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(54) **Transporter for depositing sheet material on a tray, printer provided with such a transporter as well as a method for depositing a sheet material on a tray**

(57) Transporter (1) and method for depositing sheet material (8) on a tray (2), which transporter (1) comprises at least two rollers (5,6) which can be displaced with respect to each other, whilst a belt (7) ex-

tends between said rollers (5,6) above said tray (2). The belt (7) is connected with ends to said two rollers (5,6), whereby the belt (7) can be rolled up on and unrolled from at least one of said rollers (5,6).

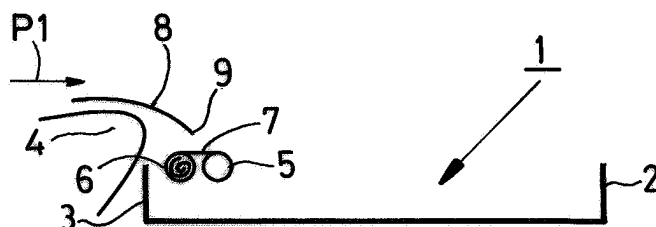


FIG. 1

Description

[0001] The invention relates to a transporter for depositing sheet material on a tray, which transporter comprises at least two rollers which can be displaced with respect to each other, whilst a belt extends between said rollers above said tray.

[0002] The invention furthermore relates to a printer provided with such a transporter.

[0003] The invention also relates to a method for depositing a sheet material on a tray by means of a transporter comprising at least two rollers which can be displaced with respect to each other whilst a belt extends between said rollers above said tray.

[0004] By such a transporter and method which are known from US-A-4,681,003, an endless belt is located around a relatively large number of rollers, whereby two rollers can be displaced with respect to each other. In an initial position a first roller is located relatively close to a second roller, whereby a first end of sheet material is being deposited on the belt extending between said two rollers. From said initial position, the first roller is being displaced away from the second roller, whereby the sheet material is being supported as well as transported by said belt. As soon as the first roller has received a predetermined end position, the first roller is being displaced back to the second roller, whereby the sheet material is being deposited on said tray.

[0005] When the first roller is being displaced with respect to the second roller, the endless belt is being guided along several deflection rollers being movable in a vertical direction for the purpose of length equalisation between the first and second roller as well as for tensioning the belt.

[0006] Due to said vertically displaceable rollers, the transporter has a relatively large height. Furthermore the vertically displaceable rollers makes the construction of the transporter relatively complicated.

[0007] It is an object of the invention to provide a transporter with a relatively simple configuration.

[0008] This object is being achieved by the transporter according to the invention in that the belt is connected with ends to said two rollers, whereby the belt can be rolled up on and unrolled from at least one of said rollers.

[0009] Since the belt is being rolled up on and unrolled from at least one of said rollers, the length equalisation during displacement of the rollers with respect to each other as well as the tensioning of the belt will be taken care of by means of the same roller between which the belt extends on which the sheet material is temporarily being deposited during transport to the tray.

[0010] An embodiment of the transporter according to the invention is characterized in that the belt can be rolled up and unrolled from both rollers.

[0011] In this manner the belt can be rolled up and unrolled from the rollers in any desirable manner.

[0012] A further embodiment of the transporter according to the invention is characterized in that the belt

is a wire.

[0013] By means of a wire a relatively good support surface for a sheet material like a paper sheet is being provided whilst the contact surface between the wire and the sheet material is relatively small so that the risk of pollution of the wire and pollution of the sheet paper by the wire is easily being prevented.

[0014] A further embodiment of the transporter according to the invention is characterized in that the rollers and the belt extending between the rollers can be rotated together around an axis extending perpendicular to the longitudinal axis of the belt and the central axes of the rollers.

[0015] In this manner the rollers, after rotating over 180°, the rollers will be exchanged, whereby the first roller has become the second roller and the second roller has become the first roller. If in the initial position the belt is being rolled up on the first roller and needs to be rolled up on the second roller, this can be achieved by exchanging the rollers with respect to each other by rotating them over 180°.

[0016] Yet another embodiment of the transporter according to the invention is characterized in that one end of at least one roller is rotatably and displaceably located between two endless belts.

[0017] By means of those two endless belts, the roller can be rotated as well as transported in two opposite directions by driving the endless belt either in the same or in opposite directions with the same or different velocities.

[0018] By means of said two endless belts a relatively simple construction for driving the roller is being achieved.

[0019] The invention furthermore relates to a printer which is provided with such a transporter. Especially by printers, relatively thin sheet material of paper on which a print is being applied, needs to be carefully deposited on a tray or on previously deposited sheets in said tray whereby sliding of a paper sheet with respect to another paper sheet is being prevented. By depositing paper sheets on top of each other instead of sliding the paper sheets over each other, each paper sheet is being transported and deposited in the same manner on the tray which improves the predictability of the paper transport since the paper transport is no longer determined by the characteristics like type of material, amount of curl, etc. of previous paper sheets. Furthermore the paper sheet on the belt as well as the previous paper sheet already deposited on the tray has, in case of an inkjet printer, additional time to dry on the belt so that the risk that the print on the paper sheet will be destroyed by a paper sheet deposited thereon will be reduced or even eliminated.

[0020] It is furthermore an object of the invention to provide a method for depositing a sheet material on a tray which is simpler and easier than the method according to the prior art.

[0021] This object is achieved by the method accord-

ing to the invention in that the belt is connected with ends to said two rollers whereby the belt is rolled up on at least one of said rollers in an initial position of the two rollers, subsequently a first roller is being displaced with respect to a second roller, whereby the belt is being unrolled from at least one roller and the sheet material is being supported and transported by the belt until the first roller has received a predetermined end position, after which the first roller is being displaced back to the second roller whereby the belt is being rolled up on one of said rollers, whilst the sheet material is being deposited on said tray.

[0022] By the method according to the invention the displacement of the rollers with respect to the others as well as the rolling up and unrolling of the belt from at least one of said rollers, causes the displacement of the belt, the length equalisation during displacement of the rollers with respect to the others as well as the tensioning of the belt.

[0023] An embodiment of the method according to the invention is characterized in that when the first roller is being displaced to the predetermined end position, the belt is being unrolled from said second roller.

[0024] In this manner by displacing the first roller to the predetermined position also the belt is being displaced in a direction to the predetermined position, so that the sheet material supported by the belt will automatically be transported in said direction.

[0025] Yet another embodiment of the method according to the invention is characterized in that when the first roller is being displaced to the predetermined end position, the belt is slightly rolled up on the first roller.

[0026] In this manner a force is applied by the belt on the sheet material supported thereby, which tends to straighten the sheet material on the belt and prevents curling of the sheet material.

[0027] Another embodiment of the method according to the invention is characterized in that when the first roller is being displaced back to the second roller, the belt is being rolled up on the first roller.

[0028] By rolling up the belt on the first roller, the roller is rolling away underneath the sheet material whereby no forces are applied on the sheet material due to which the sheet material might curling up or being moved.

[0029] Yet another embodiment of the method according to the invention is characterized in that near the initial position the belt is being unrolled from the first roller and rolled up on the second roller, before a new sheet material is being transported by said belt.

[0030] After doing so, the first roller can be displaced again from the second roller, whereby the belt is being unrolled from said second roller to transport a sheet material.

[0031] The invention will now be further explained with reference to the drawings in which:

fig. 1-6 show schematically several steps of the method according to the invention for depositing a

sheet material by a transporter according to the invention;

fig. 7 shows schematically a part of another embodiment of a transporter according to the invention;

fig. 8 shows schematically a part of a transporter according to the invention for rotating and displacing a roller.

[0032] The same elements are provided with the same reference numbers in all the drawings.

[0033] Fig. 1 shows a transporter 1 according to the invention of a printer (not shown) which comprises a tray 2 located with one end 3 under a paper sheet guiding surface 4 of said printer. The transporter 1 is furthermore provided with at least two sets of two rollers 5, 6 and a belt 7 connected with ends to the rollers 5, 6. The roller 6 is rotatably mounted with respect to a frame (not shown) of said transporter 1 whilst the roller 5 is rotatably as well as displaceably with respect to the roller 6 mounted with respect to the frame (not shown). In the situation as shown in fig. 1, the belt 7 is fully rolled up on the roller 6 and the roller 5 is in the initial position. In said situation a sheet material like a paper sheet 8 on which a print is being applied, is moved by the printer in the direction indicated by arrow P1 to the transporter 1 so that a first end 9 of the paper sheet 8 will contact the belt 7. As soon as the end 9 of the paper sheet 8 is located on the belt 7, the first roller 5 might be displaced from the roller 6 in a direction indicated by arrow P2, whereby the second roller 6 is rotated in a direction indicated by arrow R1 to unroll the belt 7. By moving the first roller 5 in the direction indicated by arrow P2, also the belt 7 as well as the end 9 of the paper sheet 8 is being transported in said direction (fig. 2). The first roller 5 is displaced in the direction indicated by arrow P2 until the roller 5 has reached the predetermined end position as shown in fig. 3. In this position the whole paper sheet 8 is supported by the belt 7 extending between the rollers 5, 6, whereby the first end 9 of the paper sheet 8 is located near the roller 5 whilst the opposite end 10 is located near the roller 6. To deposit the paper sheet 8 on the tray 2 in which already deposited paper sheets 8 may be present, the first roller 5 is being rotated in a clockwise direction indicated by arrow R2 due to which rotation, the belt 7 will be rolled up on the roller 5 whilst at the same time the roller 5 will be displaced to the roller 6 in a direction indicated by arrow P3, opposite to the direction indicated by arrow P2. The roller 6 will not be rotated. Due to the movement of the roller 5, the roller will be rolled away underneath the paper sheet 8 without applying any force on the paper sheet 8. The first end 9 and afterwards the rest of the paper sheet 8 will now be deposited on the tray 2 (see fig. 5). The roller 5 will be rotated in the direction indicated by arrow R2 until the belt 7 is fully rolled up on the roller 5 and the roller 5 is in the initial position again.

[0034] To be able to receive a new paper sheet 8 on the belt 7, to transport it and deposit it on the tray 2, the

belt 7 needs to be rolled up on the second roller 6 again to receive the start position as shown in fig. 1. Therefore, as shown in fig. 6 the rollers 5 and 6 are rotated anti clockwise in the directions indicated by arrows R3, R4 to unroll the belt 7 from the roller 5 whilst at the same time roll up the belt 7 on the roller 6.

[0035] Fig. 7 shows a part of another transporter 21 of the invention whereby the rollers 5, 6 as well as the belt 7 are simultaneously rotatable around an axis 22 in a direction indicated by arrow R5, which axis 22 extends perpendicular to the central axes 23, 24 of the rollers 5, 6 as well as of the longitudinal direction of the belt 7. By this embodiment of the transporter 21 the roller 5, 6 as well as the belt 7 will be rotated over 180° in a direction indicated by arrow R5 in the situation as shown in fig. 5 whereby the whole belt 7 is being rolled up on the roller 5. By rotating over 180°, the roller 5 will take up the former position of the roller 6 whilst the roller 6 will take up the former position of the roller 5. Due to said rotation, the roller 5 provided with the belt 7 can now function as roller 6 whilst the empty roller 6 can now function as the roller 5. By this embodiment it is not necessary to unroll and roll up the belt as is necessary in the situation as shown in fig. 6 of the transporter 1.

[0036] Fig. 8 shows a part 31 of the transporter 1 according to the invention whereby an end of the roller 5 is located between two endless belts 32, 33 which extend respectively around rollers 34, 35, 36, 37. Said rollers 34-37 are rotatably mounted with respect to a frame (not shown) of the transporter 1. If the rollers 35, 37 are being rotated in a respectively anti clockwise and clockwise direction indicated by the arrows R6, R7 the roller 5 will, due to friction with the belts 32, 33, be moved in the direction as indicated by arrow P2. If the rollers 35, 37 are both rotated anti clockwise indicated by the arrows R6, R8 the roller 5 will be rotated in a direction indicated by arrow R2. If both rollers 35, 36 are being rotated clockwise in a direction indicated by arrow R9, R8 the roller 5 will be rotated anti clockwise in a direction as indicated by arrow R3. If the rollers 35, 37 are rotated clockwise and anti clockwise respectively as indicated by the arrows R9, R7, the roller 5 will be displaced in a direction indicated by arrow P3. By rotating the rollers 35, 36 with different rotational speeds, a combination of a displacement in a direction indicated by arrow P2 or P3 and a rotation in a direction indicated by arrow R2 or R3 can be obtained. In this manner the movement of the roller 5 can easily be controlled.

[0037] If desired, the belt 7 might be slightly rolled up on the belt 5 in the situation as shown in fig. 2 due to which the end 9 of the paper sheet 8 will be pulled in the direction as indicated by arrow P2 whereby the paper sheet 8 will be straightened and be prevented from curling.

[0038] Preferably two or three sets of rollers 5, 6 are being provided whereby a wire type belt is connected to the rollers 5, 6. However, it is also possible to use relatively long rollers 5, 6, whereby the belt 7 is also rela-

tively wide and will support the paper sheet over the full surface.

[0039] It is also possible to use two sets of rollers 5, 6 above each other whereby the belts 7 are directed to each other and a sheet material like a paper sheet is being transported between the two belts 7.

[0040] It is also possible that the roller 6 is not being rotatable and forms a fixed connection with the printer, whereby the only rotatable roller is the roller 5. By the situation as shown in fig. 2 and 3, the roller 5 will then be rotated in a direction as indicated by arrow R3 (fig. 6) whilst simultaneously being displaced in a direction indicated by arrow P2. The sheet 8 will not automatically be transported by the belt 7 but needs to be pushed on the belt 7 by, for example the printer. Also roller 5 can be non-rotatable and roller 6 is rotatably connected to the printer.

[0041] It is also possible to use wires instead of belts.

[0042] It is also possible to use only one set of rollers 5, 6 in case that, for example, the belt 7 is relatively wide.

Claims

1. Transporter (1) for depositing sheet material (8) on a tray (2), which transporter (1) comprises at least two rollers (5, 6) which can be displaced with respect to each other, whilst a belt (7) extends between said rollers (5, 6) above said tray (2), **characterized in that** the belt (7) is connected with ends to said two rollers (5, 6), whereby the belt (7) can be rolled up on and unrolled from at least one of said rollers (5, 6).
2. Transporter (1) according to claim 1, **characterized in that** the belt (7) can be rolled up and unrolled from both rollers (5, 6).
3. Transporter (1) according to claim 1 or 2, **characterized in that** the belt (7) is a wire.
4. Transporter (1) according to one of the preceding claims, **characterized in that** the rollers (5, 6) and the belt (7) extending between the rollers (5, 6) can be rotated together around an axis extending perpendicular to the longitudinal axis of the belt (7) and the central axes of the rollers (5, 6).
5. Transporter (1) according to one of the preceding claims, **characterized in that** one end of at least one roller is rotatably and displaceably located between two endless belts (7).
6. Printer provided with a transporter (1) according to one of the preceding claims.
7. Method for depositing a sheet material (8) on a tray (2) by means of a transporter (1) comprising at least

two rollers (5, 6) which can be displaced with respect to each other whilst a belt (7) extends between said rollers (5, 6) above said tray (2), **characterized in that** the belt (7) is connected with ends to said two rollers (5, 6), whereby the belt (7) is rolled up on at least one of said rollers (5, 6) in an initial position of the two rollers (5, 6), subsequently a first roller is being displaced with respect to a second roller, whereby the belt (7) is being unrolled from at least one roller and the sheet material (8) is being supported and transported by the belt (7) until the first roller has received a predetermined end position, after which the first roller is being displaced back to the second roller whereby the belt (7) is being rolled up on one of said rollers (5, 6), whilst the sheet material (8) is being deposited on said tray (2).

8. Method according to claim 7, **characterized in that** when the first roller is being displaced to the predetermined end position, the belt (7) is being unrolled from said second roller.
9. Method according to claim 7 or 8, **characterized in that** when the first roller is being displaced to the predetermined end position, the belt (7) is slightly rolled up on the first roller.
10. Method according to one of the preceding claims 7-9, **characterized in that** when the first roller is being displaced back to the second roller, the belt (7) is being rolled up on the first roller.
11. Method according to one of the preceding claims 7-10, **characterized in that** near the initial position the belt (7) is being unrolled from the first roller and rolled up on the second roller, before a new sheet material (8) is being transported by said belt (7).

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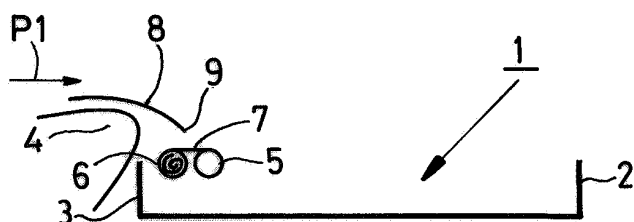


FIG. 1

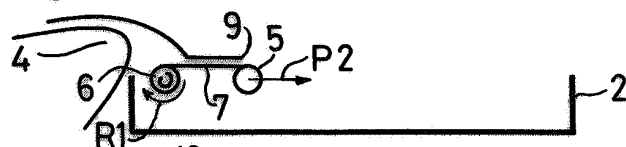


FIG. 2

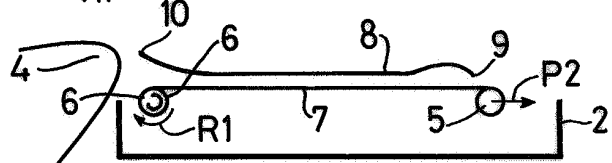


FIG. 3

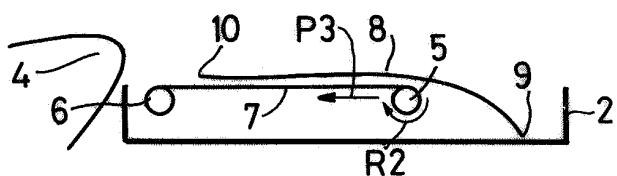


FIG. 4

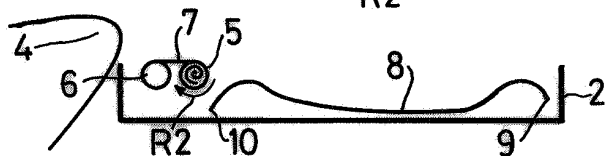


FIG. 5

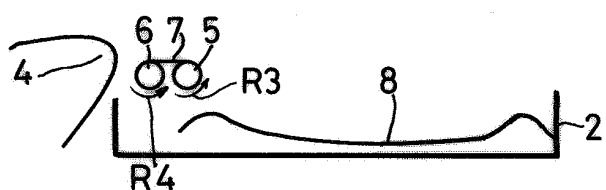


FIG. 6

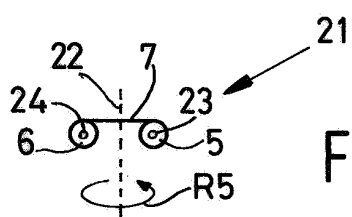


FIG. 7

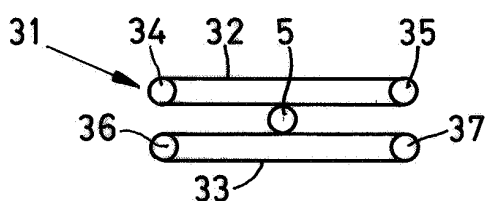
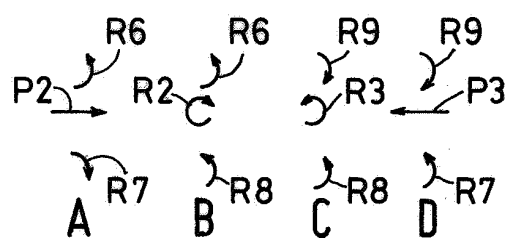


FIG. 8





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 0008

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.7)
X	GB 334 438 A (MASCHF AUGSBURG NUERNBERG AG) 4 September 1930 (1930-09-04) * page 1, line 56 - line 104; figures 1-3 *	1,5-7,10	B65H29/36
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A	CH 359 593 A (BOBST FILS SA J) 15 January 1962 (1962-01-15) * page 1, line 40 - line 68; figures 1,2 *	1,6,7	
A	US 3 411 773 A (EDWARD CORNWALL JAMES) 19 November 1968 (1968-11-19) * column 2, line 10 - line 44; figures 1,2 *	1,6,7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B65H B65G
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 May 2005	Examiner Pollet, D
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 05 10 0008

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03-05-2005

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