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54 Severing of material from continuous web.

57 A continuous length of sheet material is fed until its leading edge is detected and is then stopped and clamped. After than an intermediately positioned tensioning and folding means draws out under tension further material from the stop feed mechanism. This sets up the material for transverse clamping and severing of the already folded lengths. The transverse severing is preferably effected by deflecting the material into the path of a band knife parallel to the material face. The severed and folded unit length can be further progressed, either folded or partly completed unfolded e.g. to a cut-and-lay stack or to suitable sewing heads. (Figure 1)

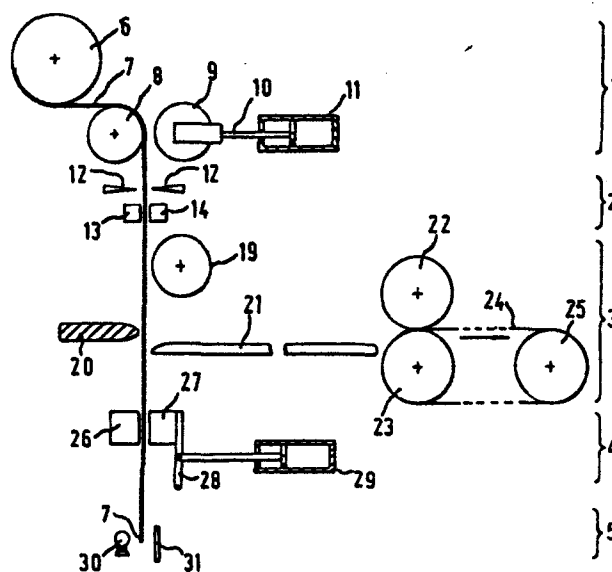


FIG. 1.

EP 0 006 009 A1

"Severing of Material from Continuous Web"

This invention relates to the severing of a predetermined unit length of material from a continuous web, to the further progressing of such unit length in any desired folded or unfolded condition to a subsequent work station and to stacking of unfolded lengths in an accurate stack.

There are many practical difficulties in cutting from a continuous web, e.g. a roll of fabric, predetermined unit lengths in such a way as to present them without interruption for subsequent manipulation e.g. folding, sewing etc. Generally these are linked with the time taken and process interruption caused by the actual severing process. Because of this it is common to pre-cut the unit lengths and then work either manually or with automatic take-up fingers from a stack.

The present invention sets out to overcome these problems, by recognising that the necessary fabric tension for further manipulation, especially folding, can be used to set up the fabric for cutting.

In one aspect the present invention consists in equipment for severing lengths of sheet material from a continuous web comprising: a feed mechanism for material; means for detecting when a progressing leading edge of material reaches a predetermined position, and stopping feed of material, when the

said leading edge reaches the said position; a clamp located to grip said material at or near the said position; tensioning and folding means which draw out further material when the feed mechanism is stopped, located between the feed mechanism and the said clamp; and severing equipment located between the feed mechanism and the tensioning and folding means to define both a new leading edge on the web and a rearward edge on the cut piece, said severing equipment being associated with further clamp means at or near the new rearward edge.

Preferably, the feed mechanism comprises a pair of rollers one of which is movable towards or away from the other, in one case defining a nip through which material is fed and in the other permitting free passage of material. Alternatively, mutually engageable and disengageable clamping belts could be used.

It is convenient if the means for detecting a progressive leading edge of material is a photo-electric cell and associated light source, but a timer or revolution-counter on the drive roller or even a micro switch could be used.

Conveniently moreover the tensioning means is a bar transverse to the web which, after the leading edge clamp is actuated is movable through the plane of the web to pull through the disengaged rollers of the feed mechanism a predetermined length of material and hold it in a folded condition. Such a tensioning bar is preferably movable thereafter a further distance to progress or manipulate the cut length.

The severing means may take various knife, guillotine or other forms as described below. Preferably, however, it comprises a band knife or

reciprocating knife with a transverse cutting flight at least substantially parallel to and spaced from the surface of the tensioned material, and usually with elongate transverse additional clamp members
5 movable to bring the material face on to the band knife cutting flight and thereby sever it.

A specific form of such severing means can be defined as a device for transversely severing a tensioned length of sheet material comprising: a
10 knife with a transversely movable transverse cutting flight at least substantially parallel to a surface of the tensioned length, two first elongate clamp members each parallel and spaced from said flight at one side of the sheet material, one or more
15 resilient biasing means which urge the first clamp members to an inoperative location whereat a clamping surface is forward of the knife edge, two second parallel elongate clamp members at the other side of the sheet each parallel to and located to
20 cooperate with one of the first such members against the acting of the resilient biasing means, and means for providing progressive movement of the said second clamping members towards the first clamp members and displacement of the first clamp
25 members so that the sheet material contacts the knife blade and is severed by its transverse movement.

Such a device is envisaged in which each clamp member has a clamp surface parallel to the path of the sheet material, and in which the resilient biasing
30 means is behind the first clamping members in relation to the sheet material whereby progressive movement of the said second clamp members towards the first clamp members presses the first clamp member surface back past the knife cutting edge to sever the sheet material.

As a modification each outer edge of either the first or the second elongate clamp member can possess a elongate projecting rib to fit outside the cooperating clamp member and thereby improve the grip of the clamps on the cloth and increase the tension in the immediate vicinity of the band knife.

While the invention is primarily concerned with the whole equipment, preferably when comprising a severing device as set forth immediately above, it also extends to such severing devices per se.

The equipment as described above is suitable for use in a line for producing from a continuous web a folded and side-sewn bag or a unit length of material, said line comprising the combination of equipment as described above with a moving table and transverse feed rollers therefor: wherein the said transverse bar holding the material in folded condition after severing is movable by a further amount to present the fold or an edge to the nip between the said feed rollers.

The invention will be further described with reference to the accompanying drawings.

In the drawings:-

Figure 1 is a diagrammatic representation of an equipment severing from a web predetermined unit lengths of material using a severing means;

Figures 2a, 2b and 2c show by way of example only an embodiment of the severing means in three stages of its operation, and

Figure 3 shows the equipment of Figure 1 incorporated into automatic machinery for folding, cutting and side seaming of pillow cases.

Figure 1 can be best considered, in the example, as a vertical sequence of five sub-assemblies

each at some point exhibiting a clearance for a vertical length of fabric, the sequence at least at the beginning of a cycle having all the various such clearances vertically aligned.

5 The sub-assemblies are a feed mechanism generally indicated at 1, a severing means indicated at 2, a folding mechanism indicated at 3, which governs the predetermined length to be separated from the web, a clamping arrangement 4 for the free end of
10 the web, and a photo-electric limit switch arrangement 5.

 The feed mechanism 1 consists in its turn of a feed roller 6 from which a length of material 7 is passed between parallel roller 8 and into the
15 clearance between this roller 8 and roller 9, which is held at the end of arm 10 capable of longitudinal movement by virtue of pneumatic cylinder 7.

 A typical severing means 2 is shown in Figures 2a, 2b and 2c by way of example only. However, any
20 severing means 12 can in theory be used, provided that it is used in conjunction with clamping members 13 and 14, for reasons discussed in more detail below. Thus, shearing members (two-bladed scissors, knives, guillotines) or other cutting expedients (hot wire,
25 laser cutting) can all be envisaged at 12 without altering the essential scope of the present invention.

 The folding mechanism 3 consists of a direction-change roller 19, a bar 20, and a receiving tray 21. At the end of the receiving tray are pick-up rollers
30 22 and 23, roller 23 being located within an endless belt arrangement 24 also passing over roller 25 and moving in the sense shown by the arrow. Once again, roller 19 and tray 21 on the one^{hand}, and the bar 20 on the other hand, define between themselves a clearance in the

initial rest position of the mechanism.

The clamping arrangement 4 is a straightforward pair of clamp members 26 and 27, one of which is mounted on an arm 28 actuated by pneumatic cylinder 29 as required.

5 The photo-electric limit switch arrangement 5 is similarly straightforward and comprises a light source 30 and a photo-electric cell 31.

10 It will be appreciated from a consideration of the Figure 1 that all of the various bar, clamp and roller members 6, 8, 9, 13, 14, 19, 20, 21, 26, 27 are shown in cross-section and are generally all of the same length. Moreover, the various clearances 8/9: 13/14: 19,21/27; 26/27; and 31/30 are all vertically aligned in the rest position of the
15 environment. Finally, the various mechanical and electrical linkages necessary to bring about movement of these components have in Figure 1 been omitted in the interests of simplicity.

20 The arrangement of Figure 1 operates as follows. Firstly, rollers 8 and 9 are engaged to define a nip. A length of material (for example cotton fabric printed with suitable panels for making pillow cases) is unrolled from roll 6 through this nip to move progressively downwards through the common vertical
25 clearance between the various component parts. When the leading edge reaches the photo-electric cell 31, conventional electrical circuitry (not shown) actuates pneumatic cylinder 29 to close clamps 26 and 27 and actuates cylinder 11 to open apart rollers 8 and 9.
30 Immediately, thereafter such circuitry actuates the mechanism of bar 20 to draw a double layer of cloth over table 21, around the end of the table and around roller 19. When the bar 20 has reached a predetermined

limit to its travel, the feed roller 5 receives a stop signal and for example the roller 9 is actuated by its pneumatic cylinders 11 against roller 8, this time to brake the fabric. At this stage, therefore, there is a tightly held length of material extending between, on the one hand, roller 8 and its clamping roller 9 and on the other the clamps 26 and 27, passing over roller 19 and table 21 by virtue of the loop formed by bar 20. Either at this stage (or earlier, when roller 9 is actuated) the clamping members 13, 14 are operated. The knife 12 is moved through the fabric and severs a predetermined length so that a clean cut is obtained. The clamping function of roller 9 could be replaced by a separate clamp, or the embodiment described below, having a clamp portion unified with clamps 13, 14.

At this stage, the cut unit length is still held between clamps 26 and 27 at one end and between clamping bars 13 and 14 at the other end. To complete the cycle, the various clamps can be released and bar 20 allowed to continue its travel in the same direction so that the folded edge is presented to the rollers 22 and 23. Thus, the folded unit length of material passes along the conveyer belt system 24 for a further processing as discussed below.

Various modifications can be made to the structure or operation as described above. For example, any one of the unit components 1 to 5 can be reversed in relation to the others, and it is not strictly necessary (although advantageous) to have a vertical clearance to feed the length of fabric. Moreover, the design of the clamping and cutting mechanism can be modified as described in more detail below. Also, by suitable adjustment of the operating cycle, and of

the dimensions of the equipment, it is possible when progressing the cut and folded lengths, to release one clamp set e.g. 26/27 or 13/14 at a different line from the other, or otherwise progress the bar 20 so far that
5 the fold disappears and only a free edge of the length is presented to the rollers for onward progressing. Indeed, by suitable adjustment to a given piece of equipment any intermediate distance of fold can also be accommodated.

10 It will be appreciated that a further advantageous feature of the machine is that it can cut and lay unit lengths of material, in a stack of single thicknesses either way up. Moreover, the laying on of each unit to the stack is highly accurate and takes place by an
15 "unrolling" of the initial fold around bar 20, which does not disturb the position of the underlying stack members. Thus, the equipment of the invention can cut-and-forward single thicknesses, either way up, or with a fold at any intermediate distance, or can cut-and-
20 aly single thicknesses either way up.

While the invention as described is exemplified in relation to cutting of cotton fabric into unit length pillow cases, a man skilled in the art will realize that it is capable of much wider application to
25 all sorts of fabrics (whether presented as folded or not at a later stage) and that even non-textile materials such as paper or synthetic polymeric film can be processed in this equipment.

The invention will be further described with
30 reference to Figure 2a, 2b and 2c, which are cross-sections through an embodiment of the severing means 2 at different stages of its operating cycle, by way of example.

This further embodiment occupies exactly the
35 same position as a severing means 2 as shown in

Figure 1. It possesses a clamping bar 32, in this instance shown as a unitary bar with a recess 33 to receive a band knife flight 34. This bar is resiliently biased by a spring 35. It is opposed by a second clamping bar 36 attached by rod 37 to a pneumatic cylinder (not shown). The clamping bar 36 has central recess 37 as before and in this embodiment possesses forwardly projecting integral ribs 39 as shown.

It will be appreciated clamping portions 33a/38a are equivalent in performance to clamps 13 and 14; clamping portions 33b and 38b are similarly equivalent to the clamped form of rollers 8 and 9, or to any separate clamp replacement for these as discussed above.

Figure 2a shows the device prior to operation of the cycle with a length of fabric stretching between the two clamping bars.

Figure 2b shows the device partway through its closure, where the ribs 39 have trapped a short length of fabric to either side of the clamping bar, so as to increase the localised tension in the region of the knife. This increase of localised tension improves the accuracy of cutting.

Figure 2c shows the improved embodiment immediately after the length of fabric is cut. The lower rib 39 gives an increased grip upon the edge of the fabric while the further progressing and folding arrangements of bar 20 are carried out.

The bank knife can be replaced by a reciprocating knife if desired. Moreover, while the band knife is shown in the drawing as having its cutting edge parallel to the length of the material, there is no reason why the edge should not be positioned at a small angle to this face, since the essential operating characteristics of the equipment

are still preserved. In such an instance the cut will progress very quickly from one edge of the material to the other. Perhaps more importantly, it is also not essential that the cut be exactly 90° transverse to the length of material. Indeed, an advantage of the invention is that the elliptical band knife can be adjusted to cut at an angle, or even along a curved line. This is sometimes necessary for certain types of printed material which, either by design or by progressive distortion during printing, do not present a straight 90° transverse edge in their printed pattern.

Figure 3 shows in a highly schematic form a whole arrangement for making bag-like shapes. The automatic cutting arrangement is shown at the right-hand side of the Figure in relation to the path of travel of an elliptical band knife. The cut and folded lengths of material, as described, are fed between rollers 22 and 23 on to endless belt 24, and on this belt their side edges are sewn together by sewing means 53 so as to produce an open-ended sack shape. This passes with the folded side foremost to counting and weighing station 54 which can be for example a rotating weigher/counter, and eventually forward to their forward to their finishing operations.

Claims:

1. Equipment for severing lengths of sheet material from a continuous web comprising: a feed mechanism for material; means for detecting when a progressing leading edge of material reaches a predetermined position, and stopping feed of material
5 when the said leading edge reaches the said position; a clamp located to grip said material at or near the said position; tensioning and folding means which draw out further material when the feed mechanism is stopped, located between the feed mechanism and the said clamp;
10 and severing equipment located between the feed mechanism and the tensioning and folding means to define both a new leading edge on the web and a new rearward edge on the cut piece, said severing equipment being associated with further clamp means
15 at or near the new rearward edge.
2. Equipment as claimed in claim 1 in which the said feed mechanism comprises a pair of rollers one of which is movable towards or away from the other, in the first case defining a nip through which
20 material is fed, and in the other permitting free passage of material.
3. Equipment as claimed in claim 1 or 2 in which the means for detecting a progressive leading edge
25 of material is a photo-electric cell and associated light source.
4. Equipment as claimed in claim 2 in which the tensioning means is a bar extending transverse to the
30 web and movable through the plane of the web to pull

through the disengaged rollers of the feed mechanism a predetermined length of material.

5. Equipment as claimed in claims 1 to 4 in which the severing means comprises a band knife or
5 reciprocating knife with a transverse cutting flight at least substantially parallel to and spaced from the surface of the tensioned material.

6. Equipment as claimed in claim 5 in which the severing means further comprises elongate
10 transverse additional clamp members movable to bring the material face on to the bank knife cutting flight and thereby sever it.

7. Equipment as claimed in claim 6 in which the severing means comprises a knife with a transversely
15 movable transverse cutting flight at least substantially parallel to a surface of the tensioned length, two first elongate clamp members each parallel and spaced from said flight at one side of the sheet material, one or more resilient biasing means which
20 urge the first clamp members to an inoperative location whereat a clamping surface is forward of the knife edge, two second parallel elongate clamp members at the other side of the sheet each parallel to and located to cooperate with one of the
25 first such members against the acting of the resilient biasing means, and means for providing progressive movement of the said second clamping members towards the first clamp members and displacement of the first clamp members so that the sheet material contacts the
30 knife blade and is severed by its transverse movement.

8. Equipment as claimed in claim 7 wherein each

clamp member has a clamp surface parallel to the path of the sheet material, and in which the resilient biasing means is behind the first clamping members in relation to the sheet material whereby progressive
5 movement of the said second clamp members towards the first clamp members presses the first clamp member surface back past the knife cutting edge to sever the sheet material.

10 9. Equipment as claimed in claim 7 or 8 wherein each outer edge of either the first or the second elongate clamp member can possess an elongate projecting rib to fit outside the cooperating clamp member and thereby improve the grip of the clamps
15 on the cloth and increase the tension in the immediate vicinity of the band knife.

10. Machinery for producing from a continuous web a folded and side-sewn bag comprising: equipment as claimed in any one preceding claim; a pair of
20 opposed transverse rollers located at the farthest point of travel of the tensioning and folding means, whereby the fold is presented to a nip between said rollers; a moving table on the further side of said rollers for receiving the emerging folded unit
25 length and two severing means positioned one to each side of said table to provide a seam up each edge as the folded unit length passes them.

11. Severing means for transversely severing a tensioned length of a continuous web of material
30 comprising a knife with a transversely movable transverse cutting flight at least substantially parallel to a surface of the tensioned length, two

first elongate clamp members each parallel and spaced from said flight at one side of the sheet material, one or more resilient biasing means which urge the first clamp members to an inoperative location whereat a clamping surface is forward of the knife edge, two second parallel elongate clamp members at the other side of the sheet each parallel to and located to cooperate with one of the first such members against the acting of the resilient biasing means, and means for providing progressive movement of the said second clamping members towards the first clamp members and displacement of the first clamp members so that the sheet material contacts the knife blade and is severed by its transverse movement.

12. Severing means as claimed in claim 11 wherein each clamp member has a clamp surface parallel to the path of the sheet material, and in which the resilient biasing means is behind the first clamping members in relation to the sheet material whereby progressive movement of the said second clamp members towards the first clamp members presses the first clamp member surface back past the knife cutting edge to sever the sheet material.

13. Severing means as claimed in claim 11 and 12 wherein each outer edge of either the first or the second elongate clamp member can possess an elongate projecting rib to fit outside the cooperating clamp member and thereby improve the grip of the clamps on the cloth and increase the tension in the immediate vicinity of the band knife.

14. A method of severing unit lengths of material

from a continuous web thereof, comprising: feeding
a predetermined length of material; immobilising
said material across its width at or near its leading
edge; causing a transverse tensioning and folding
5 member to push the web out of its plane to a
predetermined extent, to draw further material out
at the feed end and define a fold position therein;
immobilising the material across its width at two
spaced locations between the feed and the folded
10 portion; and severing the material between said
spaced locations.

15. A method as claimed in claim 14 in which
after severance the tensioning means is moved further
in the same direction to progress the cut length or
15 manipulate it into a different shape depending upon
the release of the various immobilising means.

16. A method as claimed in claim 14 or 15 wherein
severance is effected by a transverse blade progressing
or reciprocating across the web and movable from a
20 position substantially parallel thereto into a
contact position for severance.

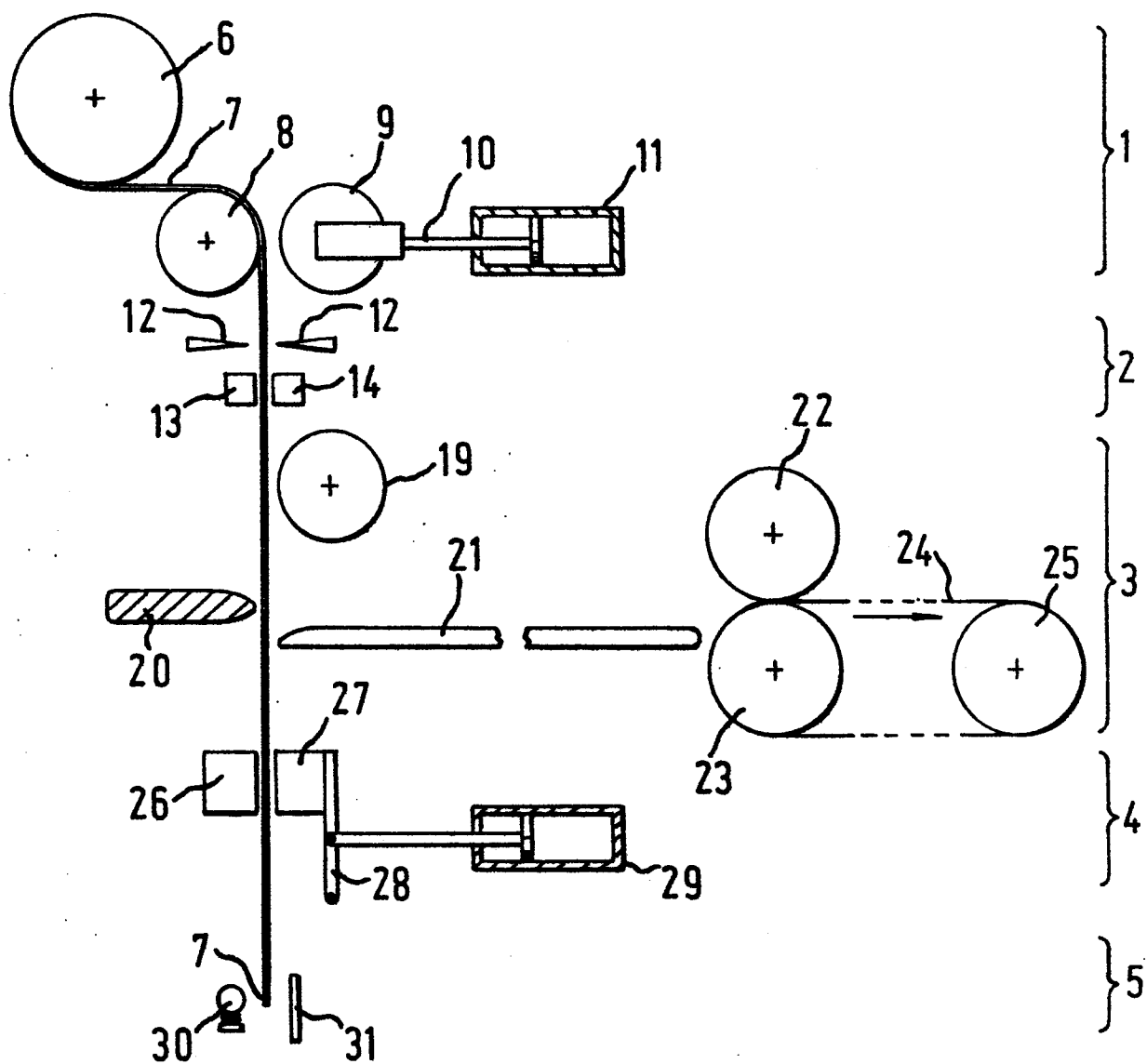


FIG. 1.

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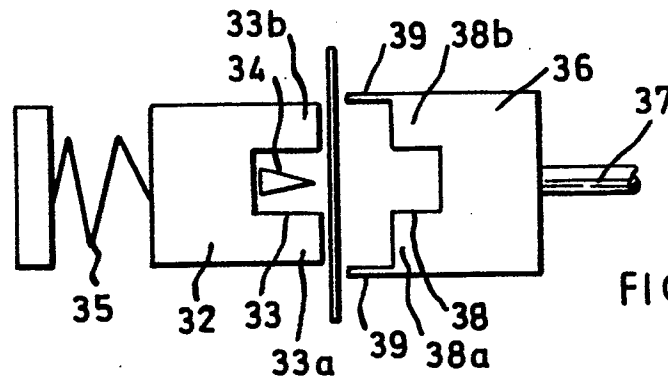


FIG. 2a.

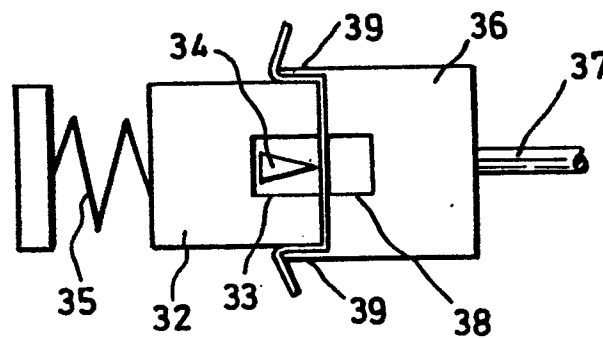


FIG. 2b.

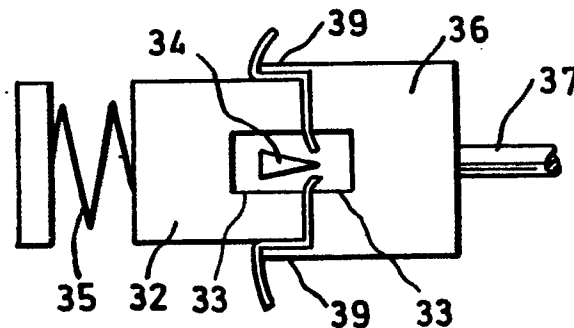


FIG. 2c.

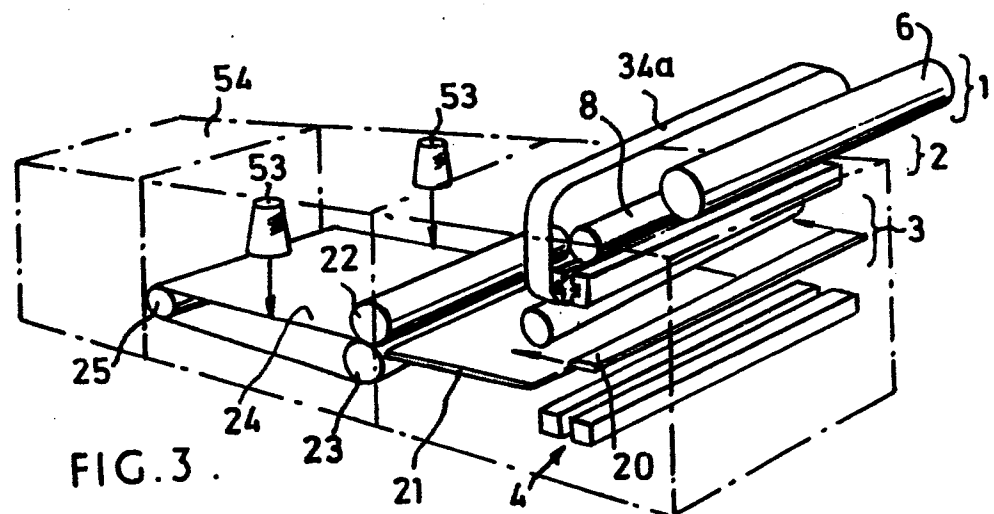


FIG. 3.



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 3 227 118</u> (G.T. GORE) * column 3, lines 60 to 75; fig. 1 ---	1,10, 14,15	B 65 H 35/04 B 31 B 1/16 B 65 H 45/18 D 05 B 13/00
	<u>US - A - 3 227 119</u> (G.T. GORE et al.) * column 6, lines 43 to 75; fig. 8 * ---	1,10, 14,15	
	<u>DE - B - 1 485 268</u> (G.M. PFAFF) * column 6, line 61 to column 8, line 41; fig. 2 to 7 * ---	1,4, 10,14	TECHNICAL FIELDS SEARCHED (Int.Cl. ³)
A	<u>DE - U - 7 502 675</u> (H.G. JENTSCH) * fig. 1 * ---	2	B 31 B 1/00 B 65 H 35/00 B 65 H 45/00 D 05 B 13/00
A	<u>US - A - 3 489 113</u> (T.L. FLANAGAN) * fig. 4 * ---		
A	<u>DE - B - 1 267 524</u> (SPINNEREI UND WEBEREIEN ZELL-SCHÖNAU) * fig. 9 * ---		CATEGORY OF CITED DOCUMENTS
A	<u>US - A - 3 477 397</u> (G.F. HAWLEY) * fig. 5 * -----		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
X The present search report has been drawn up for all claims			&: member of the same patent family. corresponding document
Place of search Berlin		Date of completion of the search 22-08-1979	Examiner BITTNER