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(54) NON-VOLATILE MEMORY DATA INTEGRITY VALIDATION

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Description

BACKGROUND

[0001] The present disclosure relates to printing systems that make use of a replaceable printing component. More particularly, the present disclosure relates to replaceable printing components that include an electrical storage device for providing information to a print mechanism in the printing system.

[0002] Printers frequently make use of replaceable components in order to extend the life of the printer. For instance, ink-jet printers frequently make use of an inkjet printhead mounted within a carriage that is moved back and forth across a print media, such as paper. As the printhead is moved across the print media, a control system activates the printhead to deposit or eject ink droplets onto the print media to form images and text. Ink is provided to the printhead by a supply of ink which is either carried by the carriage or mounted elsewhere on the print mechanism. Some printing components, such as ink containers and printheads, require periodic replacement. Ink containers are replaced when exhausted. Printheads are replaced at the end of printhead life.

[0003] As discussed in U.S. Patent No. 5,699,091, entitled "Replaceable Part With Integral Memory For Usage, Calibration And Other Data," assigned to the assignee of the present disclosure, it may be desirable to alter printer parameters concurrently with the replacement of printer components U.S. Patent No. 5,699,091 discloses the use of a memory device, which contains parameters relating to the replaceable part. The installation of the replaceable part allows the printer to access the replaceable part parameters to ensure high print quality. By incorporating the memory device into the replaceable part and storing replaceable part parameters in the memory device within the replaceable component, the printing system can determine these parameters upon installation into the print mechanism. This automatic updating of printer parameters frees the user from having to update printer parameters each time a replaceable component is newly installed. Automatically updating printer parameters with replaceable component parameters ensures high print quality. In addition, this automatic parameter updating tends to ensure the printer is not inadvertently damaged due to improper operation, such as, operating after the supply of ink is exhausted or operation with the wrong or non-compatible printer components.

[0004] U.S. Patent Nos. 6,267,463 and 6,264,301, assigned to the assignee of the present disclosure, disclose a system and method of reliably updating memory on replaceable printing components, and a method and apparatus for identifying parameters in a replaceable printing component. The complete disclosures of the above-identified patents are hereby incorporated by reference for all purposes. The exchange of information between the printer and the replaceable printing component

should be accomplished in a highly reliable manner. This exchange of information should not require the intervention of the user. Furthermore, it is important that the integrity of the information should be preserved. In the event that the information associated with the replaceable component is corrupted in some manner, the printer should be capable of identifying this data as corrupted. Furthermore, in the event of such corruption, the printing system should be configured to reject the component, so that the printer is not damaged. Finally, the printing system should have sufficient flexibility to accommodate improvements, as well as additional printer parameters necessary to support these improvements. EP1316428 discloses a method and system for communication between a device and cartridge of a consumable. EP1767369 discloses an arrangement for determining genuine consumables. EP1389528 discloses a cartridge and recording device. WO2005094455 discloses a method of error detection in an inkjet printing mechanism.

STATEMENT OF INVENTION

[0005] According to an aspect of the present invention, there is provided a replaceable printing component according to claim 1. According to another aspect of the present invention, there is provided a method according to claim 7. According to another aspect of the present invention, there is provided a printing system according to claim 13.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 depicts a perspective view of an example printing system, shown with the cover removed, that incorporates removable printing components in accordance with the present disclosure.

Figs. 2A and 2B together depict a schematic representation of the printing system shown in Fig. 1, illustrating a removable ink container printhead, each containing an electrical storage device in accordance with the present disclosure.

Fig. 3 depicts a schematic block diagram of the printing system of Fig. 1 shown connected to a host.

Fig. 4 depicts a representation of an example electrical storage device having a storage portion and two validation fields.

Fig. 5 depicts an example process used to update the storage portion and validation fields shown in Fig. 4.

Fig. 6 is a timing diagram illustrating an example data transaction between a print mechanism and a replaceable printing component.

Fig. 7 depicts an example process used to check the validity of the storage portion shown in Fig. 4.

DETAILED DESCRIPTION

[0007] Fig. 1 is a perspective view of an illustrative printing system 10, shown with its cover removed. In this example, printing system 10 is an ink-jet printing system. Other types of printing systems, such as laser or thermal, also may include replaceable components and/or utilize disclosed methods.

[0008] In this example, ink-jet printing system 10 includes a print mechanism 12 having a plurality of replaceable printing components 14 installed therein. The printing components include printheads 16 for selectively depositing ink in response to control signals, and ink containers 18 for providing ink to each of the printheads. As indicated, each printhead may be fluidically connected to a corresponding ink containers 18 by a flexible conduit 20.

[0009] Printheads 16 are mounted in a scanning carriage 22, which is scanned past print media as the print media is stepped through a print zone. As the printheads are moved relative to the print media, ink is selectively ejected from orifices in the printheads 16 to form images and text.

[0010] One aspect of the present disclosure relates to a method and device configured for storing information on replaceable printing components 14 for updating operation parameters of print mechanism 12. An electrical storage device 38 (seen in Figs. 2A and 2B) may be associated with each of the replaceable printing components 14. Electrical storage device 38 contains information related to the particular replaceable printer components 14. Installation of a replaceable printing component 14 into print mechanism 12 allows information to be transferred between electrical storage device 38 and print mechanism 12, ensuring high print quality and avoiding the installation of non-compatible replaceable printing components 14. The information provided from replaceable printing components 14 to printing portion 12 also may prevent operation of printing system 10 in a manner which damages any component of the printing system, or which may reduce the print quality.

[0011] Although printing system 10 (shown in Fig. 1) makes use of ink containers 18 which are mounted off of scanning carriage 22, the disclosed component and method are well suited for other types of printing system configurations. In one such configuration, replaceable ink containers 18 are mounted on scanning carriage 22. Printhead 16 and ink container 18 also may be incorporated into an integrated printing cartridge that is mounted to scanning carriage 22. Finally, printing system 10 may be used in a wide variety of applications such as facsimile machines, postal franking machines, copiers and large format type printing systems suitable for use in displays and outdoor signage.

[0012] Figs. 2A and 2B depict a simplified schematic representation of the printing system shown in Fig. 1. Figs. 2A and 2B are simplified to illustrate a single printhead 16 and a single ink container 18 for accomplishing

the printing of a single color. Where more than one color is desired, a plurality of printheads 16 may be used, each having an associated ink container 18 as shown in Fig. 1.

[0013] Print mechanism 12 may include an ink container receiving station 24 and a controller 26. With ink container 18 properly inserted into ink container receiving station 24, an electrical and a fluidic coupling is established between the ink container and the print mechanism. The fluidic coupling allows ink stored within ink container 18 to be provided to printhead 16. The electrical coupling allows information to be passed between ink container 18 and print mechanism 12 to ensure the operation of print mechanism 12 is compatible with the ink contained in ink container 18, thereby achieving high print quality and reliable operation of the printing system.

[0014] Controller 26 may control the transfer of information between print mechanism 12 and replaceable printing components 14. For instance, controller 26 may control the transfer of information between printhead 16, ink container 18, and controller 26. The controller also may control the relative movement of printhead 16 and the print media, as well as selectively activating the printhead to deposit ink on print media.

[0015] Ink container 18 includes a reservoir 28 for storing ink therein. A fluid outlet 30 is provided that it is in fluid communication with fluid reservoir 28. Fluid outlet 30 may be configured for connection to a complimentary fluid inlet 32 associated with ink container receiving station 24.

[0016] Printhead 16 includes a fluid inlet 34 configured for connection to a complimentary fluid outlet 36 associated with print mechanism 12. With the printhead properly inserted into scanning carriage 22 (shown in Fig. 1), fluid communication may be established between the printhead and ink container 18 by way of flexible fluid conduit 20.

[0017] Each replaceable printing component (such as the printhead 16 and the ink container 18) may include an electrical storage device 38. These electrical storage devices 38 may also be referred to as information storage devices or memory, and may be used for storing information related to the respective replaceable printer components. A plurality of electrical contacts 40 may be provided on each replaceable printing component 14, each contact being electrically connected to electrical storage device 38.

[0018] With ink container 18 properly inserted into the ink container receiving station 24, each electrical contact 40 may engage a corresponding electrical contact 42 associated with ink container receiving station 24. Electrical contact 42, in turn, may be electrically connected to controller 26 by one or more electrical conductor 44. With proper insertion of ink container 18 into ink container receiving station 24, electrical storage device 38 (associated with ink container 18) may be electrically connected to the controller 26, allowing information to be transferred between ink container 18 and print mechanism 12.

[0019] Likewise, a plurality of electrical contacts 40 on

printhead 16 may be electrically connected to electrical storage device 38. With printhead 16 properly installed into print mechanism 12, electrical contacts 40 may engage a corresponding electrical contacts 42 (associated with the printer body 12). Once engaged, the electrical storage device 38 may be electrically connected to the controller 26 by way of one or more electrical conductors 46.

[0020] Although electrical storage devices 38 associated with each ink container 18 and printhead 16 are given the same identifier to indicate similar function, the information stored in the electrical storage device (38) associated with the ink container 18 will be different from the information stored in the electrical storage device (38) associated with the printhead 16. Similarly, the information stored in electrical storage device 38 associated with each ink container of the plurality of ink containers 18 will, in general, be unique to that particular ink container. The particular information stored on each electrical storage device 38 will be discussed in more detail below.

[0021] Fig. 3 represents a block diagram of an example printing system 10 shown connected to an information source or host computer 48. Host 48 is shown connected to a display device 50. The host can be any of a variety of information sources (such as a personal computer, work station, or server, to name a few) that provides image information to controller 26 by way of a data link 52. Data link 52 may be any of a variety of conventional data links (such as an electrical link, infrared link, a wide-area or local-area network link, or any other well-known data link) for transferring information between host 48 and printing system 10.

[0022] In addition to being electrically linked to electrical storage devices 38 associated with replaceable printing components 14, controller 26 may be electrically linked to a printer mechanism 54 for controlling media transport and movement of carriage 22. This link may be a variety of different linkages such as electrical or optical linkage that supports information transfer. Controller 26 may make use of parameters and information provided by host 48 and memory 38 to accomplish printing.

[0023] Host 48 may provide image description information or image data to printing system 10 for forming images on print media. In addition, host 48 may provide various parameters for controlling operation of the printing system, typically through printer control software referred to as a "print driver". In order to ensure that the printing system provides the highest quality images, controller 26 may compensate for the particular replaceable printer component 14 installed within the printing system. Electric storage device 38 may provide parameters particular to the associated replaceable printer component 14 to controller 26, allowing the controller to utilize these parameters to ensure the reliable operation of the printing system and ensure high quality print images.

[0024] Parameters that may be associated with a replaceable printing component 14 and stored in electrical storage device 38 may include the following: amount of

ink shipped in an ink container; remaining ink in an ink container; actual count of ink drops emitted from the printhead; a date code associated with the ink container; date code of initial insertion of the ink container; system coefficients; ink type/color: ink container size; age of the ink; printer model number or identification number; cartridge usage information; just to name a few. In printing systems including other types of print mechanisms, such as laser printing systems, these parameters may be associated with other types of replaceable printing components. Accordingly, in such systems, the parameters may include information related to toner cartridges or other appropriate replaceable printing components.

[0025] Fig. 4 is a representation of an electrical storage device 38 that may be used in conjunction with controller 26 of printing system 10 for ensuring data integrity for data transfers to the electrical storage device 38. The electrical storage device 38 may be organized as an M-bit by N memory where M represents the number of bits and N represents the size of the memory device. In some systems, electrical storage device 38 may be an 8-bit (or 1-byte) device.

[0026] Each individually addressable M-bit memory location is represented an address value ranging from 0 to N-1. Although Fig. 4 is used to illustrate some of the information that may be stored in electrical storage device 38, it will be understood that electrical storage device 38 may contain additional information not discussed. In addition, the location of the information in electrical storage device 38 may be different from those locations shown in Fig. 4. Controller 26 in printing system 10 may be required to know where at least some of the information is stored.

[0027] Memory address values 0 through N-3 define storage portion 60. This portion of memory may contain data that includes various parameters relating to the replaceable printing component 14, such as the example parameters described above.

[0028] These parameters may be organized within storage portion 60 as a plurality of parameter fields 64 associated with the corresponding replaceable printing component 14. Each parameter field 64 may contain a plurality of parameter values 66 (e.g., ink color, pages printed, or any of the other example value previously mentioned). The parameter fields 64 may be organized within storage portion 60 in blocks of parameter values 66. The blocks of parameter values 66 forming the parameter fields 64 may be configured to have a preselected size. The preselected size of these blocks may be selected to ensure that a transfer of a parameter field 64 between a print mechanism 12 and an electrical storage device 38 occurs in a single block of parameter values 66. The printing system 10 may be configured to ensure that a transfer of a single block of parameter values 66 from a print mechanism 12 to an electrical storage device 38 occurs atomically, in a single operation requiring only one write. While parameter values 66 only have been shown in the first memory address 0, it should be under-

stood that each parameter field 64 from 0 to N-3 may be similarly organized.

[0029] Data corruption may occur when a transfer of data to storage portion 60 is interrupted. For instance, in cases where the replaceable printing component is ink container 18, it may be possible to remove the ink container while controller 26 is transferring data to electronic storage device 38. Interrupting this data transfer may compromise the integrity of the data. In such cases the replaceable printing component may need to be examined to determine whether storage portion 60 contains valid data.

[0030] To address such issues, memory address values N-2 through N-1 may be validation fields 62. The fields are used to store error detection codes which may be used to detect data corruption. These error detection codes may be any string of computer-readable characters (e.g., digits, letters, symbols) relating to data in storage portion 60. Electrical storage device 38 and/or controller 26 may be configured to store in validation fields 62, error detection codes which are mathematically related to the data in storage portion 60. For example, an error detection code stored in a validation field 62 may be the result of a predetermined hash function performed on the data contained in storage portion 60. Another type of error detection code that may be used is a variation of parity data. Specifically, parity data mathematically related to the data in storage portion 60 may be computed and stored in validation fields 62. Other examples of suitable error detection codes include but are not limited to cyclic redundancy checks, checksums (e.g., MD5), or any other string of computer-readable characters relating to the data in storage portion 60.

[0031] The electrical storage device 38 and/or controller 26 may be configured to store error detection codes in the validation fields 62 in a "ping-pong" (or circular in embodiments having more than two validation fields) fashion. In other words, electrical storage device 38 and/or controller 26 alternates between the validation fields 62 when storing error detection codes.

[0032] Referring now to Fig. 5, when a first block of data is ready to be transferred to electrical storage device 38 at 100, a first error detection code, relating to the data that will be stored in the storage portion 60 after this first data transfer, is computed at 102.

[0033] In some systems, controller 26 or another component of the printing system may maintain a cache of the data stored in storage portion 60. Using this cache, controller 26 (or another component) may update the cached data to reflect the addition of the first block of data, and then compute the error detection code for the updated cached data.

[0034] Once the first error detection code is computed, at 104, it may be written to a validation field 62. A first validation field may contain an error detection code matching the data currently in the storage portion 60; hence, the first error detection code may be stored in a second, unused validation field.

[0035] While the field which is updated at this point is referred to as the second validation field, one skilled in the art will understand that this is an arbitrary classification. Any validation field may be updated with an error detection code at any time, so long as the validation field to be updated does not contain an error detection code relating to the data currently stored in storage portion 60. An exception to this rule occurs in cases where more than one validation field 62 contains an error detection code relating to the data currently in storage portion 60. In such instances, the first error detection code may be written to any validation field 62.

[0036] Once the first error detection code is written at 104, the first block of data may be transferred and stored in the storage portion 60 at 106.

[0037] This process may be repeated for additional transfers of data. Continuing the above example, prior to a second transfer of data to the electrical storage device 38 (returning back to 100 along arrow 108), a second error detection code may be computed at 102 that is relating to the data that will be stored in the storage portion 60 after the second transfer. This second error detection code may be written to the first validation field at 104 (as described above, the second validation field now contains the first error detection code relating to the data currently in the storage portion). Once the second error detection code is written to the first validation field, the second transfer of data may be completed at 106.

[0038] In Fig. 6, which depicts the states of a storage portion 60 and two validation fields 62 during two example updates, time passes towards the right, as indicated by arrow T. The storage portion starts out containing OLD DATA, and validation field 2 contains an error detection code relating to the OLD DATA. The contents of field 1 at this point are not relevant. However, before storage portion 60 is updated so that it contains DATA 1, validation field 1 is updated so that it contains an error detection code relating to DATA 1. Thus, for the time period denoted by X_1 , validation field 1 contains an error detection code relating to data that will be stored in storage portion 60 in the future, and validation field 2 contains an error detection code relating to data currently contained in storage portion 60.

[0039] Once validation field 1 is updated, storage portion 60 may be updated to contain DATA 1. Thus, for the time period marked by Y_1 , validation field 1 contains an error detection code relating to the data currently stored in storage portion 60, and validation field 2 contains an error detection code relating to the data stored in the storage portion 60 immediately prior.

[0040] Continuing with Fig. 6, before storing DATA 2 in storage portion 60, validation field 2 may be updated to contain an error detection code relating to DATA 2. Once validation field 2 is updated, storage portion 60 may be updated to contain DATA 2.

[0041] As seen in Fig. 6 and from the previous discussion, immediately prior to transferring data to the storage portion 60, at points in time marked X_1 and X_2 , one val-

validation field 62 may contain an error detection code relating to the data currently in storage portion 60. Another validation field 62 may contain an error detection code relating to the data that will be stored in storage portion 60 after the transfer.

[0042] At other points in time, marked as Y_1 and Y_2 in Fig. 6 one validation field may contain an error detection code relating to the data currently in storage portion 60, and the other validation field may contain an error detection code relating to the data that was stored in storage portion 60 immediately prior to the current data.

[0043] Another aspect of the present disclosure involves error detection. As seen in Fig. 7, the integrity of the data may be verified by relating the contents of the validation fields 62 one-at-a-time to the data in the storage portion 60. If the error detection code contained in any validation field 62 matches the data in the storage portion 60, the data is valid and the replaceable printing component is not rejected. If no validation field 62 contains an error detection code matching the data, however, the data in the storage portion 60 is corrupt and the replaceable printing component may be rejected.

[0044] Starting at 200 in Fig. 7, the content of a first validation field is compared to the data contained in the storage portion at 202. This comparison corresponds to the type error detection code used. For instance, if the error detection codes are hash sums, the comparison involves computing the hash sum of the data in storage portion 60 using the same hash function that was used earlier to populate validation fields 62.

[0045] If the content of the first validation field 62 is relating to the data in the storage portion, the data in storage portion 60 is not corrupt and the replaceable printing component is accepted by the printing system 10 at 208. If the content of the first validation field 62 is not relating to the data in storage portion 60, the process proceeds to 204, where the content of a second validation field 62 is compared to the data in storage portion 60. If there is a match, the process goes to 208 and the replaceable printing component is accepted. If there is no match, however, the data in the storage portion 60 is corrupt, and printing system 10 may reject the replaceable printing component at 206.

[0046] One skilled in the art will understand that while the process depicted in Fig. 7 compares the contents of two validation fields to the data in the storage portion 60 (in 204 and 206), the content of additional validation fields may be compared to the data in storage portion 60. Such additional comparisons may occur depending on how many validation fields are configured into a particular electrical storage device 38.

[0047] It is believed that the disclosure set forth above encompasses multiple distinct embodiments of the invention.

[0048] The scope of the invention is defined by the claims.

Claims

1. A replaceable printing component (14) for use in a printing system (10) including print mechanism configured to receive the replaceable printing component (14), the replaceable printing component (14) comprising:

an electrical storage device (38) responsive to printing system control signals for selectively storing information received from the print mechanism, the electrical storage device (38) including:

a storage portion containing data associated with the replaceable printing component (14); and

first and second validation fields configured to store error detection codes relating to the data contained in the storage portion to determine whether the data is valid;

wherein the electrical storage device (38) is configured, prior to a first transfer of data from the print mechanism to the storage portion, to receive and store in one of the first and second validation fields an error detection code related to the data currently contained in the storage portion, and the electrical storage device (38) is configured to receive and store in the other of the first and second validation fields an error detection code related to the data that will be contained in the storage portion after the first data transfer; wherein prior to a subsequent transfer of data from the print mechanism to the storage portion, the electrical storage device (38) is configured to receive and store, in the one of the first and second validation fields not containing data related to the data contained in the storage portion immediately prior to the subsequent transfer of data, an error detection code related to the data that will be contained in the storage portion after the subsequent transfer.

2. The replaceable printing component (14) of claim 1, wherein the electrical storage device (38) is configured to receive and store in one of the first and second validation fields parity data computed from the data currently contained in the storage portion, and the electrical storage device (38) is configured to receive and store, in the one of the first and second validation fields not containing the parity data computed from the data currently contained in the storage portion, parity data computed from the data that will be contained in the storage portion after the first transfer.

3. The replaceable printing component (14) of claim 1, wherein the electrical storage device (38) is configured to receive and store in one of the first and second validation fields a cyclic redundancy check computed from the data currently contained in the storage portion, and the electrical storage device (38) is configured to receive and store, in the one of the first and second validation fields not containing the cyclic redundancy check computed from the data currently contained in the storage portion, a cyclic redundancy check computed from the data that will be contained in the storage portion after the first transfer.
4. The replaceable printing component (14) of claim 1, wherein the electrical storage device (38) is configured to receive and store in one of the first and second validation fields a hash sum computed from the data currently contained in the storage portion, and the electrical storage device (38) is configured to receive and store, in the one of the first and second validation fields not containing the hash sum computed from the data currently contained in the storage portion, a hash sum computed from the data that will be contained in the storage portion after the first transfer.
5. The replaceable printing component (14) of claim 1 wherein the storage portion comprises a plurality of parameter fields associated with the replaceable printing component (14), and each parameter field of the plurality of parameter fields comprises a plurality of parameter values, the plurality of parameter fields sized in the storage portion in blocks of the parameter values having a preselected size to ensure that each parameter field of the plurality of parameter fields is transferred between the printing system and the storage portion in a single block of parameter values of the blocks of the parameter values.
6. The replaceable printing component (14) of claim 1 wherein the printing system is an inkjet printing system, the print mechanism is an ink-jet printer, and the replaceable printing component (14) further includes a replaceable ink container containing a quantity of ink, the replaceable ink container providing ink to the print mechanism.
7. A method for transferring data between a printer and a replaceable printing component (14), the method comprising:
- providing a replaceable printing component (14) having an electrical storage device (38) associated therewith, the electrical storage device (38) configured for receiving a first block of data transferred from the printer, the electrical storage device (38) having a storage portion containing data related to the replaceable printing component (14) and two validation fields configured to store error detection codes relating to the data contained in the storage portion, one validation field containing a first error detection code relating to the data contained in the storage portion;
- computing a second error detection code relating to data that will be stored in the storage portion after transfer of the first block of data to the electrical storage device (38);
- storing the second error detection code in the one of the two validation fields not containing the first error detection code;
- transferring the first block of data from the printer to the electrical storage device (38);
- computing a third error detection code relating to data that will be stored in the storage portion after transfer of a second block of data from the printer to the electrical storage device (38);
- storing the third error detection code in the one of the two validation fields not containing the second error detection code; and
- transferring the second block of data from the printer to the electrical storage device (38).
8. The method for transferring data of claim 7 wherein upon failure of the step of transferring the first block of data from the printer to the electrical storage device (38), the method for transferring data includes:
- relating the error detection code stored in each validation field to the data contained in the storage portion;
- rejecting the replaceable printing component (14) when no validation field contains an error detection code relating to the data contained in the storage portion; and
- accepting the replaceable printing component (14) when at least one validation field contains an error detection code relating to the data contained in the storage portion.
9. The method for transferring data of claim 7, wherein the first error detection code is first parity data computed from the data contained in the storage portion, and the step of computing the second error detection code comprises computing second parity data from the data that will be contained in the storage portion after transfer of the first block of data to the electrical storage device (38), and the step of storing the second error detection code comprises storing the second parity data in the one of the two validation fields not containing the first parity data.
10. The method for transferring data of claim 7, wherein the first error detection code is a first cyclic redundancy check computed from the data contained in

the storage portion, and the step of computing the second error detection code comprises computing a second cyclic redundancy check computed from the data that will be contained in the storage portion after transfer of the first block of data to the electrical storage device (38), and the step of storing the second error detection code comprises storing the second cyclic redundancy check in the one of the two validation fields not containing the first cyclic redundancy check.

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11. The method for transferring data of claim 7, wherein the first error detection code is a first hash sum computed from the data contained in the storage portion using a predetermined hash function, and the step of computing the second error detection code comprises using the hash function to compute a second hash sum of the data that will be contained in the storage portion after transfer of the first block of data to the electrical storage device (38), and the step of storing the second error detection code comprises storing the second hash sum in the one of the two validation fields not containing the first hash sum.
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12. The method of claim 7, further comprising verifying integrity of the data in the storage portion including matching the data in the storage portion against the error detection codes in the first and second validation fields and rejecting the replaceable printing component (14) if the data in the storage portion is not matched against one of the error detection codes.
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13. A printing system (10) for selectively depositing visible material on print media, the printing system (10) comprising:
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- a print mechanism configured to receive a replaceable printing component (14), the print mechanism including a control portion for transferring data between the print mechanism and the replaceable printing component (14); and
- 40
- a replaceable printing component (14) as claimed in any of claims 1 to 6.
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14. The printing system (10) of claim 13, wherein the printing system (10) is arranged to verify integrity of the data in the storage portion by matching the data in the storage portion against the error detection codes in the first and second validation fields and rejecting the replaceable printing component (14) if the data in the storage portion is not matched against one of the error detection codes.
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Patentansprüche

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1. Eine austauschbare Druckkomponente (14) zur Verwendung in einem Drucksystem (10), das einen

Druckmechanismus einschließt, der zum Aufnehmen der austauschbaren Druckkomponente (14) konfiguriert ist, wobei die austauschbare Druckkomponente (14) folgendes umfasst:

eine elektrische Speichervorrichtung (38), die auf Drucksystem-Steuersignale reagiert, um Information selektiv zu speichern, die von dem Druckmechanismus empfangen wurde, wobei die elektrische Speichervorrichtung (38) folgendes einschließt:

einen Speicherabschnitt, der Daten enthält, die mit der austauschbaren Druckkomponente (14) assoziiert sind; und

erste und zweite Validierungsfelder, die konfiguriert sind, Fehlererkennungscode zu speichern, die den in dem Speicherabschnitt enthaltenen Daten zuordenbar sind, um zu bestimmen, ob die Daten gültig sind; wobei die elektrische Speichervorrichtung (38) konfiguriert ist, vor einer ersten Datenübertragung von dem Druckmechanismus an den Speicherabschnitt, in einem der ersten und zweiten Validierungsfelder einen Fehlererkennungscode zu empfangen und zu speichern, der den Daten zugeordnet ist, die derzeit in dem Speicherabschnitt enthalten sind, und die elektrische Speichervorrichtung (38) konfiguriert ist, in dem anderen der ersten und zweiten Validierungsfelder einen Fehlererkennungscode zu empfangen und zu speichern, der den Daten zugeordnet ist, die in dem Speicherabschnitt nach der ersten Datenübertragung enthalten sein werden;

wobei vor einer anschließenden Datenübertragung von dem Druckmechanismus an den Speicherabschnitt die elektrische Speichervorrichtung (38) konfiguriert ist, in dem einen der ersten und zweiten Validierungsfelder, das keine Daten enthält, die den in dem Speicherabschnitt enthaltenen Daten zugeordnet sind, unmittelbar vor der anschließenden Datenübertragung, einen Fehlererkennungscode zu empfangen und zu speichern, der den Daten zugeordnet ist, die nach der anschließenden Übertragung in dem Speicherabschnitt enthalten sein werden.

2. Die austauschbare Druckkomponente (14) nach Anspruch 1, wobei die elektrische Speichervorrichtung (38) konfiguriert ist, in einem der ersten und zweiten Validierungsfelder Paritätsdaten zu empfangen und zu speichern, die aus den derzeit in dem Speicherabschnitt enthaltenen Daten errechnet wurden, und die elektrische Speichervorrichtung (38) konfiguriert

- ist, in dem einen der ersten und zweiten Validierungsfelder, das die Paritätsdaten nicht enthält, die aus den derzeit in dem Speicherabschnitt enthaltenen Daten errechnet wurden, Paritätsdaten zu empfangen und zu speichern, die aus den Daten errechnet werden, die nach der ersten Übertragung in dem Speicherabschnitt enthalten sein werden.
3. Die austauschbare Druckkomponente (14) nach Anspruch 1, wobei die elektrische Speichervorrichtung (38) konfiguriert ist, in einem der ersten und zweiten Validierungsfelder eine zyklische Redundanzprüfung zu empfangen und zu speichern, die aus den derzeit in dem Speicherabschnitt enthaltenen Daten errechnet wurde, und die elektrische Speichervorrichtung (38) konfiguriert ist, in dem einen der ersten und zweiten Validierungsfelder, das die zyklische Redundanzprüfung nicht enthält, die aus den derzeit in dem Speicherabschnitt enthaltenen Daten errechnet wurde, eine zyklische Redundanzprüfung zu empfangen und zu speichern, die aus den Daten errechnet wird, die nach der ersten Übertragung in dem Speicherabschnitt enthalten sein wird.
 4. Die austauschbare Druckkomponente (14) nach Anspruch 1, wobei die elektrische Speichervorrichtung (38) konfiguriert ist, in einem der ersten und zweiten Validierungsfelder eine Hash-Summe zu empfangen und zu speichern, die aus den derzeit in dem Speicherabschnitt enthaltenen Daten errechnet wurde, und die elektrische Speichervorrichtung (38) konfiguriert ist, in dem einen der ersten und zweiten Validierungsfelder, das die Hash-Summe nicht enthält, die aus den derzeit in dem Speicherabschnitt enthaltenen Daten errechnet wurde, eine Hash-Summe zu empfangen und zu speichern, die aus den Daten errechnet wird, die nach der ersten Übertragung in dem Speicherabschnitt enthalten sein werden.
 5. Die austauschbare Druckkomponente (14) nach Anspruch 1, wobei der Speicherabschnitt eine Vielzahl von Parameterfeldern umfasst, die mit der austauschbaren Druckkomponente (14) assoziiert sind, und jedes Parameterfeld der Vielzahl von Parameterfeldern eine Vielzahl von Parameterwerten umfasst, wobei die Vielzahl von Parameterfeldern in dem Speicherabschnitt in Blöcken der Parameterwerte bemessen ist, die eine vorgewählte Größe aufweisen, um sicherzustellen, dass jedes Parameterfeld der Vielzahl von Parameterfeldern zwischen dem Drucksystem und dem Speicherabschnitt in einem einzigen Parameterwerteblock der Blöcke der Parameterwerte übertragen wird.
 6. Die austauschbare Druckkomponente (14) nach Anspruch 1, wobei das Drucksystem ein Tintenstrahl-Drucksystem ist, der Druckmechanismus ein Tintenstrahl drucker ist und die austauschbare Druckkomponente (14) ferner einen austauschbaren Tintenbehälter einschließt, der eine Tintenmenge beinhaltet, wobei der austauschbare Tintenbehälter dem Druckmechanismus Tinte zuführt.
 7. Ein Verfahren zur Datenübertragung zwischen einem Drucker und einer austauschbaren Druckkomponente (14), wobei das Verfahren folgendes umfasst:
 - Bereitstellen einer austauschbaren Druckkomponente (14), die eine damit assoziierte elektrische Speichervorrichtung (38) aufweist, wobei die elektrische Speichervorrichtung (38) zum Empfangen eines ersten Datenblocks konfiguriert ist, der von dem Drucker übertragen wurde, die elektrische Speichervorrichtung (38) einen Speicherabschnitt, der der austauschbaren Druckkomponente (14) zugeordnete Daten enthält, und zwei Validierungsfelder aufweist, die zum Speichern von Fehlererkennungs-codes konfiguriert sind, die den in dem Speicherabschnitt enthaltenen Daten zuordenbar sind, wobei ein Validierungsfeld einen ersten Fehlererkennungscode enthält, der den in dem Speicherabschnitt enthaltenen Daten zuordenbar ist; Errechnen eines zweiten Fehlererkennungs-codes, der Daten zuordenbar ist, die nach Übertragung des ersten Datenblocks an die elektrische Speichervorrichtung (38) in dem Speicherabschnitt gespeichert werden; Speichern des zweiten Fehlererkennungs-codes in dem einen der zwei Validierungsfelder, das den ersten Fehlererkennungscode nicht enthält; Übertragen des ersten Datenblocks von dem Drucker an die elektrische Speichervorrichtung (38); Errechnen eines dritten Fehlererkennungs-codes, der Daten zuordenbar ist, die nach Übertragung eines zweiten Datenblocks von dem Drucker an die elektrische Speichervorrichtung (38) in dem Speicherabschnitt gespeichert werden; Speichern des dritten Fehlererkennungs-codes in dem einen der zwei Validierungsfelder, das den zweiten Fehlererkennungscode nicht enthält; und Übertragen des zweiten Datenblocks von dem Drucker an die elektrische Speichervorrichtung (38).
 8. Das Verfahren zur Datenübertragung nach Anspruch 7, wobei bei Ausfall des Schritts des Übertragens des ersten Datenblocks von dem Drucker an die elektrische Speichervorrichtung (38) das Verfahren zur Datenübertragung folgendes einschließt:

- Zuordnen des in jedem Validierungsfeld gespeicherten Fehlererkennungscode den in dem Speicherabschnitt enthaltenen Daten;
Ablehnen der austauschbaren Druckkomponente (14), wenn kein Validierungsfeld einen Fehlererkennungscode enthält, der den in dem Speicherabschnitt enthaltenen Daten zuordenbar ist; und
Annehmen der austauschbaren Druckkomponente (14), wenn mindestens ein Validierungsfeld einen Fehlererkennungscode enthält, der den in dem Speicherabschnitt enthaltenen Daten zuordenbar ist.
9. Das Verfahren zur Datenübertragung nach Anspruch 7, wobei der erste Fehlererkennungscode erste Paritätsdaten darstellt, die aus den in dem Speicherabschnitt enthaltenen Daten errechnet wurden, und der Schritt des Errechnens des zweiten Fehlererkennungscode das Errechnen von zweiten Paritätsdaten aus den Daten umfasst, die nach Übertragung des ersten Datenblocks an die elektrische Speichervorrichtung (38) in dem Speicherabschnitt enthalten sein werden, und der Schritt des Speicherns des zweiten Fehlererkennungscode das Speichern der zweiten Paritätsdaten in dem einen der zwei Validierungsfelder umfasst, das die ersten Paritätsdaten nicht enthält.
10. Das Verfahren zur Datenübertragung nach Anspruch 7, wobei der erste Fehlererkennungscode eine erste zyklische Redundanzprüfung ist, die aus den in dem Speicherabschnitt enthaltenen Daten errechnet wurde, und der Schritt des Errechnens des zweiten Fehlererkennungscode das Errechnen einer zweiten zyklischen Redundanzprüfung umfasst, die aus den Daten errechnet wird, die nach Übertragung des ersten Datenblocks an die elektrische Speichervorrichtung (38) in dem Speicherabschnitt enthalten sein werden, und der Schritt des Speicherns des zweiten Fehlererkennungscode das Speichern der zweiten zyklischen Redundanzprüfung in dem einen der zwei Validierungsfelder umfasst, das die erste zyklische Redundanzprüfung nicht enthält.
11. Das Verfahren zur Datenübertragung nach Anspruch 7, wobei der erste Fehlererkennungscode eine erste Hash-Summe ist, die aus den in dem Speicherabschnitt enthaltenen Daten unter Verwendung einer vorbestimmten Hash-Funktion errechnet wurde, und der Schritt des Errechnens des zweiten Fehlererkennungscode das Verwenden der Hash-Funktion zum Errechnen einer zweiten Hash-Summe der Daten umfasst, die nach Übertragung des ersten Datenblocks an die elektrische Speichervorrichtung (38) in dem Speicherabschnitt enthalten sein werden, und der Schritt des Speicherns des zweiten Fehlererkennungscode das Speichern der zweiten Hash-Summe in dem einen der zwei Validierungsfelder umfasst, das die erste Hash-Summe nicht enthält.
12. Das Verfahren nach Anspruch 7, das ferner das Verifizieren der Integrität der Daten in dem Speicherabschnitt, einschließlich des Abgleichens der Daten in dem Speicherabschnitt gegen die Fehlererkennungscode in den ersten und zweiten Validierungsfeldern, und das Ablehnen der austauschbaren Druckkomponente (14) umfasst, falls die Daten in dem Speicherabschnitt gegen einen der Fehlererkennungscode nicht abgeglichen wurden.
13. Ein Drucksystem (10) zur selektiven Aufbringung von sichtbarem Material auf Druckmedien, wobei das Drucksystem (10) folgendes umfasst:
einen Druckmechanismus, der zum Aufnehmen einer austauschbaren Druckkomponente (14) konfiguriert ist, wobei der Druckmechanismus einen Steuerabschnitt zum Übertragen von Daten zwischen dem Druckmechanismus und der austauschbaren Druckkomponente (14) einschließt; und
eine austauschbare Druckkomponente (14), wie in einem der Ansprüche 1 bis 6 beansprucht.
14. Das Drucksystem (10) nach Anspruch 13, wobei das Drucksystem (10) angeordnet ist, die Integrität der Daten in dem Speicherabschnitt durch Abgleichen der Daten in dem Speicherabschnitt gegen die Fehlererkennungscode in den ersten und zweiten Validierungsfeldern zu verifizieren und die austauschbare Druckkomponente (14) abzulehnen, falls die Daten in dem Speicherabschnitt gegen einen der Fehlererkennungscode nicht abgeglichen wurden.

Revendications

1. Composant d'impression remplaçable (14) destiné à être utilisé dans un système d'impression (10) comprenant un mécanisme d'impression configuré pour recevoir le composant d'impression remplaçable (14), le composant d'impression remplaçable (14) comprenant :

un dispositif de stockage électrique (38) sensible à des signaux de commande de système d'impression pour stocker de manière sélective des informations reçues en provenance du mécanisme d'impression, le dispositif de stockage électrique (38) comprenant :

une partie de stockage contenant des données associées au composant d'impression

- sion remplaçable (14) ; et des premier et second champs de validation configurés pour stocker des codes de détection d'erreur pouvant être en rapport avec les données contenues dans la partie de stockage pour déterminer si les données sont valides ;
- le dispositif de stockage électrique (38) étant configuré, avant un premier transfert de données du mécanisme d'impression à la partie de stockage, pour recevoir et stocker, dans l'un des premier et second champs de validation, un code de détection d'erreur en rapport avec les données actuellement contenues dans la partie de stockage, et le dispositif de stockage électrique (38) étant configuré pour recevoir et stocker, dans l'autre des premier et second champs de validation, un code de détection d'erreur en rapport avec les données qui seront contenues dans la partie de stockage après le premier transfert de données ; dans lequel, avant un transfert ultérieur de données du mécanisme d'impression à la partie de stockage, le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans celui des premier et second champs de validation qui ne contient pas de données en rapport avec les données contenues dans la partie de stockage immédiatement avant le transfert ultérieur de données, un code de détection d'erreur en rapport avec les données qui seront contenues dans la partie de stockage après le transfert ultérieur.
2. Composant d'impression remplaçable (14) selon la revendication 1, dans lequel le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans l'un des premier et second champs de validation, des données de parité calculées à partir des données actuellement contenues dans la partie de stockage, et le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans celui des premier et second champs de validation qui ne contient pas les données de parité calculées à partir des données actuellement contenues dans la partie de stockage, des données de parité calculées à partir des données qui seront contenues dans la partie de stockage après le premier transfert.
 3. Composant d'impression remplaçable (14) selon la revendication 1, dans lequel le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans l'un des premier et second champs de validation, un contrôle de redondance cyclique calculé à partir des données actuellement contenues dans la partie de stockage, et le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans celui des premier et second champs de validation qui ne contient pas le contrôle de redondance cyclique calculé à partir des données actuellement contenues dans la partie de stockage, un contrôle de redondance cyclique calculé à partir des données qui seront contenues dans la partie de stockage après le premier transfert.
 4. Composant d'impression remplaçable (14) selon la revendication 1, dans lequel le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans l'un des premier et second champs de validation, une somme de hachage calculée à partir des données actuellement contenues dans la partie de stockage, et le dispositif de stockage électrique (38) est configuré pour recevoir et stocker, dans celui des premier et second champs de validation qui ne contient pas la somme de hachage calculée à partir des données actuellement contenues dans la partie de stockage, une somme de hachage calculée à partir des données qui seront contenues dans la partie de stockage après le premier transfert.
 5. Composant d'impression remplaçable (14) selon la revendication 1, dans lequel la partie de stockage comprend une pluralité de champs de paramètre associés au composant d'impression remplaçable (14), et chaque champ de paramètre de la pluralité de champs de paramètre comprend une pluralité de valeurs de paramètre, la pluralité de champs de paramètre étant dimensionnés dans la partie de stockage en blocs des valeurs de paramètre ayant une taille présélectionnée pour garantir que chaque champ de paramètre de la pluralité de champs de paramètre est transféré entre le système d'impression et la partie de stockage dans un seul bloc de valeurs de paramètre des blocs des valeurs de paramètre.
 6. Composant d'impression remplaçable (14) selon la revendication 1, dans lequel le système d'impression est un système d'impression par jet d'encre, le mécanisme d'impression est une imprimante à jet d'encre et le composant d'impression remplaçable (14) comprend en outre un contenant d'encre remplaçable contenant une quantité d'encre, le contenant d'encre remplaçable fournissant de l'encre au mécanisme d'impression.
 7. Procédé de transfert de données entre une imprimante et un composant d'impression remplaçable (14), le procédé comprenant :
 - l'utilisation d'un composant d'impression remplaçable (14) ayant un dispositif de stockage électrique (38) associé à celui-ci, le dispositif de stockage électrique (38) étant configuré pour re-

cevoir un premier bloc de données transféré à partir de l'imprimante, le dispositif de stockage électrique (38) ayant une partie de stockage contenant des données en rapport avec le composant d'impression remplaçable (14) et deux champs de validation configurés pour stocker des codes de détection d'erreur pouvant être en rapport avec les données contenues dans la partie de stockage, un champ de validation contenant un premier code de détection d'erreur pouvant être en rapport avec les données contenues dans la partie de stockage ; le calcul d'un deuxième code de détection d'erreur pouvant être en rapport avec des données qui seront stockées dans la partie de stockage après transfert du premier bloc de données au dispositif de stockage électrique (38) ; le stockage du deuxième code de détection d'erreur dans celui des deux champs de validation qui ne contient pas le premier code de détection d'erreur ; le transfert du premier bloc de données de l'imprimante au dispositif de stockage électrique (38) ; le calcul d'un troisième code de détection d'erreur pouvant être en rapport avec les données qui seront stockées dans la partie de stockage après transfert d'un second bloc de données de l'imprimante au dispositif de stockage électrique (38) ; le stockage du troisième code de détection d'erreur dans celui des deux champs de validation qui ne contient pas le deuxième code de détection d'erreur ; et le transfert du second bloc de données de l'imprimante au dispositif de stockage électrique (38).

8. Procédé de transfert de données selon la revendication 7, dans lequel, lors d'un échec de l'étape de transfert du premier bloc de données de l'imprimante au dispositif de stockage électrique (38), le procédé de transfert de données comprend :

la mise en rapport du code de détection d'erreur stocké dans chaque champ de validation avec les données contenues dans la partie de stockage ; le rejet du composant d'impression remplaçable (14) lorsqu'aucun champ de validation ne contient un code de détection d'erreur pouvant être en rapport avec les données contenues dans la partie de stockage ; et l'acceptation du composant d'impression remplaçable (14) lorsqu'au moins un champ de validation contient un code de détection d'erreur pouvant être en rapport avec les données contenues dans la partie de stockage.

9. Procédé de transfert de données selon la revendication 7, dans lequel le premier code de détection d'erreur est des premières données de parité calculées à partir des données contenues dans la partie de stockage, et l'étape de calcul du deuxième code de détection d'erreur comprend le calcul de secondes données de parité à partir des données qui seront contenues dans la partie de stockage après transfert du premier bloc de données au dispositif de stockage électrique (38), et l'étape de stockage du deuxième code de détection d'erreur comprend le stockage des secondes données de parité dans celui des deux champs de validation qui ne contient pas les premières données de parité.

10. Procédé de transfert de données selon la revendication 7, dans lequel le premier code de détection d'erreur est un premier contrôle de redondance cyclique calculé à partir des données contenues dans la partie de stockage, et l'étape de calcul du deuxième code de détection d'erreur comprend le calcul d'un second contrôle de redondance cyclique calculé à partir des données qui seront contenues dans la partie de stockage après transfert du premier bloc de données au dispositif de stockage électrique (38), et l'étape de stockage du deuxième code de détection d'erreur comprend le stockage du second contrôle de redondance cyclique dans celui des deux champs de validation qui ne contient pas le premier contrôle de redondance cyclique.

11. Procédé de transfert de données selon la revendication 7, dans lequel le premier code de détection d'erreur est une première somme de hachage calculée à partir des données contenues dans la partie de stockage à l'aide d'une fonction de hachage prédéterminée, et l'étape de calcul du deuxième code de détection d'erreur comprend l'utilisation de la fonction de hachage pour calculer une seconde somme de hachage des données qui seront contenues dans la partie de stockage après transfert du premier bloc de données au dispositif de stockage électrique (38), et l'étape de stockage du deuxième code de détection d'erreur comprend le stockage de la seconde somme de hachage dans celui des deux champs de validation qui ne contient pas la première somme de hachage.

12. Procédé selon la revendication 7, comprenant en outre la vérification de l'intégrité des données dans la partie de stockage, comprenant la mise en correspondance des données dans la partie de stockage avec les codes de détection d'erreur dans les premier et second champs de validation et le rejet du composant d'impression remplaçable (14) si les données dans la partie de stockage ne sont pas mises en correspondance avec l'un des codes de détection d'erreur.

13. Système d'impression (10) pour déposer de manière sélective un matériau visible sur des supports d'impression, le système d'impression (10) comprenant :

un mécanisme d'impression configuré pour recevoir un composant d'impression remplaçable (14), le mécanisme d'impression comprenant une partie de commande pour transférer des données entre le mécanisme d'impression et le composant d'impression remplaçable (14) ; et un composant d'impression remplaçable (14) tel que défini à l'une quelconque des revendications 1 à 6.

14. Système d'impression (10) selon la revendication 13, dans lequel le système d'impression (10) est agencé pour vérifier l'intégrité des données dans la partie de stockage par mise en correspondance des données dans la partie de stockage avec les codes de détection d'erreur dans les premier et second champs de validation et par rejet du composant d'impression remplaçable (14) si les données dans la partie de stockage ne sont pas mise en correspondance avec l'un des codes de détection d'erreur.

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Fig. 1

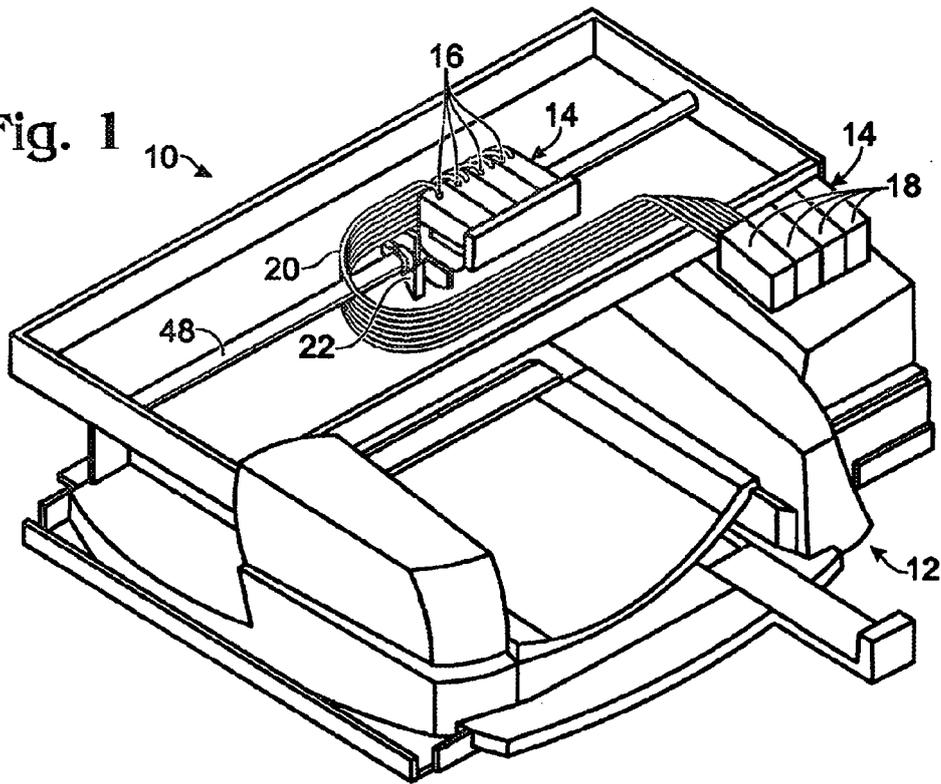


Fig. 2B

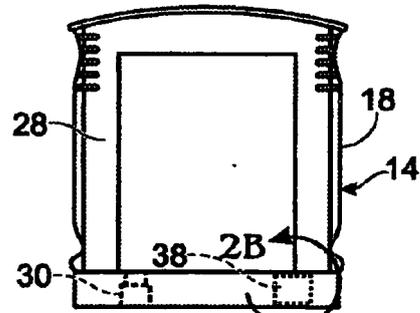
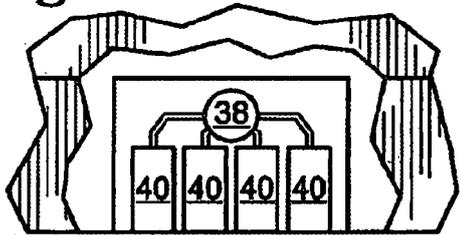


Fig. 2A

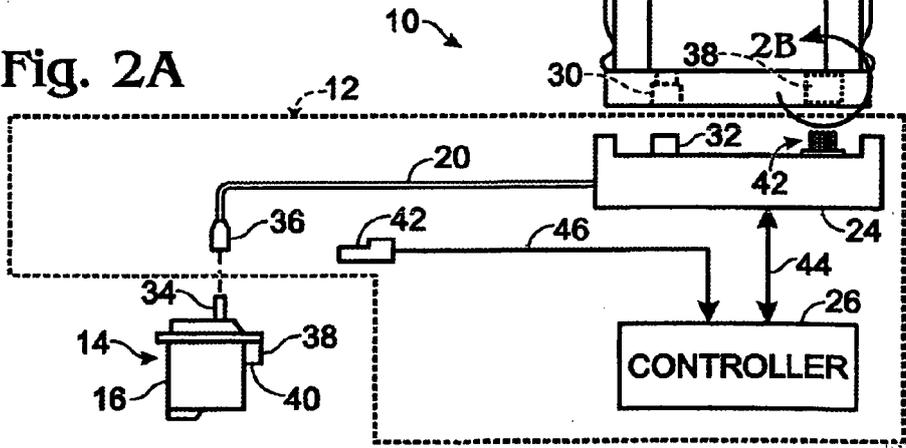


Fig. 3

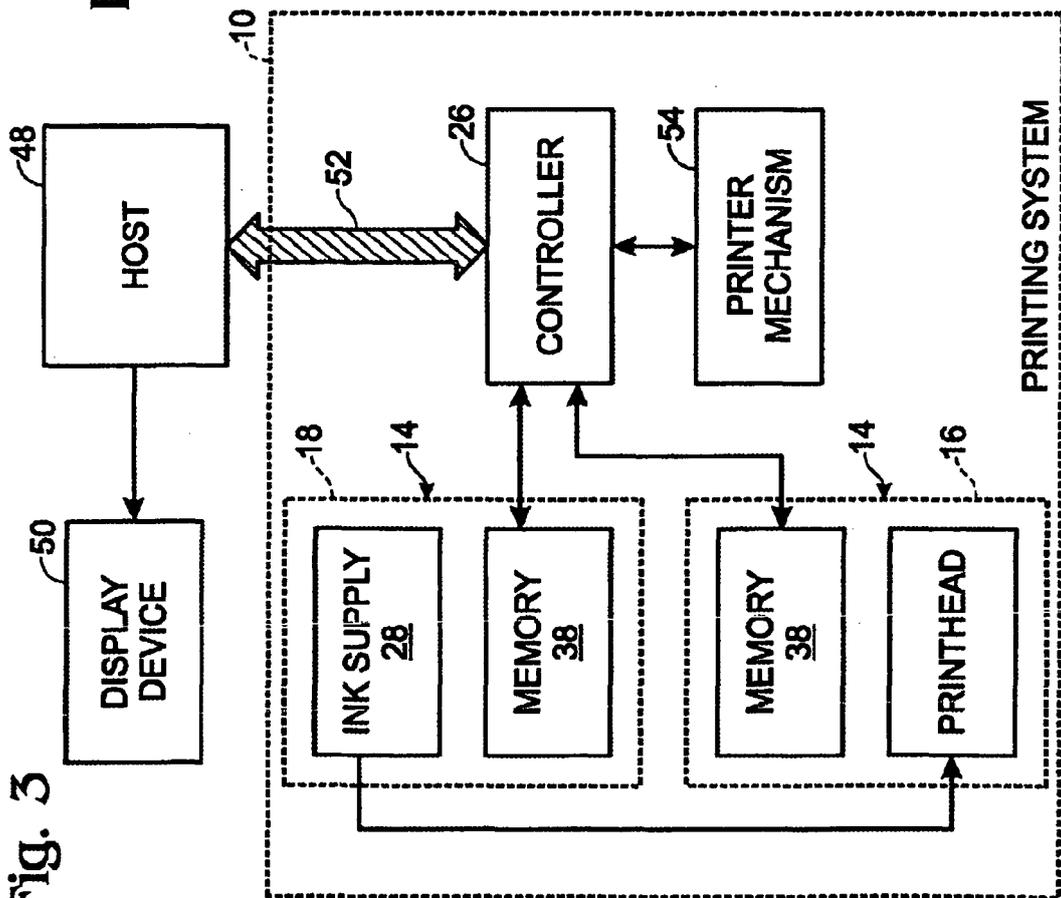
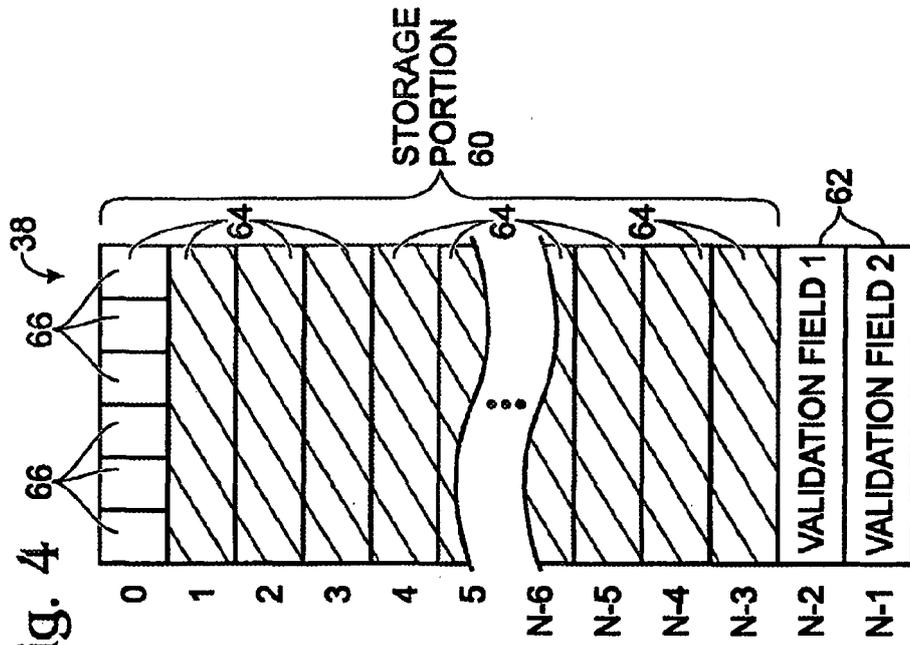


Fig. 4



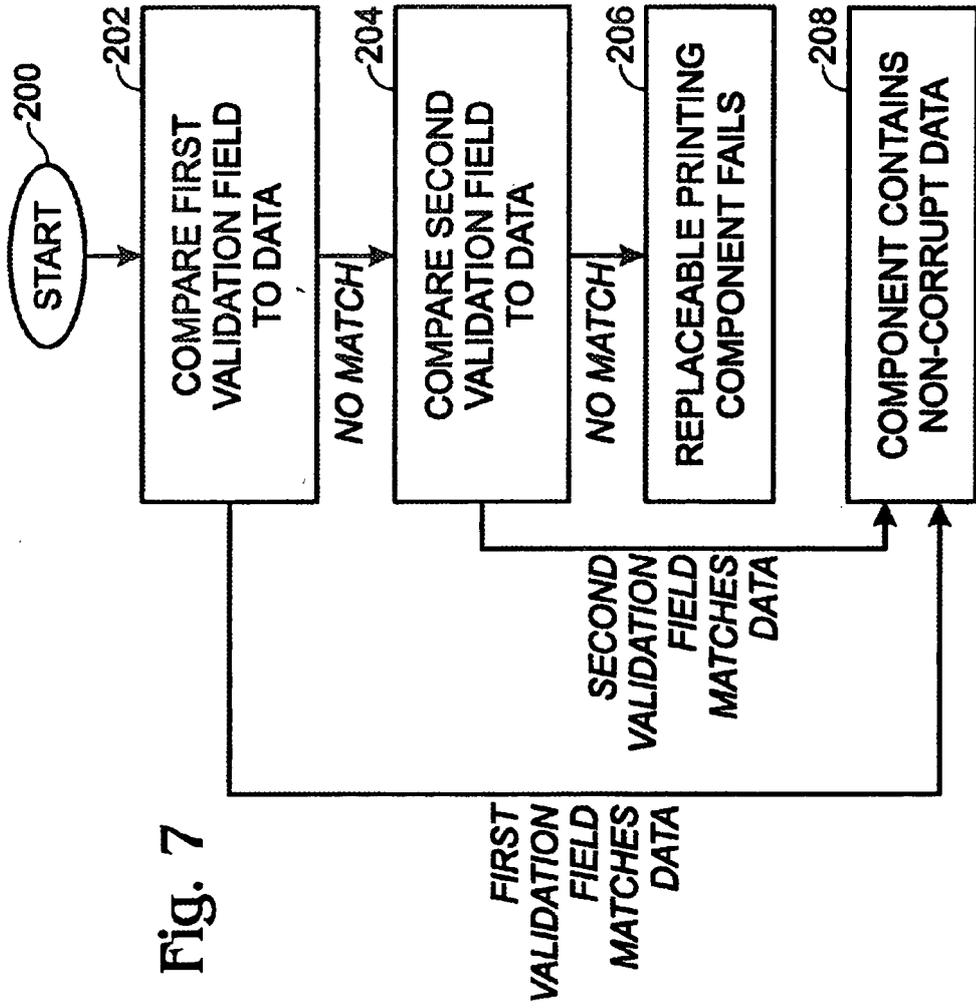


Fig. 7

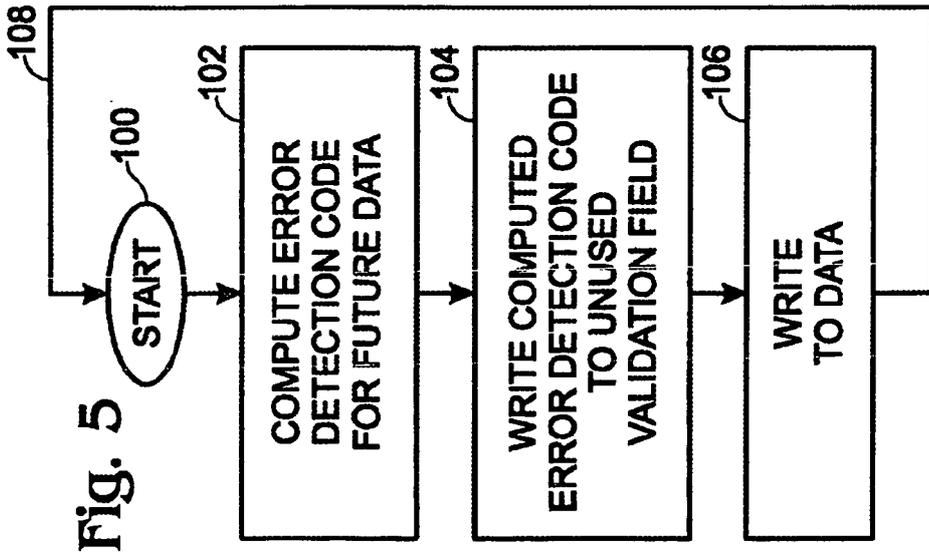


Fig. 5

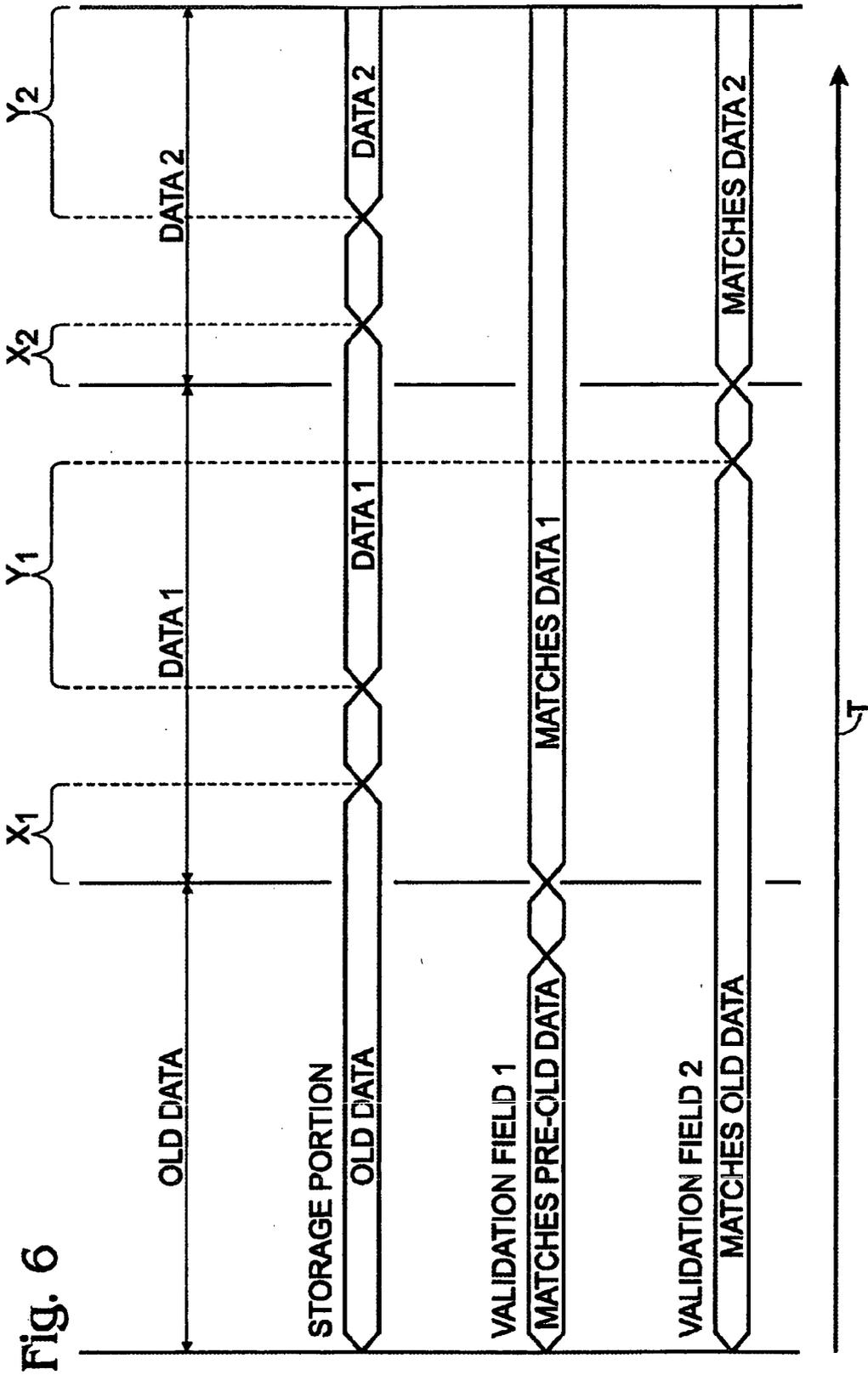


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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