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(54) **High speed winder for non-extensible yarns.**

(57) Yarn winding apparatus to produce a package with a conical end is known in which a friction roller (15) drives a rotatable package (11), the yarn Y being supplied over a disc (17) eccentrically mounted to rotate on an L-shaped lever (18) pivoted by a pin (19) to a vertically reciprocating layrail (20), the other end of the lever (18) having a slide block (22) running in a guide (23) which rotates round a pivot (24) as the package (11) increases in diameter. When used with substantially non-extensible yarn, the speed of rotation of the disc (17) is liable to vary considerably, causing unacceptable yarn package characteristics. The invention overcomes this problem by passing the yarn over a dancer roll (29) on its way to the disc (17). The dancer roll is mounted on a spring balancing means (31) which allows it to move towards and away from the disc.

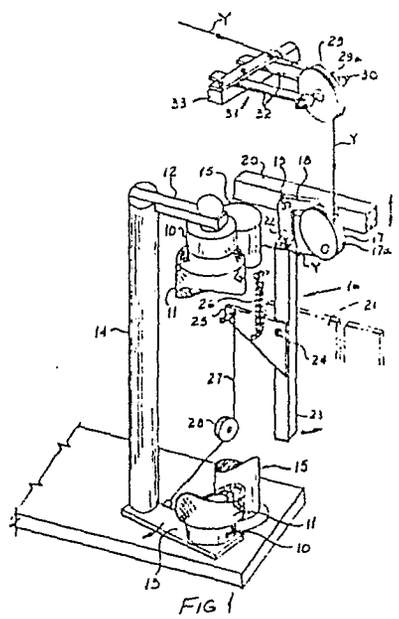

FIG 1

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HIGH SPEED WINDER FOR NON-EXTENSIBLE YARNS.

This invention relates to a vertically mounted high speed winding device for substantially non-extensible yarns, for example, air jet textured yarns.

As used herein the term "high speed winding" means winding at a yarn speed in the range of from at least 300 meters per minute to about 1000 meters per minute. The term "helix angle" means the acute angle between the helix or convolution of the yarn and a diametrical plane intersecting the convolution.

Several winding devices known in the art utilize a relatively low speed yarn traversing means which has a diminishing stroke length as the yarn package builds in order to produce a package with conical ends. When such a device is used for high speed winding of textile yarns, the yarn is laid down on the package at a small helix angle because of a high yarn speed to traverse speed ratio. As a consequence of the small helix angle, the yarn package so produced tends to exhibit poor yarn take-off characteristics and also tends to have unstable conical portions due to sloughing of the yarn therefrom caused by inadequate cohesion between the yarn at the package ends and the package body.

U.S. Patent No.4 085 903 discloses a yarn winding device for false twist textured yarns, i.e. extensible yarns, in which a vertically mounted rotatable package is driven by surface contact with a driven roller. An eccentrically mounted rotatable disc having a peripheral

groove is positioned on a reciprocating traverse means which is adapted to traverse to and fro along the length of the package as yarn is wound thereon. The rotation of the disc about its eccentric axis caused by the yarn travelling in the peripheral groove of the disc imparts a sinusoidal pattern to the yarn being laid down on the package thus providing a substantial angle between successive wraps of yarn on the package. The presence of the sinusoidal pattern and the substantial helix angle improves the take-off characteristics of the yarn and also ensures good cohesion between the yarn at the package ends and the package body i.e. the sinusoidal pattern effectively locks the yarn at the package ends into the package body.

The yarn winding device disclosed in the aforementioned U.S. Patent 4 085 903 is very satisfactory where used for the high speed winding of false twist textured or other extensible yarn. However, the winding device of U.S. Patent 4 085 903, where employed for high speed winding of substantially non-extensible yarn, for example such a yarn produced by an air jet texturing device, has the disadvantages of high winding tension peaks and that at certain positions of the reciprocating traverse means the rotation of the eccentrically mounted disc tends to slow down at the point where the yarn path around the peripheral groove of the disc to the yarn package is at its shortest length. This slowing down of the disc rotation, which is believed to be due to the inability of the substantially non-extensible yarn to compensate for the changing length of the yarn path around the peripheral

groove of the disc, causes unacceptable yarn package characteristics.

It has now been found that the above disadvantage may be overcome and non-extensible yarn may be wound at high speed on such a yarn winding device by the provision of a dancer roll prior to the eccentrically mounted rotatable disc, the dancer roll being spring balanced and adapted to move toward and away from the eccentrically mounted disc as the dancer roll and the disc are rotated by the travelling yarn.

Accordingly the present invention provides a yarn winding apparatus comprising a friction roller capable of being driven and rotatably mounted on a frame in a vertical position; a rotatable package in surface contact with the roller; a substantially horizontal layrail; means for reciprocating the layrail longitudinally of the package; an L-shaped arm rotatably mounted to the layrail at the elbow of the arm; a rotatable disc having a peripheral groove eccentrically mounted to one end of the arm, the disc and the arm being coplanar; a guide means extending substantially the length of the package, the other end of said L-shaped arm being slidably connected to the guide means, the disc being adapted to be rotated by yarn travelling in the peripheral groove of the disc to the package, characterised by the provision of a dancer roll having a peripheral groove rotatably mounted about its axis to the frame by a spring balancing means, the dancer roll being adapted to be rotated by yarn travelling in the peripheral groove of the roll on its way to the rotatable

disc, the spring balancing means being adapted to allow the dancer roll to move towards and away from the rotatable disc as the dancer roll and the rotatable disc are rotated by travelling yarn.

In one embodiment of the present invention the spring balancing means comprises at least one leaf spring attached at one of its ends to the frame and at the other to an axle of the dancer roll.

In another embodiment of the present invention the spring balancing means comprises two leaf springs, one positioned on each side of the dancer roll.

In yet another embodiment of the present invention the spring balancing means comprises a spring actuated support arm attached at one of its ends to the frame and at the other to an axle of the dancer roll.

In yet another embodiment of the present invention the support arm is actuated by a torsion spring.

In a further embodiment of the present invention the support arm is actuated by an extension coil spring.

In a still further embodiment of the present invention the support arm is actuated by a compression spring.

Embodiments of the invention will be described in greater detail with the aid of the accompanying drawings in which :

Fig. 1 is a schematic view of one embodiment of the present invention (with parts removed for clarity) in which the effective stroke length is reduced as the package diameter increases, by means of a mechanical linkage (including a U-track guide means) which senses the package build up;

Fig. 2 is a fragmentary view of the embodiment of Fig. 1 showing the U-track in position for maximum stroke with the layrail and the eccentrically mounted rotatable disc depicted (for ease of understanding) in both their highest and lowest positions;

Fig. 3 is a fragmentary view of the embodiment of Fig. 1 showing the U-track in position for minimum stroke with the layrail and the eccentrically mounted rotatable disc again depicted (for ease of understanding) in both their highest and their lowest positions;

Fig. 4 is a fragmentary view of the embodiment of Fig. 1 showing the change in position of the dancer roll and of the spring balancing means by which the dancer roll is mounted to the frame in response to rotation of the eccentrically mounted rotatable disc;

Fig. 5 is a schematic view of an embodiment of the present invention showing an alternative to the spring balancing means depicted in Fig. 4;

Fig. 6 is a schematic view of an embodiment of the present invention showing another alternative to the spring balancing means depicted in Fig. 4; and

Fig. 7 is a schematic view of an embodiment of the present invention showing yet another alternative to the spring balancing means of Fig. 4.

In the drawings, Fig. 1 shows a yarn tube 10 on which a package 11 is built during winding. The yarn tube 10 is carried by chuck arms 12 and 13 which are mounted on shaft 14. Shaft 14 is rotatably mounted such that chuck arms 12 and 13 can rotate about its axis as the package diameter increases.

The package 11 is driven at a high constant peripheral speed by a friction roller 15 against which it is held by means described hereinafter. The friction roller 15 is driven by a belt (not shown).

A traversing mechanism 16 is provided to guide the yarn to be wound onto the surface of friction roller 15 which in turn lays it on package 11. Traversing mechanism 16 (see also Fig. 2 and Fig. 3) comprises an eccentrically mounted rotatable disc 17 having a peripheral groove 17A arranged on one end of an L-shaped lever 18 by which it is reciprocated longitudinally of the yarn tube 10. The L-shaped lever 18 is rotatably attached at its elbow by a pin 19 to a layrail 20 which extends over the entire length of a winding machine and is common to all of the L-shaped levers on one side of the machine. Layrail 20 is driven with respect to machine frame 21 to reciprocate longitudinally of the yarn tube 10 at a constant stroke length.

Arranged on the other end of L-shaped lever 18 is a slide block 22 which is guided in a guide means, depicted in this embodiment as a U-track 23, in such a way that, during the reciprocation of layrail 20, it can slide to and fro in it. U-track 23 is pivotably mounted to frame 21 by pin 24. An arm 25 is rigidly attached to a midpoint of U-track 23 and extends therefrom normally to the axis of pin 24. A mid point of arm 25 is engaged by a spring 26 anchored in the machine frame 21. The free end of arm 25 is connected by cable (or chain) 27 over a change-of-direction roll 28 to the side of chuck arm 13. With this arrangement, spring 26 attempts to rotate U-track 23 (clockwise) about

pin 24, which in turn (via cable 27) pulls on chuck arm 13 and hence holds package 11 firmly against friction roller 15.

A dancer roll 29 having peripheral groove 29A (see also Fig.4) is provided upstream of eccentrically mounted rotatable disc 17. Dancer roll 29 is axially mounted on axle 30 to frame 21 by a spring balancing means 31. In the embodiment of Fig. 1 and Fig. 4, spring balancing means 31 is depicted as a pair of leaf springs 32 positioned one on each side of dancer roll 29. One end of each leaf spring 32 is attached to axle 30 and the other end of each leaf spring 32 is attached via clamping support 33 to frame 21.

Some variations of spring balancing means 31 are shown in Fig. 5 to Fig. 7 inclusive. In Fig. 5 one end of a support arm 34 is attached to axle 30 and the other end of support arm 34 is pivotably mounted to frame 21 by pin 35. A torsion spring 37 urges support arm 34 towards stop 36 which keeps support arm 34 from rotating counter clockwise beyond its operating position. The embodiment shown in Fig. 6 is the same as that of Fig. 5 except that an extension spring 37A replaces torsion spring 37. In Fig. 7, one end of a support arm 34A is attached to axle 30 and the other end of support arm 34A is attached to a compression spring 37B positioned in a housing 38. Housing 38 is attached to frame 21 via support bracket 39.

In operation, yarn Y preferably substantially non-extensible air jet textured yarn, for example such yarn obtained directly from an air jet texturing process,

travels part way around dancer roll 29 in peripheral groove 29A, part way around eccentrically mounted rotatable disc 17, in peripheral groove 17A, part way around friction roll 15 and is wound up on yarn tube 10 as a package 11. Spring 26 acting via arm 25, cable 27 and chuck arm 13 holds package 11 against friction roller 15 which is rotatably driven at constant speed.

At the beginning of package formation, yarn tube 10 touches friction roller 15. With the yarn tube in this position, spring 26 acting through arm 25 pivots U-track 23 clockwise about pin 24 to the position shown in Fig. 2. With U-track 23 in this position, the reciprocation of lay-rail 20 at constant stroke length causes slide block 22 arranged at one end of L-shaped lever 18 to slide to and fro in U-track 23. As this motion occurs, L-shaped lever 18 rotates on pin 19 such that eccentrically mounted rotatable disc 17, arranged at the other end of L-shaped lever 18, performs a yarn winding stroke of maximum length.

As the substantially non-extensible yarn Y travels around rotatable disc 17 in peripheral groove 17A, it rotates disc 17 about its eccentric axis and causes the yarn to be laid down on package 11 in a sinusoidal pattern. This sinusoidal pattern tends to prevent yarn sloughing from the ends of package 11 by ensuring good cohesion between the yarn at the ends of the package and the package body i.e. the sinusoidal loops of yarn in successive yarn loops and in successive yarn layers overlap substantially and effectively lock the yarn at the package ends into the package body. The presence of dancer roll 29 tends to

prevent the slowing down of the rotation of rotatable disc 17, which might otherwise occur frequently in winding substantially non-extensible yarn Y, at the point where the path of yarn Y around peripheral groove 17A is at its shortest distance (see Fig. 4). Dancer roll 29 does this in the following manner. In Fig. 4, the eccentrically mounted rotatable disc is depicted in its position where the path of the yarn around peripheral groove 17A is at its shortest length by the solid outline 17. When the disc 17 is in this position, leaf springs 32 to which dancer roll 29 is mounted on axle 30 extend substantially straight out from clamping support 33. The path of the non-extensible yarn around peripheral groove 29A of dancer roll 29 and around peripheral groove 17A of eccentrically mounted disc 17 is shown by solid line Y. As the rotatable disc rotates about its eccentric axis, it moves towards a position where the path of the yarn around peripheral groove 17A is at its greatest length depicted in Fig. 4 by the dotted line 17'. As the rotatable disc moves towards position 17', it begins to increase the tension on the non-extensible yarn due to the increasing length of the yarn path. However, as soon as the yarn tension begins to increase, the leaf springs begin to bend downwardly towards a position shown by dotted outline 32' thereby carrying the dancer roll towards a position shown by dotted outline 29'. The new path of the non-extensible yarn around peripheral groove 29A' of dancer roll 29' and around peripheral groove 17A' of eccentrically mounted disc 17' is shown by dotted line Y'. It may be observed from Fig. 4, that the length of

the yarn paths shown by solid line Y and dotted line Y' are substantially the same. Since the length of the yarn path remains substantially constant as the rotatable disc 17 is rotated about its eccentric axis, large variations in yarn tension, which could cause the slowing down of the rotation of the rotatable disc 17 during the winding of substantially non-extensible yarn e.g. air jet-textured yarn and result in poor yarn package characteristics, are substantially eliminated.

It will be appreciated that the length and/or the thickness of leaf springs 32 may be varied depending on the dtex of the substantially non-extensible yarn Y and the wind up tension.

Referring again to Fig. 1, as the diameter of package 11 increases, chuck arm 13 moves in a clockwise direction and via cable 27, and arm 25, pivots U-track 23 counter clockwise about pin 24, against the pull of spring 26, gradually, until at the completion of package formation, U-track 23 is in the position shown in Fig. 3. With U-track 23 in this position, the reciprocation of layrail 20 at constant stroke length causes slide block 22 arranged at one end of L-shaped lever 18 to slide to and fro in U-track 23. As this motion occurs, L-shaped lever 18 rotates on pin 19 such that eccentrically mounted rotatable disc 17, arranged at the other end of L-shaped lever 18, performs a yarn winding stroke of minimum length. Thus a conical ended package is produced having a length next to the yarn tube equivalent to the maximum yarn winding stroke and a length at its outer surface equivalent to the minimum yarn winding stroke of the eccentrically mounted rotatable disc 17.

Mechanisms for pivoting U-track 23 about pin 24 as the diameter of the package 11 increases other than that shown in Fig. 1 are depicted in Fig. 1 and Fig. 4 of the aforementioned U.S. Patent 4 085 903.

The present invention is illustrated by the following examples.

EXAMPLE 1.

A 1055 dtex - 136 filament nylon 66 air jet textured yarn was fed directly from an air jet texturing process and wound up on packages. The air jet textured yarn was substantially non-extensible. The apparatus used to wind the yarn was similar to that shown in Fig. 1 and described hereinbefore. The eccentrically mounted rotatable disc 17 was 4.45 cm in diameter and mounted 1.27 cm from its centre. Dancer roll 29, which was made from nylon and light in weight, was 2.5 cm in diameter. The unsupported length of leaf springs 32 to axle 30 of dancer roll 29 was 4.9 cm. As in indication of the stiffness of leaf springs 32, a weight of 715 g (7.0 newtons) acting on axle 30 was sufficient to deflect leaf springs 32 such that dancer roll 29 moved 0.61 cm towards eccentrically mounted rotatable disc 17 (with a weight of 1860 g (18.15 newtons) dancer roll 29 was moved 1.60 cm). The air jet textured yarn was fed from the air jet texturing process at a speed of 340 meters/min and was wound up on packages at a speed of 355 meters/min. The layrail cycle of layrail 20 was 41 seconds and the layrail stroke length was 29.2 cm. Therefore the yarn speed to traverse speed ratio was 415:1. Three yarn packages were wound on paper tubes having a diameter of 10.5 cm

and a length of 34.3 cm. The taper angle of the conical ends of each package was 33°. An examination of the three yarn packages indicated that: (1) the yarn at both ends of each package was firmly locked into the package body; and (2) the conical ends of all three packages exhibited no tendency for yarn to slough therefrom.

EXAMPLE II.

A 1060 dtex - 136 filament nylon 66 air jet textured yarn was fed directly from an air jet texturing process and wound up on packages. The apparatus used to wind the yarn was similar to that shown in Fig. 1 and described hereinabove except that: (1) the eccentrically mounted rotatable disc 17 was replaced by an axially mounted disc; and (2) no dancer roll 29 and no spring balancing means 31 were provided, these features being redundant in the absence of the eccentrically mounted disc 17. The air jet textured yarn was fed from the air jet texturing process at a speed of 340 meters/min and wound up on packages at a speed of 355 meters/min. The layrail cycle of layrail 20 was 41 seconds and the layrail stroke length was 29.2 cm. Therefore, the initial yarn speed to traverse speed ratio was 415:1. Nine yarn packages were wound on paper tubes having the same dimensions and with conical ends having the same taper angle as for the yarn packages of Example I. An examination of the nine packages indicated that: (1) a number of yarn convolutions had fallen loose from the bottom conical end of several packages; and (2) both conical ends of all nine packages were very sensitive to sloughing of yarn therefrom.

This example illustrates that yarn packages produced at the above high yarn speed to traverse speed ratio on a winder without the eccentrically mounted rotatable disc 17, are unsatisfactory.

EXAMPLE III

A 645 dtex - 102 filament polyester air jet textured yarn was fed directly from an air jet texturing process and wound on packages. The apparatus was the same as that described in Example I. The air jet textured yarn was fed from the air jet texturing process at a speed of 336 meters/min and wound up on packages at a speed 346 meters/min. Several yarn packages were wound up similar to those produced in Example I. The conical ends of each of these packages exhibited the same good package stability i.e. no tendency for the yarn to slough off the package, as did the packages of Example I.

After the winding of the above package, in order to illustrate the effect of not having a dancer roll in the apparatus, the position of axle 30 of dancer roll 29 was suddenly fixed while the winder was in operation. This meant that the dancer roll 29 could not move towards eccentrically mounted rotatable disc 17 each time there was an increase in yarn tension. As soon as the position of axle 30 was fixed the L-shaped lever 18 (on which eccentrically mounted rotatable disc 17 was mounted) began to vibrate excessively due to yarn tension peaks which occurred on each revolution of eccentrically mounted disc 17. When layrail 20 reached the top of its stroke, eccentrically mounted rotatable disc 17 slowed down and rapidly came to

a stop making it necessary to stop the winding operation in order to avoid damage to the then stationary eccentrically mounted rotatable disc 17.

This latter experiment indicates that if the dancer roll 29 and leaf springs 32 are omitted from the apparatus of Fig. 1, the remaining yarn winding apparatus is unsuitable for winding substantially non-extensible yarn such as air jet textured yarn.

CLAIMS :

1. A yarn winding apparatus comprising a friction roller capable of being driven and rotatably mounted on a frame in a vertical position; a rotatable package in surface contact with the roller; a substantially horizontal layrail; means for reciprocating the layrail longitudinally of the package; an L-shaped arm rotatably mounted to the layrail at the elbow of the arm; a rotatable disc having a peripheral groove eccentrically mounted to one end of the arm, the disc and the arm being coplanar; a guide means extending substantially the length of the package, the other end of said L-shaped arm being slidably connected to the guide means, the disc being adapted to be rotated by yarn travelling in the peripheral groove of the disc to the package, characterised by the provision of a dancer roll having a peripheral groove rotatably mounted about its axis to the frame by a spring balancing means, the dancer roll being adapted to be rotated by yarn travelling in the peripheral groove of the roll on its way to the rotatable disc, the spring balancing means being adapted to allow the dancer roll to move towards and away from the rotatable disc as the dancer roll and the rotatable disc are rotated by travelling yarn.

2. The apparatus according to claim 1 wherein the spring balancing means comprises at least one leaf spring attached at one of its ends to the frame and at the other to an axle of the dancer roll.

3. The apparatus according to claim 2 wherein there are two leaf springs, one positioned on each side of the dancer roll.

4. The apparatus according to claim 1 wherein the spring balancing means comprises a spring actuated support arm attached at one of its ends to the frame and at the other to an axle of the dancer roll.

5. The apparatus according to claim 4 wherein the support arm is actuated by a torsion spring.

6. The apparatus according to claim 4 wherein the support arm is actuated by an extension coil spring.

7. The apparatus according to claim 4 wherein the support arm is actuated by a compression coil spring.

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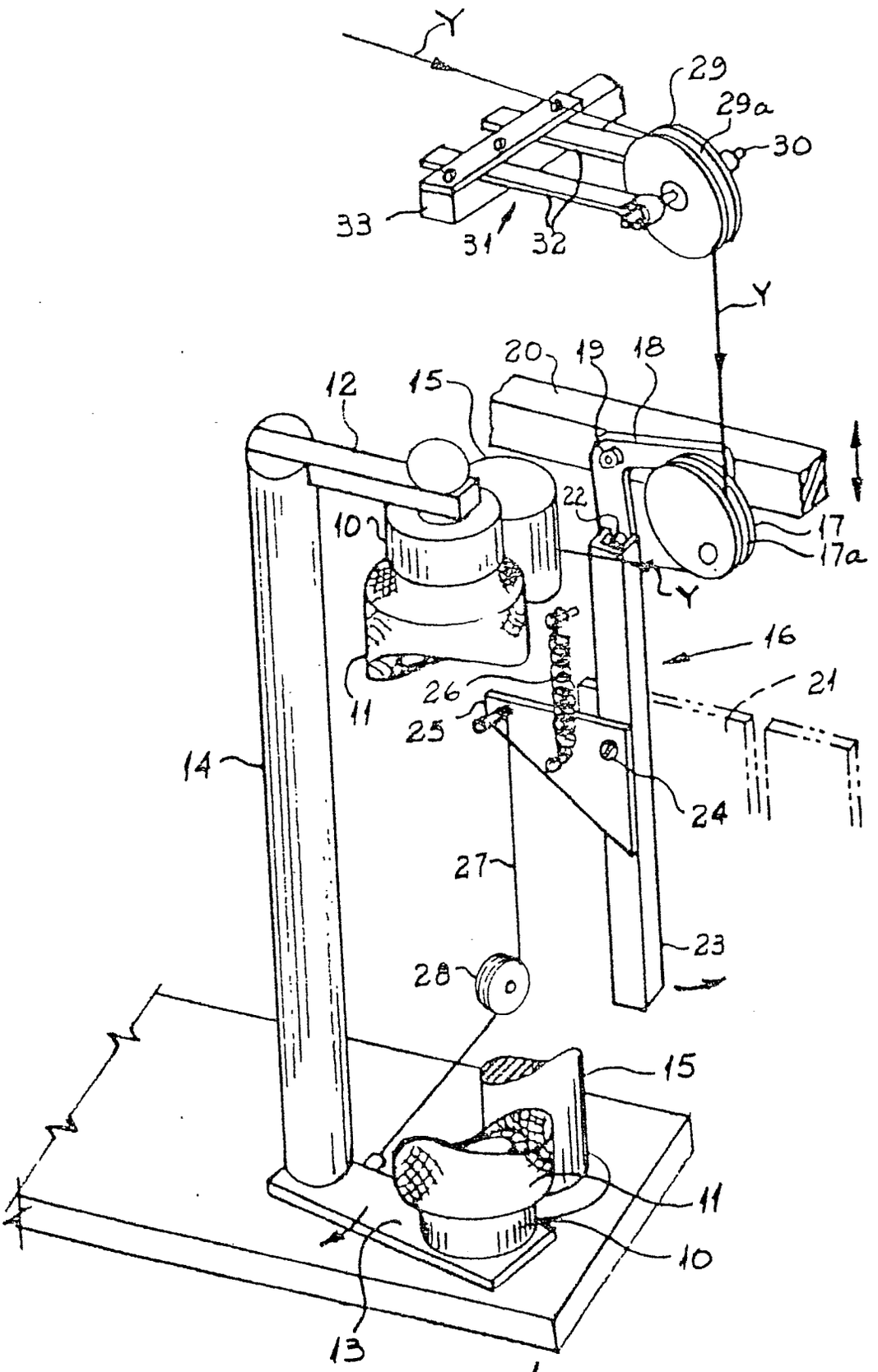
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FIG 1

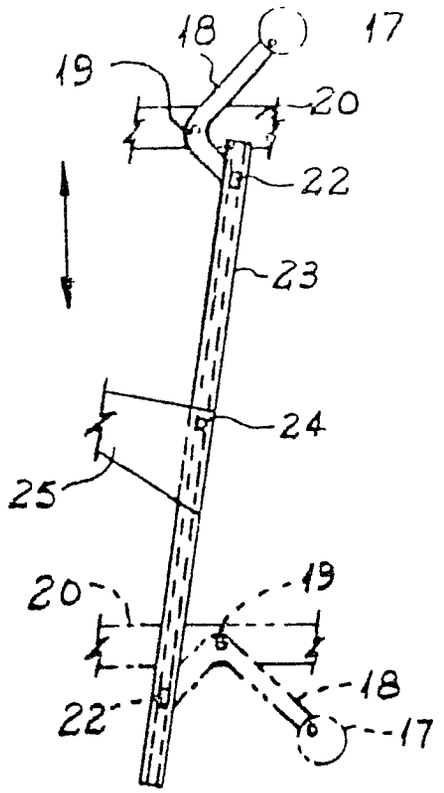

FIG 2

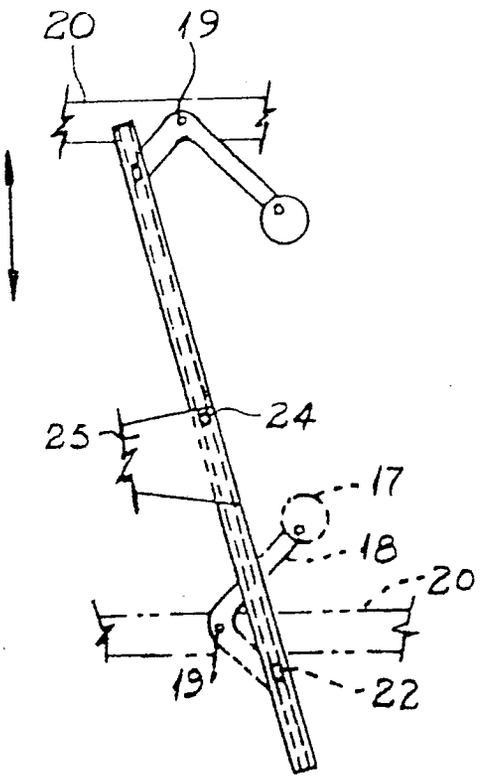

FIG 3

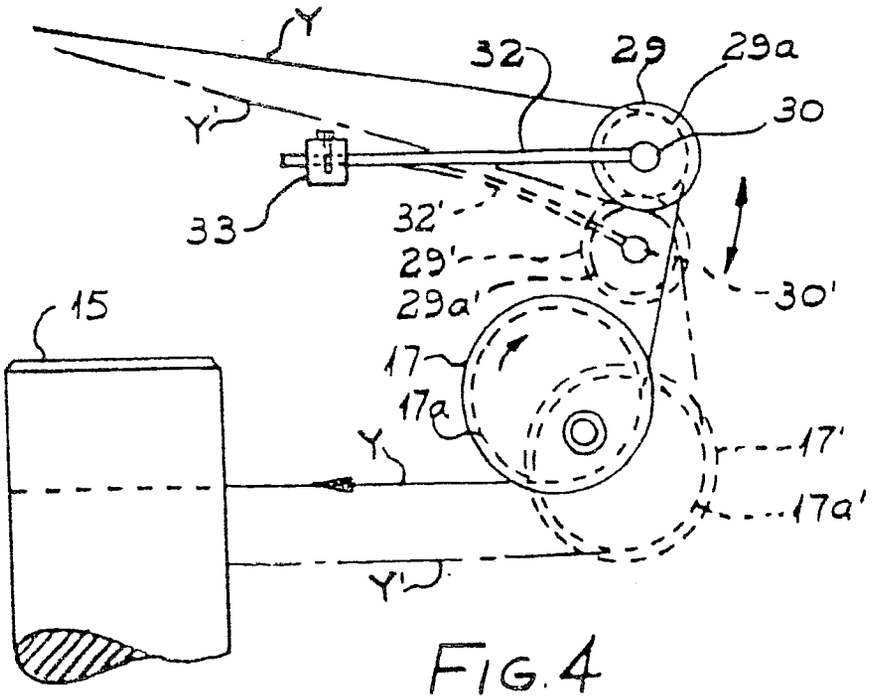

FIG. 4

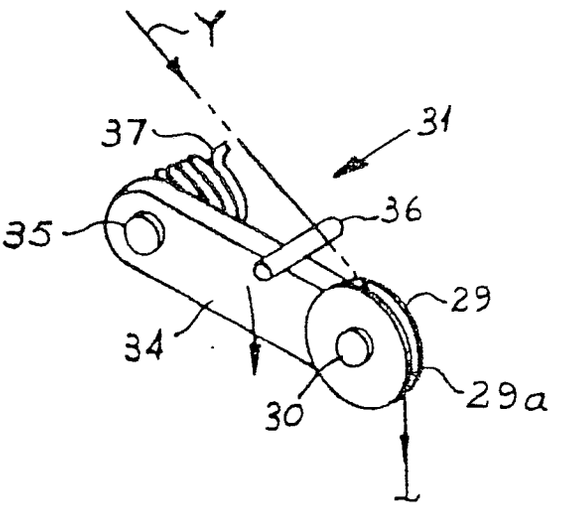

FIG. 5

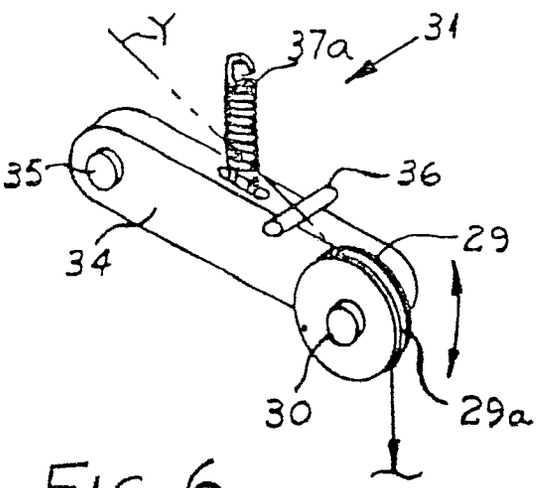

FIG. 6

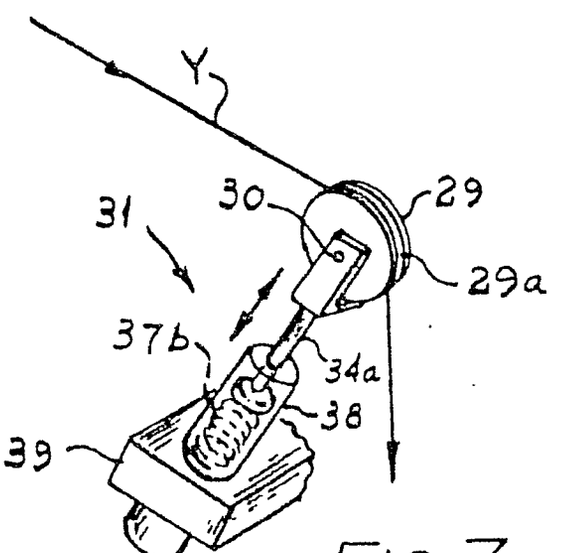

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication where appropriate of relevant passages	Relevant to claim
	DE - A - 1 421 698 (COMPAGNIE DE SAINT-GOBAIN) * Page 6, paragraph 3; figure 2 *	1,7
	GB - A - 697 303 (UNIVERSAL WINDING COMPANY) * Page 3, lines 26-54; figure 4 *	2
	BE - A - 557 859 (PHILIPS) * Page 5, paragraph 2; figure 1 *	2
	FR - A - 610 650 (S.A. DE CONSTRUCTIONS MECANIQUES DU FRESNOY) * Page 2, lines 18-36; figure 2 *	4,5
	GB - A - 387 307 (SCHWEITER) * Page 1; figure 3 *	4,5
	CH - A - 440 901 (MICAFIL) * Page 1; figure 1 *	4,6
	DE - C - 504 064 (J. KLIMA; R. SIKORA) * Page 3, lines 1-25; figure 1 *	4,7
	DE - C - 243 833 (E. MULLER) * Page 2, lines 65-78; figure 3 *	4,7

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CLASSIFICATION OF THE APPLICATION (Int Cl)

B 65 H 59/36
57/28
54/32

TECHNICAL FIELDS SEARCHED (Int Cl)

B 65 H

CATEGORY OF CITED DOCUMENTS

- X particularly relevant
- A technological background
- O non-written disclosure
- P intermediate document
- T theory or principle underlying the invention
- E conflicting application
- D document cited in the application
- L citation for other reasons

& member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28-03-1980	DEPRUN

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EUROPEAN SEARCH REPORT

0013510
Application number
EP 79 30 3058

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	GB - A - 12 070/A.D. 1910 (J.D. WHYTE) * Page 4; figure 1 *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

TECHNICAL FIELDS SEARCHED (Int. Cl. 3)