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(54) YARN SPLICER DEVICE WITH IMPROVED TAIL TEARING MEANS AND THE RELATED OPERATING METHOD

(57) A yarn splicer device (4) comprising a pair of opposite plates (8,12) which are rotatable with respect to a common drive axis (X-X), the plates (8,12) being spaced apart from each other, along said drive axis (X-X), so as to identify a passage path (14) of a first yarn (16) ending with a first thread (20) and a second yarn (24) ending with a second thread (28), to be mutually spliced, tail tearing means (32), configured to grasp and tear tails (36) of said first and second thread (20,28), so as to obtain tearing points (40) positioned at least partially inside said passage path (14) of the first and second yarn (16,24), wherein said tail tearing means (32) comprise a first pair of counter-rotating rotatable cylinders (44), configured to clamp the tail (36) of said first thread (20) and/or a second pair of counter-rotating rotatable cylinders (48), configured to clamp the tail (36) of said second thread (28).

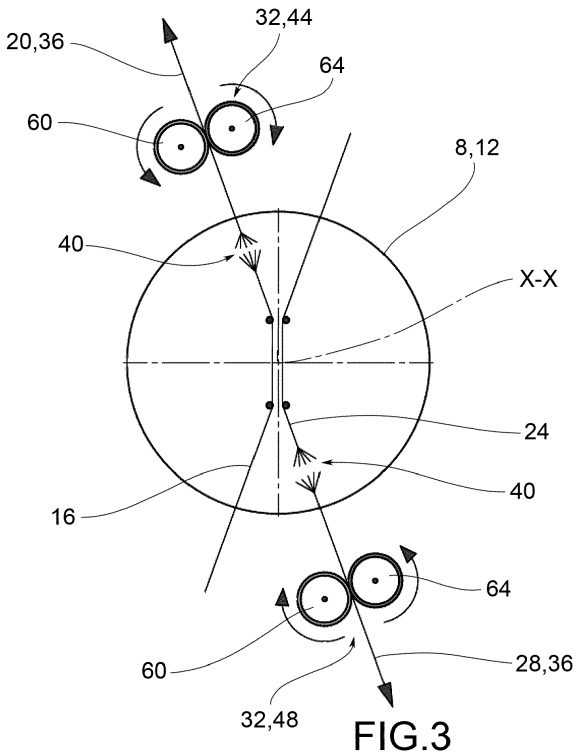

FIG.3

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Description

FIELD OF APPLICATION

[0001] The present invention relates to a yarn splicer device with improved tail tearing means and the related operating method.

STATE OF THE ART

[0002] As is known, yarn splicers are devices widely used in the textile sector to restore the continuity of a yarn following a break or a cut when a quality defect of the yarn is detected. Different types exist on the market, which fundamentally differ based on the physical principle which govern the splicing (mechanical, air, etc.), and are chosen according to the specific features of the yarn to be treated.

[0003] In particular, the use of mechanical splicers is known, such as that illustrated in patent US4637205A (figure 1), which splices two yarn ends, Y1 and Y2, respectively, without knots by means of the splitting and subsequent rearrangement of the twists by means of a pair of counter-rotating, mutually facing friction discs (or plates) aligned along the same rotation axis (Twinsplicer ®).

[0004] This splicing technology, with respect to the other solutions present on the market, is widely appreciated for the results achievable in terms of quality, strength and stability of the splicing, moreover for a wide range of fibres and titres. Furthermore, the operation occurs according to a purely mechanical principle, with the great advantage that the yarn can be controlled and guided during all the splicing steps.

[0005] Briefly, the mechanical splicing cycle with discs comprises the following main steps:

introducing the two yarns;
untwisting and stretching the two yarns;
clamping the two yarns in the central area and tearing/removal of the excess tails;
tails/yarn coupling;
retwisting;
opening the discs and extracting the splice.

[0006] In the sequence of the cycle described above, the removal of the excess tails undoubtedly represents one of the most critical steps to be managed to ensure the good success of the splice in terms of aesthetic appearance and strength. The main reason is primarily due to the fact that the threads to be discarded must be separated by gradual fraying, in order to better prepare them for the subsequent coupling and retwisting step. For this reason, in the devices of the prior art the tearing of the excess tails occurs substantially by traction, by means of a pair of clamps which precisely exploit the absence of twisting (and thus of mechanical strength) of the fibres already parallel within the discs.

[0007] The characteristic narrow and tapered "foxtail" shape of the splice, which derives precisely from the traction shredding of the fibrils, is by its nature a trait which is difficult for the tearing members to control and manipulate. In particular, there is a residual risk that:

[0008] the tearing occurs outside the splicing area defined by the two plates, giving rise to macroscopic defects, such as untwisted tails which protrude from the splice;

[0009] the removed fibrils undesirably adhere to the threads to be preserved, disturbing the correct path of the threads and increasing the risk of frays.

[0010] To overcome such drawbacks, it is very important that the tails are torn as unidirectionally as possible, in a substantially radial direction with respect to the rotation axis of the mutually facing plates, in order to manipulate the tails with firmness and repeatability.

[0011] Unfortunately, this demand does not find easy practical response, because it firstly implies the provision by the splicer of a large portion of space, so as to allow the tear levers to move radially without imposing deviations to the tails, to the evident detriment of the compactness of the device.

[0012] This aspect becomes even more onerous and evident when treating stretch yarns, which, as is known, require greater tear strokes by virtue of their elastic properties. For this reason, in the devices of the prior art the tear stroke is distributed in two directions, first radial and then axial with respect to the plates, thus imposing complicated movements combined with the levers responsible for such a function.

[0013] Obviously, for the reasons mentioned above this configuration implies a series of drawbacks, firstly the poor ability to control the tails, which typically results in the formation of defects in the splicing area.

[0014] Patent IT201900021258A1 proposes tail tearing means comprising a pair of clamps rotatable around respective pins to grasp the tails and pull them outside the splicer according to a substantially radial direction with respect to the plates. However, for the above reasons this implies an increase in the overall dimensions of the device in operation and a limitation in the range of workable yarns (especially stretch yarns) for the above reasons.

[0015] Ultimately, therefore, the solutions of the prior art involve:

a temporary increase in the dimensions of the splicer, and therefore of the space which must be reserved for it for the completion of its cycle, to the detriment of compactness;
the adoption of complicated movements aimed at limiting the movement of the stretching members, for example by distributing the stroke in different directions.

PRESENTATION OF THE INVENTION

[0016] The need is therefore felt to resolve the drawbacks and limitations mentioned with reference to the prior art.

[0017] Such needs are satisfied by an improved yarn splicer device with tail tearing means in accordance with claim 1 and by a method in accordance with claim 11.

DESCRIPTION OF THE DRAWINGS

[0018] Further features and advantages of the present invention will be more clearly comprehensible from the description given below of preferred and non-limiting embodiments thereof, in which:

figure 1 depicts a side view of a yarn splicer device with opposite plates of the prior art;
figure 2 depicts a side view of a yarn splicer device with opposite plates in accordance with an embodiment of the present invention;
figure 3 depicts a schematic front view, partially in section, of the yarn splicer device of figure 2.

[0019] The elements or parts of elements common to the embodiments described below will be indicated using the same reference numerals.

DETAILED DESCRIPTION

[0020] With reference to the aforesaid figures, reference numeral 4 globally denotes a yarn splicer device.

[0021] It should be noted that the term thread or single thread or continuous thread refers to a single filament or continuous filament (for example in the case of silk, artificial or synthetic fibres), while the term yarn refers to a group of fibrils of varying lengths which are paralleled and joined together by twisting. Hereinafter, one or the other term will be used indifferently, it being understood that the applications of the present invention are not limited to one or the other type.

[0022] The yarn splicer device 4 comprises a pair of opposite plates 8,12 which are rotatable with respect to a common drive axis X-X.

[0023] The plates 8,12 are spaced apart from each other, along said drive axis X-X, so as to identify a passage path 14 of a first yarn 16 ending with a first thread 20 and of a second yarn 24 ending with a second thread 28, to be mutually spliced.

[0024] The yarn splicer device 4 advantageously comprises tail tearing means 32, configured to grasp and tear tails 36 of said first and second thread 20,28, so as to obtain tearing points 40 positioned at least partially inside said passage path 14 of the first yarn 16 and of the second yarn 24.

[0025] In accordance with a possible embodiment, the tail tearing means 32 comprise a first pair of counter-rotating rotatable cylinders 44, configured to clamp the tail 36 of said first thread 20 and/or a second pair of counter-rotating rotatable cylinders 48, configured to clamp the tail 36 of said second thread 28. In other words, the tail tearing means 32 comprise at least one pair of rotatable cylinders 44,48.

[0026] In accordance with a possible embodiment, the rotatable cylinders of said first pair of rotatable cylinders 44 and/or of said second pair of rotatable cylinders 48 are rotatably supported about rotation axes Y-Y parallel to said drive axis X-X of the opposite plates 8,12.

[0027] In accordance with a possible embodiment, said first and second pair of rotatable cylinders 44,48 are arranged in diametrically opposite positions with respect to the drive axis X-X of the plates 8,12.

[0028] In accordance with a possible embodiment, said first and second pair of rotatable cylinders are arranged externally with respect to the plates and the passage path of said first and second yarn.

[0029] Advantageously, the tail tearing means 32 are therefore of the rotational type, consisting of pairs of rotatable cylinders 44,48 configured so as to at least partially clamp at least one parallel tail 36 and to tear it. It is thereby possible to pull tails for a theoretically infinite length as a function of the specific needs of the fibre to be treated, in particular for stretch and/or long-fibre yarns. Furthermore, a rotational type solution allows to tear the tails 36 according to a constant direction (radial, i.e., perpendicular and incident with the drive axis X-X) and to limit the operating dimensions of the yarn splicer device 4.

[0030] In accordance with a possible embodiment, said pairs of rotatable cylinders 44,48 comprise a motor cylinder 60 and an idle cylinder 64 driven by the motor cylinder 60.

[0031] Preferably, each motor cylinder 60 is controlled by a dedicated motor (not illustrated).

[0032] This embodiment allows to customize the stroke and/or the tearing speed by selecting the number of rotations and/or the angular speed of the motor cylinder 60, respectively, according to the specific needs.

[0033] Preferably, said dedicated motor is a stepper electric motor.

[0034] In fact, this type of electric motor allows precision positioning at low speed.

[0035] In accordance with a possible embodiment, at least one of said cylinders 60,64 of the first and/or second pair of rotatable cylinders 44,48 has a rubbery material surface coating and/or a knurling surface treatment and/or a roughening surface treatment, in order to increase the gripping force on the tails 36 of said threads 20,28.

[0036] For example, it is possible to select the type of rubber and/or its hardness and/or knurling and/or surface roughness, and/or modify the normal force with which the motor cylinder 60 presses against the idle cylinder 64, to increase the force necessary to tear the tails 36.

[0037] In accordance with a possible embodiment, the cylinders 60,64 of each pair of rotatable cylinders 44,48 are at least partially in contact with each other so as to

obtain a mutual contact pressure and drag the driven idle cylinder 64 by friction.

[0038] In accordance with a possible embodiment, means are included for adjusting said mutual contact pressure between the cylinders 60,64 of at least one of said pairs of rotatable cylinders 44,48.

[0039] Advantageously, the pair of motor cylinders 60 and idle cylinder 64 can also be used as stretching means. This helps to simplify the mechanical and electrical architecture of the device, reduce the weight and reduce the probability of failure thereof.

[0040] As can be appreciated from the description, the present invention makes it possible to overcome the drawbacks mentioned in the prior art.

[0041] In particular, the present invention solves the drawbacks of the prior art and allows to achieve considerable technical advantages, such as:

the constancy and radial unidirectionality of the tearing of the tails of the threads to be spliced;
the possibility of use for any type of yarn, with a particular advantage for stretch and long-fibre yarns which require an increased tear stroke;
the availability of a theoretically infinite stroke, customizable by appropriately selecting the number of rotations imposed by the motor cylinder, by virtue of the fact that the tail tearing means are of the rotational type;
the possibility of customizing the linear tearing speed by setting the rotation speed of the motor cylinder;
the reduction of the splicer's operating dimensions with respect to the solutions of the prior art;
the limiting of defects due to the undesirable adhesion of the tails to the yarns to be preserved;
the possibility of using the tail tearing means also as yarn stretching means during the untwisting step.

[0042] A person skilled in the art may make numerous modifications and variations to the solutions described above so as to satisfy contingent and specific requirements.

[0043] The scope of protection of the present invention is defined by the following claims.

Claims

1. Yarn splicer device (4) comprising

- a pair of opposite plates (8,12) which are rotatable with respect to a common drive axis (X-X),
- the plates (8,12) being spaced apart from each other, along said drive axis (X-X), so as to identify a passage path (14) of a first yarn (16) ending with a first thread (20) and a second yarn (24) ending with a second thread (28), to be mutually spliced,
- tail tearing means (32), configured to grasp and tear tails (36) of said first and second thread (20,28), so as to obtain tearing points (40) positioned at least partially inside said passage path (14) of the first and second yarn (16,24),
- wherein said tail tearing means (32) comprise a first pair of counter-rotating rotatable cylinders (44), configured to clamp the tail (36) of said first thread (20) and/or a second pair of counter-rotating rotatable cylinders (48), configured to clamp the tail (36) of said second thread (28).

2. Yarn splicer device (4) according to claim 1, wherein the cylinders of said first pair of rotatable cylinders (44) and/or of said second pair of rotatable cylinders (48) are rotatably supported about rotation axes (Y-Y) parallel to said drive axis (X-X) of the opposite plates (8,12).

3. Yarn splicer device (4) according to claim 1 or 2, wherein said first and second pair of rotatable cylinders (44,48) are arranged in diametrically opposite positions with respect to the drive axis (X-X) of the plates (8,12).

4. Yarn splicer device (4) according to claim 1, 2 or 3, wherein said first and second pair of rotatable cylinders (44,48) are arranged externally with respect to the plates (8,12) and the passage path (14) of said first yarn (16) and second yarn (24).

5. Yarn splicer device (4) according to any one of claims 1 to 4, wherein said pairs of rotatable cylinders (44,48) comprise a motor cylinder (60) and an idle cylinder (64) driven by the motor cylinder (60).

6. Yarn splicer device (4) according to claim 5, wherein each motor cylinder (60) is controlled by a dedicated motor.

7. Yarn splicer device (4) according to claim 6, wherein said dedicated motor is a stepper electric motor.

8. Yarn splicer device (4) according to any one of claims 1 to 7, wherein at least one of said cylinders (60,64) of the first and/or second pair of rotatable cylinders (44,48) has a rubbery material surface coating and/or a knurling surface treatment and/or a roughening surface treatment, in order to increase the gripping force on the tails (36) of said threads (20,28).

9. Yarn splicer device (4) according to any one of claims 1 to 8, wherein the cylinders (60, 64) of each pair of rotatable cylinders (44,48) are at least partially in contact with each other so as to obtain a mutual contact pressure and drag the driven idle cylinder (64) by friction.

10. Yarn splicer device (4) according to claim 9, wherein means are included for adjusting said mutual contact pressure between the cylinders (60,64) of at least one of said pairs of rotatable cylinders (44,48).

11. Tearing and splicing method of a textile yarn comprising the steps of:

- arranging a yarn splicer device (4) having a pair of opposite plates (8,12) which are rotatable with respect to a common drive axis (X-X),
- the plates (8,12) being spaced apart from each other, along said drive axis (X-X), so as to identify a passage path (14) of a first yarn (16) ending with a first thread (20) and a second yarn (24) ending with a second thread (28), to be mutually spliced,
- arranging tail tearing means (32) comprising a first pair of counter-rotating rotatable cylinders (44) and/or a second pair of counter-rotating rotatable cylinders (48),
- grasping and tearing tails (36) of said first and second thread (20,28) by means of said first pair of rotatable cylinders (44) and/or said second pair of rotatable cylinders (48), respectively.

12. Method according to claim 11, comprising the step of pulling and tearing by modifying the speed and the rotation stroke of said first and second pair of rotatable cylinders (44,48) as a function of the type, material and/or titre of the yarn to be treated.

13. Method according to claim 11 or 12, comprising the step of tearing the tails (36) of said first and second thread (20,28) according to a radial direction, perpendicular and incident with the drive axis (X-X) of the opposite plates (8,12).

14. Method according to claim 11, 12 or 13, comprising the step of arranging a yarn splicer device (4) according to any of claims 1 to 10.

15. Method according to any one of claims 1 to 14, comprising the step of using said first pair of counter-rotating rotatable cylinders (44) and/or said second pair of counter-rotating rotatable cylinders (48) as stretching means of the first yarn (16) and/or of the second yarn (24) in the untwisting step.

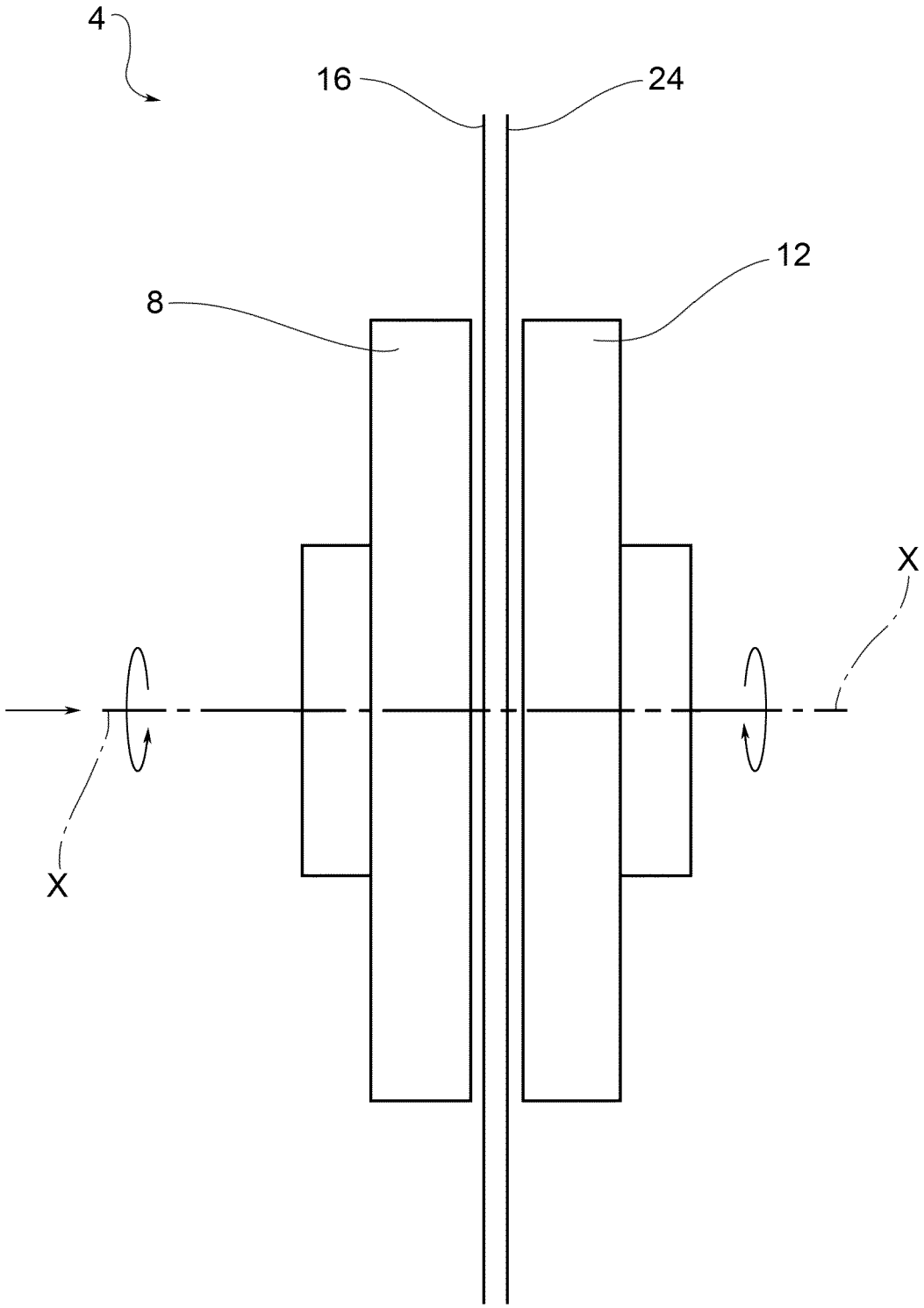
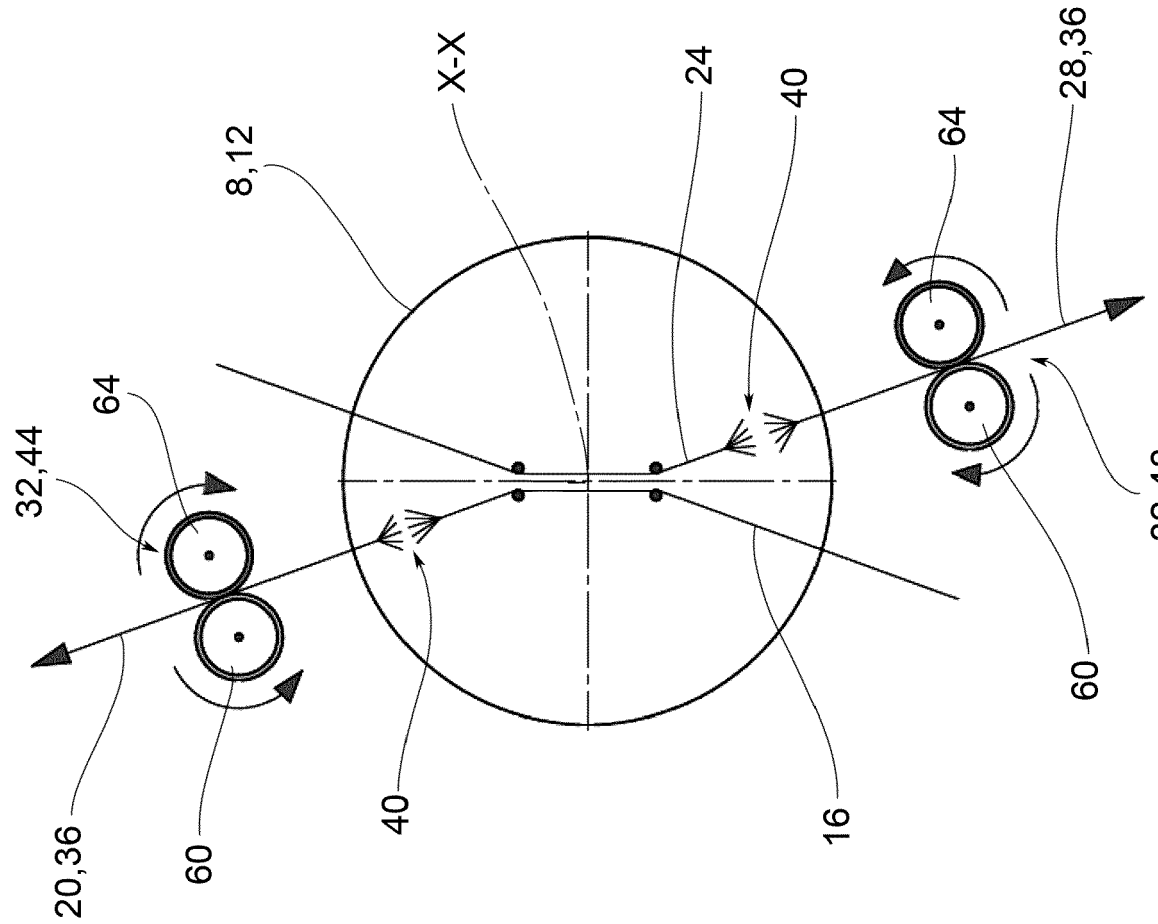


FIG.1 - Prior art


X-X
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40
16
60

FIG.3

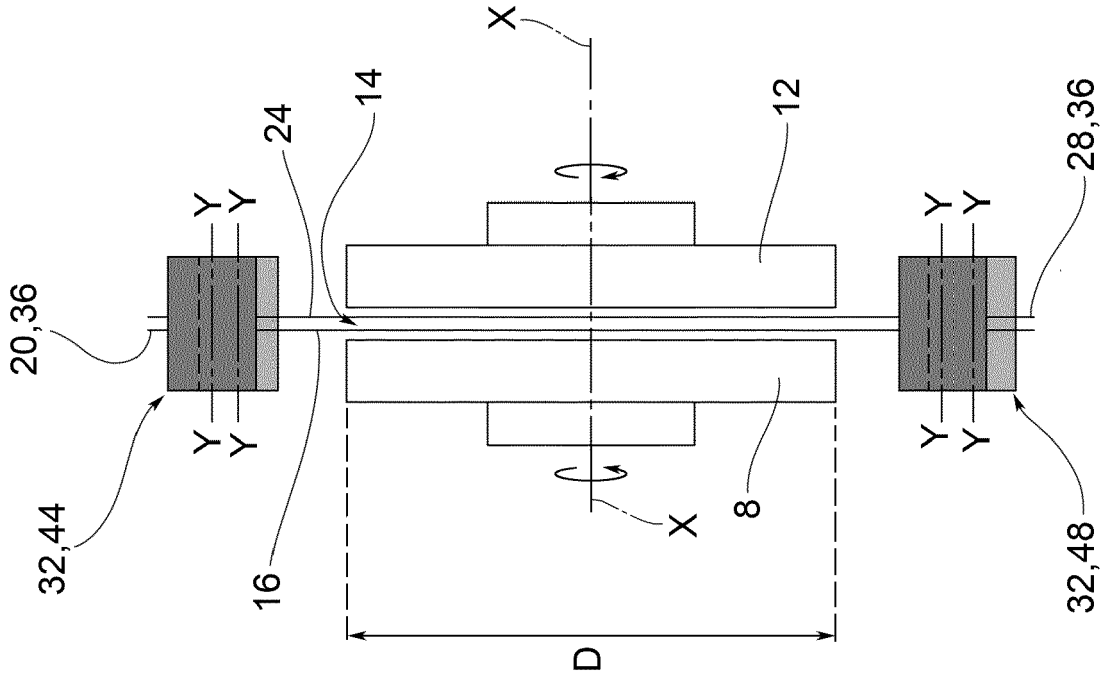
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FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 9409

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 0 078 776 A2 (SAVIO SPA [IT]) 11 May 1983 (1983-05-11) * page 3, lines 5-8, 19-31 * * page 13, line 9 - page 14, line 27; figure 11a * -----	1-9, 11-15 10	INV. B65H69/06
Y	US 4 397 138 A (ROHNER JOACHIM [DE] ET AL) 9 August 1983 (1983-08-09) * column 22, line 53 - column 23, line 10; figure 16 * -----	10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 December 2023	Pussemier, Bart

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0078776 A2	11-05-1983	AU 555794 B2	09-10-1986
		BR 8206379 A	27-09-1983
		CS 254962 B2	15-02-1988
		DE 78776 T1	27-10-1983
		EP 0078776 A2	11-05-1983
		ES 8400353 A1	01-11-1983
		MX 156263 A	29-07-1988
		US 4494367 A	22-01-1985
US 4397138 A	09-08-1983	CH 655079 A5	27-03-1986
		GB 2083090 A	17-03-1982
		IT 1171431 B	10-06-1987
		US 4397138 A	09-08-1983

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4637205 A **[0003]**
- IT 201900021258 A1 **[0014]**