Aug. 14, 1962 L. M. MOYROUD 3,049,210

TYPE COMPOSING APPARATUS

Filed April 15, 1960 6 Sheets-Sheet 1

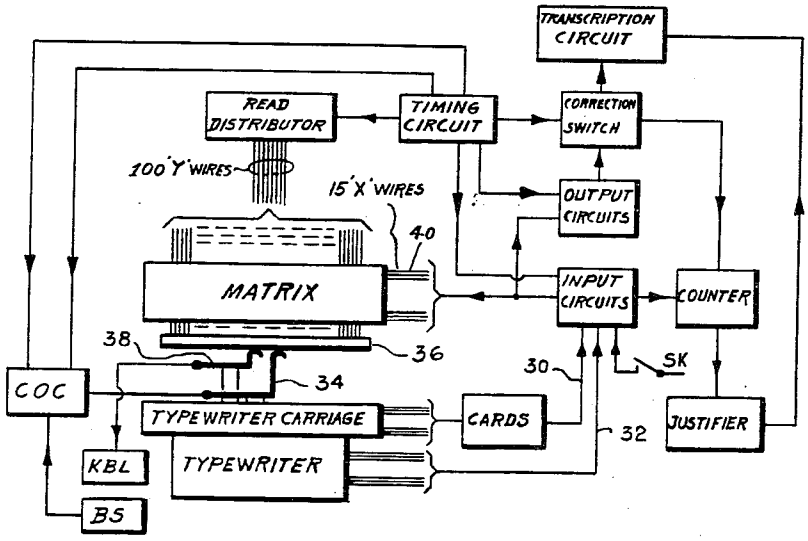


Fig. 1.

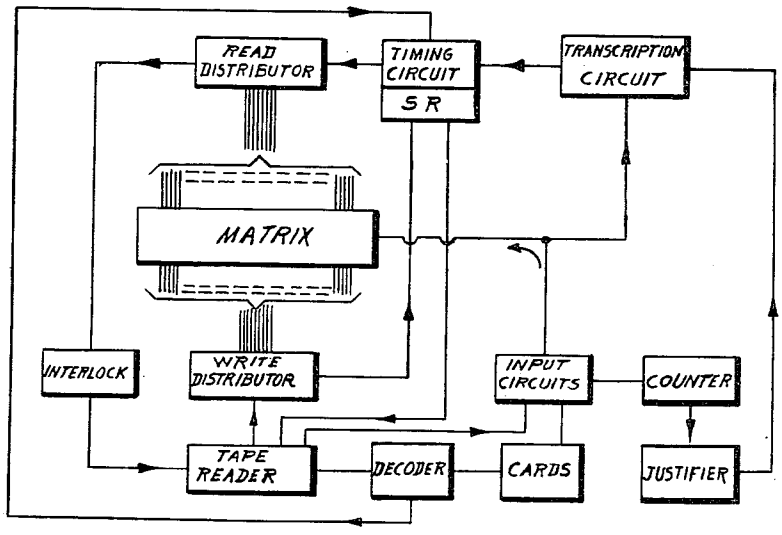


Fig. 2

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Aug. 14, 1962 L. M. MOYROUD 3,049,210

TYPE COMPOSING APPARATUS

Filed April 15, 1960 6 Sheets-Sheet 2

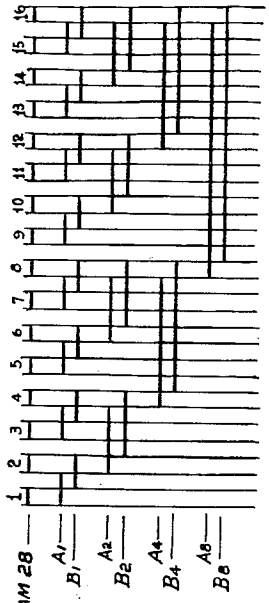


Fig. 4

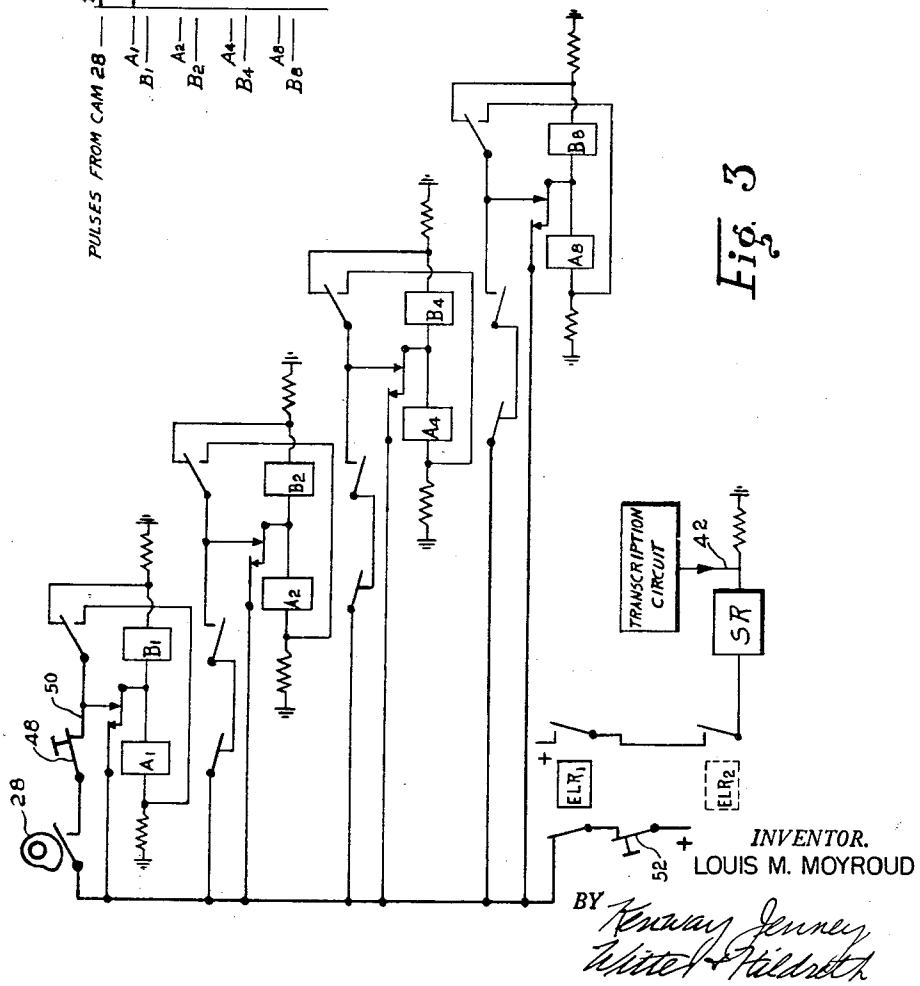


Fig. 3

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TYPE COMPOSING APPARATUS

Filed April 15, 1960 6 Sheets-Sheet 3

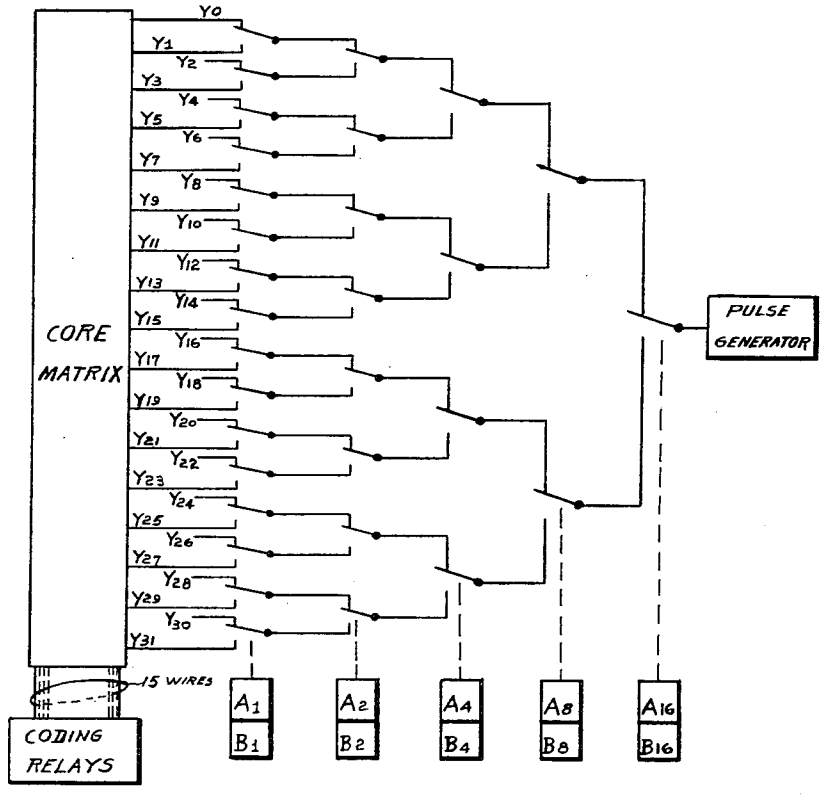


Fig. 5

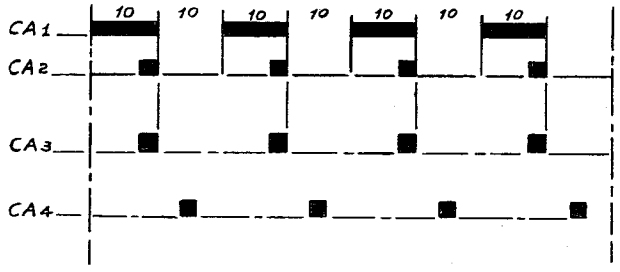


Fig. 7

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TYPE COMPOSING APPARATUS

Filed April 15, 1960 6 Sheets-Sheet 4

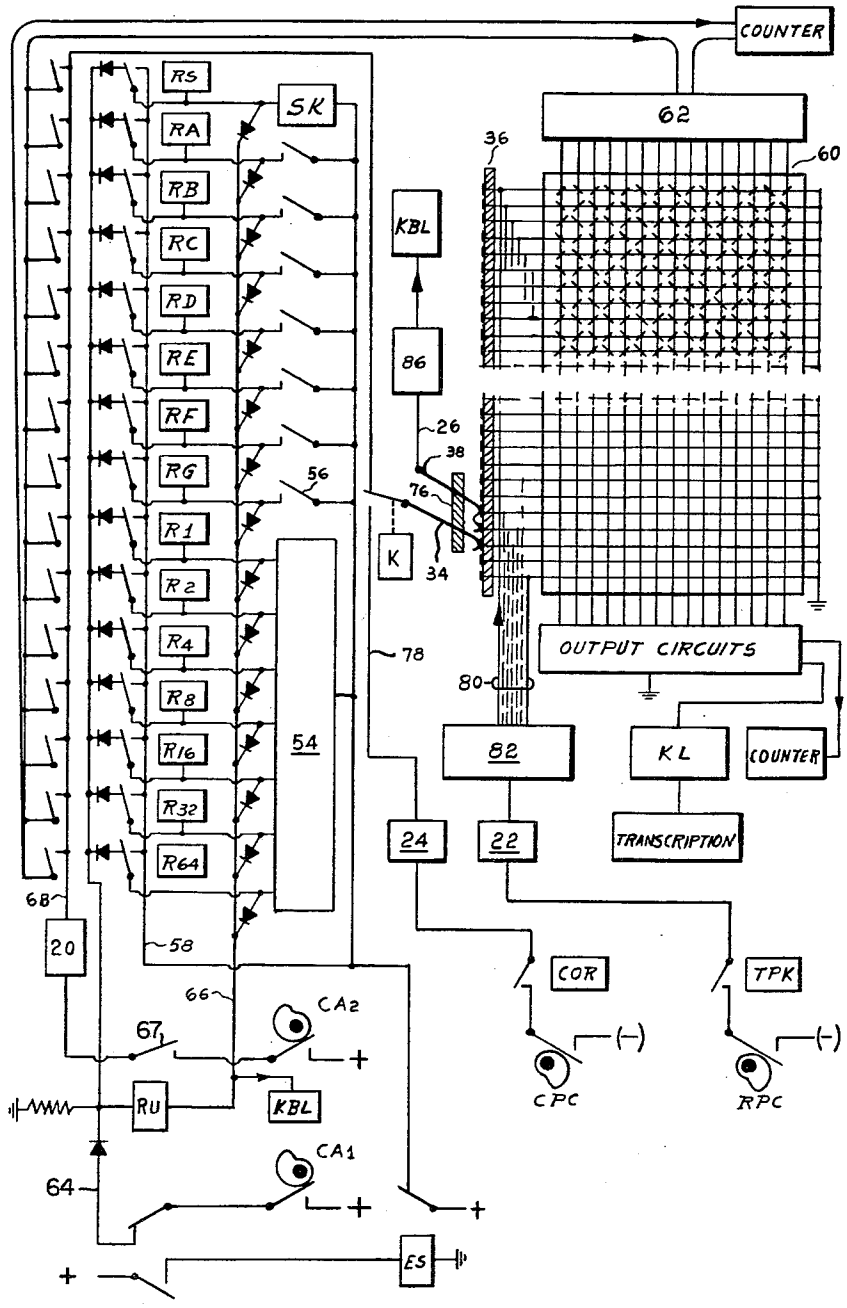


Fig. 6

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TYPE COMPOSING APPARATUS

Filed April 15, 1960 6 Sheets-Sheet 5

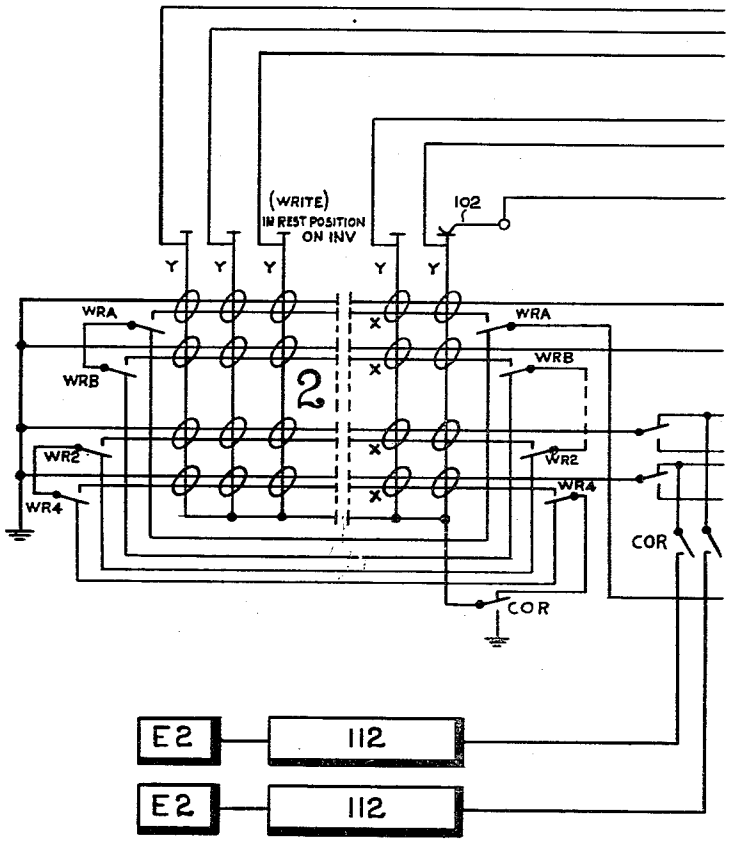


Fig. 8a

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Aug. 14, 1962 L. M. MOYROUD 3,049,210

TYPE COMPOSING APPARATUS

Filed April 15, 1960 6 Sheets-Sheet 6

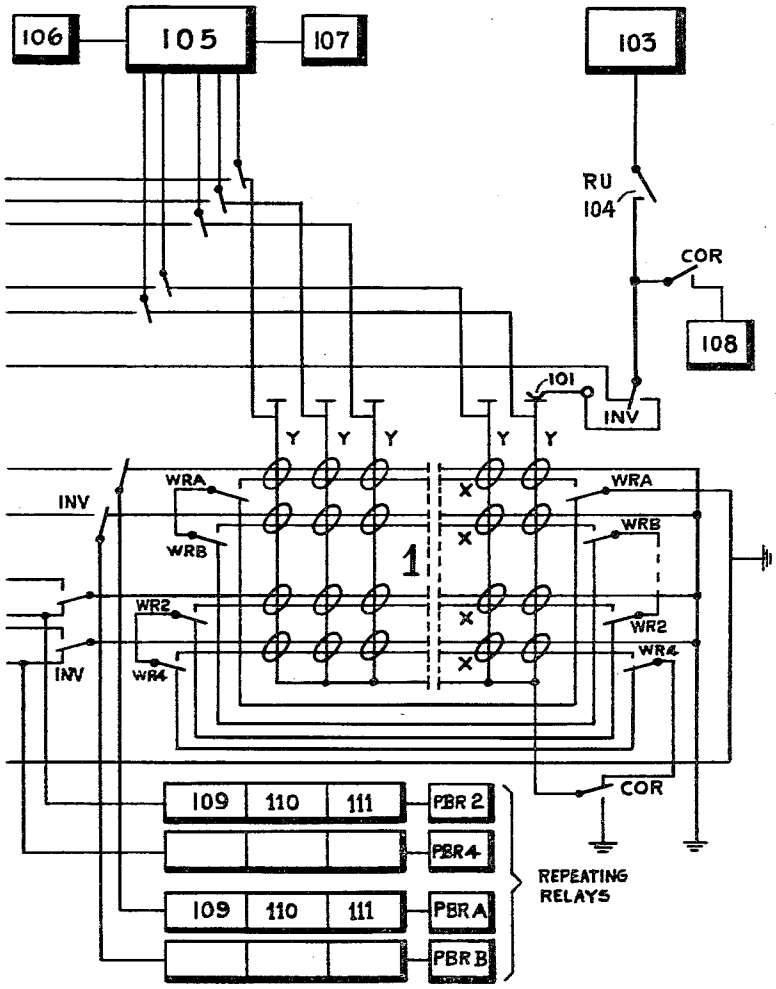


Fig. 8b

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United States Patent Office 3,049,210 Patented Aug. 14, 1962

3,049,210

TYPE COMPOSING APPARATUS

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Filed Apr. 15, 1960, Ser. No. 64,690
Claims priority, application Great Britain Apr. 17, 1959
9 Claims. (Cl. 197—19)

This invention relates generally to type composing machines, and more particularly to machines in which each full line of type is stored in a register or buffer unit prior to being transmitted to another unit which may be a photographic type composing machine, a tape perforator or a line casting machine. The present invention relates more particularly to machines of the kind described in the patent to Higonnet and Moyroud No. 2,682,814, in a copending application of Higonnet and Moyroud Serial No. 741,209, filed June 9, 1958, in a copending application of Higonnet and Moyroud Serial No. 531,023, filed August 29, 1955, and in a copending application of Higonnet, Moyroud and Hanson Serial No. 687,572, filed October 1, 1957, now U.S. Patent No. 2,999,434. According to the present invention a static register, preferably of the magnetic core type including correction means, is used as a buffer unit between the keyboard and the type setting unit of a composing machine. The main advantages of such a register are silent operation, high speed, light weight, ease of correction of erroneous characters and ease of erasure of lines.

Two variants are described, a first one in which the same memory is used for both writing and reading and a second one in which two magnetic memories are provided, one being connected to the keyboard for composing while the other controls transcription.

The invention is described with reference to embodiments shown in the drawings, in which

FIG. 1 is a block diagram of a first embodiment;

FIG. 2 is a block diagram of a second embodiment;

FIG. 3 shows flip-flop circuits used in the embodiments described;

FIG. 4 is a timing diagram;

FIG. 5 shows a distributor used in one of the embodiments;

FIG. 6 shows in more detail the arrangement shown in FIG. 1;

FIG. 7 is a timing diagram; and

FIGS. 8*a* and 8*b* constitute a block diagram of a third embodiment including two magnetic memories.

Two embodiments of the present invention are shown respectively in FIGS. 1 and 2. In both cases a matrix of bistable magnetic cores arranged in rows and columns formation is used. By the term "bistable" is meant a device which, while in an unactuated condition, will remain in either of two states, and including means to cause it to reach either state as desired. There are as many columns of cores as there may be characters in a line of type and as many rows as required by the code used to record each character and any desired service signals. In the example shown it is assumed that the maximum number of characters in a line of type is 100 and that they are coded in a system using 15 binary digits, as described in said application Serial No. 741,209. In the example shown in FIG. 1 the selection of each column at the input stage is directly under the control of the carriage of a typewriter. The output of the core matrix is controlled by a timing circuit and a distributor to select, one at a time and in sequence, each column of cores. A timing circuit divides the time in two cycles, one for the storage or input of the information and the

other for the reading out of said information to avoid possible interferences between input and output. Coincidence circuits of a well-known type are used to trigger the cores from one magnetic state to the other magnetic state during the writing or recording operation and when the stored information is read the cores which have previously been triggered are automatically returned to their previous magnetic states at the same time as they are read. In the example shown in FIG. 1 the typewriter is provided with seven permutation bars giving a seven digit binary code to identify each character. In addition, the typewriter is provided with individual contacts, one for each key, which are used to send pulses through a width selection unit to the input circuits of the machine. The arrangement is the same as the one described in said application Serial No. 741,209. The recording of each character code is obtained by sending an impulse simultaneously to the selected wires of a cable 40 and to a brush 34. This pulse is controlled by a timing circuit and generated by an input pulse generator. The brush 34, as shown in FIGS. 1 and 3, is attached to the typewriter carriage and contacts successively, as a line is being typed, a series of 100 terminals of a printed circuit 36. Each of these terminals is connected to a "Y" wire of the core matrix. These "Y" wires, which are the vertical wires of FIG. 1, are thus scanned successively during the typing of a line and at each step they receive a pulse of the same value and duration as the pulse transmitted to the "X" wires, which have been selected by the input circuits. The coincidence of the "X" and "Y" pulses in a given core trigger it from one magnetic state to the other magnetic state to "store" the bit of information corresponding to the location of said core in the matrix. At the same time as a character identity and its width are stored in the core matrix, the information relating to its width is sent to a counter to be subsequently used in a justifier which can be of the kind described in the above mentioned patent and applications.

One feature of the present invention is the possibility of making any desired correction before a line is sent to the type setting section of the machine or to a tape perforator. It is also possible to erase the whole matrix in the case where a whole line is to be erased. For the correction on a character-by-character basis, a correction key and a backspace key are provided and operate in a manner similar to that described in the patent to Higonnet and Moyroud No. 2,682,814. When the backspace key of the typewriter keyboard is operated the typewriter carriage moves back one step, and through a correction circuit COC, the timing circuit sends a pulse of a direction opposite that of the writing pulse and of an intensity at least double the writing pulse through brush 34 at the appropriate time as determined by the timing circuit. The "opposite" pulse restores to their initial state the cores which had been previously triggered and, at the same time, generates pulses on the wires 40 threaded through the cores switched by the "erase" pulse. These pulses are amplified and used to subtract the width of the erased character from the counter.

When a line has been stored in the core matrix, the operation of a "carriage return" key on the typewriter keyboard returns the typewriter carriage and the brushes 34 and 38 back to the starting position and also initiates the reading out of the previously stored line through a "read" distributor controlled by a timing circuit, as shown. The reading operation should, of course, always be in advance of the writing operation of the next line and appropriate interlock circuits are provided to that effect.

The reading operation is carried out character by character by sending successively an appropriate pulse on

each one of the "Y" wires of the core matrix. The distribution of these pulses is obtained by a relay circuit in a manner described below. If we assume that the magnetic cores were all in a given state before the first line is stored, this state being called "0," after the storage of the first line has taken place certain of the cores will have been switched from magnetic state "0" to magnetic state "1" and the reading operation will erase the stored information by returning all the cores to "0." This is obtained, as in the correction case, by sending successively to each "Y" wire a pulse of sufficient intensity and the appropriate direction to switch back to zero all of the cores which are not already at the "0" state of each column. The cores which are thus returned from "1" to "0" send a pulse on one or several of the wires **40**, which thus receive the information corresponding to the binary code of each character and transfer this information through the output circuits to the transcription circuit.

One kind of distributor which can be used in the present machine to energize successively each "Y" wire corresponding to each character of a line is shown in FIGS. 3, 4, and 5. Fig. 5 shows a well-known relay decoding "tree" with 31 outputs. The present embodiment with 100 characters in a line would require 100 outputs but a reduced number only are shown for the sake of clarity. These circuits are well-known in the art and will not be described in detail. The "tree" is controlled by pairs of relays A1—B1, A2—B2, A4—B4, A8—B8, A16—B16 etc. These relays are also part of a well-known flip-flop circuit shown in FIG. 3. When a cam **28** sends pulses to a wire **50** through a switch **48**, a relay **A1** operates immediately, a relay **B1** operates as soon as the first pulse disappears, and both relays remain energized until the second pulse appears which immediately releases the relay **A1**, the relay **B1** being released at the end of the second pulse, and so on as shown in FIG. 4. Relays **A2** and **B2** operate once for each two operations of the relays **A1** and **B1** and relays **A4** and **B4** operate once for every four operations of the relays **A1** and **B1**, and so on. It can thus be seen that by sending a series of pulses through the cam **28** to the wire **50**, the output wires numbered **Y0** and **Y31** in FIG. 5 are successively connected to the pulse generator shown in the figure.

The timing circuit is such that relays **A1—B1 . . . A16—B16** are at a stable, energized or released, position at the time the pulse is sent by the pulse generator to trigger the cores controlled by the selected "Y" wires. When it is desired to release one distributor and return it to "zero" a relay **ELR1** is operated, or a key **50** is depressed to disconnect relays A and B from the battery and release all of them simultaneously.

FIG. 6 shows in more detail the arrangement shown in the block diagram, FIG. 1. The composition unit shown at **54** comprises mainly a typewriter provided with permutation bars such as **56**, a special key SK for special function codes, an individual contact for each character, a circuit to ascertain for each character a width value expressed in units and in a binary code, and locking means to prevent the typewriter keyboard from being operated during certain intervals or under certain conditions.

When a key is depressed a pulse is sent to an arrangement of relays RS, RA . . . R32, R64. As shown, the selected relays lock on a common wire **58** and a circuit is provided to prevent a common relay RU from operating before all the repeating relays which are supposed to operate have operated. This circuit has been disclosed in detail in said co-pending application Serial No. 531,023. The relay RU is used to control the time at which an impulse of proper direction and intensity is sent to the core matrix **60** through input circuits **62**. In order for the relay RU to operate, the following two conditions should be fulfilled: All the repeating relays which have been selected by the permutation bars and the other circuits of the keyboard should have operated; and the battery connected to the relay RU to prevent its operation through a wire **64** from the cam **CA1** should have been disconnected. (All of the repeating relays are assumed to be grounded.) Cam **CA1** thus prevents the relay RU from operating except at the right time in the cycle of the machine in order to prevent interference between the writing of the characters of a line and the reading of the characters of the previous line. When the cam **CA1** opens its contacts the relay RU, which has been connected to a battery through a wire **66**, operates and closes a contact **67** which allows a pulse from the cam **CA2** to reach the "write" pulse generator **20** which is designed to send one pulse of the appropriate shape, direction, duration and intensity to the wire **68**. As can be seen in the drawing, the same pulse passes through the selected contacts of repeating relays **R64**, the appropriate "X" wires **60** of the matrix and also through the brush **34** and the "Y" wire corresponding to the position of the typewriter carriage, that is, corresponding to the location of the character along the path of the typewriter carriage **76**.

As soon as the key of the typewriter is depressed a circuit KBL is energized to lock the keyboard and prevent the depression of any key before a sequence of operation has taken place to insure that the code corresponding to the selected character has been stored and that a typewriter escapement ES has operated. The typewriter escapement is operated by the relay RU, as shown in FIG. 6, and releases the repeating relays by removing the locking battery connection from the wire **58**.

When a correction is desired, for example when it is desired to remove the last typed character by using the back space key, a relay K is operated which transfers the input brush **34** from the wire **68** to the wire **78**, thus allowing a correction cam CPC to send a pulse through the correction pulse generator **34** at the appropriate time, determined by the correction relay COR. It is clear that other means to read the code of an erroneously stored character could be used and the means described above are given as an example.

The correction pulse appearing on the wire **78** resets to zero the cores which have been previously switched to position "1." The cores thus forced to return to "0" send a pulse to the "X" wires **60** passing through them and through the appropriate output circuit. These pulses corresponding to the width of the character being erased reach the counter to subtract said width from the total count.

The reading of a line can proceed at the same time as the writing of the succeeding line in a manner similar to that described above by using an interlocked brush **38**. In order to read a previously stored line, pulses are successively sent to the "Y" wires through cable **80** connected to the output of "read" distributor **82** which may be of the type shown in FIGS. 3, 4, and 5. A pulse generator **22** sends, at the appropriate time determined by the transcription pulse relay CPR and cam RPC, a pulse of the proper direction, shape, duration, and intensity to return to "0" all the cores through which the "Y" wire selected by the distributor **82** is threaded. As explained above for the case of correction, the cores switched back to "0" generate a pulse on their respective "X" wires which is amplified and channeled through the output circuit to the transcription circuit of the machine which may be similar to that described in said co-pending application Serial No. 687,572. When it is desired to erase a whole line, a relay KL is operated which prevents the pulses read by the output circuits from reaching the transcription unit.

The interlock brush **38** which, as shown in the drawing, makes contact with two terminals of printed circuit **36** in advance of the "write" brush **34** is connected through the wire **26** to a timing circuit **86** and to the

keyboard locking mechanism KBL. The purpose of the locking circuit 86 is to prevent the operation of the keyboard for a given time, for example 100 to 200 milliseconds. Supposing, for example, that the "read" circuit of the matrix has momentarily stopped to wait for certain machine functions to be terminated, it is then possible for a fast typist to "catch up" with the "read" distributor. In this case, the brush 38 reaches the terminal receiving impulses from the "read" pulse generator and, through the circuit 86, locks the keyboard of the typewriter. The circuit 86 is such that, after reading a pulse, it remains energized for a certain length of time, for example 200 milliseconds, in order to enable the "read" circuit to move several steps ahead of the typewriter carriage.

FIG. 7 shows how one machine cycle can be divided in order to enable the use of a common matrix for the writing of a line and the reading of a previously stored line. If we assume that the machine is controlled by continuously rotating cams, as for example the cams described in said Patent No. 2,682,814, and that the speed at which characters are transcribed is 12.5 characters per second, one cycle will correspond to 80 milliseconds, which can be divided in groups of 10 milliseconds by the cam CA1. These pulses are used for the writing and correction of characters. The cam CA2 controls the "write" pulse generator, the cam CA3 controls the correction pulse generator, and the cam CA4 controls the "read" pulse generator. It can be seen that sufficient time is left between pulses used in the input circuit and those used in the output circuit to avoid interference.

The block diagram shown in FIG. 2 illustrates the case where the static storage is used to control a type setting machine from a tape which has previously been prepared on a typewriter or tape punching mechanism not provided with means to identify the widths of each character, as described for example in a co-pending application of Hanson Serial No. 21,740, filed April 12, 1960. In this case, where the only information in the tape relates to the identity of each character of a line, it is necessary in order to justify the lines to store in an appropriate storage the widths of the characters, and preferably their identity. The block diagram of FIG. 2 is similar to the block diagram of FIG. 1 except that the typewriter is, in this case, replaced by a tape reader and the typewriter carriage is replaced by a "write" distributor similar to the "read" distributor previously described. The tape reader reads the seven identity codes of each character and through a decoder width cards circuit and encoder, the width of each individual character in binary form is transmitted through the input circuit to the "X" wires of the core matrix. The identity code of the characters of the line is directly sent by the tape reader to the input circuits and the "X" wires. The width information of each character is also transferred to a counter in order to accumulate the width of each character of a line and the number of justifying spaces of said line as the tape is read and, through appropriate circuitry, the tape reader is stopped when the justification operation is desirable as explained in the co-pending application of Higonnet and Grea, Serial No. 845,237, filed October 8, 1959, now U.S. Patent No. 2,968,383. As the same core matrix is used to read the same line at the same time as another line is stored, proper circuitry has to be used to insure a safe time division. The "read" distributor, when it is operating at the same time as the "write" distributor, is always in advance of it by two steps. Assuming that the tape reader is ready to function for the first line of a text, as soon as a switch is turned on it will start to read the code information of each character, one at a time, at the speed of, for example, 12.5 steps per second. When the tape reader reads the first end-of-line code, a signal is sent via the decoder to the timing circuit. This signal allows the timing circuit to send pulses to the "read" distributor which starts to scan the "Y" wires of the matrix. The end-of-line pulse from the tape also resets to zero the "write" distributor. At the same time as the first pulse is sent to the "read" distributor, it is also sent to the tape reader via an interlock circuit which "loses" the first two pulses from the control cam and allows the tape reader to start only after the "read" distributor has moved two steps. In addition, the interlock circuit is such that the tape reader is at all times two steps behind the "read" distributor even if the latter stops for a while, for example, to allow the photo unit to perform a shift, as described in said co-pending application Serial No. 687,572. In this case, the tape reader will also stop until the "read" distributor has resumed its operation. As soon as either the tape reader or the "read" distributor transmits an end-of-line code to its associated decoder it returns to "zero" by operating end-of-line relays ELR1 and ELR2 (FIG. 3) and, in any case, the tape reader will remain at rest with all the "write" distributor relays being de-energized until the "read" distributor has started again and moved two steps.

The operation of the "read" distributor via the timing circuit is initiated at the beginning of the transcription of each line by a relay SR which is operated when both end-of-line relays ELR1 of the "read" distributor and ELR2 of the "write" distributor are energized. In this case, as shown in FIG. 3, it means that both distributors are at zero. In addition, the relay SR may be prevented from being energized by a wire 42 from the transcription circuit which keeps a shunt-down potential on this relay which prevents its energization until a number of end-of-line functions such as carriage return and line spacing have taken place.

In another embodiment of the invention shown in FIG. 8*a* and FIG. 8*b* two magnetic core memories are used alternately for writing and reading. The memories are in the form of arrays of 100 columns of 15 cores each. FIGS. 8*a* and 8*b* show only a few columns and rows for the sake of clarity. The array is of rectangular coordinates with one "Y" wire (columns) and two "X" wires (rows) in each intersection, one "X" wire being for transcription proper and the other being for corrections. In the case of corrections it is necessary to read the width of the erroneous character at the same time as it is erased for correcting the line length as explained in the above-mentioned patents and applications. Selection of the "Y" wires corresponding to the characters as typing progresses may be effected in various ways. In a preferred embodiment shown schematically in the drawing the platen of the typewriter is provided with two brushes 101 (FIG. 8*b*) and 102 (FIG. 8*a*) each cooperating with 100 terminals, each connected to a "Y" wire, of the two memories. By means of a transfer contact of a relay INV one or the other of these brushes may be connected to a source of pulses 103. This pulse generator may comprise a well-known condenser discharge circuit. A relay RU when closing its make contacts 104 causes the condenser to discharge into the "Y" wire whose terminal is in contact with the brush 102 (or 101).

The selection of the "X" wires is effected by relays WRA, WRB . . . WR2, WR4 under the control of the keyboard. Selection of the relays WRA, etc. which identify the characters in code form is made by permutation bars controlled by the typewriter keys. Selection of the width relays WR2, etc. is made by a width selection circuit described in said application Serial No. 741,209.

A magnetic core is tripped when current flows simultaneously in the two wires "Y" and "X" passing through the said core at any given intersection.

Wires "X" are threaded in the core so that the magnetic effect of the driving currents adds up. Rather than sending separate pulses in the "Y" wires and the "X" wires selected by the relays, the same pulse is sent through the "Y" wire and the "X" wires in series. FIG. 8 shows how this may be done by means of two transfer contacts for each "X" wire. It is apparent that when the relay WRA,

for instance, is at rest no current flows in the corresponding "X" wire, which is disconnected and replaced by a short circuit.

In this way synchronisation between the "X" and "Y" impulses is automatically achieved. It is only necessary that the relay RU which sends the impulse to the memory be operated after the relays WRA . . . WR2, etc. have assumed their operated positions.

In this way, the various characters are stored in the successive columns "Y" of the magnetic core array, the selection of the column being made by the displacement of the typewriter platen and its associated brushes.

In the rest position of relay INV (as shown in FIG. 8*b*) the "X" wires which were used in the writing operation are now disconnected and idle. A second set of "X" wires is connected in parallel at one end and each wire is associated with a read-out circuit. These circuits are of conventional type and may include a filter **109** for preventing induction from relay sparking, a one-shot multivibrator **110** which is triggered by the pulse and a trip thyratron **111** if it is desired to operate relays. The relays, PBRA, PBRB . . . PBR2, PBR4, etc. operate according to the code stored in the column of magnetic cores. The first set of relays identifies the character, and the second its width. Transcription takes place as described in the above mentioned patents and applications.

The selection of columns of the memory during transcription may be made in different ways. The drawing shows the use of a decoder **105** similar to the one shown in FIGS. 3 and 5. Under the control of a timing circuit (or cam) **106** (FIG. 8*b*) the decoder **105** selects in succession the "Y" wires of the array. Transfer contacts of the relay INV select one of the memories for transcription and one for composition.

Every time the decoder **105** advances one step it sends a read-out pulse to the "Y" wire selected by means of a pulse generator **107**. This may be a condenser discharge circuit controlled by a timing circuit **106**.

Provisions are made for correcting a faulty character at the typing stage. A sequential circuit controlled by the back space key of the keyboard and a relay COR performs the following operations in succession: it moves the platen of the typewriter back one step, then through the relay COR it connects the read-out "X" wires which give the width of the faulty character each to reading circuits **112**, and then it sends an impulse to the "Y" wire (by the circuit **108**).

This impulse erases the information stored in the column "Y" corresponding to the faulty character and generates an impulse on the "X" width wires which operate, through the reading circuits **112**, the width relays E2, E4, etc. At the same time the line length counter is placed in subtracting position and the width of the faulty character subtracted from the length of the line. The "Y" column is erased at the same time and ready to receive the code of the correct character.

The sequential circuits controlling the relay COR and the sending of the pulse to the "Y" wire for corrections are conventional operations similar to those described in said Patent No. 2,682,814.

The circuits described in this patent are cited by way of example and not limitation, and other means to achieve the same results can be used without departing from the scope of the present invention. It is, for example, possible to use two magnetic core matrices, each one being successively connected to the input circuits and to the output circuits, so that a line can be stored while another is being read without the possibility of interference.

The magnetic cores of the matrix units can be replaced by other bi-stable elements or other elements which can hold an electric charge. In this case, the circuits described may have to be slightly modified in a manner known to a person skilled in the art.

It will be understood that the foregoing and other alternative arrangements, embodiments and variations of structure can be effected by the use of known circuit techniques without departing from the spirit and scope of the invention.

Having thus described the invention, I claim:

1. In type composing apparatus, the combination of a memory matrix having two coordinate wire systems each consisting of a plurality of wires, each wire of one system being associated with each wire of the other system in an intersection, bistable means at each intersection for actuation upon the coincident arrival of pulses on both wires therein, a pulse source, and writing means for connection of the source to the wires of one coordinate system singly and consecutively and for simultaneous selection of combinations of the wires of the other coordinate system corresponding to the characters selected.

2. In type composing apparatus, the combination of a memory matrix having two coordinate wire systems each consisting of a plurality of wires, each wire of one system being associated with each wire of the other system in an intersection, bistable means at each intersection for actuation upon the coincident arrival of pulses on both wires therein, a typewriter having a platen carriage, a pulse source, and writing means engaged with the platen carriage for connection of the pulse source to a single wire of one coordinate system for each step of said carriage and for simultaneous selection of combinations of the wires of the other coordinate system corresponding to the characters selected.

3. In type composing apparatus, the combination of a memory matrix having two coordinate wire systems each consisting of a plurality of wires, each wire of one system being associated with each wire of the other system in an intersection, bistable means at each intersection for actuation upon the coincident arrival of pulses on both wires therein, a pulse source, writing means for connection of the source to the wires of one coordinate system singly and consecutively and for simultaneous selection of combinations of the wires of the other coordinate system corresponding to the characters selected, and reading means for sensing the selected combinations consecutively.

4. In type composing apparatus, the combination of a memory matrix having two coordinate wire systems each consisting of a plurality of wires, each wire of one system being associated with each wire of the other system in an intersection, bistable means at each intersection for actuation upon the coincident arrival of pulses on both wires therein, a pulse source, writing means for connection of the source to the wires of one coordinate system singly and consecutively and for simultaneous selection of combinations of the wires of the other coordinate system corresponding to the characters selected, and correction means engaged with the writing means for removing any selected combination corresponding to a character.

5. In type composing apparatus, the combination of a memory matrix having two coordinate wire systems each consisting of a plurality of wires, each wire of one system being associated with each wire of the other system in an intersection, bistable means at each intersection for actuation upon the coincident arrival of pulses on both wires therein, a typewriter having a platen carriage, a pulse source, writing means engaged with the platen carriage for connection of the pulse source to a single wire of one coordinate system for each step of said carriage and for simultaneous selection of combinations of the wires of the other coordinate system corresponding to the characters selected, and correction means engaged with the writing means for removing any selected combination corresponding to a character.

6. In type composing apparatus, the combination of a memory matrix having a pair of multiple-lead coordinate circuits and bistable elements interconnecting said circuits, a pulse source, writing means for connection of the source to the leads of one coordinate circuit singly and consecutively and for simultaneous selection of com-

binations of the wires of the other coordinate circuit corresponding to the characters selected, and reading means for sensing the selected combinations consecutively including a distributor adapted to complete a sensing pulse circuit to the leads of said one coordinate circuit consecutively.

7. In type composing apparatus, the combination of a memory matrix having a pair of multiple-lead coordinate circuits and bistable elements interconnecting said circuits, a pulse source, writing means for connection of the source to the leads of one coordinate circuit singly and consecutively and for simultaneous selection of combinations of the wires of the other coordinate circuit corresponding to the characters selected, each of said combinations including a numerical representation of the width

of a character, and reading means for sensing the selected combinations consecutively including a distributor adapted to complete a sensing pulse circuit to the leads of said one coordinate circuit consecutively.

8. The combination of claim 7 with a line counter, correction means engaged with the writing means for removing from the matrix any selected combination corresponding to a character and a circuit actuated by said numerical representation of the width of said character to subtract its width from said counter.

9. The combination of claim 6, including a timing circuit to cause the operation of the writing means to occur alternately with the operation of the reading means.

No references cited.