(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 503 166 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91200551.9**

(51) Int. Cl.5: **B26F 1/38**, A41H 43/00

(22) Date of filing: **12.03.91**

(43) Date of publication of application:
16.09.92 Bulletin 92/38

(84) Designated Contracting States:
BE DE FR GB IT

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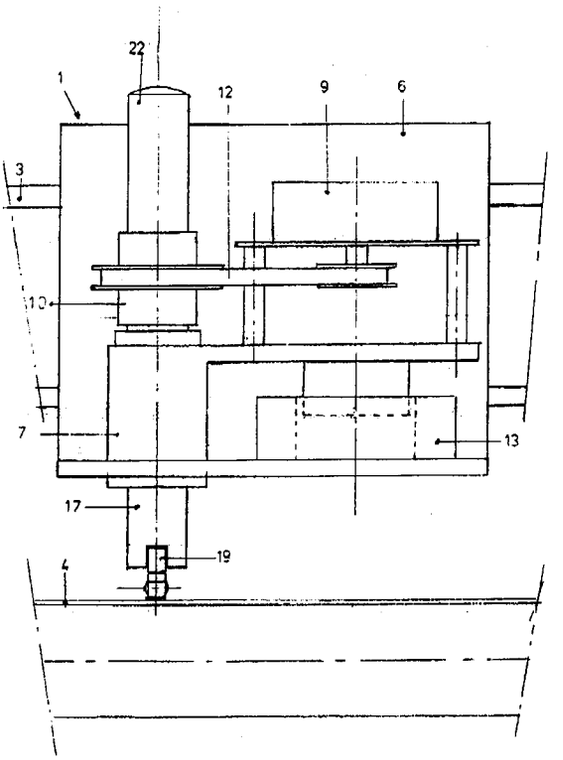
(54) Apparatus for plotting, cutting and/or punching sheet material.

(57) Apparatus for plotting, cutting and/or punching the contour of figures on and into respectively, sheet material 4, provided with a traction- and/or friction feed for moving the sheet material to and fro in accordance with a first component of a plotting, cutting or punching direction, a tool head 1 movable in a direction perpendicular to the direction of said traction and/or friction feed and parallel to the surface to be cut in accordance with a second component of said plotting, cutting or punching direction, said tool head being provided with a housing 7 which can be moved in a direction at perpendicular to the surface of said sheet material and a servo-controlled motor controlling the position of a bush rotatably arranged in said housing provided with either a plotting, cutting or punching tool, means for moving the housing towards the sheet material to be plotted, cut or punched and means for positioning the cutting or punching tool such that the cutting or punching direction coincides with the tangent of the contour to be cut, two rollers 18 being arranged at the side of the bush facing the sheet material and slightly extending therefrom to roll over said sheet material during cutting and punching respectively, said cutting or punching tool being arranged between said two rollers, its cutting direction equalling the rolling direction of said rollers and extending therefrom over a distance corresponding to the desired cutting or punching depth, the tool top being situated on the axis of rotation of the bush.

FIG.1



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The invention relates to an apparatus for plotting, cutting and/or punching the contour of figures on and into respectively, sheet material which may be laminated provided with a traction- and/or friction feed for moving the sheet material to and fro in accordance with a first component of a plotting, cutting or punching direction, a tool head movable in a direction perpendicular to the direction of said traction and/or friction feed and parallel to the surface to be cut in accordance with a second component of said plotting, cutting or punching direction said tool head being provided with a housing which can be moved in a direction at least virtually perpendicular to the surface of said sheet material and with which a servo-controlled motor is connected controlling the position of a bush rotatable arranged in said housing provided with either a plotting, cutting or punching tool, means for moving the housing towards the sheet material to be cut or punched and means for positioning the cutting or punching tool such that the cutting or punching direction coincides with the tangent of the contour to be cut.

Such apparatus are known in which the knife cuts the top layer of the laminate by means of a more or less constant force.

This has the disadvantage that the cutting depth is beyond control e.g. when the properties of the material vary.

It is also known to have the knife abut against a stop. This has the drawback that the cutting depth depends on the accuracy of the distance of the head from the material to be cut or punched and on the variations of the thickness thereof.

The invention is characterized in that two rollers are arranged at the side of the bush facing the sheet material and slightly extend therefrom to roll over said sheet material during cutting and punching respectively, said cutting and/or punching tool being arranged between said two rollers, its cutting or punching direction equalling the rolling direction of said rollers and extending therefrom over a distance corresponding to the desired cutting or punching depth the tool top being situated on the axis of rotation of the bush.

The advantage is that by moving the housing towards the sheet material the knife or punch penetrates the sheet material until the rollers touch said material, thereby limiting the cutting depth to the desired value and keeping it constant irrespective of the nature of the surface of the material, variation of its thickness and tolerances of the parallelism of the guide system of the tool head and the supporting member of the sheet material. Moreover the friction between the toolhead and the sheet material is minimized by the use of rollers.

In an embodiment of the invention the rollers are part of a nose-piece which is detachably fixed in the bush.

In this way the nose-piece can easily be changed and the rollers cleaned.

In a further embodiment of the invention the rollers are symmetrically mounted each on one arm said arms pivoting in a plan through the axes of the rollers and the nose-piece at equal distance from the face of the nose-piece and its axis of rotation said arms being pressed towards one another by spring action.

This has the advantage that the cutting tool can easily be replaced by a plotting tool without any offset between the knife top and the ball to draw and check the design before definitely cutting or punching the material.

In another embodiment of the invention on the side of the bush remote from the nose-piece a micrometer adjustment is present to accurately adjust the cutting or punching depth by pressing the tool which is slidably arranged in the bush against spring action into the desired position.

As a result the desired cutting or punching depth can easily be obtained without losing time.

The material has to be moved to and fro while cutting the desired contours and it is absolutely necessary that no slip or deformation takes place.

This requires a uniform feed along the full width of the sheet.

It is known to use rollers the surface of which are roughened by fixing hard grains thereon but it is difficult to obtain the uniformity of thickness and roughness required

It in also known to use cross-hatched knurling tools to impress a cross-wise pattern in the roller surface but it is very difficult to obtain a pattern in which the tops are of uniform height and sufficiently sharp especially in somewhat harder materials.

The use of one single roller extending over the entire width of the sheet material is not advisable as it is mostly subject to bending.

In a further embodiment of the invention the rollers of the friction feed are relatively short and drive the sheet material mainly at its edges whereas cross hatched knurls on the roller surface are obtained by means of a tipped chisol and simultaneously rotating the roller and shifting the chisol such that helical grooves are obtained with a helix angle or preferably 45° choosing the depth and the number of grooves such that the top of each resulting pyramide is sharp.

In this way the bearings can be arranged at a shorter distance from one another so that the rigidity is enormously increased and the tops of the pyrimide are sharper and have a better grip on the sheet material.

The invention will now be illustrated by way of example with reference to the accompanying drawings in which

Fig. 1 shows a front view of a part of an apparatus with tool head
Fig. 2 a left side view
Fig. 3 a nose piece with rollers on fixed axes
Fig. 4 a nose piece in which a plotting tool is inserted
Fig. 5 a side view of a friction feed roller
Fig. 6 a schematic front view of the helical grooves of a roller of Fig 5
Fig. 7 a length cut of a roller

In Fig. 1 and 2 the tool head 1 is movable in a direction perpendicular to the direction 2 of the traction- and/or friction-feed along a guide system 3 by means of rollers 5 attached to the frame 6
A housing 7 can be moved along guide bars 8 in a direction perpendicular to both the direction 2 of the traction and/or friction feed and the direction of length of the guide system 3 so at least virtually perpendicular to the surface of the sheet material.

To the housing 7 a servo-controlled motor 9 is connected which controls the position of a bush 10 which is rotatable in the housing 7 and is provided with a cutter knife or punch 11. The bush 10, so the cutter knife 11, is positioned by the motor 9 such that its direction of cutting always coincides with the tangent of the contour to be cut. In this case the motor 9 drives the bush 10 by means of a toothed belt 12 but it is equally possible to drive the bush 10 directly. The motion can be of any servo-controlled type e.g. a step-motion.

For cutting the housing 7 is moved towards the sheet material 4 by means of a solenoid 13 against the action of a spring (not shown). It will be clear that other moving means like f.e. compressed air can also be used.

To the bush 10 a nose-piece 14 is attached as shown in Fig. 3 provided with two rollers 15 which may be of the ball bearing type and slightly extend therefrom to roll over the sheet material 4 during cutting and/or punching whereas the cutting knife 11 is arranged between the two rollers 15 and extend there beyond over a distance equal to the desired cutting depth. The cutting direction or the knife 11 coincides with the rolling direction of the rollers 15. By moving the housing 7 towards the sheet material 4 the cutting knife 11 pierces said material 4 until the rollers 15 touch the surface of the material and the desired cutting depth is obtained and remains always the same during cutting irrespective of the nature of the surface of the material, variation of its thickness and tolerances in the parallelism of the guide system 3 with respect to the supporting member of the sheet material which here consists of a rubber coated rod 16. Said nose-piece 14 is detachably fixed on the bush 10 so that the nose-piece 14 can easily be changed and the rollers cleaned.

Another type of nose-piece 17 is shown in figures 1 and 2. Here the rollers 18 are symmetrically mounted, each on one arm 19 which pivots in a plane through the axes of the rollers 18 and the nose-piece 17 at some distance from the face of the nose piece 17 whereas said arms 19 are pressed towards one another by spring action. This may be obtained f.e. by a simple O-ring around the arms 19 in the notches 20.

This gives the possibility to replace the cutting knife 11 by f.e. a plotting tool 21 as shown in fig. 4 without any offset between the knife top and the top of the plotting tool.

As a result it is possible to plot and check the design before definitely cutting the material.

For accurately adjusting the cutting depth of the knife 11 a micrometer adjustment 22 is provided which presses the cutter knife 11 which is slidably arranged in the bush 10 against spring action into the desired position.

The fine adjustment is of utmost importance for precision cutting of signs and graphics for which laminated material may be used of which the top layer consists of vinyl film f.e. which is stuck to a backing layer. After cutting the vinyl layer along the desired contour of the sign or graphic, the top layer can easily be weeded from the backing layer.

For moving the sheet material 4 friction-feed rollers 23 (not shown)are provided between which and pressure rollers the sheet material 4 is pinched.

As shown in figures 5, 6 and 7 those rollers 23 are provided at their surface with a cross-hatched knurl 24 by means of a tipped chisel (not shown) and simultaneously rotating the roller and shifting the chisel such that helical grooves 25 are obtained with a helix angle of 45° so that the helixed inter one another at an angle 26 of 90°. The depth and the number of grooves are chosen such that the top of each resulting pyramid 27 is sharp so as to get a better and uniform grip on the sheet material 4 As a matter of fact multiple tipped chisels in the form of a mill can be used on an appropriate machine.

The rollers 23 are selectively shut and attached to a common shaft which may advantageously be supported in the vicinity of each roller 23.

Claims

1. Apparatus for plotting, cutting and/or punching the contour of figures on and into respectively, sheet material which may be laminated, provided with a traction- and/or friction feed for moving the sheet material to and fro in accordance with a first component of a plotting, cutting or punching direction, a tool head movable in a direction perpendicular to the direction of said traction and/or friction feed and

parallel to the surface to be cut in accordance with a second component of said plotting, cutting or punching direction, said tool head being provided with a housing which can be moved in a direction at least virtually perpendicular to the surface of said sheet material and with which a servo-controlled motor is connected controlling the position of a bush rotatably arranged in said housing provided with either a plotting, cutting or punching tool, means for moving the housing towards the sheet material to be plotted, cut or punched and means for positioning the cutting or punching tool such that the cutting or punching direction coincides with the tangent of the contour to be cut.
characterized in that two rollers are arranged at the side of the bush facing the sheet material and slightly extend therefrom to roll over said sheet material during cutting and punching respectively, said cutting or punching tool being arranged between said two roller, its cutting direction equalling the rolling direction of said rollers and extending therefrom over a distance corresponding to the desired cutting or punching depth, the tool top being situated on the axis of rotation of the bush.

2. Apparatus according to claim characterized in that the rollers are part of a nose-piece which is detachably fixed on the bush.

3. Apparatus according to claim 1 and 2, characterized in that the rollers are symmetrically mounted each on one arm said arms pivoting in a plane through the axis of the rollers and the nose-piece at some distance from the face of the nose-piece and its axis of rotation said arms being pressed towards one another by spring action.

4. Apparatus according to one of the preceding claims, charatcrized in that on the side of the bush remote from the nose piece a micrometer adjustment is present to accurately adjust the cutting or punching depth by pressing the tool which is slidably arranged in the bush against spring action into the desired position.

5. Apparatus according to one of the preceding claims, characterized in that the rollers of the friction-feed are relatively short and drive the sheet material mainly at its edges whereas cross-hatched knurls on the cutter surface are obtained by means of a tipped chisel and simultaneously rotating the roller and shifting the chisel such that helical grooves are obtained with a helix angle of preferably 45° choosing the depth and the number of the grooves such that the top of each resulting pyramid is sharp.

FIG.1

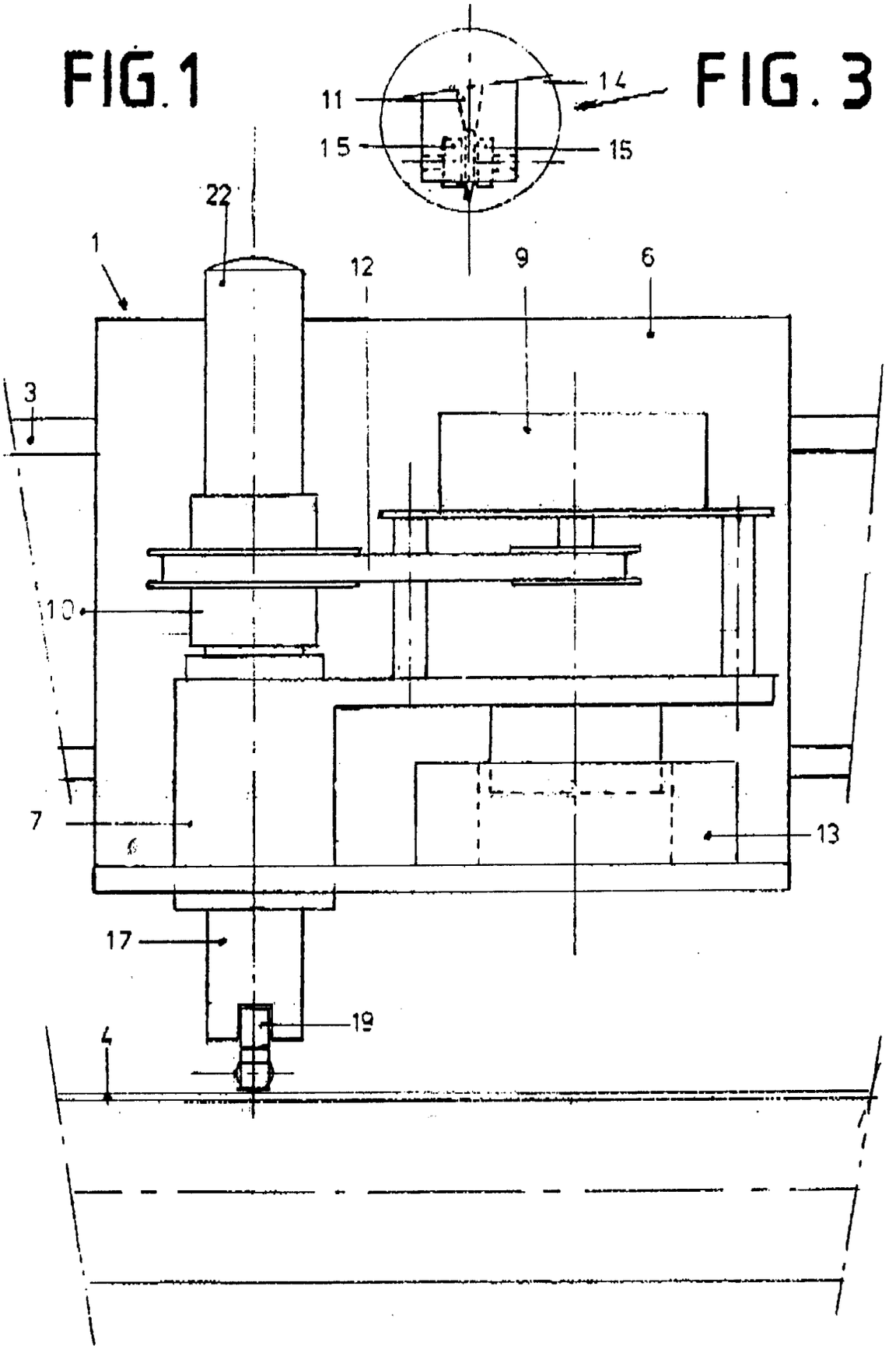

FIG. 3

FIG.2

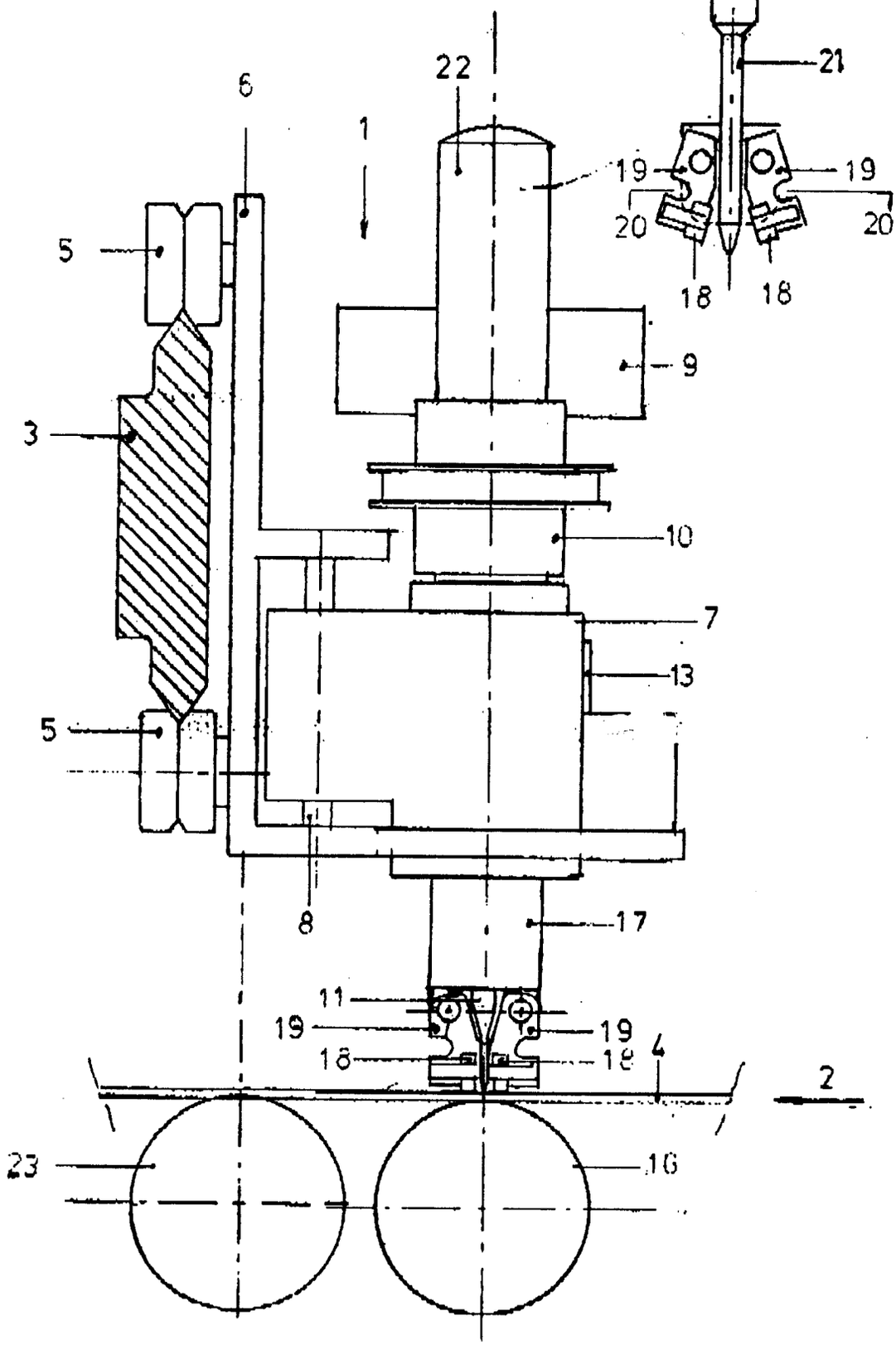

FIG.4

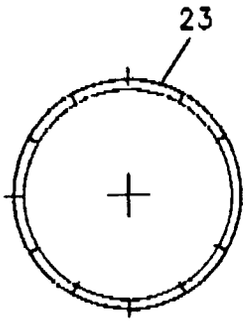

FIG 6

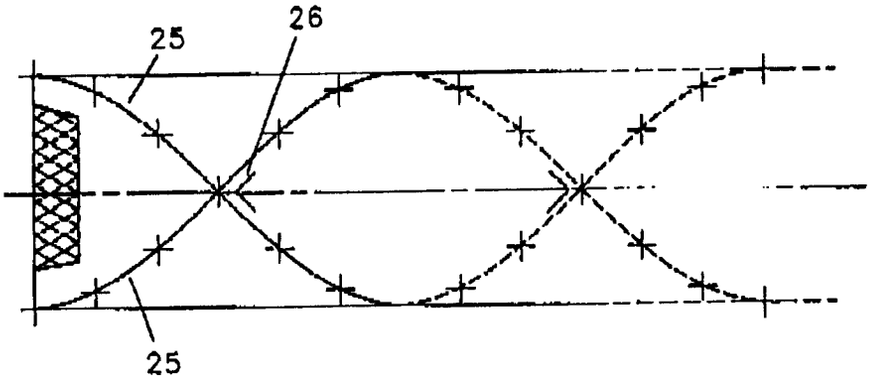

FIG 5

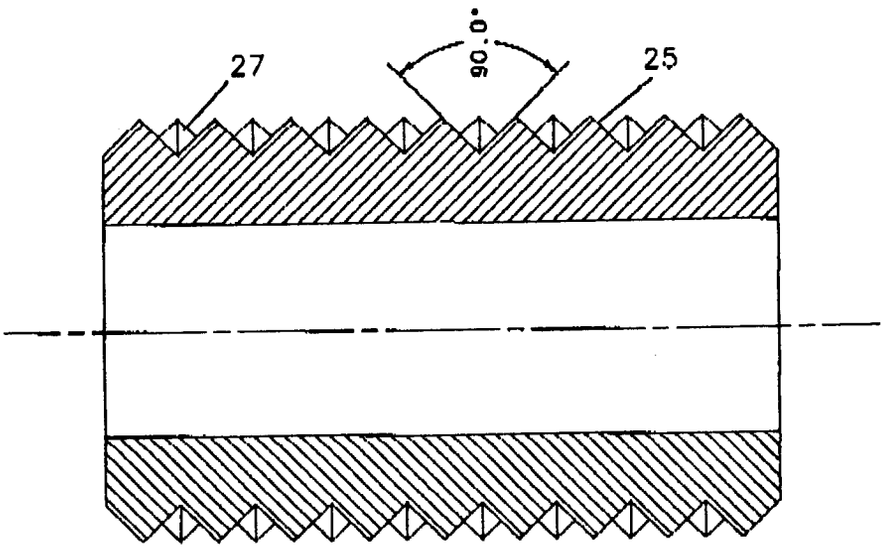

FIG 7

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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0551

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)
Y	US-A-1 897 534 (W.J. SIMPSON) * Page 2, lines 86-126; figures 1-2 *	1,2	B 26 F 1/38 A 41 H 43/00
A		3-5	

Y	DE-A-3 218 564 (ATLAS HANDELSKONTOR GmbH) * Page 29; figures 1-9 *	1,2	
A		3-5	

A	US-A-3 710 445 (ROTH) * Abstract; figures 1-8 *	1	

A	US-A-2 018 503 (J. SHOVLOWSKY) * Column 2, line 60 - column 3, line 10; figures 1-5 *	1	

A	US-A-3 097 430 (J. LEWINSKI et al.) * Column 1, line 21 - column 2, line 6; figure 1 *	1	

A	DE-A-2 006 283 (LICENTIA PATENT-VERWALTUNGS) * Figures 4-5 *	3	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
	---		B 26 F B 26 D B 43 L A 41 H
A	FR-A-2 525 140 (GERBER GARMENT TECHNOLOGY INC.) * The whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06-11-1991	SOZZI R.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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