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(71) Applicant: **HP INDIGO B.V.** [NL/NL]; Startbaan 16, 1187 XR Amstelveen (NL).

(72) Inventors: **ZAMIR, Raz**; Einstein 10, Kiryat Weizmann, 76101 Ness Ziona (IL). **SHAHAM, Noam**; Einstein 10, Kiryat Weizmann, 76101 Ness Ziona (IL). **GAASH, Amir**; Einstein 10, Kiryat Weizmann, 76101 Ness Ziona (IL).

(74) Agent: **DAY, Caroline M**; Haseltine Lake LLP, Redcliff Quay, 120 Redcliff Street, Bristol Bristol BS1 6HU (GB).

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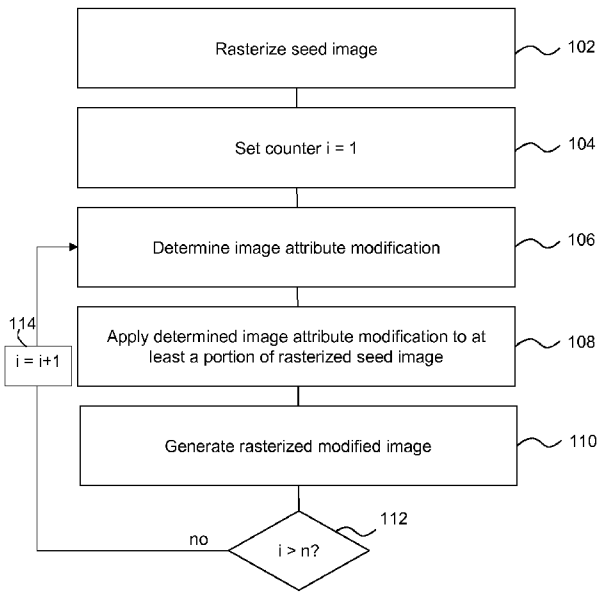

Fig. 1

(57) Abstract: In an example, a method includes rasterizing a seed image using a processor. A plurality of rasterized modified images may be generated from the rasterized seed image. Generating each rasterized modified image may include determining an image attribute modification and applying the determined image attribute modification to at least a portion of the rasterized seed image to generate the rasterized modified image.

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GENERATING RASTERIZED MODIFIED IMAGES FROM A RASTERIZED SEED IMAGE

BACKGROUND

[0001] In printing, print agents such as inks, toners, coatings and the like may be applied to a substrate. Substrates may in principle comprise any material, for example comprising paper, card, plastics, fabrics or the like. In some examples, the substrate may comprise or be formed as packaging.

BRIEF DESCRIPTION OF DRAWINGS

[0002] Non-limiting examples will now be described with reference to the accompanying drawings, in which:

[0003] Figure 1 shows an example of a method for generating a plurality of rasterized modified images;

[0004] Figure 2 shows an example of an apparatus comprising a controller;

[0005] Figure 3 shows an example of memory use in a method for generating a plurality of rasterized modified images;

[0006] Figure 4 shows an example of a method for generating and printing a plurality of rasterized modified images;

[0007] Figure 5 shows an example print apparatus; and

[0008] Figure 6 shows an example of a machine readable medium in association with a processor.

DETAILED DESCRIPTION

[0009] In some circumstances, it may be intended to provide multiple images which, while different, have a degree of consistency or commonality. For example, product packaging may be varied while retaining a generally consistent look and feel. Many items are packaged before sale to consumers. In some cases, the packaging may be intended to remain with the item when it is in use. For example, beverages may be consumed or served direct from the bottles that act as the packaging for the beverage. In other cases, the packaging may be discarded without affecting the use of the product. For example, electronic devices may be sold in boxes made of folded cardboard for protection, but the box may not be retained after the device has been purchased. Packaging may include images intended to attract the consumers, and variations in this packaging may enhance this attraction.

[0010] Packaging provides just one example however. In other examples, the attraction of print media such as magazines, newspapers, posters, and the like may be enhanced by including variations between instances thereof.

[0011] While 2D printing to a substrate is discussed in detail in the examples below, the principles set out herein may be applied to 3D printing, or additive manufacturing, wherein an object to be generated may be modified, for example in terms of appearance (e.g. surface decoration) and/or shape, based on the principles set out below.

[0012] In examples set out below, a seed image is used to produce a number of modified images. By using a common seed image, an element of consistency between the modified images may be provided. However, as is explained in greater detail below, rather than generating a plurality of modified images for printing which are subsequently rasterized, in examples herein, the seed image is rasterized and modifications of this rasterized seed image are used to produce rasterized modified images.

[0013] The process of rasterization describes converting an image expressed in one form (for example in a vector graphics format) into pixels or dots for output on a video display or printer. By modifying rasterized images, this means that the modified images do not have to be stored and subsequently rasterized prior to printing. In some examples, an image may be divided into separations corresponding to colors as part of, or before or after, rasterization. Generally, rasterized images are created immediately prior to use, for example, being held in short-term volatile memory (which may also be referred to as active

memory, primary computer memory, or RAM, depending on context) for as long as is suggested by the context. Thus, rather than generating the modified image and storing this in longer term memory (for example, non-volatile, or secondary, computer memory), the modified rasterized images may be created and printed 'on-the-fly', using volatile, or primary, computer memory. These descriptions of longer term and shorter term memory types will be used interchangeably herein. Where one term is used, it may be substituted with any other term in the corresponding memory category (where the categories comprise longer term and shorter term).

[0014] In the context of 3D printing, the seed image may comprise data representing the appearance or shape of an object to be generated. A rasterised image for 3D printing may be described in terms of 'voxels', i.e. 3D pixels, which may be associated with properties and/or materials (for example, print agents to produce colors and the like, and/or build materials which are to be solidified to form an object), or in some other way.

[0015] Figure 1 is an example of a method, which may be a computer implemented method, and may be a method for generating a plurality of modified images based on at least part of a (single) seed image. The method may be carried out using at least one processor. The method comprises, in block 102, rasterizing a seed image, which may for example comprise retrieving it from secondary computer memory. In other examples, the rasterized seed image may be received over any communications link, for example having been generated remotely and sent over a network. In some examples, the rasterized seed image comprises a plurality of separations. In other examples, a single separation is provided.

[0016] Block 104 comprises setting a counter i = 1. In this example, n modified images are to be created and the counter will count from 1 to n.

[0017] Generating each rasterized modified image comprises, in block 106, determining an image attribute modification. For example, the modification may comprise any, or any combination of, cropping (i.e. selecting a portion of a seed image), a degree of magnification (or zooming), a degree of rotation, reflection, distortion or skewing, modification of colorization and/or of transparency in the seed image, or the like.

[0018] In some examples, the image attribute modification may be determined on-the-fly, for example, being a random or pseudo-random modification of the seed image. For example, an index (which may be related to the counter value) may be input into a pseudo-random number generator, and an output number may be used to indicate one or

more modifications to be applied. In other examples, the image attribute modifications may be predetermined, for example being held in a memory or the like. For example, there may be a set of available predefined image modification attributes, which may, in some examples, depend on an image seed, and/or a set of predetermined rules or the like.

[0019] For each modification attribute, there may be a range of possible values. For example, where the modification attribute is the amount of zooming, there may be a maximum zoom and a minimum zoom, giving a maximum size and a minimum size of the resultant modified image. Where the modification attribute is the amount of distortion, there may be a maximum amount and a minimum amount, giving maximally and minimally distorted modified images. In some examples, the range may be selectable. For example, a user may select the full range of possible values to be available, or may select a subset of the possible values from the range.

[0020] Block 108 comprises applying the determined image attribute modification to at least a portion of the rasterized seed image (where the portion may be selected by cropping as described above). While a plurality of modified images could be created based on the seed image in its entirety, selecting different portions of the seed image may increase the variety between the modified images. In some examples, block 108 may comprise applying image attribute modifications to each of a plurality of separations.

[0021] Block 110 comprises generating a rasterized modified image (which may comprise a plurality of separations). In block 112, it is determined whether the counter has reached n and if so, the method may terminate. If not, in block 114, the counter is incremented by 1, and the method returns to block 106. The image attribute modification to be applied differs between iterations to produce different modified images.

[0022] As this image is 'pre-rasterized', any pre-processing carried out for printing the image will be accordingly reduced as a rasterization process is not part of such pre-processing. This may be compared with preparing an un-rasterized modified image (for example a vector graphics format image), which will be sent to appropriate storage (e.g., implying non-volatile or secondary computer memory use) and subsequent rasterization will be carried out.

[0023] This can result in significant resource savings. For example, where the images are created in vector form or the like, these may consume significant amounts of memory resources, transmission resources and the like, and then significant additional processing resource in the rasterization thereof.

[0024] Figure 2 shows an example of apparatus 200 comprising a memory 202 and a controller 206. The controller 206, which may comprise processing circuitry, comprises a rasterization module 208 and an image modification module 210. In use of the apparatus 200, the rasterization module 208 is to rasterize a seed image and the image modification module 210 is to, for each of a plurality of differently modified rasterized images: (i) determine an image attribute modification to be performed on at least a portion of the rasterized seed image, (ii) apply the image attribute modification to generate a rasterized modified image and (iii) store the rasterized modified image in the memory 202. In some examples, the memory 202 may comprise volatile memory.

[0025] An example of a method which may be performed by the controller 206 is described with reference to Figure 3.

[0026] In block 302, volatile memory storage is allocated for storing a modified rasterized image in volatile memory. This may comprise storing the modified rasterized image in volatile memory in a volatile memory portion of the memory 202, for example in a manner which is at least temporarily protected from overwriting. In block 304, at least part of a print processing operation based on the modified rasterized image is carried out. In block 306, after at least part of the print processing operation is carried out (and in some examples after printing of the modified image is complete), the volatile memory storage allocated for storing the modified rasterized images is released. This means that the data may be overwritten (although as the memory may be addressed randomly, this may not happen immediately). In some examples, the released volatile memory storage is then accessible for allocation for storage of another of the modified rasterized images generated from the seed image.

[0027] Thus, in this example, volatile memory is reserved for storage of a modified rasterized image for as long as a print processing operation based on the image data is to be carried out, prior to being released.

[0028] In one example, the print processing operation comprises compiling a composite page in a print-ready format. A print ready format may be used for print and preview operations.

[0029] In building a composite page (and as is further described below in relation to Figure 4), some image elements may be variable (for example, comprising a modification of the seed image) and some image elements may be consistent between printed images. The rasterised versions of these image elements may be stored in volatile memory for as long as they are needed (for example, consistent elements may be retained

throughout a print run job, whereas the memory allocated to variable image elements may be recycled throughout the print run. The composed page may be retained in volatile memory, which may be a memory of the printer itself, until it is 'consumed' or processed by the printer.

[0030] In another example, the print processing operation comprises printing at least part of the modified image. This may comprise a printing a separation, or a leading portion of a separation.

[0031] This therefore efficiently recycles the memory allocation. Moreover, use of volatile rather than non-volatile memory may result in an increase in processing speed. Examples of image attribute modifications which may be applied are now discussed with reference to Figure 4.

[0032] Block 402 comprises selecting a seed image. In some examples, this may be selected from a plurality of available seed images which may or may not have a degree of commonality between the designs. Providing a plurality of seed images allows for greater variety in the modified images. The seed image in this example is selected from persistent memory (which may for example be described as non-volatile, or secondary memory).

[0033] Block 404 comprises defining a template, which may for example be a template of a document or package design, which comprises at least one individualized image area. The template may also comprise a standard image area, which is to be present in each of a plurality of modified images. For example, this may comprise text, a logo, or the like. In some examples, the individualized image area and the standard image area may overlie one another. For example, a logo and product information may overlie a varying background such that the background may differ while the logo and product information remains consistent such that different products may have different packaging which conveys information in a consistent manner.

[0034] In block 406, the seed image is rasterized, which in this example comprises providing a plurality of rasterised separations.

[0035] To briefly describe different examples of separations, an image may be made up of a plurality of colorants, such that dots of the colorants combine in the human eye to produce particular colors. For example, print apparatus may comprise a set of CMYK or Cyan Magenta Yellow and Black (key) colorants. The placement of each colorant may be defined individually within an associated separation, and image areas may be

associated with grey levels indicating the coverage of the associated colorant in that region.

[0036] In addition, in some examples herein, the separation may be a spot color separation. A spot color is a predetermined color, which may in some examples be provided as a dedicated premixed colorant. For example, a company logo may be associated with a particular color. In order to assure color consistency, a premixed ink or toner having such a color may be provided in a printer. However, in principle, any color may be designated as a spot color by providing a complete specification of this color, and may be reproduced in print for example by applying the premixed ink or by emulating the color using standard process colorants (e.g. CMYK colorants). In an example, there may be a number of defined spot colors for use in a particular print run.

[0037] Separations may usually be associated with a specification of coverage of the particular colorant. For example, this may be a greyscale or grey level value which varies over the image depending on how much of that colorant is to be applied in a particular image region. In this example however, the spot color separation is defined to have N + 1 levels, where N is the number of spot colors and the levels correspond to individual spot colors with one level being dedicated to the absence of spot colors. As set out in greater detail below, color shuffling may be performed on such spot color separations.

[0038] A further example of a separation which may be utilised in some examples is at least one separation to represent transparencies and semi transparencies. In some examples, this may be referred to as an alpha channel, and may be created in the rasterizing process. Such separations may for example designate pixels as being at least partially transparent in addition to having a color.

[0039] Block 408 comprises selecting an image attribute modification. In this example, a plurality of image attribute modifications are predetermined, each being stored in non-volatile memory as an indexed data file. The image attribute modification may specify any, or any combination of cropping (which may comprise defining a sub portion of the seed image which may be further modified), rotating, translating, distorting, scaling, color shuffling, colorization, applying transparency effects, reflecting, color depth variations, brightness and contrast, gamma correction, histogram equalization and manipulation, warping, filtering, or any other image processing technique.

[0040] In some examples, selecting an image attribute modification may comprise selecting an index, which may be the next in a series of indexed data files. In other

examples, an indexed data file may be selected randomly or pseudo-randomly. In some examples, selecting an image attribute modification may comprise generating an image attribute modification. This may for example comprise providing an input to a pseudo-random number generator with the output pseudo-random number being used to determine image attribute modifications to apply. In other examples, a true random number generator may be used (although this may mean that duplicate modifications are specified). It may be noted that, even when an indexed data file may be selected randomly or pseudo-randomly, the same indexed data file will result in the same transformation, so the modification is repeatable should this be intended in particular circumstance.

[0041] In some examples, there may be a set of rules which may be used, for example in conjunction with other methods set out herein, to specify or select modifications to be applied to a seed image.

[0042] Block 410 comprises selecting a separation, which may be any separation created by the rasterizing process. Thus, in this example, the image modification is carried out on each separation separately (however this may not be the case in all examples).

[0043] Block 412 comprises applying applicable image attribute modification to the separation. However, it may be the case that some modifications are not carried out on all separations of the seed image.

[0044] In some examples, the same image attribute modification is carried out on each of a plurality of separations. For example, the same crop may be performed for all separations. Performing a crop in effect comprises selecting a portion of the seed image on which the modified image will be based. While the modified images could be based on the seed image as a whole, selecting a variable portion of the seed image allows for greater variety in the modified images. The portion of the seed image selected may in some examples fill the individualized image area of the template although, as in some examples a rasterized modified image may be scaled, the selected portion may be a different size to the individualized image area.

[0045] In other examples, the image attribute modification may comprise performing a rotation of a selected rasterized seed image portion; translating, distorting, and/or scaling this portion, or the like, and this may be performed on all separations.

[0046] Thus, in some examples, at least some image modifications are applied to each of the separations, or at least a portion thereof. However, in some examples (or in the case of certain modifications), the image attribute modification may be carried out on

some separations and not on others. For example, color shuffling may be carried out in relation to a color spot separation and not in relation to other separations.

[0047] To consider color shuffling in greater detail, if the image contains a spot color separation and the image attribute modification comprises color shuffling, this may comprise color shuffling of spot colors. For example, the image modification attributes may include a "color shuffling dictionary" that assigns a specific combination of process colors to each of the N spot colors in the seed image. Each spot color identified by a level in the seed image may be replaced by the corresponding combination of process colors according to the "color shuffling dictionary". The modified image may be created from the basic process colors where the spot color separation indicates no shuffling, and with new process color combinations for each of the pixels defined in the spot color separation as one of the N spot colors to be shuffled. Thus, in the absence of any other modification, the same design element may appear in multiple modified images but may have a different color in each of those images. In the context of 3D printing, color shuffling may for example change the association between object portions and specified colors (and recoloring may comprise recoloring selected object potions, for example having defined shapes)

[0048] An alpha channel separation describing transparencies may be attached to each of the modified images, and may in some examples vary between modified images following the same rules of attribute modifications. In other examples, the alpha channel separation may be consistent (i.e. not subject to modification between modified images). In still further examples, the alpha channel may be created using a mathematical function that combines two of more alpha channel separations into a single one thus allowing both modified and consistent data to determine the shape and appearance of the output image. For example, a consistent alpha channel may restrain the composition of the modified image such that it fills a particular shape, e.g. a round shape, while a variable alpha channel may be modified using techniques set out herein to create a variable image inside the round shape.

[0049] As indicated by the looping arrow, blocks 410 and 412 may be carried out for each defined separation. Once all separations have been modified to the appropriate extent, the modified image is defined, in this example by the plurality of modified separations.

[0050] In block 414, the modified image is associated with the individualized image area of the template and, in block 416, the modified image is associated with any standardised content.

[0051] This in effect results in a composite image being defined, which comprises the modified separations and any additional standardised content which is to be same in a plurality of output images.

[0052] Block 418 comprises printing the modified image corresponding to different separations of the seed image to form a modified output image, and the method then repeats from block 408 such that a plurality of modified images are printed based on the same rasterized seed image. In examples relating to 3D printing, printing the modified image may comprise generating an object.

[0053] In some examples, block 418 is carried out as part of a print run for printing each of a plurality of modified images, to which different modifications have been applied, and at least partially concurrently with blocks 408 to 416 operating with a different image attribute modification selection, or on a different separation (i.e. in some examples, the processing of one separation may be carried out during printing of a previous separation). In some examples, it may be the case that while the leading portions of an image are being printed, trailing portions are still being processed in preparation for printing. In other examples, rasterized modified images may be stored in a queue, which may be held in volatile or primary memory (which may be RAM), for example until all the separations associated with a particular composite modified image have been defined.

[0054] In this example, therefore, a plurality of modified images may be defined using one seed image and a plurality of image attribute modification specifications. Where the image attribute modifications are stored as individual data blocks (for example, as entries in a database) or files, the blocks/files may be relatively small, for example comprising a few bytes in memory. Thus the memory storage dedicated to the plurality of modified images may be small prior to their generation and, in particular if the method of Figure 3 is utilised, the memory may be recycled such that the overall memory resource is small both in terms of long term (non-volatile, or secondary memory) and short term (e.g. volatile memory, primary memory and/or RAM), while a print run may produce a run of images.

[0055] Figure 5 is an example of an apparatus 500 comprising a printer 502, and memory comprising in this example volatile memory 504 and non-volatile memory 506, as well as the controller 206 of Figure 2. The controller 206, in use of the apparatus 500 is to control the printer to print the modified image, for example as set out in the methods of Figures 1, 3 or 4. The seed image may be stored in the non-volatile memory 506. Rasterised images may be stored in the volatile memory 506.

[0056] Although not shown herein, apparatus 500 may also comprise additional print apparatus components, for example print agent application unit(s), charging unit(s) for charging a photoconductive surface, an Intermediate transfer member (ITM) which may receive an image from the photoconductive surface before transferring this image to a substrate, substrate handling apparatus, print agents curing or drying apparatus, printheads, laser arrays, and the like, which may depend on the type of printer provided.

[0057] Figure 6 is an example of a tangible (and non-transitory) machine readable medium 602 in association with a processor 604. The tangible machine readable medium 602 comprises instructions 606 which, when executed by the processor 604, cause the processor 604 to carry out a plurality of tasks. The instructions 606 comprise instructions 608 to cause the processor 604 to rasterize a seed image; instructions 610 to cause the processor 604 to determine a plurality of image attribute modifications; instructions 612 to cause the processor 604 to modify the rasterized seed image based on the plurality of determined image attribute modifications to form a plurality of rasterized modified images outputs; and instructions 614 to cause the processor 604 to control print apparatus to print the plurality of modified images based on the plurality of rasterized modified image outputs. The image outputs may comprise whole or partial images, or whole or partial separations

[0058] The instructions 606-614 are arranged such that modifying the rasterized seed image based on the plurality of determined image attribute modifications is performed at least partially concurrently with printing at least one previously formed modified image output (e.g. a previous separation, image, or part thereof).

[0059] Aspects of some examples in the present disclosure can be provided as methods, systems or machine readable instructions, such as any combination of software, hardware, firmware or the like. Such machine readable instructions may be included on a computer readable storage medium (including but is not limited to disc storage, CD-ROM, optical storage, etc.) having computer readable program codes therein or thereon.

[0060] The present disclosure is described with reference to flow charts and block diagrams of the method, devices and systems according to examples of the present disclosure. Although the flow diagrams described above show a specific order of execution, the order of execution may differ from that which is depicted. Blocks described in relation to one flow chart may be combined with those of another flow chart. It shall be understood that at least one flow in the flow charts, as well as combinations of the flows in the flow charts can be realized by machine readable instructions.

[0061] The machine readable instructions may, for example, be executed by a general purpose computer, a special purpose computer, an embedded processor or processors of other programmable data processing devices to realize the functions described in the description and diagrams, and which may for example comprise at least part of the controller 206. In some examples, the controller 206 may be embodied as a graphics processing unit (GPU). In particular, a processor or processing apparatus may execute the machine readable instructions. Thus functional modules of the apparatus and devices may be implemented by a processor executing machine readable instructions stored in a memory, or a processor operating in accordance with instructions embedded in logic circuitry. The term 'processor' is to be interpreted broadly to include a CPU, processing unit, ASIC, logic unit, or programmable gate array etc. The methods and functional modules may all be performed by a single processor or divided amongst several processors.

[0062] Such machine readable instructions may also be stored in a computer readable storage that can guide the computer or other programmable data processing devices to operate in a specific mode.

[0063] Such machine readable instructions may also be loaded onto a computer or other programmable data processing devices, so that the computer or other programmable data processing devices perform a series of operations to produce computer-implemented processing, thus the instructions executed on the computer or other programmable devices realize functions specified by flow(s) in the flow charts and/or block(s) in the block diagrams.

[0064] Further, the teachings herein may be implemented in the form of a computer software product, the computer software product being stored in a storage medium and comprising a plurality of instructions for making a computer device implement the methods recited in the examples of the present disclosure.

[0065] While the method, apparatus and related aspects have been described with reference to certain examples, various modifications, changes, omissions, and substitutions can be made without departing from the spirit of the present disclosure. It is intended, therefore, that the method, apparatus and related aspects be limited by the scope of the following claims and their equivalents. It should be noted that the above-mentioned examples illustrate rather than limit what is described herein, and that those skilled in the art will be able to design many alternative implementations without departing

from the scope of the appended claims. Features described in relation to one example may be combined with features of another example.

[0066] The word “comprising” does not exclude the presence of elements other than those listed in a claim, “a” or “an” does not exclude a plurality, and a single processor or other unit may fulfil the functions of several units recited in the claims.

[0067] The features of any dependent claim may be combined with the features of any of the independent claims and/or other dependent claim(s).

CLAIMS

1. A method comprising:

rasterizing, using a processor, a seed image; and

generating, using a processor, a plurality of rasterized modified images from the rasterized seed image, where generating each rasterized modified image comprises:

determining an image attribute modification; and

applying, using a processor, the determined image attribute modification to at least a portion of the rasterized seed image to generate the rasterized modified image.

2. A method as claimed in claim 1 further comprising allocating volatile memory storage for a modified rasterized image in volatile memory until a print processing operation based on the modified rasterized image is carried out.

3. A method as claimed in claim 2 wherein the allocated volatile memory storage allocation is accessible for allocation for storage of another of the modified rasterized images generated from the rasterized seed image after the print processing operation is carried out.

4. A method as claimed in claim 1 further comprising printing a plurality of modified images, wherein generation of a rasterized modified image to be printed is carried out during printing of a previously generated rasterized modified image.

5. A method as claimed in claim 1 further comprises defining a template, comprising at least one individualized image area, associating a modified rasterized image with the template and applying the, or each, modified image to the respective individualized image area.

6. A method as claimed in claim 1, wherein the rasterized seed image comprises a plurality of separations and comprising applying the image attribute modification separately to each of the plurality of separations.

7. A method as claimed in claim 6, wherein the plurality of separations comprises a spot color separation associated with N+1 levels, where N is a number of spot colors in the seed image and wherein one level corresponds to the absence of a spot color and each other level corresponds to a specific spot color and the image attribute modifications comprises color shuffling,

wherein the color shuffling comprises selecting a different colorant combination for each of the N levels specified in the spot color separation.

8. A method as claimed in claim 1, wherein applying the image attribute modification comprises applying at least one of the following modifications to the rasterized seed image: cropping, rotating, translating, distorting, scaling, color shuffling, colorization, applying transparency effects, reflecting, color depth variations, brightness adjustment, contrast adjustment, gamma correction, histogram equalization and manipulation, warping, filtering.

9. A method as claimed in claim 1 wherein rasterizing the image comprises creating separations, wherein at least one separation corresponds to a color of print agent and at least one separation corresponds to a transparency value.

10. A method according to claim 1, further comprising printing an image of the plurality modified images at least partially concurrently with applying image attribute modifications to at least a portion of the seed image.

11. A method according to claim 1 comprising receiving a seed image from persistent memory.

12. A method as claimed in claim 1, wherein determining an image attribute modification comprises a random or pseudo-random process.

13. Apparatus, comprising:

a memory; and

a controller comprising:

a rasterization module to rasterize a seed image;

an image modification module to, for each of a plurality of modified images:

determine an image attribute modification to be performed on at least a portion of the rasterized seed image;

apply the image attribute modification to generate a rasterized modified image; and

store the rasterized modified image in the memory.

14. An apparatus according to claim 13 further comprising a printer, wherein the controller is to control the printer to print the modified image.

15. A non-transitory machine-readable storage medium, encoded with instructions executable by a processor, the machine-readable storage medium comprising instructions to cause the processor to:

rasterize a seed image;

determine a plurality of image attribute modifications;

modify the rasterized seed image based on the plurality of determined image attribute modifications to form a plurality of rasterized modified image outputs; and

control print apparatus to print a plurality of modified images based on the plurality of rasterized modified image outputs,

wherein modifying the rasterized seed image based on the plurality of determined image attribute modifications is performed at least partially concurrently with printing at least one previously formed modified image output.

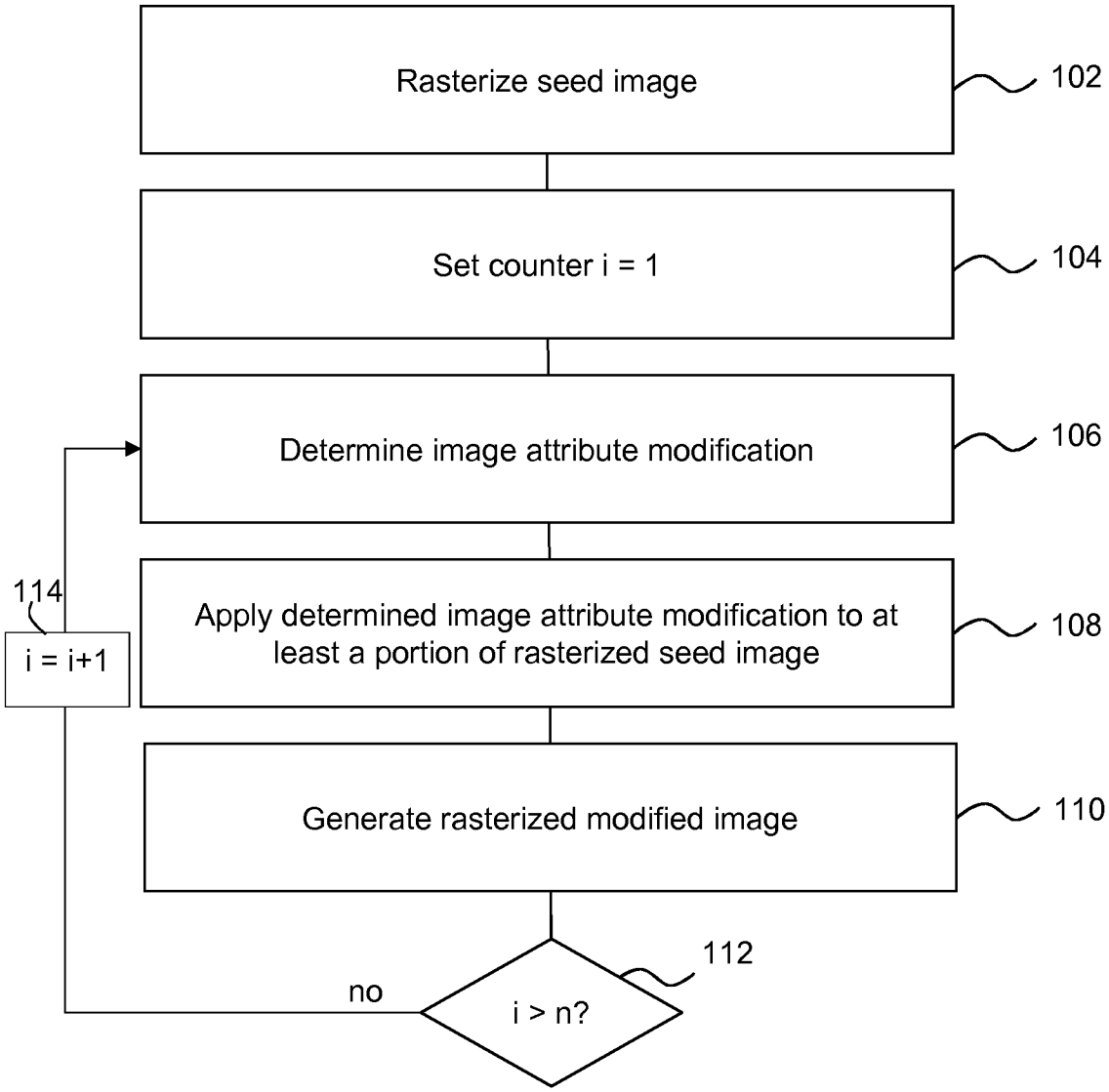
Rasterize seed image
102
Set counter i = 1
104
Determine image attribute modification
106
Apply determined image attribute modification to at least a portion of rasterized seed image
108
Generate rasterized modified image
110
i > n?
112
no
i = i+1
114

Fig. 1

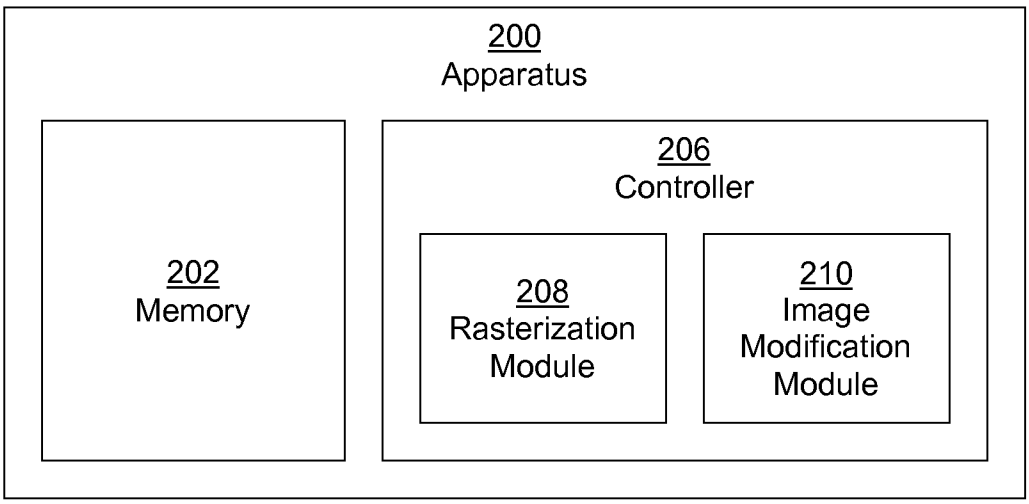
200
Apparatus
202
Memory
206
Controller
208
Rasterization
Module
210
Image
Modification
Module

Fig. 2

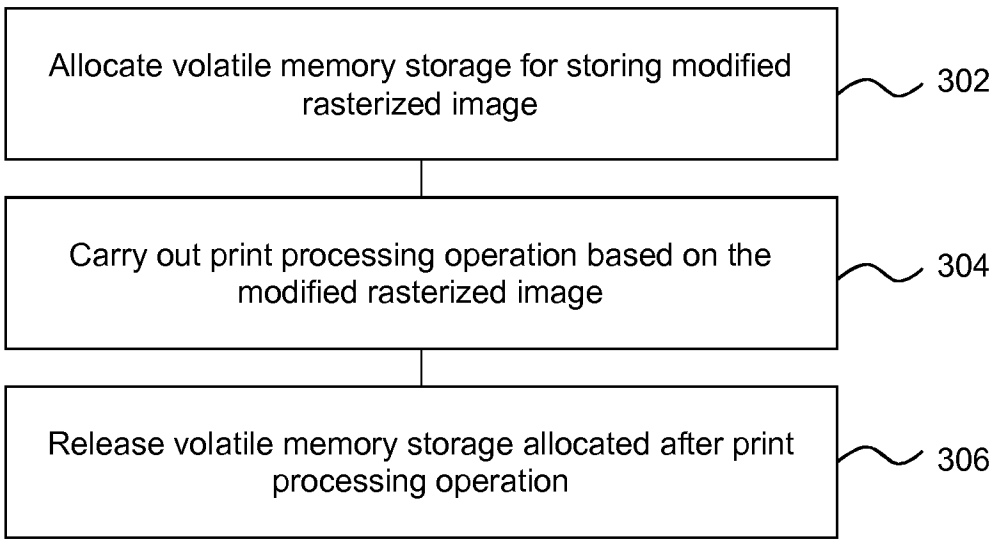
Allocate volatile memory storage for storing modified rasterized image
302
Carry out print processing operation based on the modified rasterized image
304
Release volatile memory storage allocated after print processing operation
306

Fig. 3

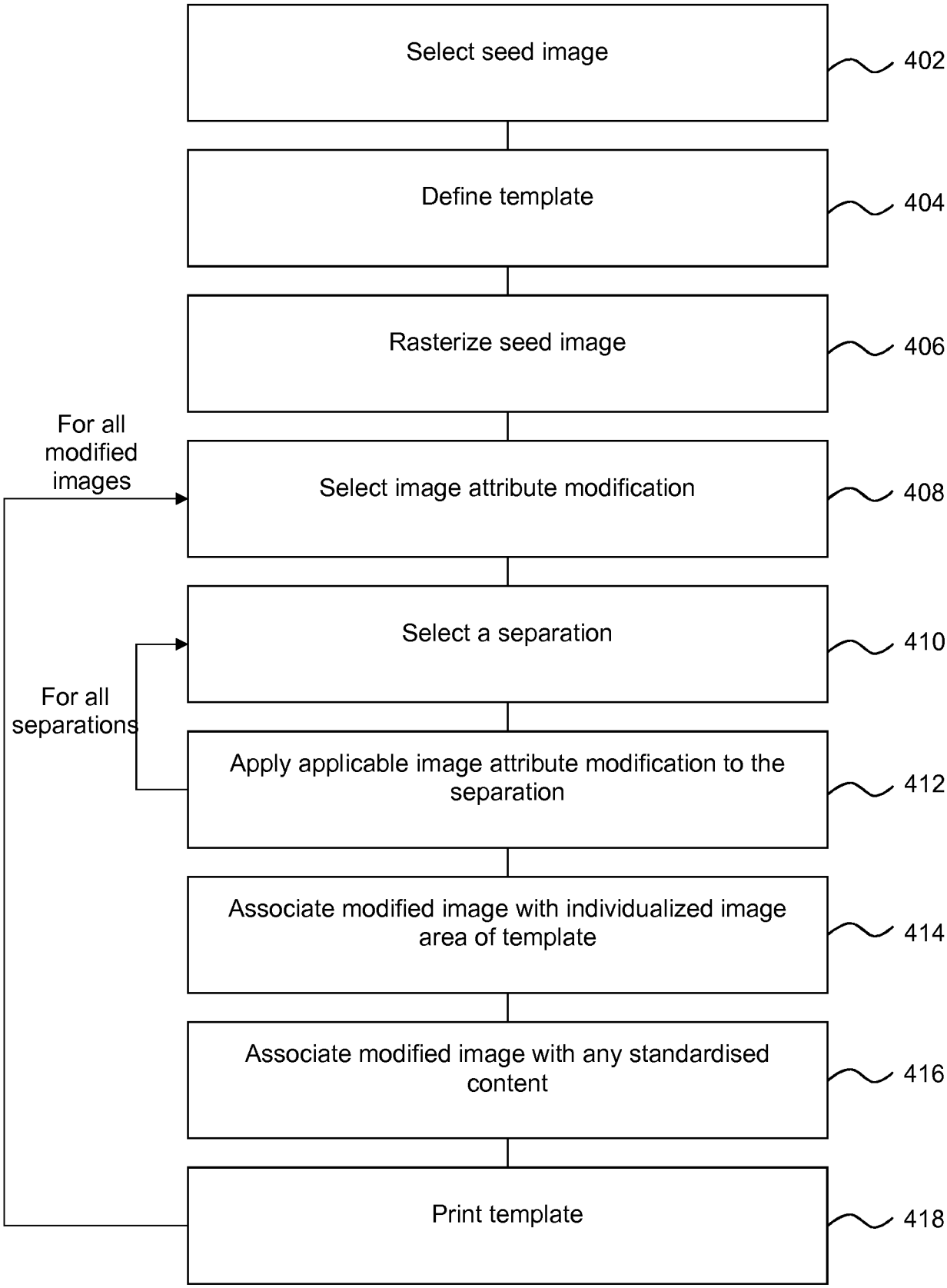
Select seed image
402
Define template
404
Rasterize seed image
406
For all modified images
Select image attribute modification
408
Select a separation
410
For all separations
Apply applicable image attribute modification to the separation
412
Associate modified image with individualized image area of template
414
Associate modified image with any standardised content
416
Print template
418

Fig. 4

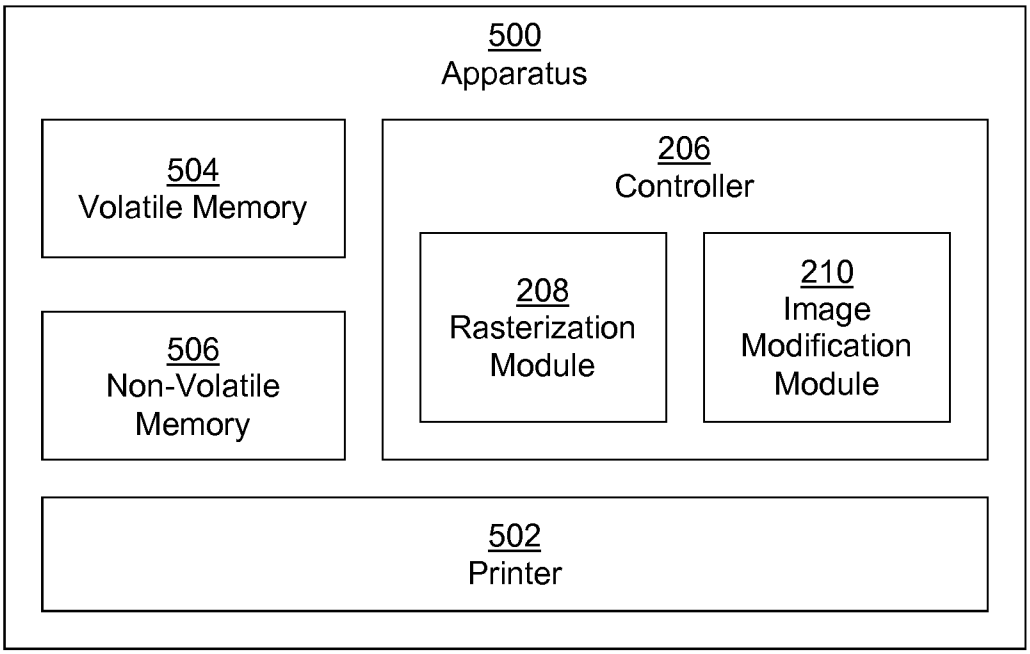
500
Apparatus
504
Volatile Memory
506
Non-Volatile Memory
206
Controller
208
Rasterization Module
210
Image Modification Module
502
Printer

Fig. 5

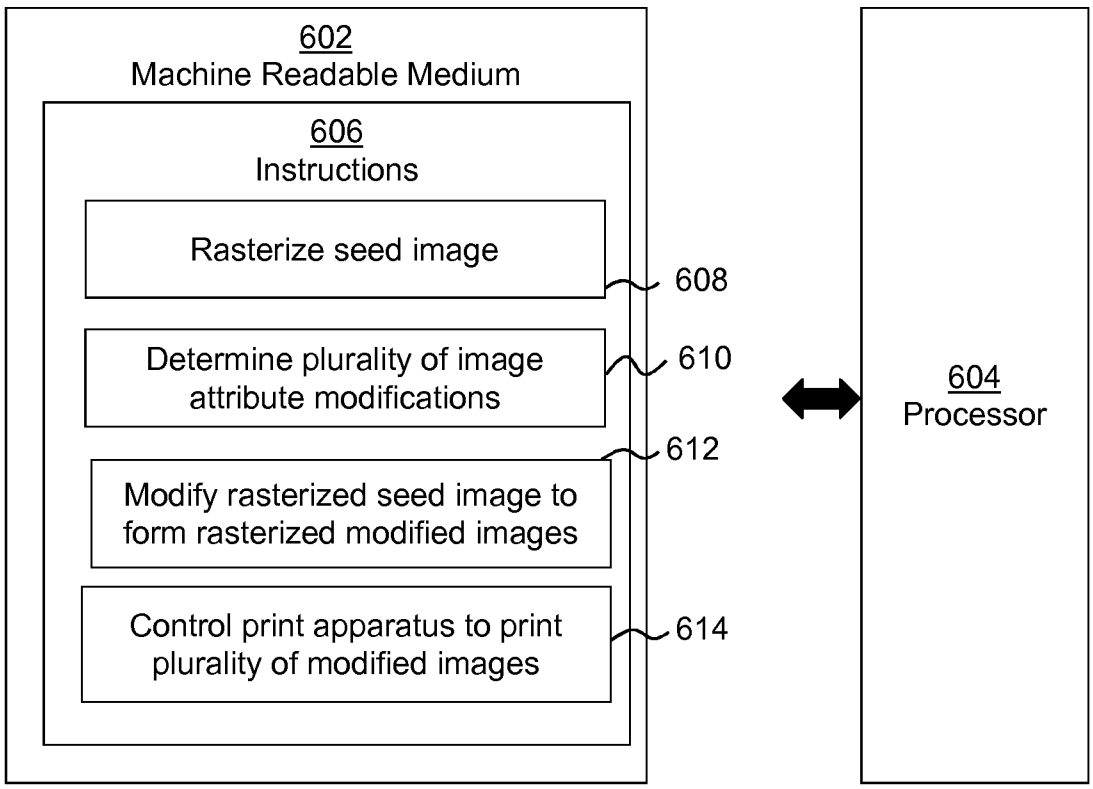
602
Machine Readable Medium
606
Instructions
Rasterize seed image
608
Determine plurality of image attribute modifications
610
612
Modify rasterized seed image to form rasterized modified images
Control print apparatus to print plurality of modified images
614
604
Processor

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/071920

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06K15/02 G06F3/12
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)
G06K G06F

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.
X	WO 99/17539 A1 (ELECTRONICS FOR IMAGING INC [US]) 8 April 1999 (1999-04-08)	1,2,4,5, 8-11, 13-15
Y	page 7, line 29 - page 10, line 26	3
A		6,7

X	WO 2015/185135 A1 (HEWLETT PACKARD INDIGO BV [NL]) 10 December 2015 (2015-12-10)	1,2,4,5, 9,10, 12-15
Y	page 3, line 19 - page 7, line 26	3
A		6,7

Y	US 6 330 071 B1 (VIDYANAND RAMGOPAL [US]) 11 December 2001 (2001-12-11) column 5, line 50 - column 6, line 2	3

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"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

"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	Date of mailing of the international search report
27 April 2018	08/05/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Geiger, Hans-Walter

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/071920

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