ABSTRACT: This invention relates to a high-speed printer to be used for output of data transmissions. The printing mechanism of this invention employs a high-speed print system and a plurality of print heads arranged in parallel, whereby mechanical-type selecting operation can be simplified. Further, the invention also employs a novel controlling circuit which is adapted to read out respective data to be printed from a memory device in correspondence with the mechanical operations. And further, the present printer provides a novel line feed mechanism and spacing mechanism.
Fig. 3C

<table>
<thead>
<tr>
<th>1 2 3 4</th>
<th>5 6 7 8 9</th>
<th>10 11 12 13 14 15 16 17 18 19 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td>A B C</td>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td>A B C D E F G H</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

1ST LINE PRINTING COMPLETION

2ND LINE PRINTING COMPLETION

PRINTING PATTERN AT EACH SPACING POSITION

CAM FOLLOWER POSITION

RIGHTWARD SPACING

RIGHTWARD SPACING POSITIONS

PRINTING PITCH

SPACING POSITIONS

SPACING CAM DEVELOPMENT

LEFTWARD SPACING

LEFTWARD SPACING POSITIONS
Fig. 4

(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

(g) 

(h) NORMAL REVERSE

(i) 1 2 3 m-1 m m-1 m

(j)
Fig. 6
HIGH-SPEED PRINTER EMPLOYING PLURAL PRINT HEADS AND PAPER FEED EXPEDIENTS

This invention relates to a high-speed printer and, more particularly, to an improvement in such printers employing a high-speed print mechanism that is used as the output device in data communication systems and the like.

In conventional line printers using high-speed print mechanisms, there have been provided print magnets and print hammers corresponding in location and number to all of printing positions of a printed line. Since the printers further require driver circuits for operating the print magnets, the devices have necessarily become very large and expensive specifically in cases where a large number of printing characters are to be printed in a print line.

The conventional mechanical printers used as the terminal equipment in data transmissions have progressed so that the printing of a print line is carried out by printing separately each character in sequential order. Thus, it has been required to employ very complicated mechanisms for selecting each particular character and, further, it has been difficult to increase printing speed, while keeping the equipment small and economical.

The present invention solves these various problems present in conventional printers and mechanical printers as mentioned above.

A principal object of the present invention is, therefore, to provide a novel printing device for high-speed and stable operation which is adaptable to any desired communication speed.

Another object of the present invention is to provide a high-speed printer which is adapted to provide a high printing speed by way of simplifying the printing character selection mechanism in combination with a high-speed print system, and employing a print mechanism having plural print hammers. Accordingly, the present invention provides a printer which omits such mechanical operation from the device as carriage return operation and also can complete the printing of each line of print with a simple spacing operation carried out at every single lateral spacing and repeated a few number of times than in conventional printers.

Other objects and advantages of the present invention will become apparent upon reading the following descriptions set forth in detail with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic view showing the structure and operational principle of the mechanism according to the present invention.

FIG. 2 is a fragmentary view showing the structure of printing head employed in the mechanism of FIG. 1.

FIG. 3A is a perspective view partially cut away of the mechanism embodying the present invention.

FIG. 3B is a perspective view partially cut away showing a paper spacing mechanism embodying the present invention.

FIG. 3C is a diagram for explaining the spacing position and printing order on the printing paper according to the present invention.

FIGS. 4(a) through 4(j) show operational time charts for explaining the time relation of the printing to the spacing in the embodiment of the present invention.

FIG. 5 is a block diagram showing the arrangement of a printing control circuit for carrying out the invention.

FIG. 6 is a block diagram of an address instructing circuit for explaining the write-in address and readout of line memory in which printing data for each line are stored.

While the present invention will be explained with reference to a preferred embodiment illustrated, it should be understood that the invention is not intended to be limited to the particular embodiment but, rather, to cover all of various alterations, modifications and equivalent arrangements to be included in the spirit and scope of the appended claims.

FIG. 1 is a diagrammatic view of the structure showing the operational principle of the mechanism of the present invention, and the correlation of the printing paper to printing heads, each of which comprises a type wheel and a typing hammer and the relationship of a plurality of the printing heads is distributed in separate positions and at regular intervals, respectively, with respect to the direction of the line of a print on the paper. FIG. 2 shows in side elevation a type wheel and print magnet in one of the printing heads. Such print mechanism of the type referred to is known, for example, in German Patent 1,235,640. The type characters are arranged, as can be noted in FIG. 2, on the periphery of the type wheel 1 which continuously rotates in a horizontal plane. In the particular embodiment of the present invention, said characters are arranged in four individual bands on the peripheral surface of the type wheel 1. That is, the characters are divided into two groups according to a shift-in and shift-out position, and each group of the shift-in and shift-out position is further divided into two bands so that the total number of selective bands of characters will be four.

The printing is carried out in such manner that a print magnet 2 opposing type wheel 1 is actuated to actuate an armature 21, so that printing hammer 3 will strike the type wheel 1 through the paper 4 and ink ribbon 5. Thus, the type wheel 1 and printing hammer 3 together form printing head with the paper 4 and ink ribbon 5 inserted there between, and a plurality n of printing heads are arranged within the range of a line to be printed, as shown in FIG. 1. Respective type wheels 1, through 4, are coupled by means of a cross gear connection or the like to a single common shaft 7 driven by a motor 6, so as to be simultaneously rotated together in a horizontal direction. At one end of the shaft 7, there is mounted a code wheel 8 having a number of slits thereon corresponding to the number of characters arranged in the peripheral surface of one of the bands of type wheels 1 to 4. Rotation of the code wheel 8 and the rotation of type wheels 1 through 4, will be controlled by means of a pickup 9 connected to a line 10 carrying electrical pulses so as to provide a code for indicating positions of the characters opposite the printing hammers by means of a control circuit as will be set forth later.

In high-speed printing it has been known to increase the printing speed, by reducing the kinds of type on the periphery of the type wheels so as to make the time required for a complete rotation of the type wheels shorter, that is, the time required for subsequent printing operations is made shorter.

For this purpose, in the present invention, the characters are distributed on the four bands as described above and a selecting operation of one particular band is carried out.

The type wheel 1 as shown in FIG. 2 moves upwardly and downwardly according to band selecting mechanism 60 (an embodiment of which mechanism is shown in FIG. 3A) in the form of a known adding mechanism or the like, so that a predetermined band will be selectively position opposite the printing hammer 3, while being continuously rotated together with a rotary shaft 11 driven by the continuously rotating common shaft 7 through worm gear wheels 71 and 72. The band selecting mechanism 60 can select four different band positions of the wheel 1 in response to input signals "1" or "0" at an input 65 for determining the shift-in or shift-out position and to a combination of the signals "1" or "0" at an input 66 for determining the band selection for each of the shift-in or shift-out positions.

Printing of a whole line will be completed by m times the printing operation. Respective n printing heads will establish respective printings thereof as printing data are read out of corresponding addresses of a line memory, in which the print-
ing data for the whole line are stored. After the printing operation of a character with respect to each of the printing heads, the printing paper 4 will carry out a spacing action toward a subsequent printing position by one space of printing separation. That is, the printing of a line will be completed when n printing heads have printed m times.

The printing paper 4 engages at both side edges with paper feeding carriages 17z and 17l as used in conventional printers and is held in engagement therewith by paper holders 15 and 16. The respective paper feeding carriages 17z and 17l are integrally interconnected to each other by means of a shaft 16, and are shifted rightward and leftward through one space by a lateral spacing mechanism (shown in FIG. 3B) utilizing such ordinarily used means as a clutch and rotary threaded shaft or the like. The printing position will reach an end of the printed line as, for example, the right end position of the line shown by the dotted line in FIG. 1 after m-1 times the spacing action of the feeding carriages. A subsequent printing operation will complete the printing for one full line and, then, a line feed of the paper will be effected by the feeding carriages 17l and 17z. 19s is a detector mechanism for detecting when the printing paper reaches the right end position, 19s is a detector mechanism for the left end position, 20s is a lead for carrying a left end signal caused by the detector mechanism 19s, and 20s is a lead for carrying a right end signal caused by the detector mechanism 19s. The printing data received will be stored in the line memory according to the number of data for each line as a unit.

It will be appreciated in the case of printing the data by means of the printing heads arranged at the respective positions shown in FIG. 1, that it may be possible to have the printing started from either end of the line, provided that the order of taking the data out of the memory correspond with the printing operation. That is to say, when the paper reaches either end of the line, the printing of the next line can be carried out in the opposite direction to that of the prior line while employing the same print operation so that an operation such as the carriage return in conventional mechanisms will not be required.

The printing position of the heads can be designated by printing head addresses and a spacing address. The former address is specific to each of the n printing heads and the latter address is the one between I through m at which one of the printing heads carries out its printing. Control of the readout will occur, however, when the addresses in the line memory coincides with the above addresses for the printing position.

FIG. 3A is a perspective view of the mechanism embodying the present invention for explaining the same partially in fragmental manner. FIG. 3B is a perspective view of a mechanism for explaining an exemplary spacing operation of the printing paper, and FIG. 3C is a diagram for explaining spacing position and printing order in the case of carrying out the printing on the printing paper according to the present invention. Thus, FIGS. 3A—3C show the embodiment of FIG. 1 more in detail. The type wheels 1 are continuously rotated by the worm gears 2 which mesh with gears 71 mounted on the continuously rotating shaft 7. The type wheel shafts 11 are respectively formed integral with each type wheel and engage the worm gears through spline or angular shafts so that the type wheels will be movable upward and downward while being rotated.

Selection of the desired type bands on the type wheel 1 is performed by means of a pair of magnets 67 and 69. Movement armatures 68 and 70 by magnets 67 and 69 is transmitted to levers 61 and 62, so that position selections by displacement of cam 13 of the type wheels 1 will be caused to occur. Displacements of the levers 61 and 62 will determine the positioning of shaft 11 by engagement with point 63 by the lever 64. Displacement of the point 63 will be increased according to required displacement of the type wheel by means of the lever ratio of the lever 64, one end of which is engaged with the type wheel shaft 11 so that the type wheel 1 may continuously rotate while being moved upwardly or downwardly to the predetermined one of the four type bands so that the particular desired type band will face the hammer 3. The lateral spacing of printing paper 4 is performed by means such as the mechanism as shown in FIG. 3B. It should be here noted that, whereas in FIGS. 2 and 3A there is shown an example suited for the printing heads where the paper feeding mechanism utilizes a chain drive for the paper feeding carriages 17, FIG. 3B shows an embodiment in which sprocket wheels are employed.

In FIG. 3B, the paper feeding carriages 17l and 17z are mounted on a rotatable shaft 111. The shaft 111 is fixed to a slidable shaft 16 by means of side frames 109z and 109s. The shaft 16, side frames 109z and 109s, shaft 111 and paper feeding carriages 17l and 17z form an integral unit, which is movable leftward and rightward with respect to a pair of fixed frames 108z and 108s along the shaft 16. A guide rail 112 is engaged by one end of each of the side frames 109z, 109s so as to guide them during leftward and rightward movements. 110 is a plurality of discs for supporting the paper, and 18z and 18s are paper holders. The slide shaft 16 is provided with a cam follower 107 secured thereto. The follower 107 engages a cylindrical spacing cam 105, so that the slide shaft 16 is moved leftward and rightward upon rotation of the cylindrical cam 105.

The paper 4 performs its spacing by m letter spaces in leftward and rightward directions upon rotation of the cylindrical cam 107, and during one complete rotation thereof two lines of printing are carried out. The cylindrical cam 107 is controlled by means of a clutch 102 of a constant rotation type and by one operable to have the clutch 102 driven by control to turn the printed paper so as to cause a partial rotation of the cam to occur for one space for one character. That is, the clutch 102 driven by a control circuit at every single-spacing operation transmits the rotation of drive shaft 101 to a worm gear 103 so that the cylindrical cam 105 is rotated by a gear 104 through a predetermined angle of rotation. By this rotation, the paper carriage is moved leftward or rightward by one lateral space. When the printing for one line is completed, the paper carriage stops at the end of its leftward or rightward stroke.

FIG. 3C explains the results of the rotation of the spacing cam and printing positions and order of the printed characters on the paper. As an example, with reference to a case in which the printing is to be carried out by printing lines of 20 letters each with four printing heads and five lateral spacing positions.

The respective positions of the cylindrical cam 105 and cam follower 107 are shown in FIG. 3C as developed during operation. As seen in the drawing, the cam follower position is shifted by one space for rightward spacing (1, 2, ..., ) and the paper is therefore moved in accordance therewith. The example of printing as illustrated at right-hand side of FIG. 3C shows a completed printing pattern at each spacing position corresponding to the rotation of the cylindrical cam 105. When the initial printing position is located at the left-hand end, the respective printing heads will receive data at the spacing address 1 (in the present instance, the printing column for printing head 2 is 6, the column for head 3 is 11, ... ) from the line memory and carry out the printing. (In the present instance, the data are taken out at every five letters.) Then, in response to the spacing operation of one space, the position of the paper relative to the hammer is shifted by one space in the rightward direction. (During this spacing operation, the respective printing heads are simultaneously adjusted to the particular band of the type wheels for data to be printed next, in accordance with the line memory readout.) From this new position the respective printing heads receive data for spacing address 2" (in the present instance, the printing column is 7 for printing head 2, the column is 12 for head 3, ...) from the line memory and perform their printing (only those letters which are underscored will now be printed at the position next to the previous printings). In the illustrated example, the spacing for one line is carried out by five repetitions of such opera-
tion and the whole line of printing is thus completed. At this point, such a desired print pattern as “ABCDEFGH...89” is already completed and, thus, a line spacing operation is performed so that the printing of the next line may be carried out. During the printing of the next line, the printing position is caused to be shifted in a leftward direction in response to the same directional rotation of the cylindrical cam 105 with that during the previous line printing. That is, in case the initial printing position is the right-hand end, the respective printing heads are caused to print data at spacing address “5” (printing columns 5, 10, 15 and 20) and, thus the sequence of the spacing address is reversed from that of the previous line printing. When the left end spacing position is reached in the like manner, the printing for the second line is finished and such print pattern as “123456...89a...” in the illustrated example is completed.

The same operations and printing orders as described above may be performed even in the case when n and m are increased, respectively.

FIG. 4 is to show the time relation and printing order of the aforementioned operation of print positioning. In the drawing, (a) shows the time T<5 required for a rotation of the type wheel, (b) shows the time T<5 required for type selection and the printing operation (print cycle), which is set so that T<5<T<5, (c) shows the spacing cycle in which the lateral spacing of the printing paper is carried out, (d) shows band selection time of the type wheel, (e) and (f) show switching time carried out simultaneously during the same time period, (e) shows the signal of left hand end of the line, (f) shows the signal of right hand end of the line, (g) shows gate signals for controlling normal and reverse advancing of an output counter which directs specific spacing address in the read out of the line memory, (h) shows the order of reading the spacing address out of the line memory, and (i) shows switching time for transferring further printing data for a subsequent line to a print memory during the time when the data are contained in a buffer memory and after the printing of the data in the line memory is completed.

FIG. 5 is a block diagram showing the circuitry of a controlling section in an embodiment of the present invention, in which parallel input signals fed from a terminal 22 are selected at a function detecting circuit 23. In the case of the printing data, an output from the circuit 23 will be fed to line 24 and stored in an input register 25 for a while. At the same time, an output line 26 from the function detecting circuit 23 will supply every character to an input character counter 27. Parallel outputting 24 from the detecting circuit 23 will be rearranged into corresponding codes to printing type instructing codes in such manner that, for example, No. 1 bit through No. 5 bit are retained in the form of the input data, No. 6 bit and No. 7 bit are changed to codes for selecting a type band on the type wheel, No. 8 bit to an input instruction, and so on, so that subsequent operations will be more convenient. The buffer memory 30 and print memory 31 are provided with a sufficient memory capacity, respectively, for containing data for each line, and are adapted to be capable of performing for example, when a delay line memory is employed, write-in and circulation memories in response to actuations of a write-in gate 32 of the buffer memory 30 and a write-in gate 33 of the print memory 31. Write-in address of the memories 30 and 31 are determined by an address counter 54 acting as a digit receiving an output from an oscillator 52. The counter 54 is adapted so as to provide a spacing address 83 and a print head address 84 in parallel relation. The print data once stored in the input register 25 will open the write-in gate 32 and thereby the information is written in the instruction address, upon actuation of a write-in control circuit 29 by means of coincidence detecting circuit 28 at the time when respective address counts of the input counter 27 and the address counter 54 are detected to be identical to each other at coincidence detecting circuit 28. Subsequent print data will likely advance the count at the input counter 27, so that the write-in of the data into instruction addresses of the buffer memory 30 will be continued in response to the coincidence of the count at counter 27 to the address count at address counter 54. At the time when a line feed signal is received or the write-in operation completes the number of characters for a whole line, the write-in control 29 is actuated to control the write-in gate 33 so as to close the same, so that the contents in the buffer memory 30 will be transferred to identical addresses of the print memory 31 and memorized therein. At the same time, a printing control circuit 53 actuates in response to the other output from the write-in control 29. With the actuation of the circuit 53, an output from an oscillator 52 will be applied to an output counter 51. The counter 51 then produces two phase signals of a spacing cycle output 73 as shown in FIG. 4(c) and a print cycle output 74 as shown in FIG. 4(d), by counting the oscillation outputs.

The output counter 51 also counts, simultaneously when the same produces both the spacing and print cycle outputs 73 and 74 alternately, the repetitions of such outputs. An output of this counting will direct such a spacing address of l-m as shown in FIG. 4(i). This spacing address instruction output represents corresponding print position (since a spacing operation of one lateral space is carried out at every one spacing cycle output 73). The spacing address also instructs a spacing address to be taken out of the print memory 31. Thus, it is possible to easily take out only the necessary data from the print memory 31 depending on coincidence instruction output from coincidence detecting circuit 44 for detecting the coincidence between the spacing address instruction output (directly corresponding to operations of a mechanical part) produced by the output counter 51 and a spacing address output 83 (memorized in the coincidence detecting circuit 44 for each of the printing heads) from the address counter 54. The output counter 51 determines at every one line print operation the normal advance or reverse advance of the counting by means of the output as in FIG. 4(h) of a gate circuit 55 for instructing the normal or reverse advancing, which circuit will be actuated in response to the left end signal 20, (as in FIG. 4(e)) provided it is at the left-hand ending position of the type wheel. The counting operations in the normal and reverse advances of said output counter 51 will be repeated alternately, corresponding with spacing operation in rightward or leftward direction as shown in FIG. 4 (i). The print informations stored in the print memory 31 are already converted to parallel codes in an output shift register 34. Among these codes, such codes as, for example, No. 1 bit through No. 5 bit and a type code for designating a particular one of the type on the type wheel to be printed are subjected to a coincidence detection carried out by a coincidence circuit 35, a result of which will then be presented to a print distributing gate 39. The type code presents a type pulse 10 produced at every type on the wheel to a type counter 36 through a shaping circuit 37 so as to produce a count output of the counter 36. In the case, for example, when the number of characters arranged on the periphery type wheel as shown in the present embodiment is 32, the count output will then be five bits, which will be common to all of n type wheels. The above coincidence detecting operation is carried out at each of the types with respect to all of the stored data by so selecting scanning cycle of the memory 31 as to be smaller than output cycle of the type pulse 10. Further, among parallel convert outputs from the register 34, certain bits such as, for example, No. 6 and No. 7 bits for instructing particular type band selections with respect to respective type bands on the type wheel will be provided to a type band selection distributing gate 45. A count output from the output counter 51 is subjected to a coincidence detection in the coincidence detecting circuit 44 with respect to an instruction bit, that is, a spacing address 83 from the address counter 54, and its resultant coincidence output is utilized for controlling the print distributing gate 39 and the type band selection distributing gate 45.
The coincidence detection outputs being provided always to the print distributing gate 39 are gated in response to a coincidence signal of the output address from the coincidence detection circuit 44 likely being provided to said gate 39 (corresponding with the spacing position at that time), to a signal 73 showing the print cycle, and further to a count output 84 instructing the print head address of the address counter 54 so as to be distributed to respective 1 through n print heads, so that the print outputs corresponding with n print heads will be obtained.

Further, the type band selection bit signals being provided always to the type band distributing gate 45 are gated in response to the coincidence signal of the output address likely being provided to said gate 45 (corresponding with the spacing position at that time), to a signal 74 showing the spacing cycle, and further to the count output 84 instructing the print head address of the address counter 54 so as to be distributed to respective 1 through n print heads will be obtained.

The print outputs obtained in correspondence with the spacing position and the n print heads are once stored in a temporary memory 40 consisting of n flip-flops, condenser memories or the like, and are read out in response to print timing determined by a type pulse output 41 in this time via the print driving circuit connected to the temporary memory 40 storing once said print outputs is actuated and its output 43 excites the print magnet 2 so that the printing will be effected.

This operation is to be carried out with respect to each one of the types in a particular one of the n print heads that satisfy respective conditions of the comparison coincidence, spacing address coincidence and print head address instruction, and is repeated with respect to each one of the types during a print cycle. The repetition of the print operation in the case, for example, of 32 types of characters contained in a type band of each type wheel will be 32 times. The print for that spacing position is completed at the time when the type wheel completes a rotation.

The band selection signals of n outputs from the type band distribution gate 45 are effective in setting the respective type wheels 1 through l, at respective predetermined type band positions during the spacing cycle, which cycle is arranged to be prior to the print cycle for the print operation at the spacing position of this moment, in such manner that a type band selective driving circuit 47 will be first actuated and its output 48 will excite one of the type character magnets. The spacing and type band selecting operations are carried out simultaneously, which spacing operation is effected at the time when the spacing driver circuit 49 is actuated and its output 50 excites the spacing clutch. The print operation for a whole line will be completed by such spacing operation, as well as the simultaneous type band selecting operation as above by repeating the printing operations, and then the spacing position will be at either one of the left-hand end or right-hand end of the line. This moment of the left or right end spacing position is sensed by the output counter 51 with a count instruction and left or right end signal, and the line feed will be carried out at the moment when all of the printings of the line is concluded (mechanism for which feed not being shown). At the moment of this line feed, contents of the memory 31 become ready to be cleared and, thus, as soon as all of the print data for succeeding print line is stored in the buffer memory 30 during the preceding line print operation, such information will then be transferred into the memory 31, so that the same operation will be repeated. This time, the output counter 51 will provide a count of reverse direction to the preceding count as shown in FIG. 4 (f), so that the spacing operation will advance in the reverse direction.

In FIG. 6, the circuitry of the input counter 27, address counter 54 and output counter 51 and correlation between them are shown in a block diagram in the present embodiment, the case in which such a circulating type memory as the delay line memory is used to store information to each of the print lines in series is shown. 75 and 76 are input character counters, respectively, which carry out the count in response to signals presented at the output terminal 26 at each time when print data are fed in. The counter 75 is adapted to advance at every m counts corresponding with the spacing positions, and the counter 76 is adapted to advance at every n counts corresponding with the printing head which is triggered at every m counts of the counter 75. Input print data are indicated successively in the forms of m and n counts. Respective counters 80, 81 and 82 constitute an address counter 54 which is always being actuated by outputs 52' of an oscillator 52 for appointing addresses of memories 30 and 31, and the counter 80 is adapted to be a bit counter for instructing bit addresses of each bit forming a character in the memories. In case, for example, a character is formed with eight bits, the bit counter 80 is an eight count counter which always advances eight counts upon receiving the output 52' from the oscillator 52. The counter 81 is adapted to be a spacing address counter that advances at every m counts corresponding with a spacing position triggered by a bit count output (produced by the counter 80 at every eight counts in case, for example, a character is formed with eight bits) so as to provide a parallel count output 83, and the counter 82 is adapted to be a print head address counter corresponding with a print head triggered by outputs applied from the counter 81 at every m count so as to provide a parallel count output 84. In the case of using such delay line memory as in the present embodiment, the delay line memory is so adapted as to have a delay time at which the output of this memory will be stored again in the same address. For this reason, the address of memory is determined by an appointment of the address counter 54 operating with outputs of the oscillator 52. Write-in of the input print informations into the memory is effected in such manner that the character addresses corresponding to m and n of the memory are found out; in response to corresponding addresses to m and n determined by the input character counter 27, that is, in response to instructions of "a" and "b" from both of an address count coincidence detector 77 for counters 75 and 81 and another address count coincidence detector 78 for counters 76 and 82 (namely, the coincidence of all of address instruction) and each bit is subsequently written in thus found addresses by instructions of bit counter 80 at that character. Both of the memories 30 and 31 are formed in the same structure, and their addresses are determined by the address counter 54, respectively. If the print information is carried out in such arrangement of divided addresses as above, it is possible to take out the input print informations from the memories very easily, in response to instructions from an address coincidence detecting circuit 44 for both of the counter 81 and output counter 51. That is to say, this instruction output is to select only a specific information that corresponds with the spacing position at each moment and, thus, it is possible to make the data to be corresponding with the print head immediately, by distributing such selected data in accordance with the print head addresses from the counter 82.

According to the present invention, as evident from the above, it is possible to obtain the memory outputs respectively corresponding with the respective print informations with the simple structure and controlling method therefor, by determining the respective addresses for the print data at the time of writing the informations into the memory so as to be corresponding with the n print heads and m spacing positions thereof. It is also possible to establish the printing operations with the same controlling method all the time, regardless of the normal and reverse advances of the output counter, that is, the normal and reverse advances of the spacing operation.

Further according to the present invention, it is possible to obtain such remarkable advantages that, with the utilized spacing control as disclosed, the printing operation of the respective lines can be executed without accompanying such a large mechanical movement as the carriage return involved in the conventional mechanical printers and, thus, the mechanism can be remarkably simplified and operational stability of the mechanism can be improved.
It will be appreciated while the invention has been disclosed herein with reference to the structure in which the spacing is carried out by the displacement of printing paper, that such spacing may be readily substituted by the displacement of the various heads and hammer driving linkages therefor.

Further according to the present invention, the mechanism of the invention is not subjected to such disadvantageous restrictions as have been involved in the conventional mechanical character selecting type printing mechanisms. That is, in the structure wherein a plurality of the mechanical character selecting type printing mechanisms as ordinarily employed in typewriters or the like is arranged at a regular interval, it has been difficult to establish dimensional arrangement of such complicated mechanism and, thus, it has not been possible to increase the number of characters that can be simultaneously printed and consequently the printing speed could have been hardly facilitated. On the other hand, in the high-speed type printing mechanism according to the present invention, it is possible to employ the code wheels as the standard of character selection in common with all of various character types, so as to enable it to effect the character selection with a circuitry operation of the comparison coincidence with the type signals. Further, the print mechanism according to the present invention brings about such advantage that the same is readily adaptable to any high-speed printers which require various kinds of characters, since the number of characters to be selected during the print cycle may be made smaller with the combination of the type band selecting mechanism for selecting an individual band of type from the divided hands on the wheel as utilized in the present invention.

We claim:

1. A high-speed printing mechanism comprising a plurality of type wheels spaced at regular intervals from each other along a print line and rotatable about a plurality of parallel spaced axes in the direction of the print line, means for rotating said type wheels at the same speed, each type wheel including a plurality of parallel superimposed bands of type arranged around the circumferential surface of each type wheel, a plurality of hammers each disposed opposite each of said plurality of type wheels, a recording medium located between said hammers and said type wheels, means for selectively moving each of said type wheels axially upwardly and downwardly so that each band may be selectively located opposite said hammer associated therewith while each type wheel is being rotated about its own axis, means for moving said recording medium laterally of said type wheels and hammers one space so that the type wheel is located opposite the adjacent space for printing the next desired character of the print line, means for selectively actuating each hammer to print a plurality of characters on said recording medium after each lateral spacing of said recording medium, the total number of the lateral spacings corresponding to the number of spaces for printed characters between adjacent type wheels to complete a print line and means for reversing the direction of the lateral spacings of said recording medium for recording a subsequent print line after completion of the preceding print line on said recording medium.