(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 805 825 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.11.2014 Bulletin 2014/48

(21) Application number: **13168748.5**

(22) Date of filing: **22.05.2013**

(51) Int Cl.:
B41F 31/00 *(2006.01)* ***B41F 31/15*** *(2006.01)*
B41F 33/00 *(2006.01)* ***B41F 23/08*** *(2006.01)*

(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 RS SE SI SK SM TR
Designated Extension States:
BA ME

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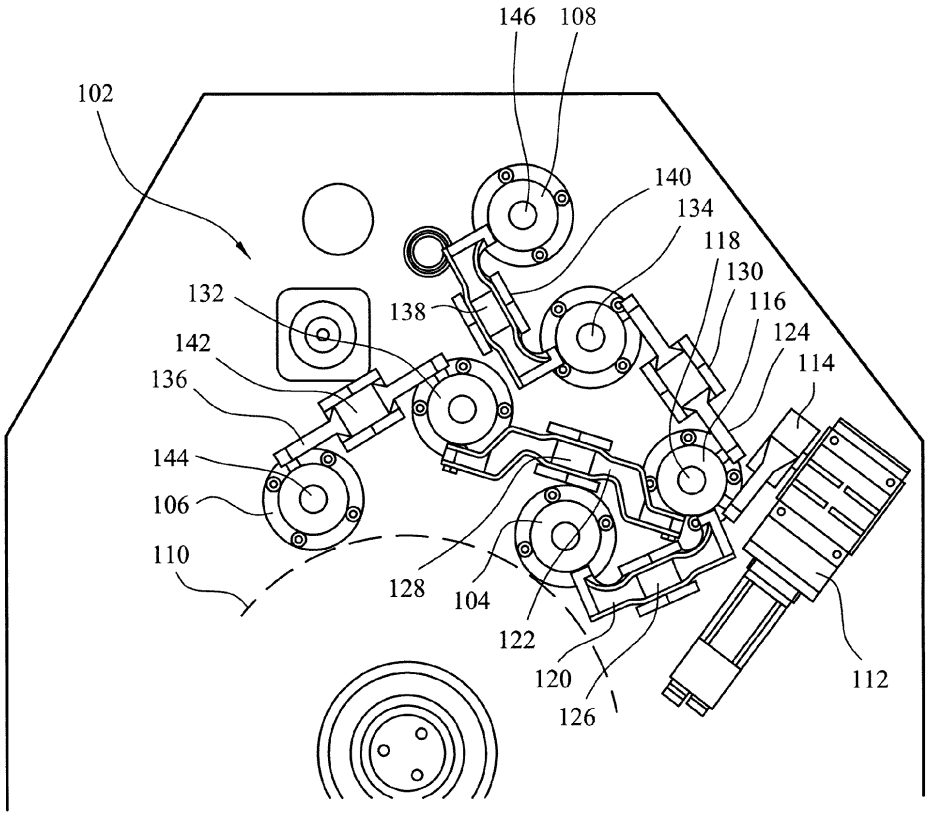
(54) **Liquid transfer apparatus**

(57) An ink transfer apparatus (102) for transferring ink to an ink application roller (110) of a sheet printing or sheet coating apparatus is disclosed. The ink transfer apparatus comprises a series of ink transfer rollers (104, 106, 108, 110) for transferring ink to the liquid application roller, and a motor (112) for causing reciprocating motion of the ink transfer rollers in a direction substantially parallel to their axes of rotation. A controller receives an input signal dependent on a rotational position of the liquid application roller and controls operation of the motor in dependence on the input signal.

FIG. 2



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Description

[0001] The present invention relates to a liquid transfer apparatus for transferring liquid to at least one roller of a sheet printing or coating apparatus. The invention relates particularly, but not exclusively, to an apparatus for applying ink to a sheet printing or coating apparatus.

[0002] Sheet printing apparatus, for example for printing sheet metal, apply ink via ink transfer rollers to an ink application roller which then applies ink to a sheet of metal to be printed. In the case of printing artwork consisting of a detailed image surrounded by a densely printed background (known as picture framed artwork), undesirable abrupt tone changes can arise. It is known to alleviate this problem by causing oscillation of one or more of the ink transfer rollers in a direction parallel to its respective axis of rotation. This oscillation is achieved by means of gears connected to the ink application roller, the gears driving a cam which in turn drives a cam follower to cause oscillation of one or more ink transfer rollers in a direction along its respective axis of rotation. Phase adjustment of the oscillation relative to the rotational phase of the ink application roller can be achieved by means of a separate mechanical phase shifting element which can also be motorised.

[0003] Such an arrangement is shown in Figure 1. An ink application apparatus 2 for a sheet printing apparatus (not shown) transfers ink from an ink reservoir (not shown) via ink transfer rollers 4, 6, 8, 10 to an ink application roller 12 which in turn applies ink to a sheet (not shown) to be printed. The ink transfer rollers 4, 6, 8 are pivotally mounted to a frame 14, which can in turn pivot about pivot axis 16. A drive roller 18 having a cam surface 20 is connected via gears (not shown) to the ink application roller 12 so that its rotation is synchronised with that of the ink application roller 12. The cam surface 20 of the drive roller 18 engages a cam follower 22 of ink transfer roller 4 to cause reciprocating motion of the frame 14 about pivot axis 16. This in turn causes reciprocating linear motion of the ink transfer rollers 4, 6, 8 about their respective rotation axes.

[0004] This arrangement suffers from the drawback that the gears implementing the oscillation are expensive to produce and offer limited flexibility and control of the oscillation since the cooperating cam surface and cam follower are continuously driven by means of permanent connection via gears to the ink application roller 12. The existing arrangement also has the drawback that the motion profile of the ink transfer rollers 4, 6, 8 is limited because it is largely defined by the fixed gears in combination with the cam design.

[0005] Preferred embodiments of the present invention seek to overcome one or more of the above disadvantages of the prior art.

[0006] According to an aspect of the present invention, there is provided a liquid transfer apparatus for transferring liquid to at least one roller of a sheet printing or sheet coating apparatus, the liquid transfer apparatus comprising:-

a plurality of liquid transfer rollers for transferring a liquid, to be applied to a sheet, from at least one liquid inlet to a liquid application roller for applying liquid to the sheet;

at least one motor for causing reciprocating motion of at least one said liquid transfer roller in a direction substantially parallel to an axis of rotation thereof; and

control means for receiving a first input signal dependent on a rotational position of said liquid application roller and for controlling operation of at least one said motor in dependence on said first input signal.

[0007] By providing control means for receiving a first input signal dependent on a rotational position of the liquid application roller and for controlling operation of a motor in dependence on the first input signal, this provides the advantage of enabling motion of the liquid transfer rollers to be controlled with greater flexibility and more precisely, which in turn leads to improved print quality. Print quality can also be improved by selection of the location on the sheet of ink tonal disturbances occurring as a result of improved fluid transfer at the dwell points of reciprocating motion of the liquid transfer rollers, for example by arranging the tonal disturbance to be located at the plate gap. In addition, the advantage is provided of avoiding the use of gear mechanisms, thereby reducing the cost of manufacture of the apparatus.

[0008] The apparatus may further comprise drive means adapted to be actuated by at least one said motor for causing said reciprocating motion of at least one said liquid transfer roller.

[0009] The drive means may comprise at least one lever pivotably mounted to a respective pivot axis such that reciprocating pivoting motion of said lever about said axis causes reciprocating motion of at least one said liquid transfer roller in a direction substantially parallel to an axis of rotation thereof.

[0010] This provides the advantage of enabling motion of a plurality of liquid transfer rollers to be caused by a single motor.

[0011] Reciprocating pivoting motion of at least one said lever about the corresponding said pivot axis may cause reciprocating movement of a plurality of said fluid transfer rollers.

[0012] The drive means may comprise at least one reciprocating member adapted to cause reciprocating pivoting motion of at least one said lever.

[0013] The drive means may comprise at least one rotating member having at least one cam member adapted to cause reciprocating motion of at least one respective cam follower.

[0014] The control means may be adapted to receive

a second input signal dependent on content of an image to be printed to a sheet and to control at least one said motor in dependence on said second input signal.

[0015] This provides the advantage of enabling reciprocating motion of the rollers to be better matched to the image to be printed, thereby further improving image quality.

[0016] The apparatus may further comprise second signal generating means for generating said second input signal.

[0017] The apparatus may further comprise image scanning means for scanning said image and generating said second input signal.

[0018] According to another aspect of the present invention, there is provided a computer program product adapted to be executed by a computer to control a liquid transfer device as defined above, the computer program product comprising first computer code executable by a computer cause said control means to receive a first input signal dependent on a rotational position of said liquid application roller and to control operation of at least one said motor in dependence on said first input signal.

[0019] The computer program product may further comprise second computer code executable by a computer to cause said control means to receive a second input signal dependent on content of an image to be printed to a sheet and to control at least one said motor in dependence on said second input signal.

[0020] The computer program product may further comprise third computer code executable by a computer for generating said second input signal.

[0021] The computer program product may further comprise fourth computer code executable by a computer to cause said image scanning means to scan said image and generate said second input signal.

[0022] A preferred embodiment of the invention will now be described, by way of example only and not in any limitative sense, with reference to the accompanying drawings, in which:-

Figure 1 is a side view of a known ink transfer roller arrangement; and

Figure 2 is a side view of an ink transfer apparatus embodying the present invention.

[0023] Referring to Figure 2, an ink transfer apparatus 102 embodying the present invention transfers ink from an ink reservoir (not shown) via a series of ink transfer rollers 104, 106, 108 to an ink application roller 110 which in turn applies the ink to a sheet of metal (not shown). A controller (not shown) receiving first input signals from a detector (not shown) to provide control signals dependent upon the rotational position of the ink application roller 110 controls a motor 112 which drives a crankshaft 114 to cause reciprocating motion of a drive cylinder 116 in a direction generally parallel to its axis of rotation 118. The drive cylinder 116 is connected to first ends of respective levers 120, 122, 124, each of which can pivot about a respective pivot axis 126, 128, 130, the second ends of the levers 120, 122, 124 being connected respectively to ink transfer roller 104 and reciprocating cylinders 132, 134.

[0024] Each of the reciprocating cylinders 132, 134 can execute oscillating motion in a direction generally parallel to its longitudinal axis and is connected to a first end of respective lever 136, 138 which can pivot about a respective pivot axis 140, 142. The levers 136, 138 are connected at their respective second ends to ink transfer rollers 106, 108 respectively such that reciprocating linear motion of reciprocating cylinders 132, 134 causes reciprocating linear motion of the ink transfer rollers 106, 108 in a direction generally parallel to their respective axes of rotation 144, 146.

[0025] The controller can also receive second input signals from an image scanner (not shown) which scans the image to be printed, and generates the second input signals by means of image interpretation software, such as software used for making lithographic printing plates. The controller then controls operation of the motor 112 in dependence on the 2nd input signals.

[0026] Because the ink transfer rollers 104, 106, 108 are not driven continuously by means of gears connected to the ink application roller 110, but are driven by the motor 112 under the action of the controller, the nature of the reciprocating linear motion of the ink transfer rollers 104, 106, 108 has a much greater flexibility of control. For example, the reciprocating linear motion can be driven intermittently to concentrate its effects on a selected region of the metal sheet being printed, and a much wider range of motion profiles can be achieved than is possible with cam and gear mechanisms driven by the ink application roller 110.

[0027] It will be appreciated by persons skilled in the art that the above embodiment has been described by way of example only and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims.

Claims

1. A liquid transfer apparatus for transferring liquid to at least one roller of a sheet printing or sheet coating apparatus, the liquid transfer apparatus comprising:-
   a plurality of liquid transfer rollers for transferring a liquid, to be applied to a sheet, from at least one liquid inlet to a liquid application roller for applying liquid to the sheet;
   at least one motor for causing reciprocating motion of at least one said liquid transfer roller in a direction substantially parallel to an axis of rotation thereof; and
   control means for receiving a first input signal dependent on a rotational position of said liquid appli-

cation roller and for controlling operation of at least one said motor in dependence on said first input signal.

2. An apparatus according to claim 1, further comprising drive means adapted to be actuated by at least one said motor for causing said reciprocating motion of at least one said liquid transfer roller.

3. An apparatus according to claim 2, wherein the drive means comprises at least one lever pivotably mounted to a respective pivot axis such that reciprocating pivoting motion of said lever about said axis causes reciprocating motion of at least one said liquid transfer roller in a direction substantially parallel to an axis of rotation thereof.

4. An apparatus according to claim 3, wherein reciprocating pivoting motion of at least one said lever about the corresponding said pivot axis causes reciprocating movement of a plurality of said fluid transfer rollers.

5. An apparatus according to claim 3 or 4, wherein the drive means comprises at least one reciprocating member adapted to cause reciprocating pivoting motion of at least one said lever.

6. An apparatus according to any one of claims 2 to 5, wherein the drive means comprises at least one rotating member having at least one cam member adapted to cause reciprocating motion of at least one respective cam follower.

7. An apparatus according to any one of the preceding claims, wherein the control means is adapted to receive a second input signal dependent on content of an image to be printed to a sheet and to control at least one said motor in dependence on said second input signal.

8. An apparatus according to claim 7, further comprising second signal generating means for generating said second input signal.

9. An apparatus according to claim 7 or 8, further comprising image scanning means for scanning said image and generating said second input signal.

10. A computer program product adapted to be executed by a computer to control a liquid transfer device according to any one of the preceding claims, the computer program product comprising first computer code executable by a computer cause said control means to receive a first input signal dependent on a rotational position of said liquid application roller and to control operation of at least one said motor in dependence on said first input signal.

11. A computer program product according to claim 10, further comprising second computer code executable by a computer to cause said control means to receive a second input signal dependent on content of an image to be printed to a sheet and to control at least one said motor in dependence on said second input signal.

12. A computer program according to claim 11, further comprising third computer code executable by a computer for generating said second input signal.

13. A computer program product according to claim 11 or 12, further comprising fourth computer code executable by a computer to cause said image scanning means to scan said image and generate said second input signal.

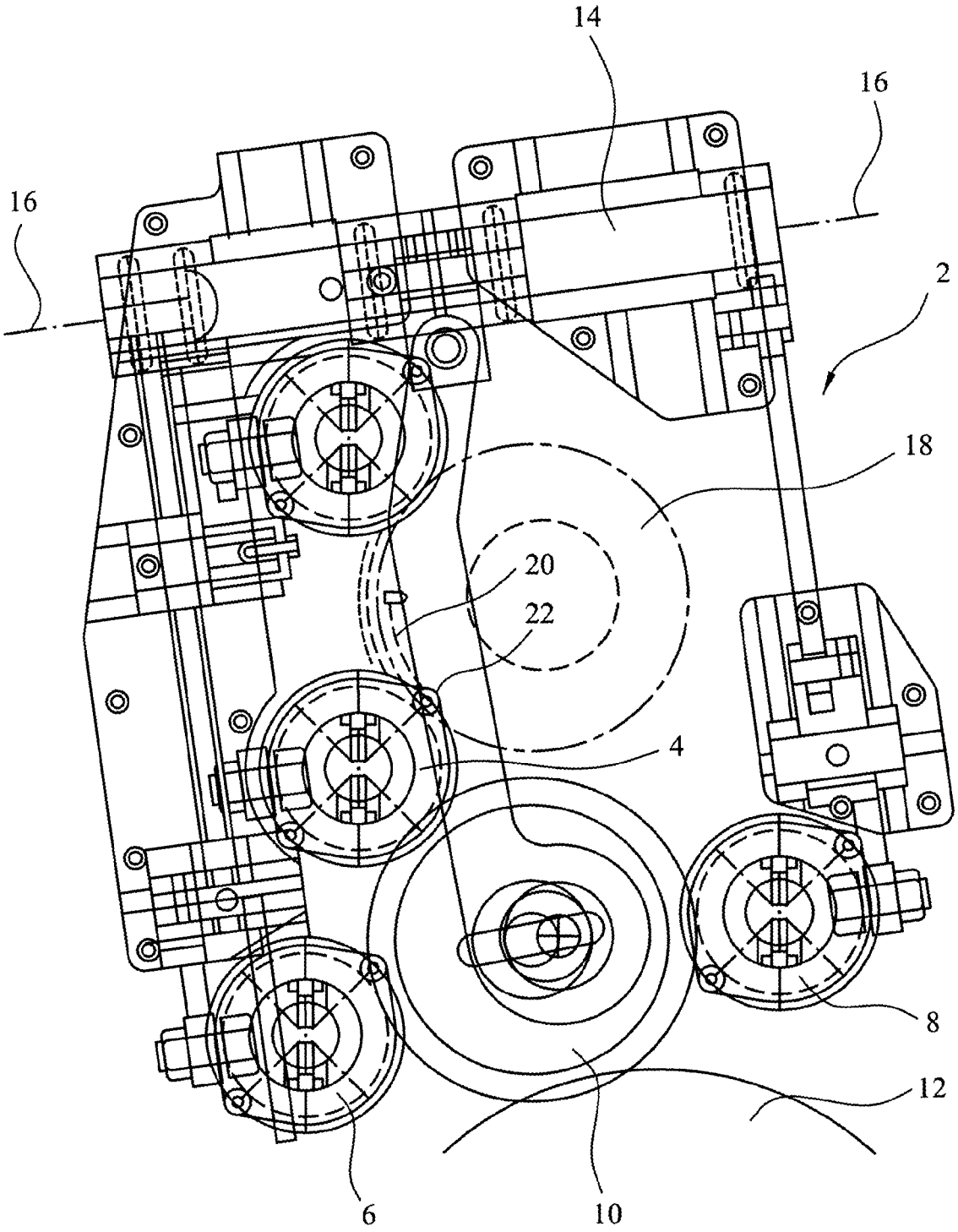

FIG. 1

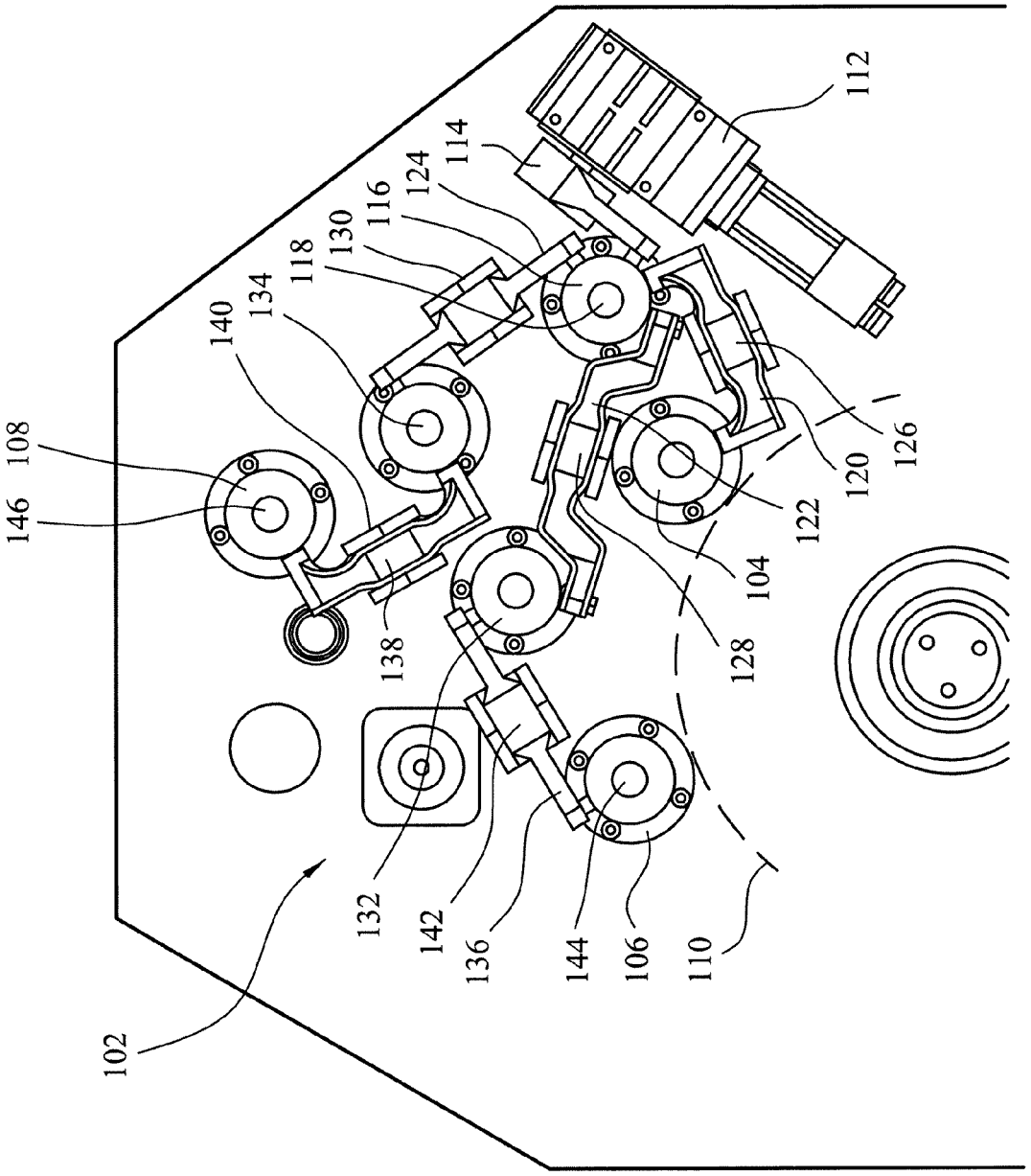
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FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 13 16 8748

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 820 648 A2 (ROLAND MAN DRUCKMASCH [DE] MANROLAND AG [DE] MANROLAND SHEETFED GMBH []) 22 August 2007 (2007-08-22) * abstract * * claim 9 * * paragraphs [0001], [0005], [0007], [0010] - [0014], [0022], [0025] - [0031], [0042], [0048] * * figures 1-3 *	1-13	INV. B41F31/00 B41F31/15 B41F33/00 B41F23/08
X	DE 10 2004 048149 A1 (KOENIG & BAUER AG [DE]) 6 April 2006 (2006-04-06) * abstract * * paragraphs [0015] - [0018], [0020] * * figures 1-2 *	1-6,10	
A	DE 10 2007 041680 A1 (MANROLAND AG [DE]) 5 March 2009 (2009-03-05) * the whole document *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC) B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 October 2013	Bellofiore, Vincenzo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 16 8748

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09-10-2013

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82