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(54) Apparatus for processing circular knit hosiery.

(57) Apparatus for turning a circular knit hose inside out, sectioning the knit hose into unit hoses, and linking each toe portion thereof with stitches, comprising an air suction pipe (2) for pulling a long knit hose (1) by air suction therethrough, a cutter unit (15) mounted on a movable carrier, the cutter unit (15) having means whereby the knit hose is first stretched so as to ensure easy cutting, an apron conveyor (21) having slats (22) transversely provided, each of the slats (22) including a hollow cylinder (24) for allowing a circular knit hose to be supported thereon, and a clamp unit (30) located at the opposite side to the cylinder, the clamp unit (30) being capable of tilting toward the cylinder (24), a linking device (32) located at a position where the clamp unit (30) is tilted, means (34) for releasing the knit hose from the clamp unit (30), and a suction duct (37) for pulling the unit knit hose by suction, the suction duct (37) being communicatable with the rear end of successive cylinders (24) as they reach a position at which the conveyor (21) changes direction.

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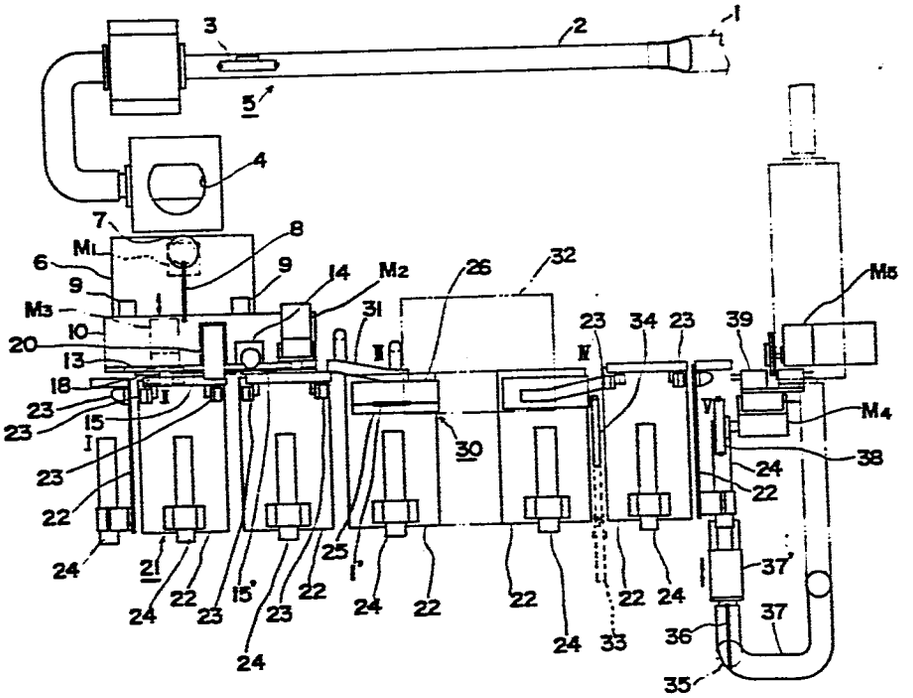
FIG.1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III
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V

APPARATUS FOR PROCESSING CIRCULAR KNIT HOSIERY

The invention relates to apparatus for processing circular knit hosiery.

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. In this process it is necessary to section a long continuous hose band into unit hoses. To this end waste portions must be interposed between adjacent unit hoses. The stitches around the sectioned part are picked up by the operator's fingers. This is an extremely time-consuming operation, which of course reflects in the price of the product.

In addition, to effect the subsequent linking operation on each toe, it is previously required to turn each hose inside out. After the linking operation is finished, the normal side is again turned outside so as to enable the unit hose to be vapour set. This is also very time-consuming.

According to the invention, there is provided apparatus for turning a circular knit hose inside out, sectioning the knit hose into unit hoses, and linking each toe portion thereof with stitches, characterised in that the apparatus comprises an air suction pipe for pulling a long knit hose by air suction therethrough, a cutter unit mounted on a movable carrier, the cutter unit having means whereby the knit hose is stretched so as to ensure easy cutting, an apron conveyor having transverse slats, each of the slats including a hollow cylinder for allowing a circular knit hose to be supported thereon, and a clamp unit located at the opposite side to the cylinder, the clamp unit being capable of tilting toward the cylinder, a linking device located at a position where the clamp unit is tilted, means for releasing the knit hose from the clamp unit, and a suction duct for pulling the unit knit hose by suction, the suction duct being communicatable with the rear end of the cylinder at a position at which the conveyor changes direction.

Such apparatus can turn a circular knit hose inside out, section it into a required number of unit hoses, close each toe thereof, and turn the normal side out in an automatic manner.

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;

Figure 2 is a plan view on an enlarged scale of the portion of Figure 1 indicated at II, at which knit hose is stretched for cutting;

Figure 3 is a front view on an enlarged scale of a cutter unit of apparatus according to the invention;

Figure 4 is a fragmentary left side view of the cutter unit of Figure 3;

Figure 5 is a front view on an enlarged scale of a guide unit;

Figure 6 is a left side view of the guide unit of Figure 5;

Figure 7 is a plan view showing one section of an apron conveyor of apparatus according to the invention in which a slat is provided to support a hollow cylinder and a clamp unit;

Figure 8 is a right side view of the section shown in Figure 7;

Figure 9 is a front view, partly omitted, of the section shown in Figure 7;

Figure 10 is a schematic view showing the relationship between a guide unit and a clamp unit of apparatus according to the invention;

Figure 11 is a schematic view showing the state at which knit hose is stretched by engagers of apparatus according to the invention;

Figure 12 is a schematic view showing the clamp unit of Figure 11 holding a sectioned unit hose;

Figure 13 is a schematic view showing the state at which the clamp unit of Figure 12 is tilted at 90^{0} thereby to cause the toe portion of the hose to stand upright for stitching;

Figure 14 is a plan view corresponding to Figure 13;

Figure 15 is a schematic view showing the operation of the clamp unit of Figure 11; and

Figure 16 is a schematic view showing the relationship of the clamp unit of Figure 11 and a pushing rod.

Referring to Figure 1, a long continuous knit hose band 1 is fed from a double cylinder knitting machine (not shown) to an air suction pipe 2. The forward end of the knit hose 1 is placed around a 'tail end' of the pipe 2 by an operator as shown in Figure 1. The reference numeral 3 designates a pair of contact rollers, which are capable of rolling on the air suction pipe 2

while keeping contact with the surface thereof, whereby the knit hose 1 is caused to slide over the surface of the air suction pipe 2 towards a 'top end' thereof until the forward end of the knit hose reaches the depth of the air suction pipe 2. At this stage the terminating end of the knit hose 1 projects slightly beyond the 'tail end' of the air suction pipe 2. When vacuum is applied to the pipe 2, the knit hose 1 is sucked into the air suction pipe 2. The air suction device is of known kind and further description thereof is thus not required. The knit hose 1 which is turned inside out is taken out at an outlet 4. The apparatus described constitutes a knit hose turning section 5.

Referring to Figures 1 and 2, there is provided a bed 6 on which a crank disc 7 coupled to a driving shaft of an electric motor M_1 is mounted. The crank disc 7 has a rod 8 suspended downwards. The downward end of the crank rod 8 is fastened to a carrier 10 capable of moving vertically on a pair of rails 9 provided on the bed 6.

The knit hose band 1 is previously provided with a toe portion 1' and a welt portion 1" between which the knit hose is additionally provided with a separating section 11 (Figure 11). The separating section 11 is sufficiently thin to produce steps at the transition positions to the toe portion and the welt portion. The steps are intended to be engaged by an upper engager 12 having an upper cutter 12', and a lower engager 13 having a lower cutter 13'. As shown in Figures 2 and 3, the upper engager 12 and the lower engager 13 are mounted on the carrier 10, with the upper engager 12 supported on a bracket 14 such that the height of the upper engager 12 is adjustable with respect to the knit hose 1, whereas the lower engager 13 is fixed to the carrier 10. A cutting blade 15 (Figure 3) is pivotally supported on the carrier 10. The cutting blade 15 is connected by means of a connecting rod 15' to a crank rod 17 of a crank disc 16 driven by an electric motor M_2.

An upper guide 18 is opposed to the side of the upper engager 12, the guide 18 being supported on a bracket 20 upright on the bed 6 such that the height thereof is adjustable with respect to the knit hose 1. Likewise, there is provided a lower guide 19 slightly spaced from the upper guide 18, the lower guide 19 being fixed to the bed 6. The positional relationship among the engagers 12 and 13, the guide members 18 and 19, and the knit hose 1 is best illustrated in Figure 11. As shown in Figure 10, the separating section 11 of the knit hose 1 is placed between the upper and the lower cutters 12'

and 13', and between the upper and the lower guides 18 and 19. At this stage both engagers 12 and 13 are moved by energizing the motor M_1 in the direction indicated by the arrows in Figure 10. Thus the separating section 11 is stretched as shown in Figure 11, and cut at a position adjacent to the welt portion 1" by means of the cutting blade 15. An apron conveyor 21 comprises a series of slats 22. As best shown in Figure 8, each slat 22 is provided with a pair of brackets 23 at the inner side thereof, the brackets 23 pivotally supporting a first plate member 26 to which a second plate member 25 is pivotally coupled. The two plate members 25, 26 are capable of pivotal movement in the direction indicated by the arrow in Figure 8, so that they take a position indicated by dotted lines therein. Figure 8 is a side view whereas Figure 9 is a front view in which, unlike Figure 8 the raised position is shown in dotted lines. The second plate member 25 is provided with a recess 25' at its top end as shown in Figure 9, which recess 25' is engaged by a metal piece 27 fixed to an end face of the first plate member 26 so as to secure the union of the two plate members 25 and 26. The second plate member 25 is additionally provided with a projecting part 25" at the opposite end, which is engaged by a spring member 28 fixed to the opposite end face of the first plate member 25. Due to the engagement by the spring member 28 the second plate member 25 is biassed upwardly. The contacting faces of the two plate members 25, 26 are formed in a saw-tooth form so as to enable both plates, when in engagement, to function as a clamp suitable for holding a soft material, such as knit hose. the unit formed by the two plate members will be hereinafter referred to as the clamp unit 30.

In addition to the clamp unit 30, each slat 22 is provided with a short cylinder 24 at the opposite side to the brackets 23, that is, at the outer side of the apron conveyor 21, the short cylinder 24 extending parallel to the top surface of the slat 22 but spaced therefrom as best shown in Figure 8. The short cylinder 24 is used to support a unit knit hose 1 which is placed around it. The short cylinder 24 can be supported by a suitable bracket or other known means.

At the position indicated II in Figure 1, an electric motor M_3 is supported on a stand on the carrier 10 as shown in Figure 15, and a cam plate 29 is coupled to the shaft of the motor M_3. The cam plate 29 comes into contact with the second plate member 25 during rotation, thereby

enabling the second plate member 25 to come into engagement with the first plate member 26. In this way the two plate members 25 and 26 are engaged with the toe portion 1' clamped between the indented faces. The knit hose 1 is fed in a continuous band to the position II at which it is sectioned into unit hoses, each of which is clamped by a respective clamp units 30 and transported to a position III (Figure 1). At the position III a pushing rod 31 is provided on the bed 6, at a position adjacent to the path along which the clamp units 30 pass. The pushing rod 31 is used to push each clamp unit 30 toward its respective short cylinder 24. The clamp unit 30 is tilted inwardly as shown in Figure 16. When the clamp unit 30 is half tilted, gravity acts to tilt it the remainder. Thus the toe portion 1' is upwardly directed so that, in that posture, the toe portion can be linked with stitches.

A linking device 32 stitches the toe portion 1', the stitching device being located above the apron conveyor 21. The linking device 32 includes a crank disc 33 located at the position IV of Figure 1, a pushing rod 34 reciprocally moved in association with the rotation of the crank disc 33 while keeping contact with the periphery of the crank disc 33, wherein the pushing rod 34 passes through the bed 6 in a diagonally upward posture as shown in Figure 8. The pushing rod 34 causes the clamp unit 30 to stand upright when the clamp unit 30 reaches the position IV with the toe portion 1' having its open ends stitched. The pushing rod 34 further advances, and lowers the second plate member 25 so as to disengage same from the first plate member 26. In this way the knit hose 1 is released from the clamp unit 30. At this stage the knit hose 1 is supported on the short cylinder 24, and reaches the position V.

At the position V there is provided a suction duct 37 whereby the knit hose 1 is again turned inside out such that its normal side comes outside. The reference numeral 37' designates a catcher reciprocally moved by means of a crank rod 36 pivoted on a crank disc 35, the catcher 37' being connected to the suction duct 37. The catcher 37' is placed into engagement with the rear end of each short cylinder 24 as shown in Figure 1.

At the position V there is provided a suction duct 37 whereby the knit hose 1 is again turned inside out such that its normal side comes outside. The reference numeral 37' designates a catcher reciprocally moved by means of a crank rod 36 pivoted on a crank disc 35, the catcher 37' being connected to the suction duct 37. The catcher 37' is placed into engagement with the rear end of each short cylinder 24 as shown in Figure 1.

At the position V where, as a result of the movement of the conveyor 21, each slat 22 changes its orientation from horizontal to vertical, there is provided a rotor 38 driven by a motor M_4, the rotor causing, by friction, knit hose supported around the short cylinder 24 to advance toward the opening of the cylinder. At this stage the short cylinder 24 is in communication with the suction duct 37 via the catcher 37'. The knit hose 1 half hung at the inner opening of the cylinder 24 is ready to be sucked into the suction duct 37 under vacuum. A bracket 39 on which the motor M_4 is mounted is movable by a motor M_5 so that the rotor 38 can be engaged with the knit hose on the short cylinder 24 or disengaged therefrom. In Figures 8 and 9 are shown carriers 40 linked to each other so as to support the slats 22. Cams 41 are located at opposite sides of the conveyor 21, whereby the toe portion 1' of the knit hose passing beneath the linking device 32 can be raised upwards so as to facilitate the linking operation.

In operation, the forward end of a long continuous knit hose band 1 is placed around the 'tail end' of the suction pipe 2 by hand. The contact rollers 3 are energised to rotate them and thereby advance them to the 'tail end' of the suction pipe 2, before returning along the length of the suction pipe 2 pulling the knit hose band by friction as they do so. At this stage the terminating end of the knit hose band 1 slightly projects beyond the 'tail end' of the suction pipe 2. Then the air in the pipe 2 is sucked out, thereby causing the knit hose band to be sucked from its terminating end into the suction pipe 2. In this way the knit hose is turned inside out. The contact rollers 3 are reversely rotated and advanced so as to facilitate the long knit hose band 1 being sucked into the pipe 2. The turned knit hose band 1 is taken out of the outlet 4 by the operator. At the position I (Figure 1) the knit hose band 1 is engaged on one of the short cylinders 24, and at the position II the separating section 11 of the knit hose 1 is placed between the upper and the lower cutters 12', 13', and between the upper and the lower guides 18, 19. The motor M_1 is switched on, and the carrier 10 is moved, thereby causing the engagers 12, 13 to separate from the guides 18, 19. Thus the separating section 11 is stretched as shown in Figure 11. At this moment the motor M_3 is switched on, and the cam plate 29 is rotated, thereby pressing the second plate member 25 against the first plate member 26 so as to hold the toe portion 1' of the knit hose therebetween. Then the motor M_2 is switched on, and the cutting blade 15 cuts the knit hose in its

separating section 11 at the position III. The clamp unit 30 continues to hold the knit hose 1, and at the position IV the clamp unit 30 comes into engagement with the pushing rod 31, whereby the clamp unit 30 is tilted through 90^{0} to cause the toe portion 1' to be directed upwards. At this moment the relevant slat 22 is raised toward the linking device 32 by the action of the cams 41. The linking operation is started on the toe portion 1'. When the clamp unit 30 comes into engagement with the pushing rod 34 at the position IV, the clamp unit 30 is caused to stand upright, and the pushing rod 34 raises the second plate member 25 thereby to release the toe portion 1' from the clamp unit 30.

When the knit hose 1 held on the short cylinder 24 reaches the position V, the motor M_5 is switched on, and the rotor 38 is moved above the short cylinder 24. Simultaneously, the catcher 37' is placed in engagement with the rear end of the short cylinder 24 so as to secure internal communication therebetween. When the suction duct 37 is connected to the short cylinder 24 through the catcher 37', the motor M_4 is switched on, and the rotor 38 is rotated in the direction in which the toe portion 1' is displaced toward the forward opening of the short cylinder by friction. The suction is started through the suction duct 37, whereby the knit hose 1 is turned inside out again, which means that its normal side comes outside.

CLAIMS

1. Apparatus for turning a circular knit hose inside out, sectioning the knit hose into unit hoses, and linking each toe portion thereof with stitches, characterised in that the apparatus comprises an air suction pipe (2) for pulling a long knit hose (1) by air suction therethrough, a cutter unit (12', 13', 15) mounted on a movable carrier, the cutter unit having means (11) whereby the knit hose (1) is stretched so as to ensure easy cutting, an apron conveyor (21) having transverse slats (22), each of the slats (22) including a hollow cylinder (24) for allowing a circular knit hose to be supported thereon, and a clamp unit (30) located at the opposite side to the cylinder (24), the clamp unit (30) being capable of tilting toward the cylinder (24), a linking device (32) located at a position where the clamp unit (30) is tilted, means (34) for releasing the knit hose from the clamp unit (30), and a suction duct (37) for pulling the unit knit hose by suction, the suction duct (37) being communicatable with the rear end of the cylinder (24) at a position at which the conveyor (21) changes direction.

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FIG.1

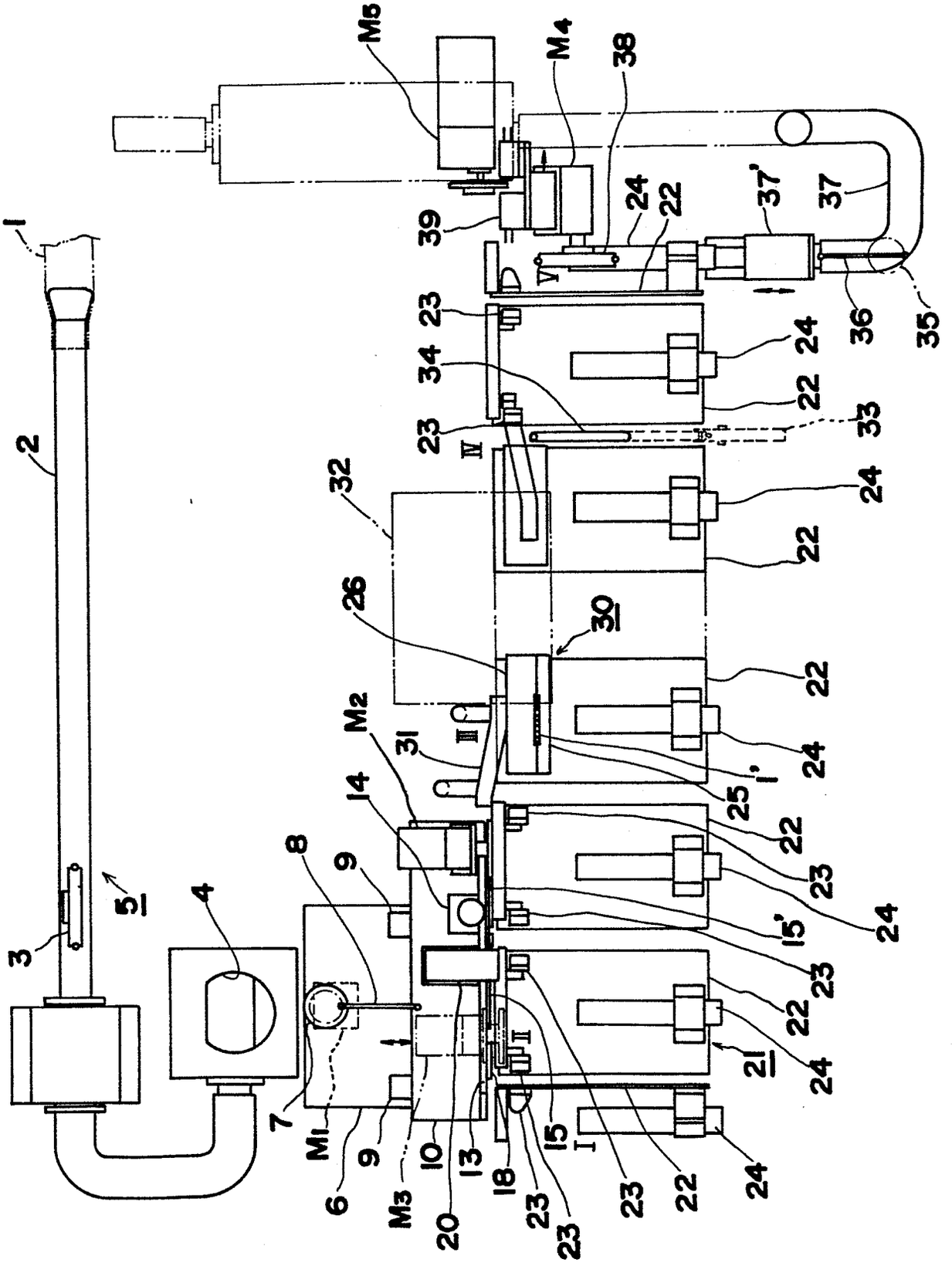

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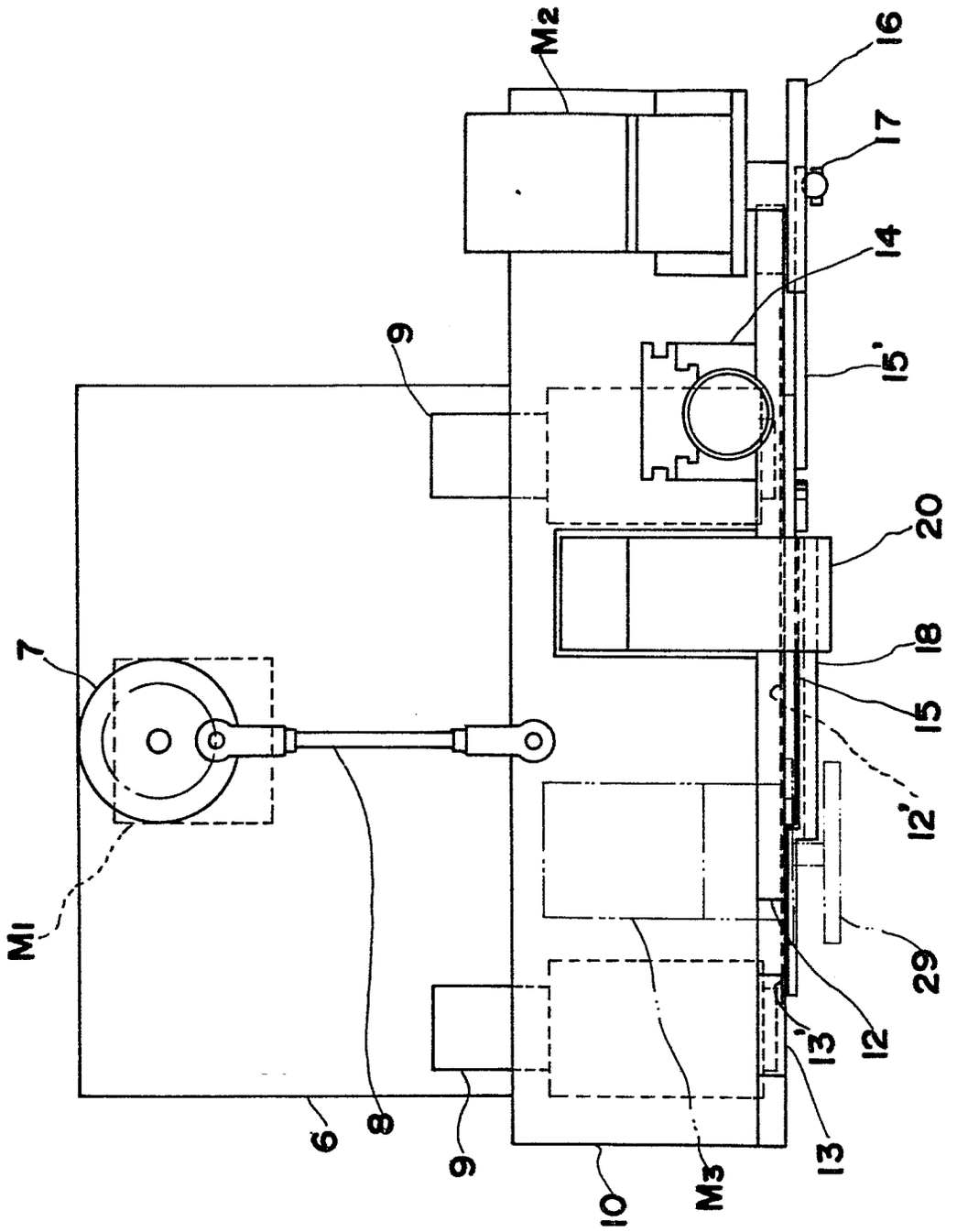
FIG.2



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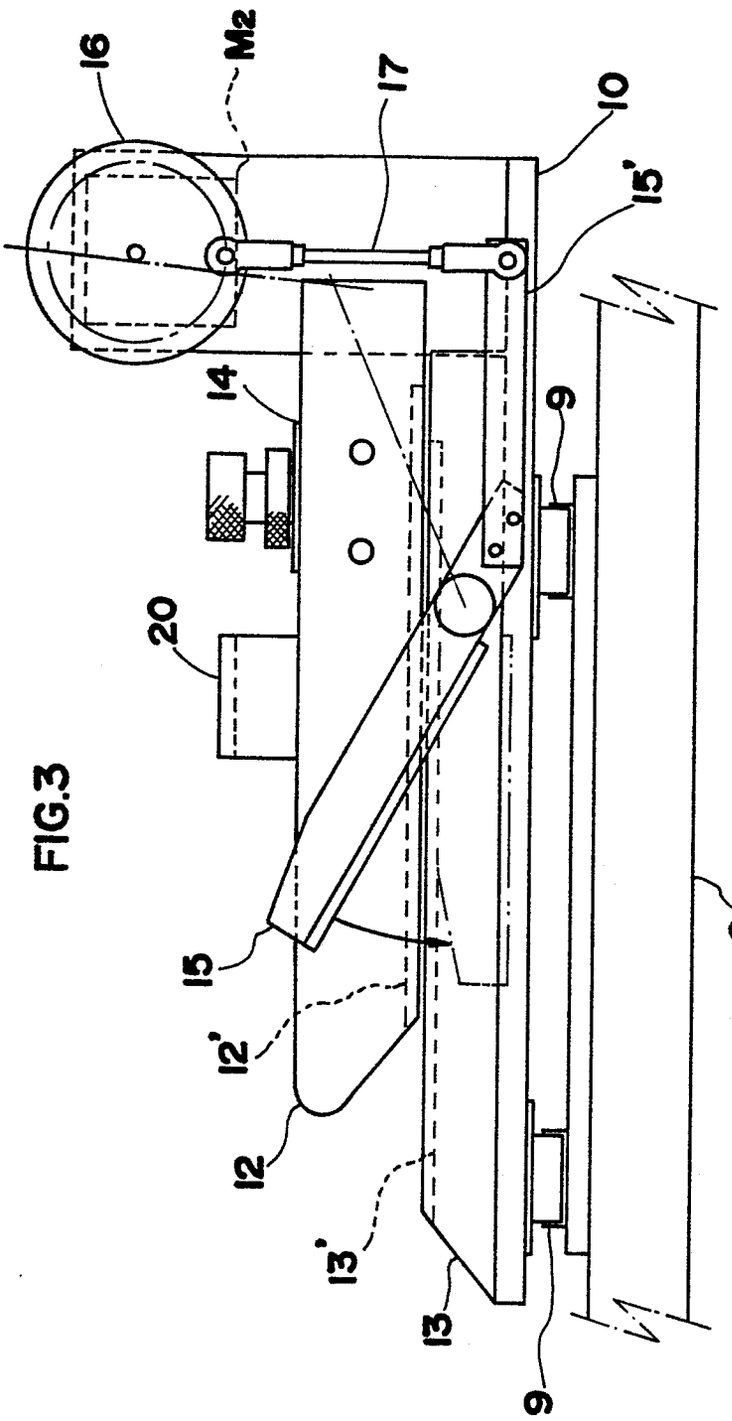

FIG.3

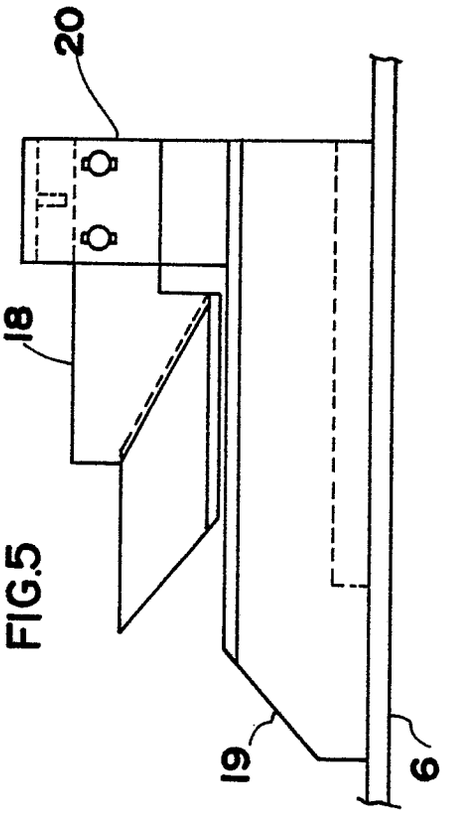

FIG.5

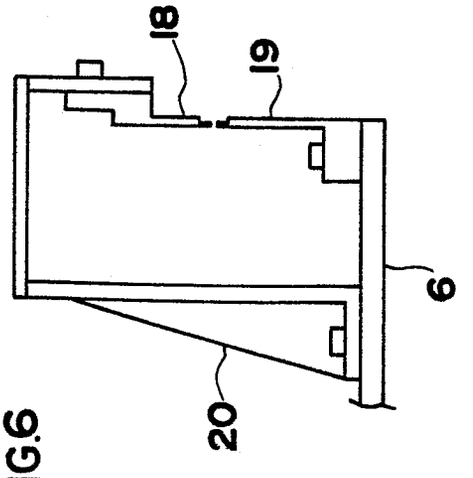

FIG.6

FIG.4

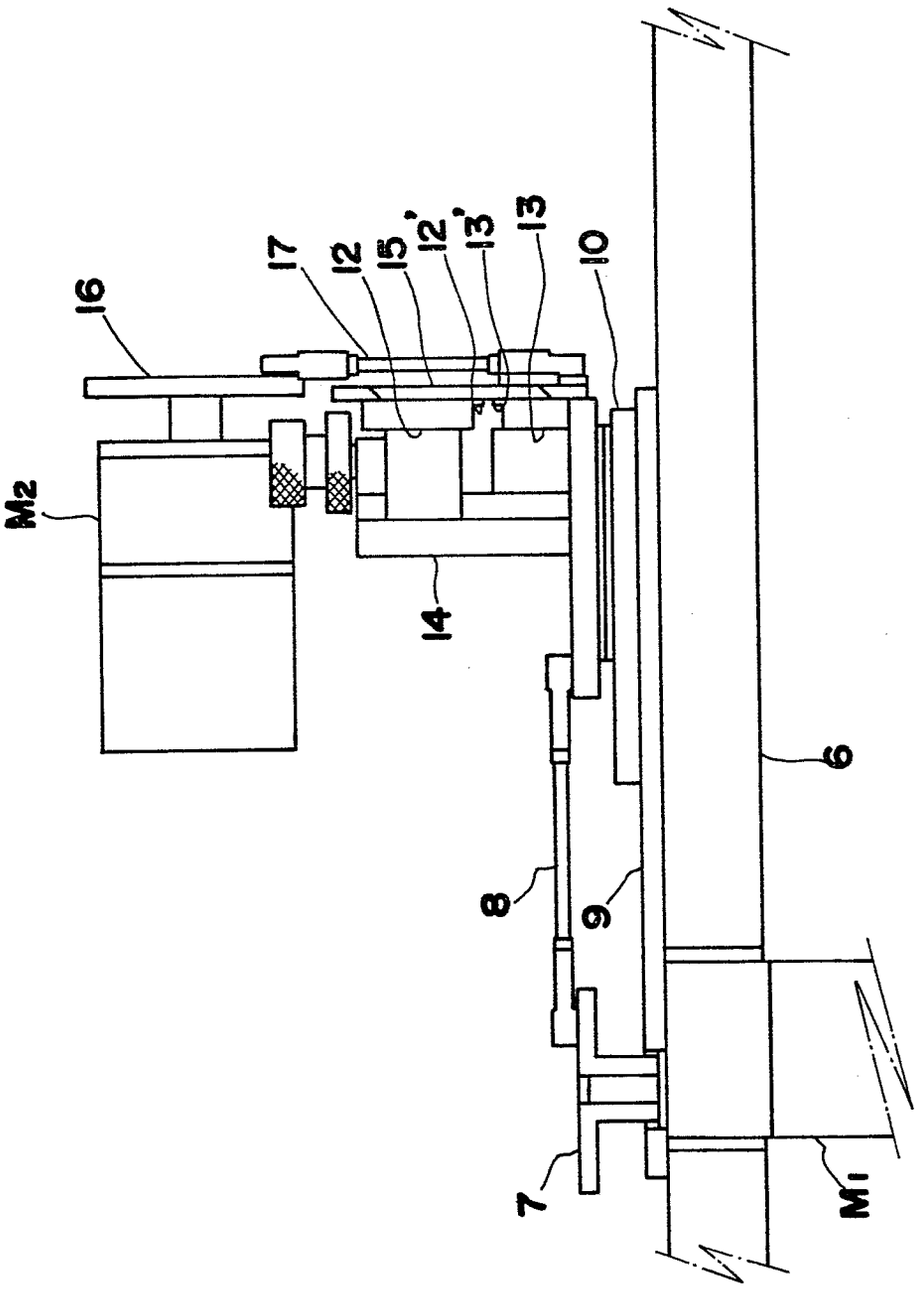

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FIG.8

FIG.7

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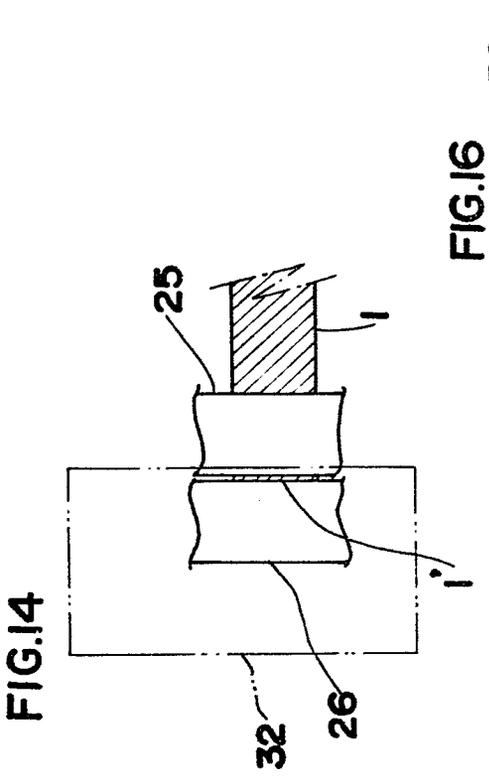

FIG.14

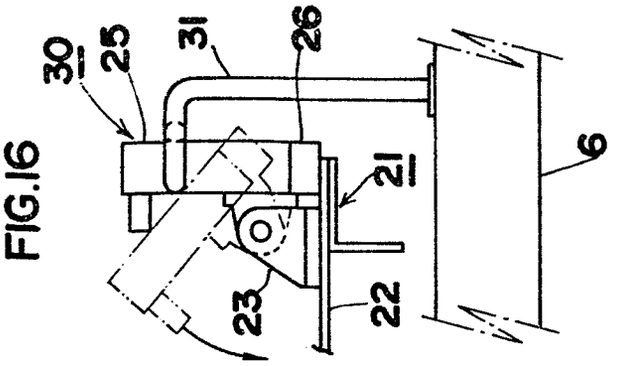

FIG.16

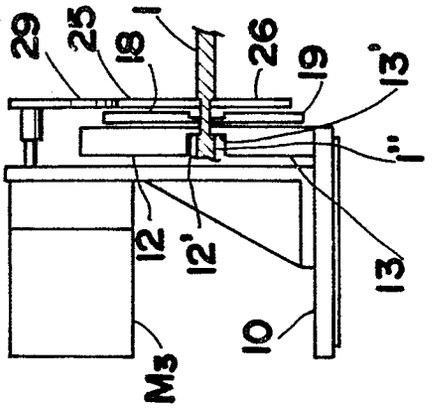

FIG.15

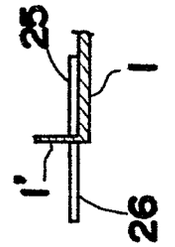

FIG.13

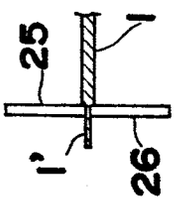

FIG.12

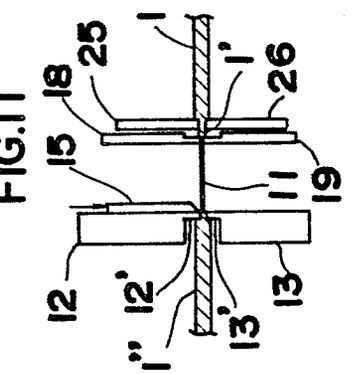

FIG.11

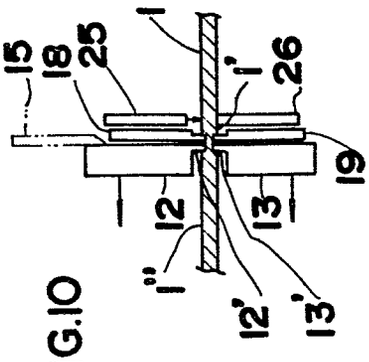

FIG.10

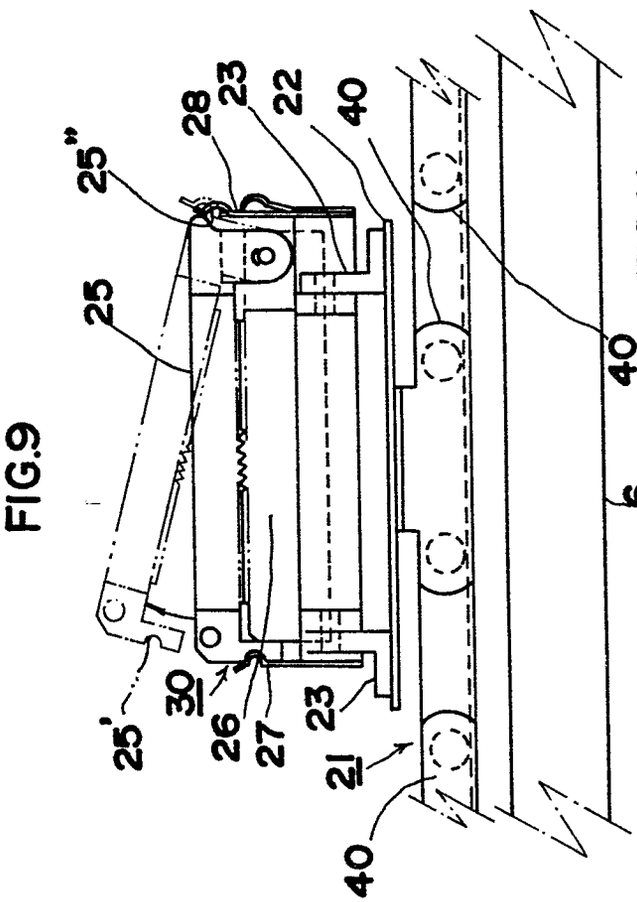

FIG.9

European Patent Office

EUROPEAN SEARCH REPORT

0149295
Application number

EP 84 30 0330

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 BONNAL) * claims 1,2; figure *	1	D 04 B 19/00
A	FR-A-2 256 276 (TAKATORI MACHINERY WORKS) * page 15, line 26 - page 19, line 17; figures 1,2 *	1	
A	US-A-3 949 913 (SMITH)		
A	FR-A-2 216 820 (TAKATORI MACHINERY WORKS)		
A	US-A-4 157 651 (COGGINS)		

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	21-09-1984	VAN GELDER P.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

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