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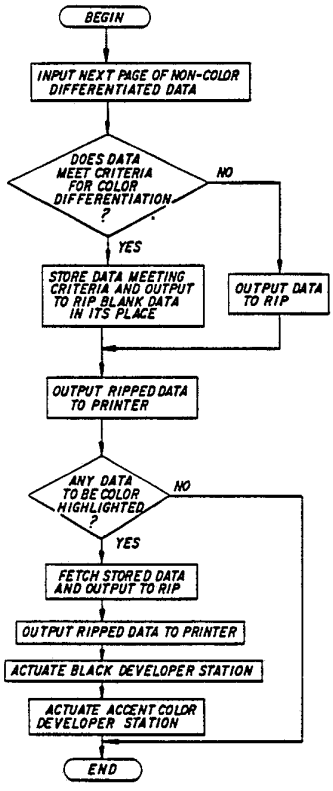
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(57) Abstract

An electronic reproduction apparatus (10, 10') is coupled to a data source (19) that generates electronic data signals that have no information associated with it as to the colors the respective data are to be printed in. The apparatus includes a computer (31) that is programmed to allow the operator via means (13) to input character criteria for color highlighting. The computer compares incoming data signals with the character criteria and identifies those characters that are to be printed in a color other than that which it prints the remaining portion of the information to provide hard copy reproductions with color accenting of selected data. In another embodiment all the data is printed in one color but the selected data is highlighted by color around the data. In still another embodiment, data signals for printing a multiple page document are compared. The fixed data on each page is printed in one color and the variable data on each page is color accented.



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ELECTRONIC REPRODUCTION APPARATUS WITH HIGHLIGHTING COLOR

Background of the Invention

This invention relates to reproduction apparatus that produces hard copy prints of more than one color so that a portion thereof is color highlighted.

Computers, word processors, image scanners, facsimile machines are well known as providing electronic data signals from which hard copy prints are generated by suitable printers. Where the printers are multicolored, prints of the data may be provided in multiple colors. However, to do so the incoming data signals to the printer need to have associated with them additional data indicating the color that the data are to be printed in. An example of such a prior art printer is disclosed in U.S. patent 4,416,533. This patent discloses a printer for printing with either of two colors so that certain information on a hard copy will be printed in a color different from that of the other information. This is particularly desirable in printing accounting information where losses are desirably highlighted in red while other data are printed in black. Color highlighting of data is particularly desirable in other fields as well to bring the reader's attention to certain data of interest. Heretofore, it has been required that data signals contain the instructions to the printer to instruct the printer that the data are to be printed in a highlighted color. This presents an inconvenience to reproducing electronic data that is already stored on for example magnetic media and for which hard copies are desired.

It is at times also desirable to be able to readily identify variable data appearing in a

multiple page document which also contains information that is the same from page to page. Such may be present in computer printouts of reports or experimental data. While one can read the document to attempt to ascertain the variable data, the apparatus of the invention is highly suited to making this task simpler.

SUMMARY OF THE INVENTION

The objects of the invention are to overcome the above deficiencies of the prior art. These and other objects are achieved by a reproduction apparatus comprising:

means for providing data signals representing non-color differentiated character data information to be reproduced;

first means for establishing a character accent color criteria;

second means for comparing the said data signals with the said criteria; and

third means responsive to data signals meeting the criteria for reproducing the said character data information so that data signals meeting the criteria have their corresponding character data information color highlighted on a record member.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings in which:

FIG. 1 is a schematic perspective view of a two-color printer apparatus for producing accent colored hard copy prints from electronic data signals in accordance with the invention;

FIG. 2 is a block diagram of portions of the printer apparatus of FIG. 1;

FIG. 3 is a side view of the subsystem stations in the printer apparatus of FIG. 1;

FIG. 4 is a flowchart for a program for operating the computer controlled printer of FIG. 1 in accordance with one mode of operation;

FIG. 5 is a flowchart for a program for operating the computer controlled printer of FIG. 1 in accordance with a second mode of operation;

FIG. 6 is a flowchart for a program for operating the computer controlled printer of FIG. 1 in accordance with a third mode of operation;

FIG. 7 is a flowchart for a program for operating the computer controlled printer of FIG. 1 in accordance with a fourth mode of operation;

FIG. 8 is a side view of subsystem stations on a reproduction apparatus forming a second embodiment of the invention; and

FIG. 9 is a side view of one subsystem station of the second embodiment but shown in more detail.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Because apparatus of the type described herein are well known, the present description will be directed in particular to elements forming part of or cooperating more directly with the present invention.

With reference to Figures 1-3, a schematic of an electrophotographic reproduction apparatus is shown which comprises one form of printer suitable for use with my invention.

The apparatus 10 includes a closed loop, flexible image transfer member, or photoconductive web 12. The web 12, is supported on rollers 14, 16, 18 and 20. The rollers are mounted on the apparatus' frame (not shown) with one of the rollers, for example, roller 20, rotatively driven by a motor 22 to effect continuous movement of the web 12 in a clockwise direction about its closed loop path. The

web has a plurality of sequentially spaced, non-overlapping image areas which pass successively through electrophotographic processing stations (charge, expose, develop, transfer, clean) located about the path of the web. The web also includes timing marks (or regularly spaced perforations) which are sensed by appropriate means, such as timing signal generator 24 to produce timing signals. Such signals are sent to a computer controlled logic and control unit (LCU) 31. The LCU or computer 31 controls the entire electrophotographic process based on the instantaneous location of the web in the travel path. An encoder 28 associated with the roller drive motor 22 also produces timing signals for the LCU. The signals from the encoder cause the LCU to fine tune the process timing. The LCU 31 has one or more digital computers, preferably a microprocessor(s). The microprocessor has a stored program responsive to the input signals for sequentially actuating, then de-actuating the work stations as well as for controlling the operation of many other machine functions.

Programming of a number of commercially available microprocessors such as one or more INTEL model 8086 microprocessors (which along with others can be used in accordance with the invention), is a conventional skill well understood in the art. This disclosure is written to enable a programmer having ordinary skill in the art to produce an appropriate control program for the microprocessor(s). The particular details of any such program would, of course, depend on the architecture of the designated microprocessor.

The LCU 31 typically comprises a temporary data storage memory, a central processing unit, a timing and cycle control unit, and a stored program

control. Data input and output is performed sequentially under program control. Input data are applied either through input signal buffers to an input data processor or to an interrupt signal processor as is well known. The input signals are derived from various switches, sensors, and analog-to-digital converters. The output data and control signals are applied to storage latches which provide inputs to suitable output drivers, directly coupled to leads. These leads are connected to the various work stations, mechanisms and controlled components associated with the apparatus.

One or more corona charging units, exemplified by corona charger 30, is located upstream of the exposure area 35, and applies a uniform primary electrostatic charge, of say negative polarity, to the web 12 as it passes the charger and before it enters the exposure area. The photoconductive properties of the web cause the primary charge in the exposed areas of the web to be discharged in that portion struck by exposure light. This forms latent imagewise charge patterns on the web in the exposed areas corresponding to the image to be printed. Thereafter, travel of the web then brings the image frames into a development area 38. The development area has two magnetic brush development stations 41, 43, both containing toners having visible pigmentation. In the preferred embodiment, one will have toner of black pigmentation, the other contains toner of another color pigmentation, for example red. The toner particles are agitated in the respective developer stations to exhibit a triboelectric charge of the same polarity to the latent imagewise charge pattern. Backup rollers 85, 86, located on the opposite side of web 12 from the development area,

are associated with respective developer stations 41, 43. Actuators 51, 52 selectively move respective backup rollers into contact with the web 12 to deflect the web from its travel path into operative engagement with respective magnetic brushes. The charged toner particles of the engaged magnetic brush are attracted to the discharged latent imagewise pattern areas to develop the pattern.

The logic and control unit 31 selectively activates an actuator in relation to the passage of an image frame that is to be processed with the respective color toner. Where the first image frame is to be developed with black toner and the second image frame is to be developed with the red toner and as the image frame containing the image to be developed in black reaches the development station 41, actuator 51 moves the backup roller 85 to deflect the web so that the latent charge image is developed by attracting black toner particles from the station 41. As soon as the image area leaves the effective development area of the station 41, the actuator 51 returns the backup roller 85 to its nondeflecting position. A similar cycle is accomplished by the logic and control unit 31 for the development of the second image frame or sector containing only the red toner from station 43. In this regard, actuator 52 and backup roller 86 are employed.

Developed black and red toned image frames must be transferred to a receiver sheet in accurately registered superimposed relation to form a hard copy having both the red and black toned images. Apparatus for providing such registered transfer are fully described in U.S. Patents Nos. 4,477,176, issued October 16, 1984 and 4,251,154,

issued February 17, 1981 in the name of Matthew J. Russel. Briefly, this is accomplished by feeding a receiver sheet or support S of say plain paper, from a supply stack 74 stored in hopper 76, in synchronism with movement of the first image frame so that the receiver sheet engages the web and is registered by mechanism 80 with the first image frame. A transfer roller 68 includes a compliant insulating surface thereon and is biased to a potential suitable for transfer of the developed image on the first image sector to the receiver sheet S and to tack receiver sheet S to roller 68. Roller 68 is driven by a stepper motor 99 which receives actuating signals from the LCU 31.

Roller 68 may also be a biased vacuum roller or a roller with sheet clamping mechanisms to clamp the sheet to it.

Continued movement of web 12 and synchronized rotation of roller 68 brings the lead edge of the copy sheet back into transferable relationship with the web as the lead edge of the next toner image arrives at roller 68. At this point, the bias on roller 68 is reversed to repel sheet S away from roller 68 back into contact with web 12. Receiver sheet S will be carried by web 12 so that the receiver sheet is in registration with the image on the second image frame. This image is transferred to the receiver sheet by charger 61 including transfer charger 62 and detack 64. The copy sheet is separated from the web and conveyed by either vacuum transport or as shown air transport 66 to roller fuser 67 and then to exit hopper 71 or an accessory finishing unit 72. While the developed image is being fixed in fuser 67, the web 12 continues to travel about its path and proceeds through a cleaning area.

To facilitate toner removal from the web, a corona charging station 100 and a rear erase lamp 101 may be located upstream of a cleaning unit 102 to neutralize any charge remaining on the web and thus reduce the adherence forces of the toner to the web.

In order to form the imaging exposure the LCU in response to timing signals from the timing signal generator 24 and/or encoder 28 selectively illuminates through its output drivers light emitting diodes (LED's). The LED's may comprise a linear bank 125 of LED arrays situated transverse to and proximate the web surface. The arrays of LED's illuminate the web via a gradient index lens array (not shown), such as a SELFOC (trademark of Nippon Sheet Glass Co., Ltd.) array which focuses light from the linear array of fibers onto the photoconductive web 12.

Electronic data signals are used to modulate the LED imaging source which is then imaged upon the photoconductive web. The photoconductive web may be in the form of a web, as shown, or drum and, as is known, different image frames may actually comprise the same areas of the photoconductor but the frames exist at different times. Other imaging sources such as laser or other light emitting devices, electrographic devices, ink-jet, thermal printers are also contemplated in implementing my invention. In the electrophotographic printer apparatus described, it is preferred to use a photoconductor and toning system that will attract toner particles to areas of the photoconductor that have been exposed. This is done since in most documents the background constitutes the major area of the document. For reproduction of the first image frame the LCU, via a

printer interface controller 48, activates the LED printer array 125 to output a beam of light to expose each pixel size area for information to be reproduced in black. Similarly, for exposure of the information to be reproduced with the red pigmented toner on the second frame the signals from the LCU illuminate the LED printer array to "print out" only that information which is to be developed with this toner.

A data source such as a computer, word processor, image scanner or facsimile or the like provides a stream of digitally coded data signals to the LCU's input signal buffers. As shown in FIG. 1, the data source may comprise a disk drive 19a and magnetic data storage disk 19b that form a part of the printer apparatus 10. The coded data signals may be ASCII or other types of coded signals with no information distinguishing which of the data is to be color highlighted. This type of data may be referred to as non-color differentiated data or black bit type data, since it would normally all be printed in hard copy printers in one color, usually black, and transferred to, for example, white copy sheets. An alpha-numeric keyboard 13 is also coupled to the printer to allow an operator to select which data is to be printed in the accent color which will be red in this example.

With reference now to the flowchart of FIG. 4, a program is provided allowing the operator to identify via inputs to the keyboard the selected data to be accent colored. For example, where a document is digitally stored on magnetic media and represents an accounting document, the operator may wish to have all data in the document indicating losses be in red with the rest of the document printed in black. Losses are generally indicated by

placing a number within parentheses and also include a monetary designator symbol, e.g, a dollar sign. When the operator desires to enter the intelligent accent color mode, he presses an appropriate predetermined button on the keyboard for calling up this special accent color program. A prompt message provided in the program and communicated to the operator on monitor 17 requests identification of the data that is to be color accented. Assume he chooses all data having the following character accent color criteria set: ($...).

The computer is programmed to recognize that a parenthesis begin character followed by a dollar sign and then by any numerical characters (including a decimal point) and then by a closed parenthesis character represents the character criteria set. All digitally coded data from the data source is examined by the microcomputer to see if it meets the programmed character criteria. Data not meeting the criteria are output to a raster image processor (RIP) 21 for bitmapping into a page memory 23a that will be used to image the page of data on an image frame to be developed with black toner. For any data meeting the character criteria, the computer sends out a signal identical to a command for a space corresponding to the space each character would take up. In the simple case where no proportional spacing of character printing is provided, the computer stores the data meeting the character accent color criteria and merely transmits to the raster image processor a space signal for each character in the data set meeting the character criteria. Along with storage of the data meeting the character criteria, the computer stores the location of the data on the page; i.e., the line it is on as well as the location of the data on that

line. For example, assume that the microcomputer in the course of comparing incoming data with the character criteria set has found a match that consists of the following data set: ($7000.59). The microcomputer stores this information and for each character member of the set sends a signal to the RIP of ten space signals. As the RIP is rasterizing the data incoming to it and bitmapping same into page memory the space signals are bitmapped as say all logic "0" so that when this data is imaged and toned, no toned image is placed in the area on the black developed image frame for the deleted set of information meeting the character criteria. After a full page of data has been sent to the RIP, the microcomputer sends to the RIP the data set meeting the character accent color criteria. The microcomputer will also send a series of space commands so that the RIP can format a page that consists of all logic "0", but for the data meeting the character criteria which is bitmapped in its proper location in page memory 23b. This page memory will then be printed by the imaging source 125 on the next image frame and will be developed with red toner in accordance with the techniques described above. The developed black and red toner image frames are then transferred in register onto the copy sheet or record member S and the respective images fixed by fuser rollers. The resulting document represents a reproduction in the respective desired colors of the data even though the original data source provided no distinction in information as to what colors the information is to be reproduced in.

Reference will now be made to the flowchart of FIG. 5 which represents a flowchart for an alternative program that may be requested. In lieu

of printing of data in different colors, it may be desired to merely highlight in yellow the area meeting the character set criteria. In this embodiment, assumption will be made that the red developer unit has been replaced by a yellow developer unit. Thus, all data is printed in say black but the area immediately around the set of data meeting the character criteria is yellow. The appearance of such a document would be similar to documents where portions are highlighted by overwriting with a highlighter marker pen. In this program the microcomputer, as before, compares the operator inputted character accent color criteria set with incoming non-color differentiated data signals from the data source. When a set of data meets the criteria, the number of characters in this set is counted and stored along with the location of the set on the page; i.e., line and location on line. All the data for the page is sent to the RIP and bitmapped in page memory 23a. The bitmapped page memory is then imaged by LED printer array 125 on an image frame that is developed with black toner. After the RIP 21 has bitmapped the page to be printed in black, the microcomputer sends to the RIP a string of space signals as well as an inverse space signal. The space signals are used to place digital logic "0" level signals in page memory 23b in all locations but for the area that would be assigned to the set of data meeting the character criteria. An inverse space signal is defined as a signal that will place digital logic "1" signals in an area which would otherwise be assigned as a character space. Thus for each character in the set meeting the criteria, a block of area in page memory is filled with digital logic signals "1" at the

position in page memory where the character would have resided for the embodiment described in the flowchart of FIG. 4. The signals of page memory 23b are sent to be printed on the next image frame and developed with yellow toner and then transferred to the same copy sheet in register with the first image. There is thus provided a two-color printed document where all the letters are printed in one color with highlighting of the character set of interest. To improve on image quality, particularly where the yellow toner is not very transparent, it may be desired to transfer the yellow toner image first to the copy sheet and have the black toner image superimposed upon the yellow toner.

The next embodiment will be described with regard to the flowchart of FIG. 6. In this embodiment, the printer is placed in a mode wherein a multisheet document is printed out and color highlighted in areas where the data differs. This is particularly desirable wherein experiments are conducted and repeating data obtained that consists of fixed information and variable information. It would be desirable to have the variable information highlighted to facilitate reading of the reports. The first page of data is read and stored by the microcomputer. The next page of data is also read and compared with the first page of data. From the comparison of the two pages a determination is made as to what is fixed data (F); i.e., information common to both pages and what is variable data for each (VD_0 and VD_1); i.e., information not common to both pages. The fixed data is sent to the RIP 21 for bitmapping into page memory 23a and then to the print array 125 which images the fixed information onto the first image frame that is to be developed with black toner. As before the locations of the

variable data for the first page (VD_0) are replaced by signals denoting a space for each character forming a part of VD_0. The variable data for the first page (VD_0) is then sent to the RIP for bitmapping in page memory 23b and as in the other embodiments, signals denoting a space are substituted for the fixed information. The variable data (VD_0), after being bitmapped, is sent to the print array 125 for printing on the next image frame. The two image frames are transferred in register to the same copy sheet and a two-color reproduction of fixed and variable information is provided wherein the variable information is color highlighted in say red. The data for the next page is printed in similar manner. The subsequent pages of data are compared with the initial determination of what constitutes the fixed information (F) and the variable data (VD_n) found in the data of subsequent pages will be printed in the accented or highlighted colors. Other algorithms also may be used for determining what is the variable data. Thus, the variable data may be that which differs from the page immediately preceding, rather than the first page. Also, the first page may be identified as a form and have only fixed data. All subsequent pages are then compared with this fixed data and have the variable information color highlighted. In lieu of printing the data in a different color, the data may be printed in all the same color but color highlighted as described for the embodiment illustrated by the flowchart of FIG. 5, where the second color toner is employed to highlight the variable data. In this regard, reference will now be made to the flowchart of FIG. 7. In this mode, the first and second pages of incoming non-color differentiated data signals are read, stored and

compared by the computer. A determination is made as to what is the fixed data (F), i.e., data common to both pages and what is the respective variable data (VD_o) and (VD_1). All the data ($F+VD_o$) for page 1 is then sent to the RIP 21 to be rasterized and bitmapped in page memory 23a. The signals in page memory 23a are then sent to be imaged by LED print array 125 on a first image frame on web 12 via printer controller 48. The black developer unit is actuated and the image of page 1 on this image frame is developed and tranferred to copy sheet S. The computer 31 also sends to the RIP 21 the data signals representing the location and dimensions of highlight data for page one (HD_o). The highlight data represents an area that would be assigned to each character in the data of page 1 that forms a part of the set of characters that have met the character accent color criteria. In the examples of FIGS. 6 and 7, the criteria is established by the computer that is programmed to distinguish between fixed and variable data, whereas in the examples of modes described in FIGS. 4 and 5 the operator selects a particular character criteria he wishes to see highlighted. The highlighted data (HD_o) is bitmapped in page memory 23b with logic level "1" in the areas to be highlighted and with logic level "0" in the areas not to be highlighted. The bitmapped data is then sent to be printed line-by-line by LED print array 125 on a second image frame of web 12. A signal is also sent to the developer unit containing the yellow toner for developing this image frame. The two developed image frames are transferred in register on copy sheet S. Similarly, the data for the second page is printed and highlighted as are the subsequent pages of data in accordance with the flowchart of FIG. 7.

Thus, there is provided a multipage document where all the data is printed in one color but the variable data is highlighted in another color.

The invention may also be realized with an optical copying apparatus. With reference now to Figs. 8 and 9, an optical copying apparatus 10' is shown which incorporates many similar parts of the printer apparatus 10 shown in Figs. 1-3. The similar parts are identified with a prime (') in Fig. 8. In this optical copy apparatus, a recirculating feeder 110 may be provided for storing a stack of multi-sheet original documents 5. Individual document sheets may be fed seriatim from a tray supporting same via drive roller 103, roller pair 104, metering roller 77 and others not shown to move the document sheets across an exposure platen 84 forming part of an exposure station. Arrows 111, 134 and 154 identify the path by which each document sheet is driven from the bottom of the stack 5 across the platen and back to the top of the original stack. In the course of being driven onto the exposure platen the document is first scanned by a document scanning unit 82 that comprises an illumination source 83, a linear light sensor 81 such as a linear CCD sensor array and a backing plate 79. An encoder is associated with metering roller 77 so that the position of incremental lines of image data are known. Roller 77 is driven by motor M_1 or other suitable drive means. As the document passes in line increments over linear sensor 81, the light and dark images sensed by same are fed in accordance with known circuitry to an image scanner processor and buffer means 75 which analyzes the image in accordance with conventional character recognition algorithms. The output of

processor 75 is then input to the computer 31 (Fig. 2) and serves as the data source 19 shown in Fig. 2. Upon input by the operator of the character criteria through keyboard 13, the computer 31 compares the operator input character criteria with the data scanned from the document. The computer 31 determines those locations of the document which meet the criteria and rather than sending out signals to RIP 21 representing character data, sends out signals representing "no data" (i.e., logic 0's) corresponding to portions of the document page just scanned not meeting the character criteria and signals representing "data" (i.e., logic 1's) corresponding to portions of the document meeting the character data. The RIP 21 processes this "data" and stores same in page memories 23a and 23b. The "data" stored in page memories 23a and 23b will be complementary to each other. In page memory 23a, a rasterized page of data is stored with logic 0's for those areas not meeting the character criteria and logic 1's for those areas meeting the character criteria. In page memory 23b, a complementary rasterized page of data is stored providing logic 1's for those areas of the document page not meeting the character criteria and logic 0's for those areas meeting the character criteria. The scanned document page is advanced to the exposure platen stopped by suitable means such as a solenoid activated stop 85 positioned to block the path of the document sheet in response to a signal from computer 31. The computer then causes the flash lamps 90, 92 to be activated to illuminate document 5 and cause an image thereof to be optically exposed via mirrors 94 and 98 and lens 96 onto an area 35' representing one image frame lying in the plane of the web 12'. The timing of the

flash of lamps 90, 92 is controlled by computer 31 and related to travel of the web 12' to expose adjacent, non-overlapping image frame areas of the web. Prior to the exposure of this first image frame, the image frame has been uniformly electrostatically charged by corona charger 30'. In addition, an electro-optical exposure source 125' is provided which comprises, for example, an LED printhead. Suitable imaging optics (not shown) such as a gradient index fiber optical array may be used for focusing light from the respective LED's onto the surface of the web 12'. In response to timing signals from computer 31 based on sensing of the first image frame over exposure source 125', RIP 21 causes a line of "data" to be output from page memory 23a to the printer interframe controller 48. Controller 48 then formats the data to LED exposure source 125'. For those lines where logic 1's have been stored corresponding to areas of the original page having a matching character criteria, the LED's are briefly flashed to erase charge from such areas. The subsequent optical exposure at exposure area 35' thus records, as an electrostatic charge image, all the information in original document 5 but for that data meeting the character criteria input by the operator. This image frame is developed with say black toner by one of the magnetic brush developer stations and transferred to a copy sheet S' on transfer roller 68'. The second image frame is also uniformly charged by charger 30' and has its charge selectively erased by selective flashing of the LED's in printhead 125' in accordance with "data" stored in page memory 23b. This data from memory page 23b thus causes erasure of charge from all areas of the second image frame but for those areas meeting the character criteria.

This second image frame is then optically exposed to the image of the same document sheet by activation of flash lamps 90, 92 and developed by the other development station with the second color toner (say red) and transferred in register to the same surface of sheet S previously developed with black toner at the transfer charger station 61' and in accordance with the description provided above. The composite images are fused at fuser station 67'. The reproduction thus represents a copy of the original document with data meeting the character criteria color highlighted even though the original document sheet had all the data in one color and no distinctiveness as to which areas were to receive highlighting.

In lieu of a recirculating feeder, other document feeders may be employed such as those for moving a document sheet seriatim from one side of the exposure platen to the other as also shown in Fig. 9.

The program for determining character criteria in the embodiment of Figs. 8 and 9 may also comprise an alogrithm wherein data from a first original document sheet is compared with a second original document sheet fed seriatim through the scanner and the difference in data printed out with highlighting as described above in reproductions of such a multisheet document as hereinabove described.

As in the embodiments for Figs. 1-3, the apparatus 10' may be modified to provide reproduction of all the data in the same color, say black, and color highlighting in yellow. This is accomplished by optically copying the document sheet on one image frame and performing no selective erase treatment to same and then not exposing the second image frame to the document sheet image but selectively erasing all areas thereof except for

those corresponding to areas of the document sheet meeting the character criteria. The areas meeting this criteria are then developed with say yellow toner and the two image frames superimposed in register (black on top of yellow, preferably) on a copy sheet to provide an all-black reproduction of image information of the original with color highlighting of data meeting the character criteria. Still other modifications include the use of electrographic charging elements in lieu of electro-optic light sources for providing the charge modulation function.

It will be appreciated that the invention improves upon the prior art which requires that the data to be accent colored be identified with a signal indicating the color to which it is printed or wherein area information needs to be provided to selectively accent color certain information. In the invention described a character accent color criteria is established and the creation of accent color achieved in an efficient and expeditious manner.

Still other modifications may be realized in accordance with the invention including the generating of a color outline highlighting, rather than "painting" with an accent color the contiguous areas of the data meeting the character accent color criteria.

The invention has been described in detail with particular reference to preferred embodiments thereof. However, it will be understood that variations and modifications may be effected within the spirit and scope of the invention.

I Claim:

1. A reproduction apparatus (10, 10') comprising:

means (19; 82, 75) for providing data signals representing non-color differentiated character data information to be reproduced;

first means (13) for establishing a character accent color criteria;

second means (31) for comparing the said data signals with the said criteria;

third means (30, 125, 38, 68; 30', 125', 38', 68') responsive to data signals meeting the criteria for reproducing the said character data information so that data signals meeting the criteria have their corresponding character data information color highlighted on a record member.

2. The reproduction apparatus of Claim 1 and wherein the third means includes means for generating signals representing areas of the data signals meeting the criteria and for producing on the record member a field of color in a highlight color on the areas adjacent that occupied by the characters meeting the criteria.

3. The reproduction apparatus of Claim 1 and wherein the first means establishes the character accent color criteria by comparing data signals forming one page of character data with a second page of character data to determine the difference in data content between the pages.

4. The printer apparatus of Claim 3 and wherein the third means includes means for generating data signals representing areas of the data meeting the criteria and for producing in the record member a field of color in a highlight color in the areas adjacent that occupied by the characters meeting the criteria.

5. The apparatus of Claim 1 and wherein the third means comprises a radiation sensitive member (12, 12') and means (125, 125') for generating image pixels for recording on the radiation-sensitive member.

6. The apparatus of Claim 1 and wherein the means for providing data signals comprises a scanner means (82) for scanning a document sheet and in response thereto generating electrical data signals corresponding to image data contained within the document sheet.

7. The apparatus of Claim 6 and including a document exposure platen (84), a document feeder (110) for feeding document sheets seriatim to the document exposure platen, and exposure means (90, 92) for optically exposing the document sheet upon an electrostatically charged photoconductive member (12').

8. The apparatus of Claim 7 and wherein the exposure means exposes a document sheet twice, once onto each of two different image frames and in response to data meeting the criteria selectively erasing areas of charge on one image frame corresponding to the location of such data and selectively erases on said second image frame areas of charge not corresponding to such data; and means (38') for developing electrostatic images on the image frames with differently colored toners and means (68', 61') for transferring the developed images in register to a record member.

9. The apparatus of Claims 6, 7 and 8 and including a document feeder (110) for feeding the document sheets seriatim and wherein the scanner means (82) scans the document sheets as they are fed serially through the feeder.

10. The apparatus of Claim 9 and wherein, in response to said scanning the first means, establishes the accent color criteria by comparing data signals from one page of a document sheet containing character data with a second page of character data to determine the fixed data common to both pages.

11. The apparatus of Claim 10 and wherein the third means includes means for generating data signals representing areas of the data meeting the criteria and for producing in the record member a field of color in a highlight color in the areas adjacent that occupied by the characters meeting the criteria.

12. The apparatus of Claim 7 and wherein the exposure means exposes a document sheet onto at least one image frame and in response to data signals meeting the criteria selectively modulates charges on a second image frame to form an electrostatic image of the highlight; means (38') for developing electrostatic images on the image frames with differently colored toners; and means (68', 61') for transferring the developed images in register to a record member.

13. The apparatus of Claims 1 and 12 wherein the data signals represent non-color differentiated financial data information to be printed and wherein the first means establishes a negative data accent color criteria.

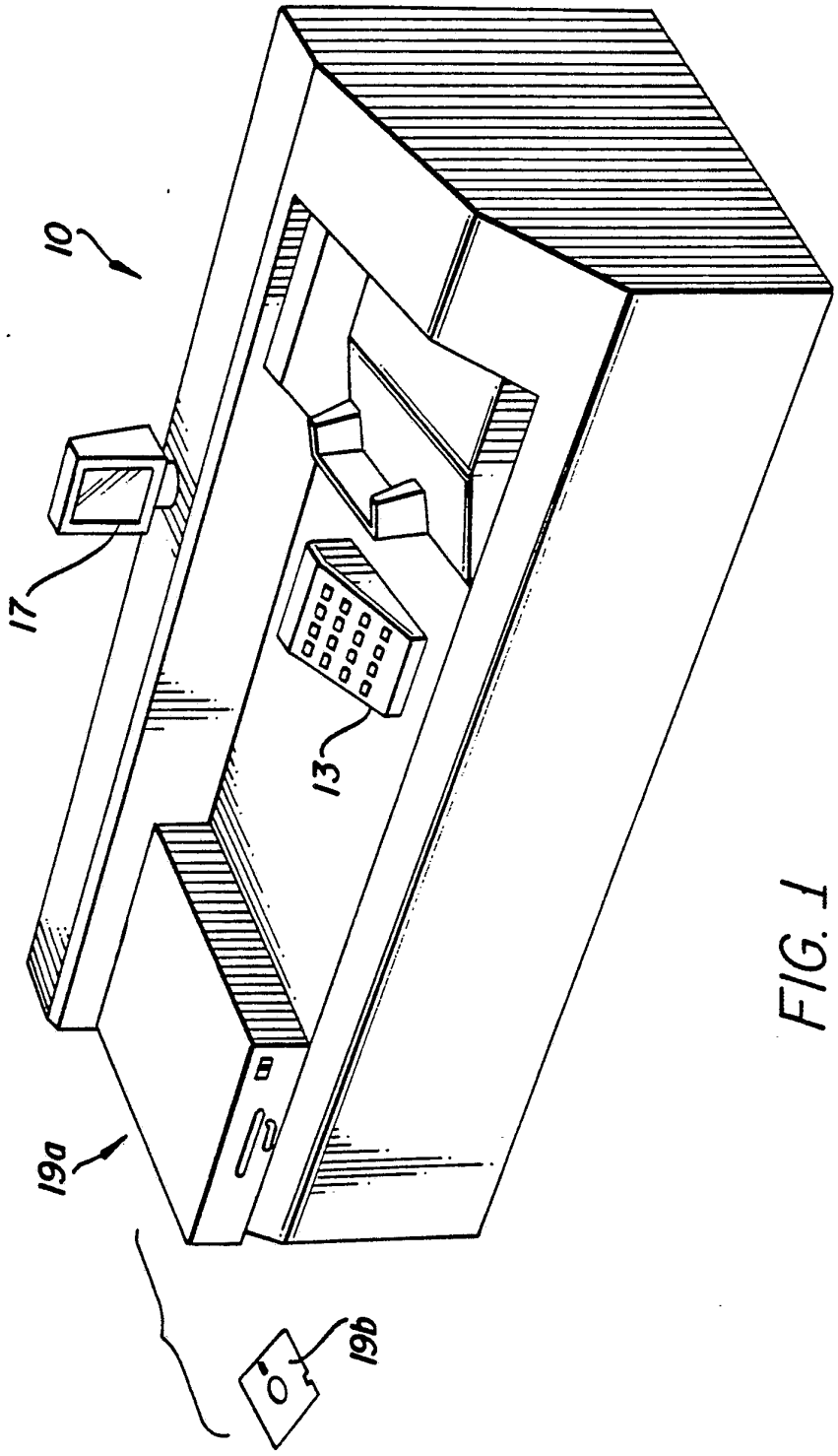


FIG. 1

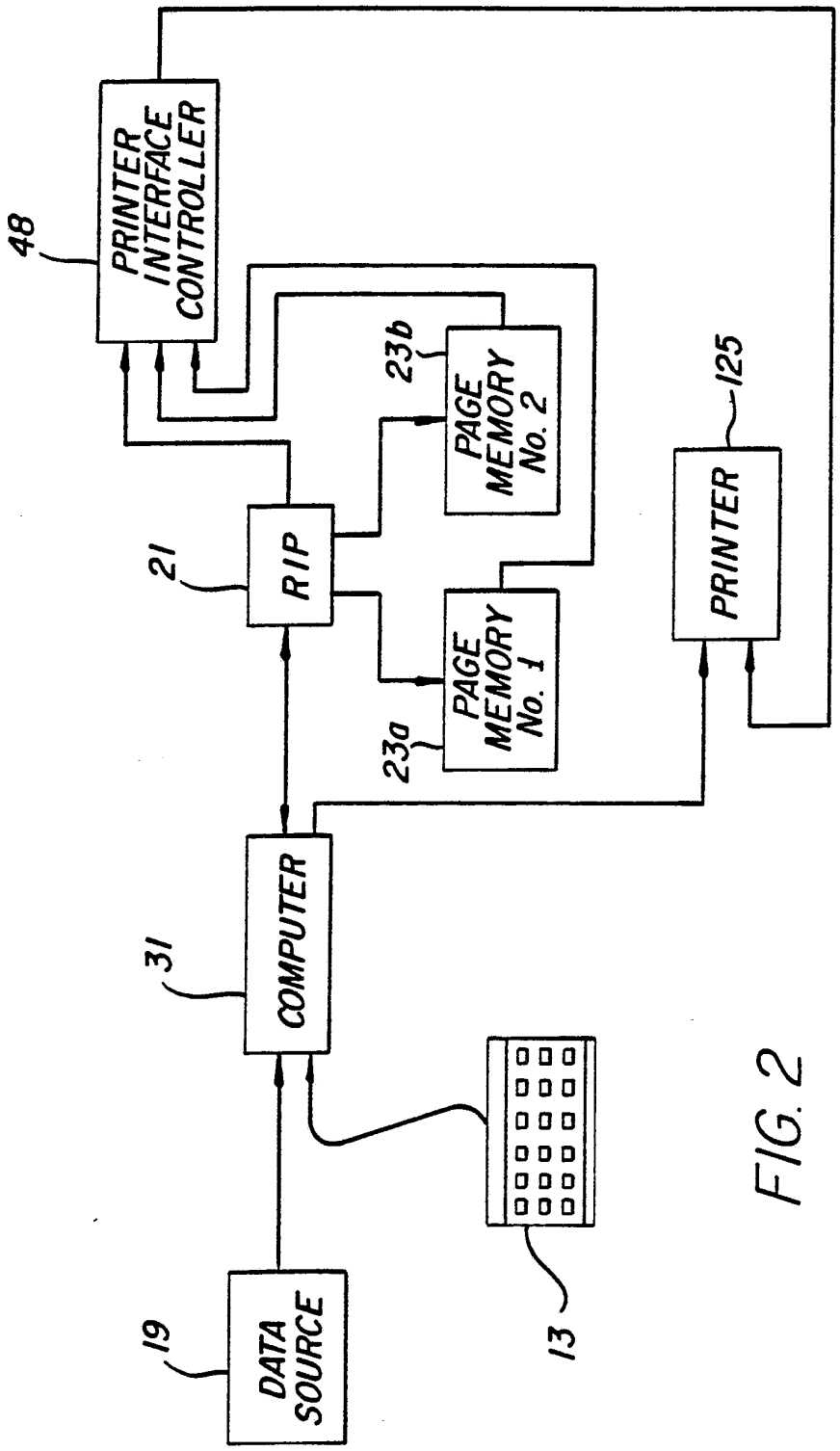

PRINTER INTERFACE CONTROLLER
48
PAGE MEMORY No. 2
23b
PAGE MEMORY No. 1
23a
RIP
21
PRINTER
125
COMPUTER
31
DATA SOURCE
19
13

FIG. 2

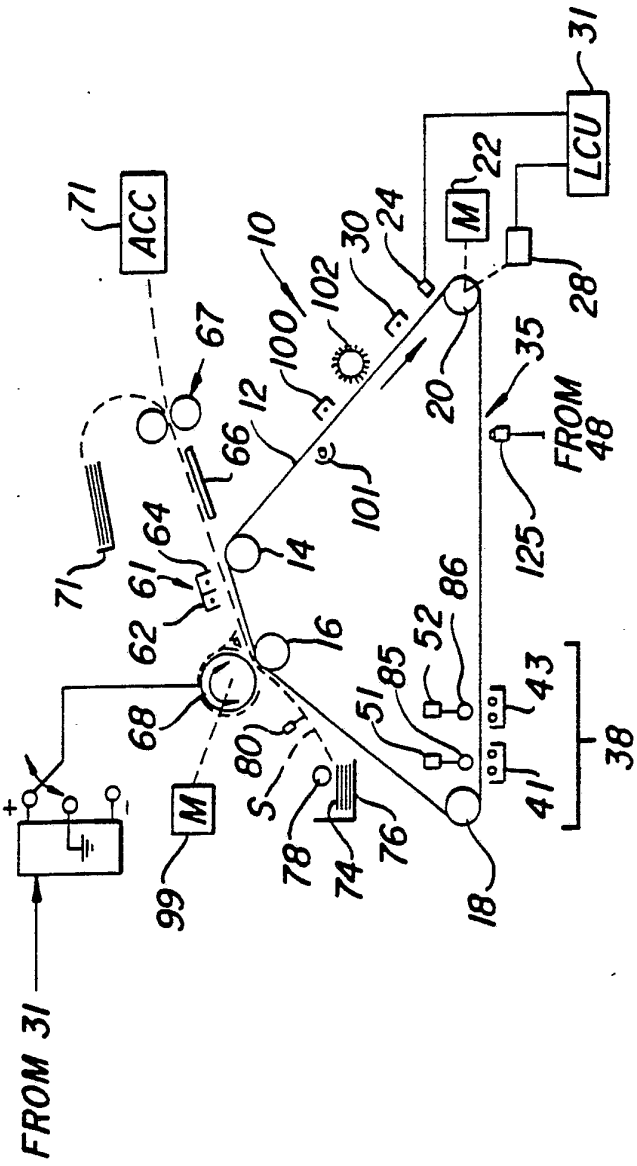

FROM 31
99
M
68
62
61
64
71
ACC
71
67
66
12
14
16
10
100
102
30
24
M
22
LCU
31
28
35
20
FROM
48
125
101
86
52
85
51
43
41
38
18
76
74
78
80
S

FIG. 3

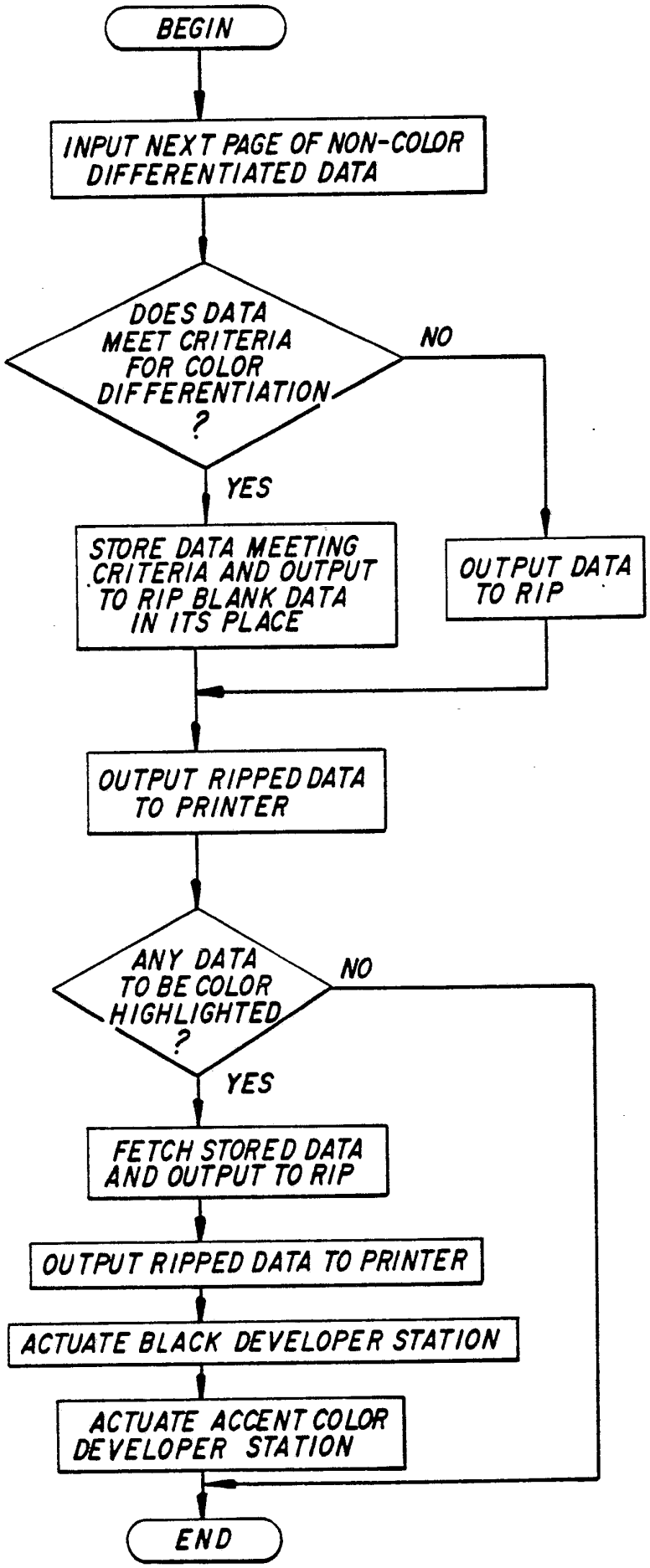

BEGIN
INPUT NEXT PAGE OF NON-COLOR DIFFERENTIATED DATA
DOES DATA MEET CRITERIA FOR COLOR DIFFERENTIATION ?
NO
YES
STORE DATA MEETING CRITERIA AND OUTPUT TO RIP BLANK DATA IN ITS PLACE
OUTPUT DATA TO RIP
OUTPUT RIPPED DATA TO PRINTER
ANY DATA TO BE COLOR HIGHLIGHTED ?
NO
YES
FETCH STORED DATA AND OUTPUT TO RIP
OUTPUT RIPPED DATA TO PRINTER
ACTUATE BLACK DEVELOPER STATION
ACTUATE ACCENT COLOR DEVELOPER STATION
END

FIG. 4

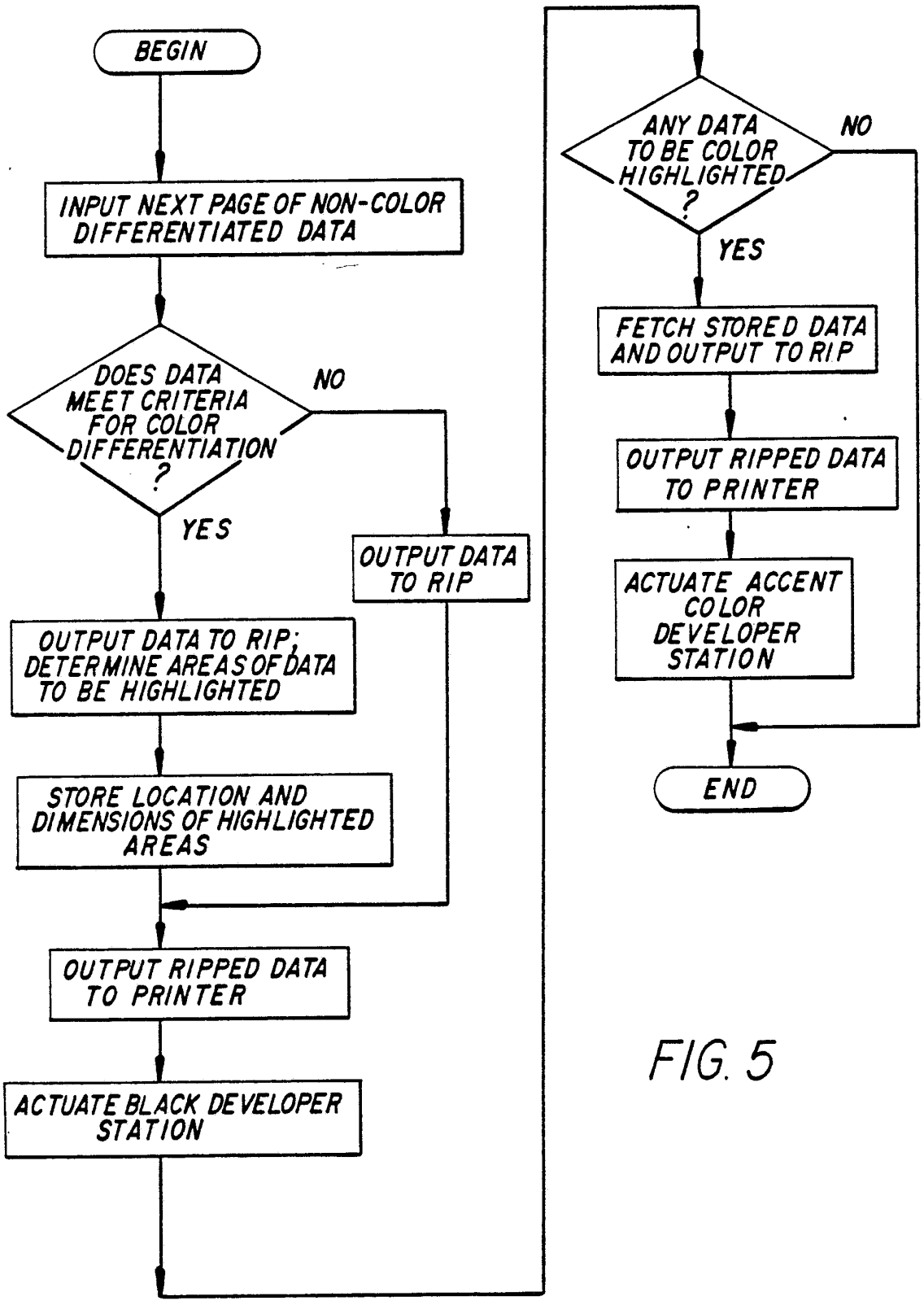

BEGIN
INPUT NEXT PAGE OF NON-COLOR DIFFERENTIATED DATA
DOES DATA MEET CRITERIA FOR COLOR DIFFERENTIATION ?
NO
YES
OUTPUT DATA TO RIP
OUTPUT DATA TO RIP; DETERMINE AREAS OF DATA TO BE HIGHLIGHTED
STORE LOCATION AND DIMENSIONS OF HIGHLIGHTED AREAS
OUTPUT RIPPED DATA TO PRINTER
ACTUATE BLACK DEVELOPER STATION
ANY DATA TO BE COLOR HIGHLIGHTED ?
NO
YES
FETCH STORED DATA AND OUTPUT TO RIP
OUTPUT RIPPED DATA TO PRINTER
ACTUATE ACCENT COLOR DEVELOPER STATION
END

FIG. 5

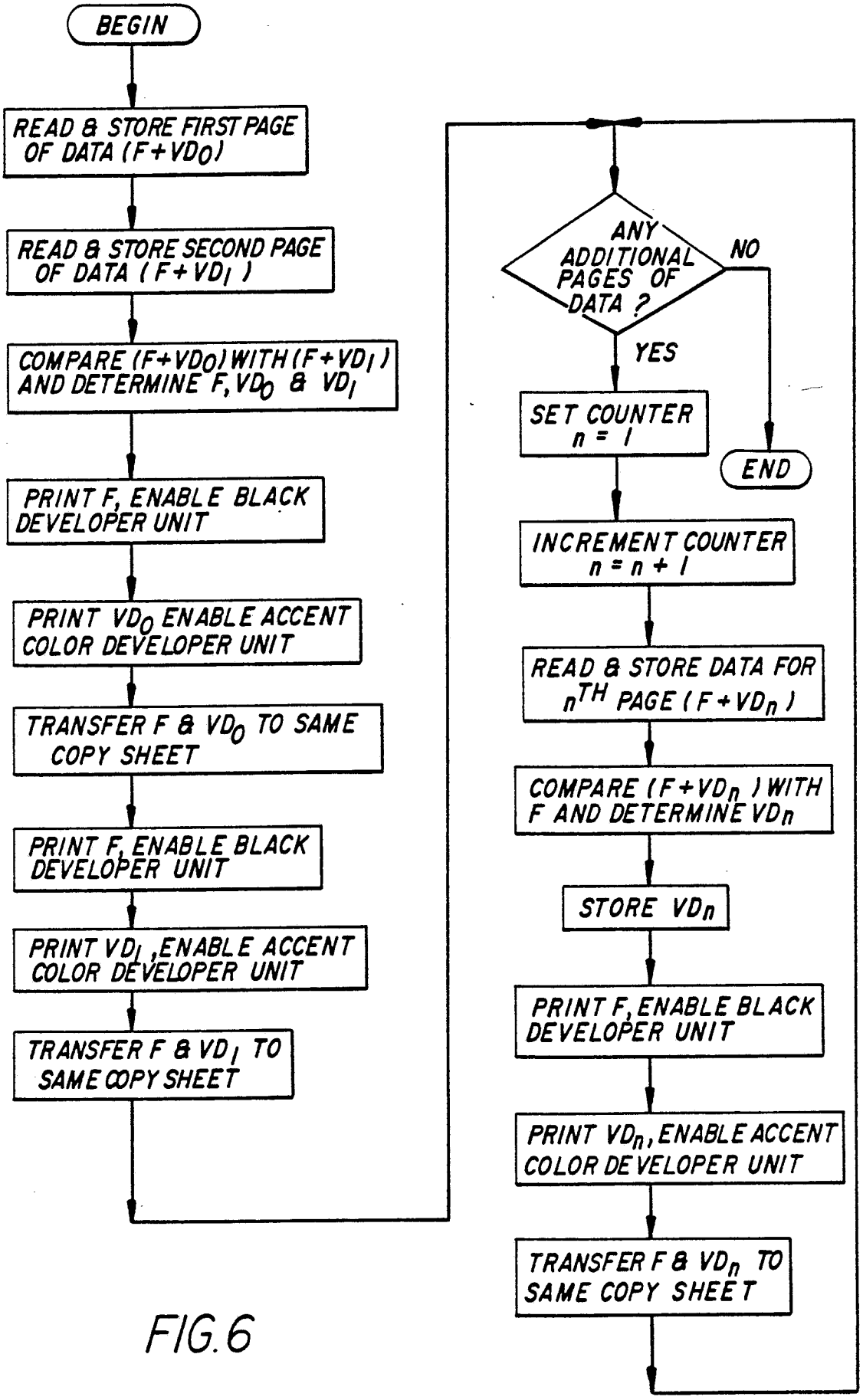
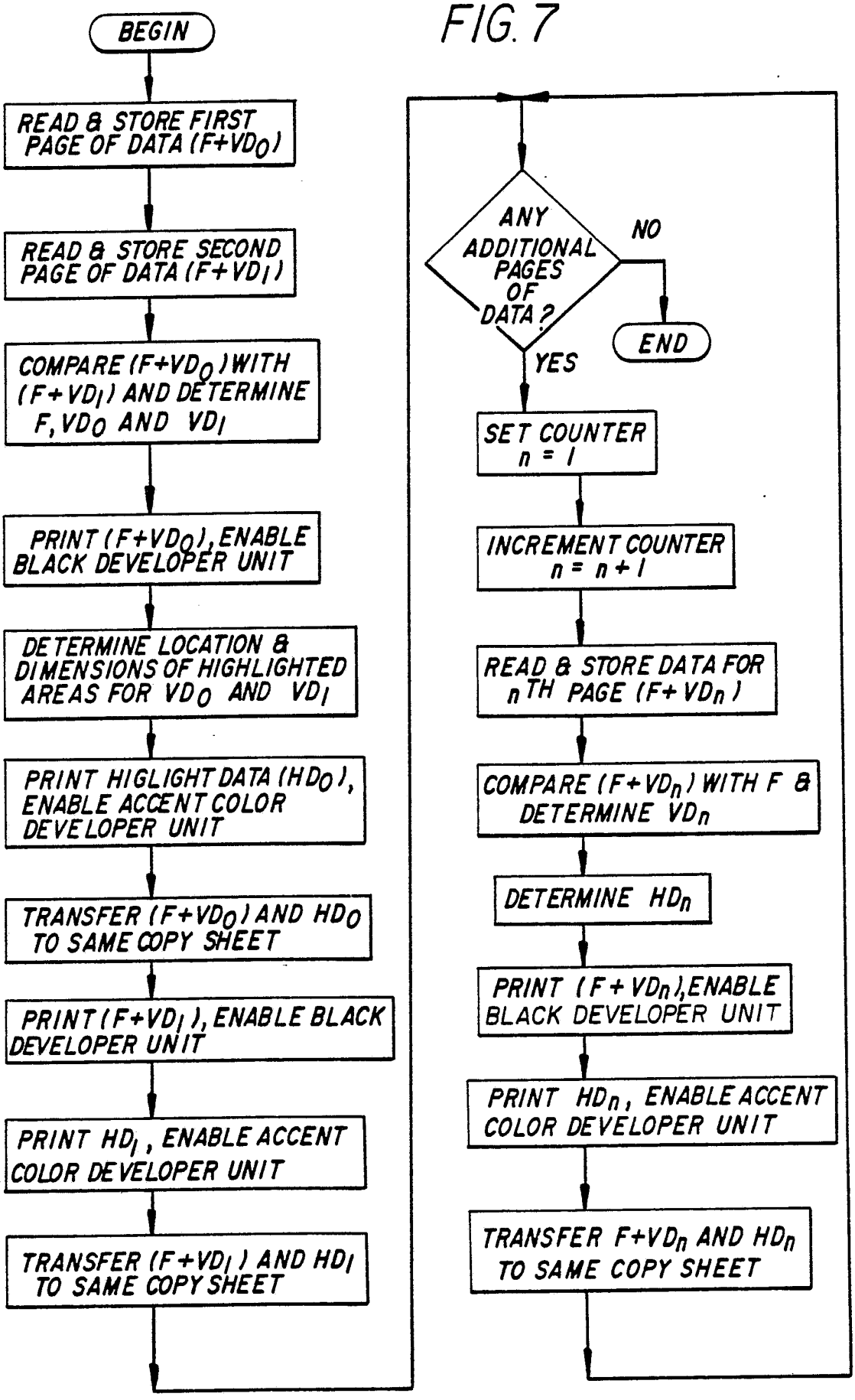

BEGIN
READ & STORE FIRST PAGE OF DATA (F+VD0)
READ & STORE SECOND PAGE OF DATA (F+VD1)
COMPARE (F+VD0) WITH (F+VD1) AND DETERMINE F, VD0 & VD1
PRINT F, ENABLE BLACK DEVELOPER UNIT
PRINT VD0 ENABLE ACCENT COLOR DEVELOPER UNIT
TRANSFER F & VD0 TO SAME COPY SHEET
PRINT F, ENABLE BLACK DEVELOPER UNIT
PRINT VD1, ENABLE ACCENT COLOR DEVELOPER UNIT
TRANSFER F & VD1 TO SAME COPY SHEET
ANY ADDITIONAL PAGES OF DATA ?
NO
YES
END
SET COUNTER n = 1
INCREMENT COUNTER n = n + 1
READ & STORE DATA FOR nTH PAGE (F+VDn)
COMPARE (F+VDn) WITH F AND DETERMINE VDn
STORE VDn
PRINT F, ENABLE BLACK DEVELOPER UNIT
PRINT VDn, ENABLE ACCENT COLOR DEVELOPER UNIT
TRANSFER F & VDn TO SAME COPY SHEET

FIG. 6

FIG. 7


BEGIN
READ & STORE FIRST PAGE OF DATA (F+VD0)
READ & STORE SECOND PAGE OF DATA (F+VD1)
COMPARE (F+VD0) WITH (F+VD1) AND DETERMINE F, VD0 AND VD1
PRINT (F+VD0), ENABLE BLACK DEVELOPER UNIT
DETERMINE LOCATION & DIMENSIONS OF HIGHLIGHTED AREAS FOR VD0 AND VD1
PRINT HIGLIGHT DATA (HD0), ENABLE ACCENT COLOR DEVELOPER UNIT
TRANSFER (F+VD0) AND HD0 TO SAME COPY SHEET
PRINT (F+VD1), ENABLE BLACK DEVELOPER UNIT
PRINT HD1, ENABLE ACCENT COLOR DEVELOPER UNIT
TRANSFER (F+VD1) AND HD1 TO SAME COPY SHEET
ANY ADDITIONAL PAGES OF DATA ?
NO
END
YES
SET COUNTER n = 1
INCREMENT COUNTER n = n + 1
READ & STORE DATA FOR nTH PAGE (F+VDn)
COMPARE (F+VDn) WITH F & DETERMINE VDn
DETERMINE HDn
PRINT (F+VDn), ENABLE BLACK DEVELOPER UNIT
PRINT HDn, ENABLE ACCENT COLOR DEVELOPER UNIT
TRANSFER F+VDn AND HDn TO SAME COPY SHEET

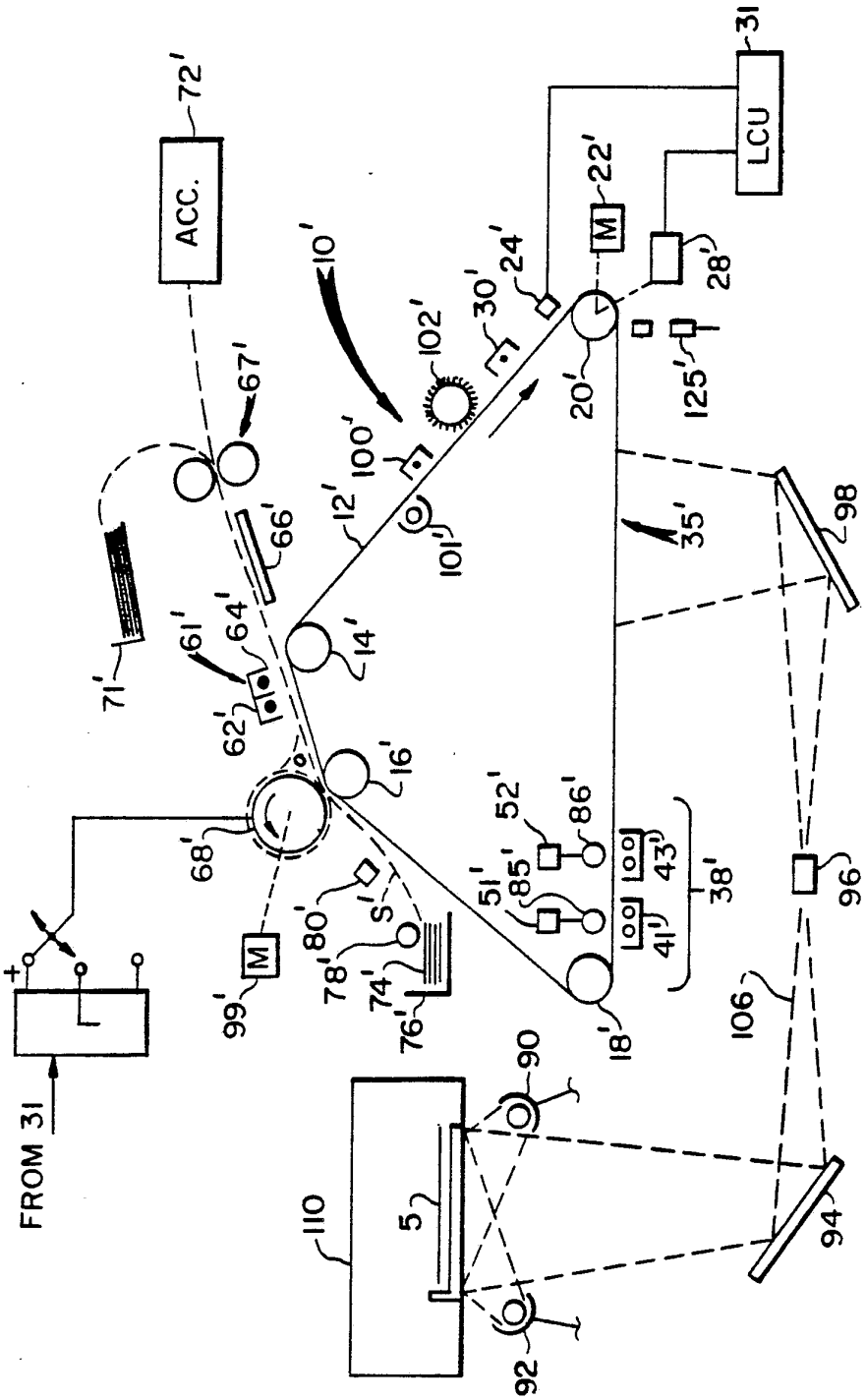

ACC.
72'
LCU
31
M
22'
28'
10'
24'
30'
102'
67'
20'
125'
100'
12'
101'
35'
98
66'
64'
61'
71'
14'
62'
16'
68'
52'
86'
51'
85'
43'
38'
96
80'
S'
78'
74'
76'
99'
41'
18'
106
FROM 31
90
110
5
94
92

FIG. 8

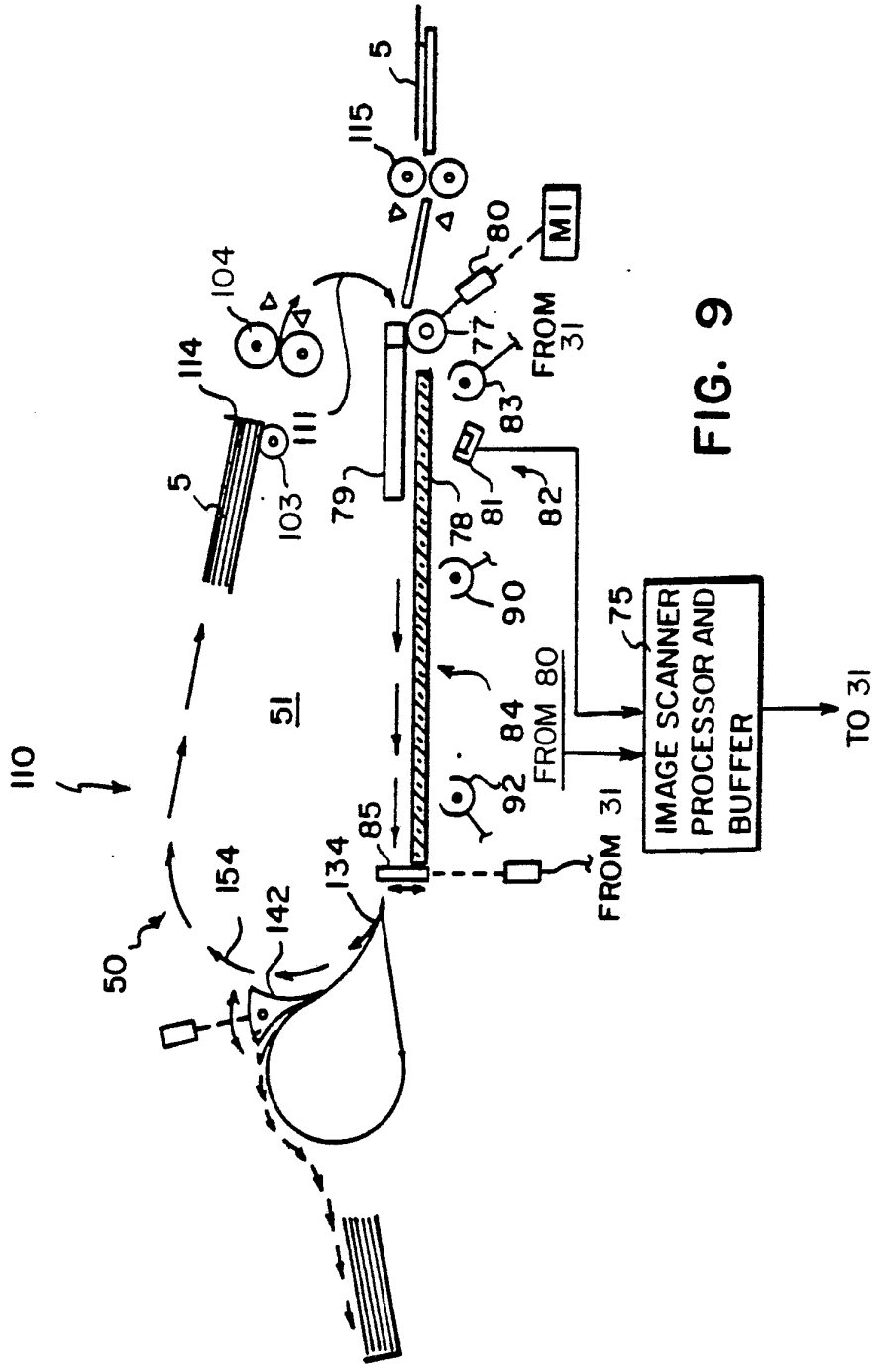

110
50
154
142
134
85
51
5
114
111
103
104
115
5
79
77
80
MI
FROM 31
83
81
82
78
90
92
84
FROM 80
FROM 31
75
IMAGE SCANNER PROCESSOR AND BUFFER
TO 31

FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 88/03199

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC4: G 03 G 15/01; B 41 J 3/18

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC4	G 03 G; B 41 J; G 06 K

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 3930724 (J.H. MCVEIGH) 6 January 1976, see the whole document --	1-13
Y	Patent Abstracts of Japan, Vol 8, No 82, P268, abstract of JP 58-224362, publ 1983-12-26 --	1-13
Y	Patent Abstracts of Japan, Vol 6, No 212, P151, abstract of JP 57-119379, publ 1982-07-24 --	1-13
Y	Patent Abstracts of Japan, Vol 8, No 202, P300, abstract of JP 59- 87470, publ 1984-05-21 --	1-13
Y	US, A, 4509850 (J.W. WEIGL) 9 April 1985, see the whole document --	1-13

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
5th January 1989	03 FEB 1989
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	M. VAN MOL

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
Y	US, A, 3960445 (W.A. DRAWE) 1 June 1976, see the whole document --	1-13

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/US 88/03199

SA 24753

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 02/11/88
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-US- 3930724	06/01/76	NONE	
US-A- 4509850	09/04/85	NONE	
US-A- 3960445	01/06/76	NL-A- 7500127	30/05/75
		CA-A- 1068763	24/12/79

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82