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(11) **EP 0 727 310 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.08.1996 Bulletin 1996/34

(51) Int. Cl.⁶: **B41F 15/10**, B41F 15/08

(21) Application number: **96200294.5**

(22) Date of filing: **10.02.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL PT SE

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(30) Priority: **14.02.1995 IT MI950260**

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(54) **Improved plant for printing fabrics and the like**

(57) A printing plant (10) for web material comprises a conveyor belt (11) for moving the web (13) to at least one printing station (14), in turn comprising a printing screen (17) and means (18) for printing of the screen on the web (13). The screen (17) is supported in the station by power-driven means for the relative movement thereof with respect to the station, to enable a precise screen positioning relative to the web (13) to be printed. In particular, the screen (17) can be supported by power-driven means (23) for moving it transversely of the web (13) and a control device (22) detects the mutual shifting in a transverse direction between the printing position on the web (13) and the screen and drives the transverse-movement means (23) of the screen to cancel this shifting. In addition, the printing screen (17) can be supported by power-driven means (36,37,38) for moving it in a direction longitudinal to the belt running direction. In this case, on stopping of the belt (11), the control device (22) detects the mutual longitudinal shifting between the printing position on the web (13) and the screen (17) and operates the power-driven longitudinal-movement means (36, 37, 38) of the screen (17) to cancel this shifting.

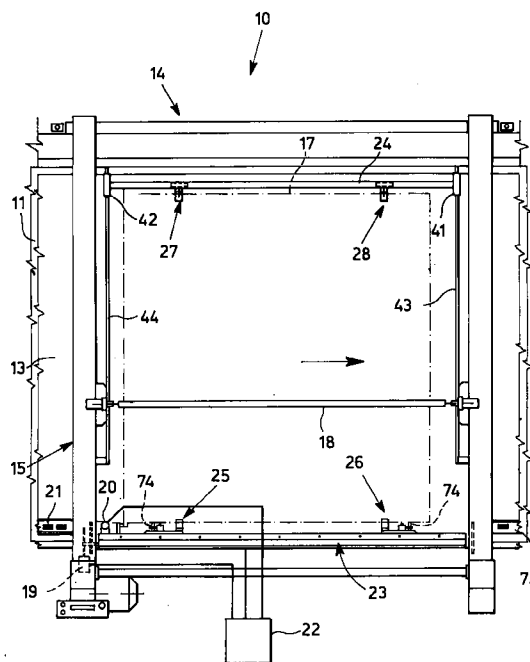


Fig. 1

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Description

The present invention relates to a plant for printing web materials, such as lengths or runs of cloth.

Known in the art are plants in which the web material to be printed is fastened to a feed belt to be lead to several printing stations in succession, each station printing one of the desired colours on the fabric, for example.

Positioning of the web under each printing screen in the different stations (or in the same station for several passages) must necessarily reach the highest degree of precision in order to ensure alignment of the images as they are printed and an exact colour matching.

In addition to being necessary to stop the feed belt under the printing screen in a very precise manner, it is also required that the belt while travelling between the different stations should not be subjected to side skiddings that would cause a transverse misalignment of the impressions.

In order to limit side skiddings and try to keep the belt at its optimal position relative to the printing screen which is fixed on supports, several devices have been developed for guiding the belt sideways, which consist of side shoulders for example, on which the belt edges rest and slide. Although increasingly more complicated devices have been suggested in an attempt to keep the belt in place, the reached precision is in any case relatively poor and this represents a limit to the quality of the obtainable impressions.

It is a general object of the present invention to obviate the above mentioned drawbacks by providing a printing plant ensuring a precise mutual positioning between the printing screens and web material to be printed.

In view of the above object, in accordance with the invention, a plant for printing web material has been devised which comprises a conveyor belt for moving the web material to at least one printing station in turn comprising a printing screen and printing means for printing of the screen on the web material, characterized in that the screen is supported by power-driven means for moving it in the station in directions parallel to the belt surface, a control device detecting a mutual shifting at least in one direction between the printing position on the web and the screen and driving the power-driven movement means of the screen to reduce this shifting.

For better explaining the innovatory principles of the present invention and the advantages it offers over the known art, a possible embodiment of the invention practising said principles will be given hereinafter by way of non-limiting example with the aid of the accompanying drawings. In the drawings:

- Fig. 1 is a fragmentary diagrammatic plan view of a printing plant according to the invention;
- Fig. 2 is a fragmentary diagrammatic and partly sectional view of part of the plant, shown in Fig. 1;

- Fig. 3 is a partial view in section taken along line III-III in Fig. 2;
- Fig. 4 is a sectional view taken along line IV-IV in Fig. 2.

Referring to the drawings, diagrammatically shown in plan view in Fig. 1 is a plant according to the invention and generally identified by 10, which comprises a conveyor belt 11 driven to bring a fabric web 13 or similar web material under at least one printing station 14. Each station 14 comprises a frame 15 on which support means is provided for a known printing screen 17. The station is comprised of known printing means, such as a doctor blade 18, not shown in detail as it can be easily imagined by a person of ordinary skill in the art.

According to the invention, the screen is supported on the fixed frame 15 by supports that are mounted on frame elements movable in directions parallel to the belt plane.

For example, the frame is movable at least in one direction transverse to the belt by means of a motor 19. A sensor 20 is disposed integral with the screen supports to be moved therewith, and it detects marks 21 integral with the web to be printed so as to be a reference for the transverse position of the web. The reference marks may consist for example of graphic elements having an edge parallel to the web edge and being greatly contrasted, so that an easy detection of the same by the sensor is enabled, said sensor thereby utilizing such an edge as an indicator of the web side position.

The graphic elements may be a sequence of black rectangles on a white background or the like, for example, printed on a narrow pressure-sensitive tape 73 applied to the belt 11 at margin of the web to be printed, the web being fastened to the belt so that it is integral with the reference marks. In the known art such a reference tape or strip is usually employed for detecting the longitudinal position of the web and operating stopping of the belt to the printing position.

The sensor 20 and side-displacement motor 19 are connected to a control device 22, consisting of a known electronic circuitry for example, advantageously provided with a microprocessor. Such a device is substantially known in the art and therefore will not be herein further described or shown as it can be easily assumed by a person skilled in the art, above all in the light of the following description relating to the plant operation.

The device 22 receives information about the side position of the web from sensor 20 and drives the motor 19 in operation to translate the screen sideways, so that the correct relative side position between the screen and web to be printed is maintained. In this manner, the presence or not of small side skipping of the belt on running of same is no longer of importance, the screen being shifted sideways so as to compensate for any belt skipping.

As described in more detail in the following, the printing screen 17 supporting means can be also

advantageously comprised of translation means for moving the screen in the belt running direction. For driving of said translation means, a connection between the latter and the control device 22 is carried out. The reference marks 21 in this case are made in such a manner that they provide edges directed transversely of the web edge, thereby offering a detecting element for the web position in the running direction as well.

In this way, the control device 22 detects the reference mark passage by means of sensor 20 and when it detects passage relative to the stop position for printing, it stops the belt 11. Typically, due to inertias and/or to its own elasticity, the belt will surpass the desired stop position. At this point, the control device, still using the edges of marks 21 as a reference, operates the transverse-translation means to centre the screen relative to the belt side skippings and the longitudinal-translation means to bring the screen exactly in register with the longitudinal printing position on the web, compensating for the belt stop error.

For better comprehension of the invention, a description of a possible embodiment of the screen movement means is given.

In this embodiment, the screen supports comprise one side-bar element or front-bar element 23 and a second side-bar element or rear-bar element 24 parallel to each other and to the belt running direction, from which fitting groups for the screen denoted by 25, 26 and 27, 28 respectively, project, which groups are directed towards each other and the belt centre, so that opposite edges of the screen may rest thereon and be connected thereto.

As best shown in Fig. 2, the front-bar element 23 comprises a section bar 29 supporting several mechanisms protected by a housing 71, 72. The bar carries the fitting pieces 25, 26 and is connected at the ends to carriages 30, 31 sliding along respective slide guides 32, 33 transverse to the belt. Motor 19 is integral with frame 15 and causes rotation of a worm screw parallel to guides 32, 33 and engaging with a nut screw 35 integral with carriage 31.

In this manner, on rotation of motor 19, bar 29 moves transversely of belt 11.

The bar ends are connected with carriages 30, 31 by interposition of slidable inserts 36, 37 received in complementary seatings formed in the bar ends. A motor 38 is fastened to the bar and causes rotation of a worm screw 39 on which a nut screw 40 integral with the insert 37 slides, so that, upon command of motor 38 (powered by the control device 22) the bar can slide axially to itself and therefore in a direction parallel to the belt running direction.

The rear bar 24, instead, is freely slidable transversely of the belt 11 by means of end carriages 41, 42 which run idly along respective slide guides 43, 44. The rear fitting pieces 27, 28 are mounted freely slidable along bar 24. In this manner, when the screen 17 is fastened to the respective supports 25, 26 and 27, 28, the transverse and longitudinal movements of the front bar

23 also cause shifting, by means of the screen, of the bar 17 and supports 27, 28 so that the screen is firmly supported on either side during movement.

Turning back to Fig. 2, the fitting means 25 and 26 are each formed of a respective carriage 45, 46 slidable in a guide 47 along the bar. Carriages 45, 46, in mirror image relationship, carry rests 48, 49 on which the screen 17 edge comes to lie.

In addition, projecting from each carriage is an automatic fitting mechanism 50, 51 for complementary coupling elements on the screen. For example, the fitting mechanisms comprise forks 52, 53 to be sideways fitted to mushroom-shaped pins 74 projecting from the screen 17, as diagrammatically shown in chain line for fork 52 in Fig. 2.

As clearly shown in connection with fork 52, forks 52, 53 are pivoted at 54, 55 to be moved towards an abutment 56, 57 by means of a lever mechanism operated by a thrust action, acting in a direction parallel to the bar 29, of a screen portion supporting the mushroom-shaped pin against rollers 62, 63.

As clearly shown in Figs. 3 and 4 as well, an electric motor 58 operates a pignon gear 59 meshing with an opposite pair of superposed racks 60, 61, parallel to the bar 29. Rack 60 has one end connected to carriage 45, whereas rack 61 has one end connected to carriage 46. On operation of motor 58 (electrically powered by the control device 22) the racks run in opposite directions, so that the carriages move close to or away from each other.

In use, screen 17 is laid on rests 48, 49 whereas carriages 45, 46 are disposed between a pair of mushroom-shaped pins projecting from the screen edge. Then motor 58 is operated to move the carriages apart from each other and lead the forks 52, 53 (directed opposite to each other) to be fitted under the mushroom heads of the pins.

A further movement of carriages 45, 46 brings the pin supports to push against rollers 62, 63, so that the forks move towards the abutments 56, 57 and lock the pin heads against the abutments themselves. Thus the screen is firmly clamped to the bar 29 and the control device 22 can move the screen in a precise manner, as above said.

As shown in Fig. 2, a feeler element 64 may be also provided on the front bar 29, for detecting the exact position of screen 17 along the bar 29. To this end, the feeler element 64 runs on a worm screw moved by an electric motor 67 by means of a transmission gear 68. On actuation of motor 67 by the control device 22, the feeler element moves parallelly to the bar 29 until it touches an abutment present on the screen 17, as shown in Fig. 1. For detecting the exact instant at which contact occurs, the worm screw is supported for a small axial movement against the thrust of a spring 69. When contact occurs, the feeler element stops against the screen and the worm screw, as a result, moves against the thrust of the spring thereby operating an end-of-stroke microswitch 70 signalling the occurred contact

between the feeler element 64 and screen 17 to the control device 22. Thus the control device detects the exact stop position of the screen on the bar.

At this point it is apparent that the intended purposes have been achieved, a printing plant being provided which has a precision positioning mechanism for the screen relative to the belt, so as to avoid printing errors due to side skippings of the belt for example, and/or stop errors of the belt. The relatively light weight of the screen and screen supports will enable very quick positionings.

Obviously, the above description of an embodiment applying the innovatory principles of the present invention is given for purposes of illustration only and must not be considered as a limitation of the scope of the invention as herein claimed.

For example, the structure of the fixed frame and movable frame for screen fastening, as well as the mutual movement means, can be different from those shown. In addition, sensor 20 may be made as any type of known sensor enabling exact identification of the web position based on the references thereon. While the sensor has been shown as a single device for the sake of simplicity, generally it will consist of two separated sensors for detection of the transverse and longitudinal positions.

Finally, while the apparatus according to the invention can be provided to advantage with both transverse and longitudinal screen movements to compensate for positioning errors in both directions, should compensation for positioning errors be deemed necessary only in one direction, it would be possible to equip the apparatus with translation means for movement in that direction alone.

Claims

1. A printing plant for web material comprising a conveyor belt (11) for moving the web material (13) to at least one printing station (14), in turn comprising a printing screen (17) and printing means (18) for printing of the screen on the web material, characterized in that the screen is supported by power-driven means (23, 36, 37, 38) for moving it in the station in directions parallel to the belt surface, a control device (22) detecting a mutual shifting at least in one direction between the printing position on the web and the screen and driving the power-driven movement means (23) of the screen to reduce this shifting.
2. A plant according to claim 1, characterized in that the control device (22) detects shifting by means of a sensor (20) identifying reference marks (21) integral with the web.
3. A plant according to claim 1, characterized in that the power-driven means comprises first translation

means (23) for moving the screen in a direction transverse to the belt.

4. A plant according to claim 1, characterized in that the power-driven means comprises second translation means (36, 37, 38) for moving the screen in a direction longitudinally of the belt.
5. A plant according to claim 1, characterized in that the first translation means (23) comprises frame elements (23, 24) on which the screen is mounted, the frame elements (23, 24) being driven so as to slide along guides (32, 33, 43, 44) transverse to the web.
6. A plant according to claim 5, characterized in that the frame elements comprise a first (23) and a second (24) bars disposed on opposite sides of the screen (17) parallelly to the belt running direction.
7. A plant according to claim 6, characterized in that the first bar (23) and second bar (24) are supported at the ends by carriages (31, 31; 41, 42) for a powered movement along respective transverse guides (32, 33; 43, 44).
8. A plant according to claim 7, characterized in that the first bar (23) is connected to an electric motor (19) for its movement along the respective transverse guides (30, 31) and the second bar (24) is freely slidable along the respective transverse guides (41, 42).
9. A plant according to claim 2, characterized in that the reference marks (21) consist of a plurality of marks aligned along a side edge of the web (13).
10. A plant according to claim 9, characterized in that the marks (21) are rectangles having contrasted edges, one transverse position of the web detected by sensor (20) being defined by the position of a side edge of the rectangle, and one longitudinal position of the web being defined by the position of a leading or trailing edge of the rectangle with respect to the movement direction.
11. A plant according to claim 9, characterized in that the marks (21) are printed on a pressure-sensitive tape (73) applied to the belt along a side edge of the web.
12. A plant according to claims 4 and 7, characterized in that the first bar (23) is supported on the respective end carriages (30, 31) by interposition of joints (36, 37) sliding in a direction longitudinal to the belt to embody said power-driven longitudinal-translation means.

13. A plant according to claim 6, characterized in that the first bar (23) supports the screen (17) by interposition of fitting groups (25, 26) of the screen, which are power-driven to slide along the first bar for fitting of complementary coupling elements (74) 5 disposed on the screen.
14. A plant according to claim 13, characterized in that the fitting groups (25, 26) comprise fork-shaped elements (52, 53) directed in opposite directions, 10 parallelly to the sliding direction of the fitting groups for coupling with the complementary elements on the screen, embodied by pins (74) having mushroom-shaped heads.
15. A plant according to claim 13, characterized in that each fork-shaped element (52, 53) is movable by means of a linkage (50, 51) to clamp a mushroom-shaped head (74) between itself and a facing abutment (56, 57), said linkage being driven by a thrust 20 action of a portion of the screen (17) against one operating end (62, 63) of the linkage (50, 51) during sliding of the fitting group.
16. A plant according to claim 13, characterized in that the first bar (23) supports an electric motor (58) 25 having a pinion gear meshing with a pair of racks (60, 61) parallel to the bar, one rack (60) having one end fastened to a fitting group (25) and the other rack (61) having an opposite end fastened to the 30 other fitting group (26), so that on actuation of the motor (58) movement of the fitting groups (25, 26) takes place in a synchronized manner in opposite directions along the bar.
17. A plant according to claim 5, characterized in that detection means (64, 70) is mounted on the frame 35 elements, for detection of the longitudinal position of the screen (17) with respect to the frame elements.
18. A plant according to claim 2, characterized in that the sensors (20) are such positioned that they move 40 integrally with the screen.

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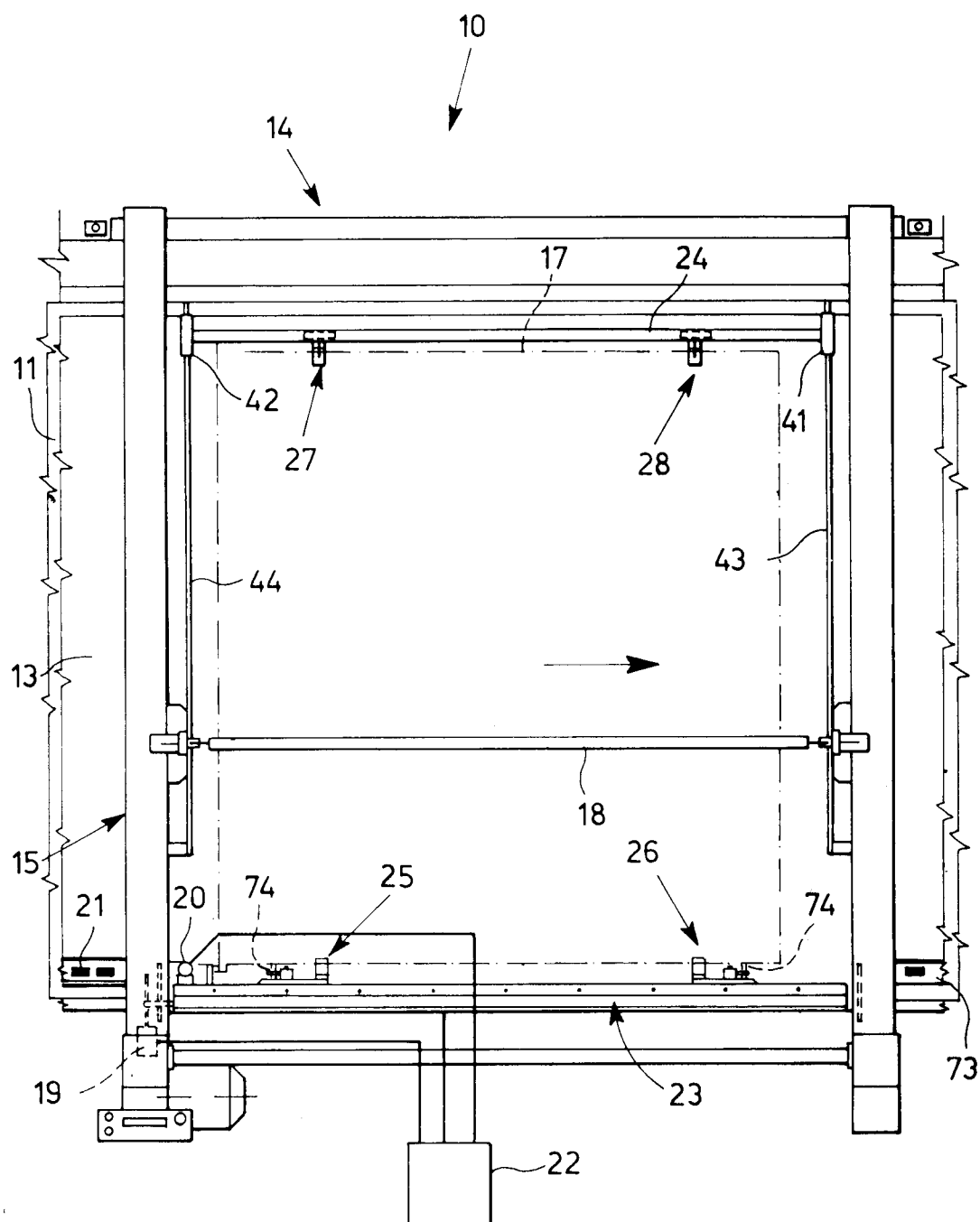


Fig. 1

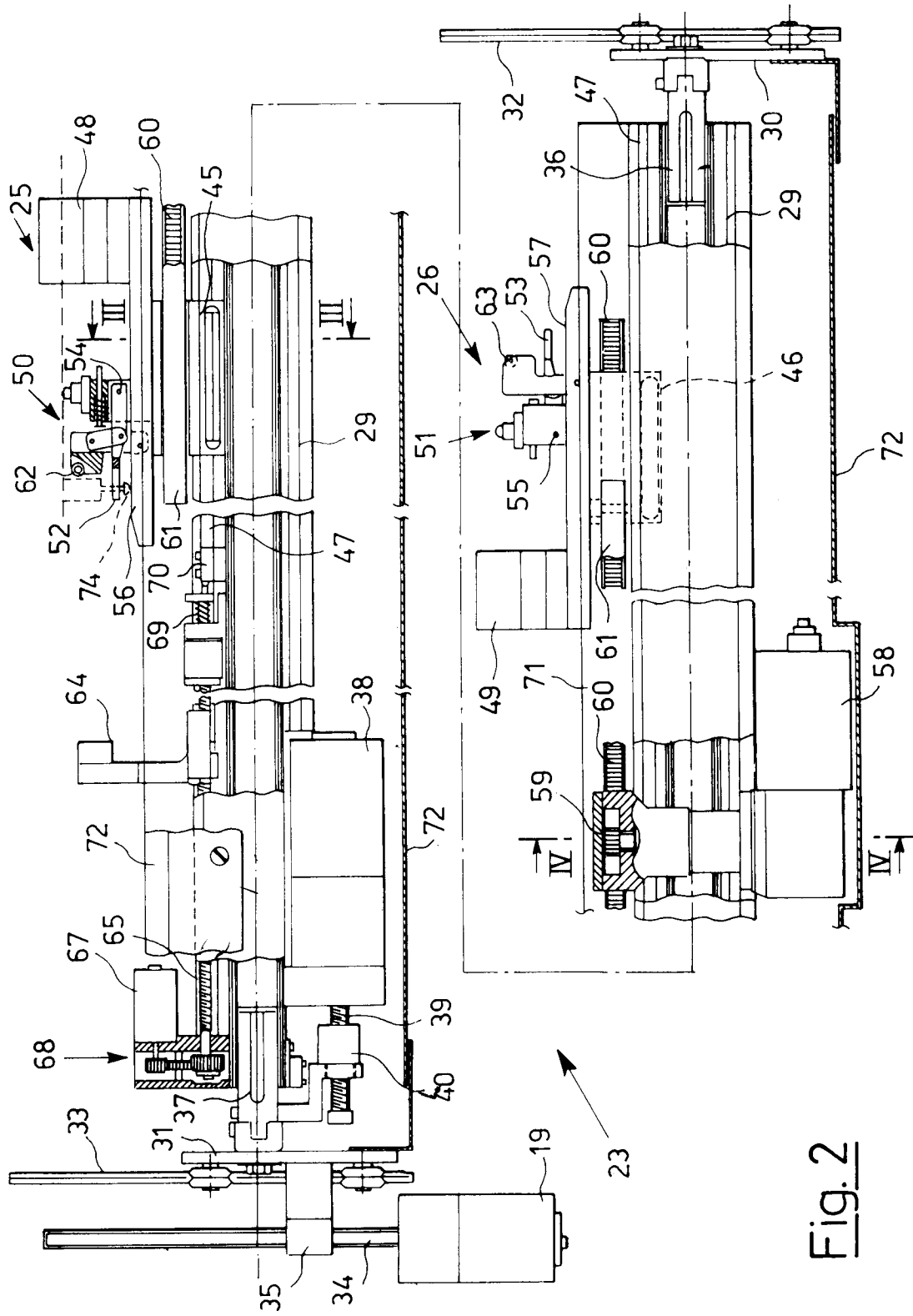
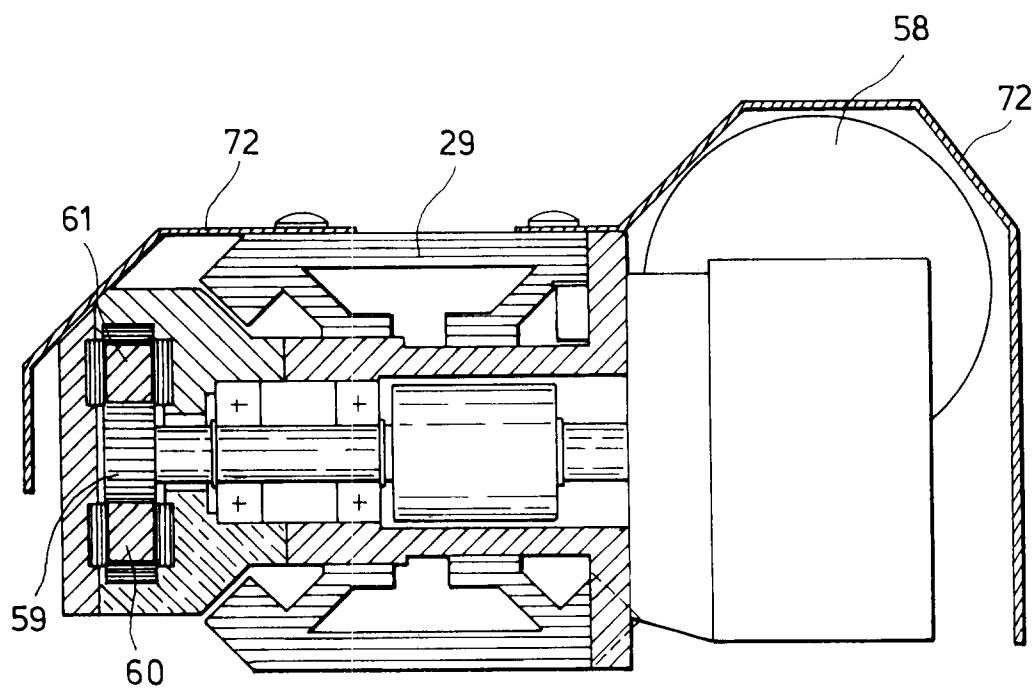
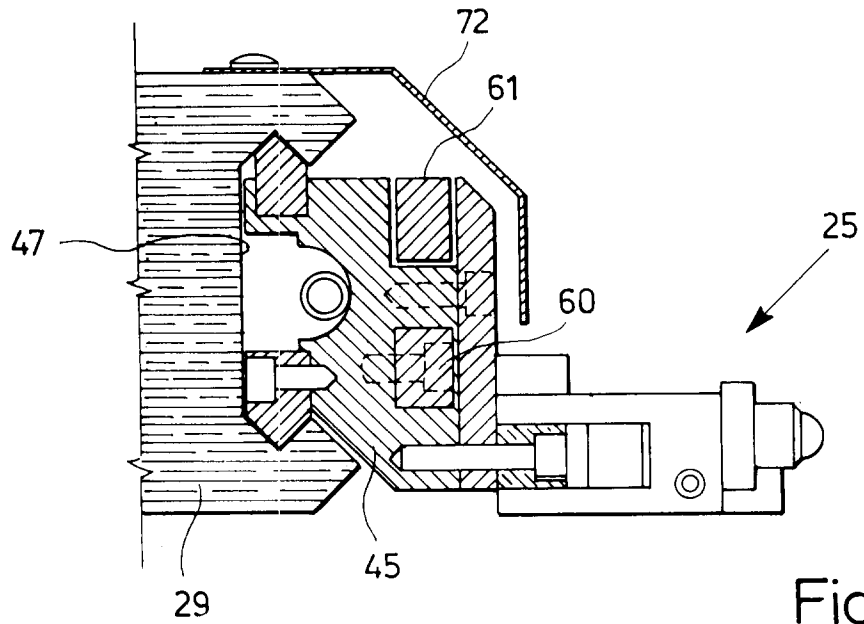


Fig. 2





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0294

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.6)
P,X	EP-A-0 687 560 (PROXIMA S.R.L.) * the whole document * ---	1-11	B41F15/10 B41F15/08
X	EP-A-0 474 268 (TOSHIN KOGYO CO. LTD) * the whole document * ---	1-11	
X	EP-A-0 488 092 (FIRMA GERHARD KLEMM MASCHINENFABRIK GMBH) * the whole document * ---	1-11	
X	EP-A-0 364 424 (SVECIA SILKSCREEN MASKINER AB) * the whole document * ---	1-11	
A	US-A-3 974 766 (P. ZIMMER) * the whole document * -----	1-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B41F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 31 May 1996	Examiner Kellner, F
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