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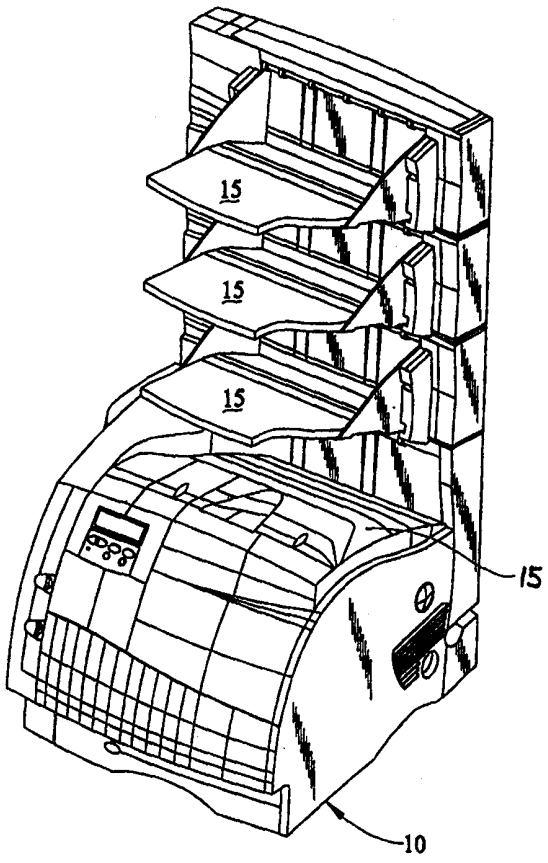
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(54) Title: ADJUSTABLE MAILBOX CAPACITY FOR NETWORK PRINTER SYSTEM

(57) Abstract

A computer-controlled paper delivery system for a printer (10) having multiple physical output bins (15). The system allows the user to combine less than all of the physical output bins (15) into a single logical output bin by assigning the same alphanumeric name to the bins to be combined. This allows certain users of the printer to have larger output capacity. The physical output bins (15) of a logical bin are filled sequentially until each is full. The printer (10) may have more than one logical output bin and may contain certain physical output bins (15) that are not part of the logical output bin.



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ADJUSTABLE MAILBOX CAPACITY FOR NETWORK PRINTER SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to the field of computer printers, and more particularly to a computer-controlled paper delivery system for such printers.

2. Description of the Related Art

Computer printers such as laser printers and inkjet printers often include a plurality of media input sources from which paper or envelopes may be fed to the printer. These various sources may be used to feed different sizes and types of paper to the printer. Typically, however, media of the same size and type is loaded into a plurality of input sources which are logically linked together. This allows a user to configure a printer with one huge input source, many small input sources, or some combination thereof.

While the user is given a great deal of flexibility with regard to input sources, there is normally much less flexibility with regard to the output of the printer. Although it is common for a printer to comprise a plurality of output bins for receiving the output of the printer, the ways in which such output bins can be used are currently very limited. The user is currently given only two options: (1) each physical output bin is uniquely addressed, or (2) all of the physical output bins are all linked.

If each physical output bin is uniquely addressed, the host (application/printer driver) or printer selects a physical output bin to receive the output of the printer. If the output bin is capable of sensing when it is full, the printer stops sending printed output to the full output bin and displays a message (referred to as an "intervention") requesting that the user remove the printed output from the full bin.

If, instead, all of the physical output bins are all linked, they are logically combined and treated as one large output bin. The host does not choose a physical output bin for the printer's output. Instead, the printer's operating system fills the physical output bins in a pre-defined order. When all of the physical output bins are full, the printer stops printing and posts an intervention requesting that the user remove the printed output from the output bins.

Currently, it is not possible for the user to combine fewer than all of the physical output bins into a single logical bin while leaving one or more independent physical output bins. It would be desirable to provide a network printer system having this capability.

BRIEF SUMMARY OF THE INVENTION

The present invention meets this and other needs by providing a computer controlled paper delivery system for a computer printer. The invention achieves improved function when there are more output bins than users (addresses) of such bins. In accordance with this invention, the printer control software, in response to predetermined control inputs from the operator panel or data received, assigns more than one bin to one user. The software then responds to the status of bins as discussed below. Thus, selected users have, functionally, larger bins and the selection is under operator and software control and so may be readily revised.

The printing system of the present invention comprises a printer having a plurality of physical output bins for receiving sheets of media printed by the printer, and a programmable electronic data processor programmed to logically link at least two, but less than all, of the physical output bins of the printer to thereby form a single logical output bin. Preferably, the programmable electronic data processor is further programmed to direct media printed by the printer to a first physical output bin of the logical output bin until said first physical output bin is full, and, after said first physical output bin is full, to direct printed media to a second physical output bin of the logical output bin. The programmable electronic data processor is preferably further programmed to continue to sequentially fill the physical output bins of the logical output bin until all of the physical output bins of the logical bin are full, and,

when all of the physical output bins of the logical output bin are full, to request that the user remove media from the physical output bins of the logical output bin.

Using the printing system of the present invention, an improved method of collecting the output of a printer having a plurality of physical output bins can be achieved. The method comprises the steps of logically linking at least two, but less than all, of the physical output bins of the printer to thereby form a single logical output bin, selecting the logical output bin as the desired output location for media printed by the printer, printing and outputting media to a first physical output bin that is part of the logical output bin until said first physical output bin is full, and, after said first physical output bin is full, printing and outputting media to a second physical output bin that is part of the logical output bin. The step of logically linking said physical output bins may be accomplished by assigning the same designation, such as an alphanumeric name, to each of the physical output bins to be logically linked.

The method may also comprise the steps of logically linking at least two of the physical output bins that are not part of said logical output bin to thereby form a second logical output bin, selecting the second logical output bin as the desired output location for media printed by the printer, printing and outputting media to a third physical output bin that is part of the second logical output bin until said third physical output bin is full, and, after said third physical output bin is full, printing and outputting media to a fourth physical output bin that is part of the second logical output bin.

Instead, the method may comprise the steps of selecting a third physical output bin that is not a part of the logical bin as the desired output location for media printed by the printer, and printing and outputting media to said third physical output bin.

The method may further comprise the steps of continuing to sequentially fill the physical output bins of the logical bin until all of the physical output bins of the logical bin are full, and, when all of the physical output bins of the logical bin are full, requesting the user to remove media from the physical output bins of the logical output bin.

The method may also include a power-on algorithm comprising the steps of determining at the time the printer is powered-on whether any of the physical output

bins of the logical output bin is full or nearly full, and, if any of the physical output bins of the logical output bin is full or nearly full when the printer is powered-on, requesting the user to remove media from the physical output bins of the logical output bin.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood by reference to the following detailed description when considered in conjunction with the following drawings wherein like reference numbers denote the same or similar portions or processes shown throughout the drawings, in which:

Figure 1 is a perspective view of a printer having a plurality of physical output bins capable of being combined into one or more logical output bins according to the invention;

Figure 2 is a flowchart illustrating the power-on initialization algorithm of the system; and

Figure 3 is a flowchart illustrating the steady state bin selection algorithm of the system.

DEFINITIONS

As used herein, the terms listed below shall have meanings as follows:

1. Linked Set of Bins — A "Linked Set of Bins" is a group of two or more physical bins that have been assigned the same alphanumeric name. A Linked Set of Bins may also be referred to as a "Logical Bin".

   Note – A Linked Set of Bins is treated by the printer's page formatting interpreters and printer operating system as a single bin. More than one Linked Set of Bins may exist on a printer system. It is not required that a Linked Set of Bins have consecutive physical names. For example, if a printer offers ten output bins, then bins 2, 3, 6, and 9 may comprise a Linked Set of Bins.

2. Start Bin — The "Start Bin" is the first physical bin chosen by the printer to receive output when all physical bins within the Linked Set of Bins are empty.

3. End Bin	The "End Bin" is the last physical bin chosen by the printer to receive output when all of the other physical bins within the Linked Set of Bins are full.
4. Current Bin	The "Current Bin" is the physical bin within a Linked Set of Bins which is currently selected by the printer to receive printed output when the Linked Set of Bins has been requested as the destination.
5. Next Bin	A printer has a fixed order for placing output in the physical bins of a Linked Set of Bins. The order begins with the Start Bin and terminates with the End Bin. The "Next Bin" is the physical bin that is next in the fixed sequence to receive printed output after the Current Bin becomes full.
6. PCL	"PCL" refers to the well-known printing language of that name.
7. PS	"PS" refers to PostScript, also a well-known printing language.
8. PPDS	"PPDS" refers to a well-known ASCII and escapement-code based printing language sometimes known as Personal Printer Data Stream.
9. PJL	"PJL" refers to control codes in a received data stream known as Printer Job Language.
10. Panel	"Panel" refers to the control panel of a printer by which an operator selects the status of operation of the printer.

DETAILED DESCRIPTION OF THE INVENTION

1. Introduction

As noted above, the present invention is a computer-controlled paper delivery system. The computer is a standard microprocessor which is a programmable electronic data processor.

Figure 1 illustrates a printer 10 having multiple physical output bins 15. Other configurations, such as bins stacked beside the printer, are equally applicable. Selection of the bins 15 from the printer 10 is under control of a computer (not shown). A fully operative printer with selection of the output bins currently is widely sold by Lexmark International, Inc., the assignee of the present invention. The printer

with such bins is disclosed in U.S. Patent Application No. 08/854,318, filed May 12, 1997 entitled "Modular Output Stackers for Printers." Details of programming the computer may take various forms and are well within the skill of the art.

As noted above, the invention allows selected users to have functionally larger bins by logically combining two or more physical output bins 15 into a single logical output bin. As a means of determining which physical bins 15 have been combined, each physical bin 15 is assigned an alphanumeric name by the printer's system administrator. Generally these names are descriptive in nature (e.g., "Ken's Mailbox"). Of course, each physical bin 15 still possesses its physical name (e.g., "Bin #2").

Two or more physical bins 15 that have been assigned the same alphanumeric name form a Linked Set of Bins. The Linked Set of Bins may be referenced using the single alphanumeric name assigned to all of the physical bins that comprise the set. In addition, the Linked Set of Bins may be referenced using the physical name assigned to any of the physical bins 15 within the linked set.

2. Bin Selection

Each of the printer's page formatting interpreters (e.g., PCL, PS, and PPDS) is required to select an output destination for each printed sheet. Some interpreters support datastream commands that allow a user to request a bin destination by calling out a bin's alphanumeric name or by using a command parameter which references the physical name. Other interpreters only allow the user to request a bin by using the command parameter method. Still other interpreters do not support any datastream command to request a bin destination. Interpreters that do not support any bin selection commands simply select the printer's user default output bin. The printer provides the user with a variety of methods to change the user default output bin (e.g., PJL control codes, Panel, etc.).

Interpreters that support bin selection using the alphanumeric name assigned to the Linked Set of Bins utilize the simplest method of bin selection. Generally, when an interpreter receives an output destination request using an alphanumeric name, the Linked Set's Current Bin is selected for the destination.

When an interpreter receives an output destination request using a physical bin name, the printer first determines if the bin associated with the requested physical name is part of a Linked Set of Bins. If so, the Linked Set's Current Bin is normally selected for the destination. If not, the bin associated with the requested physical name is simply selected.

3. Power-On Initialization Algorithm

When the printer is first powered on, it goes through the power-on initialization algorithm illustrated in Figure 2 to request that the user remove media from bins which are full or nearly full. The printer takes the user through this algorithm to help ensure output collation is preserved when a bin that is part of a Linked Set of Bins is selected to receive output.

After power is turned on (step 20), the printer determines whether any of the printer's output bins are linked (step 21). If no output bins are linked, then the printer checks to see if the user default output bin is full or nearly full (step 24). If it is, the printer posts an intervention requesting removal of media from the user default output bin and waits for the user to comply (step 25). Once the media has been removed from the user default output bin, or if the user default output bin was not full or nearly full, the printer is ready to receive a print job (step 26).

If it was instead determined that two or more output bins *are* linked (in step 21), then the printer next determines whether any bin within a Linked Set of Bins is full or nearly full (step 22). If any such bin is full or nearly full, the printer posts an intervention requesting removal of media from the Linked Set of Bins and waits for the user to comply (23). After media has been removed from the Linked Set of Bins, the algorithm returns to step 22 to determine whether any bins within any other Linked Set of Bins is full or nearly full. When no bin within any Linked Set of Bins is full or nearly full, the algorithm then proceeds to step 24 as discussed above.

During the power-on initialization, each Linked Set of Bins is identified by the printer operating system. Furthermore, for each Linked Set of Bins, the Current Bin is initialized to the Start Bin. The printer is now ready to receive a print job.

4. Steady State Bin Selection Algorithm

When the user generates a print job, the printer follows the algorithm illustrated in Figure 3 to route each sheet to the appropriate output bin. The printer first receives the request to print a sheet (step 30). The request will include bin selection information in accordance with Section 2 above.

After the printer receives the request, it first determines whether the selected bin is part of a Linked Set of Bins (step 32). If it is not, the printer determines whether the selected bin is full (step 34). If it is full, the printer posts an intervention requesting removal of media from the selected bin and waits for the user to comply (step 38). Once the media has been removed from the selected bin, or if the selected bin was not full, the selected bin is set as the sheet destination (step 36). The sheet is then printed and the printer waits for the next request (step 54).

If, however, it was determined (in step 32) that the selected bin is part of a Linked Set of Bins, the algorithm next checks to see if the Linked Set's Current Bin is full (step 40). If it is not, the Current Bin is set as the sheet destination (step 42) and the sheet is printed as discussed above (step 54).

If the Current Bin is full, the printer then determines whether the Linked Set's Current Bin is the End Bin (step 44). If it is, the printer posts an intervention requesting removal of media from the Linked Set of Bins and waits for the user to comply (step 50). The Start Bin is then set as the sheet destination and the Current Bin is then set as the Start Bin (step 52). The sheet is then printed as discussed above (step 54).

If, instead, it was determined (in step 44) that the Current Bin is not the End Bin, the algorithm then determines whether the Linked Set's Next Bin is full or nearly full (step 46). If it is, the intervention of step 50 is posted and the algorithm proceeds as discussed above. If the Next Bin is not full or nearly full, the Next Bin is set as the sheet destination and the Current Bin is set to the Next Bin (step 48). The sheet is then printed as discussed above (step 54).

5. Other Benefits

All of the printer subsystems handle the Linked Set of Bins as a single bin and use the assigned alphanumeric name to reference the bin when posting remove media

interventions and status warnings which indicate that a Linked Set of Bins is full or nearly full.

Furthermore, for users using interpreters which do not support bin requests via the datastream, the alphanumeric name of the linked set is displayed in the user default output bin value list instead of listing all of the physical bin names.

6. Summary

The present invention gives the user the capability of reconfiguring output bins (or "mailboxes") to obtain larger capacity where needed, while allowing other mailboxes to be addressed individually. In addition, this invention allows the user to best utilize the printer hardware in a given environment.

For example, assume a printer has ten 200-sheet mailboxes and one 500-sheet mailbox. Bins 1 - 10 might each have a capacity of 200 sheets, while Bin 11 might have a capacity of 500 sheets. The system administrator may only have a need for three mailboxes and one general-purpose bin. Assume that user "Sue" needs a mailbox with a 200-sheet capacity, user "Ben" needs mailbox with a 400-sheet capacity, and user "John" needs a mailbox with a 600-sheet capacity. The general purpose bin would get the remainder of the capacity.

The system administrator can assign the following names to the physical bins to achieve the desired results:

Bin 1 (200 sheets) →	"Sue's Mailbox"	200 sheets
Bin 2 (200 sheets) →	"Ben's Mailbox"	400 sheets
Bin 3 (200 sheets) →	"Ben's Mailbox"	
Bin 4 (200 sheets) →	"John's Mailbox"	600 sheets
Bin 5 (200 sheets) →	"John's Mailbox"	
Bin 6 (200 sheets) →	"John's Mailbox"	
Bin 7 (200 sheets) →	"General Purpose"	1300 sheets
Bin 8 (200 sheets) →	"General Purpose"	
Bin 9 (200 sheets) →	"General Purpose"	
Bin 10 (200 sheets) →	"General Purpose"	
Bin 11 (500 sheets) →	"General Purpose"	

Using the invention, each of the users of the printer gets his or her needed output capacity and the remaining capacity (1300 sheets) is provided for the general-purpose output (i.e., users who use the printer but do not have an assigned bin).

While the system herein described constitutes the preferred embodiment of the present invention, it is to be understood that the invention is not limited to this precise form, and that changes may be made therein without departing from the scope of the invention which is defined in the following claims.

CLAIMS

We claim:

1. A printing system, comprising:
   a. a printer having a plurality of physical output bins for receiving sheets of media printed by the printer; and
   b. a programmable electronic data processor programmed to logically link at least two, but less than all, of the physical output bins of the printer to thereby form a single logical output bin.

2. A printing system as recited in claim 1, wherein said programmable electronic data processor is further programmed to direct media printed by the printer to a first physical output bin of the logical output bin until said first physical output bin is full, and, after said first physical output bin is full, to direct printed media to a second physical output bin of the logical output bin.

3. A printing system as recited in claim 1, wherein said programmable electronic data processor is further programmed to continue to sequentially fill the physical output bins of the logical output bin until all of the physical output bins of the logical bin are full, and, when all of the physical output bins of the logical output bin are full, to request that the user remove media from the physical output bins of the logical output bin.

4. A method of collecting the output of a printer having a plurality of physical output bins, comprising the steps of:
   a. logically linking at least two, but less than all, of the physical output bins of the printer to thereby form a single logical output bin;
   b. selecting the logical output bin as the desired output location for media printed by the printer;
   c. printing and outputting media to a first physical output bin that is part of the logical output bin until said first physical output bin is full; and

d. after said first physical output bin is full, printing and outputting media to a second physical output bin that is part of the logical output bin.

5. A method of collecting the output of a printer as recited in claim 4, further comprising the steps of:
   a. logically linking at least two of the physical output bins that are not part of said logical output bin to thereby form a second logical output bin;
   b. selecting the second logical output bin as the desired output location for media printed by the printer;
   c. printing and outputting media to a third physical output bin that is part of the second logical output bin until said third physical output bin is full; and
   d. after said third physical output bin is full, printing and outputting media to a fourth physical output bin that is part of the second logical output bin.

6. A method of collecting the output of a printer as recited in claim 4, further comprising the steps of:
   a. selecting a third physical output bin that is not a part of the logical output bin as the desired output location for media printed by the printer; and
   b. printing and outputting media to said third physical output bin.

7. A method of collecting the output of a printer as recited in claim 4, further comprising the steps of:
   a. continuing to sequentially fill the physical output bins of the logical output bin until all of the physical output bins of the logical bin are full; and
   b. when all of the physical output bins of the logical output bin are full, requesting the user to remove media from the physical output bins of the logical output bin.

8. A method of collecting the output of a printer as recited in claim 4, wherein said step of logically linking said physical output bins is accomplished by assigning the same designation to each of the physical output bins to be logically linked.

9. A method of collecting the output of a printer as recited in claim 4, further comprising the steps of:
   a. determining at the time the printer is powered-on whether any of the physical output bins of the logical output bin is full or nearly full; and
   b. if any of the physical output bins of the logical output bin is full or nearly full when the printer is powered-on, requesting the user to remove media from the physical output bins of the logical output bin.

10. A printing system, comprising:
   a. a printer having a plurality of physical output bins;
   b. means for logically linking at least two, but less than all, of the physical output bins of the printer to thereby form a single logical output bin.
   c. means for selecting the logical output bin as the desired output location for media printed by the printer;
   d. means for printing and outputting media to a first physical output bin that is part of the logical output bin until said first physical output bin is full; and
   e. means for printing and outputting media after said first physical output bin is full to a second physical output bin that is part of the logical output bin.

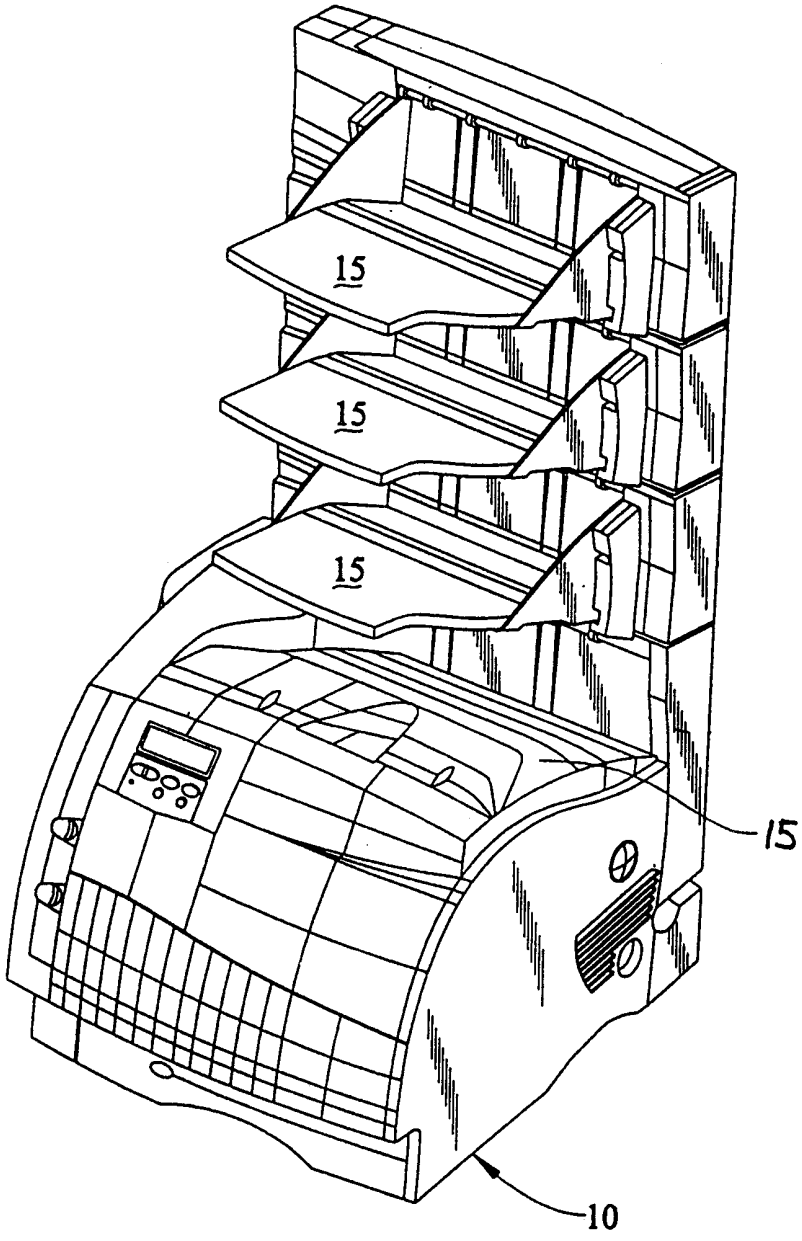
11. A printing system as recited in claim 10, further comprising:
   a. means for selecting a third physical output bin that is not a part of the logical output bin as the desired output location for media printed by the printer; and
   b. means for printing and outputting media to said third physical output bin.

12. A printing system as recited in claim 10, further comprising:
   a. means for logically linking at least two of the physical output bins that are not part of said logical output bin to thereby form a second logical output bin;
   b. means for selecting the second logical output bin as the desired output location for media printed by the printer;

c. means for printing and outputting media to a third physical output bin that is part of the second logical output bin until said third physical output bin is full; and

d. means for printing and outputting media after said third physical output bin is full to a fourth physical output bin that is part of the second logical output bin.

FIG. 1



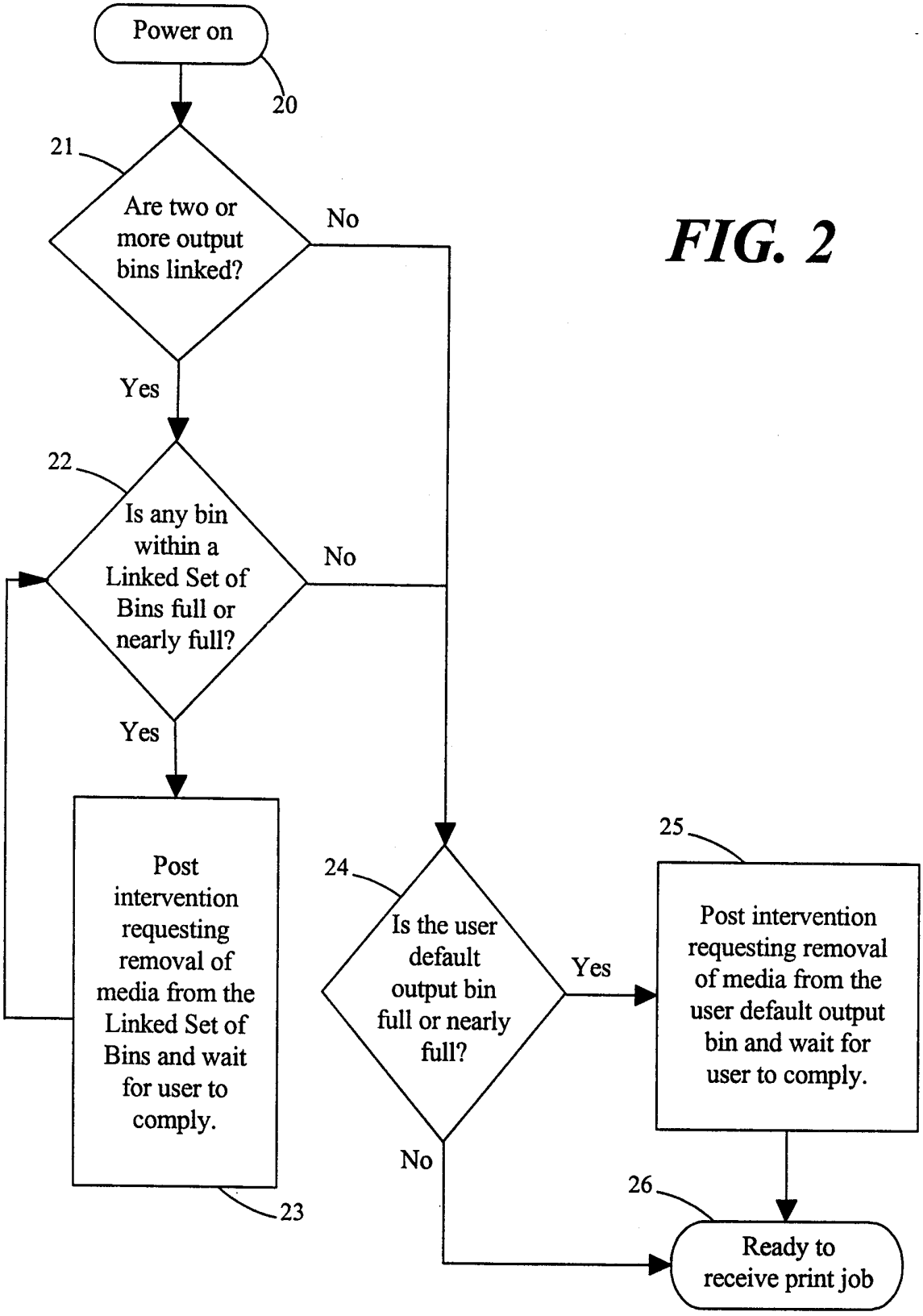

Power on
20
21
Are two or more output bins linked?
No
Yes
22
Is any bin within a Linked Set of Bins full or nearly full?
No
Yes
Post intervention requesting removal of media from the Linked Set of Bins and wait for user to comply.
23
24
Is the user default output bin full or nearly full?
Yes
25
Post intervention requesting removal of media from the user default output bin and wait for user to comply.
No
26
Ready to receive print job

FIG. 2

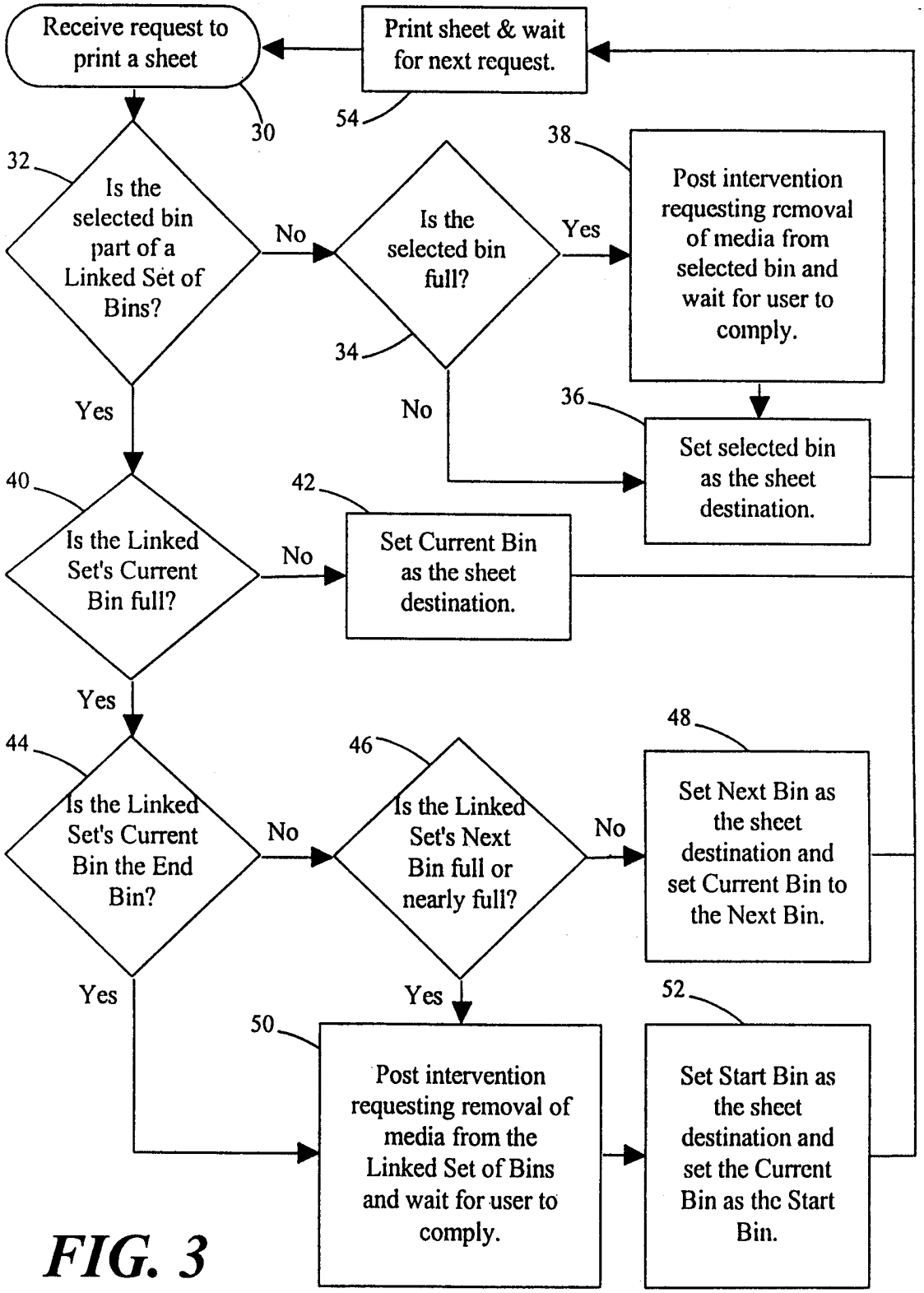

Receive request to print a sheet
30
Print sheet & wait for next request.
54
32
Is the selected bin part of a Linked Set of Bins?
No
Is the selected bin full?
34
Yes
38
Post intervention requesting removal of media from selected bin and wait for user to comply.
No
36
Set selected bin as the sheet destination.
Yes
40
Is the Linked Set's Current Bin full?
No
42
Set Current Bin as the sheet destination.
Yes
44
Is the Linked Set's Current Bin the End Bin?
No
46
Is the Linked Set's Next Bin full or nearly full?
No
48
Set Next Bin as the sheet destination and set Current Bin to the Next Bin.
Yes
Yes
50
Post intervention requesting removal of media from the Linked Set of Bins and wait for user to comply.
52
Set Start Bin as the sheet destination and set the Current Bin as the Start Bin.

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/08537

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65H 39/11
US CL : 271/288

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)

U.S. : 271/288, 287

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)

APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,134,581 A (JOHNSON et al.) 16 January 1979 (16.01.79), the entire document.	1-12
A	US 4,361,320 A (KIKUCHI et al.) 30 November 1982 (30.11.82), the entire document.	1-12
A	US 4,522,486 A (CLARK et al.) 11 June 1985 (11.06.85), the entire document.	1-12

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
30 JUNE 1999	03 AUG 1999
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer MARK A. DEUBLE Diane Smith for Telephone No. (703) 305-9734

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