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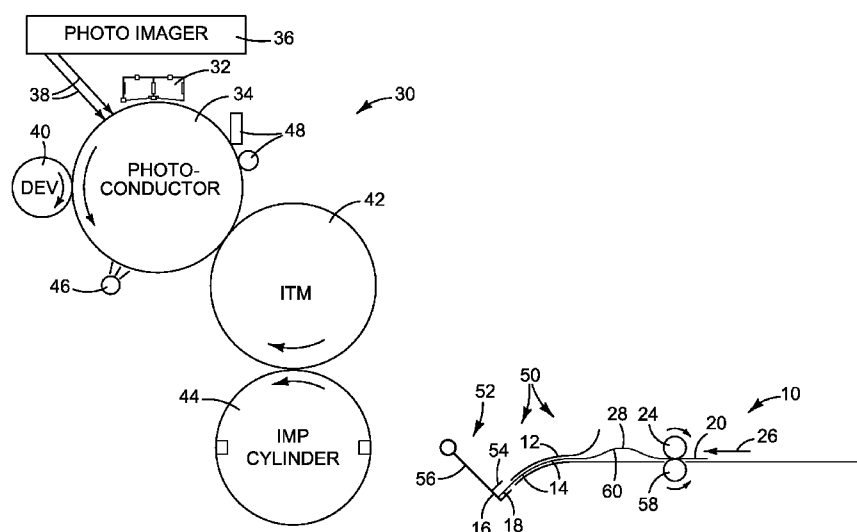


FIG. 6

(57) Abstract: In one example, a sheet media alignment system includes: a guide (12) defining a curved media path (14) that extends from an upstream part of the guide to a downstream part of the guide; a movable blocker (16, 56) to block the curved media path (14) at the downstream part of the guide, the blocker movable into and out of a blocking position in which the blocker is spaced from the downstream part of the guide a first distance; and a driver (24, 58) upstream from the curved media path to drive a media sheet into the guide along the curved media path and into the blocker. The driver is spaced from the upstream part of the guide a second distance greater than the first distance such that a media sheet driven into the blocker will buckle between the driver and the guide before it will buckle between the guide and the blocker.



GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
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MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

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— *with international search report (Art. 21(3))*

MEDIA ALIGNMENT

BACKGROUND

[0001] Liquid electrophotographic (LEP) printing uses a special kind of ink to form images on paper and other print media. An LEP printing process involves placing an electrostatic pattern of the desired printed image on a photoconductor and developing the image by presenting a thin layer of LEP ink to the charged photoconductor. Charged particles in the ink adhere to the pattern of the desired image on the photoconductor. The ink image is transferred from the photoconductor to an intermediate transfer member and then to the print media as the print media passes through a nip between an intermediate transfer member and an impression cylinder.

DRAWINGS

[0002] Figs. 1 and 2 are perspective views illustrating one example of a new sheet media alignment system.

[0003] Figs. 3-5 present a sequence of plan views showing an example alignment operation using the alignment system shown in Figs. 1 and 2.

[0004] Fig. 6 is a diagrammatic view illustrating an example printer implementation for a sheet media alignment system such as the one shown in Figs. 1 and 2.

[0005] Figs. 7-11 present a sequence of diagrammatic views showing the operation of the example alignment system shown in Fig. 6.

[0006] The same part numbers designate the same or similar parts throughout the figures. The figures are not necessarily to scale.

DESCRIPTION

[0007] In LEP printing, as in many other printing processes, it is desirable to accurately align the paper or other print media to the printing unit to produce good quality images. Sheet media may be aligned for printing by driving the leading edge of the sheet into a blocker until the sheet buckles. The blocker is oriented across the media path in the desired alignment. Any misalignment across the leading edge of the sheet, commonly referred to as “skew”, is removed as the sheet is driven into the blocker. That is to say, the sheet is “deskewed” by driving it into the blocker.

Buckling signals that the sheet has engaged the blocker across the full width of the leading edge for proper alignment. The blocker is then removed from the media path so the sheet can proceed to the printing unit.

[0008] Buckle deskew can damage the print media. It has been discovered that shaping the print media leading into the blocker helps reduce the risk of damage during deskew. In one example, a sheet media alignment system includes a guide defining a curved media path and a blocker to block the curved media path at the downstream part of the guide. A drive roller upstream from the curved media path drives a media sheet into the guide along the curved media path and into the blocker. The drive roller is spaced from the upstream part of the guide a distance sufficient to enable the sheet to buckle between the drive roller and the guide as the sheet is driven into the blocker. The leading part of the sheet, which conforms to the curve of the guide, is better able to absorb the shock of hitting the blocker and withstand the driving forces applied until the sheet buckles. Although the exact mechanism for increased toughness is not certain, it is believed the curved shape and the constraints of the guide together stiffen the sheet laterally across the media path to better resist wrinkling and increase the resilience of the sheet lengthwise along the media path to better absorb the shock of impact. The increased toughness of the shaped sheet lowers the risk of damage and expands the degree of skew that can be safely corrected. For example, testing indicates that 40mm of skew can be corrected in paper sheets as light as 45gsm using the new technique compared to 4mm for a straight sheet.

[0009] This and other examples described below and shown in the figures illustrate but do not limit the scope of the patent, which is defined in the Claims following this Description.

[0010] As used in this document “and/or” means one or more of the connected things and “side” means the top or bottom of a sheet when referring to a media sheet.

[0011] Figs. 1 and 2 illustrate one example of a new sheet media alignment system 10. Referring to Figs. 1 and 2, system 10 includes a guide 12 defining a curved media path 14 and a blocker 16 positioned along the downstream part of guide 12 to block a leading edge 18 of a media sheet 20 as it leaves guide 12. In this example, guide 12 is implemented as a deflector that deflects sheet 20 into the desired shape along media path 14. Deflector 12 constrains the top side 22 of sheet

20 along path 14. System 10 also includes a driver 24 upstream from deflector 12 to drive sheet 20 into deflector 12 along curved media path 14 and into blocker 16. In this example, driver 24 is implemented as a group of drive rollers positioned laterally across the media path to distribute the driving force uniformly across the width of sheet 20.

[0012] The group of drive rollers 24 is spaced from the upstream part of guide 12 a distance sufficient to enable sheet 20 to buckle between rollers 24 and guide 12 as leading edge 18 is driven into blocker 16, as shown in Fig. 2. In any case, the space between rollers 24 and guide 12 should be larger than the space between blocker 16 and guide 12 so that sheet 20 will buckle upstream from guide 12 before it will buckle downstream from guide 12.

[0013] The desired spacing may vary depending on the stiffness of the media sheets and the characteristics of the curved media path. For 45gsm-90gsm paper, for example, testing indicates a circular media path with a central angle Θ of at least 45° and a radius R less than 200mm should be adequate to achieve sufficient strength in each sheet 20 to absorb the shock of hitting the blocker and withstand the driving forces without damaging the sheet. (Radius R is called out in Fig. 8 and central angle Θ is called out in Fig. 9.) Although it is expected that usually it will be desirable to position blocker 16 as close as possible to guide 12, to reduce the risk of buckling or damage at the leading edge 18 of a sheet 20, blocker 16 may be positioned further from the downstream part of guide 12 for stiffer sheets 20. For 45gsm paper sheets 20, for example, a blocker positioned a distance $D1$ less than 4mm from the downstream part of guide 12 and drive rollers 24 positioned a distance $D2$ at least 50mm from the upstream part of guide 20 should be adequate to achieve the desired buckling without damaging the sheet. (Distances $D1$ and $D2$ are called out in Fig. 8.) For 90gsm paper sheets 20, for another example, a blocker positioned less than 2mm from the downstream part of guide 12 and drive rollers 24 positioned at least 70mm from the upstream part of guide 20 should be adequate to achieve the desired buckling without damaging the sheet.

[0014] Figs. 3-5 present a sequence of plan views showing an example alignment operation using a system 10 shown in Figs. 1 and 2. Guide 12 and blocker 16 are depicted with phantom lines to more clearly show sheet 20. In Fig. 3, the leading edge 18 of sheet 20 is skewed (misaligned) to the line of advance, indicated by arrow 26. Rollers 24 are driving sheet 20 into guide 12 and the leading part of sheet

20 is bending down along the curved paper path. In Fig. 4, sheet 20 is “deskewed” as rollers 24 drive the leading edge 18 of sheet 20 into blocker 16 until, in Fig. 5, a buckle 28 forms in sheet 20 between rollers 24 and guide 12. Buckle 28 signals the end of the alignment operation, when blocker 16 is removed to allow the now aligned sheet 20 to advance.

[0015] Fig. 6 illustrates an example printer implementation for a sheet media alignment system such as the one shown in Figs. 1 and 2. Referring to Fig. 6, in this example an LEP printer 30 includes a scorotron or other suitable charging device 32 to apply a uniform electric charge to a photoconductor 34, the photosensitive outer surface of a cylindrical drum for example. A scanning laser or other suitable photoimaging device 36 exposes select areas on photoconductor 34 to light 38 in a pattern corresponding to the desired ink image. A thin layer of LEP ink is applied to the patterned photoconductor 34 using a developer 40. Developer 40 represents a usually complex unit that supplies ink to photoconductor 34, for example through a series of rollers that rotate against the surface of the photoconductor. The ink from developer 40 adheres to the latent electrostatic image on photoconductor 34 to “develop” a liquid ink image on the photoconductor.

[0016] The liquid ink image is transferred from photoconductor 34 to an intermediate transfer member (ITM) 42 and then from ITM 42 to a media sheet 20 as it passes between ITM 42 and an impression cylinder 44. For some LEP printing processes, the images for each color plane are applied sequentially to a sheet 20 that goes around and around on cylinder 44 until all of the color plane images are transferred to the sheet. A lamp or other suitable discharging device 46 removes residual charge from photoconductor 34 and ink residue is removed at a cleaning station 48 in preparation for developing the next ink image.

[0017] Printer 30 also includes a media transport system 50 that includes a sheet alignment system 12 and a rotary sheet transfer mechanism 52 to transfer sheets from alignment system 12 to impression cylinder 44. In this example, transfer mechanism 52 is configured with a gripper 54 at the end of an arm 56. Alignment system 12 includes a drive roller 24 that rotates against an idler roller 58 to apply a driving force to sheet 20, and a guide 12 that defines a curved media path 14. The end of rotary arm 56 forms the blocker 16 in sheet alignment system 12. In this example, guide 12 is configured as a channel to constrain both the top side 22 and bottom side 60 of sheet 20 along path 14. Although the height of the media path

through a channel 12 may vary depending on the thickness of media sheet 20, a channel 2m to 6mm will pass paper sheets up to 600gsm with sufficient constraint to enable the desired deskew without additional risk of damage to the sheet.

[0018] Figs. 7-11 present a sequence showing the operation of the example alignment system 12 shown in Fig. 6. In Fig. 7, drive roller 24 is driving the leading edge 18 of sheet 20 into blocker 16 until, in Fig. 8, a buckle 28 forms in sheet 20 between rollers 24 and guide 12. Buckle 28 signals the end of the alignment operation and, as shown in Fig. 9, drive roller 24 is disengaged from sheet 20 as gripper 54 grips the leading edge 18 of sheet 20 and arm 56 is rotated to transfer the sheet to impression cylinder 44. As shown in Figs. 10 and 11, arm 56 rotates gripper 54 along impression cylinder 44 to complete the transfer of sheet 20 from alignment system 12 to cylinder 44. The operation may then begin again for the next sheet after the ink image has been fully applied to sheet 20 at the nip between transfer member 42 and impression cylinder 44.

[0019] The examples shown in the figures and described above illustrate but do not limit the patent, which is defined in the following Claims.

[0020] "A", "an" and "the" used in the claims means at least one.

CLAIMS

1. A sheet media alignment system, comprising:
a guide defining a curved media path that extends from an upstream part of the guide to a downstream part of the guide;
a movable blocker to block the curved media path at the downstream part of the guide, the blocker movable into and out of a blocking position in which the blocker is spaced from the downstream part of the guide a first distance; and
a driver upstream from the curved media path to drive a media sheet into the guide along the curved media path and into the blocker, the driver spaced from the upstream part of the guide a second distance greater than the first distance such that a media sheet driven into the blocker will buckle between the driver and the guide before it will buckle between the guide and the blocker.
2. The system of Claim 1, where the curved media path has a central angle of at least 45°.
3. The system of Claim 2, where the curved media path is circular with a radius less than 200mm.
4. The system of Claim 3, where the first distance is less than 4mm and the second distance is at least 50mm.
5. The system of Claim 1, where the guide comprises a channel to constrain both sides of a media sheet along the curved media path through the channel.
6. The system of Claim 5, where the curved media path through the channel is 2mm to 6mm high.
7. The system of Claim 1, where the guide comprises a deflector to constrain a top side of a media sheet along the curved media path.

8. A sheet media alignment system, comprising:
a guide defining a curved media path;
a blocker to block a leading edge of a media sheet exiting the guide; and
a drive roller upstream from the curved media path to drive a media sheet into the guide along the curved media path and to drive the leading edge of the sheet into the blocker;

the blocker positioned less than 4mm from an exit from the guide when the blocker is in a blocking position; and
the drive roller positioned at least 50mm from an entrance to the guide.

9. The system of Claim 8, where the curved media path has a central angle of at least 45°.

10. The system of Claim 9, where the curved media path is circular with a radius less than 200mm.

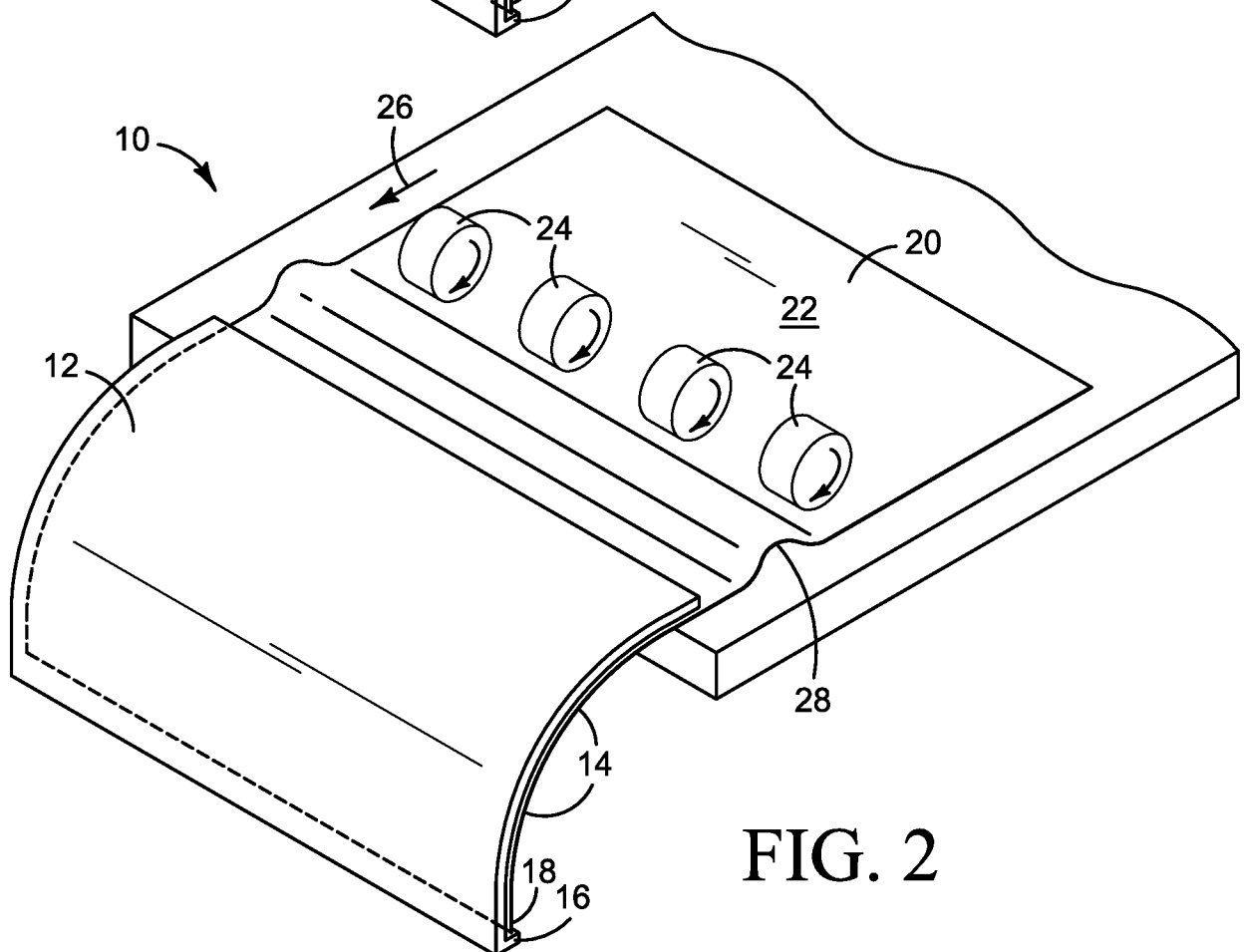
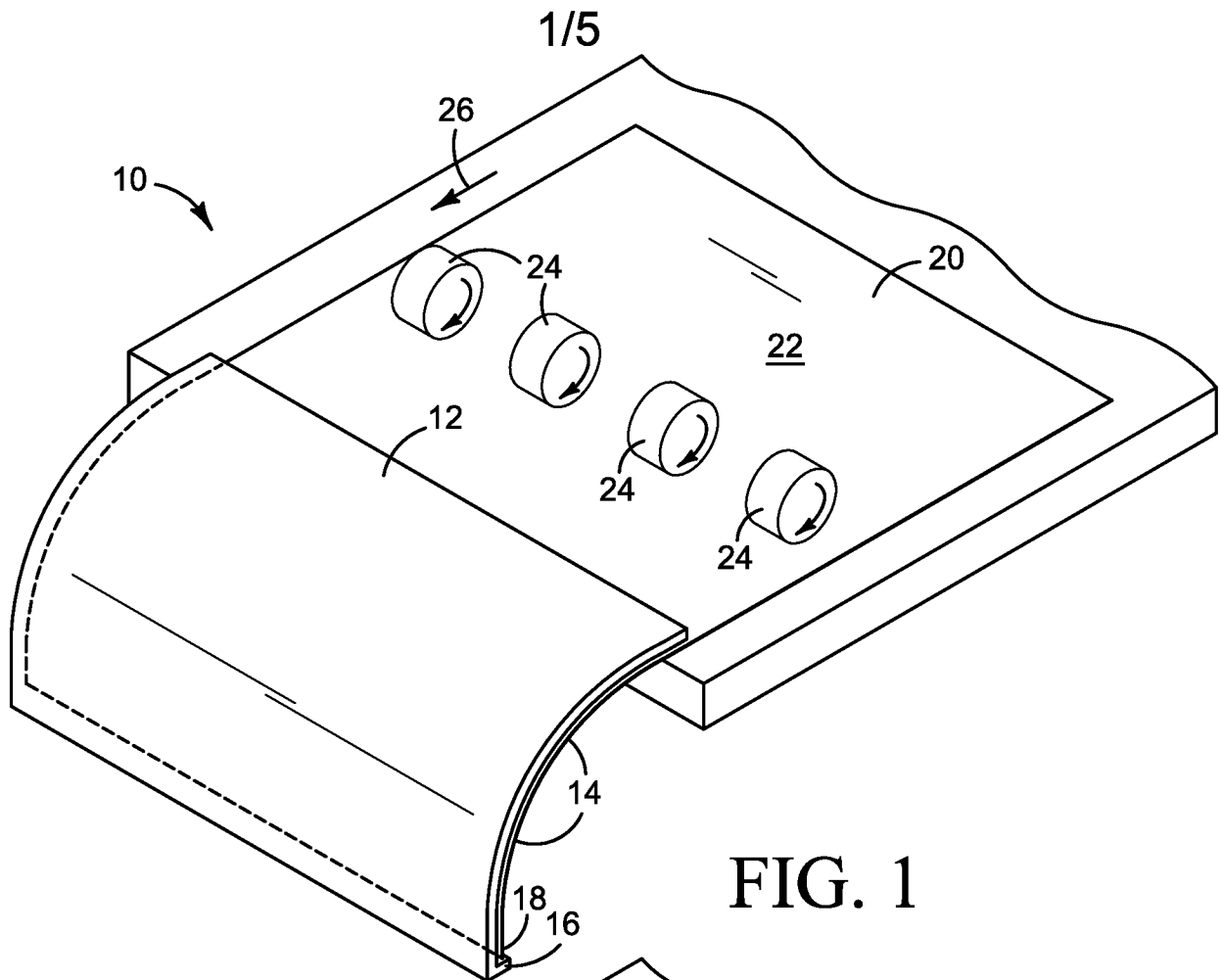
11. A sheet media alignment system, comprising:
a channel defining a curved media path that extends from an upstream part of the channel to a downstream part of the channel;
a transfer mechanism to move a media sheet away from the downstream part of the channel, the transfer mechanism movable into a stationary blocking position to block a leading edge of the media sheet leaving the channel and away from the stationary blocking position to move the media sheet out of the channel; and
a drive roller upstream from the channel to drive the leading edge of the media sheet into the transfer mechanism when the transfer mechanism is in the stationary blocking position.

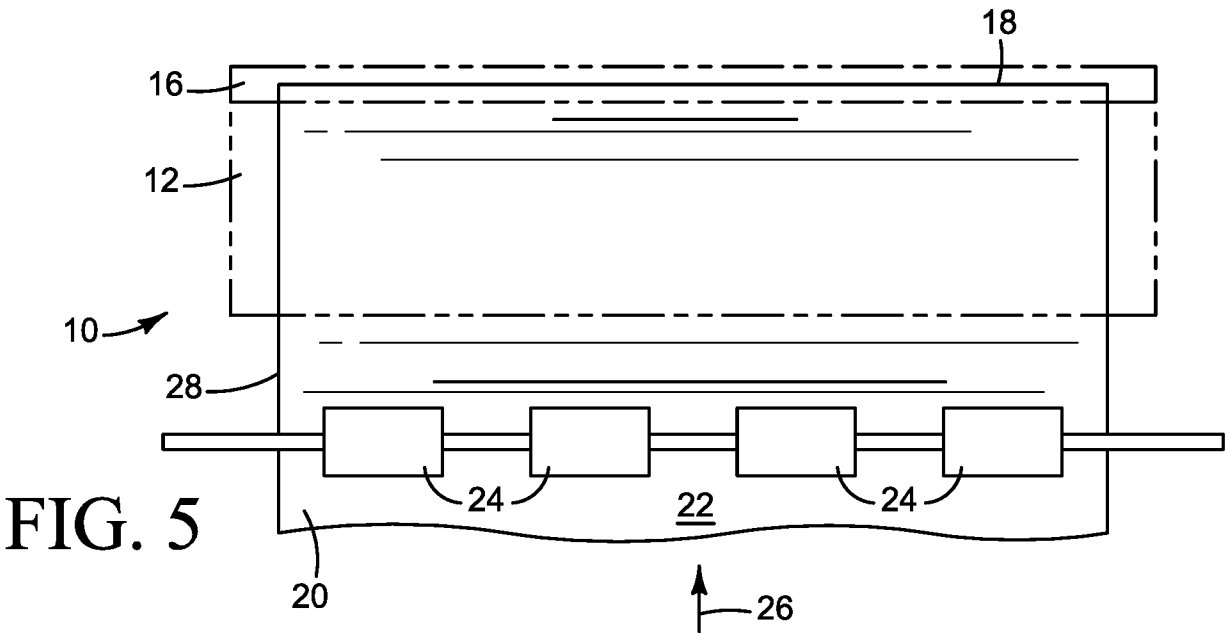
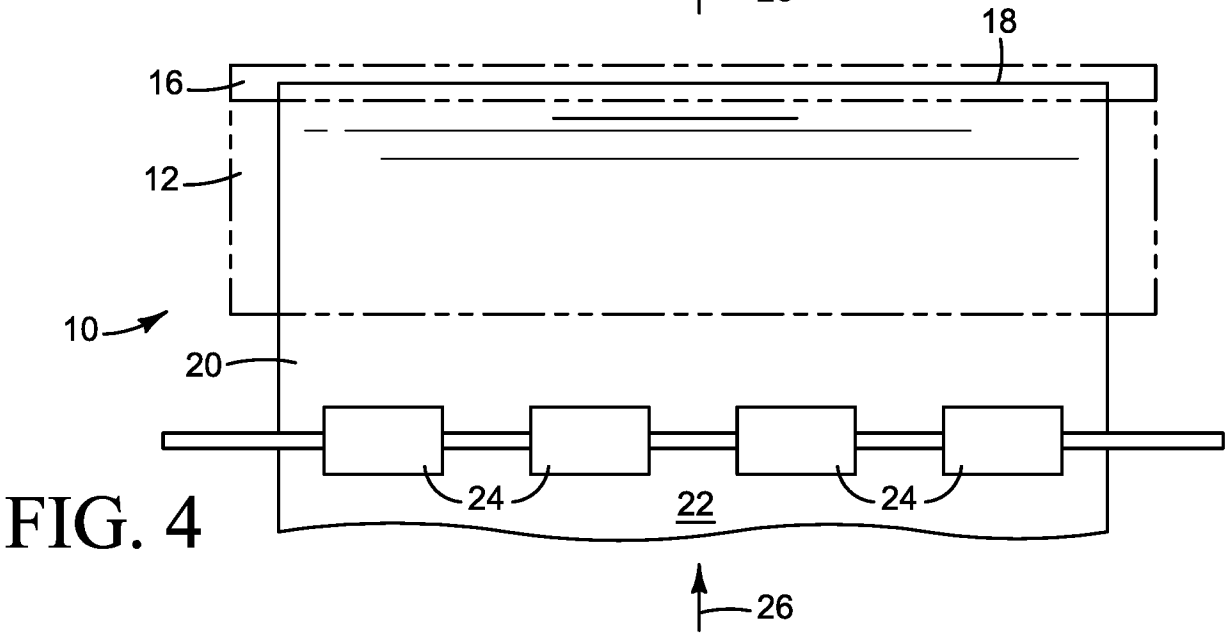
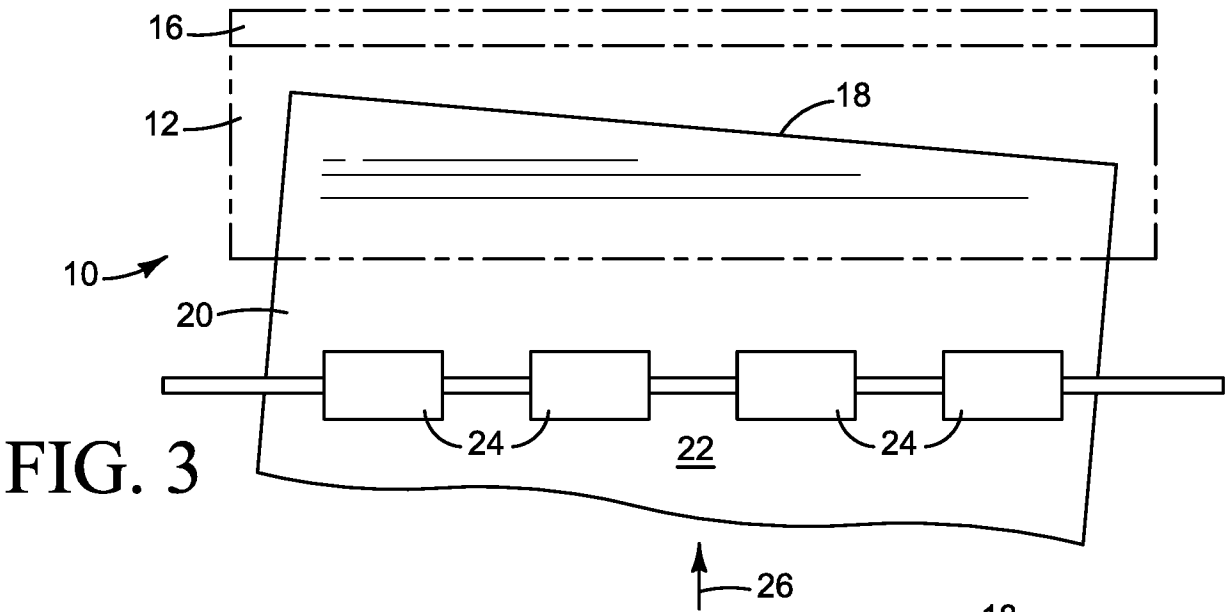
12. The system of Claim 11, where the transfer mechanism includes a gripper to releasably grip the leading edge of the media sheet, the gripper blocking the leading edge of the media sheet leaving the channel when the transfer mechanism is in a blocking position and the gripper gripping the leading edge of the media sheet when the transfer mechanism is moving away from the stationary blocking position.

13. The system of Claim 12, where the transfer mechanism comprises a rotary arm to rotate the gripper into and away from a blocking position.

14. The system of Claim 13, where:
the gripper is spaced from the downstream part of the channel a first distance when the transfer mechanism is in a stationary blocking position; and
the drive roller is spaced from the upstream part of the channel a second distance greater than the first distance such that the media sheet driven into the stationary gripper will buckle between the drive roller and the channel before it will buckle between the channel and the gripper.

15. The system of Claim 14, where:
the curved media path has a central angle of at least 45°;
the first distance is less than 4mm; and
the second distance is at least 50mm.





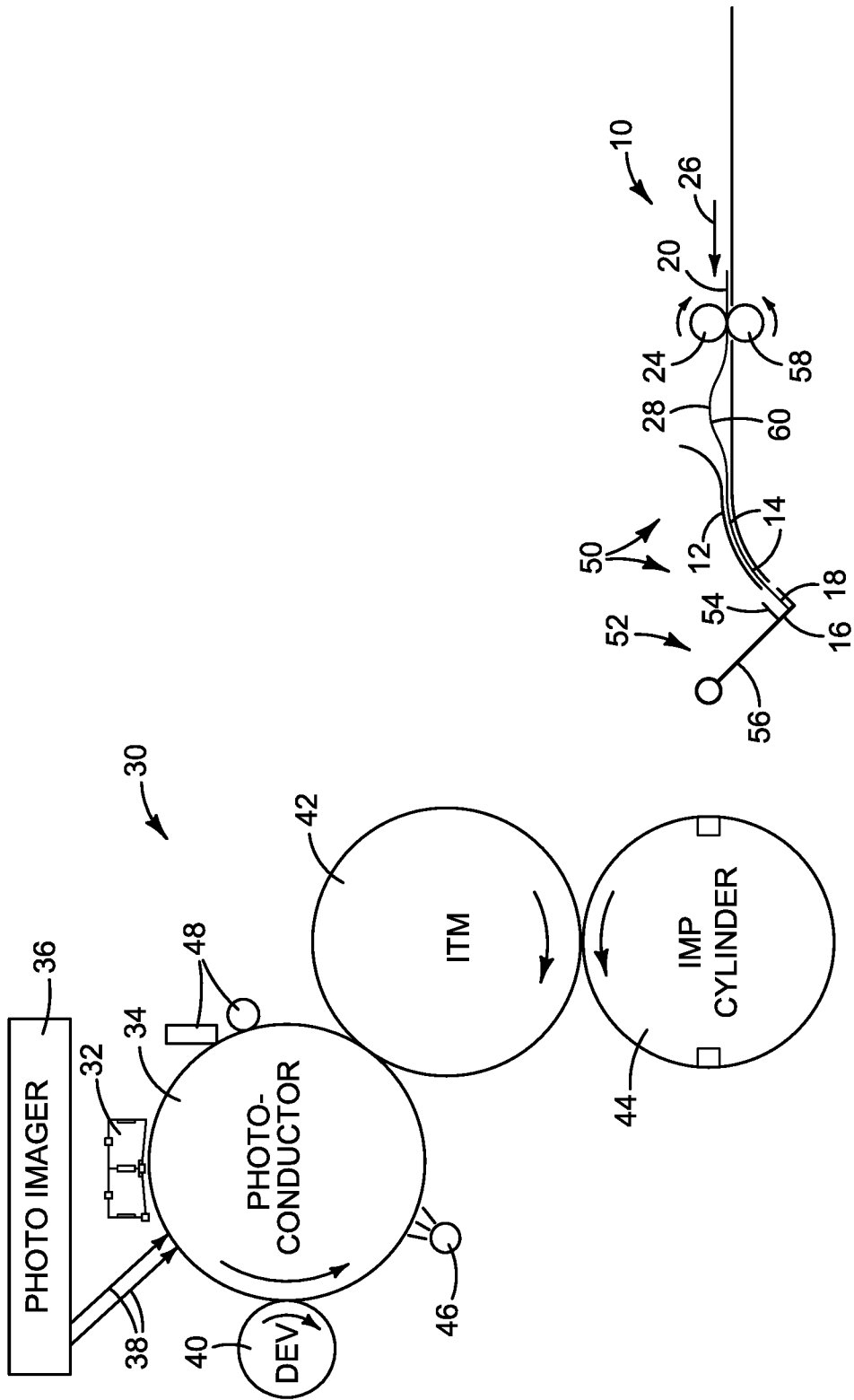


FIG. 6

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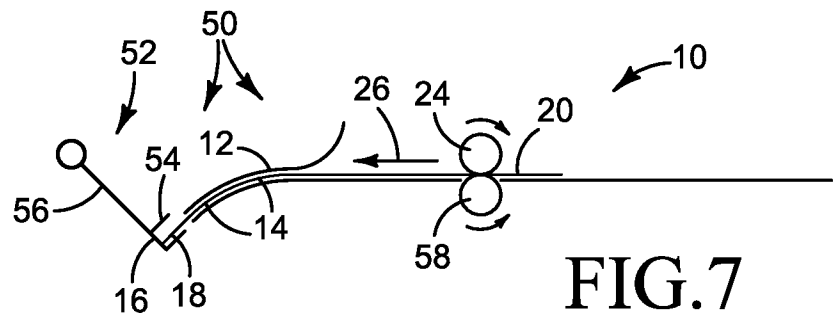
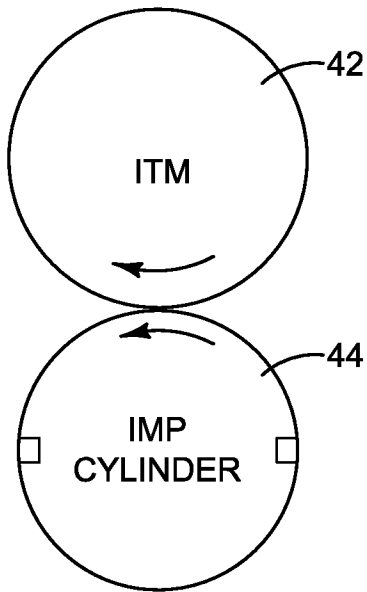


FIG. 7

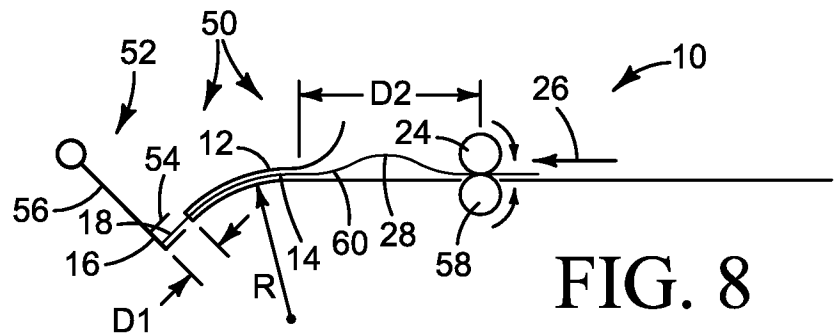
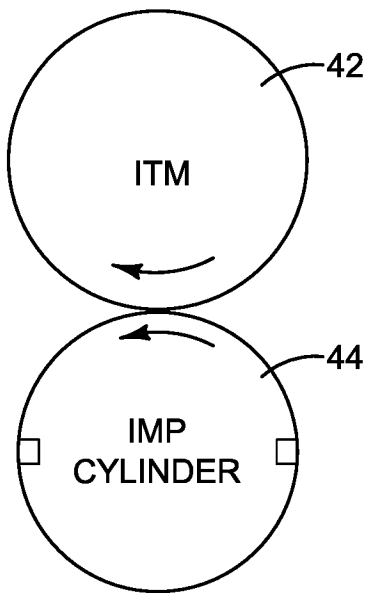


FIG. 8

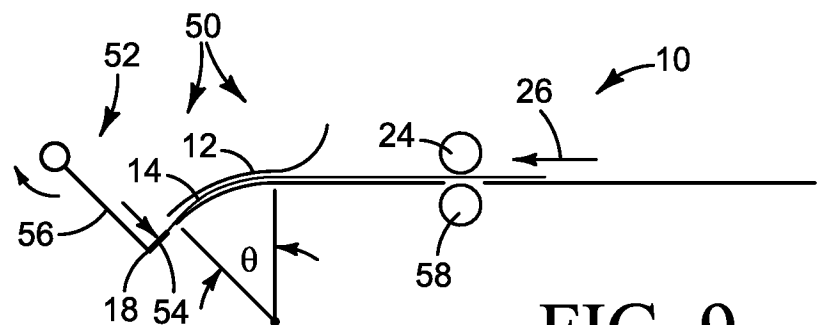
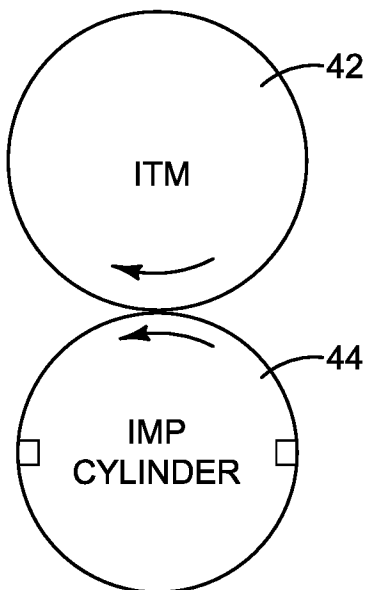
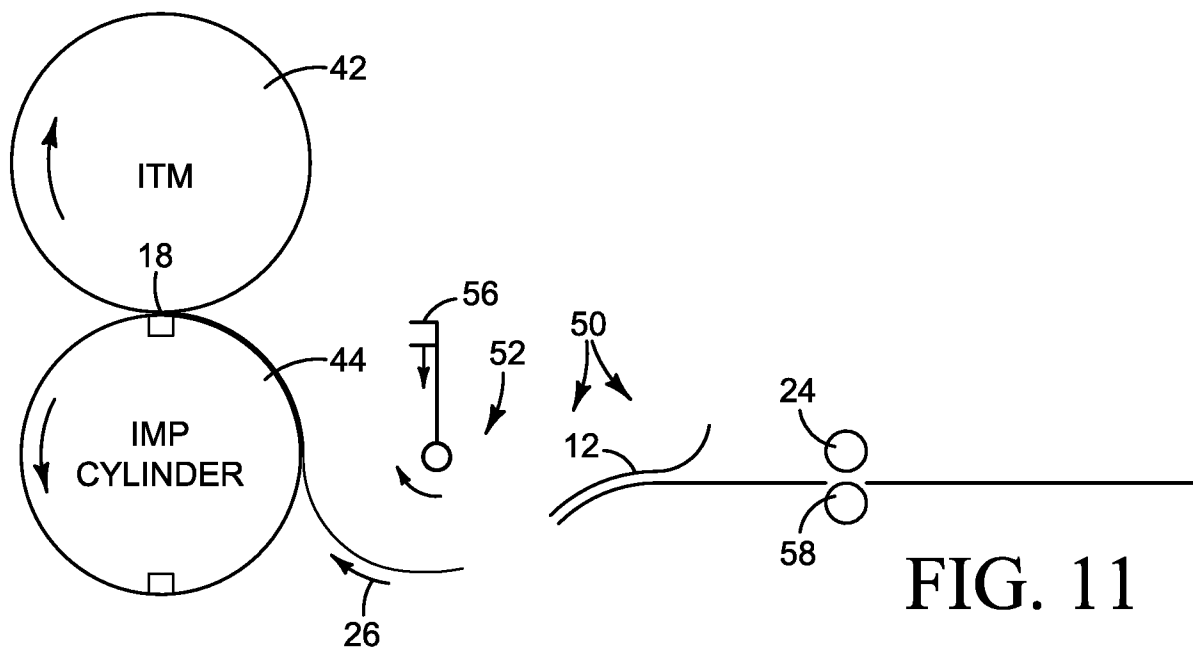
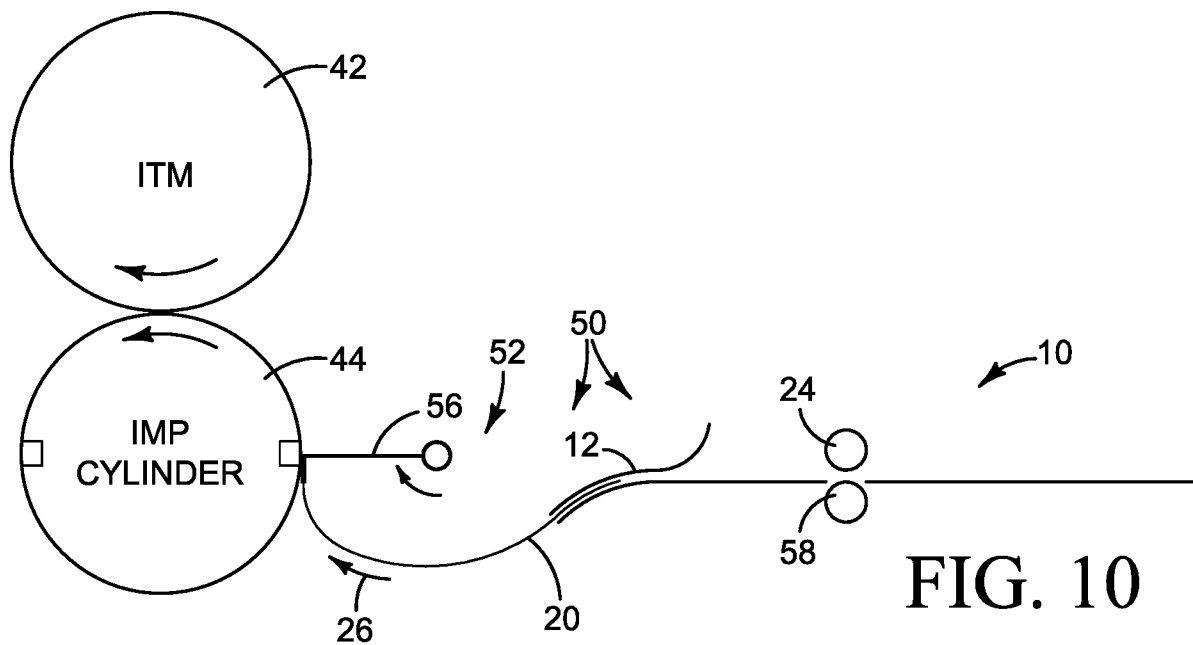


FIG. 9

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/059551

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H5/38 B65H9/06 B65H5/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/076250 A1 (JOHNSON BRUCE G [US] ET AL) 20 June 2002 (2002-06-20) paragraph [0017] - paragraph [0020]; figures 1-4	1-10
A	----- EP 2 845 824 A1 (RICOH CO LTD [JP]) 11 March 2015 (2015-03-11) paragraph [0054] - paragraph [0071]; figures 1-18	1-10
A	----- GB 1 406 346 A (IBM) 17 September 1975 (1975-09-17) page 1, line 48 - page 2, line 90; figures 1-3	1-10
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 March 2018

Date of mailing of the international search report

27/03/2018

Name and mailing address of the ISA/

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Authorized officer

Henningsen, Ole

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/059551

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004/028438 A1 (SHIN SANG-YOB [KR]) 12 February 2004 (2004-02-12) paragraph [0026] - paragraph [0035]; figures 1-8 -----	1-10
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/059551

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2017/059551

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☒ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10

Sheet media alignment system with means for controlling where along the media path the sheet media buckles when driven against a blocker.

2. claims: 11-15

Sheet media alignment system with means for aligning and directly transporting the aligned sheet media to the following process.
