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LONDON THE PATENT OFFICE

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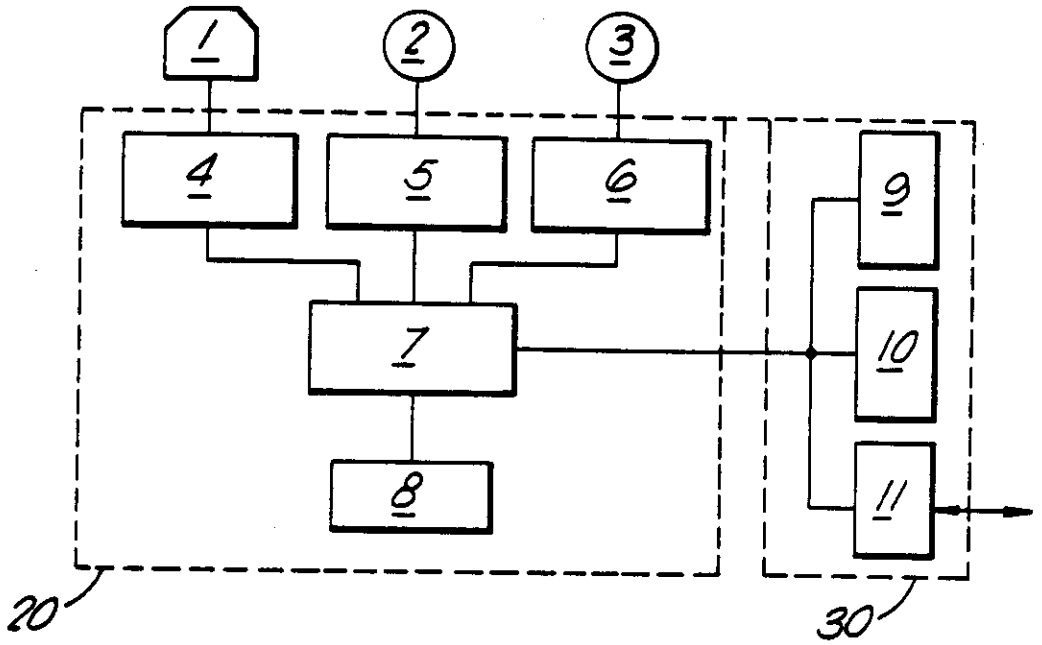
Fig.1.



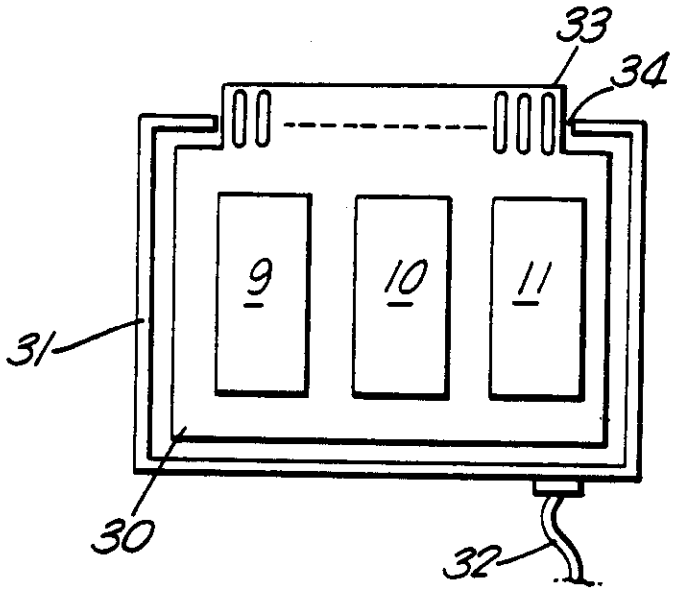
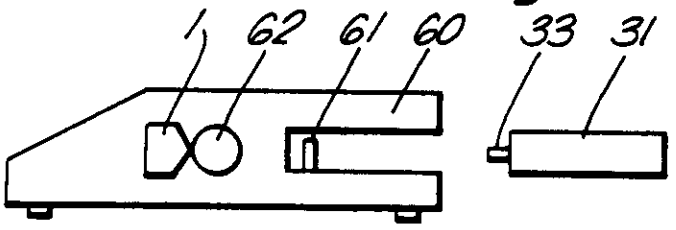


Fig.2.

Fig.3.



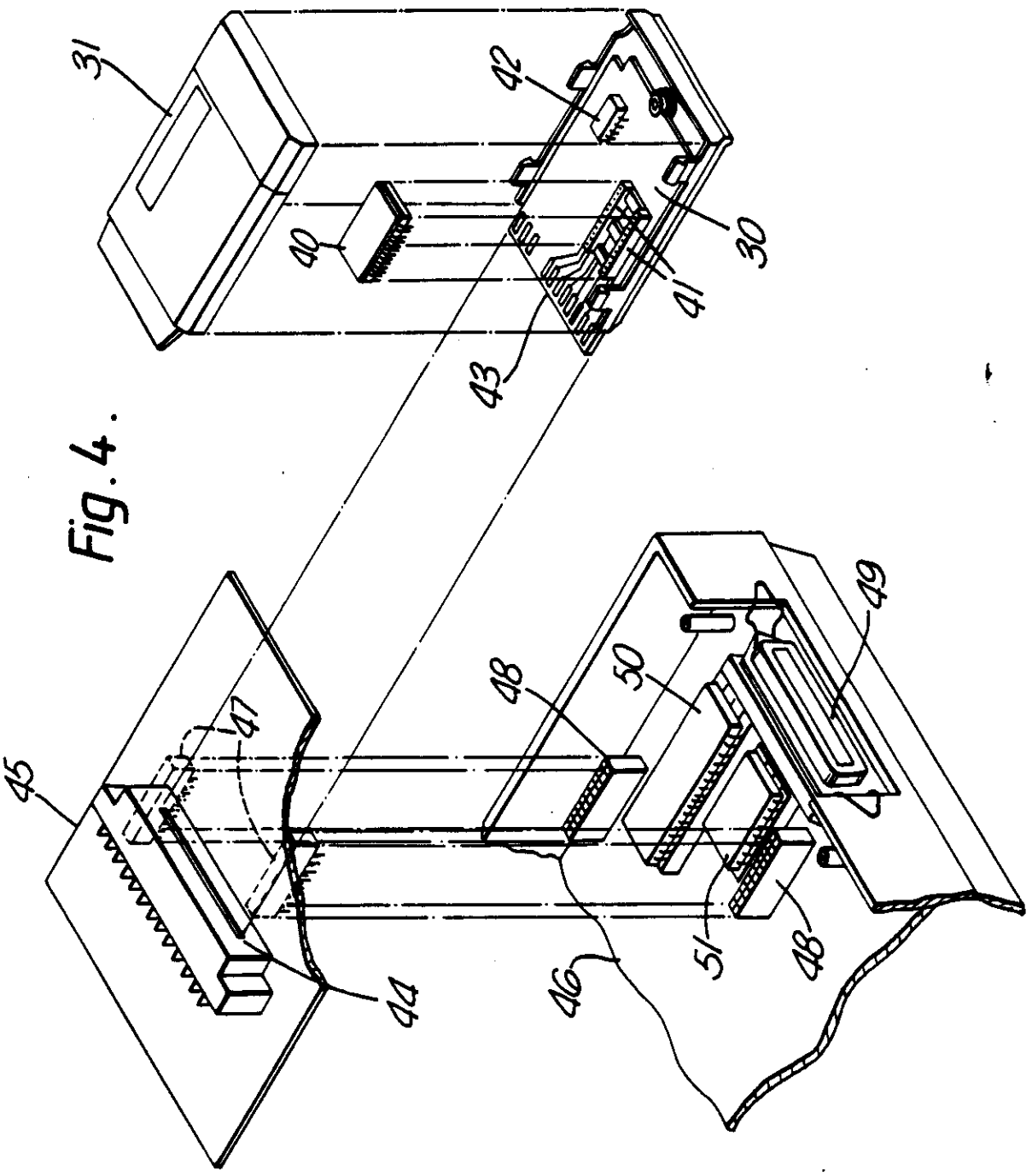


Fig. 4.

Fig . 5.

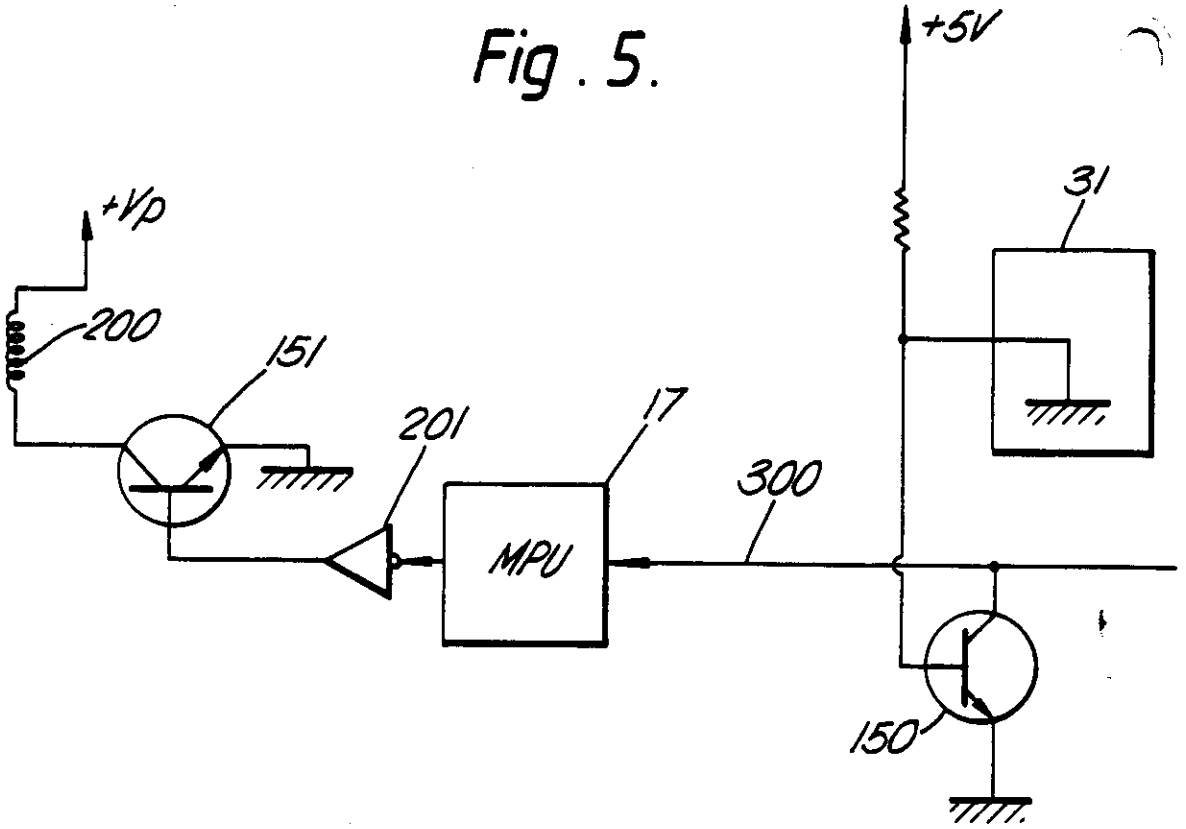


Fig . 7.

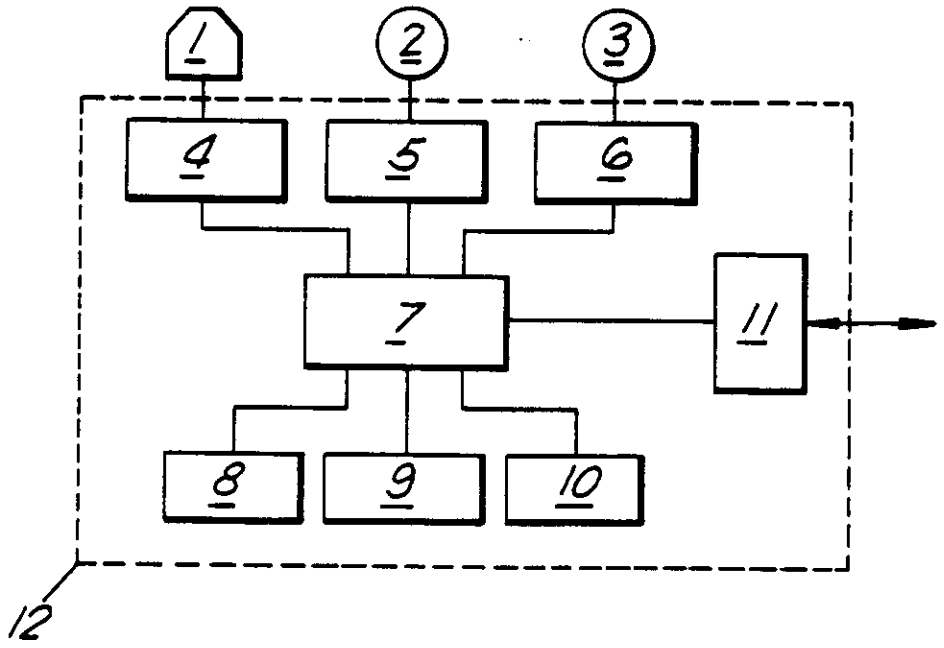
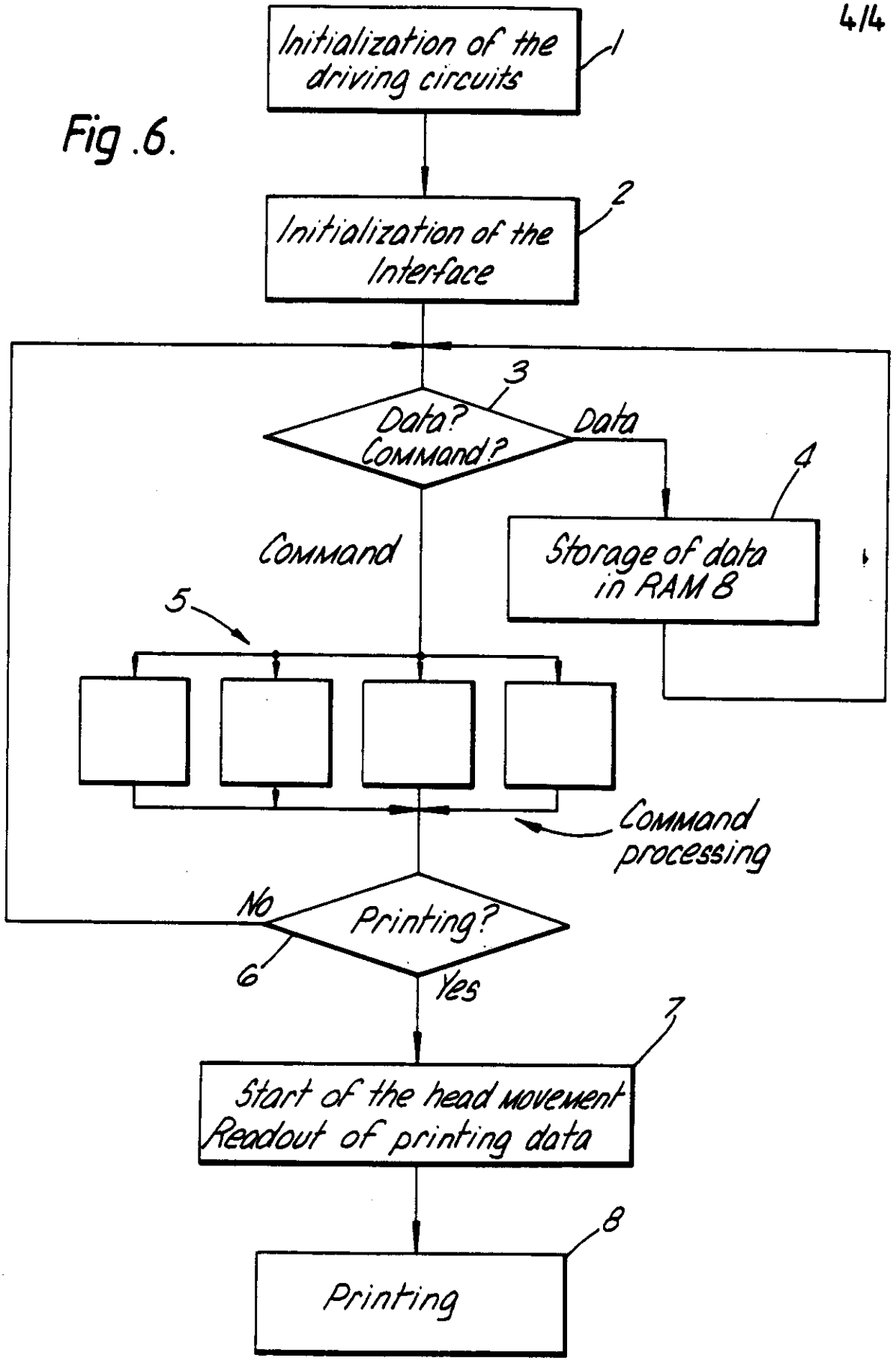


Fig .6.


Initialization of the driving circuits
1
Initialization of the Interface
2
Data? Command?
3
Data
Command
Storage of data in RAM 8
4
5
Command processing
No
Printing?
6
Yes
Start of the head movement Readout of printing data
7
Printing
8

PRINTER

This invention relates to printers.

As a result of the development of various types of computers, there are a variety of methods by which a printer is controlled by a host machine. They differ from one another in, for example, the style of characters, symbols or dot pattern, or the function of controlling the horizontal and vertical printing positions. It is necessary to change a control program in a printer in order to use it with a host machine designed for a different control method.

A conventional printer is shown in Figure 7 and comprises a printing head driving circuit 4 for driving a printing head 1, a carriage return motor driving circuit 5 for driving the carriage motor 2, a line feed motor driving circuit 6 for driving a line feed motor 3, a microprocessing unit 7 for controlling the printer as a whole, a random access memory (RAM) 8, a control read-only memory (ROM) 9 for storing instruction data for the microprocessing unit and controlling the printer, a character read-only memory (ROM) 10 for storing the printing characters and an interface 11 connected to a host machine. They are all mounted on one or more fixed bases 12. A change in these circuits requires a change in the base or bases. This is a large and expensive change. Moreover, the circuits are so complicated that it takes much time to explore a new program.

It has been necessary to employ different production lines for producing printers with different specifications. As a result, there may be production lines which are often out of operation. The difficulty resulting from the change of specifications has given rise to a great imbalance in stock. Printers of some specifications sell well and are in short supply while printers of other specifications are overstocked.

The present invention seeks to provide a printer whose specifications can be changed relatively easily.

According to one aspect of the present invention there is provided a printer comprising: a main body including a plurality of circuits for driving a printing head and motors, a microprocessing unit and a random access memory; a cartridge removably connected to said main body holding a memory circuit for controlling the printing operation and a memory circuit for storing a character font; and connecting means for connecting said cartridge to said main body.

Preferably the printer includes an interface held by said cartridge for connecting the printer to a host machine.

Said connecting means may comprise a set of male and female connectors provided on said cartridge and said main body.

According to a further aspect of the present invention there is provided a printer comprising: a printing head; a circuit for driving said printing head; a carriage motor; a circuit for driving said carriage motor; a line feed motor; a circuit for driving said line feed motor; a microprocessing unit connected to said circuits; a control read-only memory connected to said microprocessing unit for controlling the operation of said circuits; a character read-only memory connected to said miroprocessing unit for specifying a style of character; and a cartridge in which said control and character memories are provided, said cartridge being removable from a main body which comprises the printing head, carriage and line feed motors, the said circuits and the microprocessing unit.

Preferably the printing means includes a coil and the means for removably connecting the cartridge mechanically and electrically to the main body includes first circuit means in the cartridge and second circuit means in the main body of the printer for electrically coupling with the first circuit means when the cartridge is couple to the main body, and for preventing current from flowing through the coil when the cartridge is disconnected from the main body. The first circuit means may include a ground and a connector coupled to ground and said second circuit means includes switching means coupled to the connector of said first circuit means when the cartridge is connected to the main body and uncoupled from the first circuit means when the cartridge is removed from the main body, for providing an enabling or a disabling output and coil switch means for allowing current to flow through the coil when said

enabling output is produced and for preventing current from flowing in the coil when the disabling output is reduced.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a block diagram of one embodiment of a printer according to the present invention;

Figure 2 is a schematic view of a cartridge of the printer of Figure 1;

Figure 3 is an exploded view showing the cartridge of Figure 2 about to be connected to a main body of the printer;

Figure 4 is a perspective view showing another embodiment of a printer according to the present invention;

Figure 5 is a circuit diagram of the electrical connection between a cartridge and a main body of a printer according to the present invention;

Figure 6 is a flow chart outlining the operation of a printer according to the present invention; and

Figure 7 is a block diagram of a conventional printer.

Throughout the drawings like-parts have been designated by the same reference numerals.

Referring to Figure 1, one embodiment of a printer according to the present invention comprises a base 30 in a cartridge 31 (Figure 2) which is separate from a base 20 provided with the printing head driving circuit 4 for driving the printing head 1, the carriage return motor driving circuit 5 for driving the carriage motor 2, the line feed motor driving circuit 6 for driving the line feed motor 3, the microprocessing unit 7 and the RAM 8 and thereby defining a main body of the printer. The base 30 is provided with the control ROM 9 for storing the order by which the circuits 4 to 6 are controlled, the character ROM 10 for storing a variety of patterns of character styles and the interface 11 (such as, for example, RS232C), which is connected to a host machine by a plurality of lines 32 (Figure 2).

The control and character ROMs 9,10 may comprise either a single ROM or two different ones. If two separate ROMs are employed, it is sometimes necessary to provide a circuit for selecting a particular ROM. The character ROM 10 is not limited to a single character style, but may store a plurality of styles, such as Ming, Gothic and bold type. The interface 11 is not

limited to RS232C, but may be of any other specification, such as IEEE-488 or GP-IB. It is also possible to use a serial or parallel interface.

The base 30 has a connector 33 which connects it to a main body 60 (Figure 3) of the printer. The cartridge 31 has an opening 34 through which the connector 33 projects. The main body 60 has a cartridge support 61 adapted for receiving the cartridge 31 or a part thereof and engage in the connector 33 projecting from the base 30. Although Figure 3 shows the cartridge support 61 provided at the rear end of the main body 60 it may alternatively be provided at the front end, top or bottom thereof. Reference numeral 62 in Figure 3 denotes a platen.

Another embodiment of a printer according to the present invention is shown in Figure 4. A ROM 40 for storing both a control program and a character font is connected to the base 30 by an IC socket 41. The base 30 is also provided with an IC 42 for reading the ROM 40. The base 30 has a male connector 43 which is engageable in a female connector 44 on the main body of the printer to connect a cartridge 31 to the main body. The main body has an upper base 45 for supporting the cartridge 31 thereon and a lower base 46 provided below the base 45. The bases 45,46 are connected to each other by male and female connectors 47,48 extending therebetween and engaged with each other. The main body is also provided with a connector 49 for an

interface. Two ICs 50,51 are provided on the base 46.

In the printer of Figure 4, the interface is connected to the main body instead of being disposed in the cartridge 31 as in the embodiment illustrated in Figure 1. This arrangement gives the base 30 an unoccupied area in which a RAM can be provided additionally if required. This arrangement also contributes to reduction in the size of the cartridge 31 which would be considerably large if a parallel interface were provided therein instead of being connected to the main body.

Figure 5 shows a circuit for the electrical connection of the cartridge 31 to the main body of the printer. Before the cartridge 31 is connected to the main body, a transistor 150 is ON and a reset signal 300, which is pulled up, is low level. The reset signal 300 is transmitted to the microprocessing unit 7 whose output terminal is in its high level or high impedance position. In other words, the microprocessing unit 7 is in its reset position before the cartridge 31 is connected to the main body. If the cartridge 31 is connected to the main body, an electric current flows to ground through the cartridge 31. The transistor 150 is turned OFF and the reset signal 300 is high level. Accordingly, the microprocessing unit 7 is released from its reset position.

If the cartridge 31 is disconnected from the main body during a printing operation, i.e., when an electric current is being supplied to a coil 200 of the printing head, the reset signal 300

becomes low level and the output terminal of the microprocessing unit 7 is brought to its high level or high impedance position. Therefore, a signal from an inverter 201 fails to become low level and a transistor 151 is turned OFF. As a result, the supply of the electric current to the coil 200 is discontinued so that it may not overheat.

Reference is now made to the flow chart of Figure 6 showing the operation of a printer according to the present invention. If a power source for the printer is turned ON, the control ROM 9 in the cartridge is read by the microprocessing unit 7 and the printing head driving circuit 4, the carriage return motor driving circuit 5, the line feed motor driving circuit 6, the microprocessing unit 7 and the RAM 8 are initialised in accordance with the order stored in the control ROM 9 as shown at (1) in Figure 6. Then the interface is initialised, as shown at (2), to enable a host machine (not shown) to start the transmission of a command or printing data to the printer. The printer determines if the information transmitted from the host machine is data or a command as shown at (3). If it is in the form of data, it is stored in the RAM 8 as shown at (4) and returned to the processing at (3). If it is a command, it is processed accordingly and if it is a command for printing, the microprocessing unit 7 starts printing in accordance with the procedure stored in the control ROM 9, as shown at (5) to (7). More specifically, if the data to be printed is, for example, composed of characters,

a specified character pattern is read out of the character ROM 10 and the microprocessing unit 7 controls the carriage motor 2 to start moving the printing head 1. When the printing head 1 passes each specified position, the printing head driving circuit 4 causes the printing head 1 to effect printing as shown at (8).

These steps of operation are carried out in accordance with the order stored in the control ROM 9. The control ROM 9, the character ROM 10 and the interface 11 are all designed specifically to suit the host machine to which the printer is connected. A laser card, or a card punched by a laser, can be used for each of the ROMs 9, 10. A laser card can store a by far larger quantity of data than a semiconductor memory.

As described above, when the specifications of the printer is changed to suit the host computer to which the printer is to be connected, the main body of the printer according to the present invention is utilised without change with the exception of the cartridge. This enables a reduction in the cost of production and time required for development work. Furthermore, the necessary change in the specifications of a particular printer can be achieved by the use of different cartridges. Thus it is sufficient to employ a single production line for each type or model of printer irrespective of the differences in the specifications. The suppliers of printers can efficiently manufacture and keep in stock only the cartridges and printers

which sell well, and thereby eliminate or reduce any unnecessary stock of printers. The user can use the same printer with various kinds of host machines, it only being necessary to change the cartridge. Thus printers according to the present invention have a wide range of application.

CLAIMS

1. A printer comprising: a main body including a plurality of circuits for driving a printing head and motors, a microprocessing unit and a random access memory; a cartridge removably connected to said main body holding a memory circuit for controlling the printing operation and a memory circuit for storing a character font; and connecting means for connecting said cartridge to said main body.

2. A printer as claimed in claim 1 including an interface held by said cartridge for connecting the printer to a host machine.

3. A printer as claimed in claim 1 or 2 in which said connecting means comprises a set of male and female connectors provided on said cartridge and said main body.

4. A printer comprising: a printing head; a circuit for driving said printing head; a carriage motor; a circuit for driving said carriage motor; a line feed motor; a circuit for driving said line feed motor; a microprocessing unit connected to said circuits; a control read-only memory connected to said microprocessing unit for controlling the operation of said circuits; a character read-only memory connected to said microprocessing unit for specifying a style of character; and a cartridge in which said control and character memories are provided, said cartridge being removable from a main body which comprises the printing

head, carriage and line feed motors, the said circuits and the microprocessing unit.

5. A printer as claimed in claim 4 including an interface provided in said cartridge for connecting the printer to a host machine.

6. A printer as claimed in claim 1 or 4 in which the printing head includes a coil and the means for removably connecting the cartridge mechanically and electrically to the main body includes first circuit means in the cartridge and second circuit means in the main body of the printer for electrically coupling with the first circuit means when the cartridge is coupled to the main body, and for preventing current from flowing through the coil when the cartridge is disconnected from the main body.

7. A printer as claimed in claim 6 in which the first circuit means includes a ground and a connector coupled to ground and said second circuit means includes switching means, coupled to the connector of said first circuit means when the cartridge is connected to the main body and uncoupled from the first circuit means when the cartridge is removed form the main body, for providing an enabling or desabling output and coil switch means for allowing current to flow through the coil when said enabling output is produced and for preventing current from flowing in the coil when the disabling output is reduced.

8. A printer substantially as herein described with reference to and as shown in Figures 1 to 6 of the accompanying drawings.

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7th February 1989: KABUSHIKI KAISHA SUWA SEIKOSHA of 4-1 2-chome Nishishinjuku, Shinjuku-ku, Tokyo Japan Registered as sole proprietor by virtue of a merger dated 1st November 1985. JB 7/2/89

7th February 1989: KABUSHIKI KAISHA SUWA SEIKOSHA of 4-1 2-chome, Nishishinjuku Shinjuku-ku, Tokyo, Japan Registered as sole proprietor by virtue of a merger dated 1st November 1985 Certified copy filed on 2162964

SEE APPENDIX 27 page 27
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2161005 20/6/85 From: Kabushiki Kaisha Suwa Seikosha

7th February 1989: Notification of a change of name of KABUSHIKI KAISHA SUWA SEIKOSHA 4-1 2-chome, Nishishinjuku, Shinjuku-ku, Tokyo, Japan to SEIKO EPSON CORPORATION 4-1 2-chome, Nishishinjuku, Shinjuku-ku, Tokyo Japan Effective from 1st November 1985. Certified copy filed on 2162964

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RENEWAL DETAILS

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RENEWAL DATE 20·6

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