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(54) Precision-stitch sewing machine

(57) A precision-stitch sewing machine (1) for attaching a welt (2) to an edge along a predetermined sewing line (X-X) comprises: means (7) for feeding the edge (3) to which the welt is to be attached, the whole of which means (7) are positioned upstream of the sewing area (15) to reduce the size of the machine (1); a draw unit (8) for advancing the welt (2) and the edge (3) to be edged along the sewing line (X-X) and a folding unit (9) for folding the welt (2) around the edge (3) to be edged upstream of the sewing area (15). In order that the welt (2) and the edge (3) to be edged can be advanced simultaneously, the draw unit (8) comprises a belt conveyor (23) that defines a supporting surface for the welt (2) and for the edge (3) to be edged, and a draw roller (16) that cooperates with the transporting member (23).

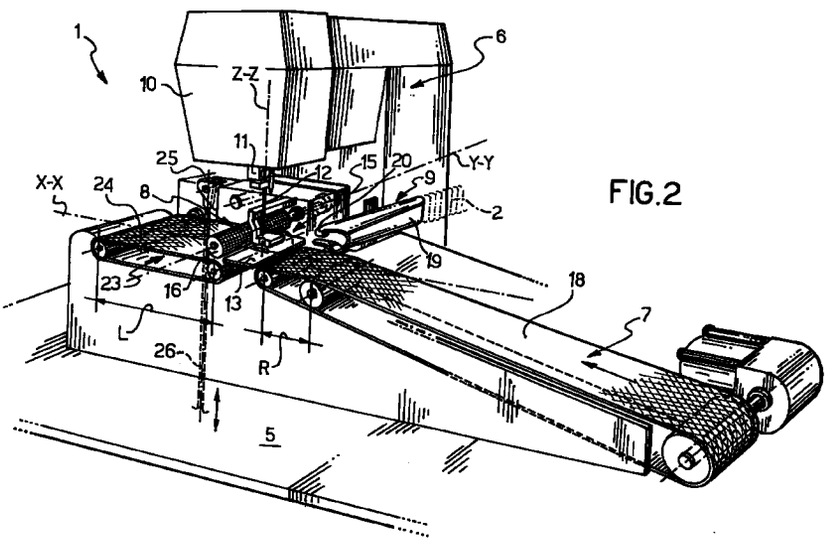


FIG.2

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Description

The present invention relates to a precision-stitch sewing machine for attaching a welt to an edge of a knitted or woven fabric or the like, along a predetermined sewing line, of the type comprising: means for feeding the edge to a sewing area of the machine; a draw unit for drawing both the welt and the edge to be edged, said unit being positioned downstream of the sewing area, for advancing the welt and the edge to be edged along the sewing line; a folding unit for folding the welt, said unit being positioned upstream of the sewing area with reference to the direction of advance of the welt along the sewing line, for folding the welt around the edge to which it is to be attached; a needle plate for supporting the welt and the edge in the sewing area; and a sewing unit positioned in the sewing area.

With the sole aim of simplifying the explanation of the present invention, the rest of the description will refer, without implying any restriction, to a garment.

It is known that the edges of a garment such as the neck, cuffs and waist of a pullover, are usually finished by a so-called edging operation in which a welt of knitted or woven fabric or the like is attached to the edge that requires finishing.

The edging operation can be done on linking machines which give an excellent finish to these edges. Unfortunately, these machines not only demand a high level of ability on the part of the person carrying out the edging operation but also have the drawback that linking each welt takes a considerable amount of time, such as to render their use economically worthwhile only with the more expensive garments.

The edging operation can also be done on precision-stitch sewing machines which quickly and economically attach a welt to the edge in question by a simulated linking operation.

The precision and quality of the finish obtained with precision-stitch sewing machines of the kind currently employed (see for example patent IT-1159823 and IT-1206766 by Exacta S.P.A.) is however poorer than the precision and quality of finish obtainable on linking machines. As a result of this, the use of precision-stitch sewing machines for the edging of more expensive and higher-value articles, where the presence of even the slightest imperfection is unacceptable, is still uncommon.

In particular, the presence of imperfections is due to the difficulty of ensuring correct advance of both the welt and the edge to be edged along the sewing line. On this point it should be remembered that, in order to avoid unwanted and unsightly deviations of the sewing it is of fundamental importance to ensure that the welt and the edge of the garment are advanced simultaneously and equally, downstream of the sewing area, given the fact that they are now sewn together.

It will be obvious from the above how great the need is to be able to edge an article faster and more economically than is possible with linking machines, without compromising the precision of the resulting finish.

The problem upon which the present invention is based is thath of devising a machine for performing the abovementioned edging operation, the structural and functional characteristics of which are such as to satisfy the abovementioned need and at the same time to solve the problems referred to earlier.

This problem is solved by a precision-stitch sewing machine of the type specified, characterized in that said means for feeding the edge are positioned upstream of the sewing area and in that said draw unit comprises: a transporting member defining, at least for a defined section close to the sewing area, a supporting surface for the welt and for the edge to which the latter is to be attached, and a draw roller cooperating with said transporting member for advancing the welt and the edge to be edged from the sewing area.

Said transporting member is preferably a first belt conveyor having a flat section close to the sewing area, which flat section forms a supporting surface for the welt and the edge to which the welt is to be attached and is caused to travel away from the sewing area.

Said draw roller preferably presses down on the flat section of the first belt conveyor so that the welt and the edge to which the welt is to be attached can be inserted between the belt conveyor and the draw roller downstream of the sewing area.

Other characteristics and advantages of the precision-stitch sewing machine according to the present invention will be made clear in the following description of a preferred embodiment thereof, given by way of non-restrictive indication with reference to the accompanying figures, in which:

- Figure 1 is a perspective view of a machine for sewing highly accurate stitches according to the invention,
- Figure 2 is a perspective view of an enlarged detail of the machine shown in Figure 1,
- Figure 3 is a simplified view in front elevation of the machine shown in Figure 2,
- Figure 4 is a sectional view on IV-IV as marked in Figure 3 of the sewing machine in one phase of its operation, and
- Figures 5 and 6 are a sectional view on IV-IV as marked in Figure 3 of the sewing machine of Figure 2 in different phases of its operation.

With reference to the accompanying figures, 1 is a general reference for a precision-stitch sewing machine according to the invention for attaching a welt 2 to an edge 3 to be edged of a garment, for example the waist of a pullover.

The machine 1 comprises a frame 4 supporting a horizontal work surface 5 with: a sewing unit 6, feed means 7 for feeding the edge 3 to he edged of the garment, a draw unit 8 for drawing the welt 2 and the edge

3 to be edged, and a folding unit 9 for causing the welt 2 to fold around the edge 3 to be edged of the garment.

The sewing unit 6 comprises a vertical column supporting an overhanging sewing head 10. A bar 11 extends from the free end of the sewing head 10 towards the work surface 5 in a vertical direction Z-Z. The bar 11 is caused to reciprocate in the vertical direction Z-Z by an electric motor of the machine 1 to which it is kinematically connected. At its lower end, the bar 11 holds a needle 12 that extends in the vertical direction Z-Z.

Underneath the sewing head 10, the machine 1 comprises a needle plate 13 parallel to the work surface 5 and containing a vertical through hole to allow the needle 12 to descend as it sews.

Defined between the sewing head 10 and the needle plate 13 is a sewing area 15, positioned upstream of which is the folding unit 9 and downstream of which is the draw unit 8. The welt 2 advances through the sewing area 15 from upstream to downstream along a sewing line X-X to be sewn by the needle 12 to the edge 3 to be edged of the garment, as will be made clear later in the description. The sewing line X-X is parallel to the needle plate 13 and passes through the vertical Z-Z in which the needle 12 lies.

The needle plate 13 is approximately rectangular and is oriented in such a way that its long sides lie in a direction Y-Y perpendicular to the sewing line X-X.

The aforesaid draw unit 8 that draws the welt 2 and the edge 3 to be edged comprises a transporting member 23 positioned immediately downstream of the sewing area 15, and a draw roller 16 cooperating with said transporting member 23 in order to advance the welt 2 and the edge 3 to be edged of the garment along the sewing line X-X.

The transporting member 23 is positioned in line with the sewing line X-X and, close to the sewing area 15, presents a flat section L which is straight and coplanar with the needle plate 13 (Fig.3). This section L of the transporting member 23 provides a theoretical continuation of the needle plate 13, both for the welt 2 and for the edge 3 to be edged of the garment, downstream of the sewing area 15.

The transporting member 23 may advantageously extend in direction Y-Y across the entire width of the needle plate 13.

In the example illustrated in the figures, the transporting member 23 takes the form of a first belt conveyor comprising a flat belt 24 supported so as to run around a closed path defined by a plurality of pulleys and drive rollers, which are supported by the sewing unit 6 of the machine 1. The belt conveyor is turned by an electric motor, preferably a stepper motor in such a way that when the machine 1 is running, the aforesaid flat section L of the flat belt 24 is travelling away from the sewing area 15.

The draw roller 16 is positioned immediately downstream of the needle plate 13, above the first belt conveyor and with its axis of rotation in the aforementioned direction Y-Y. The draw roller 16 is mounted in such a way that it can move in a direction approximately perpendicular to the needle plate 13, so that the roller 16 is pressing against the flat belt 24 of the first belt conveyor.

In the example illustrated in the figures, the draw roller 16 is rotatably cantilever supported by a first end of a lever 25, which latter is free to rotate about a pivot 17 supported by the sewing unit 6. The weight of the draw roller 16 therefore causes it to press down on the belt 24 below. The load of the roller 16 on the flat belt 24 can be increased or reduced as required by acting on the lever 25 with suitably positioned spring means.

The draw roller 16 is turned by an electric motor, preferably of the stepper type, not shown in the figures, in such a way that its peripheral speed is approximately equal, plus or minus a small predetermined tolerance value, and opposite to that of the flat belt 24. This means that the welt 2 and the edge 3 to be edged can be drawn by the flat belt 24 and draw roller 16 at the same speed of advance.

As an alternative to that which has been described above, the flat belt 24 of the transporting member 23 and the draw roller 16 can both be kinematically connected to the same motor, which turns them at equal and opposite peripheral speeds.

The drawer roller 16 preferably extends axially across the full width of the transporting member 23, i.e. of the flat belt 24.

As an alternative to the above, the draw roller 16 may, in order to satisfy particular requirements extend axially less than the width of the flat belt 24 but must always extend beyond the sewing line X-X.

The second end of the lever 25 is preferably connected by a chain 26 to a pedal-type control device 14 mounted at the bottom of the frame 4. Operating the pedal control device 14 turns the lever 25 about the pivot 17 and raises the draw roller 16 from the flat belt 24 of the first belt conveyor, in order to facilitate the initial insertion of the welt 2 and of the edge 3 to be edged of the garment between the draw roller 16 and the flat belt 24, as will be made clear in the course of the description.

The feed means 7 for the edge 3 to be edged of the garment preferably comprise a second belt conveyor comprising a flat belt 18 supported so as to rotate around a closed path defined by a plurality of pulleys and drive rollers supported by the machine 1 frame. The second conveyor belt is lined up with the sewing line X-X and, advantageously, is positioned entirely upstream of the sewing area 15.

Close to sewing area 15 the second belt conveyor presents a flat, straight section R coplanar with the needle plate 13 (Fig.3). Said section R of the flat belt 18 forms a theoretical extension of the needle plate 13 upstream of the sewing area 15. Since there are no problems with interference between the flat belt 18 and the needle 12, it is possible to use a wider flat belt 18

than is possible with the precision-stitch sewing machines of the prior art.

The second belt conveyor is turned by an electric motor, preferably d.c. type or brushless type, so that when the machine is running the flat belt 18 is advancing towards the sewing area 15 in the abovementioned section R.

The speed of advance of the flat belt 18 of the feed means 7 is regulated so as to be approximately equal, plus or minus a small predetermined tolerance value, to that of the flat belt 24 of the transporting member 23. The equivalence of these speeds is ensured by an electronic regulating and monitoring device known per se and capable of regulating the speed of rotation of the respective electric motors.

As an alternative to the above, the feed means 7 for the edge 3 to be edged of the garment comprise, in order to satisfy particular needs, a smooth surface positioned in line with the sewing line X-X and coplanar with the needle plate (13) for at least a defined distance close to the sewing area 15. The smooth surface is made of a material with a low coefficient of friction so that the edge 3 to be edged of the garment slides easily over it during the edging operation.

The folding unit 9 comprises a tubular component 19, known per se, into which is inserted the edging 2 which is directed to the sewing region 15 . Deflection tongues 20 attached to the tubular component 19 act on the welt 2 as it leaves the tubular component 19 forcing it to fold itself into a C along the sewing line X-X with both edges 22 parallel to the sewing line X-X and its concave side toward this line (Fig.4). In this way, when the machine 1 is running, the welt 2 approaching the sewing area 15 is constrained to fold itself around the edge 3 to be edged of the garment as the latter is fed into the sewing area by the flat belt 18, the edges 22 and the outer curve 21 of the welt 2 obviously ending up on opposite sides of the sewing line X-X.

The needle plate 13 comprises guide components, known per se and not illustrated in the figures, for checking and guiding the outer curve 21 of the welt 2 during its advance through the sewing area 15.

The machine 1 also comprises electrical, regulating and monitoring devices to keep it running effectively. These devices are known per se and are not described below.

With reference to the attached figures, during the operation of the machine 1 edge 3 to be edged of the garment is positioned by an operator on the flat belt 18 of the feed means 7 which then carries it towards the sewing area 15. This positioning of the garment is done in such a way that in the abovementioned flat section R close to the sewing area 15, edge 3 to be edged of the garment extends a defined short distance A beyond the sewing line X-X to which it is parallel. At the end of the flat section R the edge 3 to be edged of the garment passes from the feed means 7 to the needle plate 13 as it progresses down the sewing line X-X.

Simultaneously the welt 2 coming out of the folding unit 9 is folded around the edge 3 to be edged of the garment and carried forward with the latter along the sewing line X-X. The needle 12 obviously sews the welt 2 to the edge 3 to be edged of the garment while these are passing below the sewing head 6 (Fig.4).

On leaving the sewing area 15 the welt 2 and the edge 3 to be edged of the garment now sewn together enter between the belt 24 of the transporting member 23 and the draw roller 16 which together draw them along. Among other things this creates a continuous advancing movement of the welt 2 from the folding unit 9 to the sewing area 15. The vertical distance between the draw roller 16 and the flat belt 24 is determined by the thickness of the welt 2 and of the edge 3 to be edged of the garment. For clarity of illustration, in Fig.4 the draw roller 16 is shown pressing down on the welt 2, although in reality the weight of the draw roller 16 causes it also to contact that part of the garment not enclosed by the welt 2.

It should be pointed out that the draw unit 8 of the machine 1 enables the welt 2 and the edge 3 to be edged of the garment to be acted upon close to the sewing area 15 and at the same time provides the welt 2 and edge 3 to be edged of the garment with an extension of the needle plate 13 as they recede from the sewing area 15 for the whole of the section L downstream of the sewing area 15. It is easy to see that this prevents unwanted and unsightly deviations of the line of stitches from developing in the parts yet to be stitched as a result of the removal of the welt 2 and edge 3 to be edged of the garment from the sewing area 15 after being stitched together.

The draw roller 16 advantageously extends axially across the full width of the flat belt 24 so that it can work with said belt 24 of the first conveyor in order also to advance the garment to which the welt is to be attached.

This means, among other things, that the sewing machine 1 can be used for the finishing of edges 3 to which a finishing piece 27, e.g. of leather has previously been sewn and which when the edge is finished must project from the outer edge 22 of the welt 2 (Fig.6). In particular edging of this sort involves an initial sewing operation (Fig.5) in which the finishing piece 27 is sewn onto the edge 3 of the garment, followed by a sewing operation in which the welt 2 is folded around both the edge 3 to be edged of the garment and the finishing piece 27 and sewn to both (Fig.6).

The positioning of the feed means 7 upstream of the sewing area 15 not only brings the advantages referred to earlier, but also enables the machine to be simplified as regards its construction and be made more compact. On this point it may simply be observed that, in contrast to the sewing machines of the prior art, there is no need for any conveyor belt to run underneath the sewing area.

As may be appreciated from the above account, the precision-stitch sewing machine according to the inven-

tion overcomes the abovementioned need without introducing the disadvantages of prior-art machines, because this machine avoids those unwanted and unsightly deviations of the line of stitches caused by imperfect and varying alignment, during the course of the sewing operation, of the welt relative to the edge to be edged of the garment along the sewing line X-X.

Another advantage of the precision-stitch sewing machine according to the invention is that it is able to advance the welt and the edge to be edged of the garment simultaneously and equally after sewing.

Another advantage of the precision-stitch sewing machine according to the invention is that it is structurally and functionally simple, and therefore reliable in operation.

Obviously, a person skilled in the art would be able, in order to satisfy local and specific needs, to make many modifications and alterations to the precision-stitch sewing machine described above, all such modifications and alterations falling however within the scope of protection of the invention as defined by the following claims.

Claims

1. Precision-stitch sewing machine for attaching a welt (2) to an edge (3) to be edged of a knitted or woven fabric or the like, along a predetermined sewing line (X-X), of the type comprising:

   - feed means (7) for feeding the edge (3) to be edged to a sewing area (15) of the machine (1),
   - a draw unit (8) for drawing both the welt (2) and the edge (3) to be edged, said draw unit being positioned downstream of the sewing area (15), for advancing the welt (2) and the edge (3) to be edged along the sewing line (X-X),
   - a folding unit (9) for folding the welt (2), said unit being positioned upstream of the sewing area (15) with reference to the direction of advance of the welt (2) along the sewing line (X-X), for folding the welt (2) around the edge (3) to be edged to which it is to be attached,
   - a needle plate (13) for supporting the welt (2) and the edge (3) to be edged in the sewing area (15), and
   - a sewing unit (6) positioned in the sewing area (15),

   characterized in that said means (7) for feeding the edge (3) to be edged are positioned upstream of the sewing area (15) and in that said draw unit (8) comprises:

   - a transporting member (23) defining, at least for a defined section (L) close to the sewing area (15), a supporting surface for the welt (2) and for the edge (3) to be edged, and
   - a draw roller (16) cooperating with said transporting member (23) for advancing the welt (2) and the edge (3) to be edged from the sewing area (15).

2. Machine according to Claim 1, in which said transporting member (23) is positioned in line with the sewing line (X-X).

3. Machine according to Claim 1, in which said defined section (L) of the transporting member (23) is coplanar with the needle plate (13).

4. Machine according to one of the preceding claims in which said transporting member (23) is a first belt conveyor having a flat section (L) close to the sewing area (15), which flat section (L) forms a supporting surface for the welt (2) and the edge (3) to be edged and is caused to travel away from the sewing area (15)

5. Machine according to Claim 1, in which said transporting member (23) is turned by drive means.

6. Machine according to Claim 4, in which said draw roller (16) presses down on the flat section (L) of said first belt conveyor, the welt (2) and the edge (3) to be edged being fed between the first belt conveyor and the draw roller (16) downstream of the sewing area (15).

7. Machine according to Claim 6 in which said draw roller (16) is positioned close to the sewing area (15).

8. Machine according to Claim 6, in which said draw roller (16) extends axially across the full width of the belt conveyor.

9. Machine according to Claim 6, in which said draw roller (16) is turned by drive means.

10. Machine according to Claim 1, in which said means (7) for feeding the edge (3) to be edged comprise a second belt conveyor defining, at least for a defined section (R) close to the sewing area (15), a supporting surface for the edge (3) to be edged as it is advanced towards the sewing area (15).

11. Machine according to Claim 10, in which said second belt conveyor is positioned in line with the sewing line (X-X) and said defined section (R) is coplanar with the needle plate (13).

12. Machine according to Claim 10, in which said second belt conveyor is turned by drive means.

13. Machine according to Claim 4 or 10, in which said belt conveyor comprises a flat belt (18; 24) supported rotatably by a plurality of pulleys and drive

rollers.

14. Machine according to any one of the preceding claims, in which the speed of advance of the edge (3) to be edged, through the feed means (7) is approximately equal to the speed with which the welt (2) and the edge (3) to be edged are drawn through the draw unit (8).

15. Machine according to Claim 1, in which said means (7) for feeding the edge (3) to be edged comprise a smooth surface positioned in line with the sewing line (X-X), said smooth surface being coplanar with the needle plate (13) for at least a defined distance close to the sewing area (15).

16. Machine according to Claim 15, in which said smooth surface is made of a material with a low coefficient of friction.

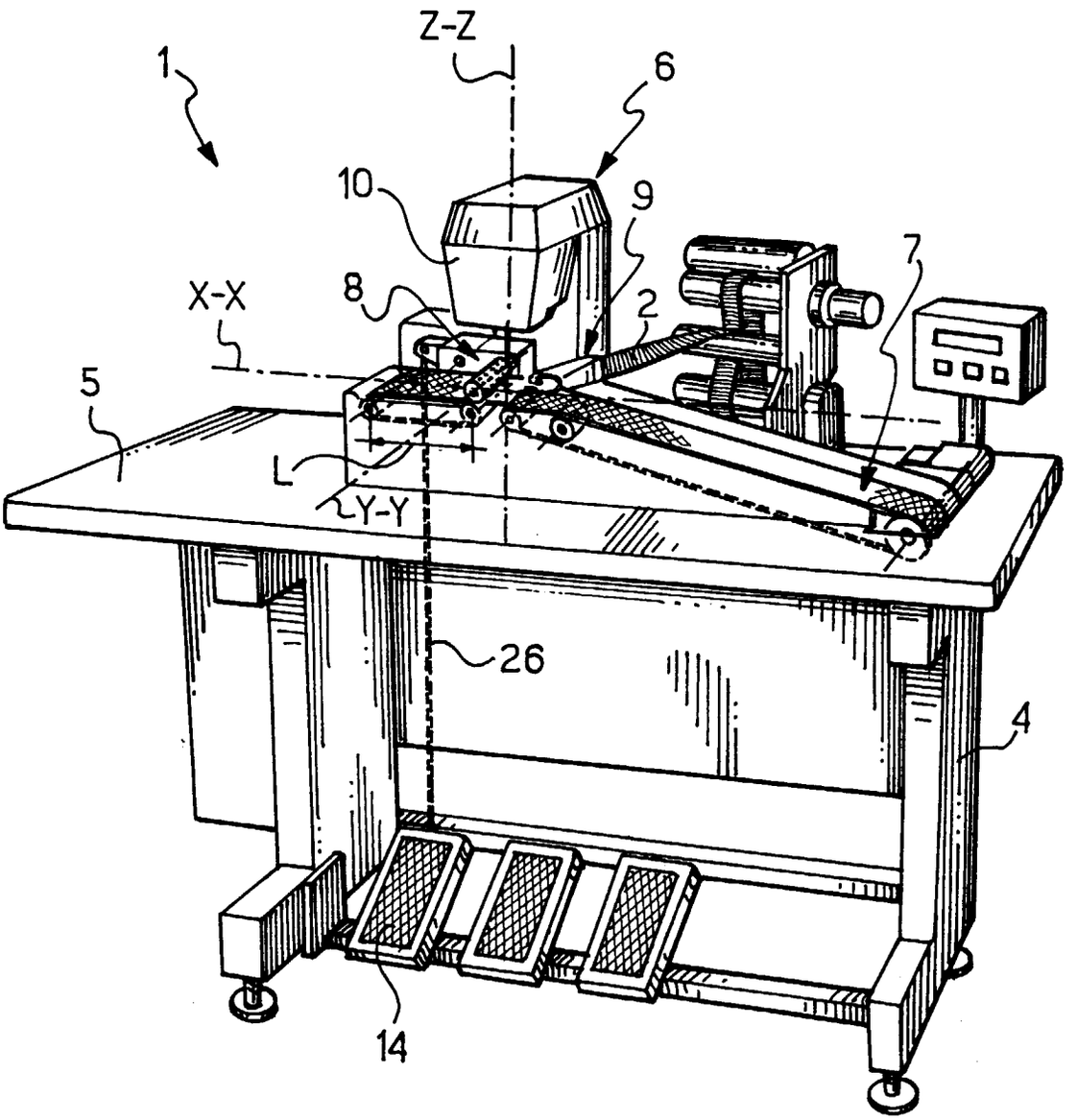
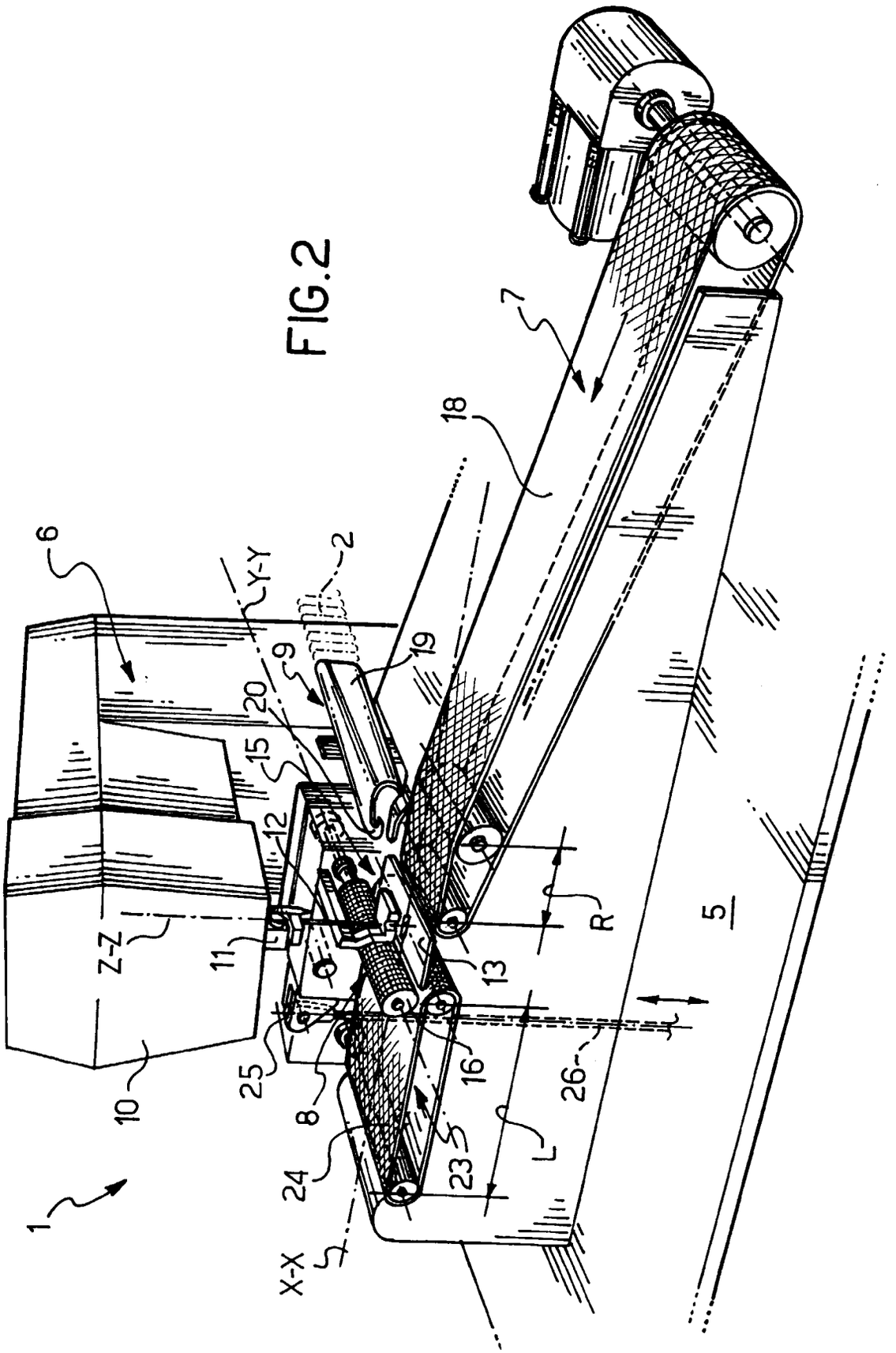


FIG.1

FIG.2



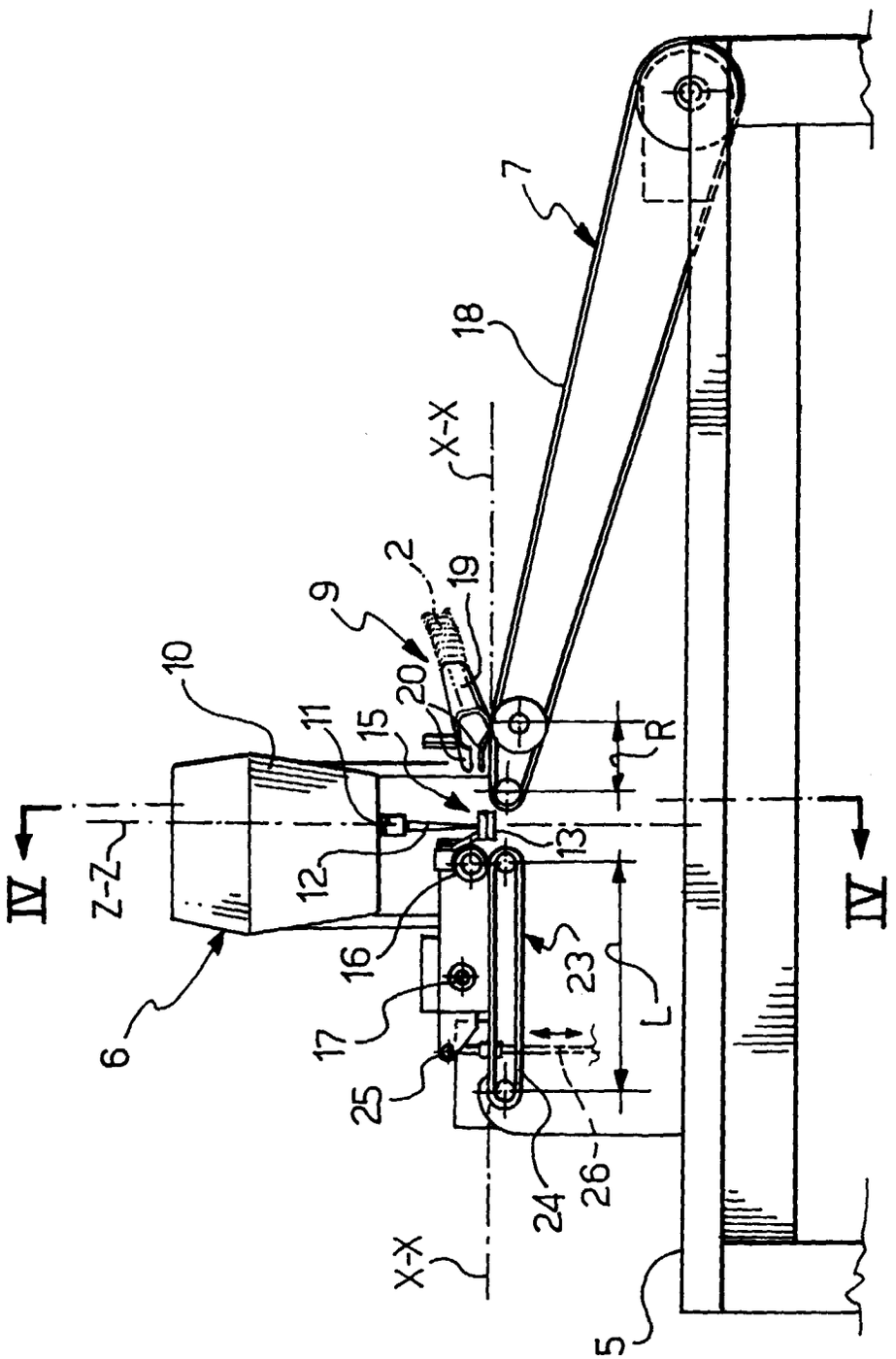


FIG.3

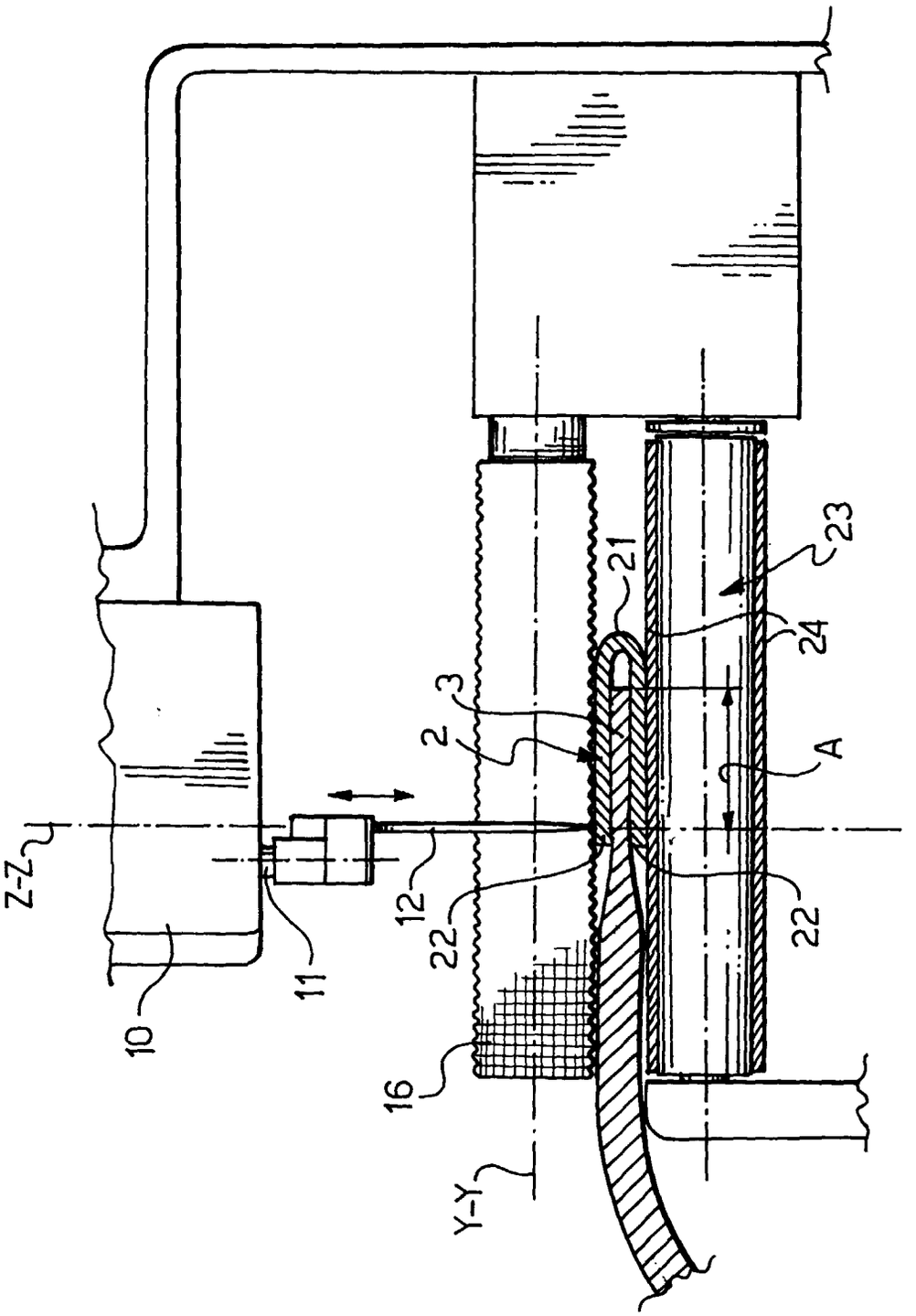


FIG.4

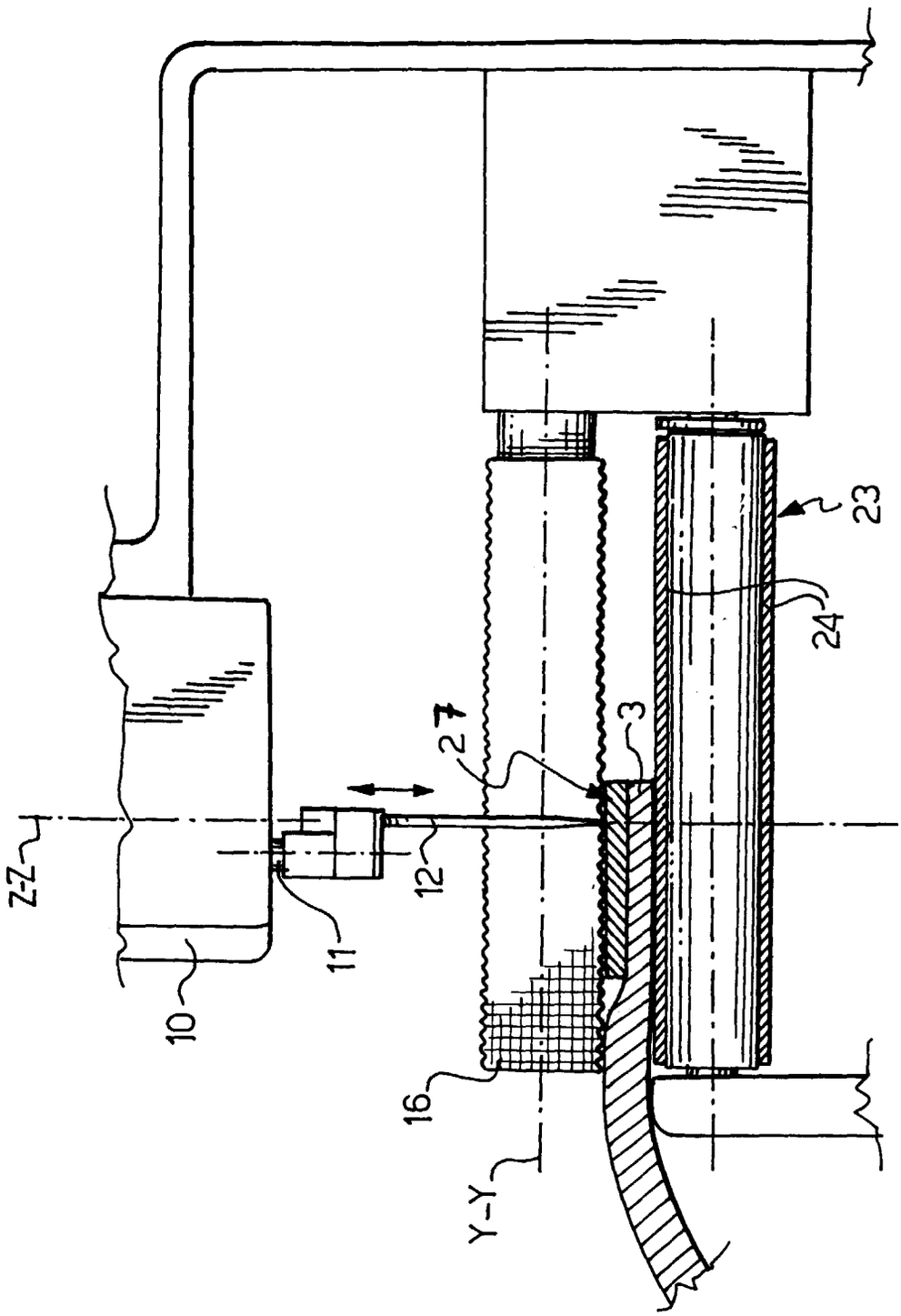


FIG.5

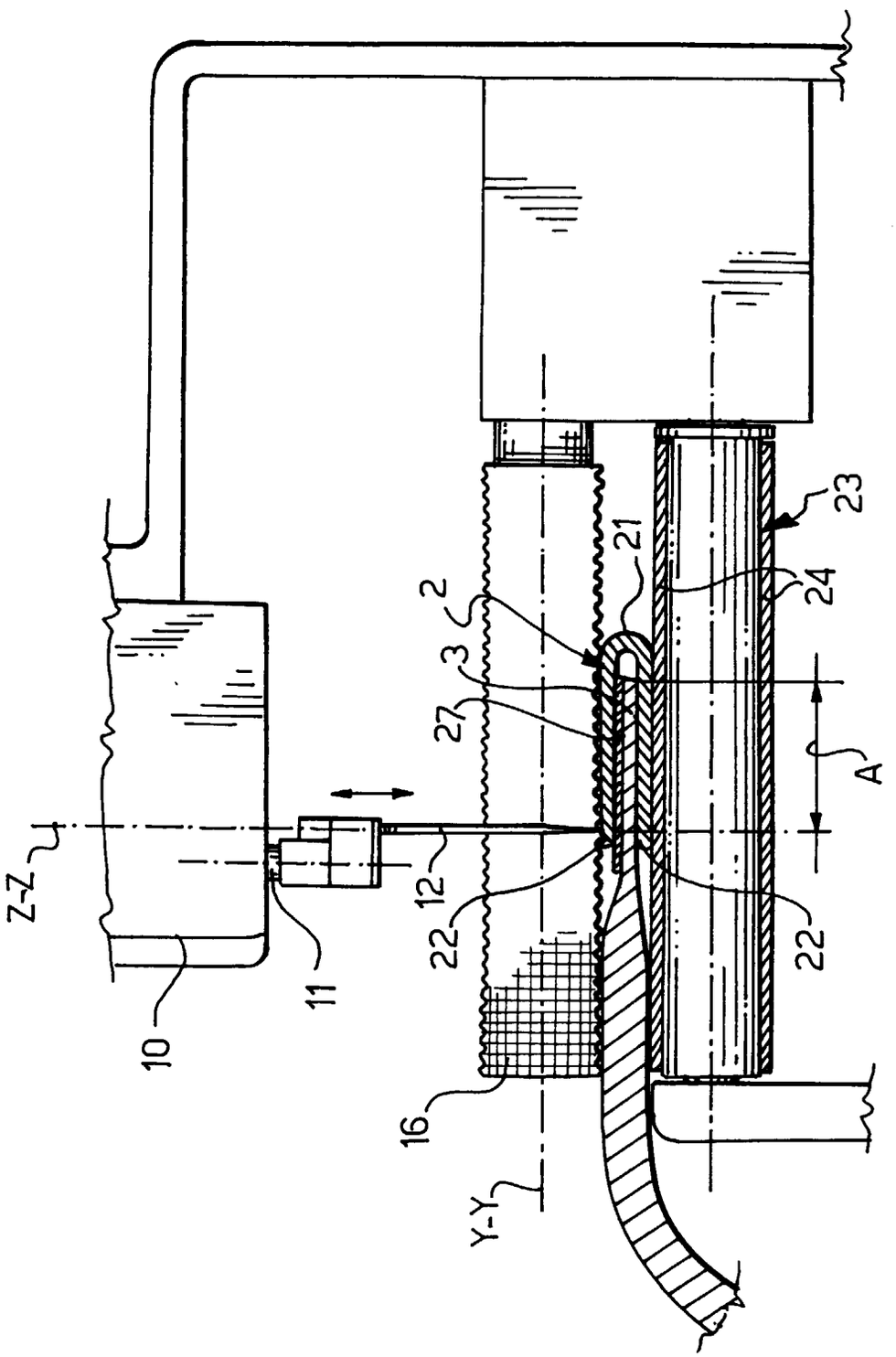


FIG.6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0324

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.6)
A	EP 0 703 309 A (CONTI COMPLETT S.P.A.) 27 March 1996 * claims; figures *	1	D05B35/06 D05B27/10
A D	US 4 577 573 A (A. PELOGGIO) 25 March 1986 * the whole document * & IT 1 159 823 B (EXACTA S.P.A.)	1	
A,D	IT 1 206 766 B (EXACTA S.P.A.) 3 May 1989 * the whole document *	1	
A	US 4 311 106 A (F. HANNEMAN) 19 January 1982		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 September 1998	D'Hulster, E

CATEGORY OF CITED DOCUMENTS

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