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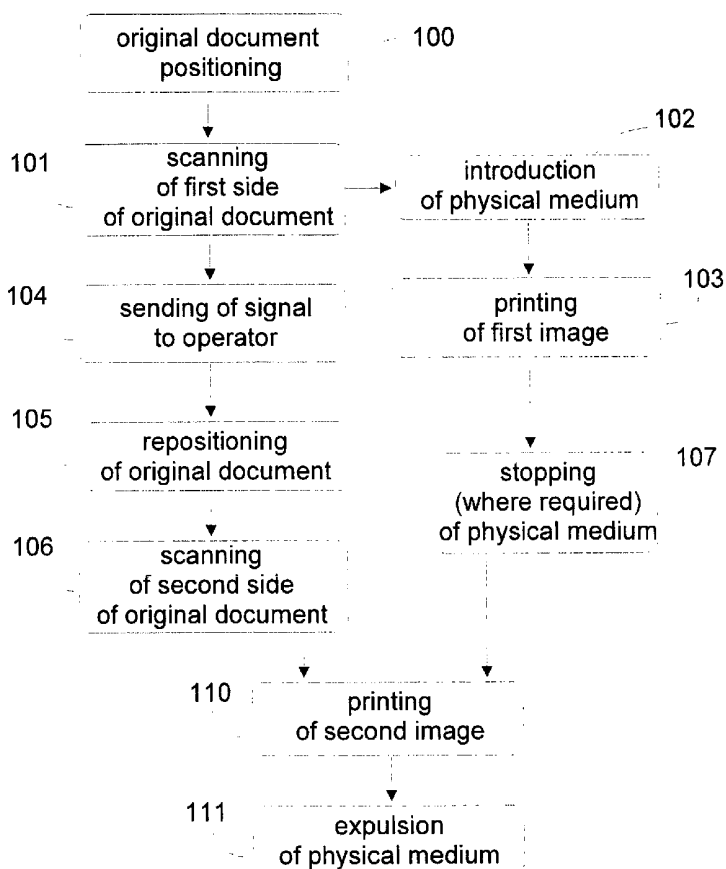
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[Continued on next page]

(54) Title: DEVICE AND METHOD FOR IMAGE SCANNING AND PRINTING



(57) Abstract: A device (43) for scanning and printing images scans a first side of an original document (53) using a scanner (73) and sends an image (50) of the original document (53) to a printer (41) which prints the image (50) on part of a page of a sheet (46); when scanning is finished, the device sends a signal to the operator, who repositions or changes the original, and scans a second side of the same original (53) or a second original (53"), sends a second image (50") to the printer (41) which prints it on a remaining part of the same page of the sheet (46), and which, finally, expels the sheet (46).



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DEVICE AND METHOD FOR IMAGE SCANNING AND PRINTING

Technical Field

The invention relates to a device for scanning and printing, on a physical medium, black and white or colour images generated from an original. The images
5 may be printed, for instance, by means of an ink jet printer.

Background Art

Fig. 1 shows a printer 41, of for instance the ink jet type, comprising a carriage 42 which has on board one or more monochromatic or colour printheads 40. The printing is performed on a physical medium 46, which is normally a sheet of paper, a sheet of
10 plastic, fabric or similar. Also shown in Fig. 1 are the reference axes:

x-axis: horizontal, i.e. parallel to the direction of movement of the carriage 42 with the heads 40; y-axis: vertical, i.e. parallel to the direction of motion of the medium 46 during printing and the line feed function; z-axis: perpendicular to the x and y axes, i.e. substantially parallel to the direction of emission of the droplets of ink.

15 The composition and general mode of operation of a printer according to the ink jet technology are already abundantly known in the sector art, so that no detailed description will be provided herein, but instead only those characteristics of relevance for the understanding of this invention will be described in depth.

Fig. 1 also shows a scanner 73 which scans an original document 53 and
20 generates electronic signals suitable for printing a corresponding image 50.

Systems configured in such a way as to produce a single image on a page of the medium 46 are known. However the original document 53 is often of considerably lesser dimensions than the page of the medium 46: this may be the case of an identity card, a driving licence, a passport, a credit card, a badge, a tax
25 code, a national health service card, a post office receipt, a cheque and similar.

If both sides of these small-size originals have to be reproduced, then two sheets must be printed of the medium 46, usually of the A4 (210 * 297 mm) or similar format, with the drawback that paper and time are wasted, and that there is no guarantee that the two sheets reproducing the two sides of one and the same
30 original will be properly matched up.

With reference to the time diagram of Fig. 2 the following are defined:

ta time to position the original

ts scan time

ti time to introduce the medium 46

5 tp printing time

ten time to expel the medium 46 according to the known art

Tn time to produce an entire page according to the known art. The following equation may be obtained:

$$1) \quad Tn = ta + 2 * (ti + tp + ten)$$

10 An alternative is recto-verso printing, but this also has drawbacks, in that it requires a more complex management of the medium 46 by the machine or by the operator.

It is more convenient to print various images on a single page, as is illustrated for instance in Fig. 3, where two images 50 and 50'' corresponding to the two sides of a single original document 53 are depicted. In the known art, this result may be
15 obtained by performing the printing and scanning operation twice, taking care to correctly move the original between one operation and the next, and making the medium 46 pass through the device twice in the required orientation: this involves a waste of time and the probability of error is high.

20 Disclosure of the Invention

This invention overcomes the above-mentioned drawbacks by means of the following cycle:

- scanning the first side of the original 53;
- printing the image 50, corresponding to a first side of the original, on a first part
25 of a page of the medium 46;
- notifying the operator that scanning has finished;
- allowing the operator to turn the original 53 over without changing its position;
- scanning the second side of the original 53;
- temporarily halting, if necessary, movement of the medium 46, if printing stops
30 before the new scan starts;

- printing the second image 50", corresponding to the second side of the original, on a second part of the same page of the medium 46;
- expelling the medium 46.

The object of this invention is to print a plurality of images on a single page of a medium.

Another object is to print, on a single page of the medium, two images corresponding to the two sides of a small-size original document.

A further object is to print, on a single page of the medium, two small-size images corresponding to the two sides of an original document that is not small-size.

Yet another object is to print, on a single page of the medium, two enlarged scale images corresponding to the two sides of an original document of very small dimensions.

Another object is to reduce the total time needed for the operation.

Another object is to reduce the amount of paper consumed.

Another object is to print, on a single page of the medium, two images in different modes, for example one in colour and one monochromatic, or having a different contrast.

Another object is to achieve more homogeneous use the colour head and the monochromatic head.

The above objects are achieved by means of a device and method for scanning and printing images, characterized as defined in the main claims.

These and other objects, characteristics and advantages of the invention will become clear from the description that follows of a preferred embodiment, provided by way of a non-restricting example, and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

- Fig. 1 - represents an axonometric view of an ink jet printer in combination with a scanner;
- Fig. 2 - is a time diagram relative to the printing of two images on two pages,
5 according to the known art;
- Fig. 3 - represents a page containing two images corresponding to the two sides of a small-size document;
- Fig. 4 - represents a page upon which two images are printed, according to the invention;
- 10 Fig. 5 - represents a page containing three images, of which two corresponding to the two sides of a small-size document, and of which the third corresponds to a second small-size document;
- Fig. 6 - represents a time diagram relating to the printing of a page containing two images, according to the invention;
- 15 Fig. 7 - represents a flow diagram of the sequence of operations of the scanning and printing method according to the invention;
- Fig. 8 - represents a flow diagram relating to the sequence of operations of the scanning and printing method according to the invention, in a second embodiment.
- Fig. 9 - represents a flow diagram relating to the sequence of operations of the
20 scanning and printing method according to the invention, in a third embodiment.

Best Mode for Carrying Out the Invention

In a preferred embodiment, a scanning and printing device 43 is considered, again illustrated with reference to Fig. 1, consisting for instance of a printer 41 and a scanner 73, which in turn includes a window 44 and an optical sensor 45.

5 The arrangement and relative motion of the various parts may be inferred from Fig. 1 as a non-restrictive example: other arrangements are in fact possible, such as for instance that which uses a “parallel” head, known to those acquainted with the sector art, which is not provided with any motion on the x-axis.

The scanner 73 scans the image of an original document 53, converts it into
10 electronic signals by means of known techniques and sends it to the printer 41 which reproduces it on a physical medium 46, generally though not exclusively a sheet of paper. As scanning and printing are not simultaneous, it is necessary to use an intermediate memory that performs the “buffer” function: as they arrive from the scanner, the electronic signals are temporarily stored in the buffer until the
15 corresponding portion of image has been printed.

To meet requirements of practicality and cost containment, it is desirable to print various images of the original document 53 on a single page of the physical medium 46, without having to remove and reposition the physical medium 46.

For this purpose, when the above-mentioned scanning is completed, the device
20 sends a signal to the operator, who turns the original document 53 over, repositioning it roughly in the same position of the window 44 of the scanner 73 and activates the device again through a scan command. The signal sent to the operator may consist of an audible beep, a luminous signal, or a visual signal on a display.

The scanner 73 scans the second side of the original document 53 and generates a
25 second image 50” which is sent to the printer 41 for printing.

In the example in Fig. 3 two images 50 and 50”, corresponding to two sides of the same original 53, are printed on the same page of the physical medium 46. According to this invention, during printing the medium 46 is fed parallel to the y-axis after each stroke of the carriage 42. As may be seen with the help of Fig. 4,
30 when printing of the first image 50 is completed, the medium 46 has been moved in

total by an interval equal to the height H of the image 50, and may if necessary be moved by a further interval equal to the distance D between two consecutive images, in such a way as to complete a feeding $L = H + D$, after which, if scanning of the second side of the original 53 has still not commenced, it is stopped in stand-
 5 by mode.

The value of L may be predetermined by the operator, or it can be determined automatically by the device 43 depending on the dimensions of the original 53 using known techniques.

Feeding of the medium 46 takes the form of motion relative to the heads 40,
 10 and therefore the principle of this invention is also applicable when the medium 46 is held motionless with respect to the fixed structure of the printer 41, while the heads 40 are moved with a motion substantially parallel to the y-axis.

Printing and the other various operations described below are executed by way of a software or firmware program, or by means of a wired logic circuit, in turn
 15 made from discrete or integrated components, not described here as they are known to those acquainted with the sector art.

As can be seen in Fig. 4, the medium 46 is fed again parallel to the y-axis by a second feed amount L, upon completion of which expulsion of the medium 46 is commanded using techniques known to those acquainted with the sector art.

20 Fig. 6 shows a time diagram of the scanning and printing of images according to the invention described. The times t_a , t_i , t_p and t_s are practically unchanged with respect to the known art described with reference to Fig. 2, whilst a new time is defined

t_{ei} time to expel the medium 46 according to the invention

which is less than t_{en} since, according to the invention, the page of the medium 46
 25 is printed in full, down almost to the bottom margin.

The time T_i to produce an entire page printed according to the invention is given by the relation:

$$2) \quad T_i = t_a + 2 * (t_i + t_p) + t_{ei}$$

If this is compared with relation 1), a reduction in the total time is obtained

30
$$3) \quad T_n - T_i = 2 * t_{en} - t_{ei}.$$

The scanning and printing device 43 effects the following steps, described with the aid of the flow diagram of Fig. 7.

In step 100 the operator positions the original document 53 in the scanning and printing device 43 with the first side facing the scanner 73.

5 In step 101 the scanner 73 scans the first side of the original document 53.

In step 104 the scanning and printing device 43 sends a signal to the operator that scanning has been completed.

In step 105 the operator positions the original document 53 in the scanning and printing device 43, with the second side facing the scanner 73.

10 In step 106 the scanner 73 scans the second side of the original document 53.

Steps 102, 103 and 107 are carried out in parallel and simultaneously with the already described steps 101, 104, 105 and 106.

In step 102, which is enabled immediately after step 101 commences, the printer 41 effects introduction of the physical medium 46.

15 In step 103 the printer 41 performs printing of the first image 50 of the first side of the original document 53 on the first part of the physical medium 46.

In step 107, the movement of the physical medium 46 may be temporarily interrupted while waiting for scanning of the second side to start (step 106). On the other hand, if, once printing of the first image is completed (step 103), scanning of
20 the second side has already started, the device immediately proceeds with the next step 110, without stopping the medium 46 at all.

In step 110 the printer 41 prints the second image 50" of the second side of the original document 53 on the second part of the physical medium 46.

In step 111 the printer 41 expels the physical medium 46.

25 **Second Mode for Carrying out the Invention**

In the description furnished up to this point, it is assumed that two images, 50 and 50", corresponding to the two sides of the original document 53 are printed on a single page of the medium 46. In the description that now follows, on the other hand, we consider the case in which more than two images are printed, as
30 illustrated in Fig. 5 in connection with which we assume, by way of non-restrictive

example, that one image 50 corresponding to the first side of an identity card, a second image 50'' corresponding to the second side of the identity card, and a third image 50''' corresponding to another original document 53'', for example a cheque, are printed.

5 In this case, the sequence of operations changes as indicated in the flow diagram of Fig. 8. The sequence of operations is similar to that shown in Fig. 7, where the steps 105, 106 and 110 are respectively replaced by the steps 120, 121 and 122.

In step 120 the operator repositions the original document 53, with the second
10 side facing the scanner 73, and the other original document 53''' in the scanning and printing device 43.

In step 121 the scanner 73 scans the second side of the original document 53 and the other original document 53'''.

In step 122 the printer 41 performs printing of the second image 50'' of the
15 second side of the original document 53 and of the other image 50''' of the other original document 53''' on the second part of the physical medium 46.

According to a variant of this embodiment, the scanning completed signal may be sent to the operator when the scanning of each side of each document is finished: in this case, the operator positions one document only at a time, and the
20 printer may interrupt movement of the physical medium 46 after each single image is printed. When the page of the physical medium 46 is completed, expulsion of the same physical medium 46 is commanded.

Third Mode for Carrying out the Invention

The case may arise where the original document 53 is of roughly the same
25 dimensions as those of the page of the physical medium 46, which may be, by way of non-restricting example, an A4 size sheet, and it is required to print two reduced images of the two sides on a single page of the physical medium 46. In this case, the scanning and printing device 43 performs the operations described in the flow diagram of Fig. 9, which is similar to that of Fig. 7, with the insertion, after step
30 102, of step 130 and, after step 106, of step 131 in which image reduction is

performed using known techniques.

Fourth Mode for Carrying out the Invention

The case may also arise in which the original document 53 is of very small dimensions, and where it is required to print two enlarged images of the two sides
5 on a single page of the physical medium 46. In this case, the scanning and printing device 43 performs similar operations to those described in the flow diagram of Fig. 9, where step 130 and step 131 are replaced by two steps, not illustrated in any figure, in which image enlargement is performed using known techniques.

This invention may be built with a different sequence of steps described and,
10 in short, while the principle of the invention remains unaltered, the construction details and embodiments may be abundantly varied with respect to what has been described and illustrated, without exiting from the scope of the invention itself.

CLAIMS

1. Scanning and printing device (43) comprising:
 - a scanner (73) suitable for generating, during a first scanning, a first image (50);
 - a printer (41) suitable for printing said first image (50) on a page of a physical medium (46),

5 **characterized in that** said device (43) further comprises signalling means suitable for signalling to an operator, when said first scanning is finished, to perform a second scan so as to produce a second image (50"); and in that said printer (41) is suitable for printing said second image (50") on the same page of said physical medium (46).

10
2. Device according to claim 1, **characterized in that** said printer (41) further comprises one or more printheads (40), that said physical medium (46) is provided, during the printing, with a motion relative to said printheads (40), and that said printer (41) is suitable for stopping said relative motion of said medium (46) with respect to said heads (40) when the printing of said first image (50) is completed, if
- 15 said second scanning has not yet commenced.
3. Device according to claim 1, **characterized in that** said printer (41) further comprises means suitable for expelling said medium (46) when the printing of said page of said physical medium (46) has been completed.
- 20 4. Device according to claim 1, **characterized in that** said scanner (73) is colour type.
5. Device according to claim 2, **characterized in that** said one or more printheads (40) are ink jet type.
6. Device according to claim 5, **characterized in that** at least one of said
- 25 printheads (40) is colour type.
7. Device according to claim 5, **characterized in that** at least one of said printheads (40) is monochromatic.
8. Device according to claim 1, **characterized in that** it further comprises means suitable for reducing the dimensions of said first image and of said second

image (50, 50'') in such a way that said images (50, 50'') fit on said page of said physical medium (46).

9. Device according to claim 1, **characterized in that** it further comprises means suitable for enlarging the dimensions of said first image and of said second
5 image (50, 50'').

10. Device according to claim 1, **characterized in that** said signalling means are suitable for generating a visual signal on a display.

11. Device according to claim 1, **characterized in that** said signalling means are suitable for generating a luminous signal.

12. Device according to claim 1, **characterized in that** said signalling means are suitable for generating an acoustic beep.

13. Method for scanning and printing images comprising the steps of (101) performing a first scan in order to produce a first image (50); and printing said first image (50) on a page of a physical medium (46),
15 **characterized in that** it further comprises the steps of:

- (104, 106) signalling to an operator, when said first scanning is finished, to perform a second scan, so as to produce a second image (50'');
- (110) printing said second image (50'') on the same page of said physical medium (46).

20 14. Method according to claim 13, **characterized in that** it further comprises the step of:

- (130) reducing the dimensions of said first image and of said second image (50, 50'') in such a way that said images (50, 50'') fit on said page of said physical medium (46).

25 15. Method according to claim 13, **characterized in that** it further comprises the step of:

- enlarging the dimensions of said first image and of said second image (50, 50'').

16. Method according to claim 13, **characterized in that** said first image (50) is obtained by way of the scanning of a first side of a document, and in that said

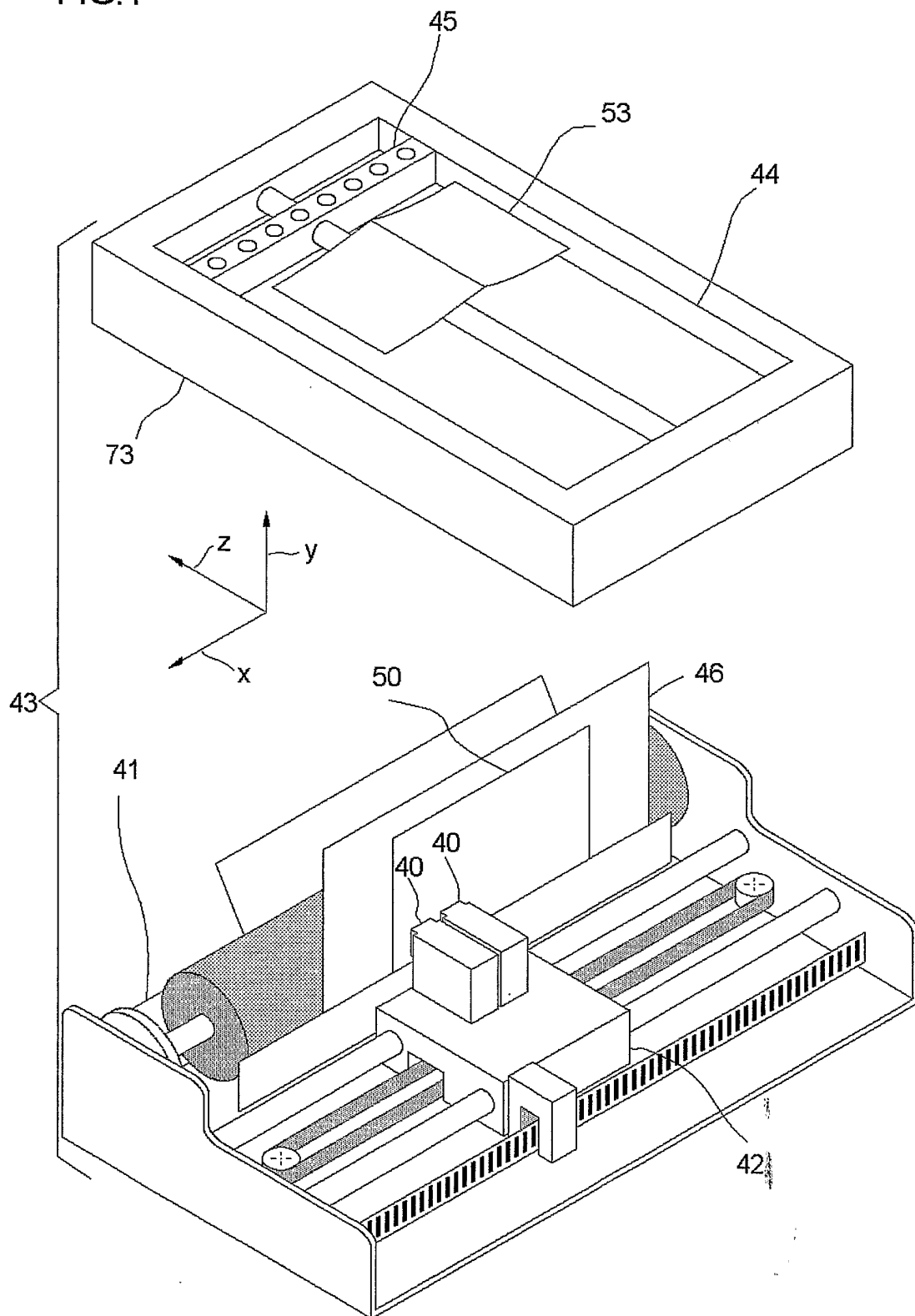
second image (50'') is obtained by way of the scanning of a second side of the same document.

17. Method according to claim 16, **characterized in that** said document may be chosen from a subset comprising:

- 5 identity card, driving licence, passport, credit card, badge, tax code card, national health service card, post office receipt, cheque.

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FIG.1



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FIG. 2

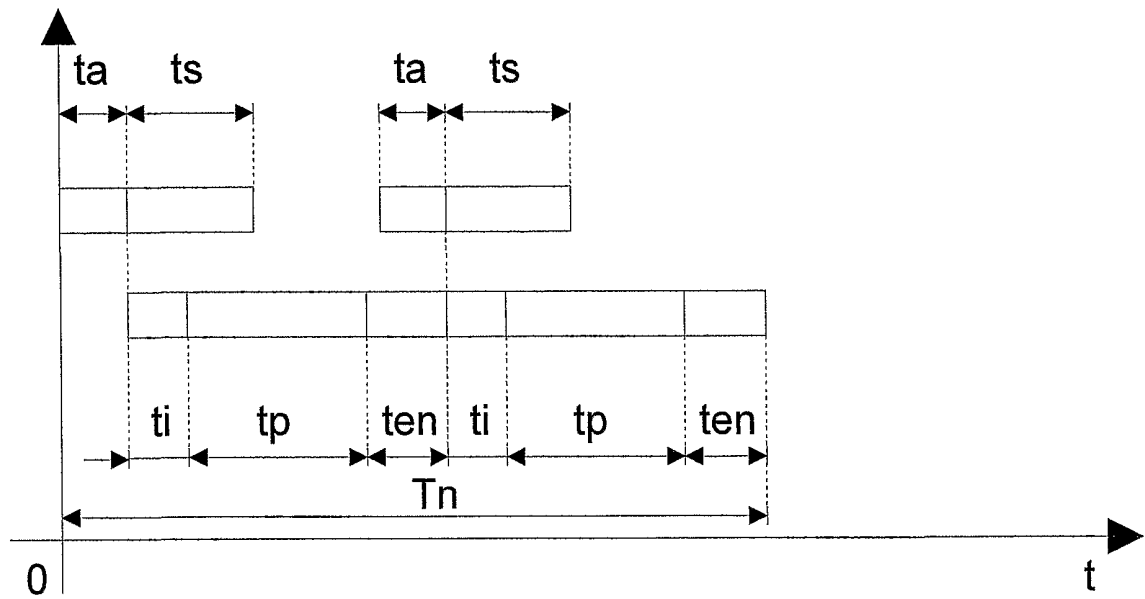


FIG. 6

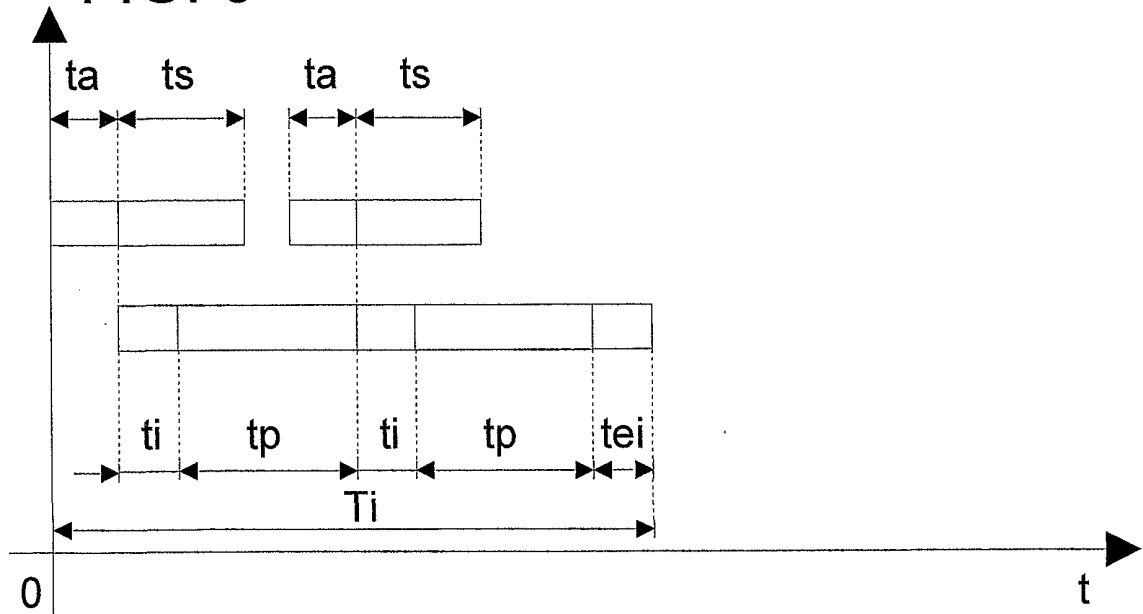


FIG. 3

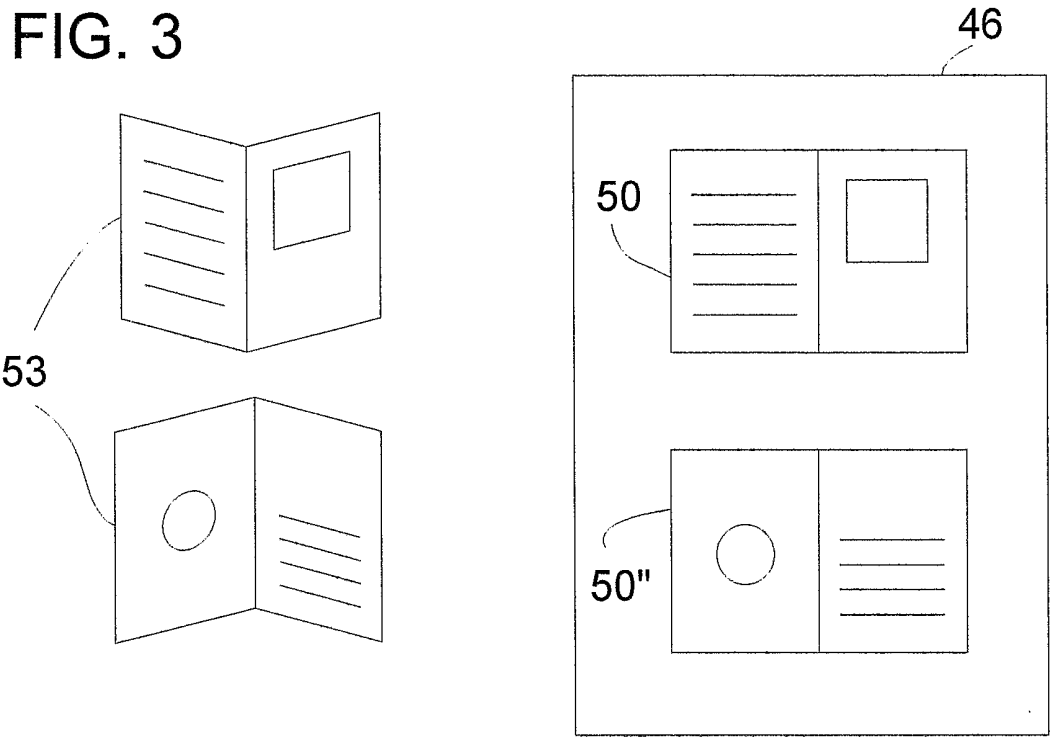
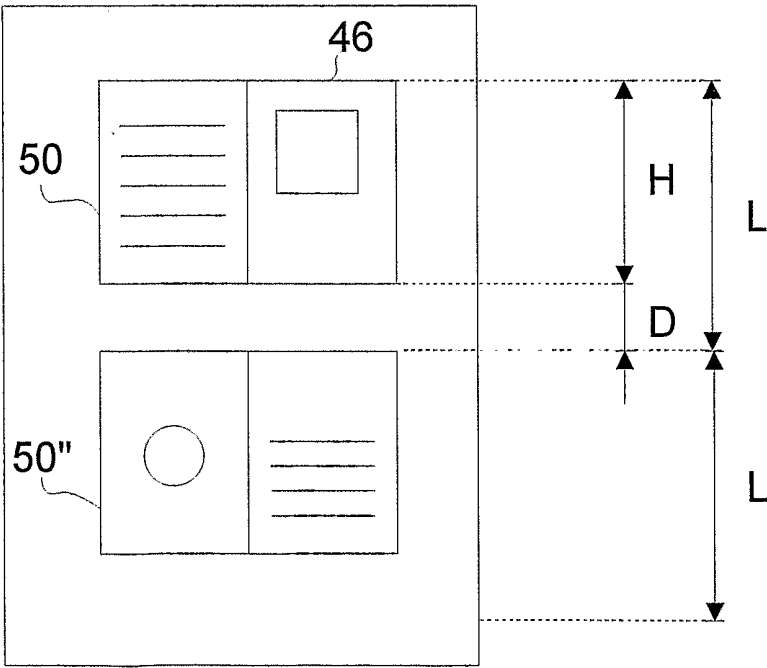
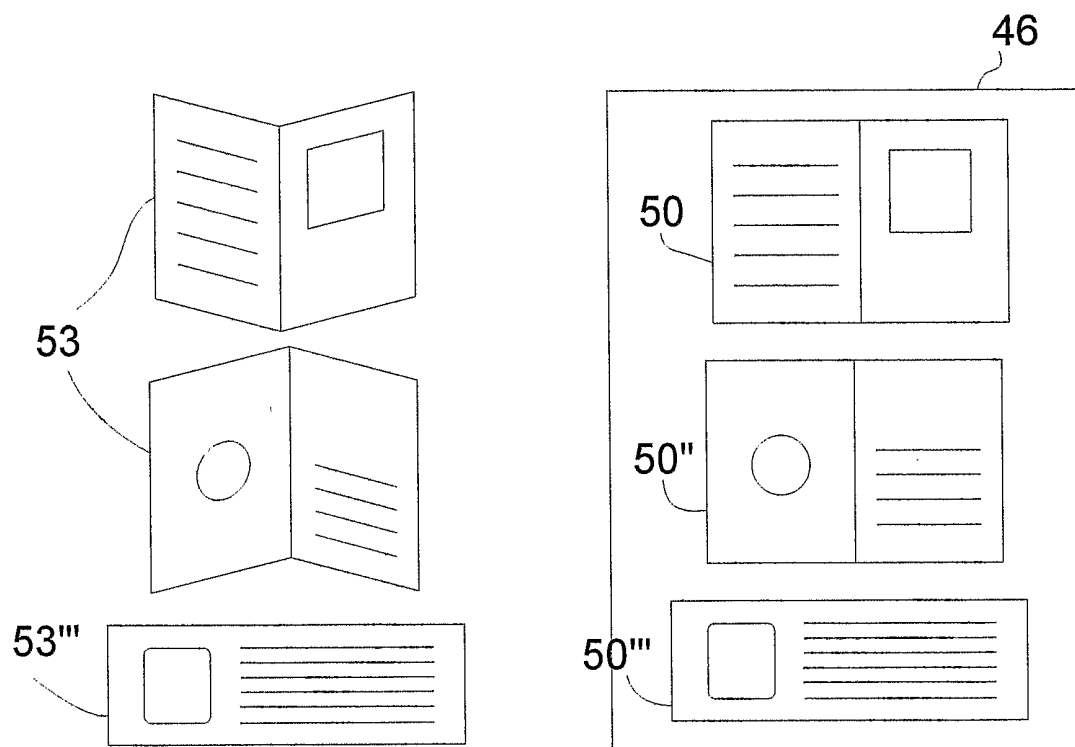


FIG. 4



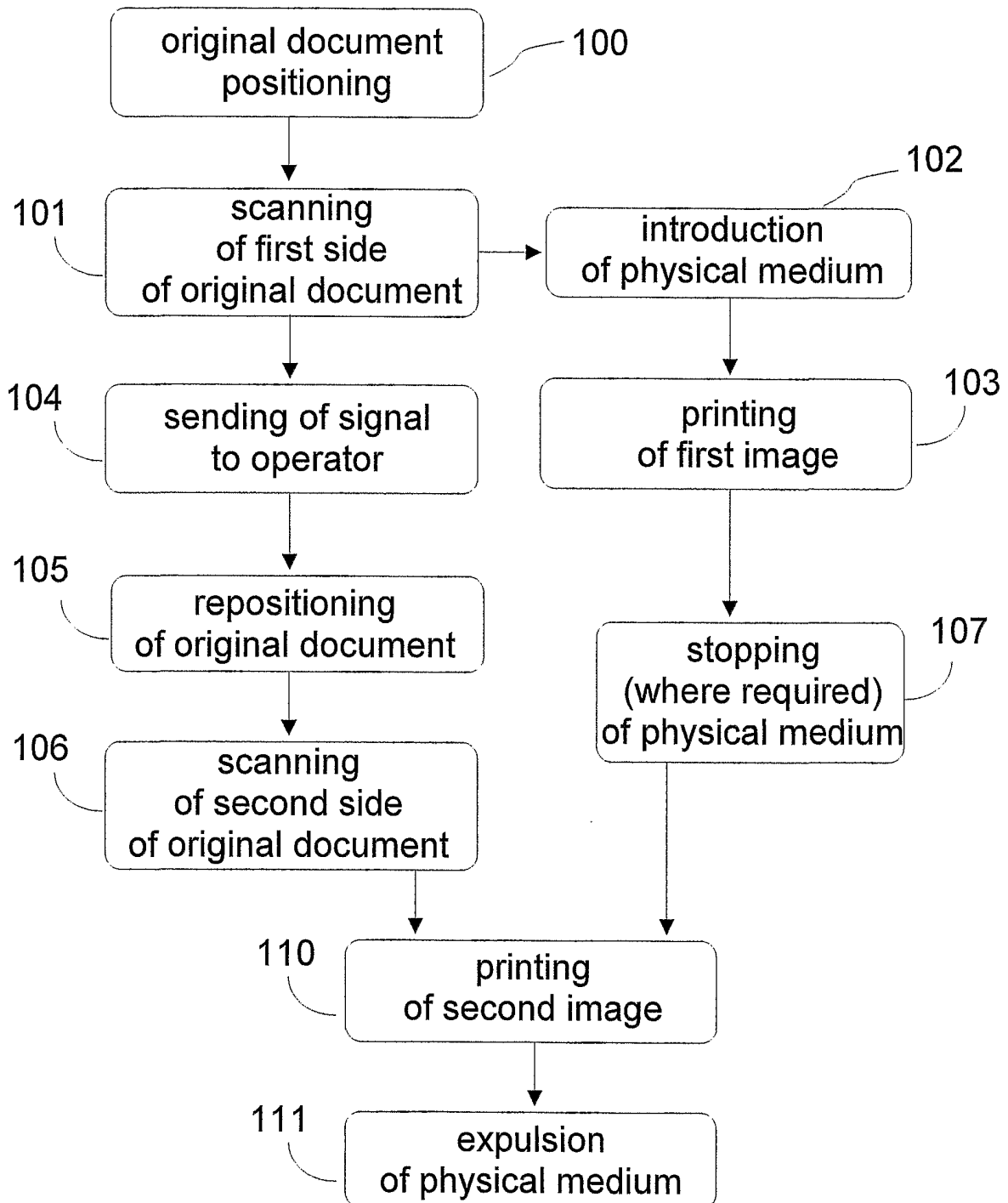
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FIG. 5



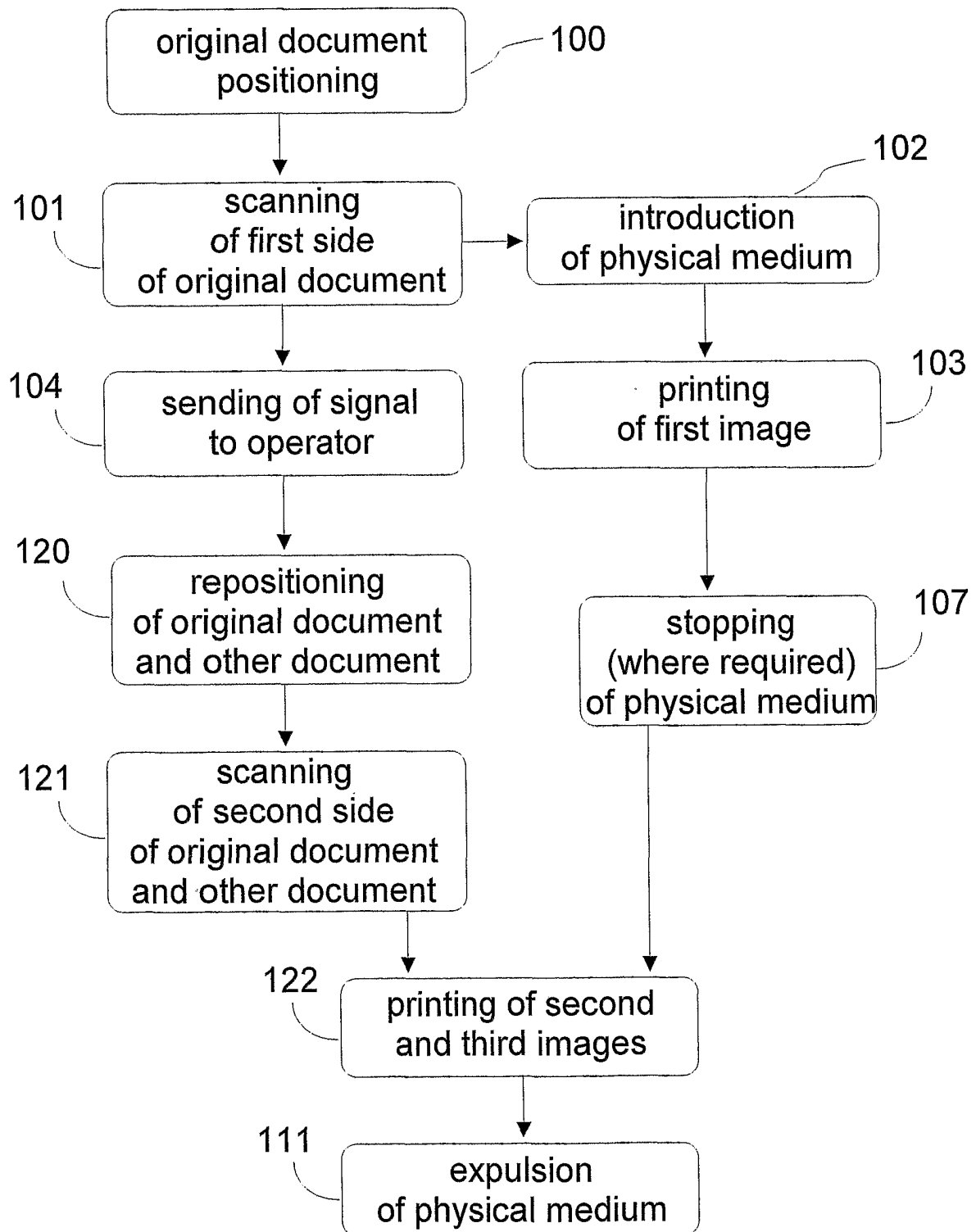
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FIG. 7



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FIG. 8



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FIG. 9

