A thermal sensitive printing head for use with information storage and retrieval systems is provided. A thermal sensitive recording head including a base plate having a high resistance, and a plurality of exothermic elements disposed thereon are thermally activated by circuit elements coupled to the exothermic elements. The base plate is formed with certain properties whereby heat is accumulated to thereby raise the temperature of the exothermic elements so as to render same particularly suited for printing on a thermal sensitive recording medium in coordinate relationship therewith. The circuit means are further adapted to pulse the plurality of exothermic elements in a certain manner to improve the operation thereof.

11 Claims, 10 Drawing Figures
FIG. 1

[Diagram of a circuit with labeled components: SEGMENT DRIVER 4, DECODER 5, REGISTER 4-BIT 6, REGISTER 3-BIT 7, DIGIT DRIVER 3, COUNTER 9, MAIN REGISTER 8.]

FIG. 5

(a) 

(b) $T_S$

FIG. 6

(a) 

(b) $T_S$

(c) $T_S$

(d) $T_S$
\[ \lambda_1 > \lambda_2 > \lambda_3 \]

FIG. 7

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>THERMAL CONDUCTIVITY CAL/CM. SEC. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>BERYLLIA</td>
<td>0.24</td>
</tr>
<tr>
<td>ALUMINA ((\lambda_1))</td>
<td>0.05</td>
</tr>
<tr>
<td>STERTITE</td>
<td>0.006</td>
</tr>
<tr>
<td>MULLITE ((\lambda_2))</td>
<td>0.004</td>
</tr>
<tr>
<td>SILICON OXIDE</td>
<td>0.003</td>
</tr>
<tr>
<td>EPOXY ((\lambda_3))</td>
<td>0.0006</td>
</tr>
</tbody>
</table>

FIG. 8
THERMAL SENSITIVE PRINTING HEAD

BACKGROUND OF THE INVENTION

This invention relates generally to an improved thermal sensitive printing head for use with storage retrieval and processing apparatus, and in particular to a thermal sensitive printing head which is adapted to print numerals, letters, symbols, etc. on a thermal sensitive recording medium brought into contact therewith. Heretofore, information storage and retrieval devices such as calculators and computers have been provided with printers or methods of printing which have not been responsive to the speed with which the information is processed and read out. For example, in computers having periodically repeated read out and write in registers, the period of the registers are determined by the words stored therein. For electronic computers, the period corresponds to the bit, figure or period of one memory cycle which is read out or stored during an arithmetic operation. Generally a computer clock pulse operates anywhere from several times to a hundred times faster than the time which it takes to print such information. Although the computer has memory registers which are adapted to effect arithmetical operations and/or display operations, the prior art printers are not able to respond to such read out and write in times which the memory register is capable of achieving, which therefore makes it impossible to utilize the memory register signal as a drive signal for the printer.

It has thus become necessary to operate such computer printers by reading out and storing the contents for the memory register in a temporary register which is adapted to store such information until printing is completed. The contents of the secondary register are continuously read out until the printing cycle is completed or until a specific letter of the printer is selected. Thus a secondary register is required which increases the expense and complexity of the computer.

In order to overcome the necessity of providing a separate register, fluorescent displays have been used because the fluorescent tubes operate at speeds which are comparable to the computer clock cycle so that it is possible to read out contents of the register directly into the display device which is of the scanning type, the scanning cycle being of the same order as the time required for the arithmetic operation cycle. A corresponding direct reading has not been previously provided for printing heads.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, an exothermic printing head for use in information and retrieval devices is provided. The exothermic printing head is comprised of a high resistance base plate, a plurality of exothermic elements disposed thereon, and circuit means coupled to the plurality of exothermic elements to provide signals corresponding to the information to be printed thereby. The plate is heat accumulative so as to raise the temperature of the exothermic elements when signals having a particular pulse width and duty cycle are applied thereto, to effect improved exothermic operation thereof and render same adapted to print on a thermal sensitive medium.

Accordingly, it is an object of this invention to provide an improved exothermic printing head which is adapted for use in information storage and retrieval device such as a digital computer.

It is a further object of this invention to provide an improved exothermic printing head adapted for use in a simplified information and retrieval device.

It is another object of this invention to provide an inexpensive printer adapted to print the contents stored in a register as it is read therefrom.

It is still another object of this invention to provide an improved exothermic printing head which is capable of printing information at speeds comparable to the display of information by fluorescent display tubes for coordinate use therewith.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent form the specification.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a circuit diagram of a conventional fluorescent display tube driving circuit;

FIG. 2 is a conventional thermal sensitive recording head drive constructed in accordance with the prior art;

FIG. 3 is a circuit diagram of a prior art thermal sensitive printing head driving circuit;

FIG. 4 is still another circuit diagram of a prior art thermal sensitive recording head;

FIG. 5 illustrates the comparisons of the thermal sensitive characteristics of a prior art recording head in relation to a time pulse of a specific duration and amplitude.

FIG. 6 is a graphical representation of the external state of the three thermal sensitive heads each having a base plate of a particular thermal conductivity and having pulses applied thereto;

FIG. 7 is a graph depicting the relation between pulse width and voltage of signals applied to base plates having different thermal conductivities;

FIG. 8 is a chart of the conductivity of high resistance materials;

FIG. 9 is a circuit diagram of a segmented thermal sensitive recording head driving circuit constructed in accordance with the instant invention; and

FIG. 10 is a perspective view of a dot matrix-type thermal sensitive head utilizing a base plate of low thermal conductivity and high resistance and being adapted to be driven by the circuit depicted in FIG. 9.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to FIG. 1, a mosaic type fluorescent tube driving circuit especially suitable for a miniature calculator is depicted. The miniature calculator includes a main register 8 which is adapted to supply serial information contained thereby. A three bit register 7 is adapted to receive bit serial signals from the main register 8 and supply parallel signals to a four bit register 6. A decoder circuit 5 receives the parallel information signals from the four bit register which corresponds to a single digit (four bits) and supplies segmented information to segment driver circuit 4. Segment driver circuit 4 includes 8 outputs corresponding...
to the eight segments of the mosaic type fluorescent segmented tube used as a display of digits and a decimal point in such a miniature calculator. Corresponding segments of each digit are connected together. A second output from the main register is applied to a digit counter which in turn is applied to digit driver 3 for indexing same. Each of the digits of the mosaic type fluorescent tube, have a common electrode 2 coupled to digit driver 3 and energized thereby.

In operation, when the bit serial signal representative of the state of a particular digit is read out from a main register it is formed into a four bit parallel signal by the register 6 which is supplied to decoder 5 wherein the signals are decoded into segmented information to drive segments 1. Only the digit energized by digit driver 3 in response to the signal from counter 9 is lit. The signals applied to counter 9 and three bit registers 7 are synchronized. Because a fluorescent tube can be lighted in the same time cycle as a computer signal, an eight bit register is adapted to directly drive such a system in real time. The method of indexing or scanning such a fluorescent tube display although compatible with the time cycles of a calculator, have heretofore been found unacceptable for use in printing devices.

Reference is now made to FIG. 2 wherein a thermal sensitive head constructed in accordance with the prior art is depicted. A base plate 10 is formed of a high resistance material such as alumina. A plurality of exothermic elements 11 form segmented information displays such as the well known seven bar display of digits with an additional element representing a decimal point. Electric conductors 12 are common to each figure and a second electric conductor 13 is coupled to each exothermic element which defines the segment. Thus for the eight segment configuration (seven bar configuration plus decimal point) it is necessary to provide eight conductors for a single digit. In order to effect thermal recording, a recording paper (not shown), which is thermally responsive to the exothermic elements at certain temperatures, is fed at right angles to the exothermic segmented elements which are organized in a line to effect a line printer. By colorization of the selected segments, numerals, letter or symbols are printed on the thermally sensitive recording medium which is discolored by the exothermic element. As depicted in FIG. 5, successive short electric pulses are applied to the exothermic elements 11, the exothermic characteristic thereof being shown in FIG. 5, waveform b.

Specific reference is made to FIG. 5, waveform a wherein $t_{p-1}$ is the pulse width of the signal applied to such segmented exothermic elements, such signal having a duration of between 5 to 15 milliseconds, and an applied voltage of 20 to 60 volts. As depicted in FIG. 5, waveform b $T_p$ is the temperature at which thermal sensitive paper becomes responsive to the thermal heat radiated by a thermal element and is thereby discolored. For the operating ranges hereinabove noted, such a color revealing temperature would be about 130°. The condition at which heat is generated is balanced between the heating and radiation properties of the plate. The heat radiation at the printing head is supposed to be achieved through the coordinate relations of the base plate, the electric conductor, and the heat sensitive recording paper. However, in view of the thermal conductivity of the base plate and contact thereof with the exothermic elements, the material and manner in which the base plate is formed takes on additional significance. Thus, the base plate should have a high thermal conductivity $\lambda$, as shown in FIG. 5, rapidly radiating heat upon the termination of the applied pulses so that the base plate can be used again for printing. As hereinabove noted, such thermal sensitive heads using alumina have been utilized in driving circuits of the type depicted in FIGS. 3 and 4 to achieve an indirect dynamic printer.

The prior art driving circuit of FIG. 3 includes a thermal sensitive head 14 which is similar to the one depicted in FIG. 2 and includes separate segmented exothermic elements disposed on the base plate and a common electric conductor 15 for each digit. A flip-flop 16 is coupled to the common digit conductor and sets the printing time thereof. Segment decoders 18 are coupled to the main computer register 19 and receive parallel signals therefrom and supply same to segment drivers 17 which in turn apply the parallel signals to the segmented exothermic elements. In accordance with this driving circuit, the common conductor for each digit is connected together, and parallel signals are received in the main memory register 19 having a pulse width of $t_{p-1}$, the current being applied to all digits simultaneously to thereby energize the resistive exothermic elements from the base plate. As is appreciated, such a circuit would be extremely complicated, very costly and would be less than completely satisfactory.

In particular, to appreciate the disadvantages of such a circuit, reference is made to FIG. 6, waveform a in which the applied voltage $V$ and the pulse width $t_{p-2}$ and the period $t_3$ corresponding to one memory cycle are depicted. In accordance with the instant invention, experiments wherein the applied voltage is fixed at 30 volts, the pulse width $t_{p-2}$ at 100 microseconds and a duty cycle at $t_{p-2}/t_3$ or 1/16th were selected, such parameters being particularly suitable for digital computers. FIG. 6, waveforms b, c, and d depict the exothermic state of each thermally sensitive head due to the application of the pulses depicted in FIG. 6, waveform a when the thermal conductivity $\lambda$ of the base plate was changed ($\lambda_1 > \lambda_2 > \lambda_3$). $T_s$ represents the color revealing temperature of thermal sensitive paper.

First, electric pulses were applied to a thermal sensitive head having a base plate with conductivity $\lambda_1$ as depicted in FIG. 6, waveform b which corresponds in every other respect to the thermal sensitive head depicted in FIG. 2. As is appreciated by the illustration of FIG. 6, waveform b the prior art head utilizing alumina did not produce any color (discoloration) on the thermal sensitive paper and therefore printing thereof at the input parameters used was unobtainable. The resulting failure occurred because the heat generated by the intermittent periodical pulses would be immediately conducted into the base plate and would not accumulate to a value which equals the color revealing temperature $T_s$ of the thermally sensitive paper. Thus, because of the intermittent pulsing of the exothermic elements into an exothermic state, the thermal conductivity $\lambda_1$ was too high to affect a printing when pulses on the order of those selected were applied.

Second, the electric pulses of FIG. 6, waveform a were applied to a thermal sensitive printing head having a base plate of a thermal conductivity $\lambda_2$ ($\lambda_2 < \lambda_1$) and the head having such a base plate printed on the thermal sensitive paper. However, it was further noted that in order to achieve such printing, utilizing base plates having a conductivity $\lambda_2$, in the circuit depicted
in FIG. 3, would require decoders having the same number of digit and segment drivers namely, eight segments times the number of digits and a separate flip-flop to obtain a pulse width of \( t_{f-1} \) which is different than the pulse width of the digits of the main memory register 19, thus increasing the expense of such a circuit.

Another driving circuit known in prior art is depicted in FIG. 4 and includes the thermal sensitive head depicted in FIG. 2. The circuit depicted therein includes a main memory register 28 and a main memory register counter 29 corresponding thereto. A digit comparator 30 is coupled to the output of the main memory counter 29 and is further coupled to a gate circuit 27 for comparing the signals therein and applying same to the digit driver 22. Digit driver 22 is coupled to digit counter 23 to receive signals therefrom and to apply signals to a flip-flop 32 which is coupled to digit counter 23 and is activated by an external signal applied thereto. The flip-flop 32 is further coupled along with the main memory register 28 through an AND gate 31 to the gate circuit 27. Gate circuit 27 applies the signals applied thereto from the main memory register to the decoder memory 26 upon actuation from the flip-flop 32. The decoder memory supplies signals to the segment decoder 25 and the segment driver 24 in order to drive the thermal sensitive head 20. Similarly a digit counter 23 receives a signal from the flip-flop 32 which is set by the printing command and reset at the finish of the processing of a first digit contained in the memory. Digit counter 23 has a period corresponding to pulse width \( t_{f-1} \) and a period different from that of counter 29 of the main memory register 28. The coincident figure read from the main register 28 by the comparator 30 is stored in the decoder memory 26 and printed during pulse width \( t_{f-1} \), the coincident figure being read successively by the comparator 30 and when the signals stored in the memory corresponding to one digit are finished the digit is reset. Thus, it is appreciated that the printing time for printing each digit is \( t_{f-1} \) times the number of digits. Although the driving circuit is far simpler than that depicted in FIG. 3, the circuit structure is considerably complicated since the period of the digit counter 23 is different from the period for which it takes to achieve an arithmetic operation and thus requires synchronization between them.

It is noted, that the prior art dynamically driven thermal sensitive recording heads utilized in thermal sensitive printing wherein numerals, letters and symbols, etc. are to be printed, can therefore be directly formed at the same speed as the driving apparatus utilized in fluorescent devices such as the one depicted in FIG. 1 by using a plural period read-out signal from the memory register to generate periodic read-out and write in signals. Accordingly the instant invention eliminates the defects of the indirect printing circuits depicted in FIGS. 3 and 4.

A thermal sensitive printing head constructed in accordance with this invention has a base plate of less thermal conductivity than the high resistance base plates of the prior art printing heads depicted in FIG. 2 so that such a printing head can be energized by a resulting thermal accumulation on the base plate. As illustrated in FIG. 5, the heat generating stage of such a base plate is a balanced state between heating and radiation. By way of example, experiments have revealed that three thermal sensitive heads having high resistance base plates but different thermal conductivities respectively demonstrate remarkable differences in effecting a printing condition when the electric pulses of the same amplitude and duration are applied thereto. Thus for certain conductivities, thermally sensitive recording paper became sensitive to and printable thereupon within a time period \( t_{f-1} \). This phenomenon occurs because heat radiation in the base plate having a thermal conductivity \( \lambda_1 \) is suppressed, but the heat generated by the periodical pulses applied to a base plate having a thermal conductivity of \( \lambda_2 \) would be gradually accumulated by an incremental rising of the temperature up to the color revealing temperatures of the thermally sensitive mediums, the heat becoming saturated thereafter to thereby render printing possible, as depicted in FIG. 6.

In the third test, the electric pulses depicted in FIG. 6, waveform \( a \) were applied to a thermally sensitive head having a base plate with a thermal conductivity \( \lambda_3 \) \( (\lambda_3 < \lambda_2) \). It was found that it was possible to print in a shorter time than in the case of \( \lambda_2 \) base plate because the heat radiation would be accumulated to a greater degree than in the case of base plate having a thermal conductivity \( \lambda_2 \). In such a case the heat would be sufficiently and effectively accumulated to thereby cause an increasing temperature gradient, the temperature rising to a color revealing temperature faster than in the case of FIG. 6, waveform \( c \) because the heat becomes saturated much sooner.

Referring now to FIG. 7 there is shown the relation between the voltage applied to a thermal sensitive printing head to a color revealing temperature \( T_2 \) wherein the duty cycle is constant \( \frac{t_f}{2 \pi} \) and maintained at a value of less than \( \frac{1}{4} \). The duty cycle can be even be maintained at values less than 1/10, the thermal conductivities, 1, 2 and 3, being the only variable parameters. It is clear from the data in FIG. 7 that the wider the pulse \( t_f \), the lower the applied voltage is and in the case where the pulse width is a constant, the higher the thermal conductivity of the base plate material the higher the applied voltage thereof. In making reference to FIG. 2, each exothermic segment is arranged in proximity to the others to form an arbitrary figure. On a prior art base plate having high thermal conductivity, the heat conducted from the selected segment warms up the adjacent segments which were otherwise not energized, and causes a lack of sharpness in the printed letters and thus a less than completely satisfactory printing condition. Thus, a base plate having a low thermal conductivity and heat accumulative characteristic constructed in accordance with the instant invention, cools slowly after pulses are applied thereto which is the opposite of base plates formed from materials having a high thermal conductivity. Accordingly, it is inevitable that the printing time will be somewhat increased.

The thermal conductivity of respective materials is shown in FIG. 8 and includes \( \lambda_1, \lambda_2 \) and \( \lambda_3 \) and their characteristics shown in FIG. 6. It is appreciated, that \( \lambda_1 \) is alumina, \( \lambda_2 \) is mullite, and \( \lambda_3 \) is epoxy resins and that the thermal conductivities thereof are reduced from \( \lambda_1 \) to \( \lambda_3 \). Thus, the thermally sensitive head consisting of a material having a thermal conductivity \( \lambda_3 \) can reduce the printing time and would appear to be an ideal material. Nevertheless, when considerations of mechanical strength and the facility with which such materials can be manufactured, a material having a
thermal conductivity in the range of $\lambda_2$ such as mullite is more appropriate for the base plate material of a dynamic thermally sensitive printing head having drive signals applied thereto. The qualities which are desired in the base plate can also be effectively gained by the use of an epoxy resin. Moreover, even if a high thermal conductivity material were utilized for the base plate, if the base plate were thinned it would reduce the heat radiation in the vicinity of the exothermic elements and the invention could be practiced thereby. However, such thinning of the base plate suffers from disadvantages in that such a thinned base plate could become bent or warped during manufacturing of the printing head.

Reference is now made to FIG. 9 wherein a block diagram of a dynamic driving thermal sensitive head driving circuit for use in driving the thermal sensitive head of the instant invention is disclosed. The thermal sensitive head includes a base plate constructed in the manner of base plate of FIG. 2 but having a lower thermal conductivity segmented exothermic elements 33 defining a plurality of digits and a conductor 34 common to and coupled to each of the exothermic elements of each digit. The common electric conductors 34 receive signals from the main memory register 38 which are counted by digit counter 39 and supplied to digit driver 35 which supplies the energization signals to the common conductors. The main memory register 38 further supplies input information through AND gate 41 to the segment decoder 37 which is coupled through a segment driver to the segmented exothermic elements 33 in the manner hereinabove described corresponding elements of each digit being coupled together. A one shot flip-flop 40 is set by the printing command of the computer or calculator and the output thereof is applied to the AND circuit to gate the input of the main memory register 38 to the segment decoder 37. When the printing command actuates the flip-flop 40 a signal having a pulse width and duration depicted in FIG. 4a is generated by the segment driver 36 for each memory cycle, and current is applied to common electric conductor 34 of each digit which is necessarily actuated during that period of the arithmetic operation, thereby heating exothermic elements and thereby allowing heat to be accumulated during each memory cycle. After several cycles are over, but during the printing time fixed by the flip-flop, the heating and radiation characteristics of the thermal sensitive head becomes balanced in a saturation state and the thermally sensitive paper can be printed. Because the period of the arithmetic operation is utilized for the printing period, synchronization disadvantages such as those which occur in the prior art thermal sensitive printing heads illustrated in FIG. 4 are thereby overcome. Accordingly, by utilizing a thermally sensitive head constructed in accordance with the instant invention, the figure counter 23, the decoder memory 26, gate circuit 27, and comparator 30 of the prior art circuits are rendered unnecessary in the novel and simplified printing head and circuit therefor, depicted in FIG. 9.

Referring now to FIG. 10, it is seen that a thermal printing head constructed in accordance with the instant invention can be effectively utilized in a dot matrix type printer for printing numerals, letters, symbols, etc. by utilizing matrix principles. Thus, a base plate 42 having low thermal conductivity and high resistance has plural exothermic elements 43 arranged on the base plate in a corresponding manner. Also disposed thereon is a common electric conductor 44 which is common to all the digits and connected to five terminal elements which are equivalent to a single digit, and line supply conductors 45 opposite to the common digit conductor and connected to each exothermic element therebetween. A driving circuit therefor would be similar to that depicted in FIG. 9. For example, a five times seven matrix requires seven times the line driver switching circuit at each matrix line and renders such a circuit structure somewhat more complicated than the driving circuit depicted in FIG. 9.

The foregoing has been directed to base plates and the thermal conductivity thereof. However, the heat accumulative effect which is desired to be obtained by the instant invention is also achieved by forming the base plate with convex and concave surfaces and disposing the exothermic elements on the convex portions. The convex portion is effective in reducing the heat radiation. Further, by reducing the heat radiation through the electric conductors connected to the segmented exothermic elements on a high thermal conductivity base plate, the width of the conductor can be reduced as long as it is not to such a degree as to affect the resistance of the exothermic elements, it being desirable that a high ratio of the resistance of the exothermic elements to the resistance of the conductors be maintained. By including this modification of the base plate, the heat accumulative effect is thereby achieved.

It is further noted that in the aforementioned thermally sensitive printing head utilizing low thermal conductivity base plates, the heat accumulative effect of the invention is able to raise the temperature even further by reducing the width of the conductors. Furthermore, control systems which were previously adapted for LSI or CRT electronic displays for computers, can now be used in printers utilizing the thermal sensitive printing head of the instant invention as well as providing computers with both fluorescent display tubes and printers, to give the computer a dual capability.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. An exothermic printing head adapted to print on a thermally sensitive recording element, comprising a base plate formed from electrically high-resistance material, a plurality of exothermic elements disposed thereon, and circuit means coupled to said elements to apply pulse signals thereto corresponding to information to be printed the pulse width of each said pulse being insufficient to heat said exothermic elements to print on said heat sensitive medium, said base plate having a thermal conductivity less than 0.006 cal/cm .sec.·C and being adapted in response to the application of at least two pulses to said exothermic elements
3,913,091

to accumulate sufficient heat to effect printing by said exothermic elements on a thermally sensitive recording element.

2. An exothermic printing head as claimed in claim 1, wherein said base plate is formed from a member of the group consisting of mullite, silicon oxide and epoxy resins.

3. A thermally sensitive printing head as claimed in claim 2, wherein said base plate is formed from mullite.

4. A thermally sensitive printing head as claimed in claim 1, wherein said base plate is formed of a thickness selected to render the thermal conductivity thereof below 0.006 cal/cm. sec.°C.

5. An exothermic printing head as claimed in claim 1 wherein said plurality of pulses applied by said circuit means have a 1 millisecond pulse width and a duty cycle less than one-half in order to print the information corresponding thereto.

6. An exothermic printing head as claimed in claim 5, wherein the exothermic elements form a segmented digit which is adapted to print a letter, numeral, signal or the like.

7. An exothermic printing head as claimed in claim 5, wherein the duty cycle is less than 1/10.

8. A thermally sensitive printing head as claimed in claim 7, wherein said printing heads are coupled through said circuit means to the main register of a computer to thereby render same capable of printing the contents stored therein.

9. An exothermic printing head as claimed in claim 8, wherein the circuit means includes a segment driver disposed so as to receive signals from the main register and apply same to the segmented exothermic elements, and digit driver means for receiving signals from the main register for selecting the digits to be printed.

10. An exothermic printing head as claimed in claim 9, including a flip-flop and a logic gate adapted to control the information supplied from the main register to the printing head during a single cycle of the main memory register.

11. An exothermic printing head as claimed in claim 6, wherein the base plate is formed with concave and convex portions, the exothermic elements being disposed on the convex portions thereof.

* * * * *