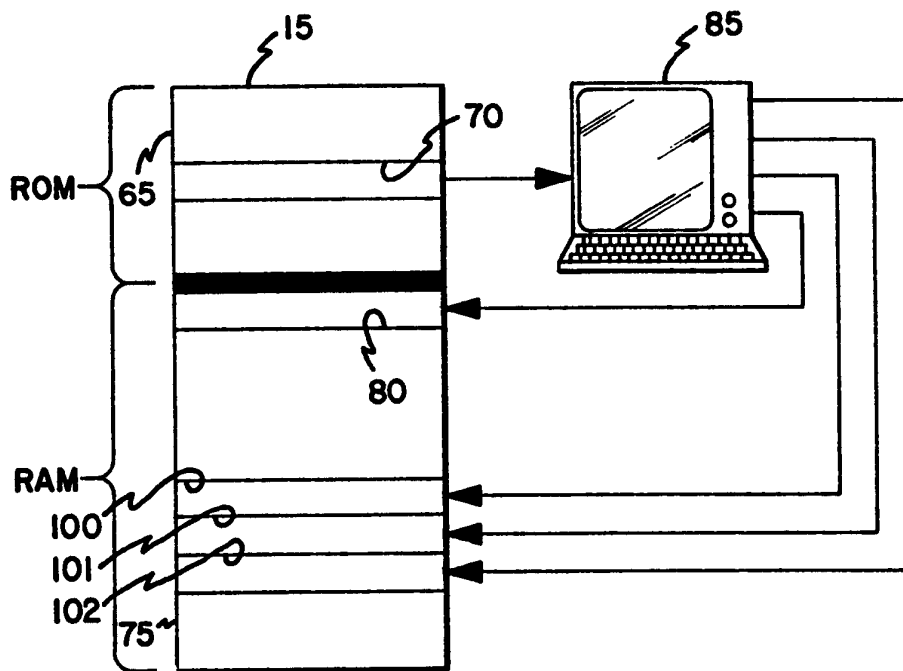




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<p>(51) International Patent Classification <sup>5</sup> : <b>B41J 11/58, 17/36, 35/36</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 94/11196</b> (43) International Publication Date: 26 May 1994 (26.05.94)</p>
<p>(21) International Application Number: PCT/US93/10561 (22) International Filing Date: 1 November 1993 (01.11.93) (30) Priority data: 07/977,809 17 November 1992 (17.11.92) US (71) Applicant: VARITRONIC SYSTEMS, INC. [US/US]; 300 Interchange Tower, 600 South County Road 18, Minneapolis, MN 55426 (US). (72) Inventor: NEHOWIG, Kelly, R. ; 13008 93rd Place North, Maple Grove, MN 55369 (US). (74) Agent: BRUESS, Steven, C.; Merchant, Gould, Smith, Edell, Welter &amp; Schmidt, 3100 Norwest Center, 90 South Seventh Street, Minneapolis, MN 55402 (US).</p>		<p>(81) Designated States: CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i></p>

(54) Title: CARTRIDGE WITH DATA MEMORY SYSTEM AND METHOD



(57) Abstract

A thermal printing machine (30) is provided with a releasably attachable tape cassette (1) which holds the tape (5) on which an image is placed. The cassette includes a memory circuit component (15) which includes at least two separate memory areas. The first area (65) contains a first value which is read by the printing machine; the second area (75) contains a second value which is placed on the cassette as a result of the first value having an algorithm applied to it. When the cassette (1) is installed in the machine, the machine applies the algorithm to the first value and checks this against the second value. This process is followed in order to see if the cassette (1) contains a compatible tape for that machine.

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CARTRIDGE WITH DATA MEMORY SYSTEM  
AND METHOD

5                                    Field of the Invention

                                  This invention pertains generally to printing  
or typing equipment involving the use of a thermal  
printing process or thermal transfer process to transfer  
a dry film impression onto an image carrying tape. More  
10 specifically, this invention relates to a cassette for  
use in a printing machine, the cassette carrying a  
memory circuit component which stores information for  
use by the printing machine to determine whether the  
cassette is compatible with the printing machine. This  
15 invention further relates to a printing apparatus  
incorporating such a cassette. This invention further  
relates to a method of enabling a tape cassette to  
operate with a printing machine.

20                                   Description of Prior Art

                                  In the field of commercial art, there is a  
significant need for simple means for transferring  
prefabricated letters or characters to a "paste-up"  
sheet for later photographing and printing. The  
25 earliest technology involving letter transfer was that  
of dry rub-on transfer sheets which had a series of  
characters preprinted thereon. These materials,  
however, are limited by the number of characters  
available on the sheet and must be very carefully  
30 aligned to produce acceptable images. Machines were  
later developed which printed such letters on a  
continuous adhesive tape. The first such machines  
employed print disks having raised characters. Such  
machines used impact printing to transfer pigment to a  
35 carrier tape. Some machines were keyboard driven while  
others were manual "spin and print" machines. See, for  
example, U.S. Pat. No. 3,912,064; 4,243,333; 4,462,708  
and 4,579,056.

The impact printing machines mentioned above had many advantages over the rub-on letters, but still suffered from certain limitations. Specifically, these machines were necessarily complicated, heavy and  
5 relatively slow since the printing effect was accomplished by using physical force against the type face with the print media and pigment ribbon in between. Such machines were also restricted to pigment transfer of some form. In addition, an expensive type disk had  
10 to be molded for every point size, type style and language, leading to enormous costs in creating a suitable library. Certain foreign languages which are written either right to left or vertically, would require very specialized type disks. Speed was further  
15 limited because the type disks had to physically move to a new location to print each successive character. Finally, the resulting output was generally not considered smear proof and would have to be further coated if used in areas where frequent contact with the  
20 print surface was anticipated.

Thermal transfer printing, such as that known in inexpensive portable typewriters (for example Canon Typestar 5 TM, etc.), employed a new technology which used a heat generating print head to melt a wax-pigment  
25 from a carrier ribbon to a receiving tape. By using digital technology, characters could be formed of a sequence of pixels and print disks were not required. A related technology is direct thermal printing where an image is created on a thermally sensitive receiving  
30 paper directly by the head without the use of an intermediate carrier ribbon.

Thermal transfer has been applied in commercial art printing machines. Such a machine is marketed under the registered trademark Merlin Express<sup>®</sup> by Varitronics,  
35 Inc., assignee of the present invention. The Merlin Express<sup>®</sup> is the subject matter of commonly assigned U.S. Pat. No. 4,815,871. Likewise, the Merlin Express<sup>®</sup> is

the subject matter of a design patent issued 4/17/90 as patent D307,296. A font module for use in the Merlin Express<sup>®</sup> is the subject matter of U.S. patent application Ser. No. 119,810 filed November 12, 1987,  
5 now abandoned.

The Merlin Express<sup>®</sup> employs a tape cassette (referred to as a cartridge in the aforementioned patent applications) which carries both an image receiving tape and an image carrying ribbon. The image receiving tape  
10 is carried on a spool housed in the cassette. The image carrying ribbon is likewise carried on a spool housed in the cassette. The image carrying tape is guided from its spool to a free end. A take-up spool is provided within the cassette for winding up the image carrying  
15 ribbon as it is utilized. The tape and ribbon are disposed so that in at least a predetermined location they are in face-to-face alignment. At the predetermined location, the cassette includes an opening which receives a transfer head and a platen when the  
20 cassette is mounted on the printing machine. The opposing tape and ribbon are disposed between the platen and the head. A gear mechanism within the head control apparatus urges the platen and head into close abutting relation with the tape and ribbon captured between them.  
25 Circuitry in the printing machine drives the platen to advance the tape and ribbon. When a desired character is inputted by an operator, the electronics of the machine energizes pixels on the thermal transfer head as the tape and ribbon advance past the head. When a  
30 command to print a letter is given a step motor actuates the platen. The head pixels are variously energized to imprint the letter on the tape.

In a printing machine such as the Merlin Express<sup>®</sup>, the machine is limited in that only a  
35 particular width of tape can be used. Also, the amount of thermal energy which is needed to effect the transfer at the pixels preferably varies from one type of tape

and pigment to another. For example, it may be desirable to transfer a white pigment onto a clear or black tape. Alternatively, it may be desirable to transfer a black pigment onto either a clear or white  
5 tape. Due to variations in types of pigments and tapes, the optimum amount of energy to effect this transfer will vary with the types of tapes and ribbons being used. Likewise, it is desirable for the machine to be able to sense numerous characteristics related to a  
10 cassette (size, density, type, etc.) by mere insertion of the cassette into the machine.

To accomplish this, cassettes can be provided with electrical circuit elements which are disposed to electrically engage exposed electrical connectors  
15 carried by the printing machine. This is described in U.S. Pat. No. 5,078,523, issued January 7, 1992, to McGourty et al. and assigned to Varitronics, Inc., the assignee of the present application. U.S. Patent No. 5,078,523 is incorporated herein by reference. In the  
20 McGourty '523 arrangement, the circuit elements are selected to cooperate with the circuitry of the printing machine to indicate desired characteristics of the cassette.

It would be desirable for a cassette to be  
25 provided with electrical circuit elements that, in cooperation with the printing machine, determine whether the cassette is compatible with the printer, and thereby whether the printer should be enabled. Use of an incompatible cassette may cause damage to the printing  
30 machine, or may cause the printing machine to create unsatisfactory images, with the user having no means of determining whether the problem lies in the printing machine itself, or in the cartridge, or in the incompatibility of the two.

### Summary of the Invention

According to a preferred embodiment of the present invention, a printing apparatus is provided including a printing machine having a thermal printing head energized in response to signals from a printing machine circuitry. A tape cassette releasably attaches to the printing machine and has a tape for receiving an image generated by the energizing of the thermal printing head. A memory circuit component is carried on the tape cassette and includes at least a first and a second memory address. The first memory address contains a first value, and the second memory address contains a second value derived from applying a predetermined algorithm to the first value. The machine circuitry includes contacts for connecting the memory circuit component to the printing machine circuitry. The machine circuitry is adapted to read the first value and apply the algorithm to the first value to generate a test value. It then compares the test value to the second value. If they are the same, the printing machine is enabled.

According to a preferred method of the present invention, a tape cassette is enabled under appropriate circumstances. More specifically, the method enables a tape cassette to operate with a printing machine wherein the printing machine includes a thermal printing head energized in response to signals from machine circuitry. The machine circuitry reads values from a first address and from a second address of a memory circuit component located on the tape cassette. Each memory circuit component is selected from one of a plurality of components, each having a unique first value at the first address. The component is carried on a tape cassette releasably attached to the printing machine. The machine circuitry applies an algorithm to the first value to generate a test value. The circuitry compares the test value to a value read at the second address.

The method comprises the following steps: reading a first value; applying an algorithm to the first value to generate a second value; writing the second value into the second address.

5           This invention further relates to a preferred tape cassette for a printing machine having a thermal head energized in response to signals from machine circuitry. The machine circuitry includes contact means exposed in a predetermined location and electrically  
10 connected to the machine circuitry. The machine circuitry includes means for reading at least a first and a second value contained in a first and second address of a memory circuit component in contact with the contact means. The machine circuitry further  
15 includes means for applying an algorithm to the first value to generate a test value and to compare the test value to the second value. The cassette includes means for releasably attaching the tape cassette to the machine in a predetermined position. The memory circuit  
20 component carried on the cassette is disposed to be in electrical contact with the contact means when the cassette is in the predetermined position. The memory circuit component includes at least the first address containing the first value and the second address  
25 containing the second value with the second value being derived by applying the algorithm to the first value.

#### **Brief Description of the Drawings**

FIG. 1 is a prospective view of a tape cassette  
30 incorporating the present invention;

FIG. 2 is a front sectional view of the cartridge illustrated in FIG. 1 inserted into a printing machine;

FIG. 3 is a schematic view of a printing  
35 machine and tape cassette incorporating the present invention;



FIG. 4 is a schematic diagrammatic representation of a memory circuit component, with arrowed lines indicating flow of information between a memory circuit component and a personal computer;

5 FIG. 5 is a schematic diagram of a memory circuit component with arrowed lines indicating flow of information to a printing machine; and

FIG. 6 is a flow chart illustrating flow of information to and from a memory circuit component.

10

### Description of the Preferred Embodiments

#### 1. General Description

Referring to the several figures in which like elements are identically numbered throughout, preferred  
15 embodiments of the present invention will now be described.

With reference to FIG. 1, a tape cartridge or cassette 1 is illustrated. The tape cartridge 1 illustrated in FIG. 1 is illustrative or exemplary of a  
20 tape cartridge. Tape cartridges which are useable in conjunction with the present invention may come in a number of forms or arrangements, such as that described in U.S. Pat. No. 5,078,523, incorporated herein by reference.

25 Generally, a tape cartridge or cassette 1 includes a paper supply roll or tape 5 supported by structure 6 in a frame 7. The paper supply roll 5 is supported such that it can be rotated about its longitudinal axis to dispense paper therefrom. The  
30 frame 7 allows for paper to be dispensed from the paper roll 5 through an opening or slot (not shown) defined in the frame 7. For use in a thermal printing machine, a tape cartridge 1 typically also includes structure 112 for supporting an image carrying ribbon supply. The  
35 image carrying tape supply dispenses image carrying tape as it is unwound from its spool. The free end of the ribbon is guided by the frame to a take-up spool. The

tape and ribbon are disposed so that in at least one predetermined location, they are in face-to-face alignment. At a predetermined location, the tape cassette includes an opening which receives a transfer head and a platen when the cassette is mounted on a printing machine.

In the embodiment illustrated in FIG. 1, frame 7 carries a memory circuit component 15, which will be described in greater detail below. At this point, it is adequate to understand that memory circuit component 15 includes a first contact surface 20. Additionally, memory circuit component 15 has a second contact surface 22 which, in the embodiment illustrated in FIG. 1, is generally parallel to and spaced from first contact surface 20 and is not visible in FIG. 1. In the embodiment of FIG. 1, a contact surface extension 25 is in electrical contact with second contact surface 22 and extends laterally outward from the memory circuit component to provide access to the contact surface extension 25. Contact surface extension 25 is preferably of some electrically conductive material, such as copper.

FIG. 2 illustrates tape cassette 1 inserted in a printing machine. The printing machine is depicted relatively schematically. The exact manner in which the tape cassette engages the printing machine is of little concern to the present invention, as long as they are compatible, and structure is provided for electrical connection between the two.

Generally, a printing machine of the type relevant to this application typically includes structure 35 for receiving a tape cartridge or cassette 1. The printing machine 30 further typically would include a driving mechanism (not shown) to advance the tape and/or the ribbon in the tape cartridge 1. A thermal print head (not shown) is provided in the printing machine and is arranged to cooperate with the

ribbon and tape of the cartridge 1 such that the thermal print head can print characters or symbols onto the tape 5. This is described in greater detail in U.S. Patent No. 5,078,523 which has been incorporated herein by 5 reference.

More specifically, a gear mechanism within the printing machine urges a platen into close abutting relation with the tape and ribbon captured between the platen and a transfer head. Circuitry in the printing 10 machine drives the platen to advance the tape and ribbon. When a desired character is input by an operator, the electronics of the machine energizes pixels on the thermal transfer head as the tape and ribbon advance past the head. When a command to print a 15 letter is given, a step motor actuates the platen. The head pixels are variously energized to imprint the letter on the tape. This is described in greater detail in U.S. Patent No. 5,078,523, which has been incorporated herein by reference.

20 The printing machine 30 typically includes a keyboard by which the user is able to selectively input the characters or symbols desired to be printed. Typically the machinery 30 will include a display, such as an LCD display, which shows the user what characters 25 or symbols have been typed, so that, for instance, mistakes can be corrected prior to printing.

A printing machine 30 further includes electrical circuitry which performs a number of functions. For example, the circuitry conveys the users 30 input and characters or symbols to the thermal print head. Further, according to the present invention, a printing machine 30 includes electrical circuitry 50 which is in contact with the memory circuit component 15 of the cartridge or cassette 1. This electrical 35 circuitry 50 terminates in first and second contacts 55 and 56. One of these contacts 55 engages the first contact surface 20 of the memory circuit component 15.

In the embodiment illustrated in FIG. 2, first contact 55 is formed of a spring leaf-like member 57. The second contact 56 engages the second contact surface 22 of the memory circuit component 15. In the embodiment 5 illustrated, the second contact 56 of the printing machine circuitry contacts the contact surface extension 25 located on the cartridge frame 7. Thus, when cartridge 1 is inserted into the printing machine 30, the memory circuit component 15 becomes a part of the 10 electrical circuitry 50 of the printing machine.

As illustrated in FIG. 3, the electrical circuitry 50 of the printing machine 30 includes a microprocessor 60 linked to electrical contacts 55 and 56 through a bidirectional data line 62. Through the 15 data line 62, the microprocessor 60 can pass information to and from the memory circuit component 15.

## 2. Memory Circuit Component

The memory circuit component 15 is of the type 20 possessing a read only memory (ROM) section, as well as a random access memory (RAM) section. An example of a memory circuit component 15 that is commercially available is the DS 1992 Touch Memory, made by Dallas 25 Semiconductor of Dallas, Texas. The read only memory portion, illustrated in FIG. 4 at reference numeral 65, includes a plurality of addresses in which information can be stored. In one of the addresses is a serial number which is unique to each memory circuit component. In the DS 1992, this number is factor-lasered has 48- 30 bits serial number. In FIG. 4, that address is indicated by a horizontally-extending space indicated by reference number 70. Because this address is located within the ROM section 65 of the memory circuit component 15, it is not possible to write over the 35 information given at this first memory address 70.

The RAM portion 75 of the memory circuit component 15 similarly has a plurality of addresses for

storing information. Because section 75 is random access, information can be written into and read from the addresses in the RAM section of the memory circuit component 15. One address of particular importance, as  
5 will be understood from the discussion below, is indicated schematically by the space indicated by reference number 80, which will be identified as a second memory address.

According to the present invention, during  
10 manufacturing of a tape cartridge 1, one memory circuit component 15 is selected and electronically connected to a personal computer 85. The personal computer 85 reads the serial number or first value located in first memory address 70. This serial number is unique to that  
15 particular memory circuit component. The PC 85 performs an algorithm on the serial number which modifies the serial number to create a second value which it then writes to second memory address 80 in the memory circuit component 15. Thus, in the manufacturing process, the  
20 serial number or first value located in the first memory address is converted into another number and placed in the second memory address 80, and that conversion is made by applying a particular algorithm to the information located in the first memory address 70.

25 In use, when the tape cassette 1 is placed in the printing machine, with the memory circuit component 15 in electrical connection with the printing machine 30, the microprocessor 60 in the printing machine 30 reads the serial number or first value located in first  
30 address 70. After reading the serial number, the microprocessor 60 in the printing machine 30 performs the same algorithm as was performed by the PC 85 during the manufacturing process. Thus, the printing machine microprocessor 60 arrives at a test value, which is the  
35 first value modified by the algorithm. The microprocessor then reads the information or number in the second memory address 80 and compares that second

value 80 with the test value generated by the printing machine microprocessor 60. If the test value matches the value located in second memory address 80, then the printing machine is enabled, having been satisfied that the cartridge is compatible with the printing machine. If the test value generated by the printing machine microprocessor 60 does not match the number located in second memory address 80, then the printing machine is precluded from operating.

FIG. 6 illustrates, in flowchart form, the use of a memory circuit component to enable a printing machine as described above. FIG. 6 is generally divided into two columns. The steps in the left hand column take place during manufacturing of a tape cassette. The steps in the right hand column occur during use of a tape cassette.

### 3. Uses for other Addresses in RAM

As illustrated in FIGS. 4 and 5, the RAM section 75 of a memory circuit component 15 includes a plurality of addresses. During manufacturing, the PC 85 can be used to write into those addresses various characteristics of the cartridge onto which the memory circuit component is being placed. For example, characteristics such as size, burn time, length, color, and so forth can be inserted into various addresses within the RAM portion of the component 15. Three exemplary addresses are given by reference numbers 100, 101 and 102 in FIGS. 4 and 5. In use, the microprocessor 60 of the printing machine 30 reads from these addresses so as to "learn" the characteristics of the cartridge that has been inserted into the machine 30. The printing machine 30 can then adjust burn time, size of print, and so forth, accordingly. In general, this is described in US Patent No. 5,078,523, discussed above.

It is to be understood that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts, within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

WHAT IS CLAIMED:

1. A printing apparatus comprising:
  - a printing machine having a thermal printing head energized in response to signals from a printing machine circuitry;
  - a tape cassette releasably attachable to said machine and having a tape for receiving an image generated by reason of said energizing of said thermal printing head;
  - a memory circuit component carried on said tape cassette and including at least a first and a second memory address, said first memory address containing a first value, said second memory address containing a second value derived from applying a predetermined algorithm to said first value;
  - said machine circuitry including contact means for connecting said memory circuit component to said machine circuitry;
  - said machine circuitry further including means for reading said first value and applying said algorithm to said first value to generate a test value and then comparing said test value to said second value.
2. An apparatus according to claim 1 wherein said memory circuit component is selected from one of a plurality of said components, said first value of said selected component unique to said selected component.
3. An apparatus according to claim 2 wherein said first address is a read only memory address and wherein said second address is a random access memory address.
4. A method for enabling a tape cassette to operate with a printing machine wherein said printing machine includes a thermal printing head energized in response to signals from a machine circuitry, said machine



circuitry including means for reading a value from a first and second address of a memory circuit component comprising a selected one of a plurality of components each having a unique first value at said first address,  
5 said component carried on a tape cassette releasably attached to said printing machine and said machine circuitry further including means for applying an algorithm to said first value to generate a test value and comparing the test value to a value read at said  
10 second address, said method comprising the following steps:

    reading said first value;  
    applying said algorithm to said first value to generate a second value;  
15 writing said second value into said second address.

5. A tape cassette for a printing machine having a thermal head energized in response to signals from a machine circuitry and said machine circuitry including  
20 contact means exposed in a predetermined location and electrically connected to said machine circuitry, said machine circuitry including means for reading at least a first and a second value contained in a first and second address of a memory circuit component in contact with  
25 said contact means and said machine circuitry further including means for applying an algorithm to said first value to generate a test value and comparing the test value to the second value, said cassette comprising:  
    means for releasably attaching said tape  
30 cassette to said machine in a predetermined position;  
    said memory circuit component carried on said cassette and disposed to be in electrical contact with said contact means when said cassette is in said predetermined position;  
35 said memory circuit component including at least said first address containing said first value and said second address containing said second value with

said second value derived from applying said algorithm to said first value.

6. A cassette according to claim 5 wherein said  
5 cassette memory circuit component is selected from one of a plurality of said components and where said first value is unique to said selected component.
7. A cassette according to claim 6 wherein said memory  
10 circuit component first address is a read only memory address and wherein said second address is a random access memory address.

FIG. 1

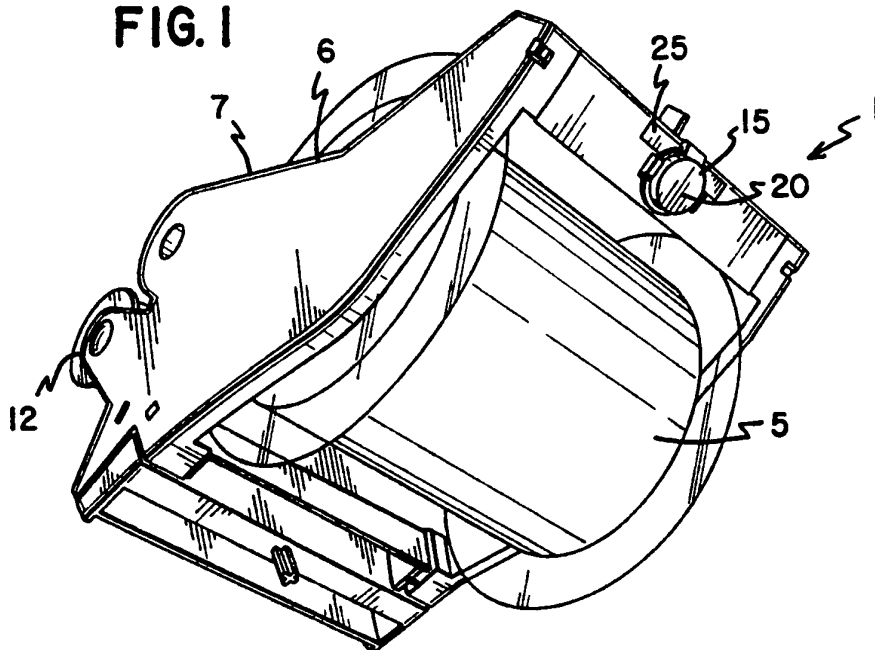


FIG. 2

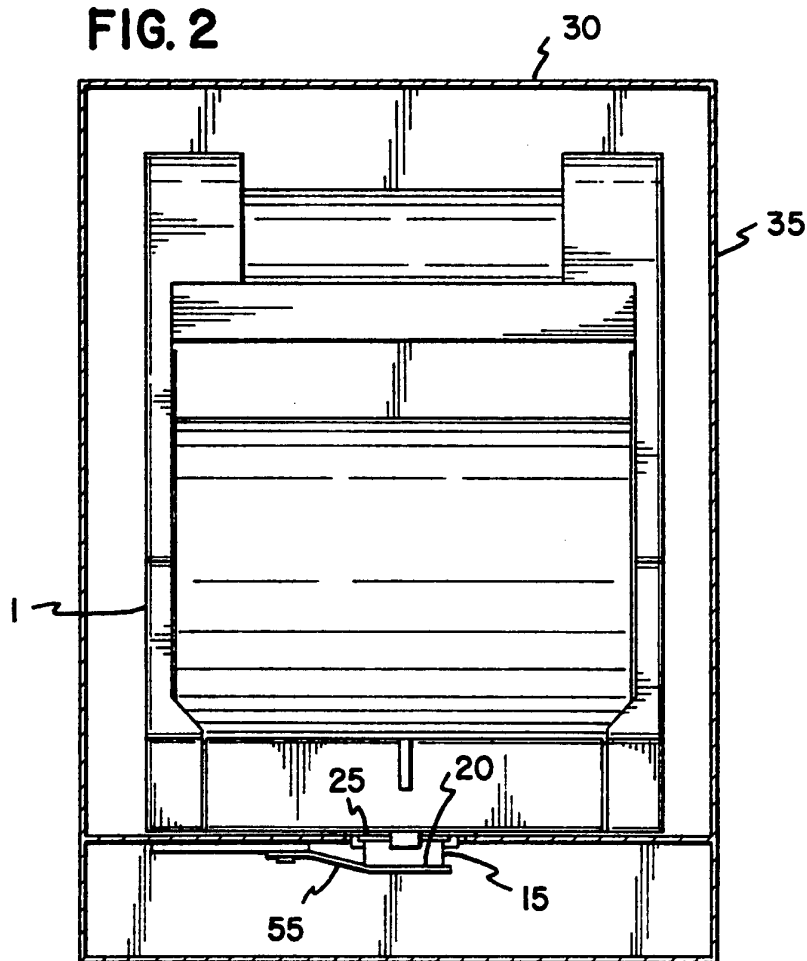


FIG. 3

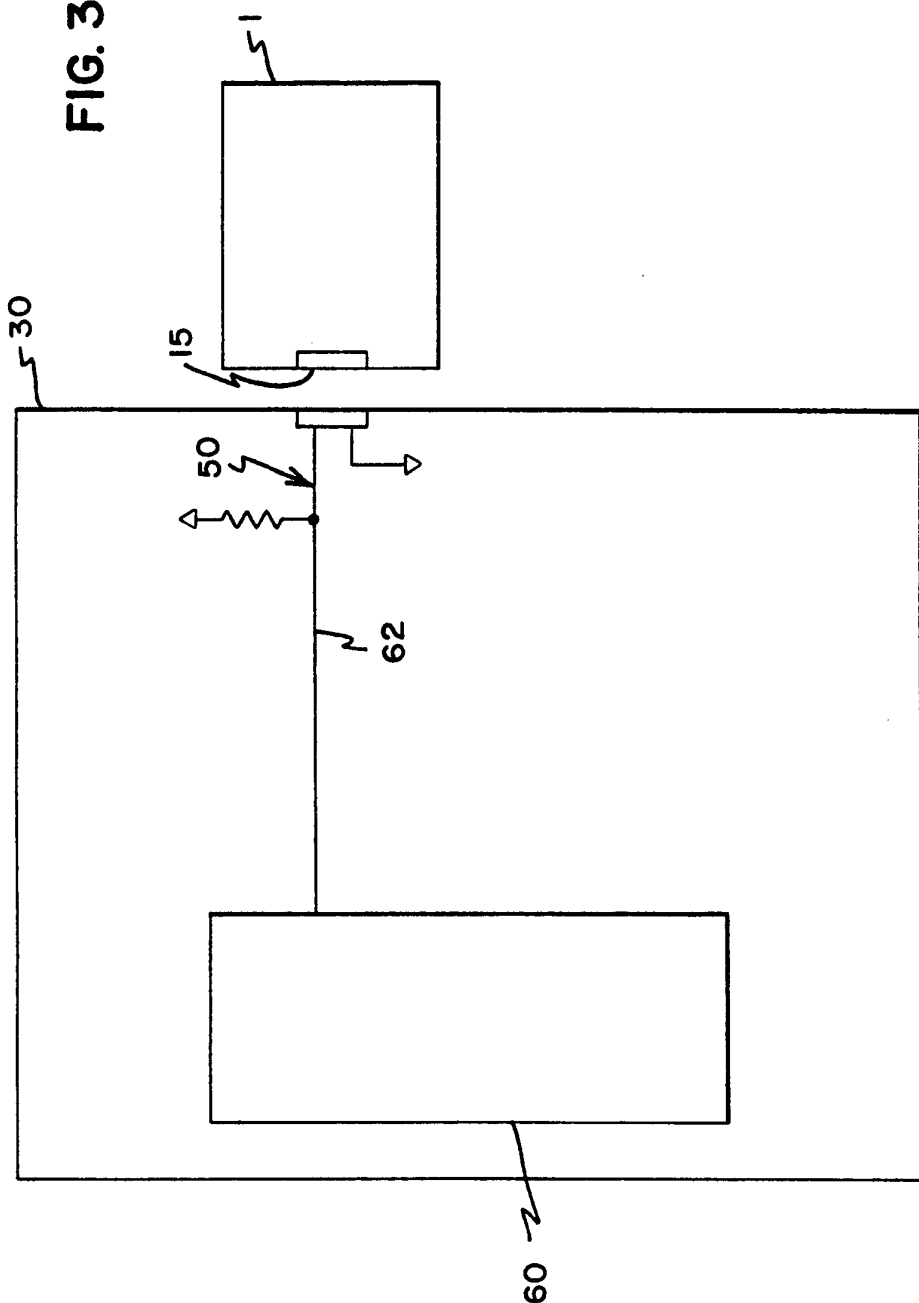


FIG. 4

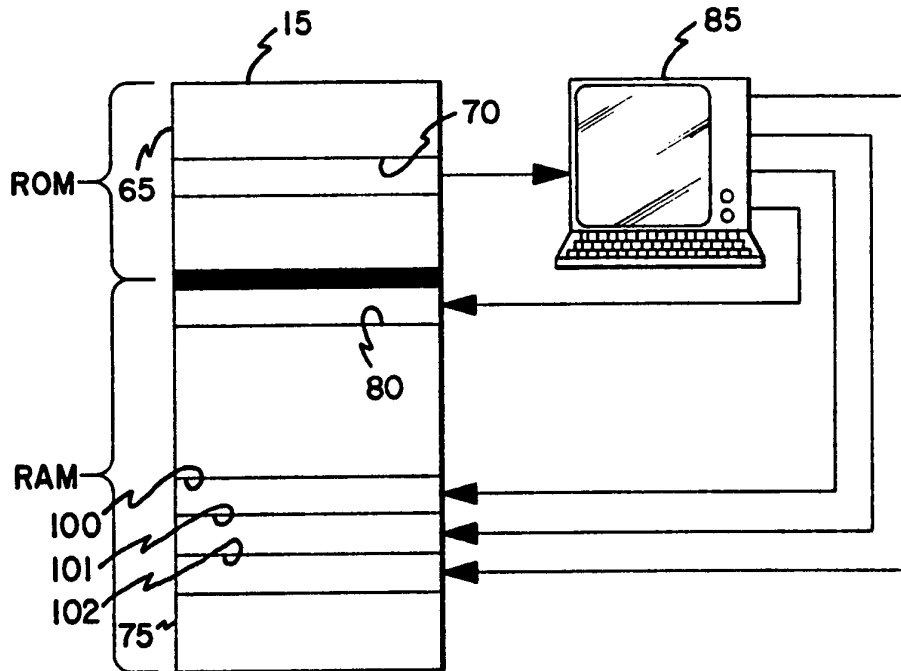
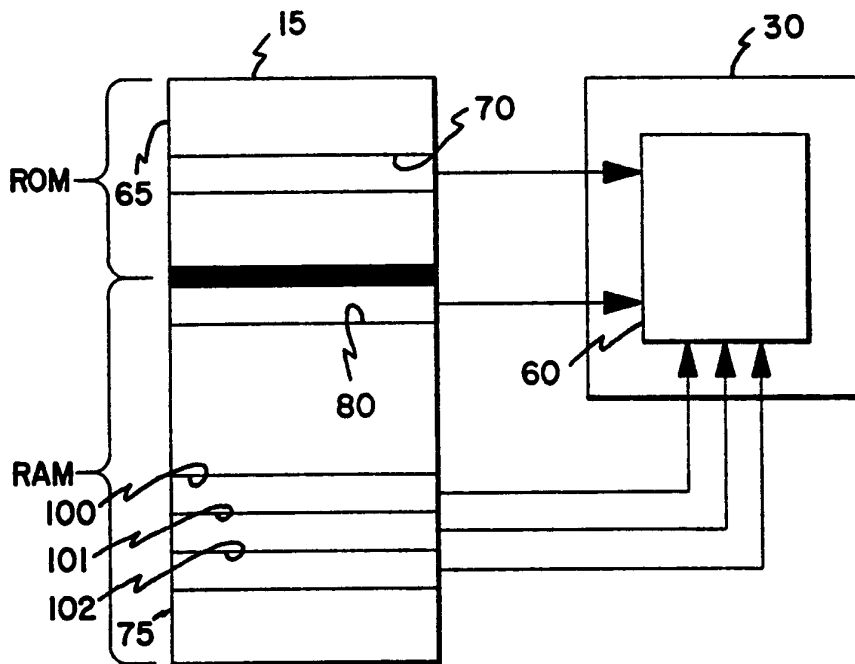


FIG. 5



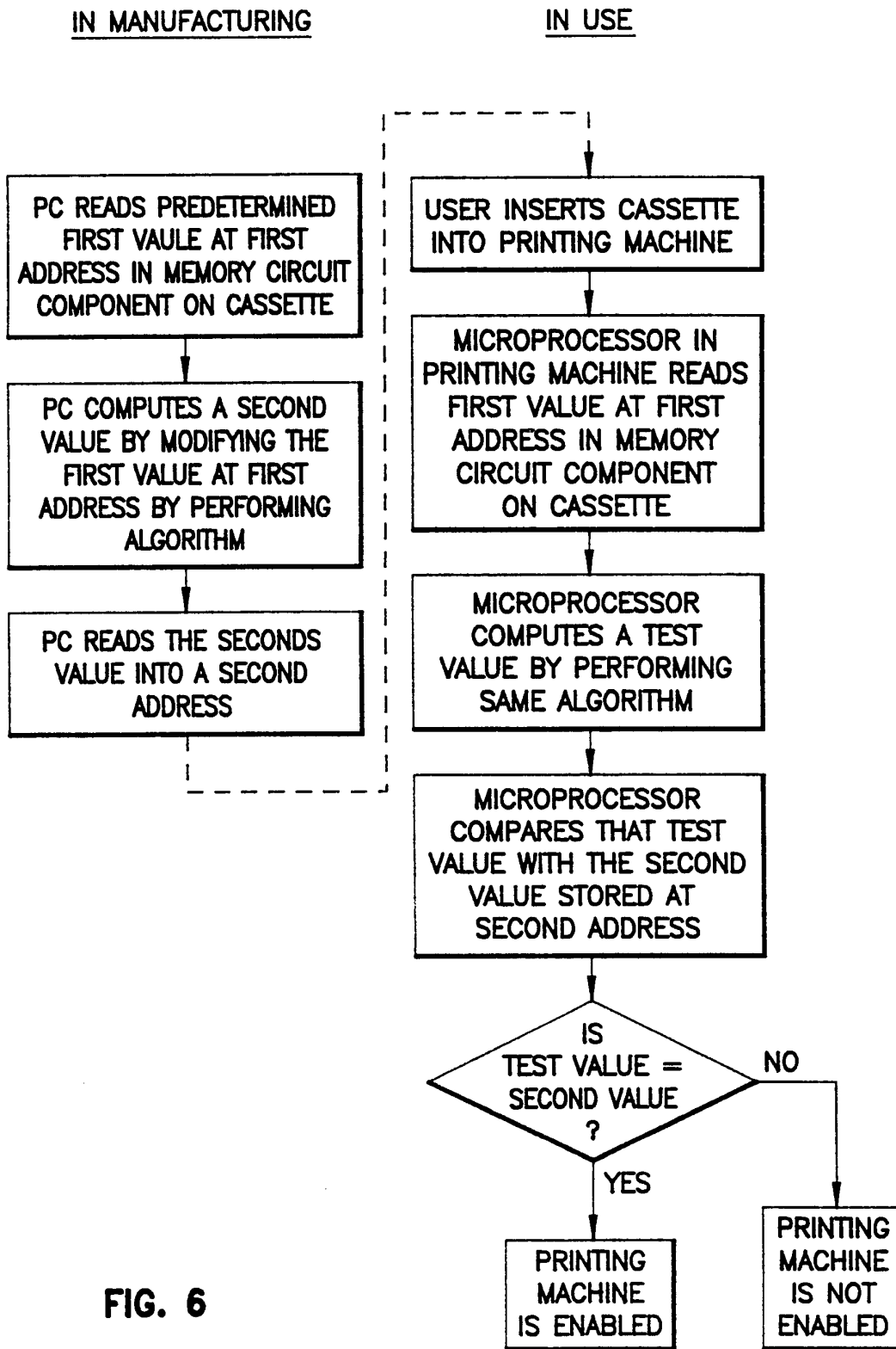


FIG. 6

## INTERNATIONAL SEARCH REPORT

 Internat: Application No  
 PCT/US 93/10561

 A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 5 B41J11/58 B41J17/36 B41J35/36

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

 Minimum documentation searched (classification system followed by classification symbols)  
 IPC 5 B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB,A,2 205 071 (TA TRIUMPH ADLER A.G.) 30 November 1988 see the whole document ---	1,4,5
A	WO,A,90 00974 (SIEMENS A.G.) 8 February 1990 see the whole document ---	1,4,5
A	US,A,5 078 523 (T.K. MCGOURTY) 7 January 1992 cited in the application see the whole document -----	1,4,5

 Further documents are listed in the continuation of box C.

 Patent family members are listed in annex.

## \* Special categories of cited documents :

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- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
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Date of the actual completion of the international search

27 January 1994

Date of mailing of the international search report

18.02.94

Name and mailing address of the ISA

 European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Van der Meerschaut, G

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal	Application No
PCT/US 93/10561	

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2205071	30-11-88	DE-C- 3718013 CH-A- 677464 JP-C- 1757140 JP-B- 4044914 JP-A- 63299968 US-A- 4797018	10-11-88 31-05-91 23-04-93 23-07-92 07-12-88 10-01-89
----- WO-A-9000974	08-02-90	EP-A, B 0433280	26-06-91
----- US-A-5078523	07-01-92	NONE	-----