

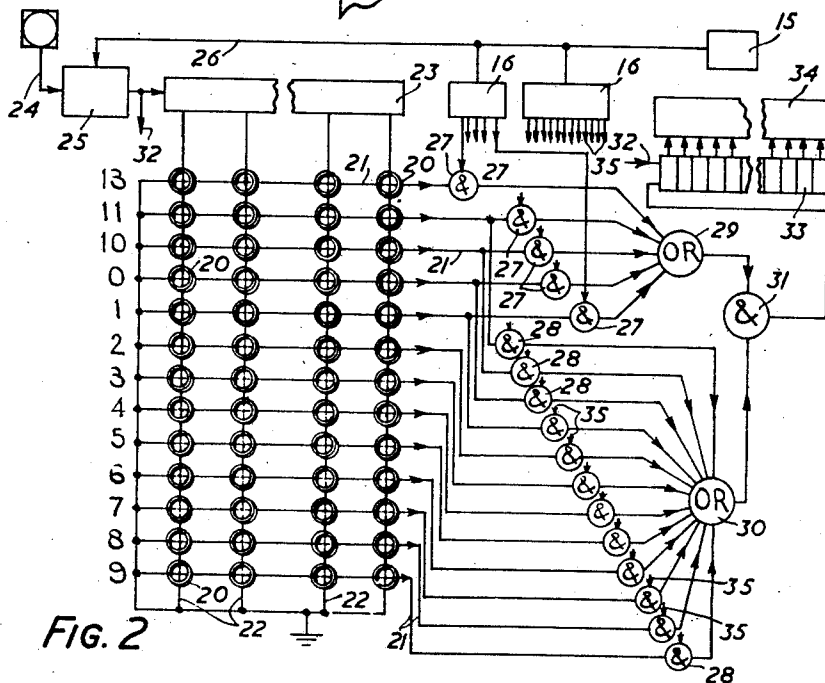
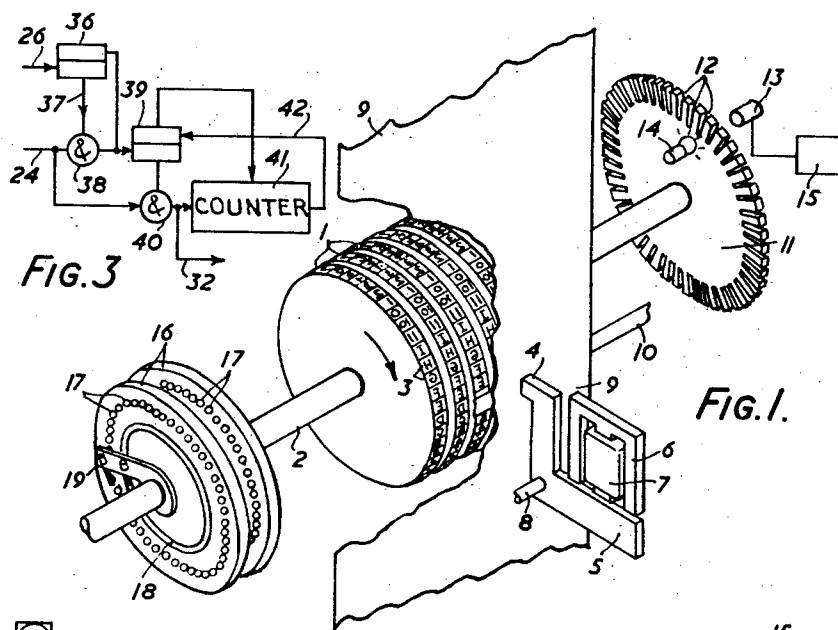
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APPARATUS FOR RECORDING CHARACTERS

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APPARATUS FOR RECORDING CHARACTERS

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The present invention relates to character recording.

Character recording apparatus is known in which, for example, a number of characters bearing type wheels are supported side-by-side on a common shaft. Rotation of the shaft causes the characters carried by a typewheel to be presented in succession at a printing position and the wheels are so mounted that corresponding characters on all wheels arrive at the printing position at substantially the same time. Printing of a character is effected by the production of an electrical signal, momentarily to energise a hammer control circuit associated with the typewheel at the time when the required character on the typewheel is at the printing position.

Previously known apparatus has been used to print both numeric, alphabetic and symbol characters, the alphabetic and symbol characters being identified by a code representation containing a zone and a numeral component while the numeric characters are identified by the presence of only the appropriate numeral component. Consequently, the characters on the typewheel have been arranged in groups according to the significance of the numeral component and it has been customary to select characters to be printed, for example, from a storage device, according to the numeral code component of the character groups approaching the printing position and determining the hammer circuit energisation time in dependence upon the presence or absence of a particular zone code component. Thus, each wheel has required a separate zone component storage or decoding circuit for the production of a final character indicating signal to initiate energisation of the associated hammer circuit.

According to the present invention character recording apparatus include means for passing a plurality of character carrying tracks past a recording position, each track carrying a succession of different characters, similar characters being included in all tracks and presented concurrently at the recording position, a like plurality of groups of storage devices, each group being associated with a corresponding one of the character bearing members, the devices of a group each being settable to store a character code component, a character being stored in a group by setting a pair of devices corresponding to a unique pair of code components representing the character, means for interrogating the groups of devices in sequence as each of the different characters is carried past the recording position to derive two trains of pulses corresponding respectively to the code elements comprising the representation of the character currently presented at the recording position, means for combining the two pulse trains to produce a single output pulse train in which a pulse occurs only if both code components are stored in a group and means responsive to the output pulse train to record the characters from those tracks corresponding to the groups in which both components are stored.

It is an object of the invention to provide improved apparatus for controlling a device for recording a plurality of characters in which signals representing code components of characters are derived from a storage device and the components of each character are combined to produce a single character representing signal to control recording of that character.

Apparatus embodying the present invention will now

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be described, by way of example, with reference to the accompanying drawing, in which

FIGURE 1 shows diagrammatically a printing device,

FIGURE 2 shows in schematic form apparatus for controlling the printing device of FIGURE 1, and

FIGURE 3 is a diagrammatic representation of a pulse gating circuit.

Referring now to FIGURE 1, a device for printing a line of characters consists of a group of typewheels 1 mounted on a common shaft 2. Each typewheel carries type faces 3 round its outer edge and a complete fount of type consisting of numeric characters, alphabetic characters and special characters or symbols is carried by each wheel. The typewheels 1 are so secured to the shaft 2 that similar characters carried by all the typewheels are arranged in line. The shaft 2 is rotated so that the different characters are available for printing in turn at a predetermined printing line.

Characters may be selected for printing by the operation of hammers 4. For the sake of clarity, only one hammer 4 is shown, but it will be appreciated that a hammer is provided for each of the wheels. The hammer 4 is carried by an armature 5 of an electromagnet assembly 6 having an operating coil 7. Hence, in order to print a character from a typewheel 1 it is necessary to energise the coil 7 associated with the hammer 4 of the required typewheel 1. The armature 5 of the selected hammer assembly is attracted by the energisation of the coil 7 and pivots about a spindle 8, impelling the hammer towards the typewheel. A document 9 is positioned between the hammers 4 and the typewheels 1 and a suitable inked ribbon 10 is interposed between the wheels and the document. Thus, the movement of the selected hammer 4 causes the character opposite the hammer to be printed in the conventional manner on the document. It will be seen therefore, that, in order to print a selected character from a type wheel it is required to energise the electromagnet coil 7 of the hammer assembly associated with the wheel at a time when the required character is in the printing position opposite the hammer 4.

The shaft 2 also carries a timing pulse generating wheel 11 having slots 12 arranged about its periphery. A slot 12 is provided for each of the characters carried by the typewheels 2 and the slots are photoelectrically detected by a photoelectric cell 13 in co-operation with a light source 14. Timing pulses generated by the photoelectric cell 13 are amplified by an amplifier 15 and the positional relationship between the photoelectric cell 13 and the wheel 11 is such that a timing pulse is generated as each character on the typewheels arrives at the printing position.

A pair of distributing commutators 16 are also mounted about the shaft 2. Each distributor has a number of contacts 17, one for each character on a typewheel, and a continuous slip ring 18. The shaft 2 carries a contact brush assembly 19 for each distributor 16 arranged so that an electrical connection is provided between the slip ring 18 and a different one of the contacts 17 as each character on a typewheel arrives at the printing position.

The co-operation of the timing pulse generating wheel 11 with the distributors 16 in selecting a character to be printed will be described in greater detail with reference to FIGURE 2 of the drawing. It will be helpful, however, to consider at this point the manner in which the characters are arranged on each of the typewheels and the manner in which a character representation is encoded in the apparatus.

A code employing thirteen components is used to represent the characters. Each character is uniquely defined by two of these components and, for each character, one component may be termed the numeral component and the other, the zone component. Twelve numeric charac-

ters are provided, the numerals 0 to 9 with two additional characters, 10 and 11. Each of these characters is represented by a different one of twelve of the components accompanied in all cases, by the thirteenth component. For the sake of clarity, these twelve components will be identified by the numeric characters they represent and it will be seen that in the case of numeric characters, these components are the numeral code components while the thirteenth component is the zone component. These coding arrangements are shown in Table 1.

Table 1

Numeral	Zone				
	13	11	10	0	1
9	9	I	R	Z	$\frac{3}{4}$ @
8	8	H	Q	Y	$\frac{1}{2}$
7	7	G	P	X	$\frac{1}{4}$
6	6	F	O	W	$\frac{1}{8}$
5	5	E	N	V	$\frac{1}{16}$
4	4	D	M	U	$\frac{1}{32}$
3	3	C	L	T	$\frac{1}{64}$
2	2	B	K	S	$\frac{1}{128}$
1	1	A	J	&	$\frac{1}{256}$
0	0	%	*		
10	10	£			
11	11				

The numeric characters occur successively on the typewheels starting at the character 9 and proceeding in the order shown in Table 1 reading downwards in the column marked Zone 13. The next succeeding characters on the typewheel are all associated with the code component 11 as a zone component and are principally alphabetic characters as shown in the appropriate column of the table. Further characters follow in succession and are associated in turn with the components 10, 0 and 1 as zone components, again as shown in the table. It will be appreciated that the code representation shown is merely by way of example and the character representations are not limited to those shown. For example, the number of characters may be increased by using the remaining components as zone components in turn. Further, other coding arrangements may be employed in which the characters occur in a different order from that shown or in which some, at least, of the characters are not the visually recognisable characters shown in the table.

In describing the present invention it will be assumed that the code components representing characters to be printed are stored in a storage device of, for example, a data processing apparatus such as a computer. Such a storage device will be described with reference to FIGURE 2 of the drawings but since the method of entering the code components into the storage device forms no part of the present invention and methods of entry of coded information are well known, this operation will not be described in detail. However, it may be said that the code components may be derived from information entered into the computer or they may be derived from processing operations carried out by the computer. In this connection it will be appreciated that the coding of characters closely resembles one of the well known five-zone systems of coding used in record card controlled equipment in which characters are represented by perforations occurring in columns of a record card. In such a system an alphabetic or symbol character is represented in a card column by perforations occurring in two out of twelve predetermined index point positions, one perforation occurring in a zone position and one in a numeral position. A numeric character, on the other hand is represented by a single perforation in the appropriate numeral position. It will be appreciated that a record card in which characters are coded in this way may, for example, be sensed to enter data into the storage device, using a conventional parity generating arrangement to provide an auxiliary code component in the thirteenth position of the storage device for numeric characters so that each of the characters is uniquely repre-

sented by two code components after entry into the storage device.

Referring now to FIGURE 2 the storage device consists of a conventional matrix of storage cores 20 arranged in rows and columns. Each column is used to store a single character and has thirteen cores 20, one for each character code component. Characters may be entered into the storage device by conventional word and digit driver lines and for the sake of clarity these lines have been omitted from the figure. In this entering operation each character representation may be regarded as a word and the individual code components of the representation may then be regarded as digits, the character being stored, for example, by concurrent energisation of the word line representing the required character storage column and the digit lines corresponding to the code components representing that character. Thus, at the end of the entering operation two cores are set in each column of the storage device which is storing a character and the set cores correspond to the code components comprising the code representation of the character. As indicated in the figure, the top row of cores is used to store the thirteenth code components and the remaining rows, reading downwards store the code components having the significance 11, 10, 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 respectively. Thus the storage device, except for the top row, may be said to be storing an image of a record card upon which the characters have been recorded. British Patent No. 750,636, for example, shows a core storage matrix for entering and storing a card image in this way. Parity element generators for providing the code components such as are registered in the top row of cores have also previously been proposed.

Each row of cores is threaded by an output winding 21 which carries a signal if any core in the row is reset and the columns of the store are each threaded by a reading winding 22. For the sake of clarity only four columns of cores are shown, but it will be appreciated that in practice a much larger number of columns would usually be provided to store a greater number of characters. In order to read out a character from the storage device, a drive current is applied by means of a character selector driving network 23 to the column read-out winding 22 of the required character. The direction and magnitude of the read-out current is such that any set cores in the column are reset and an output signal is induced into the row windings 21 threading the reset cores.

The storage device is operated according to the well-known mode in which the selection of a word—in this case a column-drive line is employed in a read-write cycle of operation. In this mode, the resetting of cores during a reading phase of the cycle is followed by a writing phase during which those cores reset during the reading cycle are restored to the set state, thereby preserving the character in the column. This preservation may, for example, be accomplished by providing a recirculating loop from the row outputs to the group of writing amplifiers associated with the rows of the matrix, the re-writing taking place while the selection of the appropriate column is maintained by energization of the selected column winding 22. An example of a recirculating loop for re-writing the information read out is shown in British Patent 856,303 in which the selection of each column is performed by energising a column winding corresponding to the winding 22 of FIGURE 2. Each column winding is selected in sequence under control of a stepping register and row windings corresponding to the windings 21 carry resultant output signals which are applied to row amplifiers. The amplifier outputs are connected through phase control gates to trigger stages, which preserve the outputs during the period between phases and outputs from the trigger stages are then recirculated back to row current generators which are effective during the writing phase to re-enter the information read out. Since the

operation of a storage matrix in this way is well known, however, the additional circuitry required for preservation of the character during the writing phase is omitted from FIGURE 2 for the sake of clarity.

In the present case, the column read out windings 22 are selected in turn during successive cycles of operation of the store under control of a series of clock pulses derived from the computer and applied over a line 24. A pulse gating circuit 25 is conditioned by an impulse on a line 26 to pass a number of clock pulses to the selector network 23 so that all the column lines are selected in succession. This sequential succession may be performed, for example, by the use of a timing and selecting chain of trigger stages in much the same way as is described in the British Patent No. 856,303 referred to above. The initiating impulse for this purpose on the line 26 is conveniently derived from the amplifier 15 shown in FIGURES 1 and 2. Thus, a complete cyclic selection of all column drive lines is performed as each of the characters on the typewheel reaches the printing position. In other words, all the stored characters are read out of the storage device each time a new character on the typewheel reaches the printing position.

Resultant code element representing output signals on the row lines 21 which correspond to the row amplifier output signals of the patent referred to, are passed to two groups of gates 27 and 28 respectively. The gates 27 are controlled by one of the distributors 16 (FIGURES 1 and 2) to select an output from a row line 21 carrying signals of zone code component significance and the second group of gates 28 is controlled by the other of the distributors 16 to select an output from a row line carrying signals of numerical code component significance. The output pulses from the amplifier 15 are applied to the distributors 16 so that the selection of the code component signals is dependent upon the particular character at the printing position. For example, the uppermost row line 21 associated with the storage of the thirteenth component is connected to a gate 27 which is selected to be open during the times when the numeric characters 9 to 11 as shown in Table 1 are at the printing position. The next lower row line is connected to the second gate 27, open when the characters in the next group associated with zone component 11 as shown in Table 1 are at the printing line. The third, fourth and fifth row lines are similarly connected to gates 27 opened respectively when each of the following groups of characters pass the printing position.

Output signals on the row lines 21 representing the code components 11 to 9 are similarly gated by the gates 28. For example, the appearance at the printing position of the character "9" causes the gate 28 associated with the 9 component row line to be opened by the transmission of a signal over a line 35 associated with the appropriate row line from the appropriate one of the distributors 16. The next following character "8" causes the gate 28 associated with the 8 component row line to open in a similar manner. The row lines corresponding to components 7 to 11 are selected in turn in a similar way by the remaining gates 28 as the remaining characters of the first group reach the printing position. As the character "I" reaches the printing position the gate 28 associated with the 9 element row line is again opened and the successive opening of the gates 28 continues during the passage of characters of the second group past the printing position. A similar selection is performed to allow the passage of the appropriate row line signals through the gates 28 during the remainder of the typewheel cycle.

The outputs of the gates 27 are applied to an OR gate 29 and the outputs of the gates 28 are applied in a similar way to an OR gate 30. Since the selector network 23 performs a complete cycle of operation for each typewheel character it will be appreciated that for each character appearing at printing position a signal train is passed by the gates 29 and 30 and that the signals in each train

represent the presence of a code component of appropriate significance in one of the character storage columns of the store. The timing of the signal in the train indicates the particular column in which the code component was stored.

The signal trains from both gates 29 and 30 are applied to an AND gate 31 which passes an output signal only if signals occur at the same time in both trains. As an illustration, let it be supposed that the extreme left-hand column of the storage device is storing the character "9" and that the next column is storing the character "8." Hence, the cores storing the code components "13" and "9" are set in the extreme left-hand column and the cores storing the components "13" and "8" are set in the next column. During the cycle of the character selector 23 associated with the presence of the character "9" at the printing position the output signal train from the gate 29 will carry signals at time intervals corresponding to the interrogation of both columns under consideration. The gate 30 however will pass a signal only at the time interval corresponding to the interrogation of the first column. Thus the output signal train from gate 31 will only carry a pulse at the time interval corresponding to the interrogation of the first column, i.e. the column storing the character "9." In the same way, during the period when characters "8" are at the printing position the final output from the gate 31 carries a pulse at the time interval corresponding to the interrogation of the column storing an "8" but not at the time interval corresponding to the interrogation of that storing a "9." It will be seen that for each character on the typewheels that arrives at the printing position a pulse is passed by the gate 31 containing pulses at time intervals corresponding to the interrogation of store columns storing that character. This output train may be regarded as a train of binary information in which the pulses represent binary ones and the absence of pulses represent binary zeros, the binary digits being distributed in the train at time intervals corresponding to the interrogation or scanning of successive columns of the store. Since the cycles of the character selector 23 are controlled by clock pulses the binary digits in the output train occur at clock pulse frequency.

The output train from the gate 31 is distributed to the printing hammer operating circuits. The train is applied to the input of a shifting register 33 which is shifted synchronously with the interrogation cycle by clock pulses supplied over a line 32 from the pulse gating circuit 25. The register 33 has as many stages as there are columns in the store so that at the end of an interrogating cycle the distribution of binary ones in the register 33 corresponds to those columns storing the character currently at the printing position. At the end of interrogating cycle the stages containing binary ones cause operation of the appropriate hammer circuits 34 to cause the momentary energisation of the hammer electromagnets 7 (FIGURE 1) associated with the typewheels from which the character is to be printed.

It is well known, for example, to employ a gas filled relay valve to control the hammer mechanism by energizing the hammer control magnet coil 7 (FIGURE 1) in response to a triggering impulse. In the present case, the requisite triggering impulse may be obtained by gating the binary one outputs from the stages of the register 33 in response to a hammer-blow signal. This signal may conveniently be derived from a further pulse generator similar to the wheel 12 (FIGURE 1) the further wheel being so timed relative to the wheel 12 that an impulse is generated at a time when the scanning of all columns of the store has been completed. Alternatively the hammer blow signal may be obtained by providing an additional output from the scanning control device 23 which is effective after scanning of all columns is completed.

It will be appreciated that the stages of the register 33 may be directly connected each to a separate hammer operating circuit in which case the register 33 must have

a separate stage for each typewheel and the storage device must also have the same number of columns as there are typewheels. However, it is possible, for example, by the use of plugs and sockets, to provide a greater number of typewheels than there are register stages and to select any particular typewheel to operate in response to the setting of any register stage. This allows, for example, the printing of characters in a different order to that in which they are stored and may also be employed to allow an economy of storage columns where a limited number of stored characters are to be distributed in various ways over a larger number of typewheels.

It will also be appreciated that other forms of control pulse distribution may be employed than those described above. For example, instead of the stepping register 33 a cyclic distributor may be employed to distribute output pulses from the gate 31 directly to selected ones of the typewheel hammer control circuits. The distributors 16 may also take other forms, for example, a pair of stepping registers may be used or a single stepping register with suitable OR gates to connect the register stages to the gates 27 and 28, and in this case the stepping control signals for operating these registers may be derived from the wheel 12 (FIGURE 1) or from a further similar wheel.

Where a large number of characters are to be recorded the total number may exceed the capacity of a single row in the storage device. Under these circumstances additional sections of the storage device may be provided, each section storing a group of characters. The typewheels may then also be arranged in corresponding groups. If, now, the sections are scanned in turn, corresponding groups of typewheels may be so fixed to the common shaft that characters in the successively scanned groups appear at the printing position after a suitable delay.

In the foregoing description it has been assumed that interrogation of the store columns starts from a fixed point in the revolution of the typewheels. It will be apparent, however, that since each character on the typewheels is separately identified, the recording cycle may start at any character. It is desirable, however, to prevent clipping of the initiating pulse of a scanning cycle and it is also desirable to ensure that only a single full cycle of the typewheels is used to control a succession of interrogating cycles.

The arrangement of the pulse gating circuit 25 is shown schematically in greater detail in FIGURE 3. The character initiating signal from the amplifier 15 (FIGURE 2) is applied over line 26 (FIGURES 2 and 3) to a trigger 36. The trigger 36 is set and produces an output signal over a line 37 to open an AND gate 38. Clock pulses are applied over the line 24 to the AND gate 38 and the first pulse occurring after the setting of trigger 36 passes through the gate 38 to set a second trigger 39 and is also applied to reset the trigger 36 to its normal state. Setting of the trigger 39 opens a further AND gate 40 which allows subsequent clock pulses to pass to line 32. Pulses on the line 32 are also applied to a counter 41. When the required number of clock pulses on line 32 has been counted, the counter 41 produces an output pulse on a line 42 which is applied to reset the trigger 39. Resetting of this trigger closes the gate 40 to prevent the passage of any further clock pulses and also produces an output signal to reset the counter 41. Hence the action of trigger 39 ensures that only unclipped scanning control pulses are passed by the gate 40 and the counter 41 meters the required number of these pulses.

While the invention has been described as applied to the recording of characters from continuously unidirectionally rotating type wheels mounted on a common shaft, the characters may alternatively be carried on a single drum, characters being arranged in tracks around the drum in much the same way as if the tracks were each formed by a typewheel. Further, other recording devices may be used, for example, bar printers or other bidirec-

tionally moving character-carrying numbers. In these cases the timing pulses may be generated by suitably proportioned commutators or pulse generating devices and the character identifying distributors 16 may then be similar commutators with contacts connected in a similar way to that described. Furthermore the characters may be recorded in other ways than by printing in the manner described. For example, the characters may be printed in coded form by the use of recording members carrying suitably coded type faces or the characters may be embossed as, for example, in recording Braille characters. It is therefore preferred to use the terms "recording" and "recording position" to include other forms of recording than printing and to denote the position at which characters are presented for recording, respectively.

The storage device of the foregoing description is arranged so that two rows are scanned out simultaneously. It will be appreciated that a part of a conventional storage device in a computer may be arranged in this way for the purpose of controlling the recording of characters as described. However, under these circumstances it is necessary to transfer the characters to be recorded into this part of the storage device prior to the actual recording operation.

In another arrangement this prior transfer of the characters may be avoided. The storage device in this case has a number of separately addressable storage locations, each location containing a row of storage elements similar to one of the rows of cores described. The storage elements are each arranged, as before, to store a character code component and like code components are stored in order in the location. Locations are each read out serially and the reading out of location produces a train of pulses similar to the pulse train derived by interrogating a row of cores in the previously described embodiment. For each character at the recording position a sub-programme of operation is initiated. This programme is applied in the conventional manner to the computer in the form of a recording sub-routine to control reading out of particular locations of the storage device in dependence upon the code representations of the character. The two locations concerned are read out separately in two successive reading cycles respectively. An output registers is provided, somewhat similar to the previously described register 33, and this register is associated with a recirculation path. An AND gating arrangement is connected in the entry path to the register. During the first reading cycle the AND gating arrangement is opened so that the pulse train from the first location passes unchanged into the register.

During the second reading cycle, the second location is read out and the contents of the output register are circulated in synchronism. The recirculated train is passed through an additional stage and the train from the second location is applied through another additional stage, the two additional stages being connected to form a comparing device. The AND gating arrangement is controlled by the comparing device output and is opened only if the contents of the two stages both signify for example, a binary one. The AND gating arrangement thus combines the recirculated train with the second pulse train derived from the second location to produce a final pulse train for entry into the output register in which final train pulses occur only in those positions in which pulses occur in both first and second trains. It will be appreciated that the AND gating arrangement may be arranged to open during the first reading cycle under control of the comparing arrangement by resetting the output register to contain binary ones prior to performing the first cycle. Recirculation of this information synchronously with the application of the first pulse train then allows the passage of the first pulse train unchanged. Although described as consisting of storage cores it will be appreciated that other suitable storage elements may be used to provide the pulse trains upon interrogation. For example, other bistable devices, such as trigger stages, may be set to one

state to denote the presence of a code element and may be reset by an interrogating signal to produce an output pulse.

We claim:

1. Apparatus for recording characters carried by tracks past a recording position, similar characters in all tracks passing the recording position at the same time, including means for storing coded representations of a plurality of characters to be recorded comprising a like plurality of groups of storage elements, the elements of a group being settable to store all the code components of a character; means for non-destructively reading out all the stored components from each of the groups in turn to output lines common to all the groups, each of the output lines respectively corresponding to each of all the possible character code components; a group of AND gates connected in series with said output lines, a gate for each line; code component distributors connected directly to said group of gates and scanned in synchronism with the passage of the tracks past the recording position to enable those gates of said group corresponding to the code components representing the characters currently at the recording position; means for detecting the presence of signals passed concurrently by all said enabled gates to produce a final signal; and means responsive to said final signal to record a character from that track corresponding to the group of storage devices currently being read out.

2. Apparatus for recording characters carried by tracks past a recording position, similar characters in all tracks passing the recording position at the same time, including means for storing coded representations of a plurality of characters to be recorded comprising a like plurality of groups of storage elements, the elements of a group being settable to store all the code components of a character; a number of output lines individually corresponding respectively to the individual ones of the possible character code components connected to the storage groups in common; means for non-destructively reading-out the stored components from each of the groups in turn to produce trains of output pulses on the output lines, the time at which an output pulse occurs in a train corresponding to the time of reading out of a group in which the corresponding code component was stored; a group of AND gates connected in series with said output lines; code component distributors connected directly to said group of gates and scanned in synchronism with the passage of the tracks past the recording position to enable those gates of said group corresponding to the code components representing the characters currently at the recording position; means for detecting the presence of signals passed concurrently by all said enabled gates to produce a signal in a final signal train; recording means for each track operable in response to an applied signal to record a character; and means for distributing the final signal train to the recording means in synchronism with the reading out of the storage groups to apply the signals in said final signal train to record characters from those tracks corresponding to the storage groups in which the representation of the character at recording position was stored.

3. Apparatus for recording characters carried by tracks past a recording position, similar characters in all tracks passing the recording position at the same time, including means for storing coded representations of a plurality of characters to be recorded, each character being represented by two components having numerical and zone significance respectively, the storage means comprising a separate group of storage elements for each character to be stored, the elements being settable to store all the code components of a character representation; a number of output lines individually corresponding respectively to the individual ones of the possible character code components connected to the storage groups in common; means for non-destructively reading out the stored components from each of the groups in turn to produce trains of output pulses on the output lines, the time at which an output

pulse occurs in a train corresponding to the time of reading out of a group in which the corresponding code component was stored; first and second groups of AND gates connected to the output lines and having numerical and zone significance respectively; first and second code component distributors synchronised to the tracks connected respectively directly to said first and second groups of AND gates to enable the gate of each group having significance corresponding respectively to the code components representing the character currently at the recording position; a first OR gate connected in common to the outputs of the first group of AND gates; a second OR gate connected in common to the outputs of the second group of AND gates; a final AND gate connected to the outputs of the first and second OR gates operable to pass a final signal train in which signals are present only if signals are concurrently passed by both said first and second AND gate groups representing the numerical and zone code components of the character at the recording position; recording means for each track; and means for distributing signals in the final signal train over the recording means in synchronism with the reading out of the storage groups to record characters from those tracks corresponding to the storage groups storing a representation of the character currently at the recording position.

4. Apparatus for recording characters carried by tracks past a recording position, similar characters in all tracks passing the recording position at the same time, including means for storing coded representations of a plurality of characters to be recorded, each character being represented by two components having numerical and zone significance respectively, the storage means comprising separate groups of bistable storage cores, a group for each character to be stored consisting of a separate storage core for each possible character code component, these cores corresponding to the components of a stored character being switched to a set state; output lines respectively corresponding to each of the possible character code components connected in common to appropriate storage cores of all groups; means for scanning the storage groups in ordered sequence to non-destructively read out the stored code components from the set cores to produce signals on said output lines; a first group of AND gates respectively connected in series with the output lines corresponding to code components of numerical significance; a second group of AND gates respectively connected in series with the output lines corresponding to code components of zone significance; first and second code component distributors synchronised to the tracks connected respectively directly to said first and second AND gate groups to enable a gate from each group to pass signals respectively corresponding to the numerical and zone components representing the character currently at the recording position; first and second OR gates respectively connected to said AND gate groups to pass signals from said enabled gates; a final AND gate connected to said OR gates to pass final signals only if signals are passed concurrently by said enable gates of both AND gate groups; recording means for each track operable in response to an applied signal to record a character; and distributing means synchronised to said scanning means to apply said final signals to the recording means for those tracks corresponding to those storage groups storing a representation of the character currently at the recording position.

5. Apparatus for recording characters carried by tracks past a recording position, similar characters in all tracks passing the recording position at the same time, including means for storing coded representations of a plurality of characters to be recorded, each character being represented by two components having numerical and zone significance respectively, the storage means comprising separate groups of bistable storage cores, a group for each character to be stored consisting of a separate storage core for each possible character code component, those cores corresponding to the components of a stored character be-

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ing switched to a set state; output lines respectively corresponding to each of the possible character code components connected in common to appropriate storage cores of all groups; means for generating scanning signals; means responsive to said scanning signals to scan the storage groups in ordered sequence to non-destructively read out the stored code components from the set cores to produce signals on said output lines; a first group of AND gates respectively connected in series with the output lines corresponding to code components of numerical significance; a second group of AND gates respectively connected in series with the output lines corresponding to code components of zone significance; first and second code component distributors synchronised to the tracks connected respectively directly to said first and second AND gate groups to enable a gate from each group to pass signals respectively corresponding to the numerical and zone components representing the character currently at the recording position; first and second OR gates respectively connected to said AND gate groups to pass

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signals from said enabled gates; a final AND gate connected to said OR gates to pass signals only if signals are passed concurrently by said enabled gates of both AND gate groups; separate means for recording a character from each track in response to an applied signal; and a shifting register responsive jointly to said final signals and to said scanning signals to apply said final signals to the recording means for those tracks corresponding to the storage groups storing representations of the character currently at the recording position.

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