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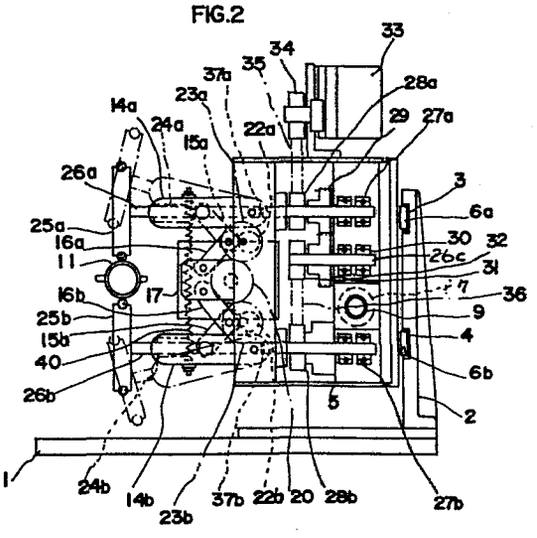
(54) Apparatus for turning a circular knit hose inside out and sectioning the knitted hose into unit hoses.

(57) Apparatus for turning a circular knitted hose inside out and sectioning it into unit hoses, includes an air suction pipe (11) extending in the direction of feeding of the knitted hose, a pair of rotatable contact rollers (25*a*, 25*b*) carried on pivot arms (14*a*, 14*b*) mounted on a carrier (5) capable of reciprocally moving along the air suction pipe (11), the contact rollers (25*a*, 25*b*) frictionally retaining the knitted hose which is extended to cover the air suction pipe (11), thereby allowing the tail end of the knitted hose to be sucked into a 'tail end' of the pipe (11) unit by unit with its tail end ahead. The apparatus additionally includes a cutter located adjacent a 'top end' of the air suction pipe (11) from which 'top end' an end portion of the knitted hose is caused to protrude by successive unit lengths to be cut off by the cutter.

FIG.2



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APPARATUS FOR TURNING A CIRCULAR KNIT HOSE INSIDE OUT AND SECTIONING THE KNITTED HOSE INTO UNIT HOSES

The invention relates to apparatus for turning circular knit hose inside out and sectioning it into a required number of unit hoses and more particularly to apparatus for enabling a long continuous circular knit hose to be turned inside out and sectioned into unit hoses, thereby facilitating subsequent linking and vapour setting processes.

In the production of hosiery, such as stockings and socks, a commonly-called "rib knitter" or a double cylinder knitting machine is employed to knit a long continuous circular hose. It is required that the hose be turned inside out and sectioned into unit hoses. The open end of each unit hose is closed by linking into a toe portion, and then each hose is vapour set in the state in which its normal side is outwards. Conventionally, the circular knit hose is sectioned unit by unit by hand, wherein the stitches around the sectioned part are picked up by the operators' fingers. This is an extremely labour-cunsuming operation, and can cause harm to the operators' eyes. In addition, there is a danger of spoiling the hoses by picking up wrong stitches. In order to avoid such problems and troubles involved in the manual operation, several mechanical methods have been proposed, but they have been found to be unsatisfactory partly because of the very high cost and partly because of the spoiled finish of the general appearance.

The present invention has among its objects to solve the difficulties mentioned above and to provide an improved apparatus for turning a circular knit hose inside out and sectioning it into a required number of unit hoses in an automatic manner.

According to the invention, there is provided apparatus for turning a circular knitted hose inside out and sectioning the knitted hose into unit hoses, characterised in that the apparatus comprises a bed; an air suction pipe for pulling a circular knitted hose by suction therethrough, the air suction pipe extending along the length of the bed, a carrier reciprocally moving along the air suction pipe;

a pair of contact rollers carried on the carrier, the contact rollers being located on opposite sides of the air suction pipe; means for rotating the contact rollers in either direction of rotation; pivot means for enabling the contact rollers to move toward and away from the air suction pipe, the pivot means being carried on the carrier, and a cutter located adjacent a 'top end' of the air suction pipe.

In use of the apparatus the hose is dragged until it covers the air suction pipe from its tail end to its top end, the contact rollers frictionally retaining the knit hose so as to allow the knit hose to be sucked into the pipe unit by unit, and the cutter located adjacent to the top end of the air suction pipe cuts off protruding end portions of the hose to form unit hoses.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:-

Figure 1 is a plan view showing apparatus according to the invention for turning a circular knit hose inside out and sectioning it into unit hoses:

Figure 2 is an end view of the apparatus of Figure 1 taken from the lefthand side of Figure 1; and

Figure 3 is a view, on an enlarged scale, showing a cutting section where hose, extracted by unit length by air suction, is sectioned by a cutter.

Referring toFigures 1 and 2, a bed 1 has several spaced apart supports 2 at one edge therof with a pair of parallel rails 3, 4 mounted on the supports 2. Each guide rail 3, 4 has a channel-like cross section.

A carrier can move reciprocally along the guide rails 3, 4 and is provided with rollers 6a, 6b which are received in the channel-like guide rails 3, 4, respectively. The carrier 5 has a box-like structure on which a pair of contact rollers 25a, 25b are rotatively mounted. The other elements mounted on the carrier 5 are ancillary to the contact rollers 25a, 25b.

The carrier 5 is provided with an internally threaded sleeve 7 in its lower section. A feed screw 9 extends above the bed 1 in parallel with the guide rails 3, 4, the feed screw being supported in bearings 8 and connected to an electric motor 10. The electric

motor 10 can be rotated in either direction, thereby enabling the feed screw 9 to rotate in either direction as desired. The feed screw 9 extends through the internally threaded sleeve and thus the carrier 5 can be reciprocated along the feed screw 9, the direction of movement depending upon the direction of rotation of the electric motor 10.

The carrier 5 is provided with two pairs of pivot arms 14a and 14b; the pair 14a being located at an upper position and the pair 14b being located at a lower position.

Each pair of pivot arms 14a, 14b comprises twinned or paired elements for its associated members as shown in Figure 1. For simplicity, reference will be made only to one element.

The upper pivot arm 14a is pivotally supported on a bracket 17 on the carrier 5 by links 15a and 16a which are pivotally connected to each other. Likewise, the lower pivot arm 14b is pivotally supported on the bracket 17 by links 15b and 16b, which are pivotally connected to each other. The pivot arms 14a, 14b are pivotally connected to the carrier 5 at their root portions. Each first link 15a, 15b is pivoted to the middle portion of the respective pivot arm 14a, 14b.

A torque motor 18 is mounted on the carrier 5 by a bracket 19, the torque motor 18 being effective to pivot arms 14a, 14b by way of a cam mechanism, as further explained below.

The torque motor 18 is connected to a gear 20, which engages with gears23a, 23b. The gear 23a is for the pivot arm 14a, and the gear 23b is for the pivot arm 14b. Each gear 23a, 23b is coupled to a respective cam 22a, 22b respectively, the cams 22a, 22b being provided transversely in the carrier 5. Each cam 22a, 22b is located adjacent to the joint of the respective two links 15a, 16a, and 15b, 16b such that the cams 22a, 22b can act on the joint of these links so as to enable the links to open and close.

Each pivot arm 14a, 14b is provided with a respective bearing 24a, 24b in which a respective shaft 26a, 26b is rotatably supported Second bearings 27a, 27b support the rotary shafts 26a, 26b at the terminating ends. Each rotary shaft 26a, 26b supports a respective one of the contact rollers 25a, 25b. The rotary shaft 26a mounts a pulley 28a, and a gear 29 and the rotary shaft 26b mounts a pulley 28b. The pulley 28a is connected to a drive pulley 34 by means of

a belt 35. The pulley 34 can be driven by an electric motor 33, commonly called a "brake motor". There is also a further pulley unit which comprises a rotary shaft 26c, a pulley 31, and a gear 32, the pulley 31 and the gear 32 being mounted on the rotary shaft 26c. A belt 36 is carried on the pulleys 31 and 28b. A belt 36 is carried on the pulleys 31 and 28b. The reference numeral 30 designates bearings supporting the rotary shaft 26c. When the motor 33 is switched on, the drive is transmitted to the rotary shaft 26a through the belt 35, to the rotary shaft 26c through the gears 29 and 32, and finally to the rotary shaft 26b through the belt 36. The rotary shafts 26a, 26b are provided with universal joints 37a, 37b respectively, whereby the rotary shafts can swing through an angle as indicated by broken lines in Figure 2.

An air suction pipe 11 extends parallel to the feed screw 9, the air suction pipe 11 being so disposed as to allow a knit hose to be sucked therethrough during which the hose is turned inside out. The air suction pipe 11 is connected to a vacumn pump (not shown). The reference numeral 12 designates a fixture for securing the air suction pipe 11 to the bed 1. In this specification the lefthand end of the pipe 11 as viewed in Figure 1 will be referred to as the 'tail end' and the righthand end as the 'top end'. A phototube 13 is provided adjacent the 'tail end' of the pipe 11, the phototube 13 being electrically connected to the torque motor 18 which controls movement of the swinging arms 14a. 14b. It senses the initial placement of a knitted hose 38 around the 'tail end' of the air suction pipe 11.

Referring to Figure 3 a cutter 39 is located above the 'top end' of the air suction pipe 11, the cutter being effective to cut along a predetermined outline 38a of the knitted hose 38 which is specially knitted for the cutting purpose.

Figure 1 shows a coil spring 40 effective to bias the pivot arms 14a and 14b for movement towards one another.

In operation, a long continuous circular knitted hose 38 is fed from a "rib knitter" (not shown) to the apparatus. As shown in Figure 1, the forward end of the knitted hose 38 is placed around the 'tail end' of the air suction pipe 11. The initial placement of the

knitted hose 38 is sensed by the phototube 13 which then switches on the motor 18 thereby allowing the pivot arms 14a, 14b to approach the knitted hose 38 surrounding the air suction pipe 11. Thus the links 15a, 16a and 15b, 16b were previously kept open by means of the cams 22a, 22b against the force of the coil spring 40, thereby keeping the contact rollers 25a, 25b away from the air suction pipe 11. However, when the motor 18 is energized, the links 15a, 16a and 15b, 16b are released from the stops provided by the cams 22a, 22b and the pivot arms 14a, 14b are drawn towards each other by the force of the coil spring 40. In this way the rollers 25a, 25b engage the knitted hose 38, and at this stage the motor 33 is switched on, thereby causing the rollers 25a, 25b to rotate while in engagement with the knitted hose 38. The rollers 25a, 25b are so rotated as to cause the knitted hose 38 to be forcibly fed toward the 'top end' of the air suction pipe 11, shown in Figure 3. When the rollers 25a, 25b are rotated, the motor 10 is switched on to move the carrier 5. In this way the knitted hose 38 is caused to slide on the surface of the air suction pipe 11 toward the 'top end' thereof until the leading end of the knitted hose 38 reaches a position A, Figure 1. When the carrier 5 reaches a position B Figure 1, the motors 10 and 33 are switched off. It is previously calculated that when the carrier 5 reaches the position B the tail end of the knitted hose 38 projects slightly beyond the 'tail end' of the air suction pipe 11; otherwise it would be impossible for the knitted hose to be sucked into the air suction pipe 11. The calculation is made by taking into account the rotating speed of the carrier and the total length of the knitted hose 38, and based upon the calculation a timer is set.

When the carrier 5 reaches the position B, a vacuum pump (not shown) is switched on. At the same time, the motor 33 is switched off to stop the rotation of the contact rollers 25a, 25b, but they maintain engagement with the knit hose 38. At this stage, the motor 10 is reversely rotated, thereby causing the carrier 5 to return to its original position C, Figure 1. In the course of the return travel the contact rollers 25a, 25b urge the knitted hose 38 by friction toward the 'tail end' of the air suction pipe 11, which helps the knit hose 38 to be sucked into the air suction pipe 11.

When the contact rollers 25a, 25b reach the position C, they are again but reversely rotated, thereby causing the knitted hose 38 turned inside out in the pipe 11 to advance until its tail end protrudes by a desired unit length from the'top end' of the pipe 11. In Figure 3 the desired unit length is indicated by (S). Finally the knitted hose 38 is sectioned along the predetermined outline 38a by the cutter 39, which is prearranged so as to work on each unit hose successively protruding from the 'top end' of the pipe 11. It is necessary for the rollers 25a, 25b to keep contact with the knitted hose 38 which is being sucked into the pipe 11, otherwise, the knitted hose could be sucked wholly into the pipe 11.

As is evident from the foregoing, it is essential for the contact rollers 25a, 25b to impart friction drive to the knitted hose 38 extended to cover the air suction pipe 11. To this end, it is preferred that the contact rollers 25a, 25b are provided with frictional bands on their rims. The frictional bands may be, for example, rubber bands, cloth bands or plastics bands.

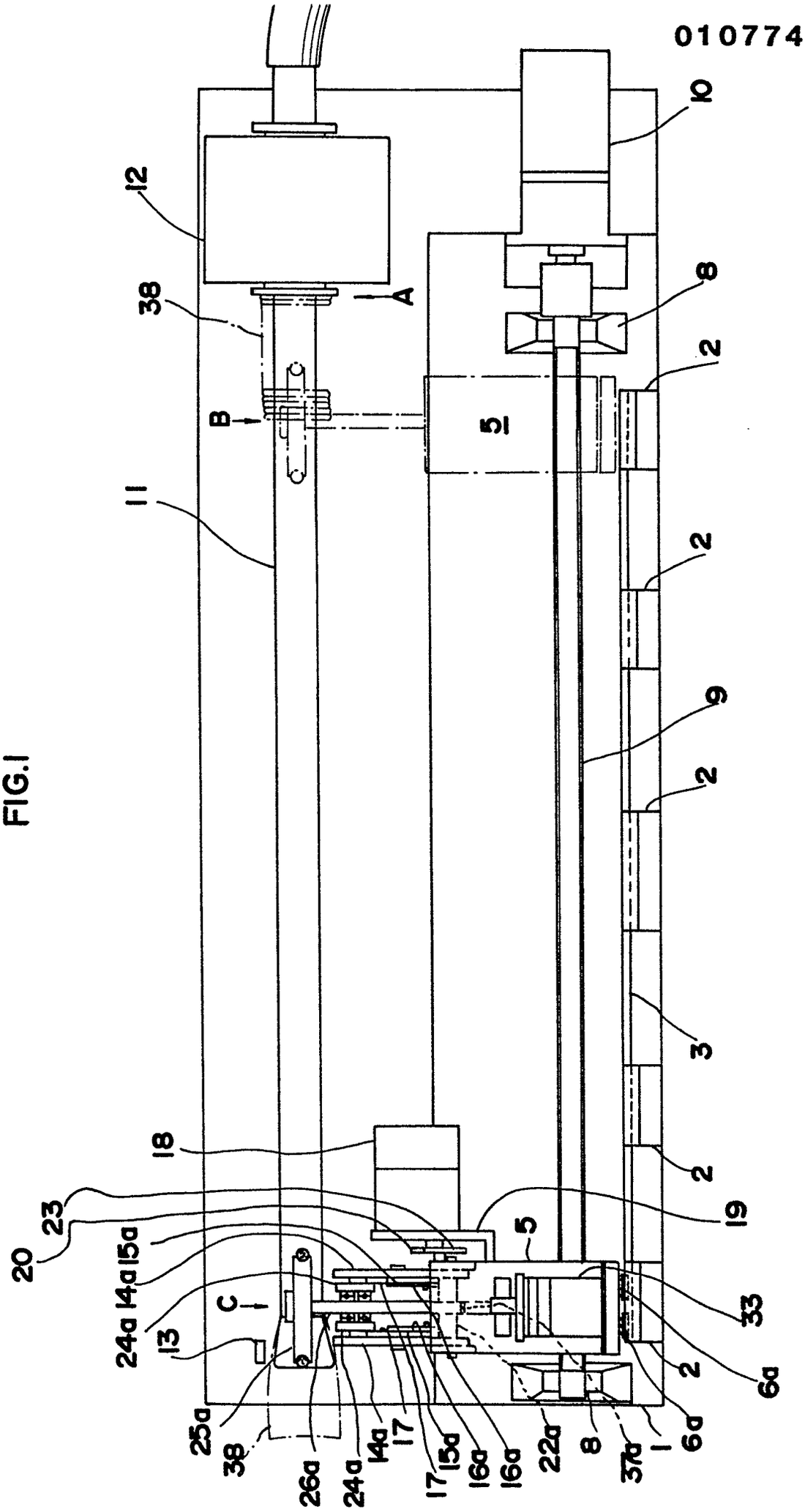
CLAIMS

1. Apparatus for turning a circular knitted hose inside out and sectioning the knitted hose into unit hoses, characterised in that the apparatus comprises a bed (1); an air suction pipe (11) for pulling a circular knitted hose (38) by suction therethrough, the air suction pipe (11) extending along the length of the bed (11); a carrier (5) reciprocally moving along the air suction pipe (11); a pair of contact rollers (25a, 25b) on the carrier (5), the contact rollers (25a, 25b) being located on opposite sides of the air suction pipe (11); means (33, 34, 35, 28a, 29, 32, 31, 36, 28b) for rotating the contact rollers (25a, 25b) in either direction of rotation; pivot means (18, 20, 23a, 23b, 22a, 22b, 15a, 15b, 16a, 16b, 14a, 14b), for enabling the contact rollers (25a, 25t) to move toward and away from the air suction pipe(11), the pivot means being carried on the carrier (5); and a cutter (39), located adjacent a 'top end' of the air suction pipe (11).

2. Apparatus according to Claim 1, characterised in that the pivot means comprises a pair of pivot arms (14a, 14b) secured to the contact rollers (25a, 25b), the pivot arms (14a, 14b) being pivotally mounted on the carrier (5) by means of pivotal links (15a, 15b, 16a, 16b) which can be acted upon to effect swinging action of the contact rollers (25a, 25b).

3. Apparatus according to Claims 1 or Claim 2, characterised in that the contact rollers (25a, 25b) are provided with frictional bands on their rims, to enhance the friction drive imparted by the contact rollers (25a, 25b) to the knit hose (38).

FIG.1


12
10
38
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8
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9
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14a
24a
C
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FIG.2

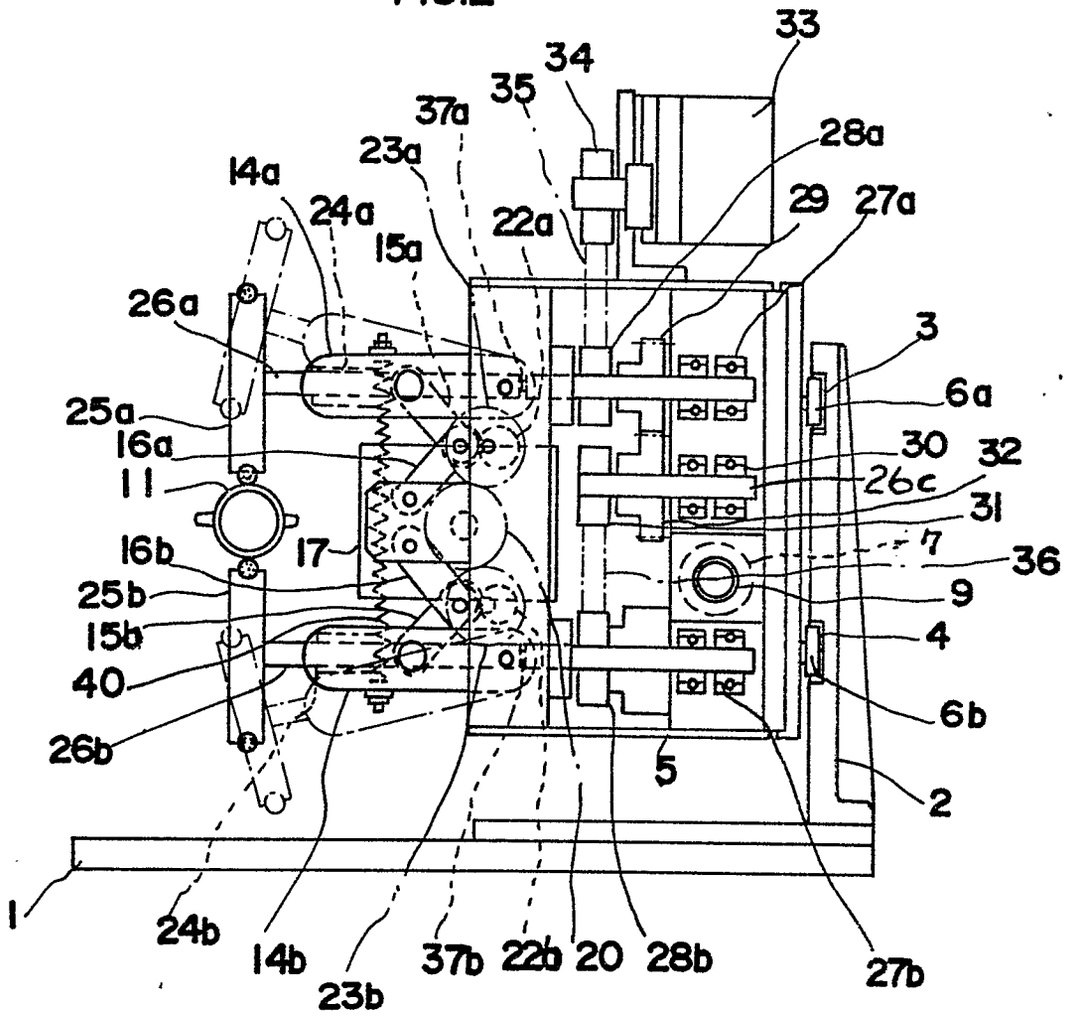
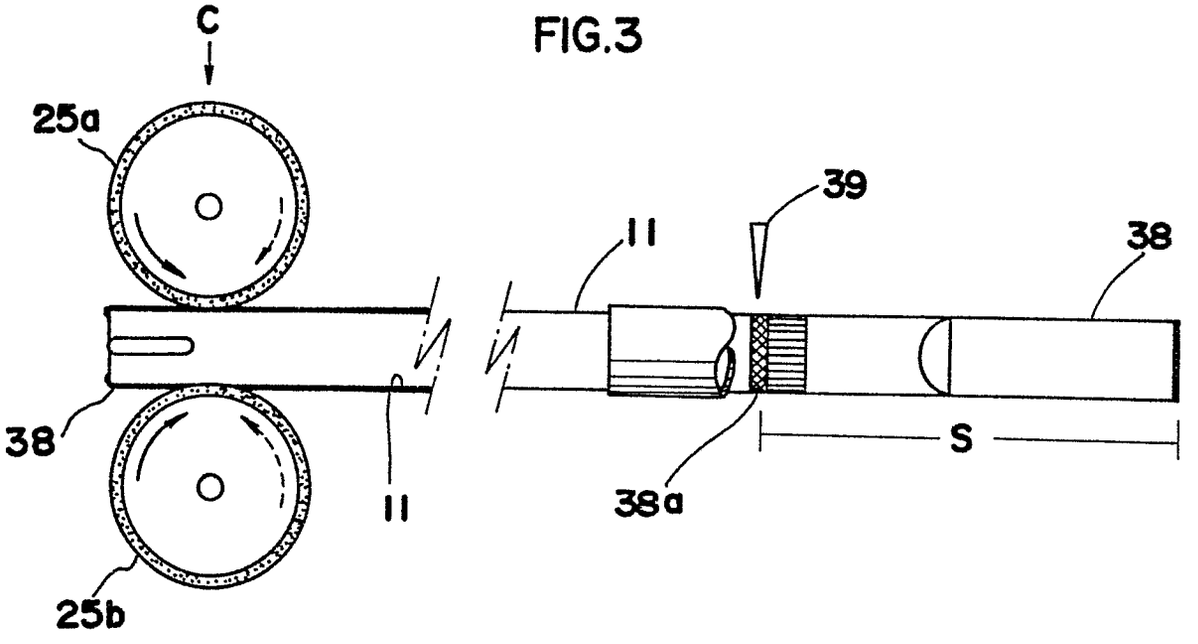


FIG.3



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EUROPEAN SEARCH REPORT

Application number

EP 82 30 5468

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. ³)
A	FR-A-2 435 553 (LA BONNETERIE ALSACIENNE) * Page 3, line 8 - page 4, line 19; figure *	1	D 04 B 19/00 D 06 H 3/16
A	US-A-3 908 874 (HASELGROVE) * Column 2, line 64 - column 3, line 48; figures 1-3 *	1,2	
A	US-A-3 887 120 (HARRILL)		
A	US-A-3 949 913 (SMITH)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

D 04 B
D 06 H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18-01-1984	VAN GELDER P.A.

CATEGORY OF CITED DOCUMENTS

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