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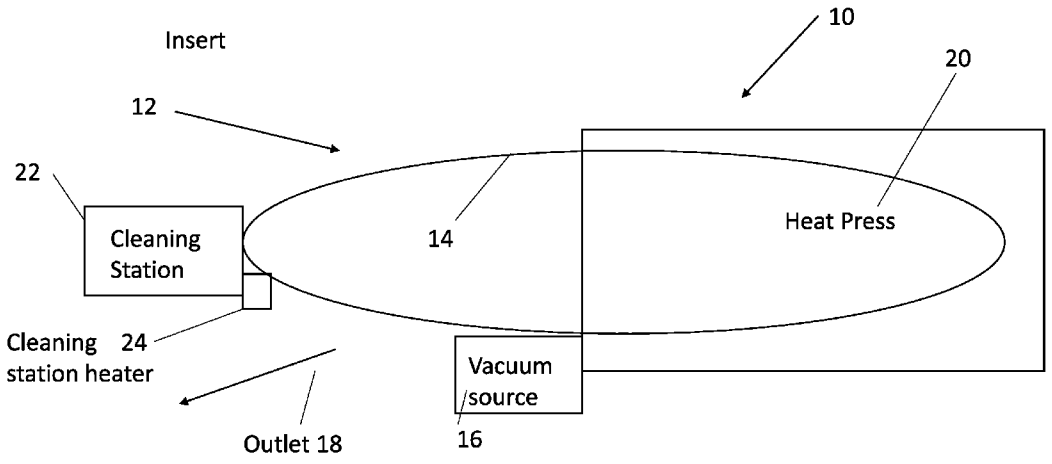


FIG. 1

(57) Abstract: A fixation/transfer device for control of dye waste in a dye sublimation process. The device comprises a textile inlet, a textile outlet, a heat press or calender, an endless belt for driving the textile from the textile inlet to the textile outlet through the heat press, the heat press being held at a temperature sufficient to cause sublimation of the printing dye, and a cleaning station for cleaning the endless belt, the cleaning station being located downstream of the textile outlet and upstream of the textile outlet. The feed belt may be heated at the cleaning station so that sublimation may assist cleaning.

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DYE SUBLIMATION CALENDER

FIELD AND BACKGROUND OF THE INVENTION

The present invention, in some embodiments thereof, relates to a heat press or calender for use with a textile printer which uses dye sublimation.

Digital printing has replaced traditional methods in different branches of the graphics industry. There are multiple reasons for this shift but the main drivers are the cost-efficiency, possibility to personalise prints and flexibility.

The textile printing business is part of the graphics industry and the same trends apply. Traditional screen-printing is being replaced by digital textile printing solutions using ink jet and sublimation printing for shorter production runs and prints that require multiple colours and photographic imagery. The digital alternatives are ideal for the personalisation of prints, which is extremely popular nowadays.

Sublimation printing is a technique that uses heat sensitive inks. These inks turn into gas under the influence of heat and combine with various textile media such as a 100% polyester medium. The ink may actually become part of the structure of the material so that the images on the fabric do not fade or crack even after multiple washing. The ink may be transferred to the textile using transfer paper or a blanket. US 20080229962 A1 to Shedd et al relates to an example of sublimation transfer paper.

Calendering is used as a finishing process on textiles, typically to smooth, coat or thin a material, and to cause sublimation to occur when sublimation inks are in use. The fabric is passed through rollers, or between rollers and a drum, at high temperature and pressure with the inks being applied. The elevated temperature causes rapid sublimation, leading to a cloud of ink vapor. The vapor can get back to the textile, blurring the image or can cause breathing problems for the operator.

The excess ink, that wasn't absorbed by the fabric, needs to be absorbed to avoid smudging the image. The textile is thus placed on a moving belt and paper ("protective/kraft paper") is generally placed between the textile and the belt to absorb the ink. The paper mops up excess ink and is disposed of, and new paper is used for the next cycle. Thus the next cycle begins with a clean system. If the excess ink is somehow still present during the continuation, then ghosting of the new image may occur so it is important to do each image with fresh paper.

In one implementation, in which a mirror image of the print to be made on the fabric is provided on transfer paper. The transfer paper is placed on the fabric and moved to the heat press or calender to carry out the sublimation process to transfer the image from the paper to the fabric. In

such a case the transfer side of the fabric is in any event protected from the dye to be disposed on the calender as a new transfer is used. Hence there is no issue of ghosting on the new image or part of the fabric. The other side of the fabric, away from the transfer paper, however, does need to be protected from the effects of absorbed ink and this is achieved using another protective paper in order to prevent dye that penetrates the fabric from getting onto and contaminating the calender.

A second implementation, direct printing – in which the ink is printed directly onto the fabric requires protecting of the calender from both sides of the fabric with protective paper.

A belt calender is disclosed in US Patent 7000536 to Markus Laitila et al, filed May 3, 2001.

Thus in the current art, protective paper, or tissue paper, is used for excess dye absorption in a calender or heat press to protect the drum/platen and/or the blanket from the excess ink, and to protect the image from smudging. The paper, typically positioned between the fabric and the drum, absorbs excess dye that does not penetrate into the fabric.

The protective paper is a consumable and a waste product of the sublimation calender or heat press process. Suitable protective paper is often provided by the manufacturer of the calender.

The constant need to replace paper is wasteful. The paper does not do anything to control the cloud of particles due to sublimation.

SUMMARY OF THE INVENTION

The present embodiments may provide for an endless feed belt that can be cleaned directly, or for a drum that is cleaned directly. Hence the protective paper is not needed.

In the present embodiments the drum or platen may be protected by a moving belt, typically the feed belt, or there may be a feed belt and a pressure belt. The feed belt is an endless belt, and any of the belt, or both belts, or the belt and drum, may be cleaned as they turn. The feed belt, and for that matter the pressure belt, may perform the function of absorbing excess dye from the fabric and may be cleaned before being involved in forming the next image

According to an aspect of some embodiments of the present invention there is provided a calender for fixation/transfer of dye sublimation, comprising:

a textile inlet;

a textile outlet;

a heat press or heated drum;

an endless belt for driving the textile from the textile inlet to the textile outlet through the heat press, the heat press being held at a temperature sufficient to cause sublimation of the at least one dye; and

a cleaning station for cleaning the endless belt, the cleaning station being located downstream of the textile outlet and upstream of the textile outlet.

In an embodiment, the textile is in physical contact with the belt and the cleaning station is configured to clean dye residue from the belt.

In an embodiment, the cleaning station comprises a squeegee that cleans by wiping over a surface of the belt.

In an embodiment, the cleaning station comprises an applicator for applying a cleaning fluid to the belt.

In an embodiment, the belt comprises a smooth non-absorbing surface.

In an embodiment, the belt comprises an absorbing material.

An embodiment may comprise a heating unit at the cleaning station to cause sublimation of ink residue on the endless belt to aid with cleaning.

An embodiment may comprise a drum, a drum cleaning station for cleaning a surface of the drum, the cleaning unit being located downstream of the outlet point and upstream of the inlet point.

An embodiment may comprise a linear platen having a length, the platen being independently heatable at different locations to form a temperature profile along the length.

An embodiment may comprise a second endless belt and a second endless belt cleaning station, the second endless belt cleaning station being located downstream of the outlet point and upstream of the inlet point.

According to a second aspect of the present invention there is provided a calender for fixation/transfer of dye sublimation, comprising:

a textile inlet;

a textile outlet;

a heat press;

an endless belt for driving textile from the textile inlet to the textile outlet through the ink applicator and the heat press, the heat press configured to apply pressure to textile on the belt, the heat press further being heated to a temperature sufficient to cause sublimation of the dye,

a vacuum source to clear vapor resulting from the dye sublimation.

In an embodiment, the textile is in contact with the belt during application of the at least one dye and a cleaning station is located downstream of the textile inlet and upstream of the textile outlet to clean dye residue from the belt.

According to a third aspect of the present invention there is provided a method of using a calender and dye sublimation, comprising:

inserting a textile into contact with an endless belt;

using the belt to drive the textile against a heat press;

maintaining the heat press at a temperature sufficient to induce sublimation of at least one temperature sensitive dye on the textile;

removing the textile; and

cleaning the endless belt.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

FIG. 1 is a simplified block diagram illustrating a generalized embodiment of the present invention;

FIG. 2 is a simplified schematic diagram showing an embodiment of the present invention with a drum and a single belt;

FIG. 3 is a simplified schematic diagram showing an embodiment of the present invention with a drum, a pressure belt and a feed belt;

FIG. 4 is a simplified schematic diagram showing an embodiment of the present invention using a feed belt, a pressure belt and a platen;

FIG. 5 is a simplified flow chart showing a method of using subliming inks and cleaning the feed belt and optionally the pressure belt and drum, according to an embodiment of the present invention; and

FIG. 6 is a simplified diagram showing a method of using subliming inks and pumping the excess dye by vacuum through the belt.

DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

The present invention, in some embodiments thereof, relates to a heat press or calender which is used for dye sublimation transfer/fixation.

In calender printing on textiles and fabrics, including on garments, the fabric with inks applied, is passed through rollers or a drum at high temperature and pressure is applied. Typically the inks are sublimation inks and the elevated temperature causes rapid sublimation, leading to a cloud of ink vapor which may be problematic and thus should be kept under some level of control. In addition, excess ink, which is not absorbed by the fabric, needs to be absorbed somewhere so that the image is not spoiled, and which needs to be removed before the next image is processed so as to avoid ghosting.

The present embodiments provide a feed belt that keeps excess ink, including ink vapor, under control. The belt may carry out the task of absorbing the excess inks from the process. Absorption is helped if the belt has a porous consistency, and desublimation occurs if the belt is held at or reaches a low enough temperature, that is to say the belt is at a temperature that is below the sublimation temperature by a margin sufficient to cause significant levels of desublimation, typically not exceeding 100 to 120 degrees Celsius, and the belt may reach these temperatures outside of the calender. The belt may be cleaned between rotations, for example at a cleaning station. The cleaning station may wipe the belt surface, and/or use cleaning fluids, and/or use of heating unit or combine both wiping and use of cleaning fluids and heating.

Control of the vapor cloud may be carried out by vacuuming. In the case of a porous belt vacuuming may be carried from behind the belt within the calender. In the case of a smooth belt, the belt itself confines the vapor and vacuuming can be applied at the exit of the calender.

A linear version of the calender allows for a temperature profile to be set up along the fixation/transfer machine.

The term “calender” refers herein to a drum and rollers that press the textile under heat, and “calendering” refers to the activity of pressing within a calender.

A calender is a form of heat press, and the present embodiments extend to the use of heat presses in general to bring about sublimation of the inks.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not necessarily limited in its application to the details of construction and the arrangement of the components and/or methods set forth in the following description and/or illustrated in the drawings and/or the Examples. The invention is capable of other embodiments or of being practiced or carried out in various ways.

Referring now to the drawings, FIG. 1 is a simplified diagram that illustrates a generalized schematic of a calender according to the present embodiments. The machine 10 is intended for sublimation process of textiles, whether in cloth, say as rolls, or cut, as in garment form, using dye sublimation of heat sensitive inks or dyes. The machine 10 comprises an insert point 12 where textile is inserted into the device, and more particularly onto an endless feed belt 14. Printing may have been carried out using deposition of the ink by inkjet or screen printing or other methods or may include insertion of transfer paper which is already printed for transfer to the textile. It is noted that the terms "ink" and "dye" are used interchangeably herein.

The endless belt drives the textile from the textile insert point 12 through heat press 20, to eventually arrive at textile outlet 18. The heat press may apply heightened temperature and pressure levels to the textile, and is held at a temperature sufficient to cause sublimation of the dye or dyes, which is typically in the range of 180 to 220 degrees Celsius, depending on the type of dye. The heat press may typically but not necessarily be a calender. In the case of transfer the transfer paper enters the calender with the textile and transfer of the image may occur within the calender.

The image is fixed on the textile in the heat press and then the textile is removed from the calender at outlet 18. The endless belt continues on towards insert point 12, on the way passing cleaning station 22. The cleaning station is located as shown, downstream of the outlet and upstream of the insert point and cleans the endless belt before next use. As the textile was in physical contact with the belt whilst in the heat press, ink residue may reside on the belt and is removed at the cleaning station.

The cleaning station may physically clean the belt. For example the cleaning station may use a squeegee that operates by wiping over a surface of the belt. Cleaning may be carried out dry.

The cleaning station 22 may alternatively or additionally use wet cleaning. Cleaning fluid may be applied directly to the belt, say from an applicator. The cleaning fluid may be water or

any other suitable solvent and may contain added detergent and/or IPA (isopropyl acetate) and/or Acetone

In addition, a combination of the above may be used, in which the squeegee serves to wipe the cleaning fluid over the surface of the belt.

The belt itself may in one embodiment comprise a smooth non-absorbing surface, say Teflon™. Such a non-absorbing surface is particularly suitable for physical cleaning.

Alternatively the belt may comprise an absorbing material, for example a material with a porous or spongy consistency. Such a material is suitable for wet cleaning. Examples of such material include polyurethane.

In embodiments, the feed belt may be of a porous material and other surfaces that need cleaning may be of a smooth material.

In the case of a porous belt, a vacuum may be applied across the belt to clear away the cloud. In the case of a smooth belt, the belt itself may confine the vapor cloud and vacuum need only be applied at vacuum source 16 at the exit of the heat press.

The cleaning station may include a cleaning station heating unit 24 to heat the belt during cleaning. The result is further sublimation of the ink particles, this time to clean the belt.

As discussed, the heat press may be a calender. As will be discussed in greater detail below, the calender may be formed by a drum and rollers as shown in FIG. 2, or by two belts, a drum and rollers as in FIG. 3 or by a platen, rollers and belts as shown in FIG. 4.

Reference is now made to FIG. 5, which is a simplified flow chart showing use of the sublimation machine using a calender or heat press and dye sublimation. The method comprises inserting a printed textile or a transfer paper and a textile onto a feed belt at an input location – box 500 so that the textile is in physical contact with the belt. As shown in box 504 the calender heats the dye to a sufficient temperature and causes sublimation, as the textile is pressed by the belt against the calender. The textile is removed as shown in box 506 and then the belt is cleaned, box 508.

Reference is now made to FIG. 6, which is a simplified flow chart illustrating use of an alternative embodiment of the present invention. Again, the flow chart shows use of the sublimation machine using a calender or heat press and dye sublimation. The method comprises inserting a printed textile or a transfer paper and a textile onto a feed belt at an input location – box 510 so that the textile is in physical contact with the belt. As shown in box 514 the calender heats the dye to a sufficient temperature and causes sublimation, as the textile is pressed by the belt against the calender. In box 516 the region is then vacuumed to remove the vapor from the ink sublimation. In the case of a porous belt, vacuuming can be carried out in the calender

through the belt. In the case of a smooth belt, the belt itself may confine the vapor within the calender, and vacuuming may be carried out at the exit of the calender. The textile is then removed as shown in box 518. Typically the belt is cleaned as in the previous flow chart and box 508.

Returning now to FIG. 2 and a cross section is shown of a calender device 30 having a drum 32 and an endless feed belt 34. The drum rotates anti-clockwise as indicated by arrow 36. The belt rotates in the same direction around the drum and in the opposite direction around the periphery of the calender device. Textiles are inserted at media insertion point 36 and are driven around the drum 32 by belt 34 and delivered at media outlet 38. The textile is located between the drum 32 and belt 34. The drum 32 is part of a calender together with rollers 39, and the heats and presses the textile, causing sublimation of the ink and causing excess ink to be absorbed into the fabric. Some of the ink that is in vapor phase may collect either on the drum or on the belt and is the reason why cleaning is required. Optional main evaporation unit 40 clears vapors.

Following removal of the textile at outlet 38, the drum rolls on to drum cleaning evaporation unit 42 and cleaning unit 44. The evaporation unit clears vapor and then the cleaning unit uses squeegee 46 and/or cleaning fluid applicators 48, to clean the surface of the drum and thus prevent the ink residues from causing ghosting on subsequent images.

A similar cleaning mechanism is provided for the belt 34. Following removal of the textile at outlet 38, the belt feeds on to evaporation unit 50 and cleaning unit 52. The evaporation unit may help to encourage sublimation of the residues, and then the cleaning unit uses squeegee 54 and/or cleaning fluid applicators 56, to clean the surface of the belt and thus prevent the ink residues from causing ghosting on subsequent images.

An inspection camera 58 may optionally be provided in order to identify any residue remaining on the belt.

Reference is now made to FIG. 3, which is an alternative calender device 60 according to an embodiment of the present invention in which the textile is located between two belts, outer belt 62 and inner belt 64. Thus the textile is in physical contact with the belts and not directly with the drum 66.

The drum rotates anti-clockwise as indicated by arrow 68. The outer belt 62 rotates in the same direction around the drum and in the opposite direction around the periphery of the calender device. The inner belt 64 rotates in the same direction as the drum. Textiles are inserted at media inlet 70 and are driven around the drum 66 by inner and outer belts 62 and 64 and delivered at media outlet 72. The textile is located between the inner and outer belts and thus does not touch the drum. The drum 66 is part of a calender together with rollers 74 and 76, and the calender

heats and presses the textile, causing sublimation of the ink and causing excess ink to collect, either on the inner or outer belt. Main evaporation unit 78 causes ink to sublime.

Following removal of the textile at outlet 72, the inner belt feeds on to inner belt cleaning evaporation unit 80 and cleaning unit 82. The evaporation unit clears fumes from the inner belt and then the cleaning unit uses squeegee 84 and/or cleaning fluid applicators 86, to clean the surface of the inner belt and thus prevent the ink residues from causing ghosting on subsequent images.

A similar cleaning mechanism is provided for the outer belt 62. Following removal of the textile at outlet 38, the belt feeds on to outer belt cleaning heating unit 88 and cleaning unit 90. The heating unit heats the belt to cause sublimation of the residues and then the cleaning unit uses squeegee 92 and/or cleaning fluid applicators 94, to clean the surface of the belt and thus prevent the ink residues from causing ghosting on subsequent images.

Optional camera 96 may observe areas of residue on outer belt 62 which have not been cleaned.

Optional heating unit 98 may heat the inner belt 64 prior to use.

Reference is now made to FIG. 4, which is an alternative calender device 100 according to an embodiment of the present invention in which the textile is located between two belts, upper belt 102, which is a pressure belt, and lower belt 104, which is the feed belt. The embodiment may use a platen 106 instead of a drum for calendering. Thus the textile is in physical contact with the belts and the inlet and outlet points are at opposite sides of the calender. Both belts are cleaned.

The platen 106 remains fixed as both belts pass over in the direction from media inlet 108 to outlet 110 carrying the textile. Textiles are inserted at media inlet 108 and are driven over the platen 106 by the upper and lower belts 102 and 104 and delivered at media outlet 110. The textile is located between the upper and lower belts and thus does not touch the platen 106. The platen is part of a calender together with rollers 112 and 114 which press the belts against the platen to provide pressure. Heating units 116 heat the platen 106, and the heat and pressure causes ink residue to gather on the belts and sublimation of the ink. Optional evaporation unit 118 may suck vapor through the belt.

An outlet evaporation unit 119 may further help to clear fumes. Following removal of the textile at outlet 110, the lower belt rolls on to lower belt cleaning heating unit 120 and cleaning unit 122. The heating unit 120 heats the lower belt to cause sublimation of the residues and then the cleaning unit 122 uses squeegee 124 and/or cleaning fluid applicators 126, to clean the

surface of the lower belt and thus prevent the ink residues from causing ghosting on subsequent images.

A similar cleaning mechanism is provided for the upper belt 102. Following removal of the textile at outlet 110, the upper belt feeds on to upper belt cleaning heating unit 128 and cleaning unit 130. The heating unit 128 heats the upper belt to cause sublimation of the residues and then the cleaning unit 130 uses squeegee 132 and/or cleaning fluid applicators 134, to clean the surface of the belt and thus prevent the ink residues from causing ghosting on subsequent images.

Optional camera 136 may observe areas of residue on lower belt 104 which have not been cleaned.

The embodiment of FIG. 4 uses a platen instead of a drum. A pressure belt provides pressure to the textile by pressing the textile and first belt to the platen. The embodiment allows for a series of heaters in a linear arrangement to provide a controllable temperature profile rather than a single temperature. The separate heaters allow for the platen to be independently heatable at different locations to form a temperature profile along its length.

With such a temperature profile, the high temperature needed for subliming need be applied only at a defined part of the travel, and different temperatures may be provided at other parts of the travel to achieve different purposes. In particular, materials that are particularly sensitive to temperature can be kept at the high temperature needed for subliming only for the minimum time necessary, and there is more control over the length and timing of the process.

Aside from the temperature profile, the arrangement has an advantage for material control. The textile material enters at one side and exists at the opposite side, rather than returning to the same side as with the drum machines.

It is expected that during the life of a patent maturing from this application many relevant heat press and calender devices will be developed, as well as different kinds of sublimation inks and dye and the scopes of the corresponding terms are intended to include all such new technologies *a priori*.

The terms "comprises", "comprising", "includes", "including", “having” and their conjugates mean "including but not limited to".

The term “consisting of” means “including and limited to”.

As used herein, the singular form "a", "an" and "the" include plural references unless the context clearly dictates otherwise.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single

embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention, and the present specification is to be construed as if all such combinations are written out explicitly. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting.

WHAT IS CLAIMED IS:

1. A calender for fixation/transfer of dye sublimation, comprising:

a textile inlet;

a textile outlet;

a heat press or heated drum;

an endless belt for driving said textile from said textile inlet to said textile outlet through said heat press, said heat press being held at a temperature sufficient to cause sublimation of said at least one dye; and

a cleaning station for cleaning said endless belt, said cleaning station being located downstream of said textile outlet and upstream of said textile outlet.

2. The calender of claim 1, wherein said textile is in physical contact with said belt and said cleaning station is configured to clean dye residue from said belt.

3. The calender of claim 1 or claim 2, wherein said cleaning station comprises a squeegee that cleans by wiping over a surface of said belt.

4. The calender of claim 1 or claim 2, wherein said cleaning station comprises an applicator for applying a cleaning fluid to said belt.

5. The calender of claim 1, 2, or 3 wherein said belt comprises a smooth non-absorbing surface.

6. The calender of claim 1, 2 or 4, wherein said belt comprises an absorbing material.

7. The calender of any one of the preceding claims, comprising a heating unit at said cleaning station to cause sublimation of ink residue on said endless belt to aid with cleaning.

8. The calender of any one of the preceding claims, comprising a drum, a drum cleaning station for cleaning a surface of said drum, said cleaning unit being located downstream of said outlet point and upstream of said inlet point.

9. The calender of any one of claims 1 to 7, comprising a linear platen having a length, the platen being independently heatable at different locations to form a temperature profile along said length.

10. The calender of claim 8 or claim 9, further comprising a second endless belt and a second endless belt cleaning station, said second endless belt cleaning station being located downstream of said outlet point and upstream of said inlet point.

11. A calender for fixation/transfer of dye sublimation, comprising:

a textile inlet;

a textile outlet;

a heat press;

an endless belt for driving textile from said textile inlet to said textile outlet through said ink applicator and said heat press, said heat press configured to apply pressure to textile on said belt, said heat press further being heated to a temperature sufficient to cause sublimation of said dye; and

a vacuum source to clear vapour resulting from said dye sublimation.

12. The calender of claim 11, wherein said textile is in contact with said belt during application of said at least one dye and a cleaning station is located downstream of said textile inlet and upstream of said textile outlet to clean dye residue from said belt.

13. The calender of claim 11, wherein said cleaning station comprises a squeegee that cleans by wiping over a surface of said belt.

14. The calender of claim 11, wherein said cleaning station comprises a cleaning applicator for applying a cleaning fluid to said belt.

15. The calender of any one of claims 11 to 14, wherein said endless belt comprises a smooth non-absorbing surface.

16. The calender of any one of claims 11 to 14, wherein said endless belt comprises an absorbing material.

17. The calender of any one of claims 11 to 16, comprising a heating unit at said cleaning station to cause sublimation of ink residue on said endless belt to aid with cleaning.

18. The calender of any one of claims 11 to 17, wherein said heat press comprises a calender.

19. The calender of claim 18, wherein said calender comprises a drum.

20. The calender of claim 18, wherein said calender comprises a second endless belt.

21. A method of using a calender and dye sublimation, comprising:

inserting a textile into contact with an endless belt;

using said belt to drive said textile against a heat press;

maintaining said heat press at a temperature sufficient to induce sublimation of at least one temperature sensitive dye on said textile;

removing said textile; and

cleaning said endless belt.

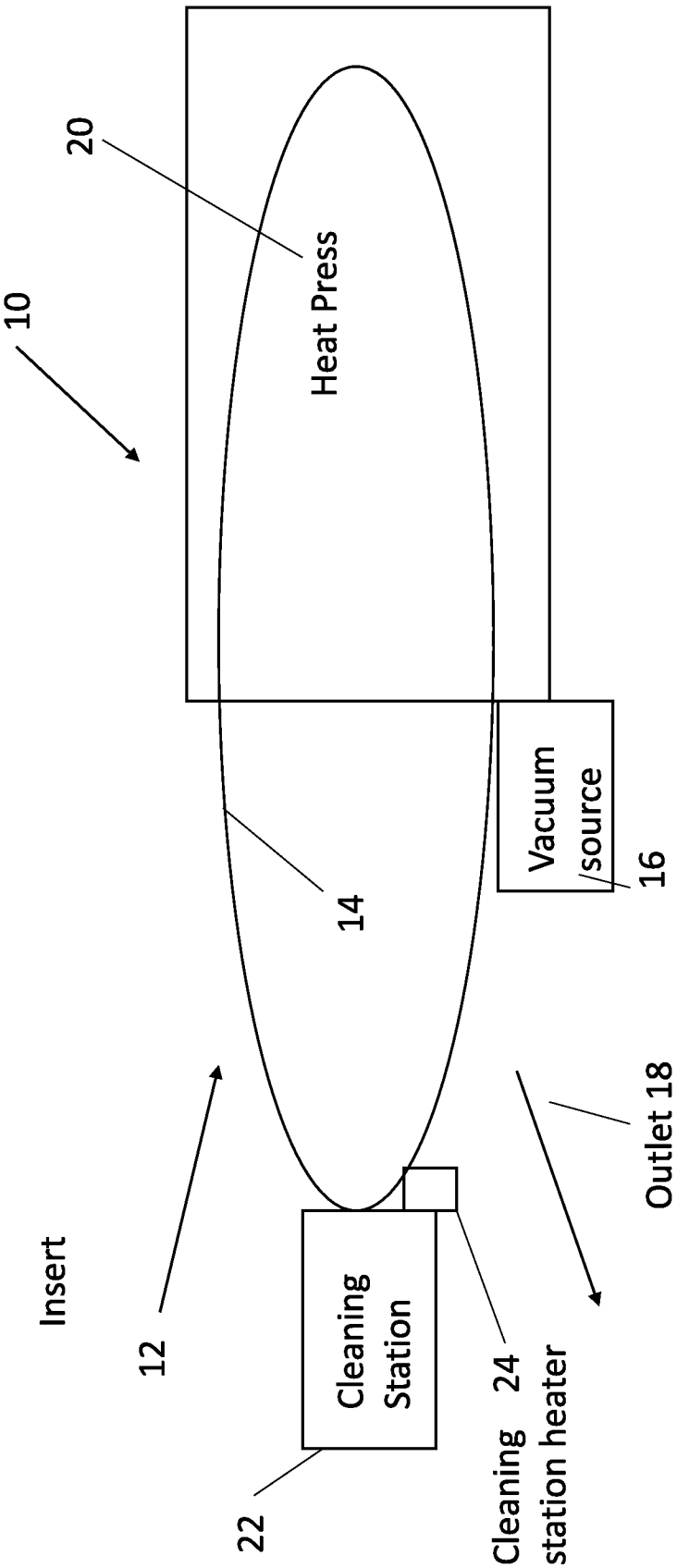

20
Heat Press
10
14
Vacuum source
16
Insert
12
Cleaning Station
22
24
Cleaning station heater
Outlet 18

FIG. 1

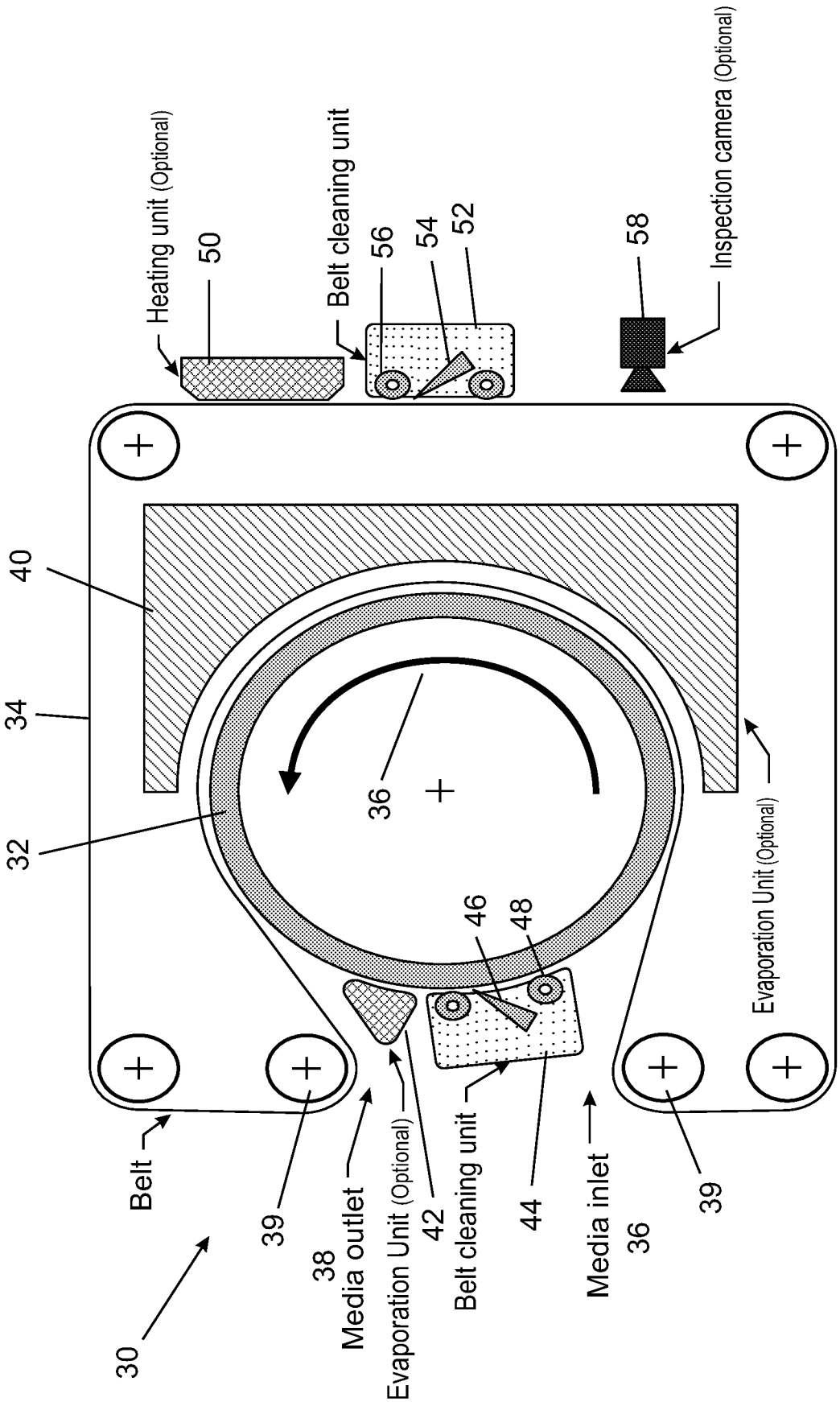

Heating unit (Optional)
50
Belt cleaning unit
56
54
52
58
Inspection camera (Optional)
40
34
32
36
46
48
Evaporation Unit (Optional)
Belt
39
38
Media outlet
Evaporation Unit (Optional)
42
Belt cleaning unit
44
Media inlet
36
39
30

FIG. 2

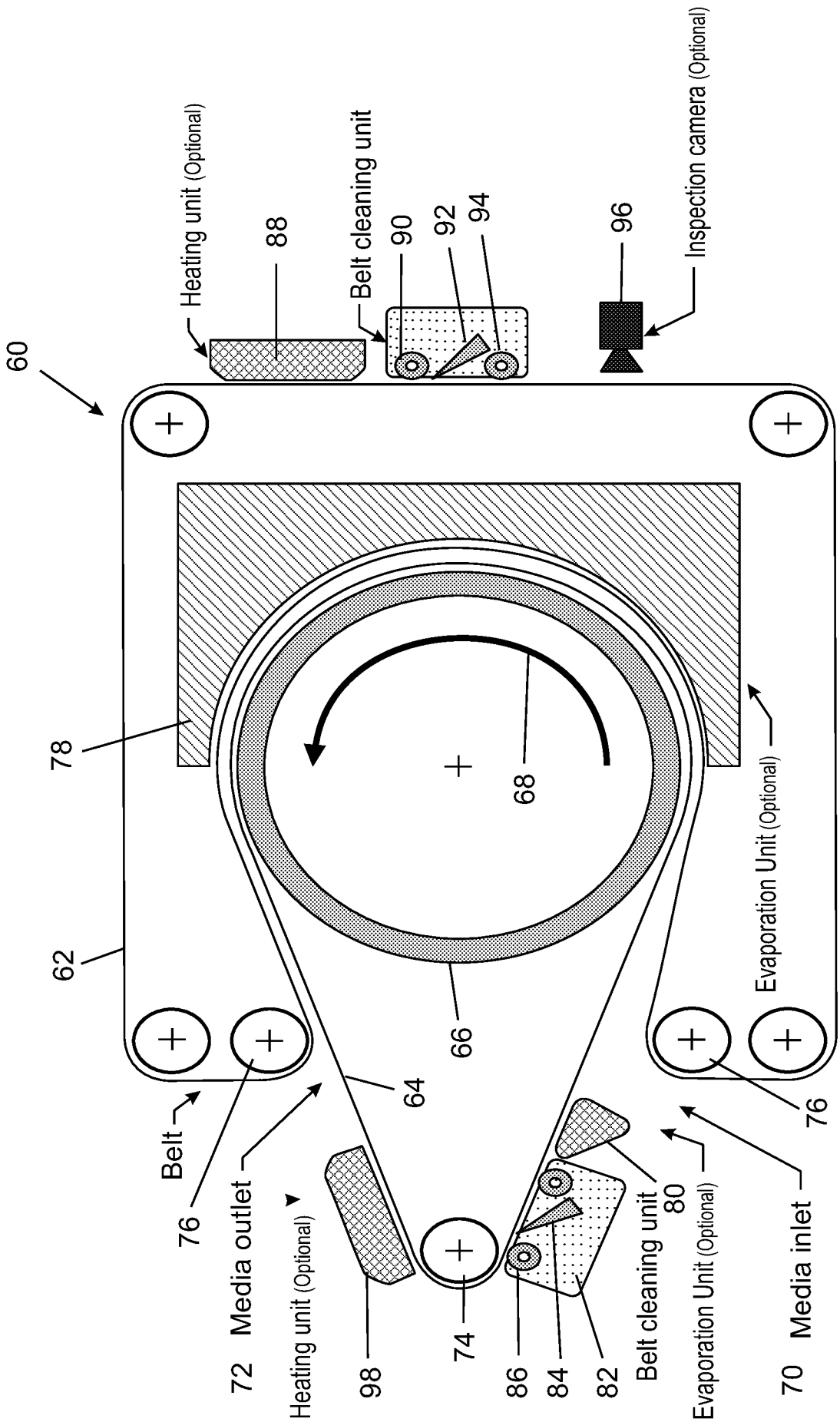

60
Heating unit (Optional)
88
Belt cleaning unit
90
92
94
96
Inspection camera (Optional)
78
62
68
66
64
Belt
76
Media outlet
72
Heating unit (Optional)
98
74
86
84
82
Belt cleaning unit
80
Evaporation Unit (Optional)
70
Media inlet
76
Evaporation Unit (Optional)

FIG. 3

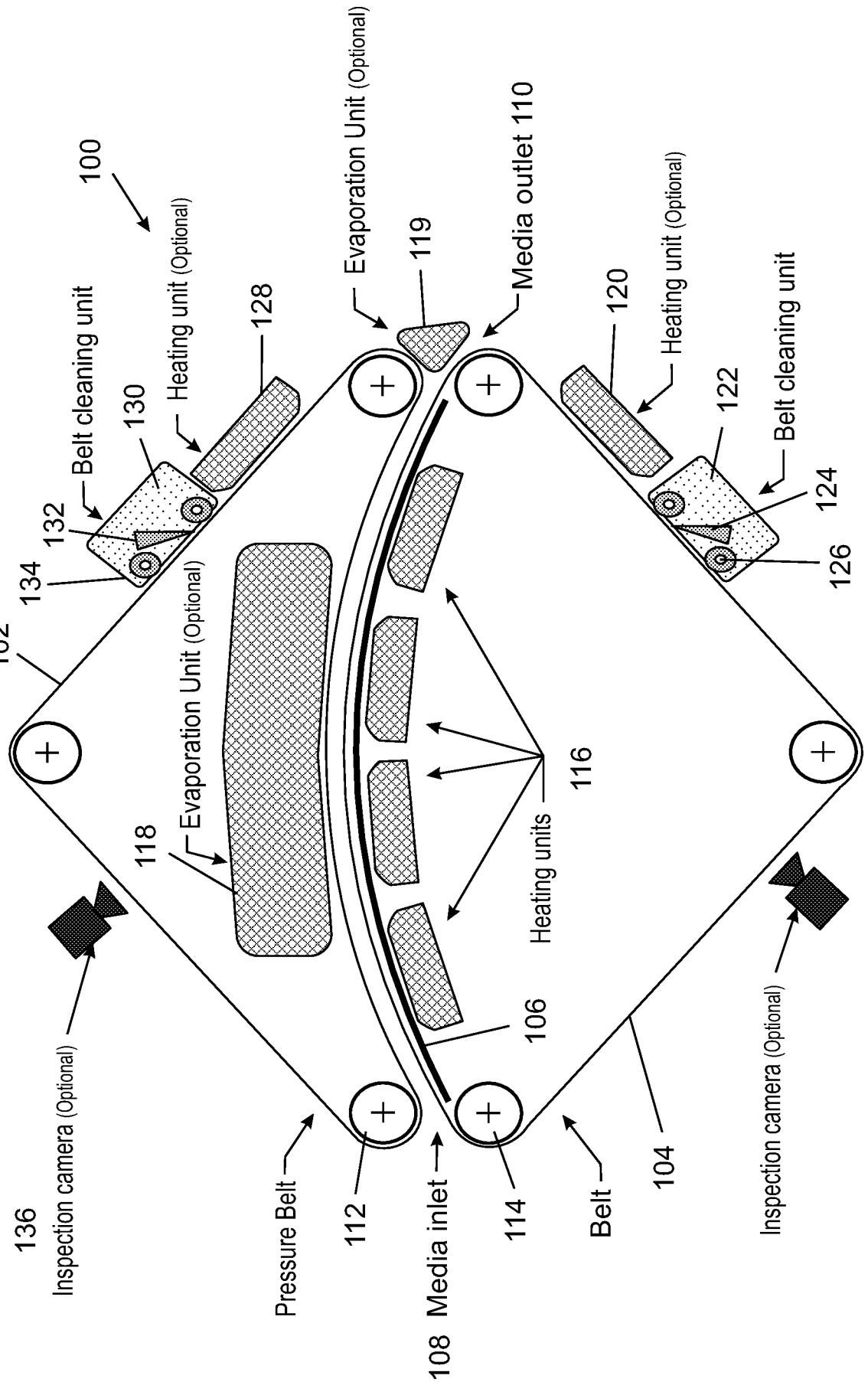

100
Belt cleaning unit
Heating unit (Optional)
128
Evaporation Unit (Optional)
119
Media outlet 110
120
Heating unit (Optional)
Belt cleaning unit
130
122
132
124
134
126
102
Evaporation Unit (Optional)
118
116
Heating units
106
136
Inspection camera (Optional)
Pressure Belt
112
108 Media inlet
114
Belt
104
Inspection camera (Optional)

FIG. 4

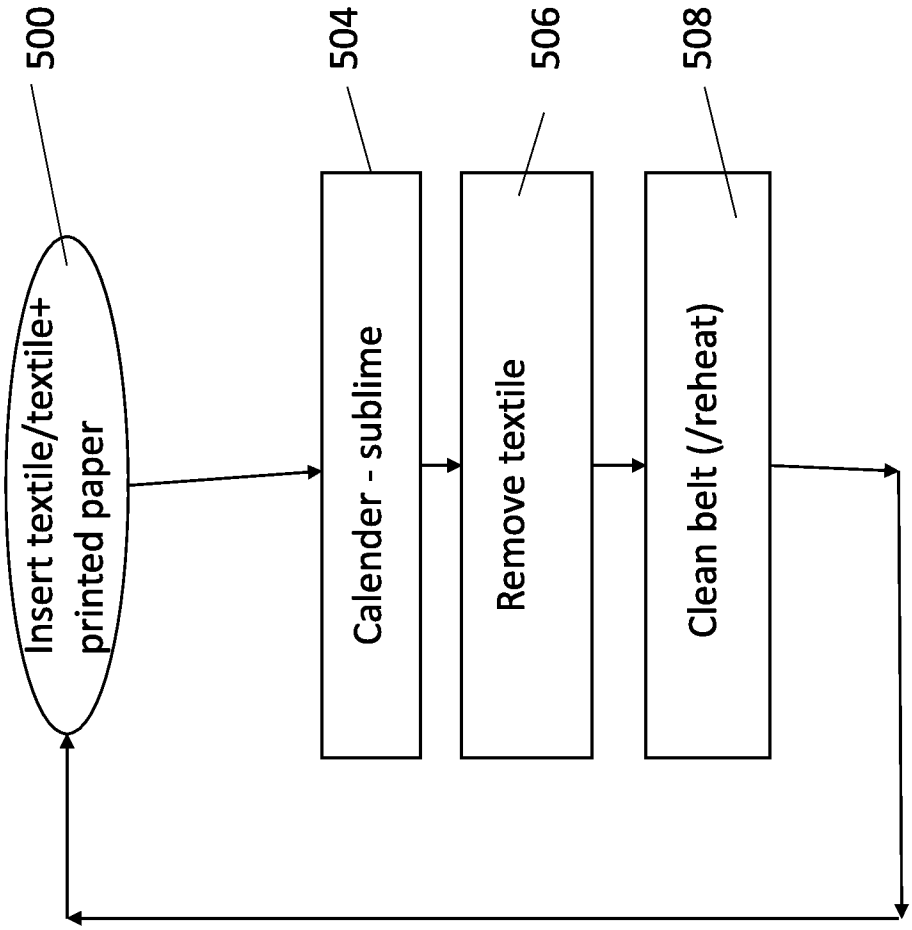

500
504
506
508
Insert textile/textile+ printed paper
Calender - sublime
Remove textile
Clean belt (/reheat)

FIG. 5

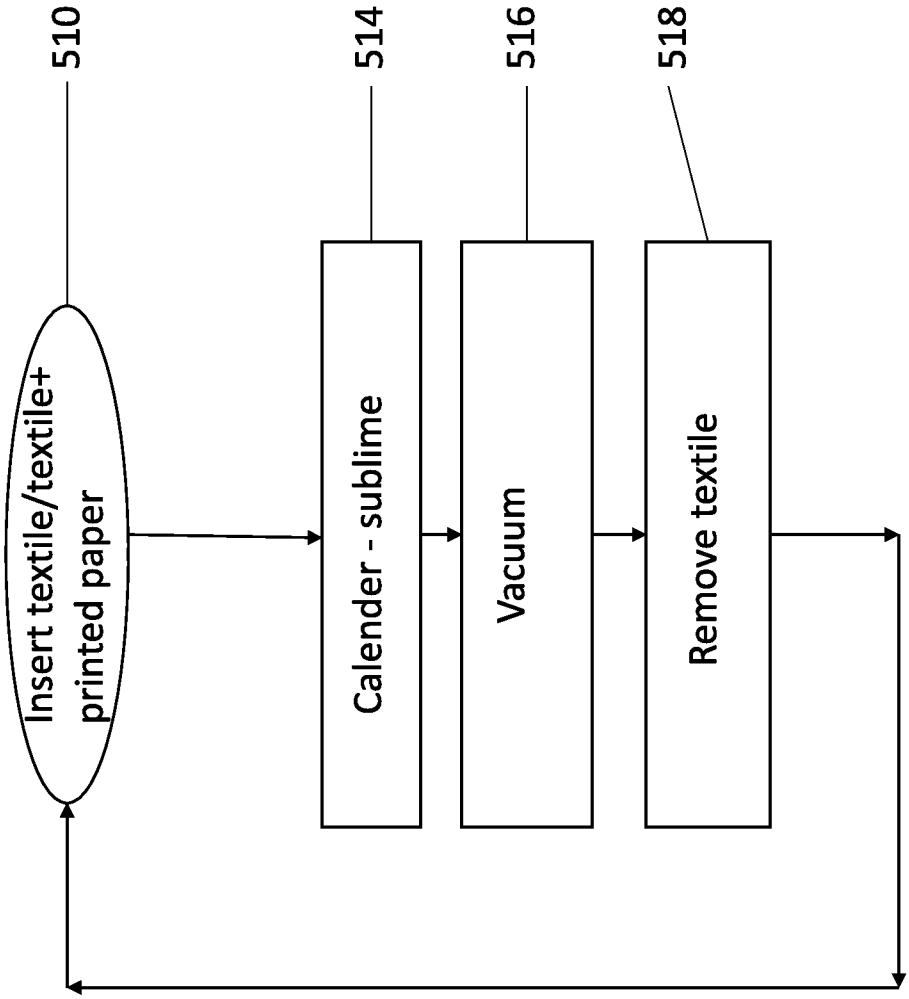

510
514
516
518
Insert textile/textile+ printed paper
Calender - sublime
Vacuum
Remove textile

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2017/051401

A. CLASSIFICATION OF SUBJECT MATTER
IPC (2018.01) B41M 5/035

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)
IPC (2018.01) B41M 5/035

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)
Databases consulted: Derwent Innovation

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2529333 A HITCH DAVID 17 Feb 2016 (2016/02/17) the entire document	1-21
A	US 9156248 B1 THAYER BRUCE EARL? 13 Oct 2015 (2015/10/13) the entire document	1-21

☐ 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
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"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
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"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	Date of mailing of the international search report
11 Apr 2018	12 Apr 2018
Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616	Authorized officer NARGASI Ayelet Telephone No. 972-2-5651620

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IL2017/051401

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
GB 2529333 A	17 Feb 2016	GB 201519745 D0	23 Dec 2015
		GB 2529333 A	17 Feb 2016
		GB 2529333 B	03 Aug 2016
		GB 201419961 D0	24 Dec 2014
		WO 2016075446 A1	19 May 2016
US 9156248 B1	13 Oct 2015	US 9156248 B1	13 Oct 2015
		US 2015314589 A1	05 Nov 2015
		CA 2888876 A1	30 Oct 2015
		DE 102015206829 A1	05 Nov 2015
		JP 2015212080 A	26 Nov 2015