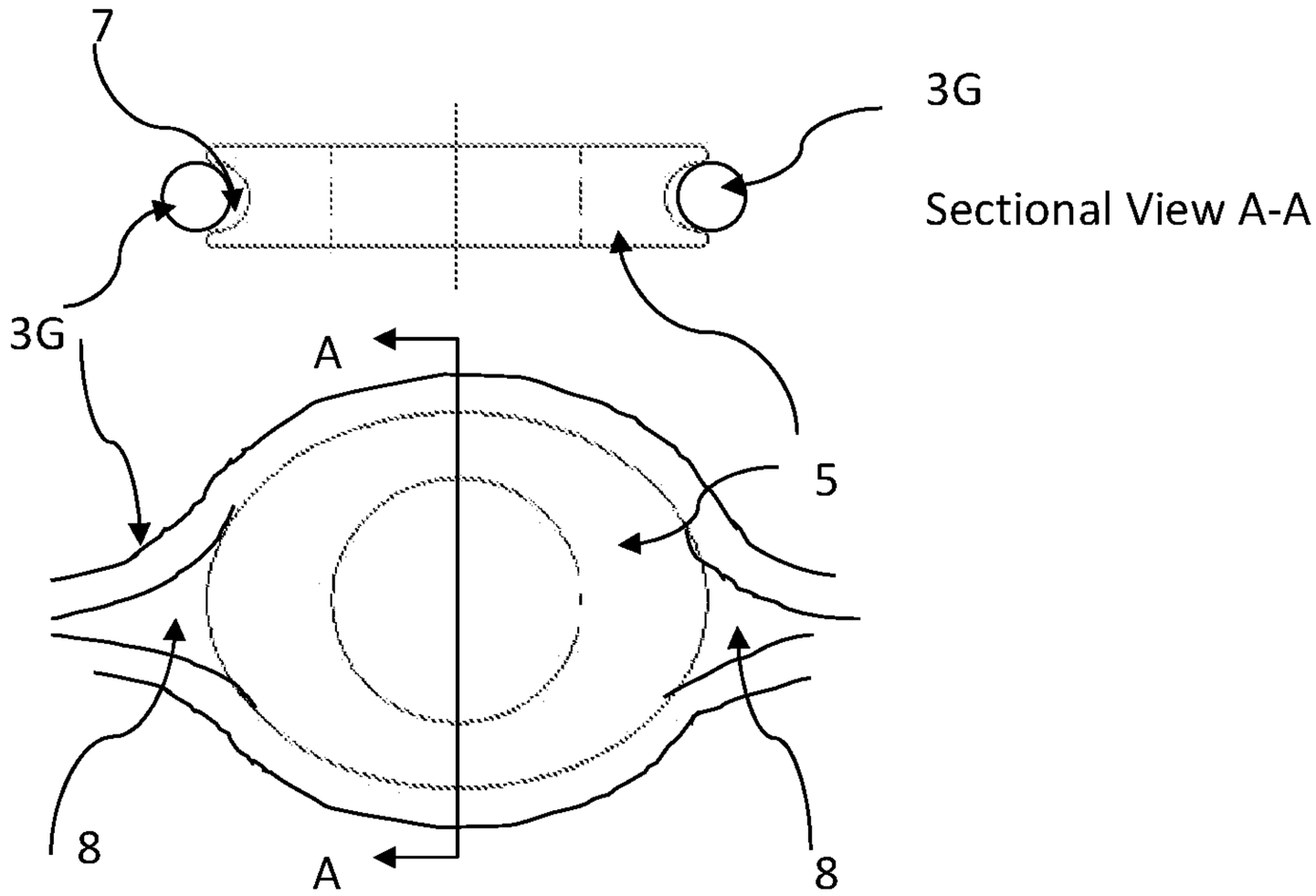

Figure 2

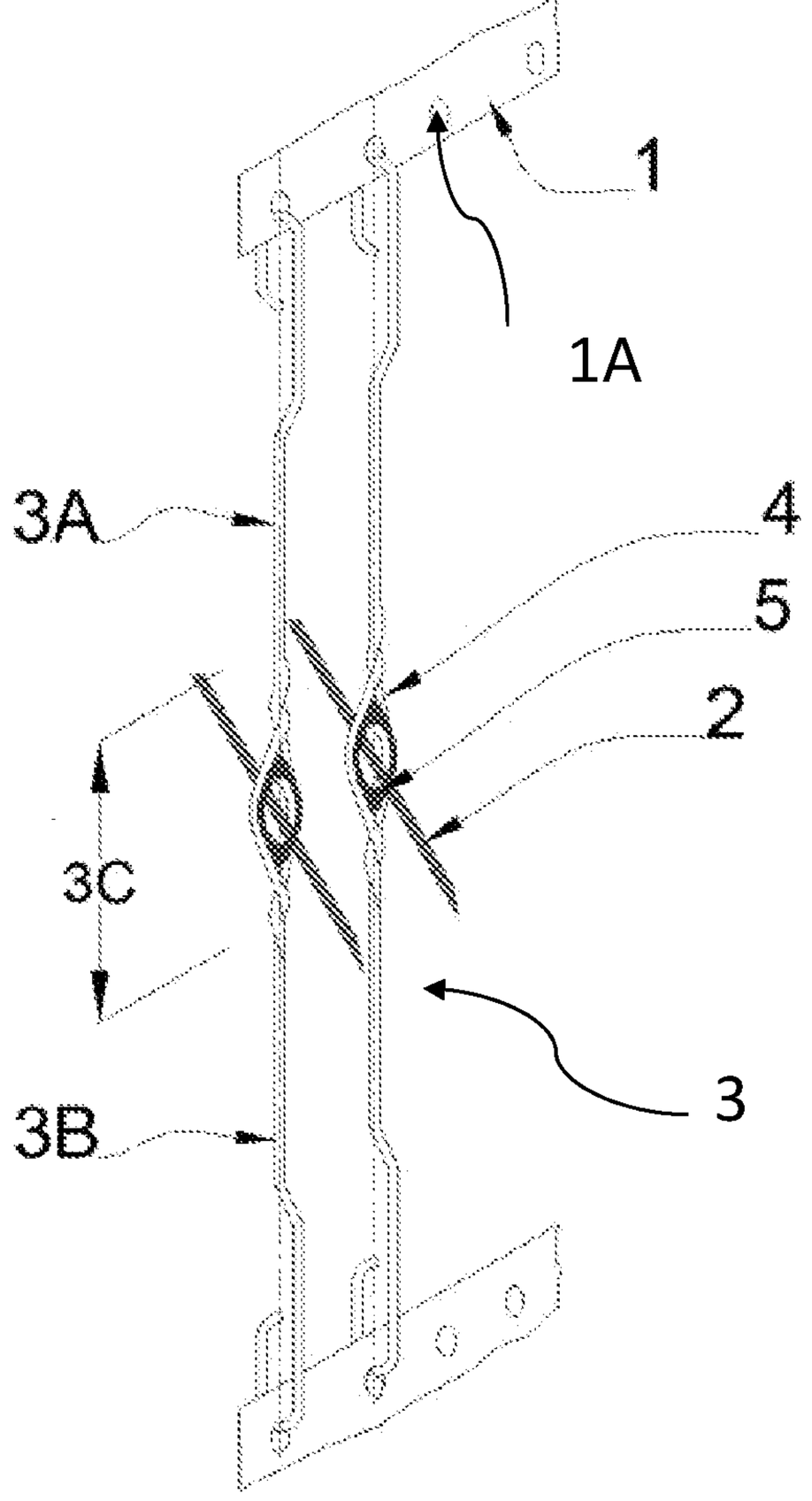

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2020/061115

A. CLASSIFICATION OF SUBJECT MATTER
D03D37/00,D03C9/00,D03C7/06 Version=2021.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: D03D37, D03C9, D03C7

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

TotalPatent One, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP1015675 B1 (GROZ BECKERT KG) July 25, 2001 (25/07/2001) Figures 1-4; Claims 1-8; Paragraphs [0011],[0013-0014] & [0018-0024] as per English translated copy available in Espacenet.	1-9
A	EP2730687A1 (GROZ BECKERT KG) May 14, 2014 (14/05/2014) Figures 1 &2 ; Paras [0009-0010],[0015-0018], [0023-0025]; Claims 1-15	1-9
A	DE102007048761A1 (HEINRICH DERIX GmbH) April 16, 2004 (16/04/2009) Figure 1, Claims 1-9	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05-02-2021	05-02-2021
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Citation	Pub.Date	Family	Pub.Date
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