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(54) Printing machine with variable width, method to vary the printing width and method for lateral movement of the machine

(57) The printing machine is divided into two structural units (1, 3), the first (1) supporting the counter rollers (2A, 2B) and the second (3) supporting the other printing rollers. The two units (1, 3) can translate to reciprocally stagger the respective rollers in the direction of the width of the printing substrate, and both are provided with translation means (19. 21, 23) and deactivatable means to lock translation (14B, 15B) and an electronic control unit of said means to vary the printing width and if necessary move the entire machine laterally.

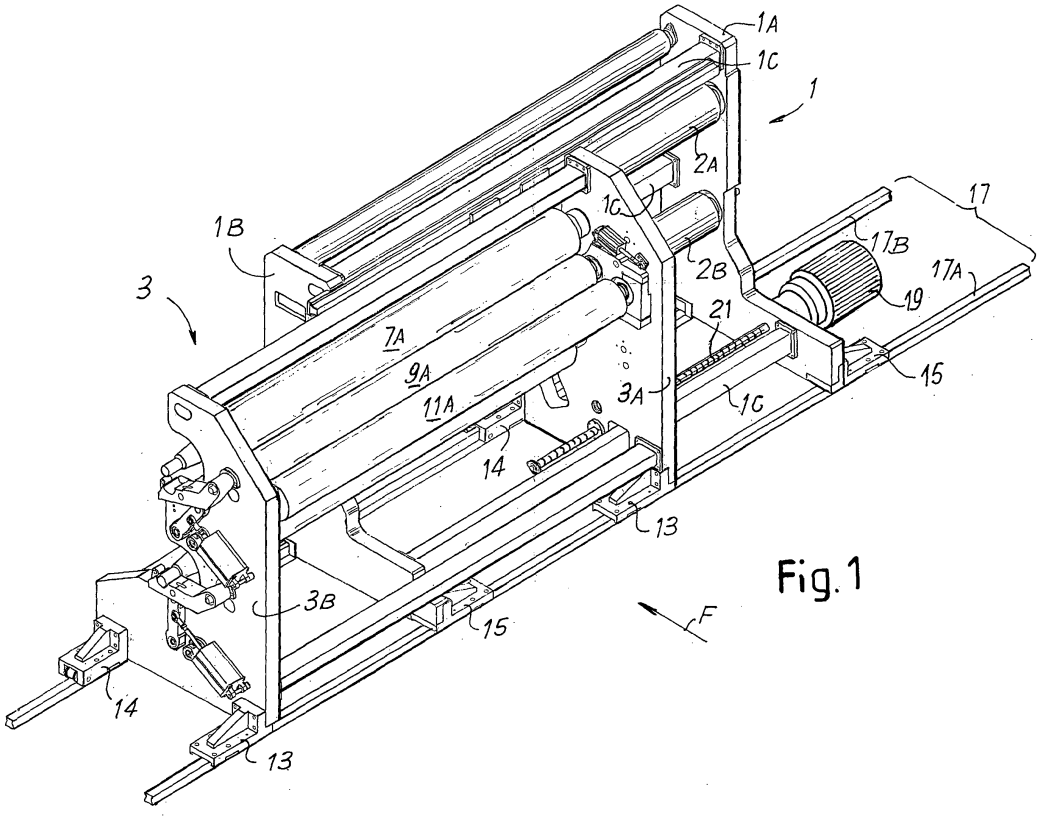

Fig. 1

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Description

Technical field

[0001] The present invention relates to a printing machine to print patterns in at least one color, such as a flexographic machine applicable to a line for manufacturing corrugated cardboard for packagings, to print the flat surface of the cardboard which is to remain on the outside of said packagings.

Prior art

[0002] When printing boxes for packaging, a production of boxes of various dimensions is generally provided for and, consequently, rapid variation of both the pitch and the printing width is necessary. A printing machine described in EP 1277574, by the same applicant, allows programmed variation of the pitch but not of the printing width.

Objects and summary of the invention

[0003] In order to overcome this limitation, the machine according to the present invention, which can also incorporate the features of EP-A-1277574, is divided into two structural units capable of translating with respect to each other to reciprocally stagger the respective rollers in the direction of the width of the printing substrate. The first of these units supports, for each print color, a respective counter roller over which the printing substrate is fed. The second unit supports, for each color, the other printing rollers, such as the cliché roller, the anilox roller and the rubber roller.

[0004] Preferably, the counter rollers of the first unit and the printing rollers of the second unit are the same width as each other, to allow printing of the printing substrate on the entire width thereof, or on portions of decreased width by consequently staggering the two units with respect to each other.

[0005] According to an advantageous embodiment of the invention, the two structural units comprise feet which support sliding blocks, to slide independently from one another along parallel rectilinear guides. Moreover, at least one of said structural units is provided with motorized means for translation along said guides and deactivatable locking means suitable to lock the unit on the respective guide. In a preferred embodiment of the invention, both units can translate along sliding guides. One of the units is locked in the desired position along the guides, while the other is made to translate as desired by the motorized means to vary the printing width.

[0006] According to an advantageous embodiment, the machine comprises a control unit suitable to control said translation and locking means to take said structural units to predetermined reciprocal positions on said guides, thereby allowing printing on the entire width of the printing substrate or on a portion thereof of decreased width with a programmed or manual variation of the printing width.

[0007] In a preferred embodiment of the invention, said guide is a track common to said two structural units, the sliding block supporting feet of each unit being inserted between the supporting feet of the other unit.

[0008] A machine according to the invention, for example applicable to a system for producing corrugated cardboard boxes, allows the printing cliché to follow a sequential movement of the format of boxes to be produced, said format generally varying in different dimensions in a batch of boxes. To pre-print the cover of the cardboard of said boxes, i.e. the part (ply) which will form the outside of the box, the cliché must necessarily follow the movement of the median axis of the boxes forming the batch when the format thereof is varied. This is possible by consequently moving, according to the width of the printing substrate, the structural unit of the machine that supports the clichés, while leaving the unit that supports the counter rollers, with the printing substrate of constant width wound thereon, fixed laterally. The lateral travel of one unit with respect to the other from the initial alignment can reach considerable values, e.g. 1500 mm with a printing substrate width of 2500 mm.

[0009] Various solutions and preferred constructional forms are described in the dependent claims.

[0010] The present invention also relates to a method for printing a printing substrate of constant width by means of a printing machine as described, wherein longitudinal portions of the substrate are printed with respective printing widths differing from one another, the position of the second supporting structure with the relative printing rollers being varied transversely to the printing substrate between one section and the next. During this variation in relative position, printing is interrupted; if feed of the printing substrate cannot be stopped, the portions of substrate printed before and after the variation will be separated by a section of substrate devoid of printing. The variation in the respective lateral position of the units can also be controlled in a programmed way by the control unit of the printing machine.

[0011] Finally, the present invention also relates to a method for lateral movement of a printing machine as defined above, for example to withdraw it from the operating position in a corrugated cardboard production line when printing thereof is not required. In the process, this movement is carried out by a plurality of subsequent steps, during one of which the locking means of the first structural unit are activated while those of the second unit are deactivated and the motorized translation means are activated to laterally distance the two structural units from each other. Then, in the subsequent step, the locking means of the first unit are deactivated while those of the second unit are activated and the motorized translation means are activated to move the two units laterally towards each other, and so forth. Said sequence of operations to move the printing machine laterally is preferably controlled by the control unit of the machine for a

predeterminable number and length of steps.

[0012] In this way the machine according to the invention is capable of moving laterally in a controlled manner, for example from an operating area to a storage or maintenance area, with said areas which can even be at a distance of 10 m or greater. Movement takes place, for example, by means of a single motor unit.

Brief description of the drawings

[0013] The invention will be better understood by following the description and accompanying drawing, which shows a non-limiting example of the invention. In the drawing:

Figure 1 shows a perspective view of a printing machine according to the invention;
Figure 2 shows a front view of the machine according to the arrow F in Figure 1;
Figure 3 shows a plan view of the machine in Figure 1;
Figure 4 shows an enlarged section according to IV-IV in Figure 2;
Figure 5 shows an enlargement of the detail V in Figure 2;
Figure 6 shows a sectional view according to VI-VI in Figure 5;
Figure 7 shows an enlargement of the detail VII in Figure 2; and
Figure 8 shows a sectional view according to VII-VII in Figure 5.

Detailed description of a preferred embodiment of the invention

[0014] With reference to Figures 1 to 4, the printing machine is divided into two structural units 1, 3, translatable with respect to each other in the direction of the width of the printing substrate 5. The first of said units - indicated with the reference 1 - comprises two side panels 1A, 1B connected by four crosspieces 1C and supports, for each print color, a respective counter roller 2A, 2B around which the printing substrate 5 passes. The second unit — indicated with the reference 3 - comprises two side panels 3A, 3B connected by three crosspieces 3C and supports, for each color, the other printing rollers, such as a cliché roller 7A, 7B, an anilox roller 9A, 9B and a rubber roller 11A, 11B (in Figure 1, the rollers 7B, 9B and 11B have been omitted for clarity of the description).

[0015] The two structural units 1, 3 comprise sliding block supporting feet, respectively 13, 14 for the unit 3 and 15, 16 for the unit 1, to slide independently from each other along a track 17. In substance, the sliding blocks 13, 15 which slide on a rail 17A of the track 17, differ from the sliding blocks 14, 16, which slide on the other rail 17B of the track 17, as the former comprise a recirculating ball sliding unit (Figure 5), which transmits the vertical load to the rail 17A and guides the sliding block 15 laterally without play on the sides of said rail 17A, while the sliding blocks 14, 16 comprise a sliding unit produced with idle rollers 14A (Figure 7) to transmit only the vertical load to said rail 17B. All the sliding blocks 13, 14, 15 and 16 also comprise respective brake units 15B, 14B (Figures 5 to 8) with pneumatically controlled friction elements which act on the sides of the rails 17A, 17B of the track 17.

[0016] With respect to the side panels 1A, 1B of the unit 1, the respective feet 15, 16 project to the right, observing Figure 2, while with respect to the side panels 3A, 3B of the unit 3, the respective feet 13, 14 project to the left. In this way the unit 3 can translate to the right with respect to the unit 1 until the outer face 3X of the side panel 3A comes, or almost comes, into contact with the inner face 1X of the side panel 1A, for example to print the printing substrate 5 on the entire width thereof.

[0017] On the other hand, the unit 3 can be translated to the left - with respect to the structure 1 - moving the distal faces 13X (Figure 2) of the sliding blocks 13 of the side panel 3A towards the distal faces 15X of the sliding blocks 15 of the side panel 1B of the unit 3, to reach a reciprocal limit position of the units 1, 3 corresponding to the minimum useful printing width at the level of the left side of the printing substrate. This limit position of minimum width is defined by the overall dimensions of the machine components.

[0018] By varying the relative position of the units 1, 3 to positions intermediate to those described above, any printing width, included between said minimum width and the width of the printing substrate 5, can be obtained. Moreover, the pattern of a cliché which involves a limited portion of the width of the printing substrate 5 can be translated to any position along said substrate. These variations in the relative position of the two units 1, 3 are obtained by means of a motor 19 applied on the outside of the side panel 1A of the unit 1, a female screw 23 applied to the side panel 3A of the unit 3 and a screw 21 with axis parallel to the track 17 coupled with the female screw 23, said screw being rotated by the motor 19 in one direction or the other to move said units 1, 3 laterally away from or towards each other.

[0019] In general, in the actual printing operation, both units 1, 3 are locked on the track 17 by means of the brakes 14A, 15A of the respective supporting feet 15, 16 and 13, 14. Variation in the relative position of the unit 3 with respect to the unit 1 is performed by releasing the brakes 14A, operating the motor 19 to rotate the screw 21 in the female screw 23 and then, after reaching the desired relative position, by interrupting operation of the motor 19 and locking the brakes 14A again.

[0020] The machine comprises an electronic control unit suitable to control said translation and locking means to make the units 1, 3 take predetermined positions on the track 17, thereby allowing printing on the entire width of the printing substrate or on a portion thereof of decreased width with programmed or manual variation of the printing width. All these operations can be performed

in succession under the control of the control unit of the machine in which said positions to be reached have been set.

[0021] The machine according to the invention described above can also be translated on the track 17 to a position in which both units are laterally withdrawn with respect to the operating position, for example to perform maintenance. This translation is obtained in steps utilizing the lateral translation system described above and alternating phases in which the unit 1 is locked on the track 17 and the unit 3 is translated, for example by offsetting it laterally with respect to the unit 1, with phases in which the unit 3 is fixed on the track 17 and the unit 1 is translated with respect to the unit 3, for example, laterally repositioning it in alignment therewith.

[0022] It is understood that the drawing only shows an example provided purely as a practical embodiment of the invention, as said invention can vary in forms and arrangements although without departing from the scope of the concept on which the invention is based. Any reference numerals in the appended claims are provided for the purpose of facilitating reading of the claims with reference to the description, and do not limit the scope of protection represented by the claims.

Claims

1. A printing machine to print patterns in at least one color on a printing substrate moving according to a direction of feed, **characterized in that** it is divided into two structural units (1, 3), for each print color, a first (1) of said units supporting a respective counter roller (2A, 2B) around which the printing substrate passes and a second unit (3) supporting the other printing rollers, such as cliché rollers (7A, 7B), anilox rollers (9A, 9B) and rubber rollers (11 A, 11B), the two units (1, 3) being translatable with respect to each other in a direction transverse to said direction of feed, to reciprocally stagger the respective rollers in the direction of width of the printing substrate, and vary the printing width, translation means (19, 21, 23) being provided to control reciprocal translation of said units.

2. Machine as claimed in claim 1, **characterized in that** it comprises activatable and deactivatable means to lock translation (14B, 15B) of at least one of said two units.

3. Machine as claimed in claim 1 or 2, **characterized in that** both said units move transversely and both are provided with activatable and deactivatable means to lock translation.

4. Machine as claimed in claim 3, **characterized in that** said translation means (19, 21, 23) comprise a single motor to translate said two units with respect to each other and to translate both units, alternatively, with respect to fixed guides (17A, 17B).

5. Machine as claimed in one or more of the previous claims, **characterized in that** it comprises an electronic control unit of said translation means (19, 21, 23).

6. Machine as claimed in one or more of the previous claims, **characterized in that** it is a flexographic machine applicable to a line for manufacturing corrugated cardboard for packagings, to print the flat surface of the cardboard which is to remain on the outside of said packagings.

7. Machine as claimed in one or more of the previous claims, **characterized in that** the counter rollers (2A, 2B) of the first unit (1) and the printing rollers (7A, 9A, 11A; 7B, 9B, 11B) of the second unit (3) have the same width, to allow printing of the printing substrate on the entire width thereof, or on portions of decreased width, consequently staggering the two units (1, 3) with respect to each other.

8. Machine as claimed in one or more of the previous claims, **characterized in that** said two structural units (1, 3) comprise sliding block supporting feet (13, 14; 15, 16) to slide independently from each other along parallel rectilinear fixed guides (17A, 17B).

9. Machine as claimed in claims 2 and 5, **characterized in that** said control unit is programmed and designed to control said translation means (19, 21, 23) and said locking means (14B, 15B) to make said structural units (1, 3) take predetermined positions, thereby allowing printing on the entire width of the printing substrate (5) or on a portion thereof of decreased width with a programmed or manual variation of the printing width.

10. Machine as claimed in one or more of the previous claims, **characterized in that** said structural units (1, 3) move along fixed guides (17A, 17B) common to said two structural units.

11. Machine as claimed in claims 8 and 10, **characterized in that** the sliding block supporting feet (13, 14) of the second unit (3) are inserted between the supporting feet (15, 16) of the first unit (1).

12. Machine as claimed in one or more of the previous claims, **characterized in that** said translation means of one structural unit with respect to the other comprise an actuator (19) and a screw and female screw mechanism, the screw (21) being axially locked to one of said units (1) and the female screw (23) being fixed to the other of said units (3).

13. Machine as claimed in claim 8, **characterized in that** said sliding block supporting feet (13, 15) are provided with rolling means to support and laterally guide said sliding blocks.

14. Machine as claimed in claim 13, **characterized in that** said rolling means to support and laterally guide the sliding blocks comprise recirculating ball elements (15A).

15. Machine as claimed in claim 3, **characterized in that** said locking means of said structural units (1, 3) on the respective guides (17) comprise friction blocks (14B, 15B) which can act by means of a pressurized fluid against the sides of the guides (17).

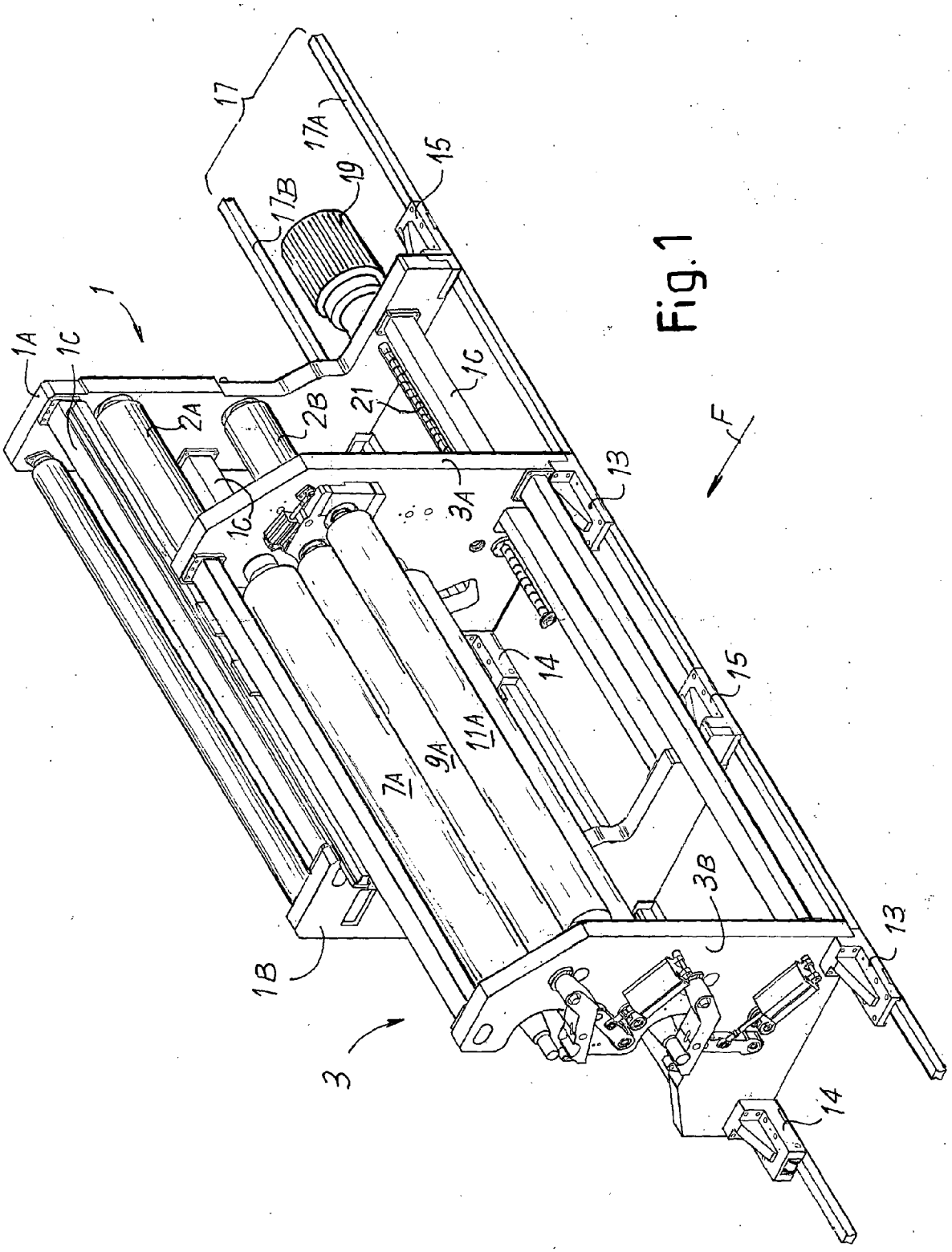
16. Machine as claimed in one or more of the previous claims, **characterized in that** the printing rollers (7A, 9A, 11A; 7B, 9B, 11B) are moved by variable speed motors provided with a control system for angular feed and rotation speed, to print printing sequences varied in pitch and in printing width.

17. A method for printing a printing substrate of constant width by means of a printing machine as claimed in one or more of the previous claims, **characterized in that** longitudinal portions of said substrate are printed with respective printing widths differing from one another, the position of the second structural unit (3) with the relative printing rollers being varied transversely to the printing substrate (5) between one section and the next while printing is interrupted.

18. Method as claimed in claim 17, **characterized in that** said variation of the lateral position is controlled in a programmed way by the control unit of the printing machine.

19. A method for lateral movement of a printing machine as claimed in one or more of claims 1 to 16 to take it to an idle position with respect to a production line when printing of the substrate is not required, **characterized in that** said movement is carried out by a plurality of subsequent steps, during one of which the locking means (15B) of a first structural unit (1) are activated while those (14B) of the second unit (3) are deactivated, and the motorized translation means (19, 21, 23) are activated to laterally distance the two structural units (1, 3) from each other, and then, in the subsequent step, the locking means (15B) of the first unit (1) are deactivated while those (14B) of the second unit (3) are activated and the motorized translation means (19, 21, 23) are activated to move the two units (1, 3) laterally back towards each other, and so forth.

20. Method as claimed in claim 19, **characterized in that** said sequence of operations for stepped lateral movement of the printing machine is controlled by the control unit of the machine for a predeterminable number and length of steps.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17B
19
15
1
1A
1C
2A
2B
21
1C
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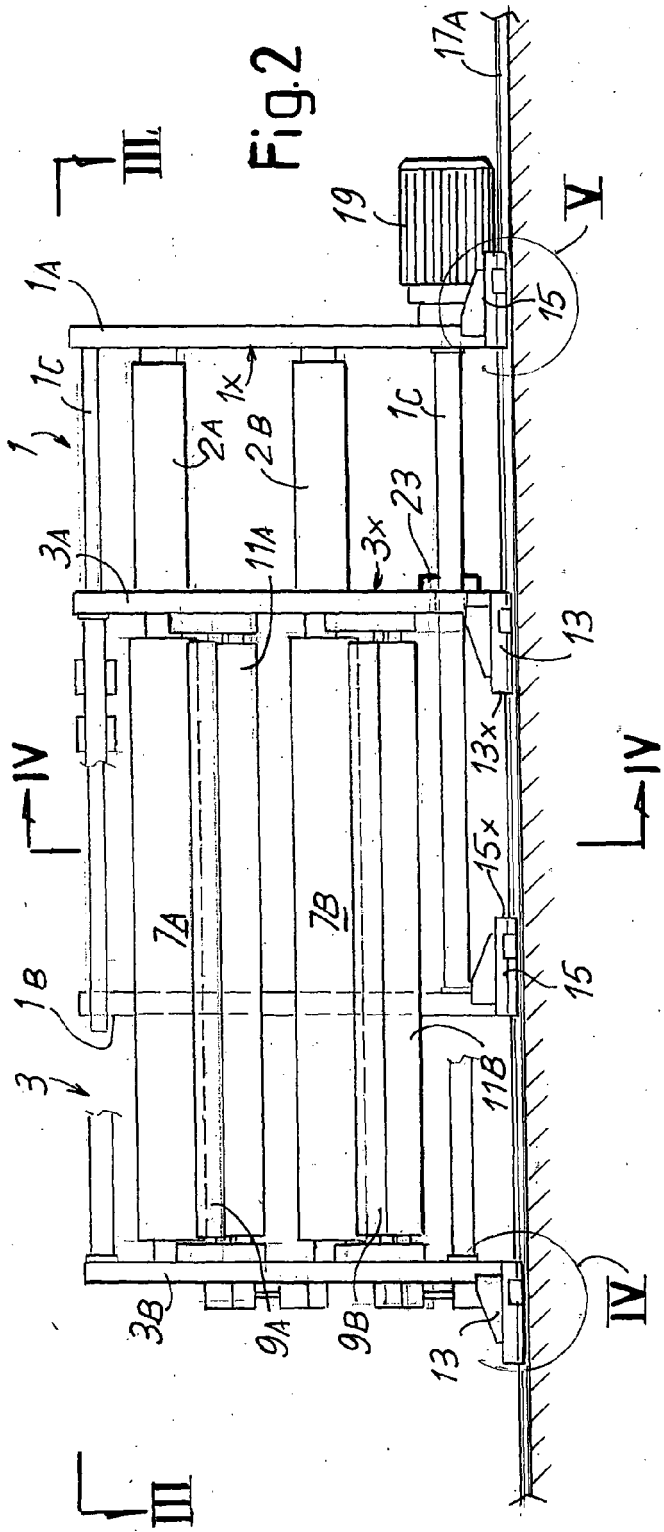
7A
9A
11A
3B
13
1B
3
14

Fig.1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IV
IV
IV
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2A
2B
3
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7B
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11B
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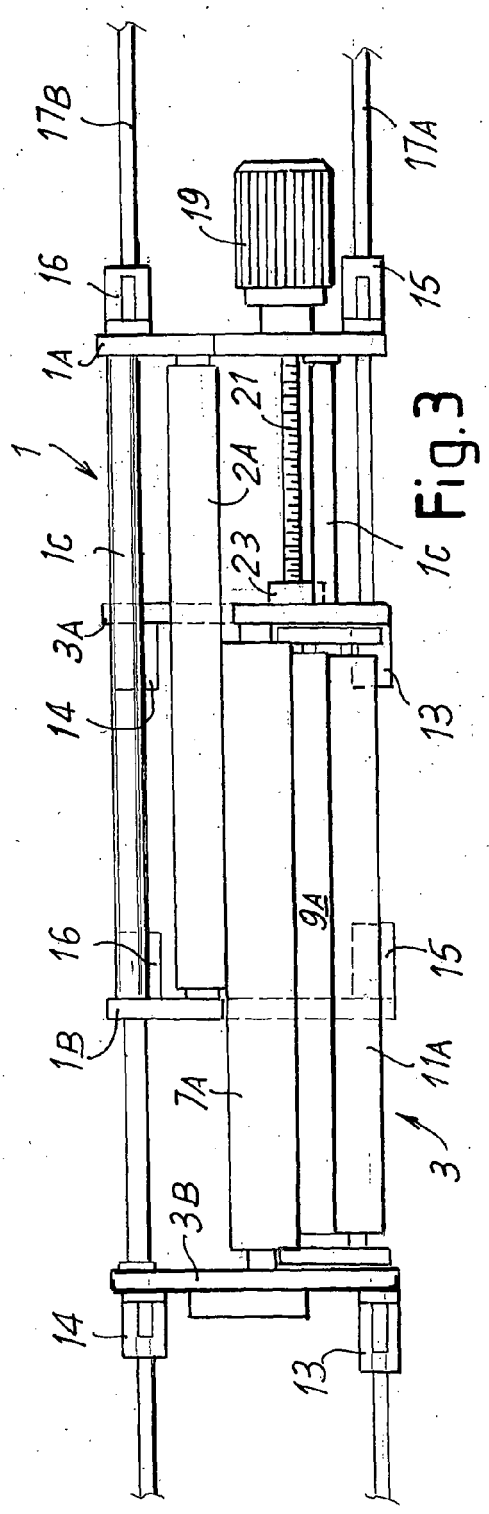
15
15x
17A
19
23

Fig.2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1B
1C
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17A
17B
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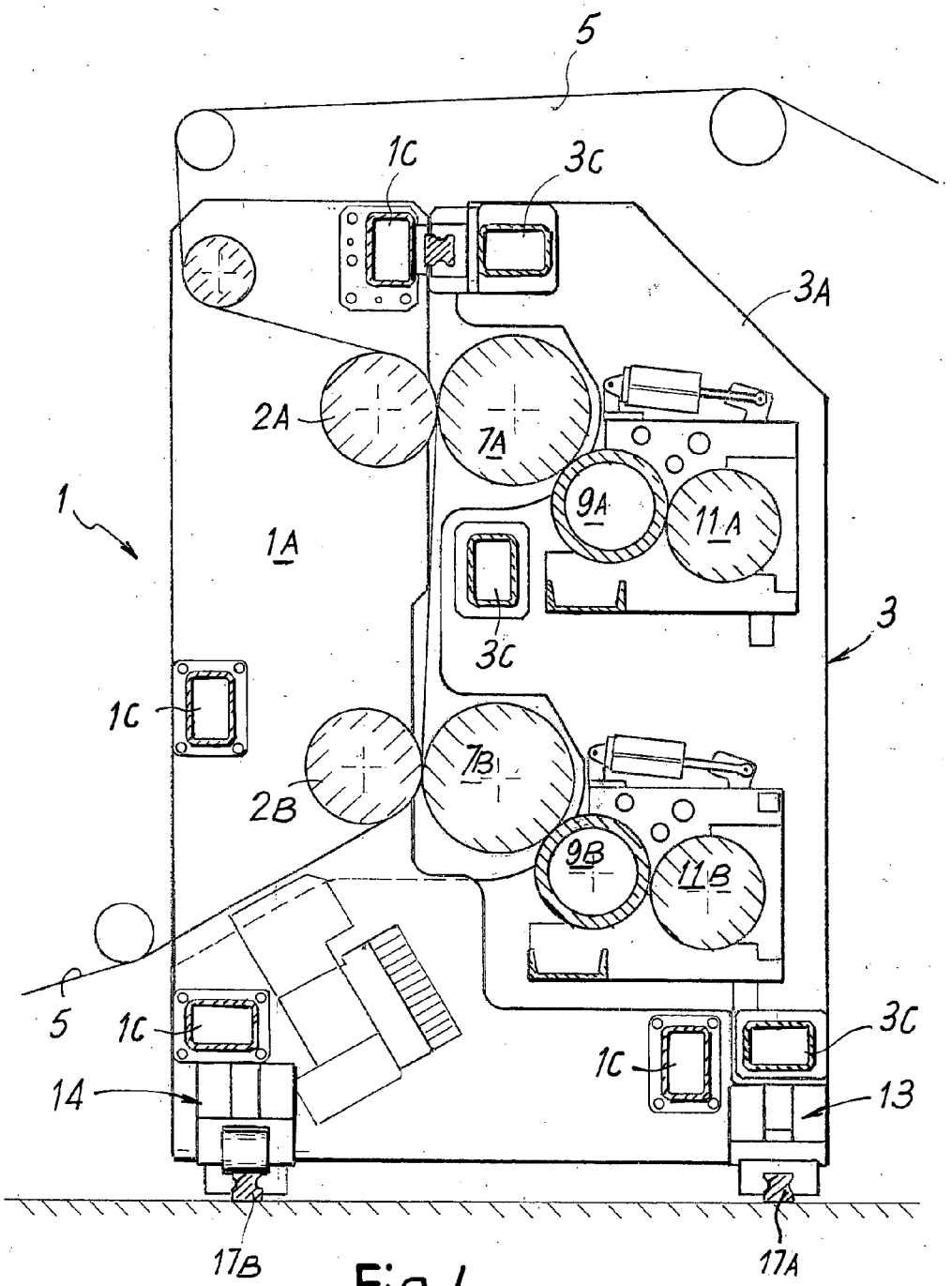
21
23

Fig.3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14
13
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17A

Fig. 4

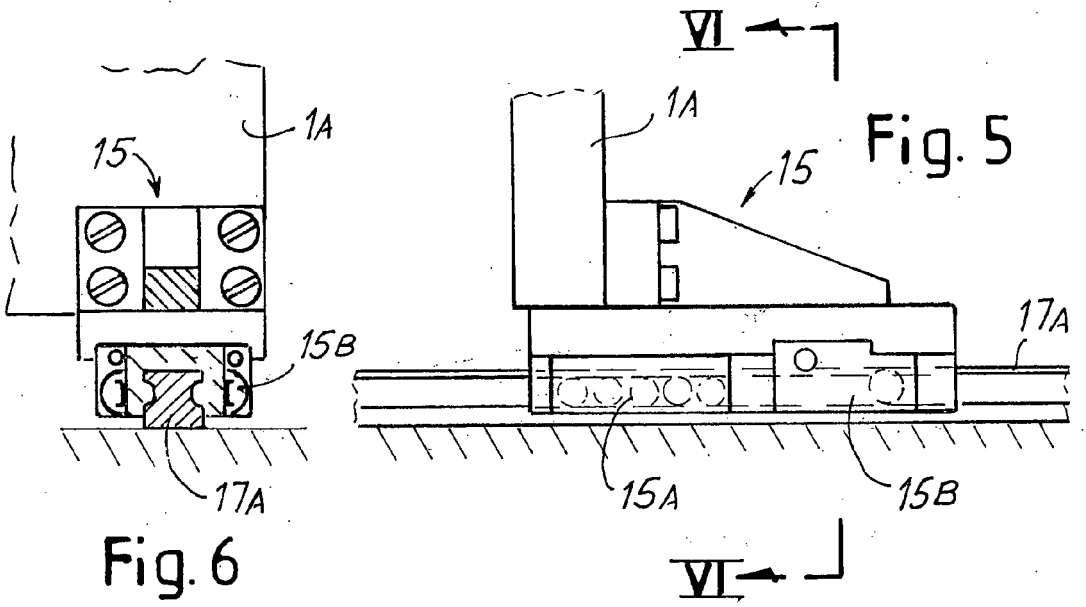

Fig. 5

Fig. 6

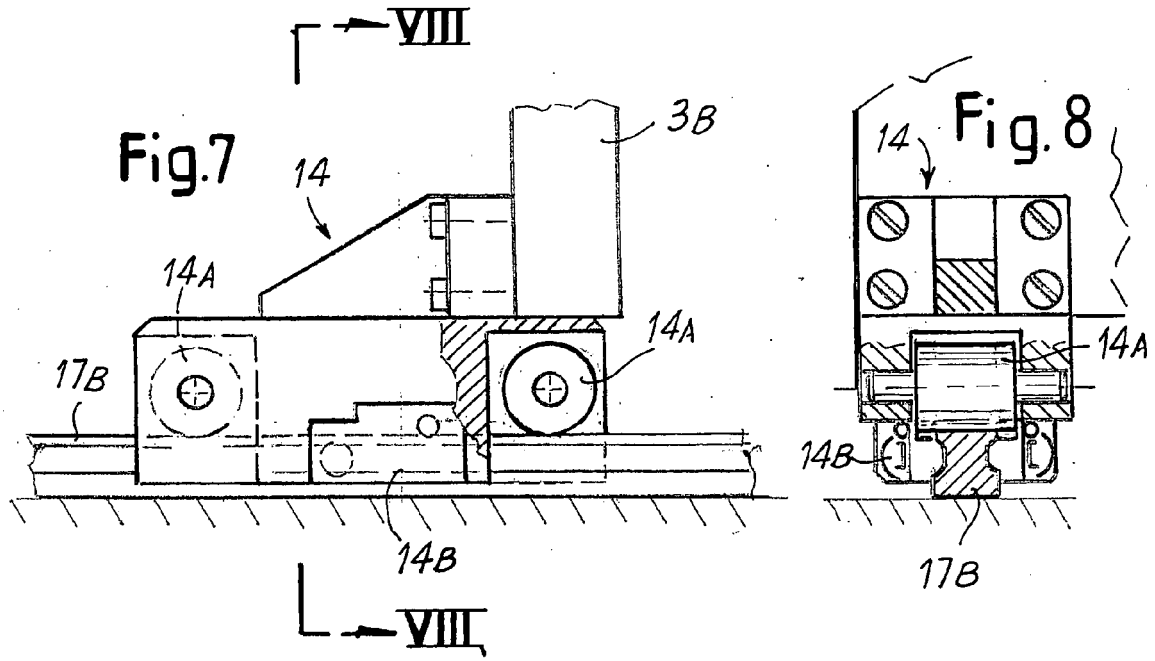

Fig.7

Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1277574 A **[0002] [0003]**