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(54) Thread cutting method and apparatus.

(57) A method and apparatus for cutting a thread, comprising a cutter (30) having a pair of blades (31A, 31B) which define a generally V-shaped blade edge (33) having end portions and a valley portion (33a) remote from said end portions, the cutter (30 being disposed at a predetermined angle (θ_2) so that said valley portion (33a) of said V-shaped blade edge (33) is positioned in the downstream side of a thread feeding path (P_1) than said end portions of said V-shaped blade edge (33), feeding means for feeding said thread (21) along said thread feeding path (P_1) that is disposed between said pair of blades (31A, 31B), and guiding means (25) for guiding said thread (21) to said valley portion (33a) of said V-shaped blade edge (33) by bringing said thread (21) and said cutter (30) into close relationship. The thread (21) guided to said valley portion (33a) of said V-shaped blade edge (33) is cut with a tension of the thread in the downstream side of the cutter.

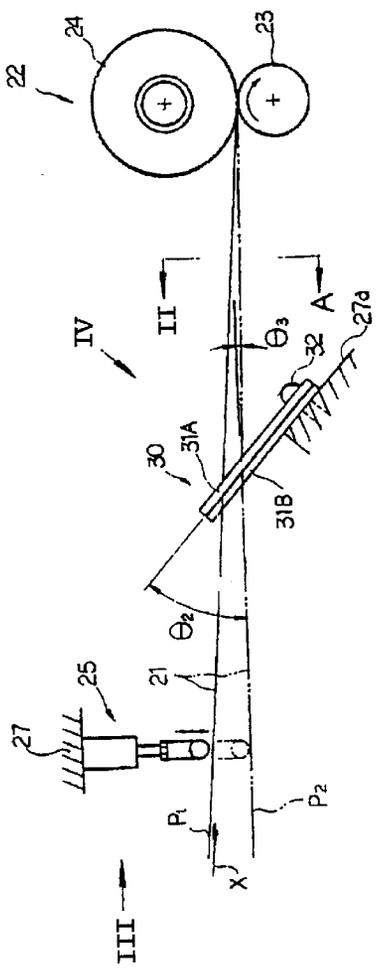

FIG. 1

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FIELD OF THE INVENTION

The present invention relates to a thread cutting method and apparatus, and more particularly to a thread cutting method and apparatus by which a thread currently being wound on a bobbin of an automatic winder is cut when the bobbin is exchanged.

DESCRIPTION OF THE PRIOR ART

In an automatic winder with bobbin switching means, there is provided a cutting apparatus by which a thread currently being wound on the bobbin is cut when the bobbin is switched.

A conventional thread cutting apparatuses such as this is shown in Figs. 7 and 8 by way of example.

In the cutting apparatus shown in Figs. 7 and 8, when a solenoid 1 is electrically connected, it retracts a plunger 1a connected to a cutter 2, and the cutter 2 is raised from a position indicated by the solid line in Fig. 7. A spring 3 is interposed between the solenoid 1 and the cutter 2 and is compressed in proportion to an amount that the plunger 1a is retracted. If the solenoid 1 is electrically disconnected, then the cutter 2 will be lowered by the restoring force of the spring 3 to a position indicated by the broken line in Fig. 7 in which the cutter 2 comes into collision with a cradle 4. As a result, a thread 5 currently being fed from the thread feeding side to the thread winding side is cut between the cutter 2 and the cradle 4.

In another conventional thread cutting apparatus shown in Figs. 3-11, a support member 12 connected to an actuator 11 is raised and lowered by the actuator 11. As the support member 12 is raised and lowered, the blades 15A and 15B of a cutter 14 is driven through link members 13A and 13B. The blades 15A and 15B are rotated in opposite directions about a supporting axis 16. When the actuator 11 protrudes and the blades 15A and 15B are opened as shown in Fig. 9, a thread 17 currently being fed is inserted between the blades. The blades 15A and 15B are then closed by the actuator 11, so that the thread 17 is cut by the cutter 14.

However, a thread cutting apparatus such as that shown in Fig. 7 and the thread cutting method have the disadvantage that a thick thread such as a tire cord (e.g., 1000 to 1500 de (denier)) cannot be cut.

A thread cutting apparatus such as that shown in Fig. 9 and the thread cutting method also have the disadvantage that it is difficult to cut a thick thread with the cutter 14 and that the cutter 14 itself is pulled to the thread winding side by the thread 17 currently being fed.

Further, since the apparatus of Fig. 7 is constructed such that the cutter 2 is raised and lowered by the solenoid 1 and the spring 3 and the apparatus of Fig. 9 is constructed such that the cutter 14 is opened and closed by the actuator 11 and the link members 13A and 13B, there was the drawback that the number of the components is increased. In addition, the cutting apparatus of this kind is provided every spindle of each winder, so there was the drawback that the cost of production is increased.

It is, accordingly, an object of the present invention to provide a thread cutting method which is capable of cutting a thread surely and cutting even a thick thread.

It is another object of the present invention to provide a thread cutting apparatus which is structurally simple and inexpensive and capable of cutting even a thick thread.

SUMMARY OF THE INVENTION

In accordance with one important aspect of the present invention, there is provided a method of cutting a thread, comprising the steps of preparing a cutter having a pair of blades which define a generally V-shaped blade edge having end portions and a valley portion remote from the end portions, disposing the cutter so that the valley portion of the V-shaped blade edge is positioned in the downstream side of a thread feeding path than the end portions of the V-shaped blade edge and inclining the cutter at a predetermined angle, feeding the thread along the thread feeding path that is disposed between the pair of blades, guiding the thread to the valley portion of the V-shaped blade edge by bringing the thread and the cutter into close relationship, during feeding of the thread, and cutting the guided thread with a tension of the thread in the downstream side of the cutter. The predetermined angle is an acute angle defined by the thread guided to the valley portion and the cutter.

In the present invention, the cutter is inclined so that the valley portion of the V-shaped blade edge is positioned in the downstream side of a thread feeding path than the end portions of the V-shaped blade edge. Therefore, if the thread currently being fed is guided to the valley portion of the V-shaped blade edge, it is automatically locked to the valley portion of the V-shaped blade edge. If in this condition the thread is slightly pulled to the downstream side, then it will be cut instantaneously. Thus, the thread can be cut surely with the tension of the thread in the downstream side of the cutter. As a result, since a complicated operation of the cutter is not needed, the thread cutting apparatus is made structurally simple and also the cost of production can be reduced.

In accordance with another important aspect of the present invention, there is provided an apparatus for cutting a thread, comprising a cutter having a pair of blades which define a generally V-shaped blade edge having end portions and a valley portion remote from the end.portions, the cutter being disposed at a predetermined angle so that the valley portion of the V-shaped blade edge is positioned in the downstream

side of a thread feeding path than the end portions of the V-shaped blade edge, feeding means for feeding the thread along the thread feeding path that is disposed between the pair of blades, guiding means for guiding the thread to the valley portion of the V-shaped blade edge by bringing the thread and the cutter into close relationship, and cutting means for cutting the thread guided to the valley portion of the V-shaped blade edge. The predetermined angle is an acute angle defined by the thread guided to the valley portion and the cutter. The cutting means may comprise a tension of the thread in the downstream side of the cutter.

The generally V-shaped blade edge may have an acute angle of between 15 degrees and 60 degrees. The predetermined angle is between 15 degrees and 60 degrees. In that case, the thread is easily guided to the valley portion of the V-shaped blade edge of the cutter. As a result, a reliable cutting operation can be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages will become apparent from the following detailed description when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a schematic view showing an embodiment of a thread cutting apparatus according to the present invention;

FIG. 2 illustrates the blades viewed along line II-II of FIG. 1;

FIG. 3 illustrates the thread guiding unit viewed from arrow III of FIG. 1;

FIG. 4 illustrates the blades viewed from arrow IV of FIG. 1;

FIG. 5 is a sectional view taken substantially along line V-V of FIG. 4;

FIG. 6 is a similar view to FIG. 5 showing different blades;

FIG. 7 is a schematic view showing a conventional thread cutting apparatus;

FIG. 8 shows the conventional thread cutting apparatus viewed from arrow VIII of FIG. 7;

FIG. 9 is a schematic view showing another conventional thread cutting apparatus;

FIG. 10 shows the conventional thread cutting apparatus viewed from arrow X of FIG. 9; and

FIG. 11 is a sectional view taken substantially along line XI-XI of FIG. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1-6, there is shown a preferred embodiment of a thread cutting apparatus in accordance with the present invention.

In Figs. 1 and 2, a thread 21 is supplied from a thread supplying apparatus (not shown) and fed in a direction X along a thread feeding path P_1. The thread 21 is wound on a bobbin 24 by rotation of a friction roller 23 of a winder 22. Between the thread supplying apparatus and the winder 22, there are provided a thread guiding unit 25 and a cutter 30.

The thread guiding unit 25, as shown in Fig. 3, comprises a thread guide bar 26 extending at right angles with respect to the thread feeding path P_1 and an actuator 28 supported on an apparatus frame 27. The thread guide bar 26 is moved upward and downward by the actuator 28. Upon upward and downward movements of the thread guide bar 26, the thread 21 is displaced between the thread feeding path P_1 and a thread cutting path P_2. During the time that the thread 21 is wound on the bobbin 24, it is displaced to the thread feeding path P_1 by the thread guiding unit 25. When the thread 21 is cut, it is displaced to the thread cutting path P_2 by the thread guiding unit 25. That is, the thread guiding unit 25 constitutes guiding means for guiding the thread 21 so that it is contacted with a generally V-shaped blade edge 33 of the cutter 30.

The cutter 30 has a pair of blades 31A and 31B which form the generally V-shaped cutting edge 33. As shown in Fig. 2, the aforementioned thread feeding path P_1 is located between the blades 31A and 31B. These blades 31A and 31B are fixedly mounted on a cutter mounting surface 27a of the apparatus frame 27 by a fixing pin 32, and as shown in Fig. 4, the blade edge lines f1 and f2 define an acute angle θ_1 of the V-shaped blade edge 33. The blade edge angle θ_1 of the V-shaped blade edge 33 is between 15 degrees and 60 degrees, for example. As shown in Fig. 2, the V-shaped blade edge 33 has a valley portion 33a which is positioned slightly above the thread cutting path P_2, so that when the thread 21 is displaced to the thread cutting path P_2, it is brought into contact with the V-shaped blade edge 33. The cutter 30 is inclined with respect to the paths P_1 and P_2 so that the valley portion 33a of the V-shaped blade edge 33 is disposed in the downstream side of the thread feeding direction X than the upper ends of the V-shaped blade edge 33. When the thread 21 is displaced to the thread cutting path P_2 and contacted with the valley portion 33a of the V-shaped blade edge 33, the cutter 30 is disposed at an angle of inclination such that an acute angle θ_2 defined by this thread 21 (thread 21 contacted with the valley portion 33a of the cutter 30) and a plane containing the blade edge lines f1 and f2 of the cutter 30 is, for example, between 15 degrees and 60 degrees. This angle of inclination is an angle of inclination from the conventional cutter shown in Fig. 7 or 9 that crosses with a thread in the upstream side of the cutter, and in the embodiment of the present invention the aforementioned acute angle θ_2 will hereinafter be referred to as an acute angle corresponding to the angle of inclination of the cutter 30. While in the embodi-

ment of the present invention the blades 31A and 31B of the cutter 30 are single-edged blades as shown in Fig. 5, it is noted that they may also be double-edged blades such as those shown in Fig. 6. Also, the aforementioned fixing pin 32 is a fixing member such as a bolt, and the angle of the blades 31A and 31B with respect to the mounting surface 27a and the acute angle between the blades can he adjusted by fastening and unfastening the fixing pin 32.

The operation of an embodiment of a thread cutting method of the present invention that is carried out by the thread cutting apparatus as constructed above will hereinafter be described.

The cutter 30 is first disposed in a predetermined position in which the thread feeding path P_1 is between the V-shaped blade edge 33 of the cutter 30. The cutter 30 is also inclined so that the valley portion 33a of the V-shaped blade edge 33 is positioned in the downstream side of the thread feeding direction X than the upper ends of the V-shaped blade edge 33. Also, the thread 21 is positioned along and on the thread feeding path P_1.

The thread 21 is then fed along the thread feeding path P_1 and also the winder 22 starts winding the thread 21 on the bobbin 24. If a nearly requisite amount of the thread 21 is wound on one bobbin 24, then an operation for switching to the next empty bobbin will be started.

In this bobbin switching operation, the thread 21 is first displaced from the thread feeding path P_1 to the thread cutting path P_2 by the tread guiding unit 25. Upon this downward movement of the thread 21, it is guided within the V-shaped blade edge 33 of the cutter 30. At this time, with the tension of the thread 21 in the downstream side of the thread feeding direction X that is exerted from the winder 22, the thread 21 is brought into contact with the V-shaped blade edge 33 and also automatically locked to the valley portion 33a of the V-shaped blade edge 33. If in this condition the thread 21 is slightly pulled to the downstream side, then it will be cut instantaneously.

Thus, by including the cutter 30 so that the valley portion 33a of the V-shaped blade edge 33 of the cutter 30 is positioned in the downstream side of the thread feeding direction X than the upper ends of the V-shaped blade edge 33 and also by guiding the thread 21 to the valley portion 33a of the V-shaped blade edge 33, the thread 21 can be cut surely with the tension of the thread 21 exerted from the winder 22. In addition, since a complicated operation of the cutter 30 is not needed, the thread cutting apparatus is made structurally simple and also the cost of production can be reduced. Particularly, in a system in which a great number of such winders and cutting apparatuses are disposed in parallel, the cost of installation can be greatly reduced.

Two experimental examples performed with the aforementioned method will hereinafter be described.

In the first experimental example, a thread of thread thickness 1500 de (denier) was cut with a NT cutter (trade name "ORUFA CUTTER", type 227J04070 (double-edge blade)). The thread cutting was satisfactory when the acute angle θ_2 corresponding to the angle of inclination of the cutter 30 is between 15 degrees and 60 degrees. The cutting conditions are as follows. The tension of the thread in the upstream side of the cutter 30, T_1, is 20 gr. The tension of the thread in the downstream side of the cutter 30, $T_2 - T_1$ (T_2 = winding tension at the time of cutting), is 150 gr. The acute angle θ_1 of the V-shaped blade edge 33 is 40 degrees, and an angle θ_3 corresponding to a depth of cut (depth between 33a and P_2) is 15 degrees.

In the second experimental example, the same thread as that of the first experimental example was cut with the same NT cutter as that of the first experimental example. When the acute angle θ_1 of the V-shaped blade edge 33 is between 15 degrees and 60 degrees, the thread cutting was satisfactory. The cutting conditions are as follows. The tension of the thread in the upstream side of the cutter 30, T_1, is 20 gr. The tension of the thread in the downstream side of the cutter 30, $T_2 - T_1$ (T_2 = winding tension at the time of cutting), is 150 gr. The acute angle θ_2 corresponding to the angle of inclination of the cutter 30 is 40 degrees, and the angle θ_3 corresponding to a depth of cut (depth between 33a and P_2) is 15 degrees.

The lower limit value (15 degrees) of the acute angle θ_1 of the V-shaped blade edge 33 or lower limit value (15 degrees) of the acute angle θ_2 corresponding to the angle of inclination of the cutter 30 is a lower limit value of a practical range, and thread cutting is also possible at a value less than this lower limit value.

Thus, a reliable thread cutting operation can be performed in accordance with the present invention by using the cutter 30 in which the acute angle θ_1 of the V-shaped blade edge 33 is between 15 degrees and 60 degrees and also by disposing the cutter 30 at the angle of inclination θ_2 between 15 degrees and 60 degrees. While in the aforementioned embodiment the blades 31A and 31B of the cutter 30 have been symmetrically positioned, they may also be asymmetrically positioned so that one blade is close to the thread feeding path P_1. In this case, when the thread 21 is cut, it can be guided positively to the valley portion 33a of the V-shaped blade edge 33 of the cutter 30. In addition, although in the aforementioned embodiment the blades 31A and 31B have a straight blade edge, they can also have a suitably curved blade edge, Further, although in the aforementioned embodiment the thread has been moved toward the cutter so that the thread is guided to the valley portion of the cutter, it is noted that the cutter may also be moved to the thread.

While the subjection invention has been described with relation to the preferred embodiment, vari-

ous modifications and adaptations thereof will now be apparent to those skilled in the art. All such modifications and adaptations as fall within the scope of the appended claims are intended to be covered thereby.

Claims

1. A method of cutting a thread, comprising the steps of:

   preparing a cutter (30) having a pair of blades (31A, 31B) which define a generally V-shaped blade edge (33) having end portions and a valley portion (33a) remote from said end portions;

   disposing said cutter (30) so that said valley portion (33a) of said V-shaped blade edge (33) is positioned in the downstream side of a thread feeding path (P_1) than said end portions of said V-shaped blade edge (33) and inclining said cutter (30) at a predetermined angle (θ_2);

   feeding said thread (21) along said thread feeding path (P_1) that is disposed between said pair of blades (31A, 31B);

   guiding said thread (21) to said valley portion (33a) of said V-shaped blade edge (33) by bringing said thread (21) and said cutter (30) into close relationship, during feeding of said thread (21); and

   cutting the guided thread (21) with a tension of said thread (21) in the downstream side of said cutter (30);

   said predetermined angle (θ_2) being an acute angle defined by said thread guided to said valley portion (33a) and said cutter (30).

2. A method as set forth in claim 1, which further comprises the step of disposing said generally V-shaped blade edge (33) so that it has an acute angle (θ_1) of between 15 degrees and 60 degrees.

3. A method as set forth in claim 1, wherein said predetermined angle (θ_2) is between 15 degrees and 60 degrees.

4. A method as set forth in claim 1, which further comprises the step of winding said thread on a bobbin (24) of a winder (22).

5. An apparatus for cutting a thread, comprising:

   a cutter (30) having a pair of blades (31A, 31B) which define a generally V-shaped blade edge (33) having end portions and a valley portion (33a) remote from said end portions, the cutter (30) being disposed at a predetermined angle (θ_2) so that said valley portion (33a) of said V-shaped blade edge (33) is positioned in the downstream side of a thread feeding path (P_1) than said end portions of said V-shaped blade edge (33);

   feeding means for feeding said thread (21) along said thread feeding path (P_1) that is disposed between said pair of blades (31A, 31B);

   guiding means (25) for guiding said thread (21) to said valley portion (33a) of said V-shaped blade edge (33) by bringing said thread (21) and said cutter (30) into close relationship; and

   cutting means for cutting said thread (21) guided to said valley portion (33a) of said V-shaped blade edge (33);

   said predetermined angle (θ_2) being an acute angle defined by said thread guided to said valley portion (33a) and said cutter (30).

6. An apparatus as set forth in claim 5, wherein said cutting means comprises a tension of said thread (21) in the downstream side of said cutter (30).

7. An apparatus as set forth in claim 5, wherein said generally V-shaped blade edge (33) has an acute angle (θ_1) of between 15 degrees and 60 degrees.

8. An apparatus as set forth in claim 5, wherein said predetermined angle (θ_2) is between 15 degrees and 60 degrees.

9. An apparatus as set forth in claim 5, which further comprises a winder (22) including a bobbin (24) on which said thread (21) is wound.

FIG. 1

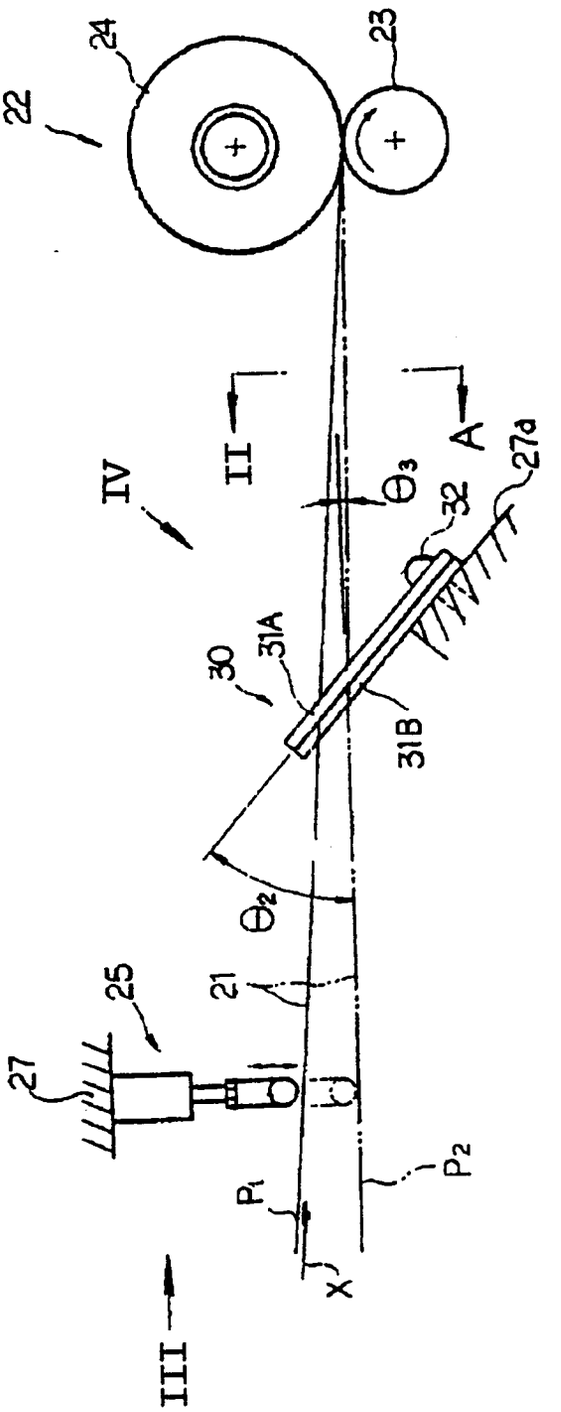

22
24
23
II
IV
A
27a
32
Θ_3
30
31A
31B
Θ_2
21
25
27
P_1
P_2
X
III

FIG. 2

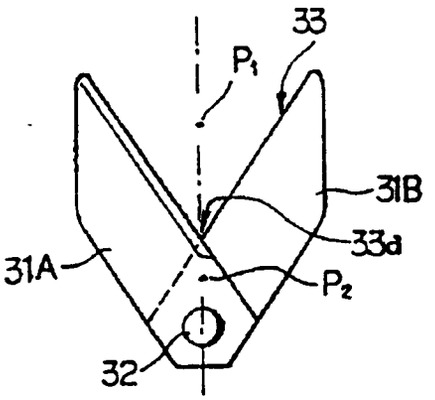


FIG. 3

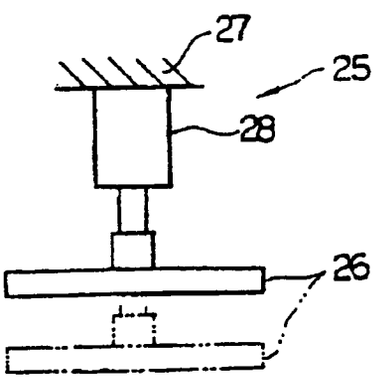


FIG. 4

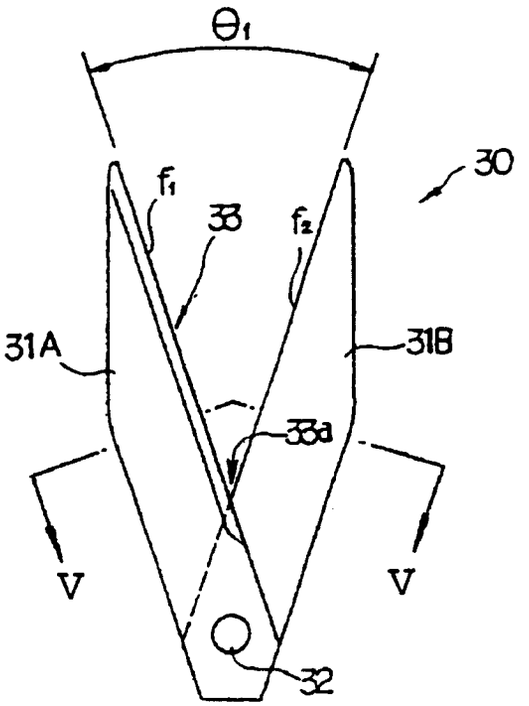


FIG. 5

FIG. 6

FIG. 7
PRIOR ART

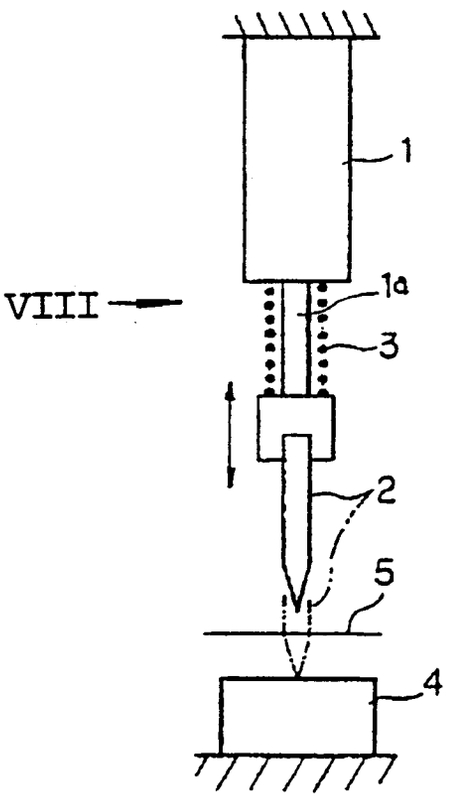


FIG. 8
PRIOR ART

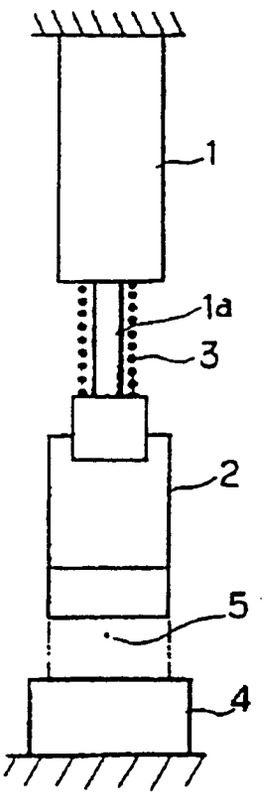


FIG. 9
PRIOR ART

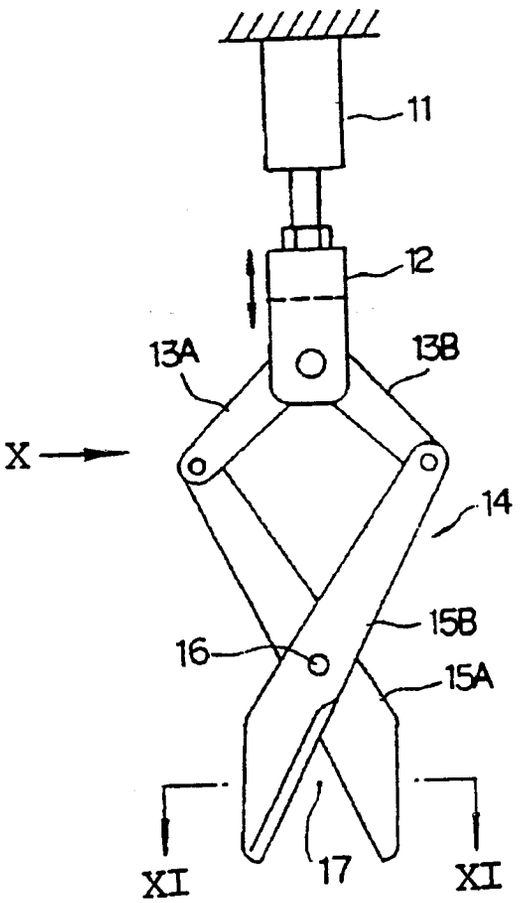


FIG. 10
PRIOR ART

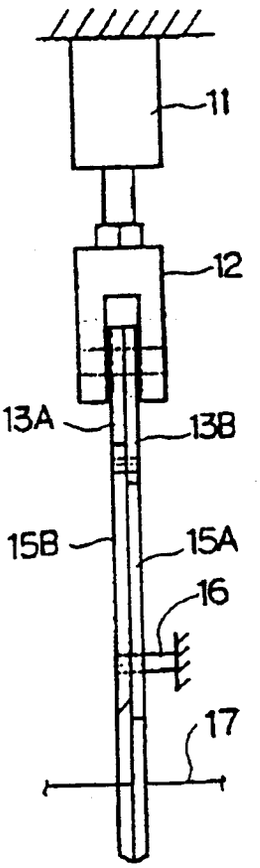
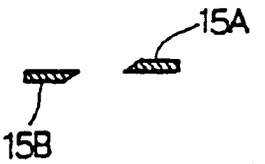


FIG. 11
PRIOR ART



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EUROPEAN SEARCH REPORT

Application Number
EP 92 31 1345

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-1 166 402 (ALGEMENE KUNSTZIJDE UNIE N.V.) * figures 1-3 *	1-9	B65H54/71
X	GB-A-913 320 (GLANZSTOFF-COURTAULDS GMBH) * the whole document *	1-9	
X	DE-A-1 922 241 (LEESONA CORP.) * the whole document *	1-9	
A	EP-A-0 404 045 (BARMAG AG) * column 12, line 27 - column 14, line 46; figures 5,8,9 *	1-9	
A	FR-A-1 271 149 (L'ÉLECTRONIQUE TEXTILE S.A.R.L.)		
A	FR-A-2 528 077 (IZBA WELNY W GDYNI)		
A	US-A-3 023 656 (H. GLASTRA)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B65H
D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 MARCH 1993	D HULSTER E.W.F.

CATEGORY OF CITED DOCUMENTS

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