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

(11) EP 1 160 089 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.12.2001 Bulletin 2001/49

(51) Int Cl.[7]: **B41J 29/17**, B41J 13/08, B65G 45/22, B65G 45/24

(21) Application number: **01304446.6**

(22) Date of filing: **21.05.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.05.2000 US 583819**

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(54) Transport belt cleaning module using serviceable cleaning implements

(57) A transport belt 232 in an operating environment containing contaminants is provided with subsystems 301, 302 for ondemand cleaning of the belt. Wet and dry pressure pads 305, 307, 309 are provided with associated mechanisms 303, 311-319 for engaging and disengaging simultaneously with both the inner and outer surfaces of the belt.

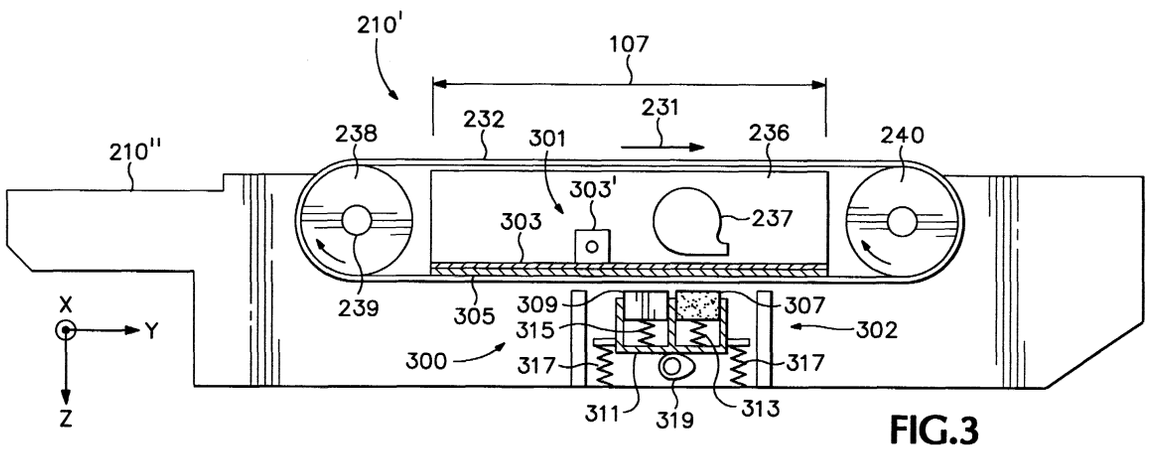

FIG.3

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to transport belts (sometimes referred to in the art as conveyor belts), particularly to a method and apparatus for cleaning a transport belt and, more specifically, to cleaning a print media transport belt in an ink-jet hard copy apparatus.

2. Description of Related Art

[0002] The art of ink-jet technology is relatively well developed. Commercial products such as computer printers, graphics plotters, copiers, and facsimile machines employ ink-jet technology for producing hard copy. The basics of this technology are disclosed, for example, in various articles in the *Hewlett-Packard Journal,* Vol. 36, No. 5 (May 1985), Vol. 39, No. 4 (August 1988), Vol. 39, No. 5 (October 1988), Vol. 43, No. 4 (August 1992), Vol. 43, No. 6 (December 1992) and Vol. 45, No.1 (February 1994) editions. Ink-jet devices are also described by W.J. Lloyd and H.T. Taub in *Output Hardcopy [sic] Devices,* chapter 13 (Ed. R.C. Durbeck and S. Sherr, Academic Press, San Diego, 1988).

[0003] **FIGURE 1** (PRIOR ART) depicts a hard copy apparatus, in this exemplary embodiment a computer peripheral, ink-jet printer, 101. A housing 103 encloses the electrical and mechanical operating mechanisms of the printer 101. Operation is administrated by an electronic controller 102 (usually a microprocessor or application specific integrated circuit ("ASIC") controlled printed circuit board) connected by appropriate cabling to a computer (not shown). It is well known to program and execute imaging, printing, print media handling, control functions and logic with firmware or software instructions for conventional or general purpose microprocessors or with ASIC's. Cut-sheet print media 105, loaded by the end-user onto an input tray 120, is fed by a suitable paper-path transport mechanism (not shown) to an internal printing station where graphical images or alphanumeric text is created. A carriage 109, mounted on a slider 111, scans the print medium. An encoder subsystem 113 is provided for keeping track of the position of the carriage 109 at any given time. A set of individual ink-jet pens, or print cartridges, 115"X" is mounted in the carriage 109 (generally, in a full color system, inks for the subtractive primary colors, cyan, yellow, magenta (X=C, Y, or M) and true black (X=K) are provided; in some implementations an ink-fixer chemical (X=F) is also used). An associated set of replaceable or refillable ink reservoirs 117"X" is coupled to the pen set by ink conduits 119. Ink is deposited on the sheet of media 105 at a "print zone," or "printing station," 107. Once a printed page is completed, the print medium is ejected onto an output tray 121. The carriage scanning axis is conventionally designated the x-axis, the print media transit axis is designated the y-axis, and the printhead firing direction is designated the z-axis.

[0004] For convenience of describing the ink-jet technology and the present invention, all types of print media are referred to simply as "paper," all compositions of colorants are referred to simply as "ink," and all types of hard copy apparatus are referred to simply as a "printer. " No limitation on the scope of invention is intended nor should any be implied.

[0005] **FIGURE 2** is a schematic depiction of another ink-jet hard copy apparatus 210 as may be associated with the present invention. A writing instrument 115X is provided with a printhead 214 having drop generators including nozzles for ejecting ink droplets onto an adjacently positioned print medium, e.g., a sheet of paper 105, in the apparatus' printing zone 107. A perforated, endless-loop belt 232 is one type of known manner printing zone input-output paper transport. A motor 233 having a drive shaft 230 is used to drive a gear train 235 coupled to a belt pulley, or roller, 238 mounted on an fixed axle 239. A biased idler wheel 240 provides appropriate tensioning of the belt 232. The belt rides over a platen 236 (sometimes including heating devices) in the print zone 107 associated with a known manner vacuum induction system 237. The paper sheet 105 is picked from an input supply (not shown) and its leading edge 254 is delivered to a guide 250, 252 where a pinch wheel 242 in contact with the belt 232 takes over and acts to transport the paper sheet 105 through the printing zone 107 (the paper path is represented by arrow 231). Downstream of the printing zone 107, an output roller 244 in contact with the belt 232 receives the leading edge 254 of the sheet 105 and continues the paper transport until the trailing edge 255 of the now printed page is released.

[0006] Ink-jet technology is used to describe the present invention even though it has wider applicability because the ink-jet environment typifies a transport belt use where the local environment may contain contaminants such as ink mist and paper dust which can soil a transport belt and clog perforations in a vacuum belt or even be sucked through the belt, contaminating the subjacent platen and other subsystems of the apparatus. Furthermore, the latest generation of ink-jet printers has found commercial success for economical color printing of high resolution graphics, including photographic reproductions, which require edge-to-edge paper printing (referred to as "full bleed"). Overspray and aerosol will build up on the belt over time. Not only does this affect performance of the belt itself, ink on the belt can be transferred undesirably to the back side of the print, particularly if the ink remains in a liquid or semi-fluidic state.

[0007] It can also be recognized that this type of problem can occur in other vacuum transport systems such as for transporting thin sheets of metal where particulate flakes might be present or for coating processes where

an aerosol spray is used on a passing receptor on the transport belt.

[0008] Thus, there is a need for a method and apparatus for cleaning transport belts.

SUMMARY OF THE INVENTION

[0009] A transport belt in an operating environment containing contaminants is provided with subsystems for on-demand cleaning of the belt. Wet and dry pressure pads are provided with associated mechanisms for engaging and disengaging simultaneously with both the inner and outer surfaces of the belt.

[0010] In one basic aspect, the present invention provides a method for cleaning a transport belt, having a transport surface, including the steps of: positioning at least one wiper in non-contacting juxtaposition to at least the transport surface; and selectively repositioning the wiper into contact with the associated belt side.

[0011] In another basic aspect, the present invention provides a transport belt cleaning apparatus including: mechanisms for cleaning non-contactingly juxtaposed on each side of the belt; and mechanisms for engaging the cleaning means with the belt.

[0012] In another basic aspect, the present invention provides an ink-jet hard copy apparatus including: a transport belt for media input-output; a belt inner-surface cleaner; and a belt outer-surface cleaner, wherein the inner-surface cleaner and outer-surface cleaner are releasably engagable with the belt.

[0013] In another basic aspect, the present invention provides a method for re-furbishing an ink-jet printer having a belt cleaning apparatus, including the steps of: removing the cleaning apparatus; and replacing the cleaning apparatus.

[0014] In another basic aspect, the present invention provides consumable ink-jet belt cleaning apparatus including: mounts for positioning cleaners in contraposition to each side of the belt; and cleaners affixed to the mounts.

[0015] In another basic aspect, the present invention provides an ink-jet hard copy apparatus endless-loop, vacuum-actuated, media transport belt cleaning system, including: a renewable first belt cleaning subsystem mounted adjacent an inner surface of the belt, including at least one belt wiper; a renewable second belt cleaning subsystem mounted adjacent an outer surface of the belt, including at least one belt wiper, wherein the first belt cleaning subsystem and second belt cleaning subsystem are contraposed with the belt therebetween and are selectively engagable and disengagable with the respective inner surface and outer surface.

[0016] Some advantages of the present invention are:

it provides a self-contained subsystem which may be repaired, replenished, or replaced independently the transport belt subsystem;

it provides commercial implementation using consumable parts which can be obtained and installed by the end user; and

it provides a simple re-manufacture capability to the apparatus in which it is implemented.

[0017] The foregoing summary and list of advantages is not intended by the inventors to be an inclusive list of all the aspects, objects, advantages and features of the present invention nor should any limitation on the scope of the invention be implied therefrom.

[0018] This Summary is provided in accordance with the mandate of 37 C.F.R. 1.73 and M.P.E.P. 608.01(d) merely to apprise the public, and more especially those interested in the particular art to which the invention relates, of the nature of the invention in order to be of assistance in aiding ready understanding of the patent in future searches. Other objects, features and advantages of the present invention will become apparent upon consideration of the following explanation and the accompanying drawings, in which like reference designations represent like features throughout the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIGURE 1 (PRIOR ART) is a perspective view drawing typifying an ink-jet hard copy apparatus.

FIGURE 2 (PRIOR ART) is a schematic elevation view illustration of a paper transport vacuum belt type ink-jet hard copy apparatus.

FIGURE 3 is a schematic elevation view illustration of a paper transport vacuum belt type ink-jet hard copy apparatus showing belt cleaning devices in accordance with the present invention.

[0020] The drawings referred to in this specification should be understood as not being drawn to scale except if specifically noted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0021] Reference is made now in detail to a specific embodiment of the present invention, which illustrates the best mode presently contemplated by the inventors for practicing the invention. Alternative embodiments are also briefly described as applicable.

[0022] Turning to **FIGURE 3**, a belt cleaning subsystem 300 in accordance with the present invention is shown in an exemplary embodiment implementation as part of an ink-jet hard copy apparatus 210' schematically represent by a framework 210". The present invention comprises two subsystems: a belt 232 inner-surface cleaner 301 and a belt outer-surface cleaner 302, wherein the "outer-surface" is a vacuum-holding transport surface of the belt. The cleaner 301, 302 subsystems are preferably independently serviceable. In the exemplary embodiment shown, the cleaner 301, 302

subsystems are subjacent a vacuum-box-platen 236.

[0023] The inner-surface cleaner 301 includes an inner-surface wiper mount 303, such as a stiff, flat plate - *e.g.*, a metal, sheet metal, or plastic plate - with a mounting flange 303'. The wiper mount 303 should be at least as wide as the belt 232 cross-sectional dimension and have a length to optimize wiping area and wiper absorbent capacity as the belt passes between the drive rollers 239, 240. A belt inner-surface wiper 305 is affixed to the mount 303 such that a wiping surface is adjacent the inner-surface of the belt 232. In order to prevent excessive wear it is preferable that the wiping surface to belt inner-surface have a clearance, e.g., approximately one millimeter ("mm"), when not being used to clean the inner-surface. It is preferred that this wiper 305 be fabricated of a dry, absorbent, lint-free material. For example, a three-to-five millimeter thick, felt pad, or a relatively high density, absorbent, sponge material may be employed. Launderable, reusable, pad materials can be employed. Disposable pad materials can be employed. In general, the contact surface of wiper, or pad, 305 material should be relatively smooth and somewhat compliant in order to clean the belt surface effectively. If made of a fiber-based material, the contact surface of the wiper 305 could be singed or otherwise treated as would be known in the art to prevent fibers from tracking onto the belt 232. All wiper materials should be soft enough not to damage belt surfaces.

[0024] The inner-surface wiper 305 can be glued to the mount 303 such that the entire subsystem is disposable and replaceable. Alternatively, the inner-surface wiper 305 can be releasably secured to the mount 303 in a known manner so that the belt inner-surface wiper 305 is removable and replaceable with a clean wiper replacement pad for a reusable mount 303. The inner-surface wiper 305 should be equal to or slightly greater than the belt 232 width dimension.

[0025] The outer-surface belt cleaner 302 subsystem could be a mirror embodiment of the inner-surface belt cleaner 301, subjacent the belt 232 opposing the inner-surface belt cleaner 301 subsystem. Each subsystem 301, 302 can employ a known manner elevating subsystem to engage respective wipers with the belt 232 inner and outer surfaces. However, as the outer surface of the belt 232 will have a far greater degree of deposits, it has been found to be preferable to use both wet and dry wiping of at least the outer surface.

[0026] As shown in the embodiment of FIGURE 3 therefore, a wet pressure pad 307 and a dry pressure pad 309 are provided in series for sequentially wiping the belt 232 outer surface. In the belt travel direction, arrow 231, the wet pressure pad 307 is upstream and the dry pressure pad 309 downstream. A pad holder 311 is mounted in the apparatus 210' subjacent the belt 232 and opposing at least some part of the inner-surface belt cleaner 301 subsystem. The pad holder 311 is provided with positive pressure biasing members 313, 315 for each pad 307, 309. The pad holder 311 is mounted on at least one return biasing member 317. In the shown embodiment, a clearance, for example in the range of approximately one to three millimeters, is provided between the reach of each pads' 307, 309 cleaning surface and the outer surface of the belt 232 when the subsystem 302 is disengaged. The belt 232 during a paper transport and printing operational cycle through the print zone 107 is thus free to travel between the inner-surface cleaner 301 and the outer-surface cleaner 302. To clean the belt 232, the elevating subsystem 319 (in this embodiment a cam having a mechanical linkage (not shown) for end-user manipulation) lifts the holder 311 until the gap between the wet pressure pad 307 and dry pressure pad 309 in the holder 311 and the belt surface is closed. Then, the holder 311 elevating subsystem 319 continues upward until the gap between the inner-surface belt cleaner 301 is also closed. Thus, both surfaces of the belt 232 are being wiped by the belt wiping pads 305, 307, 309 when the elevating subsystem 319 is engaged. It should be recognized that separate elevating subsystems can be provided for each cleaner subsystem 301, 302. The wet pressure pad 307 is pre-soaked with a solvent appropriate to the type of ink employed (or other aerosol chemical being used in a non-ink-jet environment). The dry pressure pad 317 should be absorbent of the solvent and ink residue and solvent mixtures.

[0027] Either the entire belt outer-surface cleaner 302 subsystem can be replaceable as a unit or each pad can be separately replaceable in the same manner as with the inner-surface wiper 305. The wet and dry cleaning pads may be replaceable at every cleaning cycle or be designed to be more durable as needed.

[0028] In operation, such when ink smearing is noticed on the back side of a finished print or during routine maintenance by the end-user, fresh wipers are installed if needed, and the cam 319 is turned (counter-clockwise in this illustration) to raise the holder 311 and contained pressure pads 307, 309 up against the outer surface of the belt 232 (direction indicated by arrows on the belt drive rollers 239, 240) until the biasing members 313, 315 exert enough force to push the belt 232 upward until its inner surface is pressed against the inner surface wiper 305. The pressure will squeeze some solvent out of the wet pad 307. Note that since the belt 232 is perforated for transmission of a vacuum in this embodiment, some solvent will be passed through the perforations to the inner surface of the belt and, consequently, onto the inner surface wiper 305. The inner wiper 305 can be of a material having a higher surface energy than that of the transport surface wipers 307, 309 in order to help solvent to be drawn through the belt perforations. Thus, both sides of the belt 232 are "washed." Downstream, the inner surface wiper 305 and the dry pressure pad 309 will absorb the mixture of solvent and particulate residue washed from the belt 232.

[0029] After a predetermined, recommended time of contact, the cam 319 is reversed and the belt 232 re-

leased from the cleaner 301, 302 subsystems. While a predetermined pressure of the wipers against the belt surfaces can be tailored, it should also be recognized that solvent can be transferred to the belt via capillary forces created by the interface between the belt and wipers when the belt is moving.

[0030] In order to eliminate reverse bending of the belt and reduce belt fatigue, the inner surface cleaning subsystem can also be movable into engagement with the belt only during a cleaning operation.

[0031] The foregoing description of the preferred embodiment of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form or to exemplary embodiments disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in this art.

[0032] The present invention has been described in an implementation for an ink-jet hard copy apparatus, but this is not intended as a limitation (nor should any be implied) as it is known to use vacuum belts in many conveyor systems for flexible materials. While the outer-surface cleaner 302 is shown as two replaceable pads, one wet and one dry, a single pad having a wet region upstream of a dry, solvent-absorbing region may also be employed to reduce manufacturing costs and to simplify pad replacement. Another example of a modification contemplated by the inventors is a C-clamp type mechanism with the pads mounted for clamping the belt therein. Moreover, it should be recognized that automated, electromechanical devices can be employed for activating the cleaner mechanisms to wipe the belt.

[0033] Similarly, any process steps described might be interchangeable with other steps in order to achieve the same result. The embodiment was chosen and described in order to best explain the principles of the invention and its best mode practical application, thereby to enable others skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use or implementation contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather means "one or more." Moreover, no element, component, nor method step in the present disclosure is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the following in the following claims. No claim element herein is to be construed under the provisions of 35 U.S.C. Sec. 112, sixth paragraph, unless the element is expressly recited using the phrase "means for. . .."

Claims

1. Method for cleaning a transport belt 232, having a transport surface, **characterized by** the steps of:

positioning at least one wiper 305/307-9 in non-contacting juxtaposition to at least the transport surface; and

selectively repositioning the wiper into contact with the associated belt side adjacent the surface.

2. The method as set forth in claim 1, **characterized by** the step of:

at least one wiper 307 bearing cleaning fluid.

3. The method as set forth in claim 2, **characterized by** the step of:

applying the cleaning fluid 307 upstream of an absorbing region 309 of at least one wiper.

4. The method as set forth in claim 1, 2, or 3, the step of positioning **characterized by**:

positioning a wiper 305/307, 309 in non-contacting juxtaposition to each associated belt side by positioning a first wiper 305 adjacently to a back side of the belt 232, positioning a second wiper 306/307 adjacently to the transport surface of the belt, opposing the back side, wherein the first wiper and the second wiper are contraposed with respect to each other with the belt therebetween.

5. The method as set forth in claim 4, the step of positioning **characterized by**:

providing the second wiper with an upstream solvent bearing member 307 and a downstream solvent absorbing member 309.

6. The method as set forth in claim 5, the step of selectively repositioning **characterized by**:

pressing the second wiper 307-9 against the first wiper 305 with the belt 232 therebetween at a predetermined pressure for releasing the solvent from the upstream solvent bearing member onto the belt.

7. The method as set forth in claim 5, the step of selectively repositioning **characterized by**:

contacting each wiper against a belt side such that solvent is transferred to belt surfaces by a capillary force in the interface between each wiper and each associated belt side when the belt is moving.

8. The method as set forth in claim 5, the step of selectively repositioning each wiper into contact with the associated belt side **characterized by**:

the predetermined pressure is set such that the solvent passes through perforations in the belt and is received by the first wiper 305.

9. A transport belt 232 cleaning apparatus 301 **char-**

acterized by:

means for cleaning 305-9 non-contactingly juxtaposed on each side of the belt; and
means for engaging 302 the cleaning means with the belt.

10. The apparatus as set forth in claim 9, **characterized by**:
the cleaning means 305-9 are replaceable.

11. The apparatus as set forth in claim 9, **characterized by**:
the cleaning means 305-9 are refurbishable.

12. The apparatus as set forth in claim 9, **characterized by**:
the cleaning means 305-9 are disposable.

13. The apparatus as set forth in claim 9, 10, 11, or 12 further **characterized by**:
at least one cleaning means 307 bearing a cleaning solvent.

14. The apparatus as set forth in claim 9, **characterized by**:
a second cleaning means 305/309 is solvent absorbing, said second cleaning means mounted downstream of the one cleaning means.

15. The apparatus as set forth in claim 9, 10 , 11, 12, 13, or 14 **characterized by**:
the engaging means 302 includes means for selectively causing 311-19 contact of each cleaning means 305-9 with opposing surfaces of the belt 232.

16. An ink-jet hard copy apparatus 210 **characterized by**:

a transport belt 232 for media 105 input-output 231;
a belt inner-surface cleaner 301; and
a belt outer-surface cleaner 302, wherein the inner-surface cleaner and outer-surface cleaner are releasably
engagable 311- 319 with the belt.

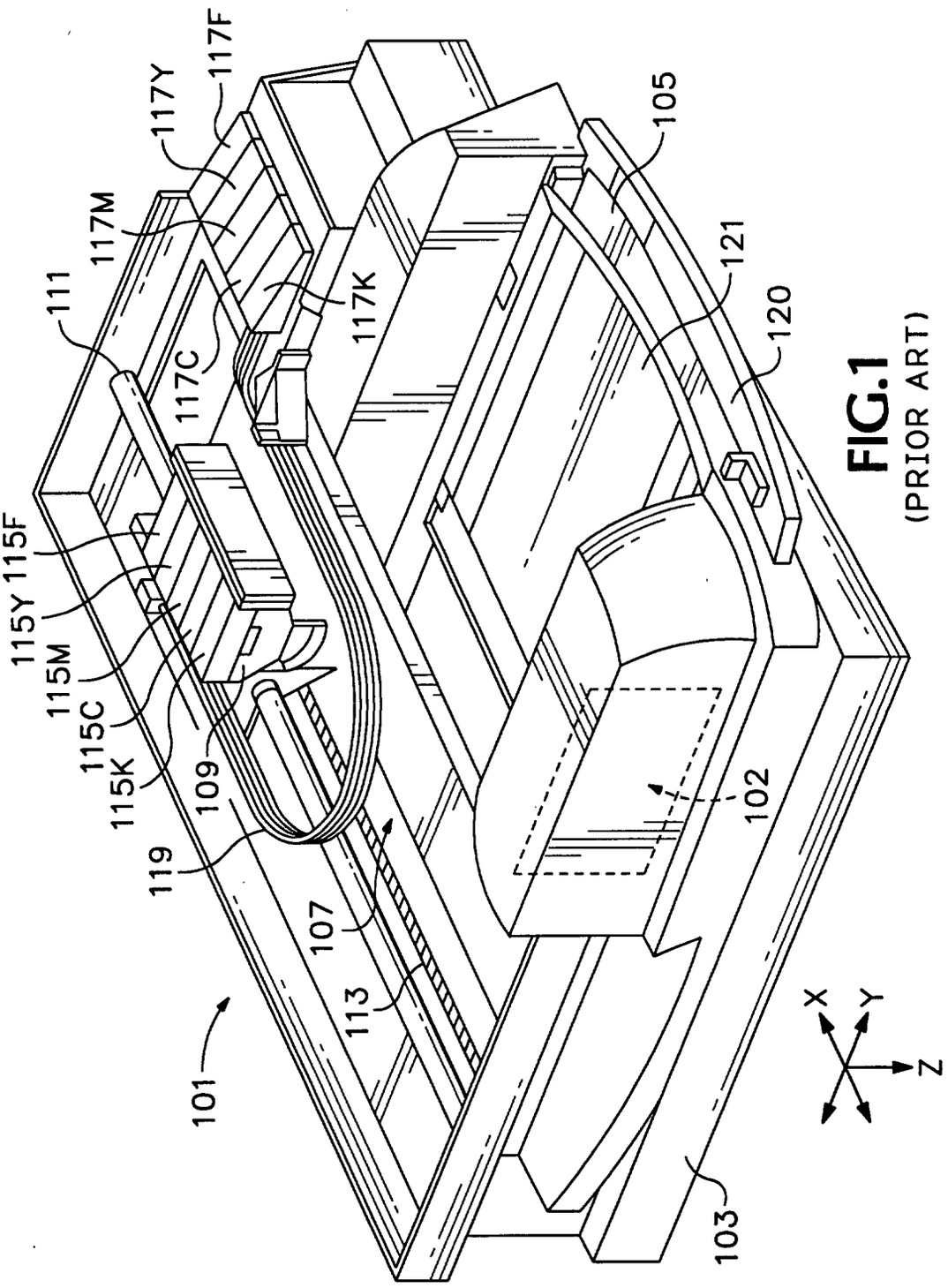

FIG.1
(PRIOR ART)

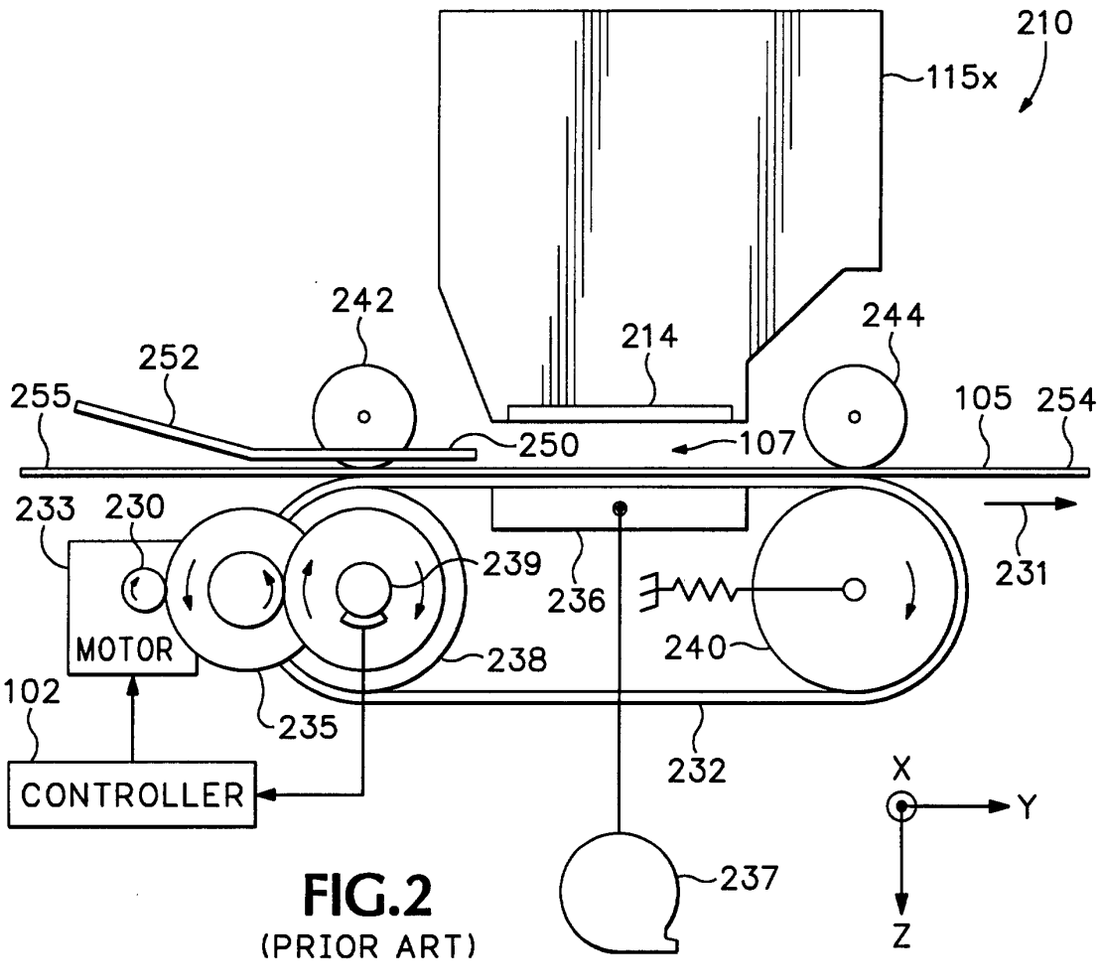

FIG.2
(PRIOR ART)

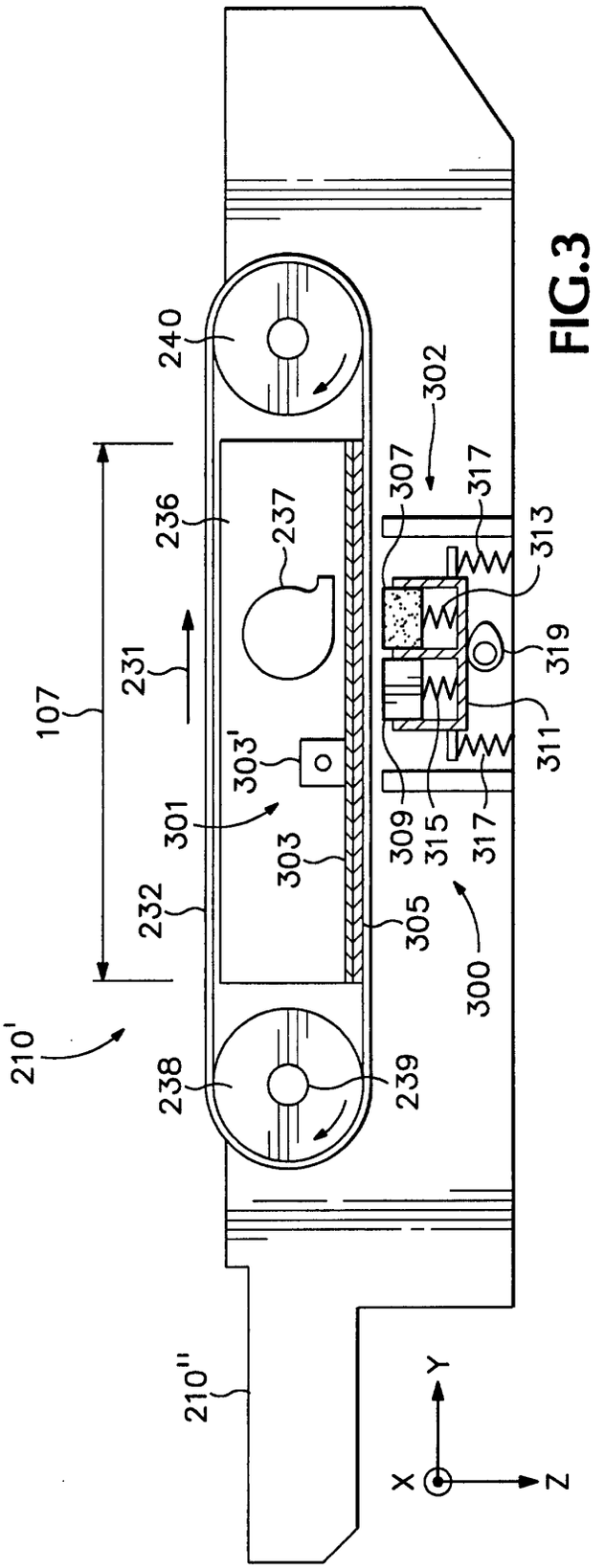
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FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 4446

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	US 5 526 028 A (ROTTMAN ROBERT M) 11 June 1996 (1996-06-11) * column 5, line 45 - column 7, line 20; figure 3 *	1-16	B41J29/17 B41J13/08 B65G45/22 B65G45/24
X	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 12, 29 October 1999 (1999-10-29) & JP 11 192768 A (CANON INC), 21 July 1999 (1999-07-21) * abstract *	1-16	
X	US 5 225 852 A (IKKATAI MASATOSHI ET AL) 6 July 1993 (1993-07-06) * column 8, line 3 - line 66; figure 3 *	1-8	
X	US 5 239 926 A (JOHNSON CHRISTOPHER B ET AL) 31 August 1993 (1993-08-31) * column 10, line 25 - line 36 * * column 10, line 52 - line 59 * * figure 6 *	1-8	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B41J
B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	26 July 2001	Bridge, S

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 01 30 4446

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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26-07-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5526028 A	11-06-1996	BR 9602343 A	01-09-1998
		DE 69601248 D	11-02-1999
		DE 69601248 T	02-06-1999
		EP 0744301 A	27-11-1996
		JP 8324067 A	10-12-1996
JP 11192768 A	21-07-1999	NONE	
US 5225852 A	06-07-1993	JP 2891796 B	17-05-1999
		JP 4219264 A	10-08-1992
		US 6196654 B	06-03-2001
		US 5912680 A	15-06-1999
US 5239926 A	31-08-1993	EP 0624128 A	17-11-1994
		JP 7503911 T	27-04-1995
		WO 9314934 A	05-08-1993

EPO FORM P0459

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