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(54) Arrangement for guiding a printer carriage along a guiding means

(57) The invention relates to an arrangement for guiding a printer carriage (4) along a guiding means (3,7,8), wherein said printer carriage (4) comprises multiple roller bearings (5,9), wherein at least a part of the amount of roller bearings are in rolling contact with at

least one running surface (3,7,8) making part of said guiding means (3,7,8). The invention also relates to a printer carriage for use in such an arrangement. The invention further relates to guiding means for use in such an arrangement. Moreover, the invention relates to an inkjet printer provided with such an arrangement.

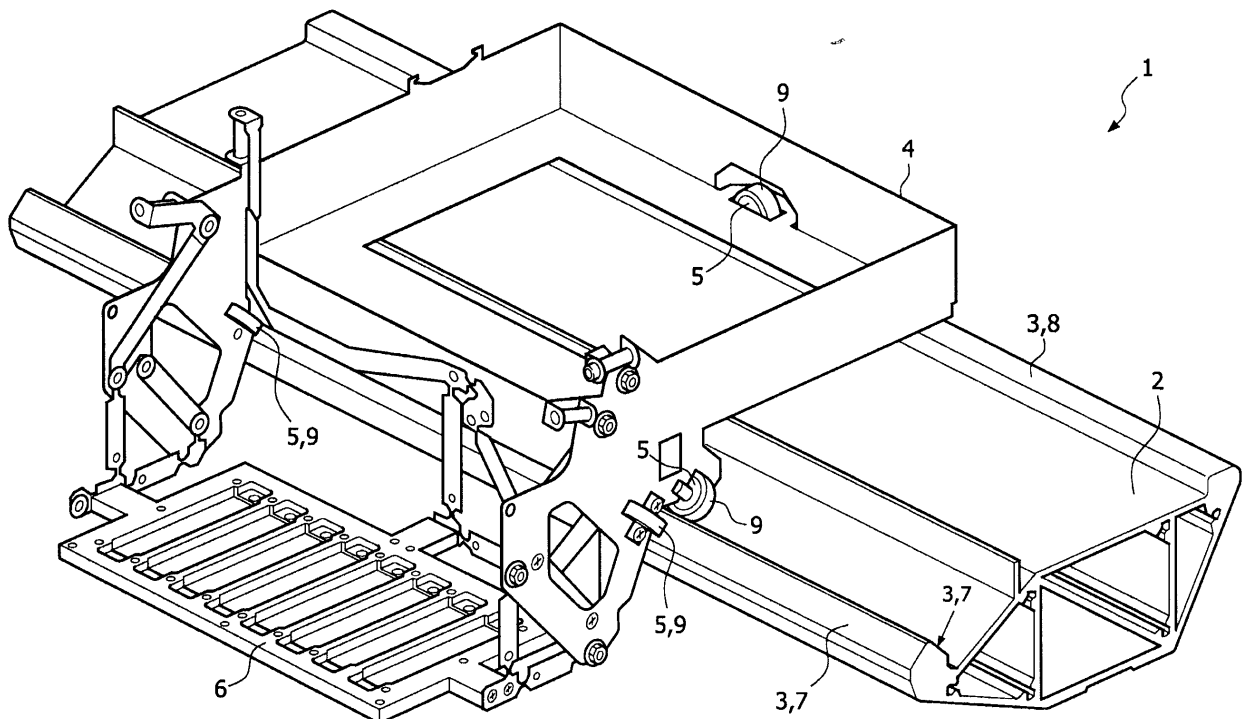


FIG. 1

## Description

**[0001]** The invention relates to an arrangement for guiding a printer carriage along a guiding means, wherein said printer carriage comprises multiple roller bearings, wherein at least a part of the amount of roller bearings are in rolling contact with at least one running surface making part of said guiding means. The invention also relates to a printer carriage for use in such an arrangement. The invention further relates to guiding means for use in such an arrangement. Moreover, the invention relates to an inkjet printer provided with such an arrangement.

**[0002]** An arrangement of this kind is known from US patent number US 5,332,321. This arrangement comprises a set of two substantially parallel smooth guide rods made of steel on which a printer carriage made of moulded plastic is mounted. The printer carriage is adapted to carry various inkjet print heads. The printer carriage comprises multiple C-shaped bushings which are in sliding contact with said guide rods. The bushings thereby enclose the rods partially to realise a stable moving contact between the printer carriage and the guide rods. Since carriage bushing systems require high tolerance and low friction design of the arrangement, and in particular of the guide rods and the corresponding bushings, is extremely critical. Although the known arrangement provides a (relatively complex) solution for reducing friction during movement of the carriage, it is nevertheless common that friction between the bushings and the rods will still occur during movement of the carriage along the guide rods. Recently, an arrangement for guiding a printer carriage along a guiding means is known, wherein the printer carriage is provided with multiple roller bearings (instead of slide bearings) made of steel, and wherein the guiding means are formed by an extrusion profile made of aluminium. However, it has been found that during operational use the arrangement is subjected again to considerable wear in particular due to the steel-on-aluminium interaction, thereby (still) requiring relatively intensive maintenance to prevent an undesired change of the critical alignment between the print heads mounted on the printer carriage and a print medium, in particular a sheet of paper, which would lead to a significantly reduced print accuracy and hence a strongly reduced print quality. Furthermore, the considerable wear may also lead to hindered movement of the printer carriage along the extrusion profile.

**[0003]** It is an object of the invention to provide an improved arrangement for guiding a printer carriage along a guiding means, with which frictional wear can be reduced further.

**[0004]** The object of the invention can be achieved by providing an arrangement according to the preamble, characterised in that the roller bearings and/or the running surfaces are provided with a running member substantially made of plastic. It has been found that by providing at least one of the roller bearings on one side and

the running surfaces of the guiding means on the other side with running members substantially made of plastic, a metal-on-metal contact can be eliminated, thereby significantly reducing wear of the arrangement, in particular of the roller bearings and the guiding means, during operational use. The running members may be formed by separate member applied around and/or to the roller bearings respectively the guiding means, and can even be formed by a plastic coating. However, it may be clear that the roller bearings and/or the guiding means per sé may also be made of plastic, wherein the running members are integral part of the roller bearings respectively the guiding means. The significant reduction of wear of the arrangement due to the generated plastic-on-metal or plastic-on-plastic contact leads to a relatively low maintenance and durable arrangement, wherein the alignment of the printer carriage with respect to a print medium, such as paper, can be maintained at a constant critical level for a relatively long time. An auxiliary advantage is that less grinding dust is produced during operational use, resulting in less fouling of the arrangement in a period of time. Furthermore, an additional advantage is that the application of the plastic running member commonly also leads to a considerable noise reduction during operational use, resulting in a relatively silent operating arrangement. The engagement of the roller bearings on the running surfaces can be optimised as to both achieve a stable movement of the printer carriage along the guiding means and to minimize the mutual friction between these components. Thus, the invention provides a relatively advantageous arrangement for an inkjet printer which is structurally relatively simple, maintenance-friendly, and therefore durable.

**[0005]** In a preferred embodiment said guiding means is formed substantially integrally of a single piece. The guiding means thereby functions as a solid base on which the printer carriage stably rests. In a more preferred embodiment said guiding means are formed by at least one extrusion profile. An extrusion profile can be manufactured relatively easily and relatively cheap, while an extrusion profile is commonly very suitable to carry the printer carriage movable with respect to the extrusion profile. Common raw materials for the manufacturing of suitable extrusion profiles are metals and polymers. In case of for instance aluminium, the aluminium profile may be subjected to an anodisation or hard anodisation treatment to increase resistance to wear. It is however also conceivable to apply separate strips, foils or other material layers made of metal, in particular steel, or plastic onto said single piece to optimise the running surface of the guiding means for guiding the printer carriage.

**[0006]** It is mentioned above that the roller bearings on one side and/or the running surfaces of the guiding means on the other side are provided with running members substantially made of plastic with the main purpose to reduce wear, due to friction between metal components. To this end, the roller bearings can each be pro-

vided with the plastic running member, which may be integral part of the roller bearings. It is also imaginable to apply plastic running surfaces making part of the guiding means to achieve the desired reduction of wear of the arrangement. In a particular preferred embodiment, both the roller bearings and the running surfaces are provided with a running member substantially made of plastic to realise a plastic-on-plastic contact to further the reduce wear, and eventually noise production, of the arrangement during operational use.

**[0007]** The guiding means can be of arbitrary shape and geometry. However, preferably said guiding means has a non-planar upper surface thereby defining different running surfaces. The non-planar upper surface can thereby be optimised for interaction with the printer carriage. Said running surfaces defined by the non-planar upper surface can be oriented in substantially parallel directions, wherein for example two neighbouring running surfaces can be separated by one or multiple protruding surface members. In a preferred embodiment every running surface defines a plane extending in a direction, wherein at least two defined planes mutually enclose an angle, preferable an (acute) angle which is situated substantially between 70° and 100°, more preferably between 80° and 90°. In this manner movement of the printer carriage along the guiding means can be stabilised and (external) shocks can be absorbed in an improved manner. This stabilisation is mainly directed to prevent overturning of the printer carriage with respect to the guiding means during operational use due to the commonly relatively heavy load of the print heads mounted on the printer carriage commonly resulting in a certain tilting moment of the printer carriage. In an alternative preferred embodiment at least one running surface is positioned in a recess of the non-planar upper surface of the guiding means. In this manner the roller bearings, or at least one roller bearing, can be locked laterally in said recess, resulting in an improved stabilisation of the printer carriage with respect to the guiding means during operational use of the arrangement according to the invention.

**[0008]** Commonly, the printer carriage is provided with a counterweight and/or is loaded at a portion opposite to the print heads installed into said printer carriage in order to realise an optimal positioning of the centre of gravity of the printer carriage. The print heads are thereby commonly positioned at a lower height level than the counterweight to facilitate the printing process or at least certain printing processes. For this reason at least a part of the amount of running surfaces are preferably positioned at different height levels to optimise resting of the printer carriage on the guiding means. Commonly, it is advantageous to position one or multiple running surfaces near the print heads mounted on the printer carriage to optimise the stabilisation of the printer carriage resting on the guiding means.

**[0009]** Said roller bearings can be formed by ball bearings to minimize friction between the printer carriage and the guiding means during mutual movement of these

components. However, preferably, said roller bearings are formed by wheels, wherein each wheel is rotatable around a wheel axle. Preferably, every wheel is provided with a protective circumferential running member made of plastic. In this way the printer carriage can be moved relatively smoothly along the guiding means in a relatively silent manner as mentioned above.

**[0010]** In a preferred embodiment a low-wear plastic is used to reduce the wear of the arrangement, in particular during use. Preferably, running members are substantially made of polymers, in particular elastomeric polymers. Suitable low-wear elastomeric polymers are for example polymers chosen out of the polymeric groups: poly-ether-ether-ketones (PEEK), nylons, poly-imides, and poly-urethanes.

**[0011]** The invention also relates to a printer carriage for use in such an arrangement.

**[0012]** The invention further relates to guiding means for use in such an arrangement.

**[0013]** The invention moreover relates to an inkjet printer provided with such an arrangement. The inkjet printer thereby comprises at least one print head (releasably) fixed on the aforementioned printer carriage, which is in rolling contact with - preferably supporting - guiding means. The printer further comprises movement means for moving the printer carriage along the guiding means in a main scanning direction on one side and for moving a receiving material in a sub-scanning direction substantially perpendicularly to the main scanning direction along the printer carriage. Alternatively, the movement means are adapted for moving the printer carriage both in the main scanning direction and in the sub-scanning direction. In this latter embodiment, the receiving material is preferably positioned stationary in the inkjet printer.

**[0014]** The invention can further be illustrated by way of the following non-limitative embodiments, wherein:

figure 1 shows a perspective view of an arrangement according to the invention, and  
figure 2 shows a perspective view of an inkjet printer provided with another arrangement according to the invention.

#### Figure 1

**[0015]** Figure 1 shows a perspective view of an arrangement 1 according to the invention. The arrangement 1 comprises an extrusion profile 2 made of aluminium on which multiple elongated running surfaces 3 are applied. The arrangement 1 also comprises a printer carriage 4 which rests upon said extrusion profile 2, and which carriage 4 is movable with respect to said profile 2. The printer carriage 4 is provided with multiple rotatable wheels 5 which are in rolling contact with the underlying running surfaces 3 of the extrusion profile 2. By means of the wheels 5 the printer carriage 4 can be displaced by rolling along the running surfaces 3 relatively smoothly. The printer carriage 4 is substantially made of

sheet metal, in particularly steel, or eventually plastic and is adapted to carry multiple ink cartridges (not shown) which can be releasably coupled with a platform 6 of said printer carriage 4. In the shown embodiment the running surfaces 3 are slightly oversized with respect to the width of the wheels 5, and is therefore adapted to handle and compensate an eventual difference in expansion between the carriage 4 and the profile 2. As shown in figure 1 two pairs of wheels 5 respectively rest on two front running surfaces 7, while a single wheel 5 rests on a back running surface 8. The front running surfaces 7 are positioned near the platform 6 for the print heads to optimise the stabilisation of the printer carriage 4, in particular during movement of the printer carriage 4 along the profile 2. The single wheel 5 has a certain (lateral) tolerance with respect to the horizontal back running surface 8. The front running surfaces 7 are positioned at substantially equal heights, whilst the back running surface 8 is positioned at a higher height level compared to the front running surfaces 7. The orientation of all running surfaces 7, 8 mutually differs in the arrangement 1 as shown in this figure. The planes defined by the front running surfaces 7 mutually enclose in this illustrative embodiment an angle of substantially 90°, wherein each of these planes encloses an angle of substantially 45° with a vertical oriented plane. In addition to this it is noted that the back running surface 8 defines a substantially horizontal plane. By varying the orientations of the running surfaces 7, 8 the mutual interaction between the extrusion profile 2 and the printer carriage 4 can be improved and stabilised, in particular during movement of the printer carriage 4, in a satisfying manner. To reduce wear between the wheels 5 acting as roller bearing and the running surfaces 7, 8, every wheel 5 is provided with a circumferential running ring 9 made of a low-wear material, like for example an elastomeric polymer, such as a polyether-etherketone (PEEK) or a nylon. These kinds of polymers have a relatively good to excellent wear resistance.

**Figure 2**

**[0016]** Figure 2 shows a perspective view of an inkjet printer 1 provided with another arrangement according to the invention. In this embodiment, the printer 1 comprises two pairs of rollers 2 and 3 for supporting a receiving material 4, for example a sheet of paper, and feeding it along four print heads 5a, 5b, 5c and 5d (each for one of the colours: black, cyan, magenta and yellow). Roller pair 2 is drivable by means of motor 6. In this case the top one of the two rollers is actively driven in a direction indicated by arrow A. As a result, the receiving material 4 can be displaced in the sub-scanning direction Y so that the receiving material can be moved with respect to the print heads 5a, 5b, 5c, 5d. A scanning carriage 7 carries the four print heads 5a, 5b, 5c and 5d and can be moved in reciprocation in the main scanning direction X, parallel to the roller pairs 2 and 3. For this purpose, a

conveyor belt 8 is fixed to the scanning carriage 7 so that the latter can be moved over the guide system formed by steel rods 9 and 10. By the combination of the movement of the scanning carriage in the sub-scanning direction Y and the main scanning direction X the print heads 5a, 5b, 5c, 5d can completely scan the receiving material 4. Considered in cross section one rod 9 is shaped circularly, while the other rod 10 is shaped rectangularly, and more specific squarely. The scanning carriage 7 is in sliding connection with the guide system via six supporting wheels 11 substantially made of a low-wear elastomeric polymer which are operatively connected to or at least near the four outermost corners of the scanning carriage 7. The wheels 11 engaging the right angled rod 10 engage on a single upper side of the rod 10 to stabilise the scanning carriage 7, in particular during movement. The wheels 11 engaging the cylindrical rod 9 in or at least near a corner of the scanning carriage 7 enclose an angle which is more or less perpendicularly, for further stabilisation of the carriage 7, in particular during movement of the scanning carriage 7 along the guiding rods 9, 10. In this manner the scanning carriage 7 can be moved along the guiding rods 9, 10 in a relatively economical and durable manner.

**[0017]** It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

## Claims

1. Arrangement for guiding a printer carriage along a guiding means, the printer carriage comprising multiple roller bearings, wherein at least some of the multiple roller bearings are in rolling contact with at least one of multiple running surfaces making part of said guiding means, **characterised in that** the roller bearings and/or the running surfaces are provided with a running member substantially made of plastic
2. Arrangement according to claim 1, wherein said guiding means is formed substantially integrally of a single piece.
3. Arrangement according to claim 1 or 2, wherein said guiding means is formed by at least one extrusion

profile.

4. Arrangement according to one of the foregoing claims, wherein said guiding means has a non-planar upper surface thereby defining different running surfaces. 5
5. Arrangement according to one of the foregoing claims, wherein every running surface defines a plane extending in a direction, and wherein at least two defined planes mutually enclose an angle of between 70° and 100°. 10
6. Arrangement according to one of the foregoing claims, wherein at least a part of said running surfaces are positioned at different height levels. 15
7. Arrangement according to one of the foregoing claims, wherein said roller bearings are formed by rotatable wheels. 20
8. Arrangement according to claim 7, wherein every wheel is provided with a circumferential running member. 25
9. Arrangement according to one of the foregoing claims, wherein each running member is substantially made of a low-wear elastomeric polymer.
10. Inkjet printer provided with an arrangement according to any claims 1 to 9. 30

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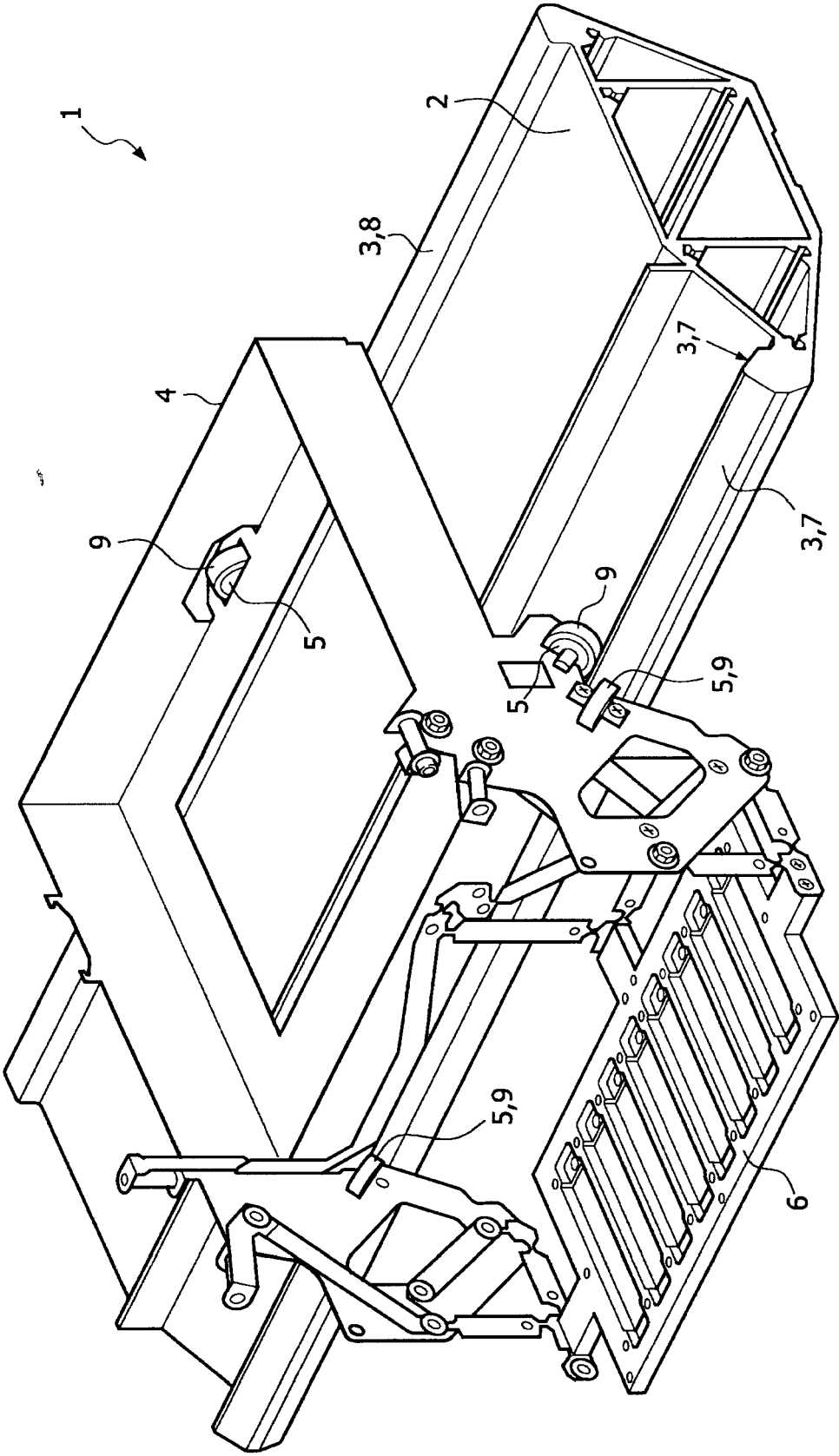


FIG. 1

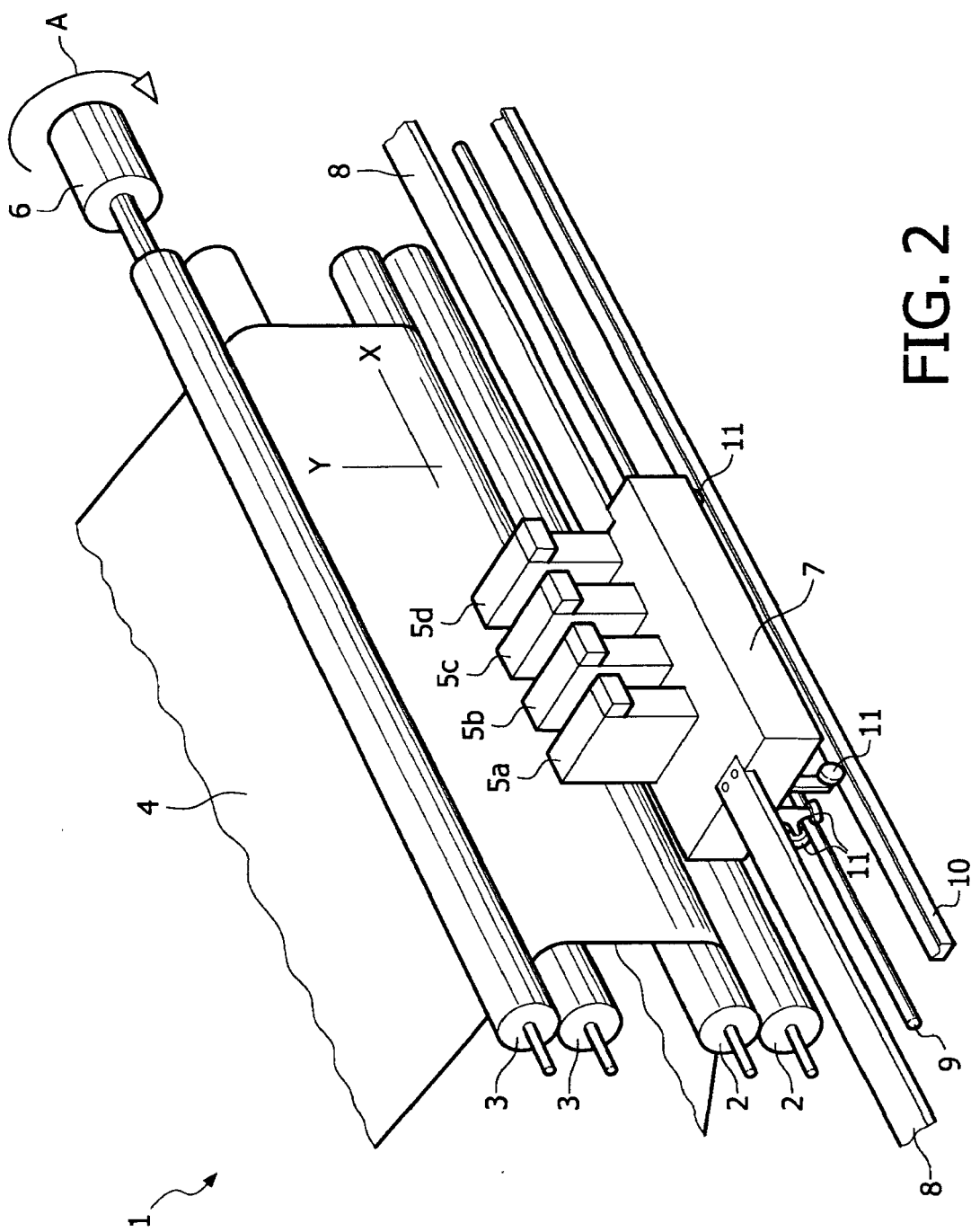


FIG. 2



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 04 10 6273

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                  |                                  |                                              |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                  |                                  |                                              |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                  | Date of completion of the search | Examiner                                     |
| The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                  | 11 May 2005                      | De Groot, R                                  |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                                                  |                                  |                                              |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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11-05-2005

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