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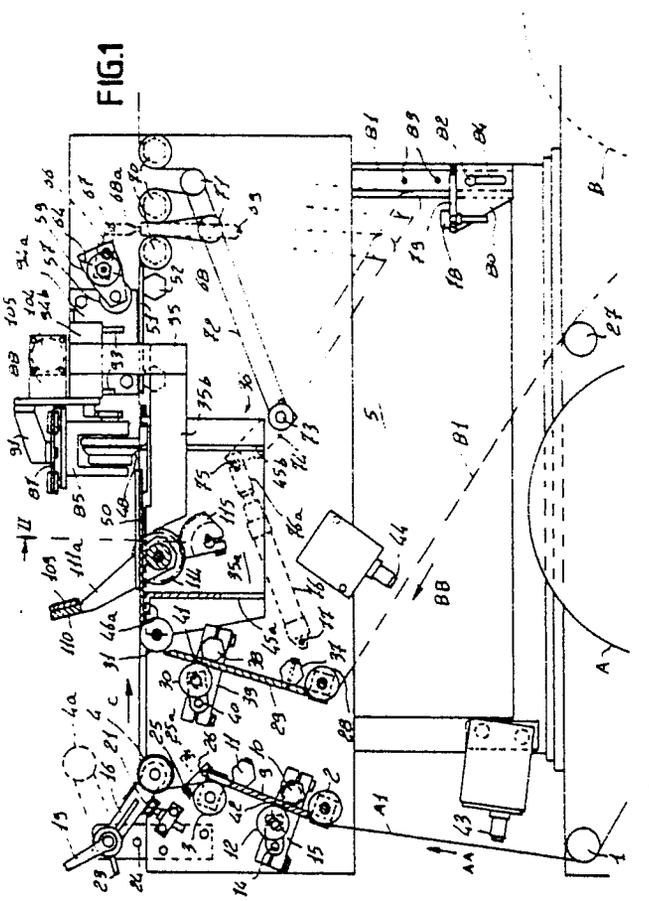
(54) Device for joining the web from an exhausted spool to the initial end of a new spool.

(57) The device comprises a station (50) in which web is normally in transit in one direction only and in which the initial end of web from a new spool (A) is adapted to be positioned in the same direction and aligned transversely to the station (50). Sensors (43, 44) detect when a spool (B) is nearly exhausted, and locking members (57, 59, 64, 66 -69) are disposed downstream of the station (50) and controlled by the sensors (43, 44) so as to stop the tail end of the web in transit in the station (50), a cutting device (48) cuts the tail end of the transverse alignment, thus determining the terminal end of the exhausted web. The device also comprises a selector (25) for removing the cut tail end for the terminal end, and a gripping device (110, 111a, 114, 115) for transferring and sticking an adhesive strip and movable from the transverse alignment zone to a position remote therefrom and adapted to hold the strip in the remote position and stick it in the alignment position to the initial and terminal ends placed in abutment.

FIG.1



EP 0 251 102 A2

DEVICE FOR JOINING THE WEB FROM AN EXHAUSTED SPOOL TO THE INITIAL END OF A NEW SPOOL

The invention relates to a device for joining the web from an exhausted spool to the initial end of a new spool.

Some known automatic machines are supplied with a web from a spool and use pieces of the web for wrapping products. When a spool of web is about to be exhausted in these packaging machines, the end of the web has to be joined to the beginning of the web from a new spool. Usually the web ends to be joined are superposed and struck to one another, usually with interposition of a strip which is adhesive on one or both surfaces. The ends are positioned relative to one another, the strip is applied and secured to the two webs, partly manually and partly by devices provided on the packing machine. Often these operations are difficult for the operator and inconvenient for the machine, since it is necessary to manipulate a bi-adhesive strip which tends to stick in the wrong places before being secured to both webs.

Positioning is necessary in difficultly-accessible locations and the work has to be done while the machine is in operation and without interrupting it. The problems are even more complicated when the webs are rather wide and therefore less rigid. On the other hand it would be certainly preferable if the web ends for joining were placed adjacent and in abutment and if a mono-adhesive strip (i.e. adhesive only on one surface) be superposed partly on one end and partly on the other.

The object of the invention therefore is to construct a device by means of which the end of a web from an exhausted spool is joined, after being accurately placed in abutment, with the beginning of the web from a new spool, so that the intervention required from the operator is limited and easy.

Another aim, as part of the preceding, of an aforementioned devce combined with a packaging machine is to join the two webs while the machine is still supplied with web and consequently in operation.

The aforementioned and other objects which will become apparent hereinafter are achieved by a device for joining the web or strip from an exhausted spool to the initial end of the web from a new spool, the device being characterized in that it comprises a station in which the web is normally in transit in one direction only and in which the initial end of the web from a new spool is adapted to be positioned in the same direction - face to face and adjacent the web in transit - when aligned transversely to the station, sensors detecting when a spool is nearly exhausted, locking means disposed downstream of the station and controlled by the sensors so as to stop the tail end of the web in transit in the aforementioned station, a cutting device adapted to cut the tail end at the transverse alignment and thus determine the terminal end of the exhausted web, so that the terminal end remains adjacent and abutting the initial end, selector means for removing the cut tail end from the terminal end, and an elongated means for gripping, moving and sticking an adhesive strip and movable from the transverse alignment zone to a position remote therefrom and adapted to grip the strip when in the remote position and to stick it in the alignment position to the initial and terminal ends when placed in abutment, the locking means becoming inoperative after the sticking operation.

Further details will be clearer from the following description of a preferred embodiment of a device for joining the web from an exhausted spool to the initial end of a new spool, the embodiment being shown by way of illustration only in the accompanying drawings wherein:

Fig. 1 is a longitudinal view in elevation, partly cut away, of an embodiment of the device;

Fig. 2 is a vertical cross-section of the same embodiment along line II-II of Fig. 1;

Fig. 3 is a partial plan view, partly cut away, of the same embodiment;

Fig. 4, a supplement to Fig. 3, shows other parts of the device which, for greater clarity, are tilted into a horizontal plane and moved apart in the same plane so as not to overlap;

Fig. 5 is a longitudinal vertical section through the device showing details of the cutting device;

Fig. 6 shows a section of the gripping and transfer device, and

Fig. 7 shows the mode of operation of the device, with particular reference to a second embodiment thereof and based on a program of eight successive operating steps arranged in rows in the drawing.

In the device (in the embodiment of either Fig. 7 or in the other drawings) two spools A and B of the web of sheet material (usually paper) are disposed on respective holders. Spools A and B alternately serve as the exhausted and the new spool and, with reference to Fig. 7, are distinguished by placing an e or n behind the capital letter indicating the spool.

In Fig. 1 the two spools are at the same level and side by side, whereas in Fig. 7 spool A is above spool B. In both drawings, the axes of the holders and spools mounted thereon are horizontal and transverse to the device which is being described.

A known packaging machine is disposed downstream of the device. During its known operating cycle, the machine pulls the web so as to unwind it from spool A or B as required. Suitable means (known and therefore not shown) for assisting in the unwinding are mounted near each spool.

After leaving spools A and B, the webs first follow respective, clearly distinct paths A1 and B1 defined by appropriate guide means. With particular reference to Figs 1 and 4 and the web from spool A, the guide means comprise rollers 1, 2, 3, 4 in succession and from bottom to top, the rollers having horizontal shafts which are transverse to the device and, like the rollers which will be described later, are on the same side and project outwardly from a composite wall 5 of the device.

In practice, as shown in figure 4 by way of example for roller 4, each roller comprises a cylindrical tube 6 idly mounted at its ends, with interposition of bearings 7, on a suitably-secured respective shaft 8. The ends of the shafts of rollers 2 and 3 are rigidly associated with a pair of lugs formed at the bottom and top ends respectively of a flat, nearly vertical element 9. Element 9 is rigidly associated with two section members 10, 11 which project from wall 5. In the direction of arrow AA, the web portion A1 runs on element 9 without the possibility of return. This is because the runner 12 of a free wheel mounted on one end of a pin 13 bears on the web. The other end of the pin, which is axially misaligned with respect to the first end, is coupled to a radial arm at the end of a rod 14 locked by a clamp 15 projecting from section member 10 and thus disposed parallel thereto. The end of shaft 8 nearest to wall 5 is rigidly associated with an arm 16 extending radially from a tube 17 mounted oscillating around a shaft 18 and secured at its end to a projection of wall 5. A clamp comprising a screw and handle 19 and a sort of washer 20 normally secures tube 17 in the angular position corresponding to that of the roller 4 shown in continuous lines in Fig. 1; in this position, arm 16 bears on an adjustable buffer 21. The clamp can be loosened via handle 19 and then raised, by means of a knob 22 at the free end of roller 4, to the continuous line position 4a indicated in Fig. 1 and a projection 23 of tube 17 can be brought against an abutment 24. If clamp 19-20 is again tightened, the roller is held in position 4a as long as desired, as will be described hereinafter. The path portion A1 between rollers 3 and 4 and therefore downstream of the non-return device 12-13 can be intersected by a rod or plate 25 projecting from an arm 26 keyed to the output shaft of an actuator 26a. The actuator body is ridgidly associated with the wall 5 and is adapted to move arm 26 in reciprocation through an angle in which, as will be shown, plate 25 moves from its normal position (shown by a continuous line in Fig. 1) to position 25a (chain-line) intersecting path A1.

Path B1 is similar to A1. The web portion corresponding to B1 unwinds in the direction BB and (Figs. 1 and 3) engages roller 27 and 28, the flat almost-vertical element 29, the anti-return runner 30 and roller 31. The ends of shaft 32 of roller 31 are rigidly associated with upstream projections of the ends 35a-b of a sort of box-like bracket 36, end 35a thereof being rigidly associated with the wall 5. The upper generatrix of roller 31 and that of roller 4, in its normal position, are substantially at the same level, roller 4 being behind roller 31. Section member 37, 38 are rigidly associated with and project from wall 5 and bear element 29, which is formed at its bottom edge with lugs for securing the shaft of roller 28. Clamp 39 locks to the section member 38 a rod ending in the arm on which wheel 30 is idly mounted. The wheel bears on element 29 at a block or wedge 41 which can be replaced when worn; Fig. 5 does not show the corresponding block 42 of element 9 in the operating position. Upstream of the flat elements 9 and 29, the webs travelling along paths A1 and B1 are scanned by respective sensors 43 and 44 rigidly associated with the wall 5 and adapted to detect when a special mark on the web passes them and indicates that the spool is about to be exhausted.

Bracket 36 is defined by ends 35a and 35b and also by flat vertical longitudinal members 45a and 45b disposed upstream and downstream respectively and having respective flaps 46a and 46b. The flap 46b (Figs. 2, 3 and 5) holds a counter-blade 47 co-operating with a rotary blade 48 described hereinafter, and a thickness and connecting straight member 49 which is stepped and disposed upstream of the counter-blade and slightly spaced therefrom in suitable manner. The counter-blade projects from end 35a whereas member 49 is shorter than the distance between ends 35a and 35b and therefore remains at a distance from end 35b, as does a shelf 50 secured on it and connected thereto. Shelf 50, which is also secured on flap 46, is followed by member 49 and counter-blade 47 and also by a second shelf 51 rigidly associated with a pair of section members 52 projecting from wall 5. On shelf 50, the webs from spools A and B are guided between an edge 53 rigidly associated with and extending along the side of the shelf nearest wall 5 and a facing edge 54 at a distance from 53 which is adjustable depending on the width of the webs. Edge 54 is secured to a slider 55 which can be locked along a dovetail slot 56 in shelf 50 and extending transversely to the device. Shelves 50 and 51 bear a station through which the web from spool A or B

normally travels in direction C and in which the other web is adapted to be positioned in the same direction, i.e the initial end of the other web is to be aligned transversely to the station so as substantially to coincide with the downstream side of member 49. On surface 50, the path A2 of the web from spool A lies above the path B2 of the web from the other spool (see Fig. 7) and is normally adjacent thereto. Beyond surface 50, the paths of the two webs unite.

Locking means disposed near the end of shelf 51 are controlled, as will be shown, by sensors 43, 44 and are normally in a rest position. When actuated, these means grip the web moving on shelf 51 and stop the tail end thereof in the station. The locking means (figs 1 and 3) comprise a runner 57 of a free wheel which can be positioned, depending on the width of the webs, along a horizontal shaft 58 transverse to the device. The ends of the shafts are rigidly associated with the arms of a sort of fork 59 mounted so as to oscillate, partly on an end portion of a shaft 60 and partly on the central portion of a tube 61 rigidly associated with and projecting from wall 5. Shaft 60 is mounted so as to oscillate in tube 61 and, outside tube 61 and fork 59, bears an axially slidable but tangentially engaged ring 62 loaded against the fork by a spring 63. A step 64 formed by fork 59 engages a corresponding front step on ring 62, thus normally securing the fork to shaft 60. However, ring 62 can be moved away from fork 59 against the biasing action of spring 63, by acting on the handle 65 secured to the ring, whereupon the fork is released and can be raised so as to insert the beginning of a web in the packaging machine. The other end of shaft 60, which projects from tube 61, has a radial arm 66 articulated at 67 to the rod 68a of a double-acting jack 68 which is preferably pneumatic and is articulated at 69 to wall 5.

A plurality of rollers 70 downstream of shelf 51 have their shafts rigidly associated with and projecting from wall 5. Other rollers 71 have their shafts rigidly associated with an arm 72 of a two-arm lever journalled to wall 5 at 73. The other arm 74 of the lever is journalled at 75 to the rod 76a of a pneumatic jack which is jointed to wall 5 at 77. Normally arm 72 is in a low position (indicated by chain lines in Fig. 1) where it bears on an adjustable abutment 78. The abutment can be positioned and locked along a slot 79 formed horizontally in a holder 80 and longitudinally along the device. The holder, which is slidable in a vertical cavity 81 in wall 5, is lockable at the desired height by a screw 82 for screwing into one of a vertical row of apertures 83 and through a vertical slot 84 in the holder. On leaving shelf 51, the web of paper is wound onto one of rollers 70 or alternatively onto one of rollers 71. These rollers thus define a variable-capacity store of web. Normally the store has the maximum capacity; jack 76 is positively actuated so as to remain extended and rollers 71 are in the lowest position, where their arm 72 bears on abutment 78. When runner 57 clamps the tail end of the web, the packaging machine continues to operate, using web from the store and gradually raising rollers 71 and their arm (as indicated by a continuous line in Fig. 1) and retracting the rod 76a, the discharge of jack 76 being controlled by a suitable constriction.

The rotary blade 48 is disposed in an upturned U-shaped carriage 85 and its top plate has a set of four runners 86 having shaped grooves engaging the correspondingly-shaped edges of a horizontal track 87 transverse to the device. The track is suspended from a vertical, likewise transverse plate 88. A set of brackets 91 are disposed between straight members 89 and 90 secured on the plate and on the track respectively. Plate 88 and the adjacent plate 92 are rigidly associated, at the bottom, with one of the longitudinal members 93 - the upstream member - of another box-shaped bracket whose end 94a is rigidly associated with a raised part of wall 5 whereas the end 94b is secured by plate 95 to a projection of end 35b. The bracket also has a cover 96. A shaft 97 is rotatably mounted, with interposition of bearings, between the arms of the U of carriage 85, which are parallel to plate 88. Blade 48 is tangentially rigidly associated with shaft 97 by a pin 98 and is thus axially slidable on the shaft to some extent. A set of springs 99 disposed between blade 48 and a drum formed on shaft 97, press blade 48 against counter-blade 47. A runner 100 rotatably mounted on shaft 97 in front of blade 48 has a suitable lining on its periphery and is adapted during cutting to press the web in operation at the stationary part which, when cut, will constitute the terminal end of the web. Externally of the carriage 85 and towards plate 88, shaft 97 is keyed to a pinion 101 which engages a pinion 102 idly mounted on the carriage. Pinion 102 engages a rack 103 rigidly associated with the base of plate 88 and extending horizontally and transverse to the device. Carriage 85 is moved and consequently blade 48 is moved in translation and rotation by a pneumatic jack 104 of the type not having a rod. The jack is disposed above the cover 96 of the second box-shaped bracket and its ends project beyond those of the bracket and are rigidly associated with the ends of plate 88 by angle members 105. The slider 106 of jack 104 is connected at one side to the jack piston whereas at the other side it has a projection guided in a slot in plate 92 and through a corresponding slot 107 in plate 88 and terminating in a fork engaging a pin 108 rising from carriage 85. As Fig. 3 shows, at the

end of its travel the carriage is alongside shelves 50 and 51 and consequently blade 48 does not interfere with the web on the other side of the shelves.

The device also comprises an elongated means for gripping, moving and sticking an adhesive strip 109 (Figs. 1 and 7), the means normally being at rest in a position (Fig. 1) remote from alignment with reference to the new tape and for cutting the old tape, such alignments corresponding in practice to the downstream side of straight member 49 and the edge of the counter-blade 47. In the present case the means reaches the aforementioned alignment and immediately returns to the remote position. More particularly the means also comprises a bar 110 extending transversely to the device and borne at its ends by a pair of arms 11a-b secured to the end portions of a tube 112. The tube is mounted oscillably on a shaft 113 rigidly associated with the ends 35a-b and is keyed to and bears a toothed wheel 114 engaging a toothed sector 115 (Figs. 1 and 2) keyed to the output shaft of an actuator 116 pressed against the end 35a. In front and longitudinally, bar 110 has a milled portion 117 (Figs. 3 and 6) closed by a plate 118 on which a seal 119 is vulcanized. The plate and seal are formed with a number of corresponding apertures 120 for connecting to a vacuum source. A duct 121 which opens into milled portion 117 is formed inside part of bar 110 and inside arm 111a and communicates with an annular cavity defined between shaft 113 and tube 112. A passage 112 axial with shaft 113 communicates with the cavity and with one end of the shaft, the end being connected to the vacuum source and suitably actuated so as to stop the suction at apertures 120 when strip 109 has been stuck, as will be shown.

The operation of the device, in the embodiment shown in Figs. 1-6 or in the embodiment in Fig. 7, will be clear with reference from the eight diagrams in Fig. 7. The situation where the packaging machine is drawing the web for use from spool B will be first considered. The machine continuously cuts a portion, shapes it and uses it to pack a product. Markings are often present step by step along the web showing where a piece of web is to be separated from the next piece. The web must therefore be supplied to the packaging machine in suitable phase therewith. If therefore the abutment 78 is suitably positioned, the maximum normal capacity of the web store, defined between rollers 70 and 71, is adjusted so that a corresponding whole number of web portions are disposed between the cutting device 47-48 and the cutting device of the packaging machine. Also the initial end 123 of the new spool (spool A in the present case) is held at one of the markings. While spool B is unwinding, the operator has plenty of time to dispose portion 123 at the reference position comprising the downstream side of member 49. Depending on the path A2 the initial portion of spool A is superposed and adjacent the path B2 of spool B (Fig. 7a). There is also plenty of time to position an adhesive strip 109 against seal 119, to which the strip is sucked by suction through apertures 120. When sensors 44 detects that spool B is nearly exhausted, it sends a signal controlling the cycle of the packaging machine, which at a suitable phase causes jack 68 to extend and runner 57 to clamp the tail end of spool Be, i.e. against the edge of the counter-blade 47 which is substantially at one of the markings on the web from the same spool. Consequently, while the packaging machine is using tape from the store, carriage 48 is travelling and cuts the tail end of the exhausted spool, thus fixing the terminal end 124 of the web therefrom (Fig. 7b): ends 123 and 124 are contiguous and abut one another. Next, bar 110 descends and presses the adhesive tape 109 against the ends (Fig. 7a). After the suction in apertures 120 stops, the bar rises and leaves the strip. The jack retracts, runner 57 releases its hold, and the store of webs returns to its maximum capacity. The packaging machine is not drawing web from spool An (Fig. 7e).

The operator removes spool Be and the cut tail end from the device. Next, in order to position the end 123 of spool Bn as stated (Fig. 7e) he temporarily moves roller 4 into position 4a. The steps for joining end 123 of spool Bn to end 124 of spool Ae are the same as the preceding, except that this time they are started by a suitable signal from sensor 43. Furthermore, before bar 110 descends and presses strip 109, plate 25 moves to 25a (Fig. 7g) and removes the cut tail end of spool Ae from the alignment for cutting and sticking in the device.

Claims

1. A device for joining the web or strip from an exhausted spool (B) to the initial end of the web from a new spool (A), the device being characterized in that it comprises a station (50) in which the web is normally in transit in one direction only and in which the initial end (123) of the web from a new spool (A) is adapted to be positioned in the same direction - face to face and adjacent to the web in transit - when aligned transversely to the station (50), sensors (43, 44) detecting when a spool (B) is nearly exhausted, locking means (57-69) disposed downstream of the station and controlled by the sensors (43, 44) so as to stop the tail end of the web in transit in the aforementioned station, a cutting device (47, 48) adapted to cut the tail end of

the transverse alignment and thus determine the terminal end (124) of the exhausted web, so that the terminal end (124) remains adjacent and abutting the initial end (123), selector means (25) for removing the cut tail end from the terminal end (124), and an elongated means (110, 112-122) for gripping, moving and sticking an adhesive strip (109) and movable from the transverse alignment zone to a position remote therefrom and adapted to grip the strip when in the remote position and to stick it in the alignment position to the initial (123) and terminal (124) ends when placed in abutment, the locking means (57-69) becoming inoperative after the sticking operation.

2. A device according to claim 1, characterized in that a store of web in transit is disposed immediately downstream of the locking means (57-69), the capacity of the store being variable and adapted to be reduced during the time when the locking means (57-69) are in operation.

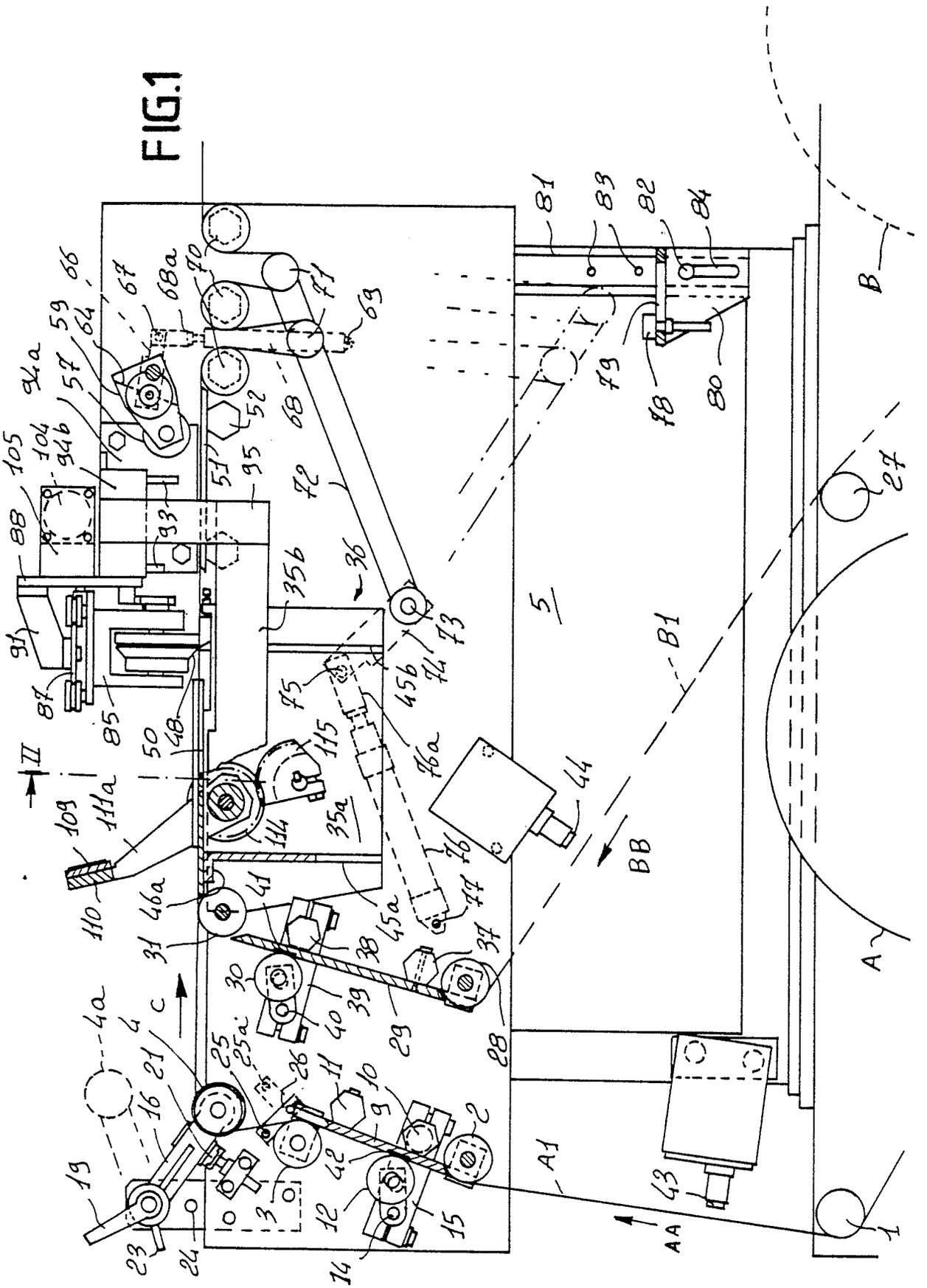
3. A device according to claim 1, characterized in that the means for gripping comprises a bar (110) which is held oscillating between the remote position and the aforementioned zone and has its front longitudinally formed with a set of apertures (120) for connection to a vacuum source so as to hold the strip after it is gripped and during the transfer thereof.

4. A device according to claim 1, characterized in that holders for the spools (A, B) of web are disposed upstream of the station (50) and two respective unwinding paths for the web are defined from the holders, the paths being initially distinct and interacting with respective non-return means (12-13) for the web, whereas at the station the paths are superposed and normally adjacent and then join.

5. A device according to claims 1 and 4, characterized in that the selector means comprise a rod (25) which is held oscillating and which, immediately downstream of the respective non-return device (12-13), is adapted to intersect that one of the paths which is subsequently above the other in the station and is more immediately adjacent to the aforementioned means (25).

6. A device according to claims 1 to 4, characterized in that a roller (4) for guiding the tape in relation to that path which is above the other in the station and more immediately adjacent to the means (25), is held oscillating near the station and is manually adjustable so as to remove its tape from the other path at the station.

FIG.1



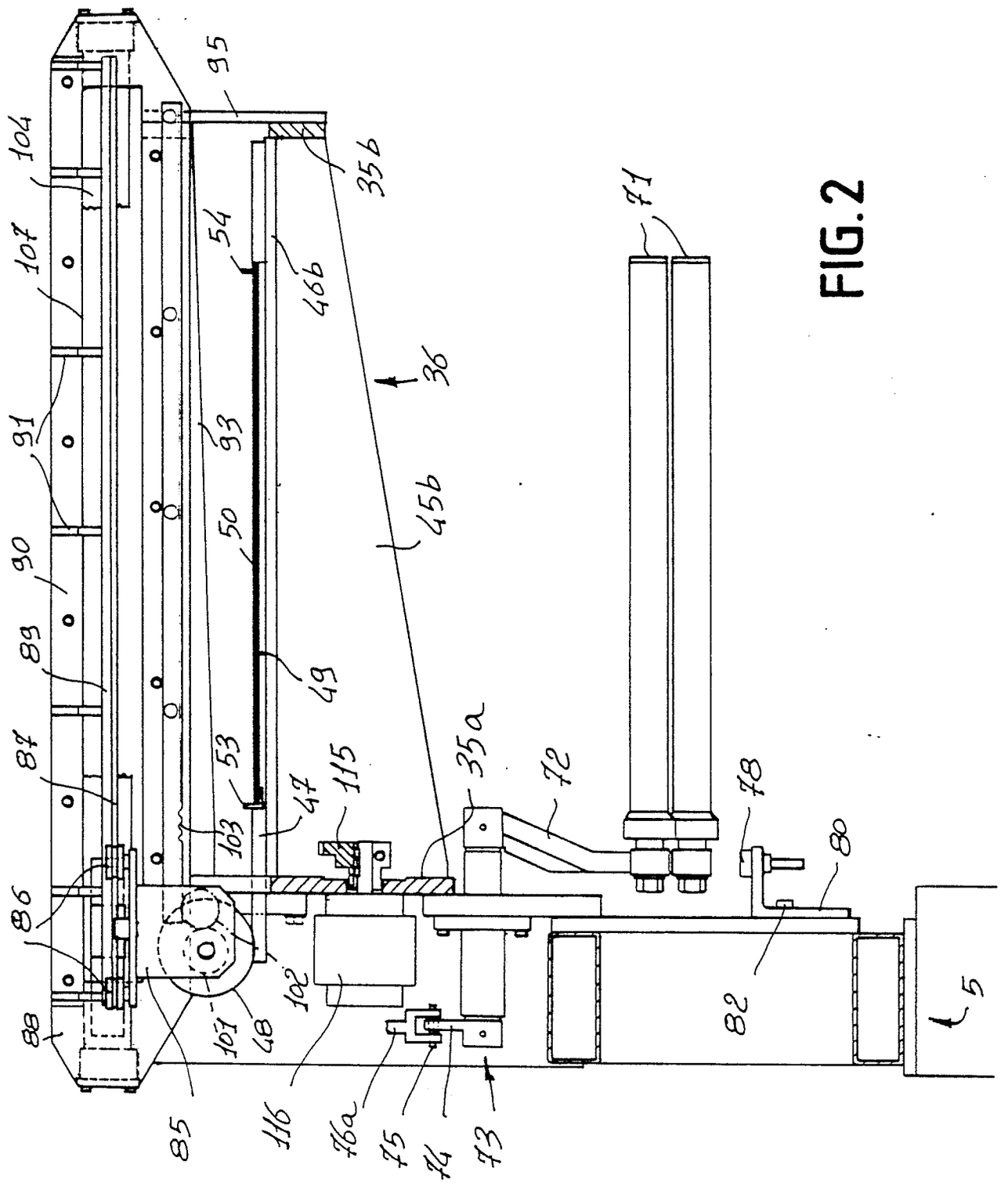

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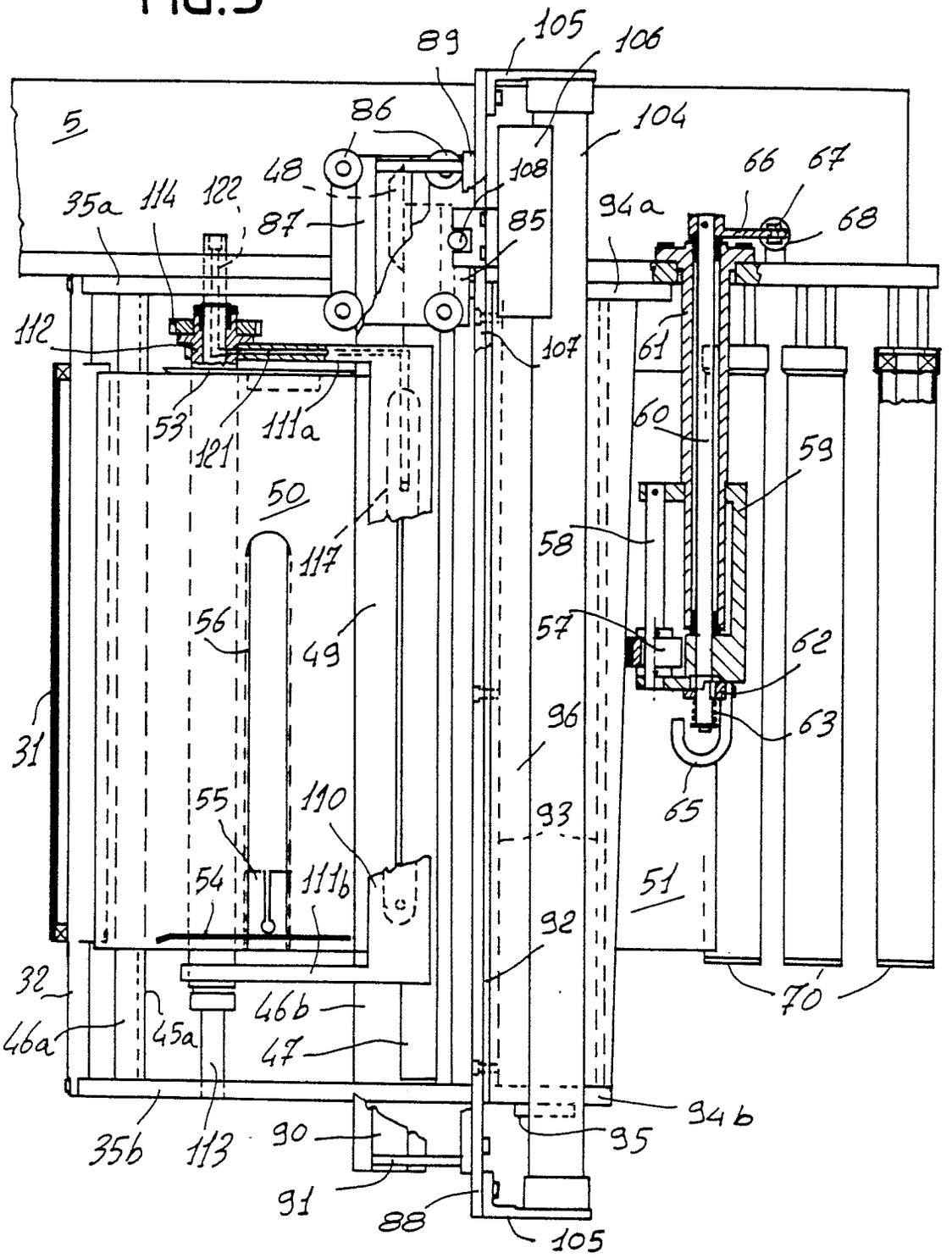
FIG.2

FIG.3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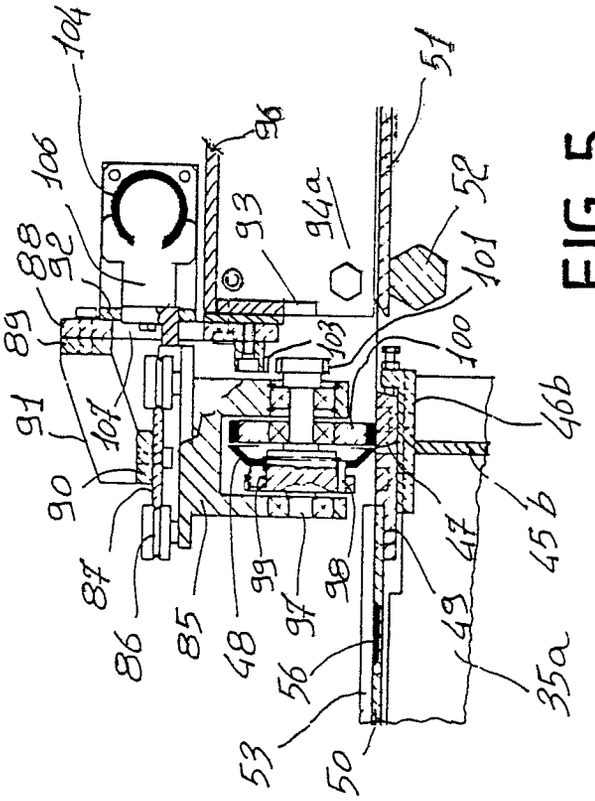


FIG. 5

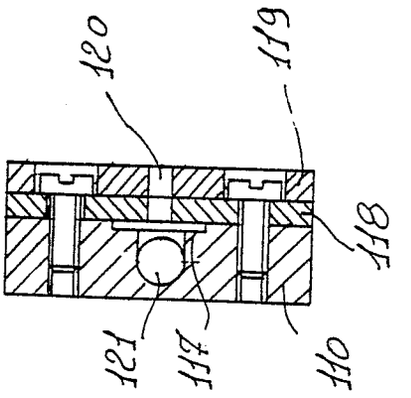


FIG. 6

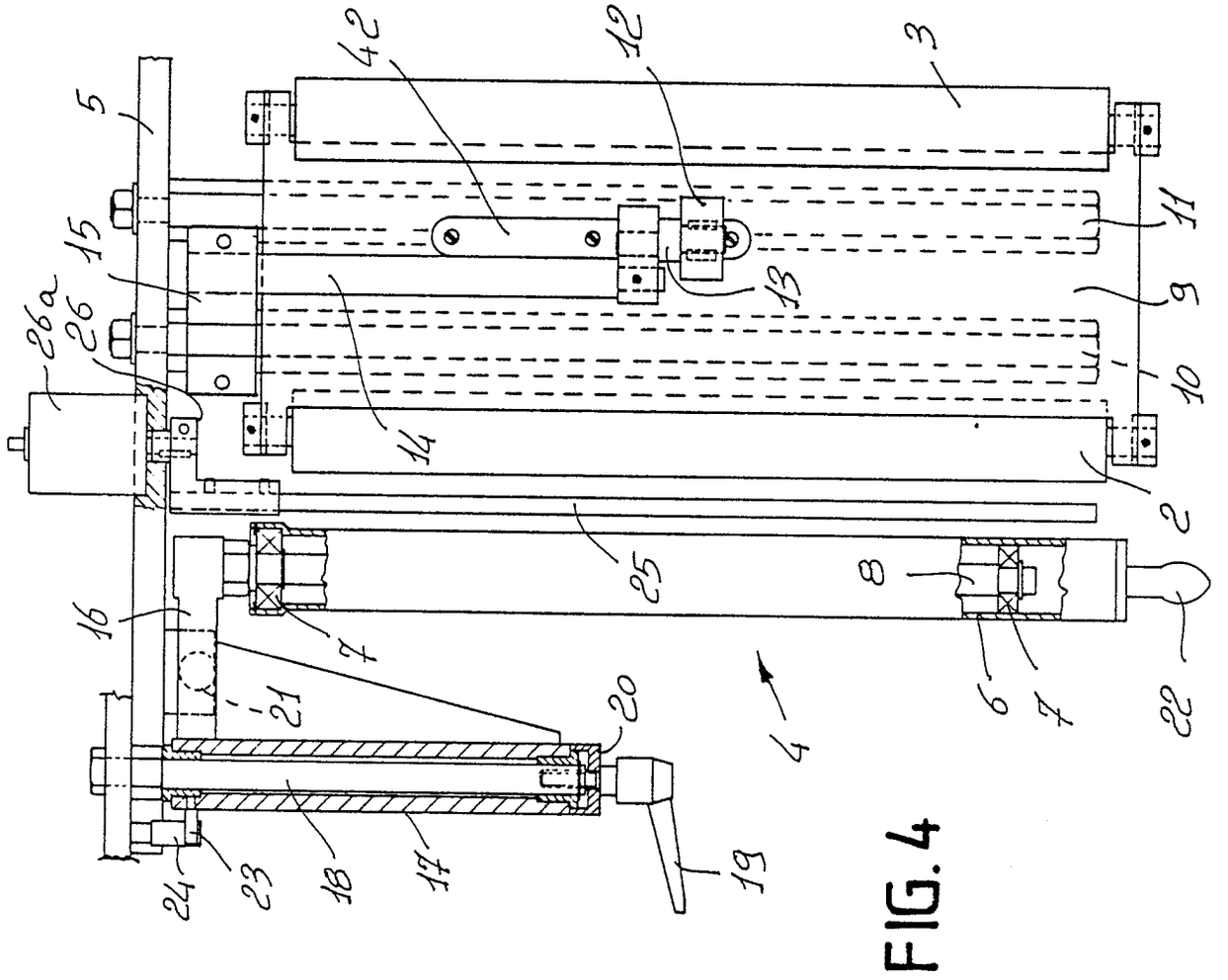
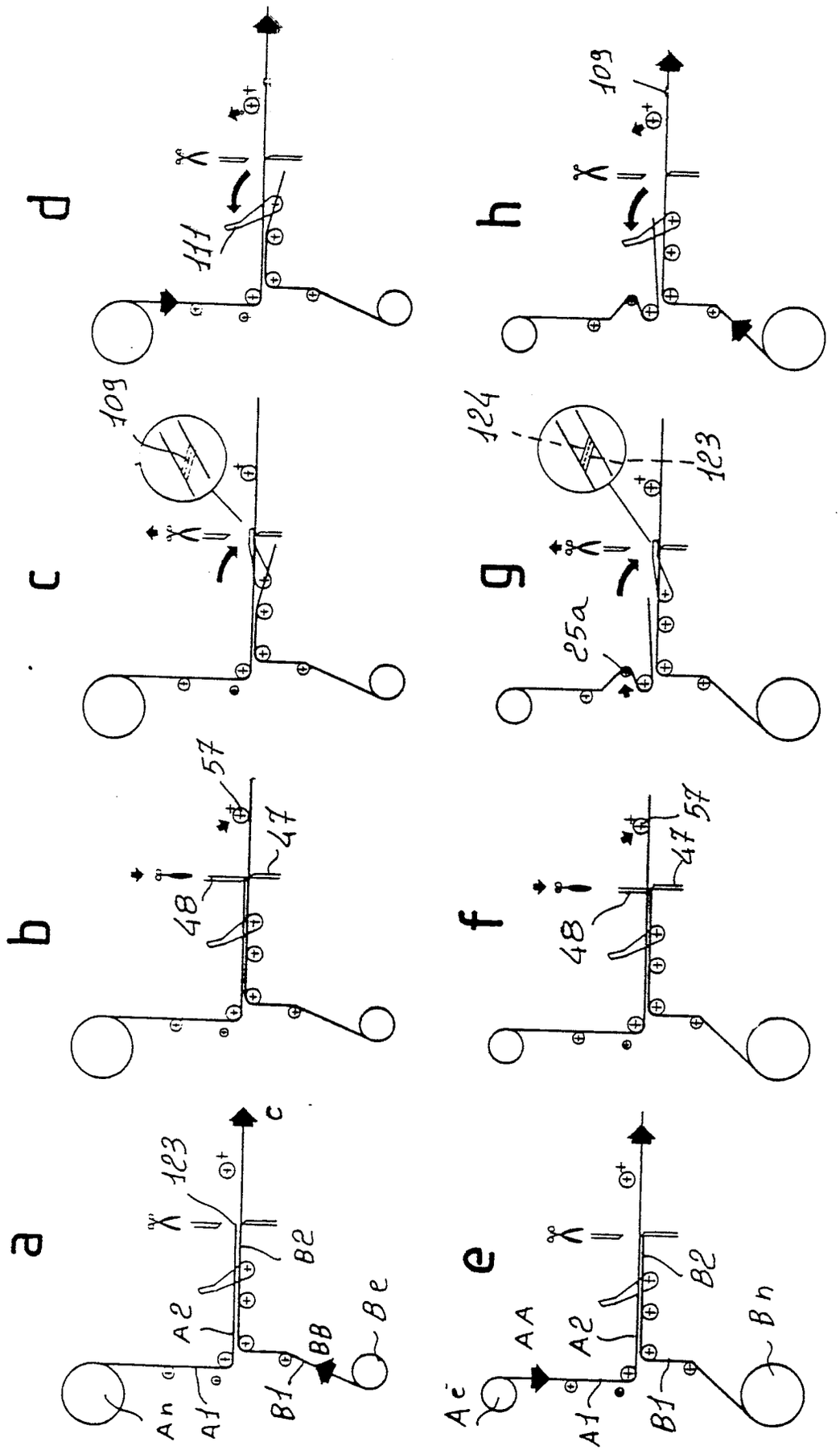


FIG. 4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109
g
124
123
25a
f
48
47
57
e
Ae
AA
A1
A2
B1
B2
Bn

FIG.7