



(11) **EP 2 476 558 A1**

(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**18.07.2012 Bulletin 2012/29**

(51) Int Cl.:  
**B41J 15/08<sup>(2006.01)</sup> B41J 3/407<sup>(2006.01)</sup>**  
**B41F 17/24<sup>(2006.01)</sup>**

(21) Application number: **10813377.8**

(86) International application number:  
**PCT/ES2010/070442**

(22) Date of filing: **30.06.2010**

(87) International publication number:  
**WO 2011/027012 (10.03.2011 Gazette 2011/10)**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR**

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(30) Priority: **07.09.2009 ES 200930657**

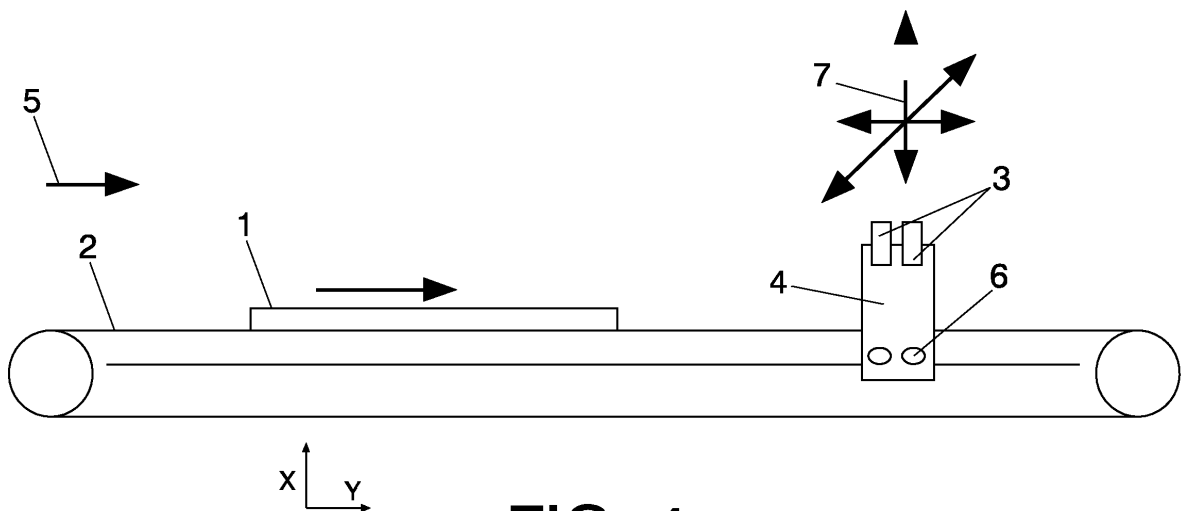
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(54) **PRINTER DEVICE USING INKJET TECHNOLOGY**

(57) The device has a conveyor belt (2) moving in a direction X, along which are the objects (1) to be printed, also having at least one support (4) for print heads (3). Each support (4) has independent scrolling means (6)

according to various directions, the movements of the belt (2) and each holder (4) being governed by a programmable controller; so that during printing the movements of these objects (1) and those heads (3) can be combined.



**FIG. 4**

**Description****OBJECT OF THE INVENTION**

[0001] The present invention, as stated in the title of this specification, refers to a printing device using "Inkjet" technology.

[0002] The main aim of the invention is to provide a printing device, especially applicable to the decoration of ceramic tiles without ruling out other applications, in which the failure of one or more of the print head nozzles does not cause major defects in the corresponding decoration.

[0003] In order to get this purpose, the movements of heads and/or conveyor belt and objects to be printed are combined, so that the movements required in the print heads are not of great extent and so as to unite the advantages of high productivity benefits of printing machines with stationary print heads, with high qualities provided by printers with moving print heads such as "plotter", avoiding the respective drawbacks of large defects in the decorations because of failures in the nozzles and low productivity due to the need of manually feeding the object to be printed;

[0004] The invention combines the mobility of a conveyor belt with that of the at least one print head support that acts as a multi-axis Cartesian robot, these movements being governed by a programmable controller which can also be responsible for managing the execution of the corresponding printing.

**BACKGROUND OF THE INVENTION**

[0005] They are known in the market a variety of printers with inkjet technology having various functions and application fields.

[0006] Within the category of wide-format printers, there are known the "plotter"-type printers, in which the object to be decorated or printed (paper, vinyl, etc.) is driven through an area in which the print heads are moved, which by oscillating movements perpendicular to the forward motion of the object to be printed and with small sequential passes of such object, high quality images, suitable for decorating billboards, posters, tiles and others are produced. However, such printers have drawbacks related to low productivity, needing to be fed with the objects to be decorated, usually by hand and costly in terms of time spent.

[0007] On the other hand, there are known printers which print heads remain stationary, said print heads being fixed and distributed so as to cover the width of the object to be decorated, in this case, only the object is moved. These printers are so-called "single-pass" printers, being an example of this type of printers the patent WO2000021760A1 / EP1038689B1 / ES2219068T3 stated as "DEVICE FOR DECORATING CERAMIC TILES". These "single-pass"-type printer have disadvantages relative to the print heads nozzles, which by being

fixed do not allow the printing qualities of "plotter"-type printers outlined above, arising the further drawback that a failure in the nozzle or group of nozzles causes major defects in the decoration of the object, such as stripes, bands or other, which could be minimized by not only moving the object to be decorated but also moving the print heads.

**DESCRIPTION OF THE INVENTION**

[0008] To achieve the objectives and avoid the drawbacks mentioned in previous sections, the invention consists of a printing device using inkjet technology having print heads, each one equipped with various nozzles, and used in printings (so-called "single-pass") wherein the print heads are stationary and the object to be printed is moved beneath them.

[0009] Innovatively, according to the invention, the device itself has a conveyor belt capable of moving in a direction X and additionally in a direction Y perpendicular thereto, placing in such belt the objects to be printed; said device further having at least one head support on which several of the mentioned print heads are mounted; each support having independent scrolling means, at least in a direction parallel to the referred direction X and according to one or more directions different of the aforementioned direction parallel to the direction X; the movements of the belt and of each support being governed by using a programmable controller, so that the impression being performed can combine the movements of the objects to be printed and the movements of print heads in all of these directions.

[0010] According to the preferred embodiment of the invention, the said print heads are distributed in the corresponding support so that they are oriented along perpendicular and oblique directions with respect to the main plane of the conveyor belt, thus allowing a simultaneous printing throughout the width of the object to be printed.

[0011] On the other hand, in the preferred embodiment of the invention, the displacements of the support in that direction parallel to the direction X are between a standby position and a limit switch position set in a portion of the conveyor belt length.

[0012] The mentioned one or more directions different to the direction parallel to the direction X, in the displacements of the print head support may include at least one U transverse direction with respect to the mentioned direction X that facilitates the interlaced print of the nozzle in a single head, as well as the interlaced print of the nozzle in different heads.

[0013] In the preferred embodiment of the invention, in addition to those parallel and transverse directions with respect to the direction X of the belt, the print head support has a vertical scroll direction that allows adjusting the height of the printing and the access to maintenance stations; so that said support can act as a three-axis Cartesian robot.

[0014] Moreover, in the preferred embodiment of the

invention, the aforementioned programmable controller manages the movements of the movable elements of the belt and supports, so that such movements are executed simultaneously, sequentially or in a combination of both, to either directions (forward/reverse) of each scroll direction existing in the scrollable belt and support elements; allowing the printing during both motion and stop at one, several or all of the scrollable elements.

**[0015]** Furthermore, in such preferred embodiment of the invention, the aforementioned programmable controller that governs the movements of the belt and supports of the print heads is further responsible for managing the print run, commanding the electronic signals from the nozzles of the print heads.

**[0016]** According to various embodiments of the invention, the number of supports for print heads is sized based on the number of inks to be used in the corresponding printing.

**[0017]** With the structure described above, the device of the invention has advantages concerning to which gives movement to the print head support used in fixed head printings, and/or to the conveyor belt. The movement of the supports can be combined with the movement of the object to be decorated, whereby the benefits of high productivity of "single-pass" printers are brought together with the benefits of high quality printers such as "plotter", although the requirement of the head movements in the device of the invention in the case do not need to have such extent as in "plotter" printers, since the width of the object to be decorated is covered by the special distribution of print heads in each print head support.

**[0018]** Using the device of the invention allows the use of the functionalities of a "plotter" or a "single-pass" printer or a combination of both, thereby increasing the flexibility of printings according to the required productivity and the quality.

**[0019]** In the preferred embodiment of the invention, the device thereof is capable of simultaneously working with the belt running (non-stop) and performing the decoration of the object by consecutive passes of the print heads with some interlacing, by the oscillating moving of the head supports in directions parallel to the movement of the conveyor belt and perpendicular thereto.

**[0020]** In another preferred embodiment of the invention, the device thereof is capable of simultaneously working with the belt running (non-stop) and performing the decoration of the object by consecutive passes of the print head with an interlaced hit, by the oscillating movement of the conveyor belt in directions perpendicular to those of the movement of the object to be decorated.

**[0021]** Moreover, the device of the invention behaves like a "single-pass" machine in which the print head supports, and therefore also such heads, have complete mobility in three axes, two of them being parallel to placement plane of the object to be printed and the other perpendicular to that plane in order to provide, in the case of such perpendicular axis, the benefits of allowing ad-

justments in the printing height and facilitating functionalities to a maintenance station.

**[0022]** Next, in order to provide a better understanding of this specification, and being an integral part thereof, a series of figures in which the object of the invention has been represented with an illustrative and not limitative manner are attached.

### **BRIEF DESCRIPTION OF THE FIGURES**

#### **[0023]**

Figure 1.- Shows a top plan and schematic view of a printing device using inkjet technology made according to the present invention.

Figure 2.- Shows a view similar to that of the figure 1 above, showing the device's capacity to decorate an object by moving a print head support over such object.

Figure 3.- It is a view similar to that of the previous figure 2 which in this case shows the device's capacity to decorate the object referred when moving this on a conveyor belt under the mentioned print head support.

Figure 4.- It is a profile and schematic view of the device of the above three figures, which represents different directions of movement in the conveyor belt and the print head support of the device.

Figure 5.- It is a front view that in this case shows the distinctive capacity to regulate the printing height of the aforementioned print head support above the conveyor belt (position from 5a to 5b) and the movement of the belt in direction X perpendicular to the forward direction of the object to be decorated (5c).

Figure 6.- It is a perspective view, which in this case shows the capacity of the device for the decoration by the combined action of the displacement of the aforementioned print supports in a direction X, parallel to the forward motion of the object to be decorated with a certain displacement of the printing belt in a direction Y perpendicular thereto.

Figure 7.- It is a perspective view, which in this case shows the device's capacity to introduce the material (7a), decoration by combined action of the displacement of the aforementioned head supports in a direction X parallel to the forward motion of the object to be decorated (7b), and the output of the decorated object (7c).

### **DESCRIPTION OF AN EMBODIMENT OF THE INVENTION**

**[0024]** Below is a description of an example of the invention with reference to the numbering adopted in the figures.

**[0025]** Thus, the printing device using "Inkjet" technology in this example of the invention has a conveyor belt 2, in which the object to be printed 1 is located, as well

as a support 4 on which various print heads 3 are distributed, as can be seen in all the figures.

**[0026]** Heads 3 are placed on the support 4 so that they are distributed perpendicularly and obliquely to the path 5 of the conveyor belt 2 in order to ease decorations throughout the width of the object 1 to be decorated 1.

**[0027]** The support 4 has its own scrolling means 6, such as shown in Figure 4, which allow moving the support in a direction parallel to that of the referred path 5 from a standby position 8 to a limit switch position 9 such as shown in figure 2.

**[0028]** Furthermore, these independent scrolling means 6 of the support 4 facilitates its horizontal movement, but in a direction perpendicular to the referred path 5 of the belt 2, allowing the interlaced print of the nozzles of the same print head or different injection heads, especially between adjacent print heads.

**[0029]** Alternatively, the conveyor belt 2 has means to facilitate its horizontal movement in a direction Y perpendicular to the referred path 5 of the objects to be decorated 1, allowing the interlaced print of the nozzles of the same print head or different injection heads, especially between adjacent print heads.

**[0030]** In addition, the scrolling means 6 of the support 4 are applied to a vertical axis perpendicular to the former ones, thus allowing the adjustment of the printing height and the access to maintenance stations, having referred as 7 all these possible paths in the displacement of the support 4 determining a movement in such support 4 similar to that of a three-axis Cartesian robot.

**[0031]** Print heads 3 may act decorating the object 1 both by being the conveyor belt 2 moving and the position of the support 4 fixed, and by being both in motion or by being the belt 2 stopped and the support 4 in motion. Furthermore, these movements of the belt 2 and support 4 may be simultaneously or sequentially. Furthermore, these movements may be in each direction from two directions, i.e. forward and reverse.

**[0032]** All these movements of the belt 2 and support 4 are managed by a programmable controller that also manages the execution of printing commanding the electronic signals associated with the nozzles of each print head 3.

**[0033]** Although this example shows a single support 4, other embodiments has a plurality of supports 4, number of which is defined depending on the number of inks used in certain decoration; all the movements of all the supports 4 and the conveyor belt 2 being synchronized by the referred programmable controller.

## Claims

**1. Printing device using inkjet technology**, having print heads (3), each of them being provided with various nozzles, used in printings (so-called "single-pass") wherein the print heads are stationary and the object (1) to be printed moves beneath thereof;

**characterized in that** it has a conveyor belt (2) with a capacity to move in a direction X; the objects (1) to be printed being on said belt; the device also having at least one head support (4) in which a number of the referred print heads (3) are mounted; each support (4) presenting independent scrolling means (6) at least in a direction parallel to the referred direction X and in one or more directions different to that referred direction parallel to the direction X; the movements of the belt (2) and of each support (4) being governed by a programmable controller, so that the print being performed can combine movements of the objects (1) to be printed and movements of the print heads (3) in all these directions.

**2. Printing device using inkjet technology** according to claim 1, **characterized in that** the heads (3) are distributed in the support (4) so that they are oriented along directions perpendicular and oblique to the main plane of the conveyor belt (2), thus allowing the simultaneous printing throughout the width of the object (1) to be printed.

**3. Printing device using inkjet technology** according to claim 1 or 2, **characterized in that** the displacements of the support (4) in that direction parallel to the direction X are between a standby position (8) and a limit switch position (9) established in a portion of the length of the conveyor belt (2).

**4. Printing device using inkjet technology** according to any one of the preceding claims, **characterized in that** the referred motion range of the conveyor belt along at least one direction X, includes the possibility of moving thereof in one direction Y perpendicular to said direction X, which facilitates the interlaced print of nozzles of a single head (3) and the interlaced print of nozzles of different print heads (3).

**5. Printing device using inkjet technology** according to any of the preceding claims, **characterized in that** the said one or more directions different to the direction parallel to the direction X, in the movements of the support (4), consist of at least one direction transversal with respect to said direction X that facilitates interlaced print of nozzles of a single head (3) and the interlaced print of nozzles of different print heads (3).

**6. Printing device using inkjet technology** according to claim 5, **characterized in that** in addition to those parallel and transverse directions with respect to the direction X of the band (2), the support (4) has a direction of vertical displacement that allows adjusting the printing height and the access to maintenance stations; so that said support (4) can act as a three-axis Cartesian robot.

7. **Printing device using inkjet technology** according to any one of the preceding claims, **characterized in that** said programmable controller manages the movements of the scrollable elements of the belt (2) and supports (4) so that said movements are executed simultaneously, sequentially, or a combination of both, for any of the two directions (forward/reverse) of each scroll direction existing in the scrollable elements of the belt (2) and supports (4); enabling the printing during both motion and stop of one, several or all of the scrollable elements.

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8. **Printing device using inkjet technology** according to any one of the preceding claims, **characterized in that** the programmable controller that governs the movements the band (2) and support (4) is also responsible for managing the print run commanding the electronic signals of the nozzles of the print heads (3).

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9. **Printing device using inkjet technology** according to any one of the preceding claims, **characterized in that** the number of print head supports (4) is sized based on the number of inks for use in the corresponding printing.

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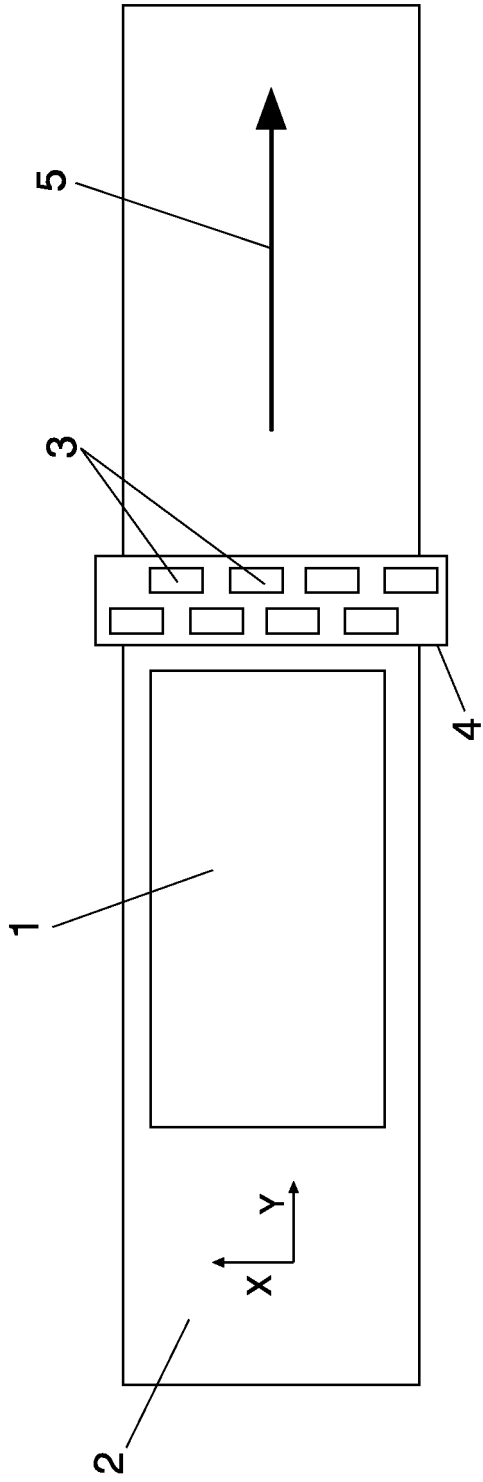


FIG. 1

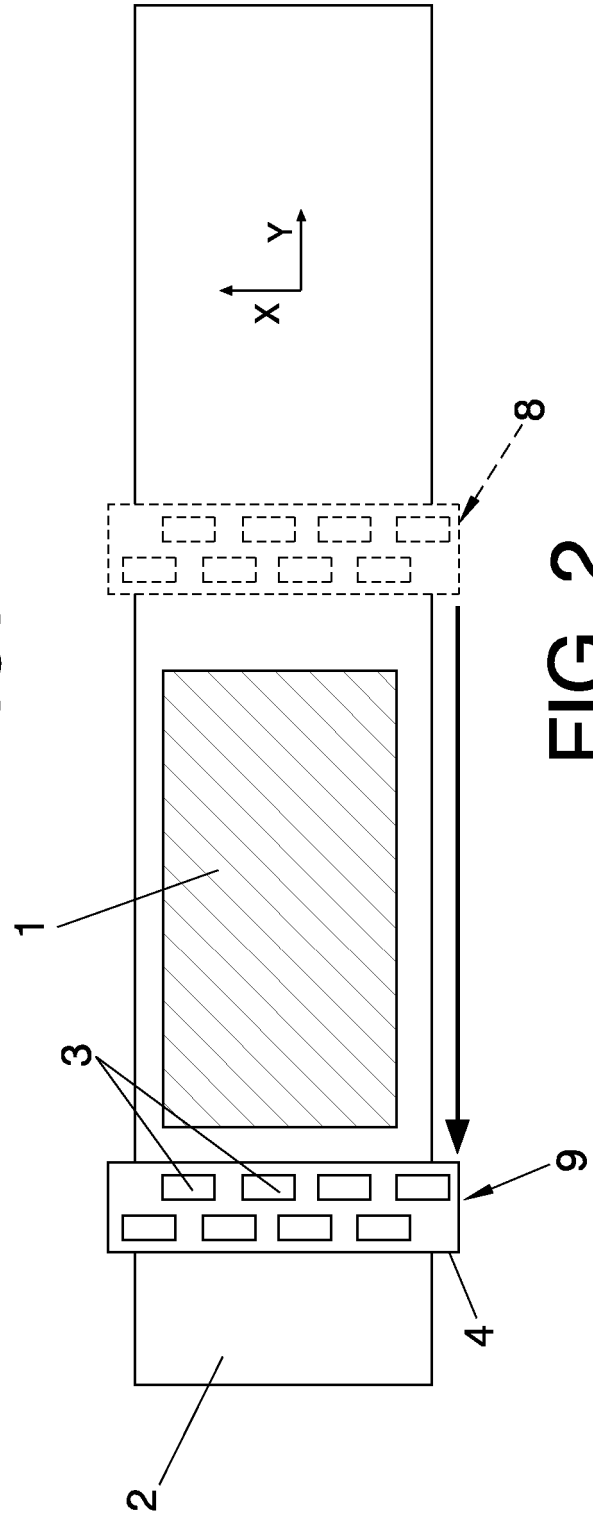


FIG. 2

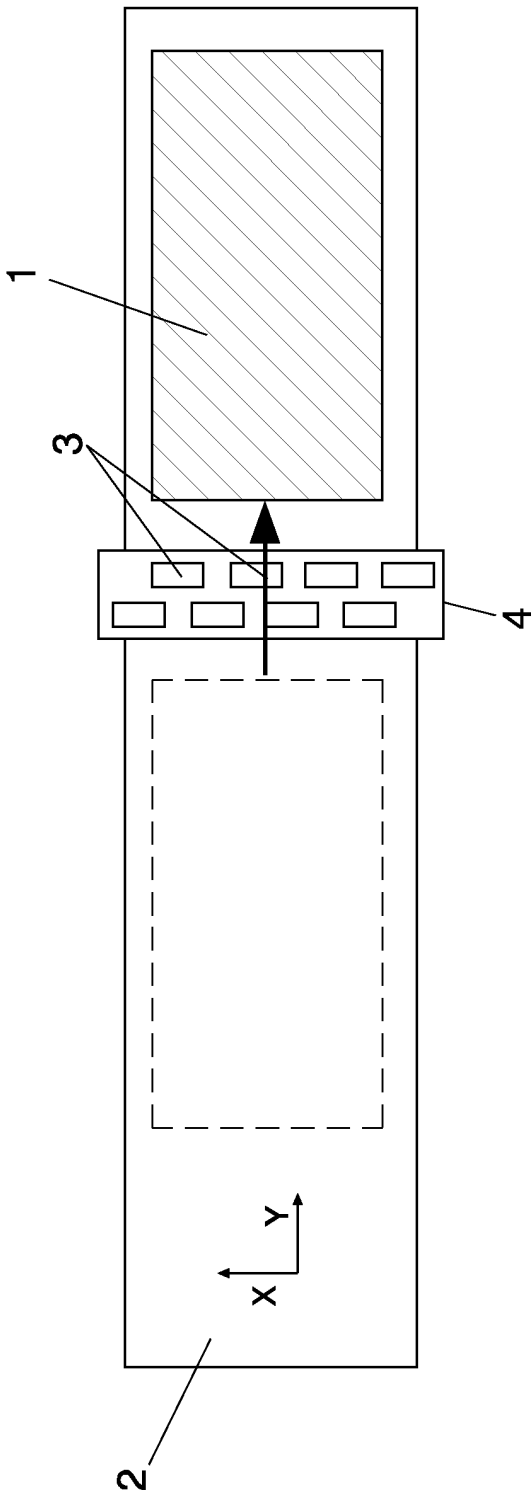


FIG. 3

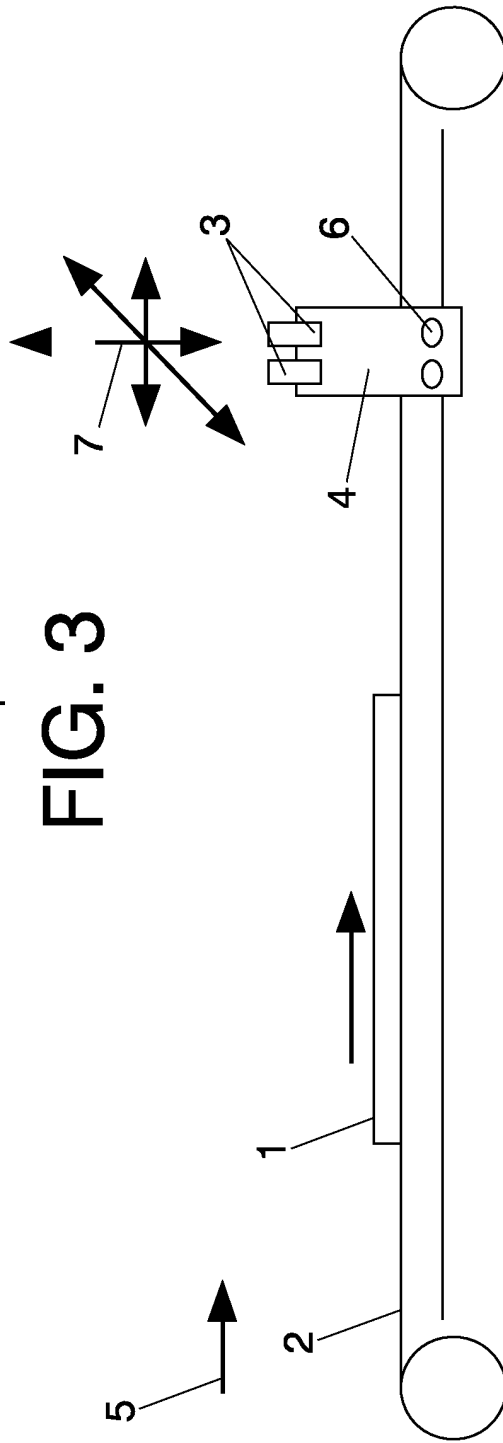


FIG. 4

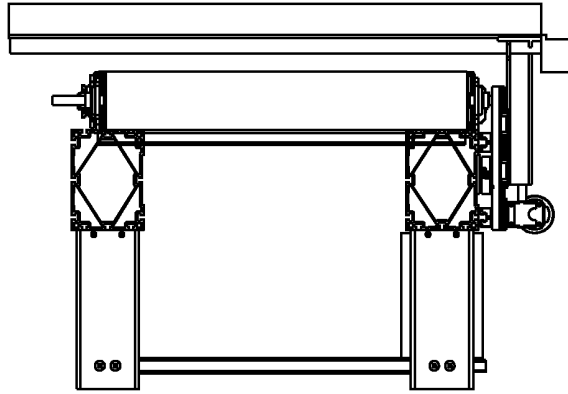


FIG. 5a

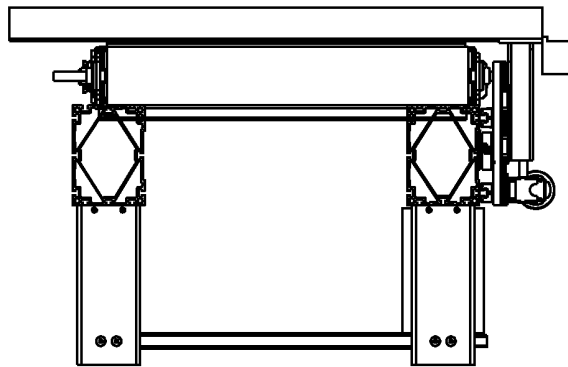


FIG. 5b

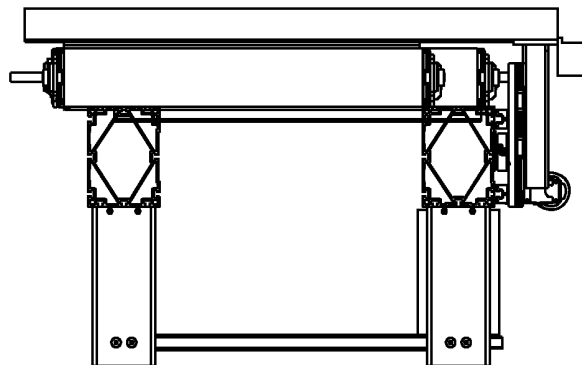


FIG. 5c

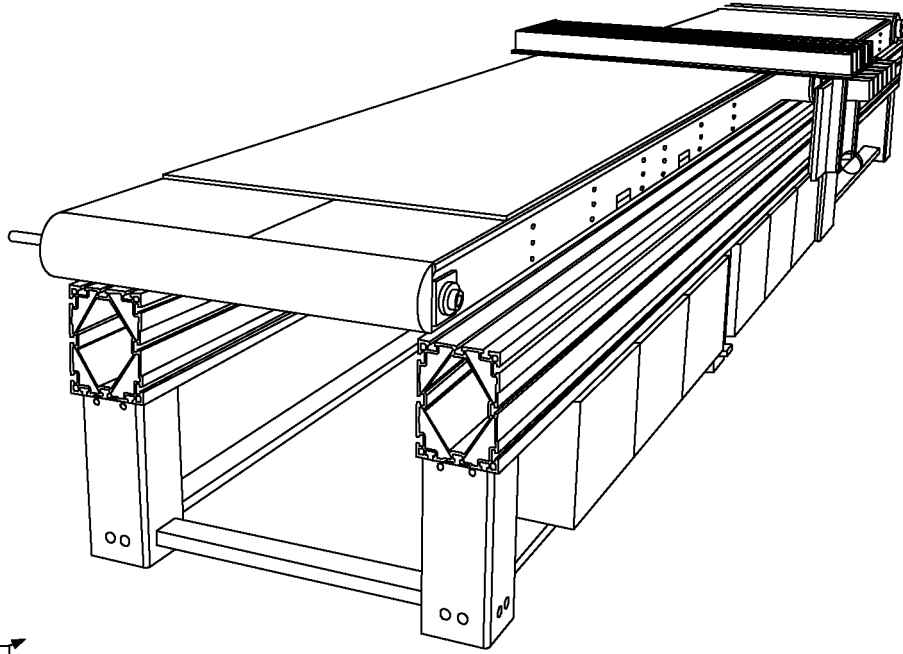


FIG. 6a

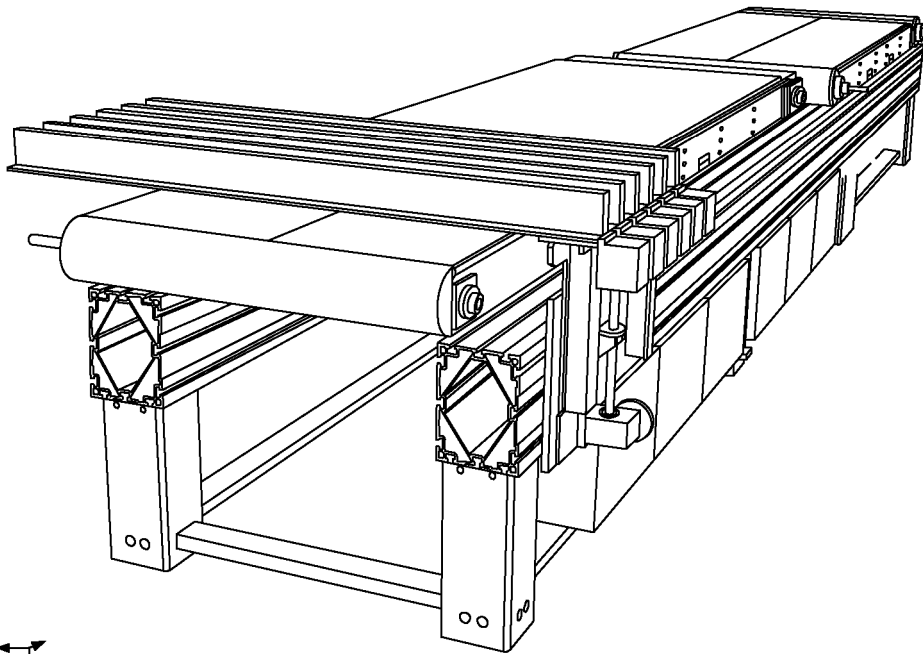


FIG. 6b

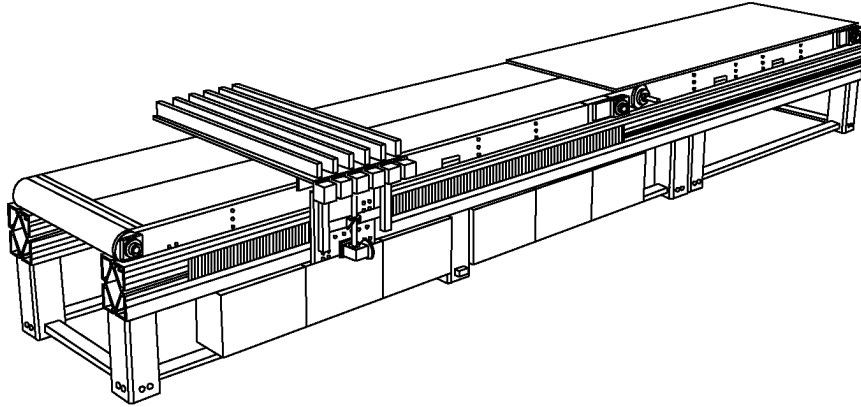


FIG. 7a

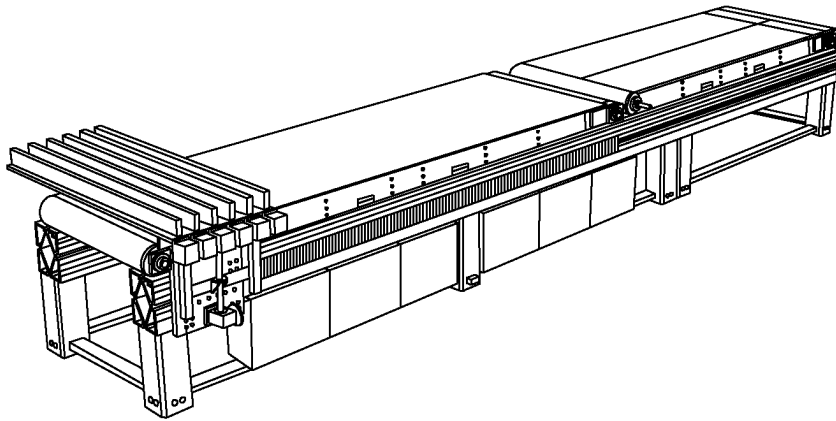


FIG. 7b

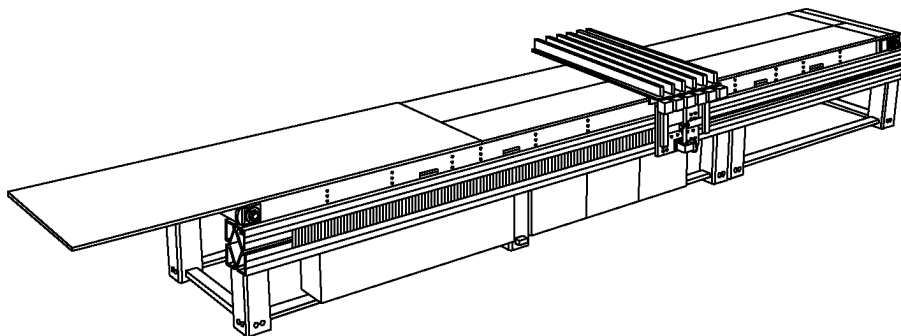


FIG. 7c

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES 2010/070442

A. CLASSIFICATION OF SUBJECT MATTER		
see extra sheet		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B41J+, B41F+		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) INVENES,EPODOC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0211987 A1 (AGFA GEVAERT AG ; LORENZ BERNHARD ; MUELLER PETER ;) 14.02.2002, page 9, line 11 - page 11, line 18; figures.	1-9
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
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"P" document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family
Date of the actual completion of the international search 05.October.2010 (05.10.2010)	Date of mailing of the international search report (14/10/2010)	
Name and mailing address of the ISA/ O.E.P.M. Paseo de la Castellana, 75 28071 Madrid, España. Facsimile No. 34 91 3495304	Authorized officer G. Villarroel Alvaro Telephone No. +34 91 349 85 71	

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International application No.

PCT/ES 2010/070442

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES 2010/070442

CLASSIFICATION OF SUBJECT MATTER

**B41J 15/08** (2006.01)

**B41J 3/407** (2006.01)

**B41F 17/24** (2006.01)

**REFERENCES CITED IN THE DESCRIPTION**

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