

[54] AUTOMATIC ERASING TYPEWRITER SYSTEM

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[51] Int. Cl. B41j 5/30

[58] Field of Search 197/16, 19, 20, 113, 197/151, 172, 181; 340/146.1 R

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[57] ABSTRACT

A typewriter having a character erase mechanism is combined with an automatic control system including a changeable memory that maintains a record of both characters printed and characters erased to enhance the typist's ability to edit and correct text as it is typed. With this system the typist can select automatic erasure of individual characters, selected words, or an entire line simply by depression of a key. Furthermore, typist can add, delete or correct words as desired and the typewriter will automatically reprint correct text that was erased to enable such insertion or deletion.

20 Claims, 11 Drawing Figures

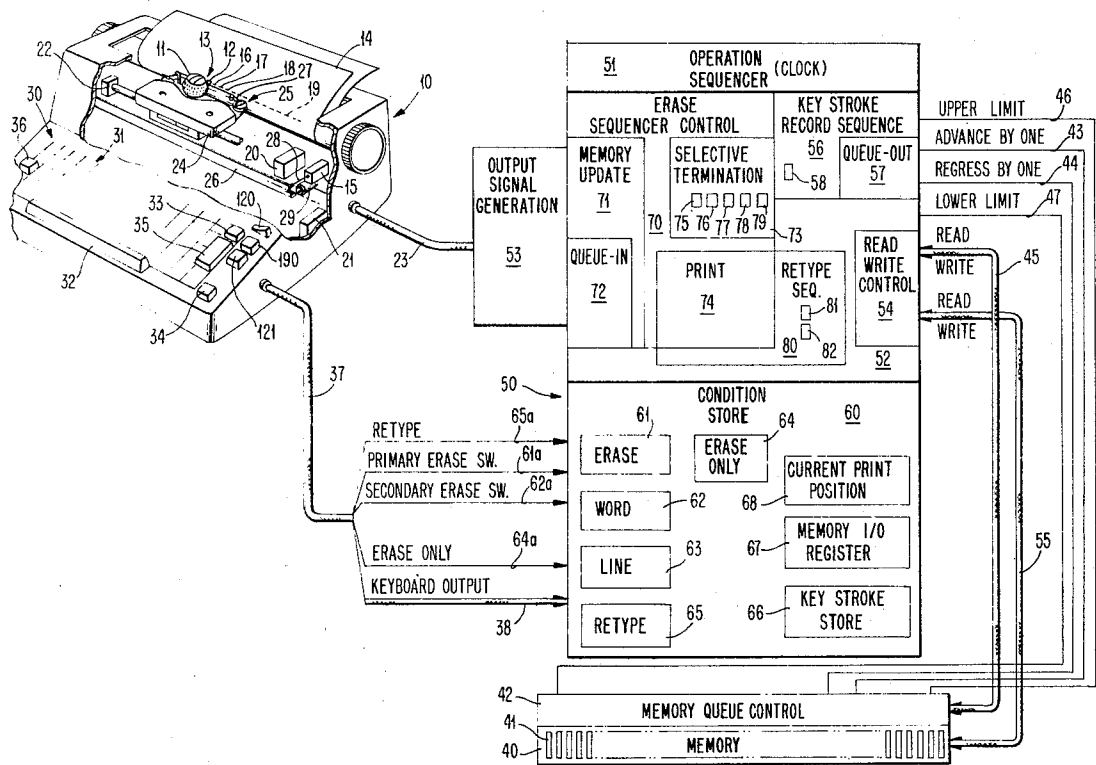


FIG. 1

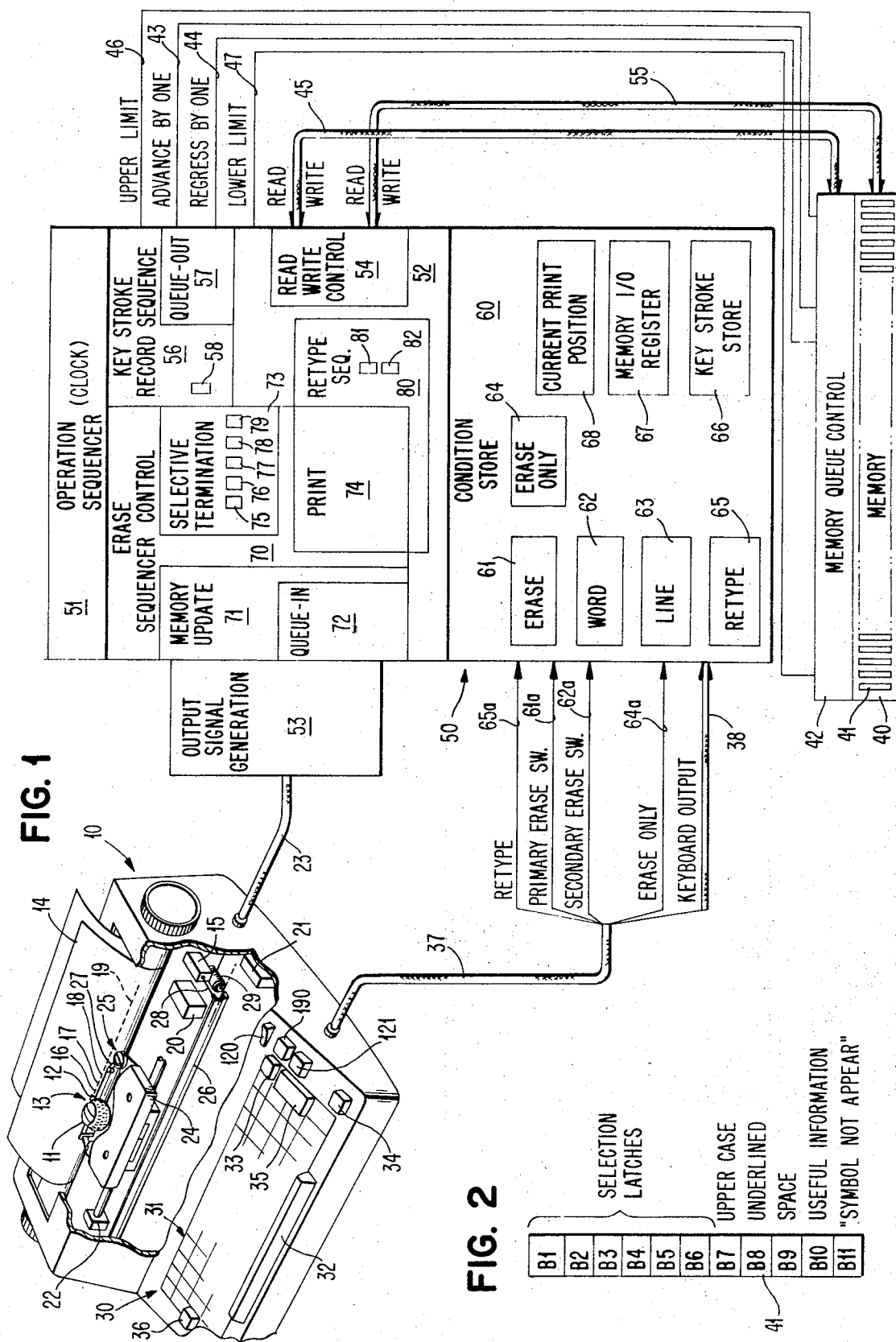


FIG. 2

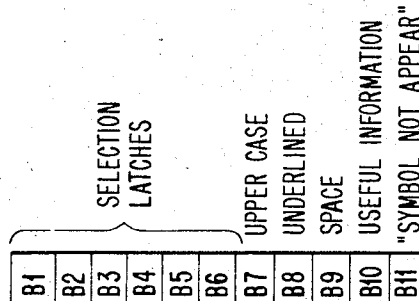


FIG. 3

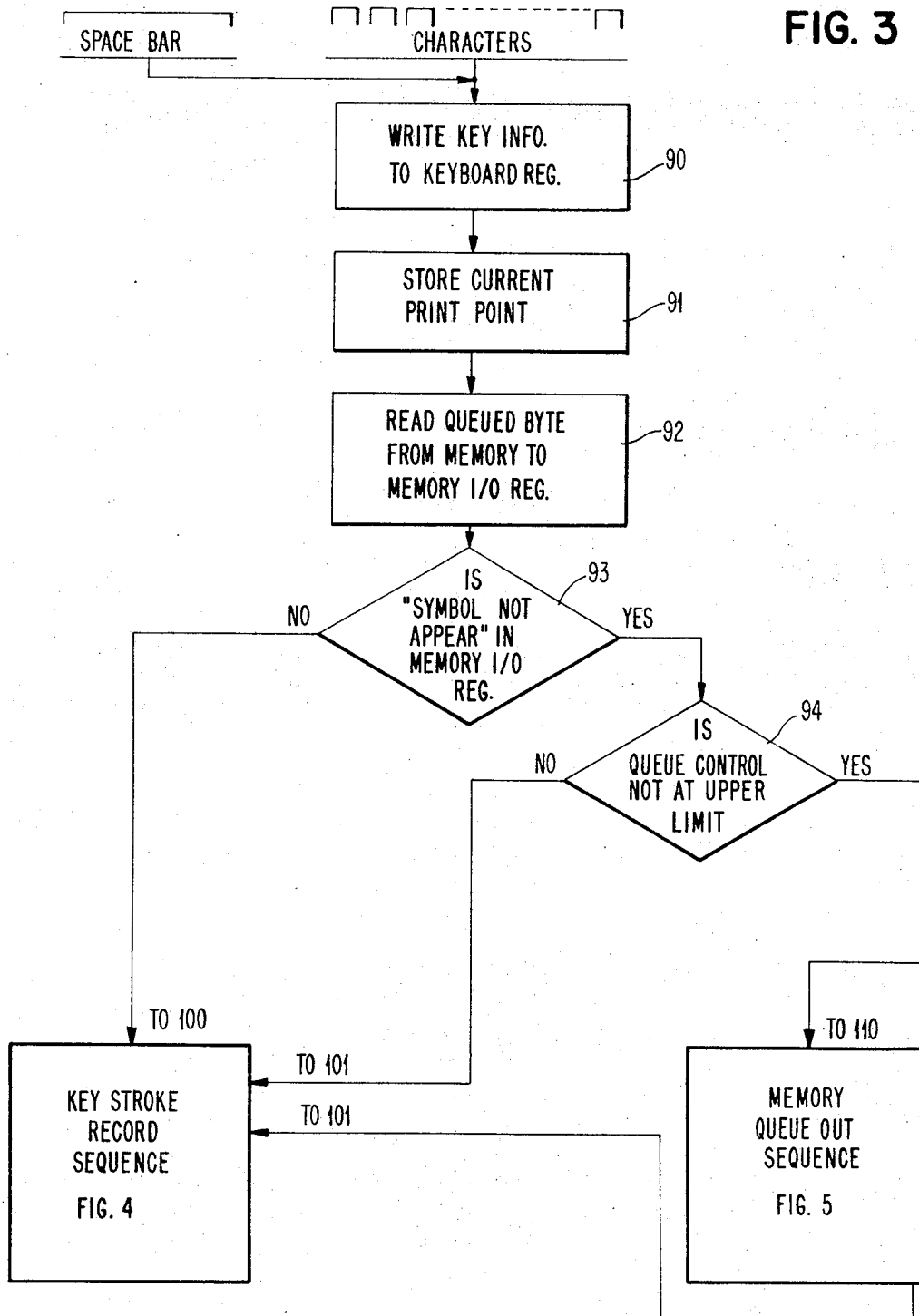


FIG. 9

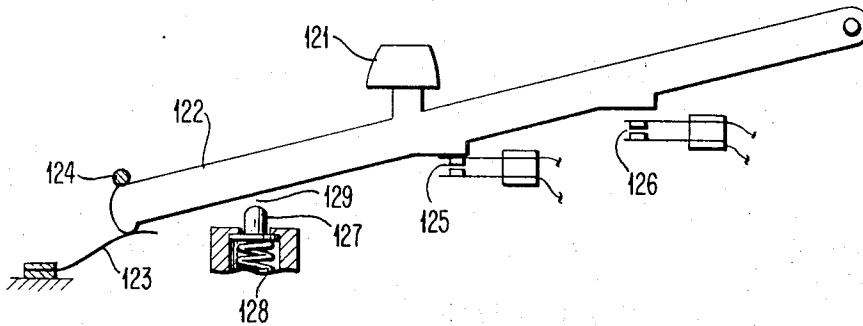


FIG. 4

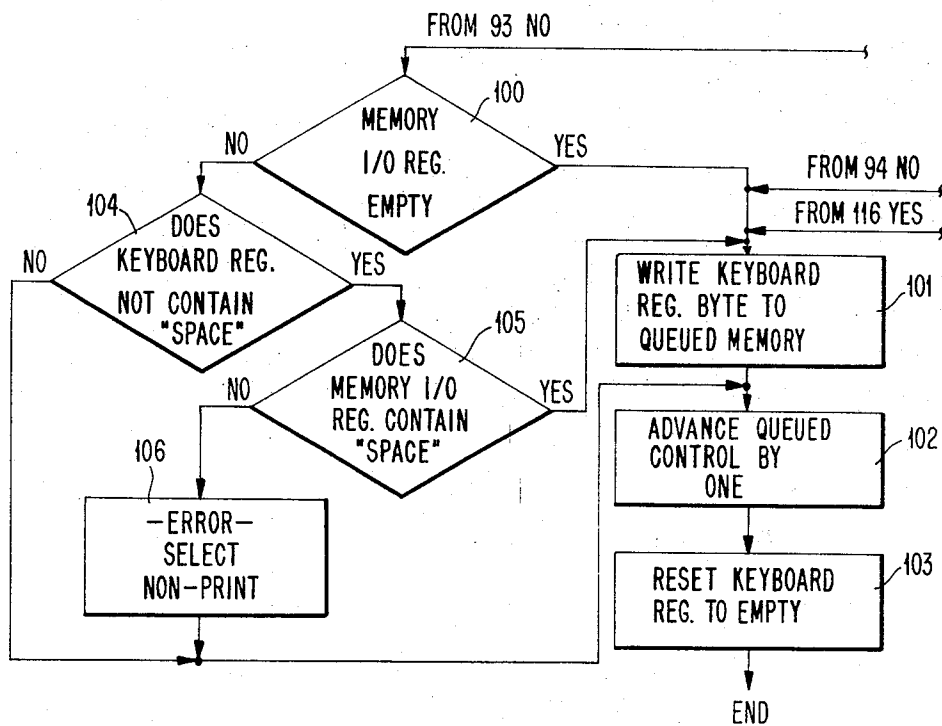


FIG. 5

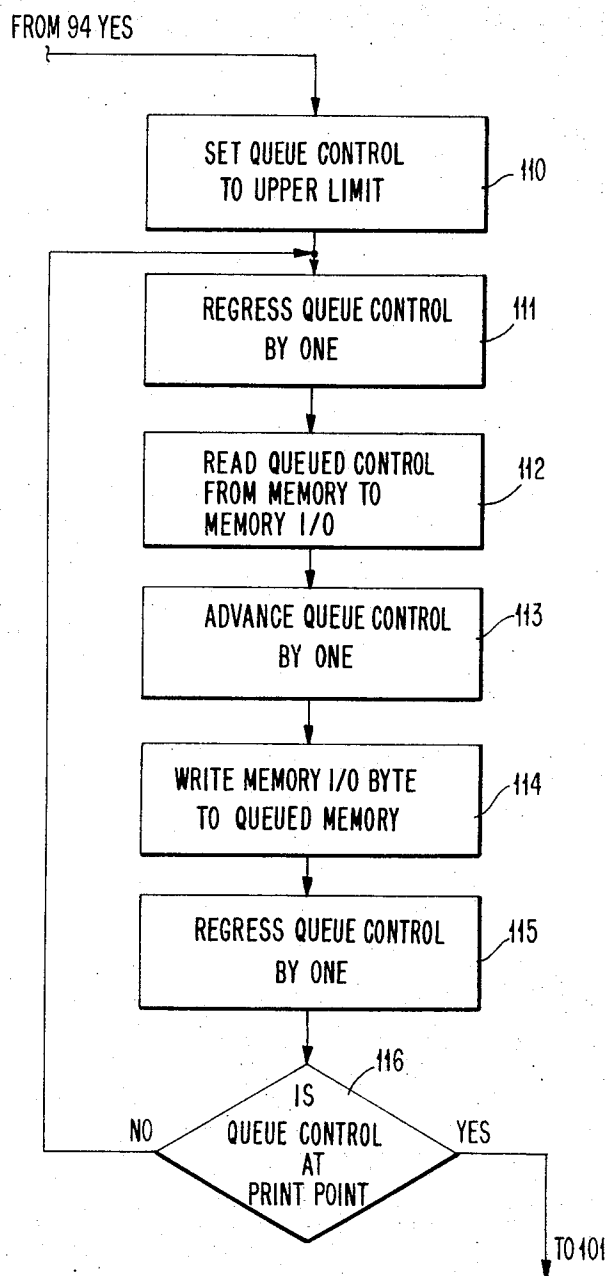


FIG. 6

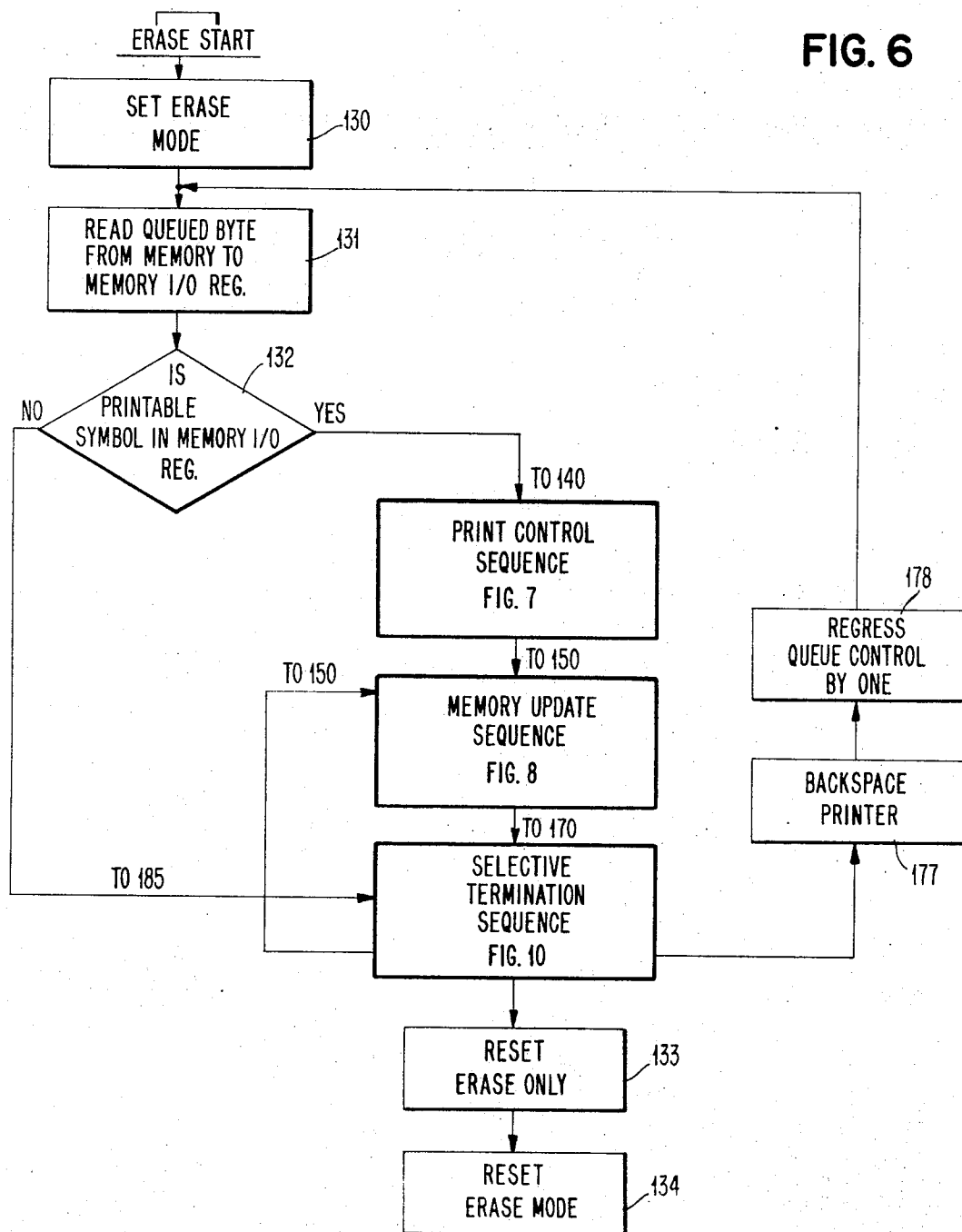


FIG. 7

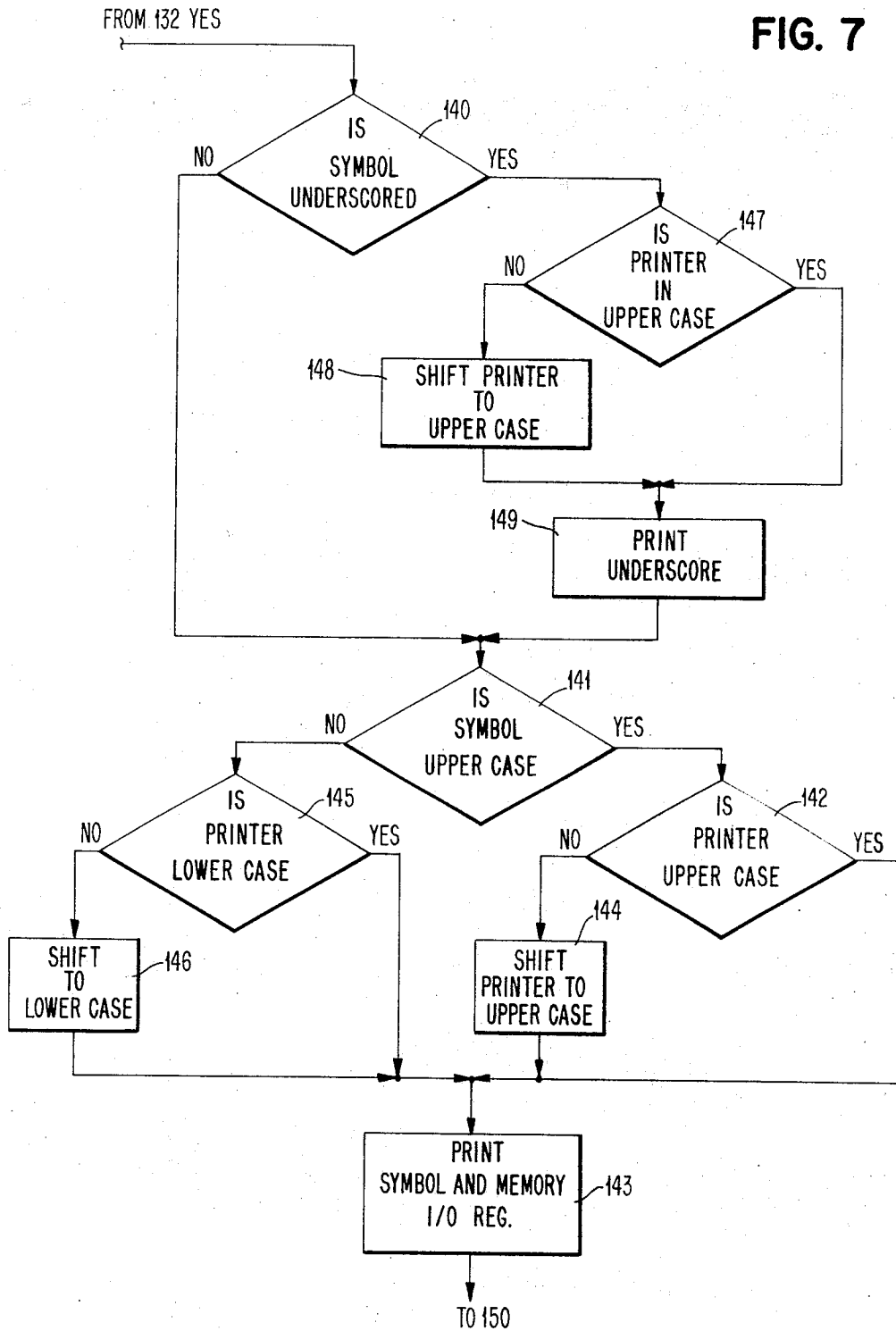


FIG. 8

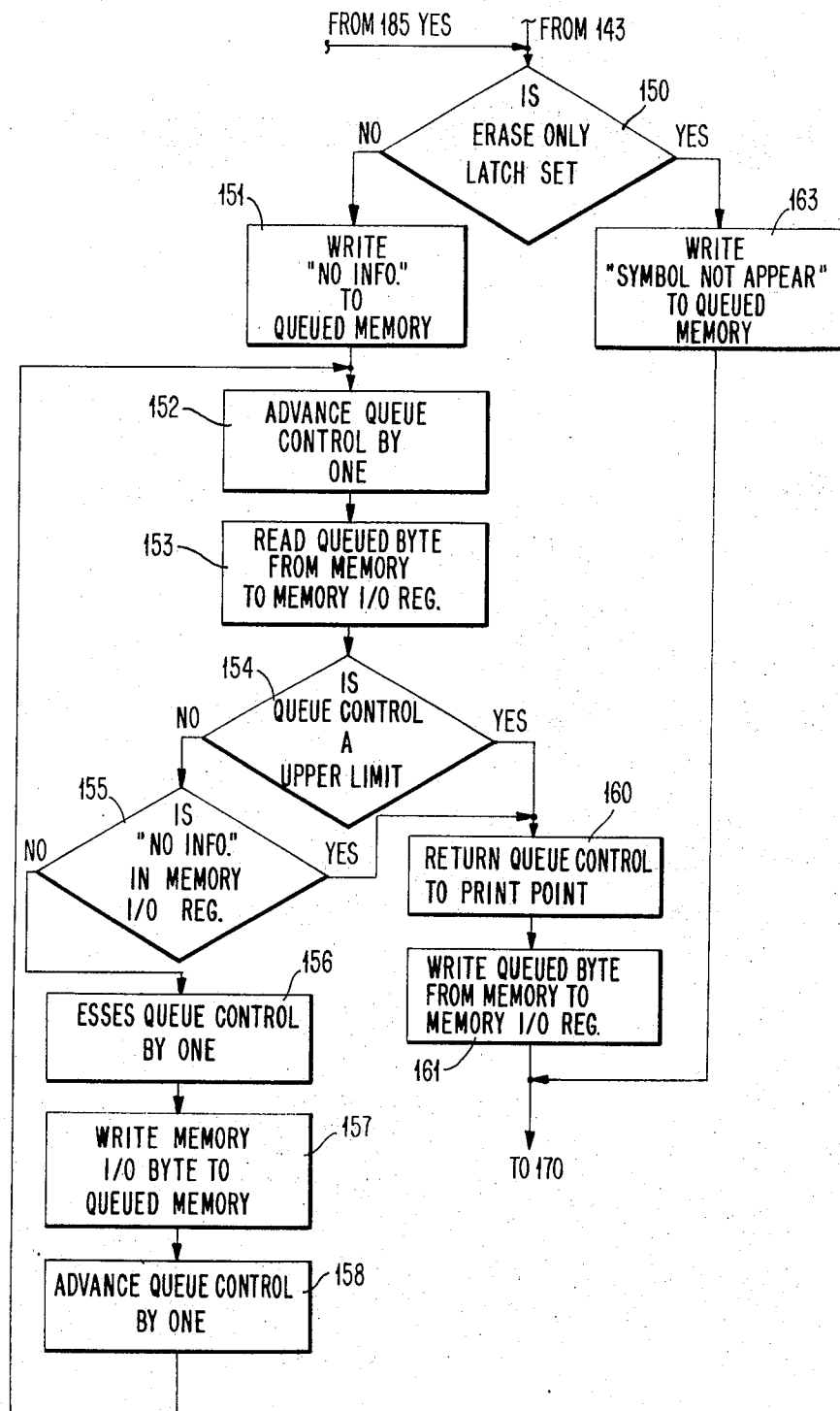


FIG. 10

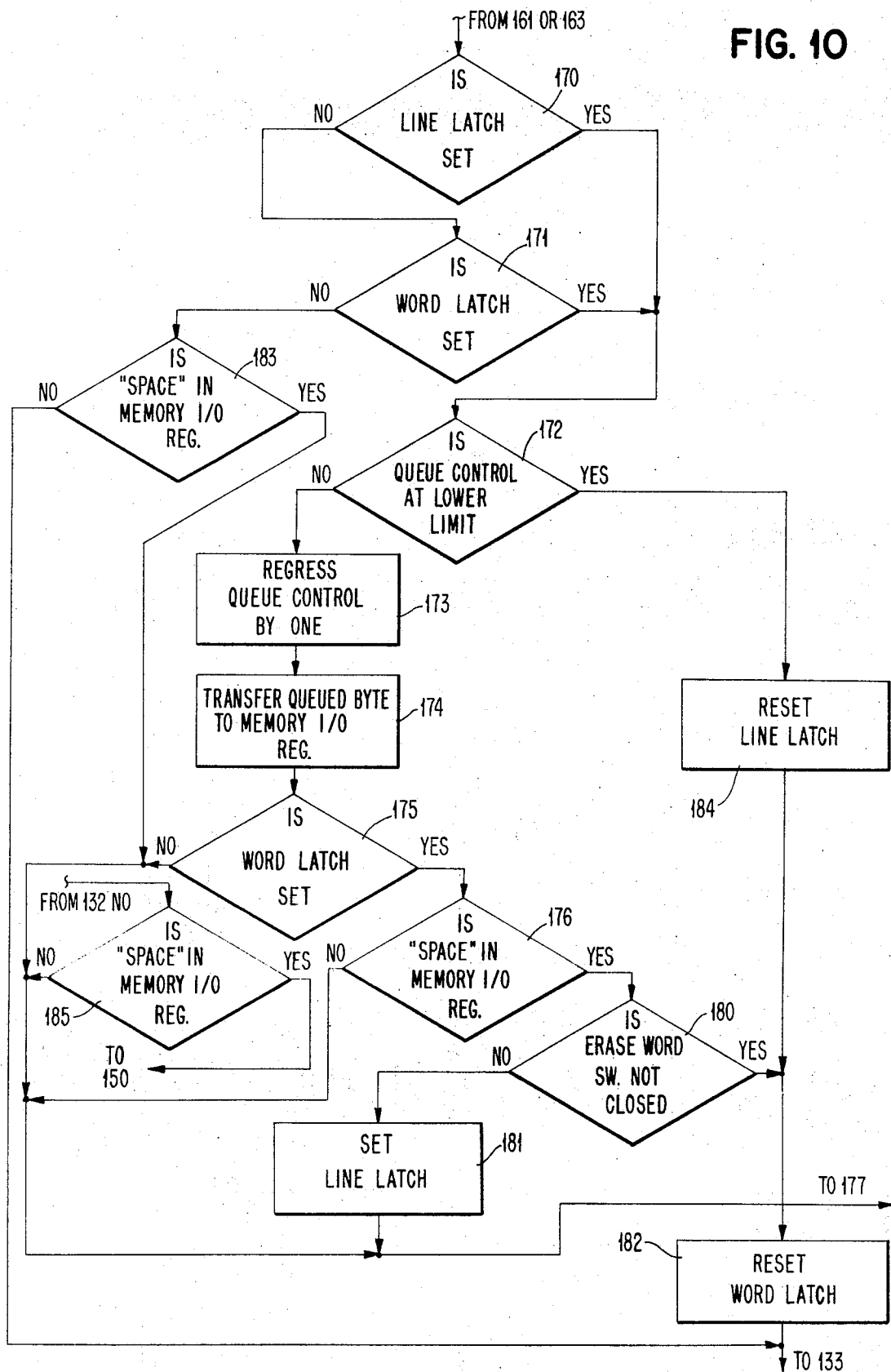
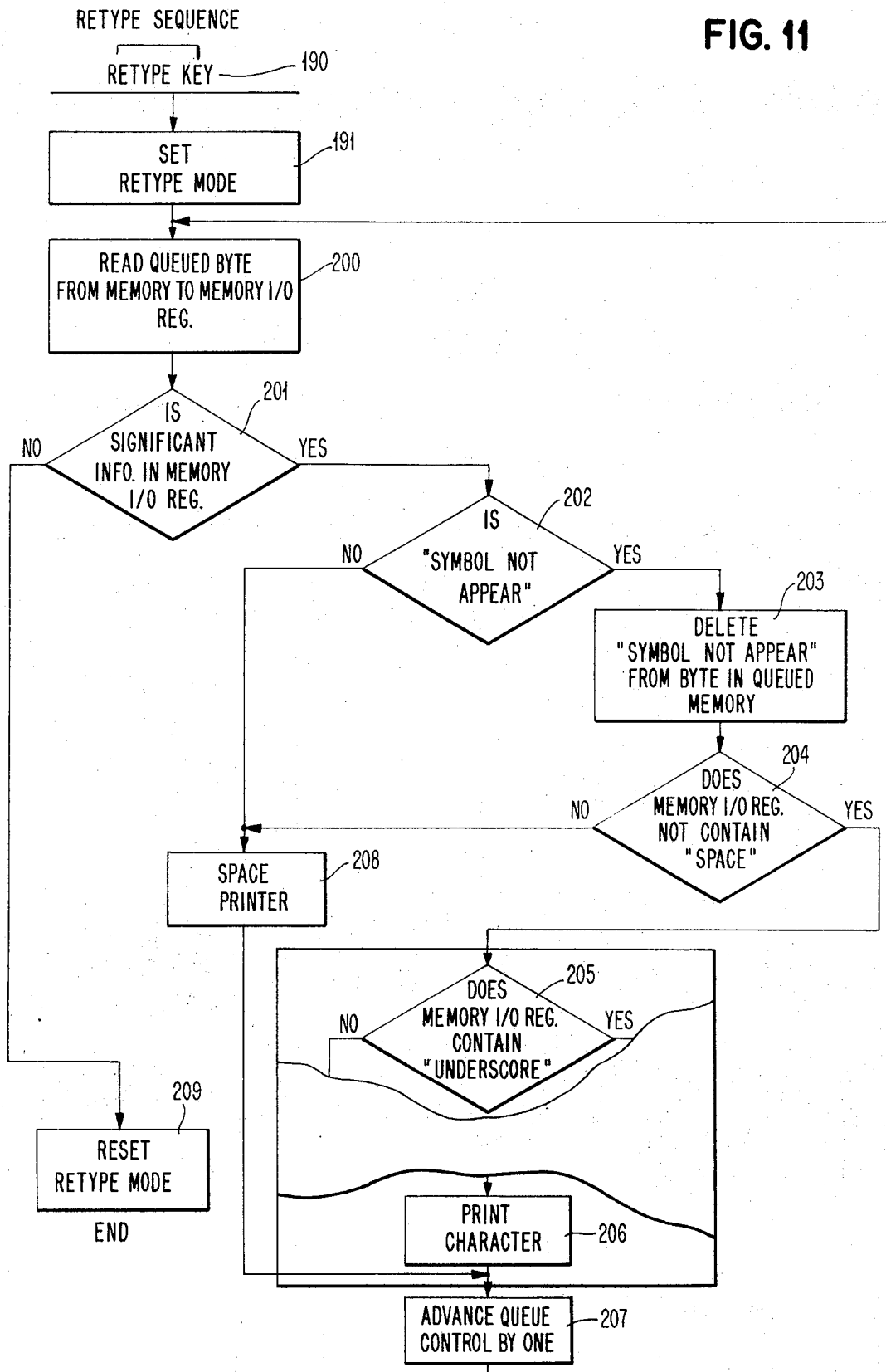


FIG. 11



AUTOMATIC ERASING TYPEWRITER SYSTEM

CROSS-REFERENCES

Cross reference is made to U.S. Pat. 3,724,633 and to co-pending applications, Ser. No. 102,696 to S.A. Okcuoglu, R.V. Davidge, C.J. Davis, and J.O. Schaefer, filed Dec. 30, 1970 and entitled "Automatic Erase Mechanism" and Ser. No. 266,764, to R.W. Lehnhardt and J.O. Schaefer filed June 27, 1972, entitled "Erase Ribbon Feed." These documents disclose structure by which a typewriter is given the capability of effectively erasing individual characters either by the use of an adhesive tape to lift the inked image of a character from a page or through the use of a white cover-up transfer ribbon for masking the character so as to no longer be visible.

BACKGROUND OF THE INVENTION

Effective typing speed has been increased through the use of typing systems having magnetic memory that allow a typist to simply restrike a correct key over an incorrect character. Following initial keying of text and the correction of errors, the record is then "played out" onto a clean sheet of paper to show only the correct text. More sophisticated systems enable the typist to insert or delete information that is recorded in a memory together with originally typed text which then is "played out" to produce final copy that is free of errors. Specially configured text editing systems employing cathode ray tube displays combined with bulk storage memories have been proposed. While these systems are quite versatile in the editing permitted the typist, their output is again some form of record that must be "played out" to produce finished error-free copies.

The patent and applications identified in the Cross-References section above disclosed mechanism by which a typewriter is given the capability of erasing characters from a page. A typewriter equipped with such mechanism can be operated manually by a typist to erase characters one at a time from the page. The material erased can then be re-keyed correctly. Upon completion of the page, errors have been corrected and there is no need for a further "play out" operation. While manually controlled erasure and retyping is quite adequate for those errors detected within one or two keystrokes of their occurrence, errors such as character or word omission may involve such a large number of manual operations to correct that the operator would prefer simply to retype the page rather than attempt to correct it.

To assist a typist in gaining the full value of a character erase capacity within a typewriter, we have devised a control system for the typewriter including a memory capable of recalling characters and other information previously typed as well as whether such information currently appears on the printed page or has been erased. Having provided this basic capability, the versatility of the more sophisticated text editing systems employing non permanent displays such as a cathode ray tube display can be incorporated into a simple typing station. With our system it becomes both possible and practical for the typist to make corrections involving addition or deletion of words or letters anywhere within an operative segment of text such as the current line in which the typist is operating.

Our system is particularly important where the erasing mechanism requires for its operation restriking of

an erroneous character. Since the characters originally keyed are recorded in the memory, a simple instruction to erase is automatically translated into the sequence necessary to re-select a print operation of the erroneous pre-recorded character with the typewriter adjusted to perform an erase rather than print operation. The same sequence performed manually requires the operator to select erase and then manually re-key the erroneous character.

DISCLOSURE OF THE INVENTION

As briefly indicated above, our invention relies on a memory that is capable of recalling characters previously keyed and whether those characters currently appear on the printed page or have been erased. The memory can be conceptually divided into a plurality of bytes or cells made up of multiple digital storage bits capable of identifying what symbol is intended to be printed including whether the symbol is printed from upper case or lower case on the typewriter and whether it is modified as by an underline or accent. The byte or cell also should be capable of recording a space in place of a printable character. To accomplish our invention, the byte should further be capable of indicating the presence of significant information within the byte and whether that information currently is appearing on the printed page or has been erased. Such bytes or cells within the memory are ordered to correspond with ordered print positions within a text segment such as a line. Having provided this memory capacity, erase operations are produced upon selection of the typist and under the control of sequence generating circuitry and the character identifying information within the memory. Depending upon whether the characters erased are desired to be reprinted or are to be deleted entirely, the memory is updated by recording respectively the fact that a desired character does not appear on the printed page or, in the case of a deletion, that a previously recorded byte no longer contains useful information.

To facilitate deletions, "queue-in" sequence circuitry is provided and operates upon deletion of a character to move higher order erased characters into the deleted position within the memory order.

To facilitate insertions, "queue-out" sequence control circuitry is provided for moving recorded erased characters in the memory to higher orders within the memory order as the typist retypes new, unrecorded characters into erased location corresponding to erase characters to be ultimately printed.

Having completed a correction, the typist can return automatically to where the normal typing was interrupted simply by striking a retype key to operate retype sequence circuitry provided in our system that operates under control of the character identifying data within the memory to reprint those erased characters marked to be reprinted and, in the event that printed characters are recorded and remain printed on the page will simply space the print point without restriking the characters.

These and other objects, features and advantages of our invention will be made more apparent to those skilled in the art by the following description of a specific illustrative embodiment wherein reference is made to the accompanying drawing of which:

FIG. 1 is a block organizational view showing the primary components employed in the preferred embodiment of our automatic erasing system;

FIG. 2 is a diagrammatic representation of the memory organization to be employed in the automatic erase system of FIG. 1;

FIGS. 3-5 are an operational flow diagrams of a key-stroke record logic sequence illustrating the necessary details required for one skilled in the art to configure the specific circuitry to be incorporated in the system of FIG. 1;

FIGS. 6-8 and 10 are operational flow diagrams showing an erase logic sequence illustrating the necessary details required for one skilled in the art to configure the specific circuitry to be incorporated in the system of FIG. 1;

FIG. 9 is a side elevational view of an erase key constructed in accordance with a preferred embodiment of our invention; and

FIG. 11 is an operational flow diagram showing a retype logic sequence illustrating the necessary detail required for one skilled in the art to configure the specific circuitry to be incorporated in the system of FIG. 1.

Referring now more specifically to the drawing, in FIG. 1 there is shown a typewriter 10 such as the IBM SELECTRIC I/O Typewriter manufactured by International Business Machines Corporation, Armonk, N.Y. and described in Customer Engineering Manual of Instruction Form Part No. 241-5159-3, published May, 1962. This typewriter 10 has the capability of generating electrical signals representative of the keyboard action and further has the capability of operating from electrical input in addition to operating from keyboard input. Although a full set of typewriter functions can be performed by the typewriter 10, those of primary importance to our invention are the character-by-character printing mechanism 11 that prints an inked symbol 12 at a print point 13 on a page 14, an escapement or letter feed mechanism 15 for moving the print point 13 rightwardly to successively higher order print positions 16, 17, 18, etc within a writing line 19, and a backspace mechanism 20 for displacing the print point 13 rearwardly or leftwardly to successively lower order print positions along the writing line 19. In addition, the typewriter 10 includes shift mechanism 21 to select printing of upper or lower case characters and non-print mechanism 22 like that of U. S. Pat. No. 3,592,309.

The typewriter 10 includes a keyboard 30 having a group of character selecting keys 31, a spacebar 32 for controlling the escapement mechanism 15 independent of character printing, a backspace key 33 for controlling the backspace mechanism 20, a shift key 34 for controlling shift mechanism 21, a line return key 35 for returning the print point 13 to a left margin position and feeding the page 14 upwardly to a new writing line, and a tabulation key 36 for moving the print point 13 in a continuous run rightwardly along the writing line 19. The operation of the keyboard 30 generates electrical representative output signals on lines 37, including data lines 38. Input signal lines 23 deliver control electrical signals to the typewriter 10 for controlling its operation.

The typewriter 10 is also provided with a print ribbon feed mechanism 24 which preferably is like that disclosed in U. S. Pat. No. 3,604,549 and symbol erase

mechanism including erase ribbon handling mechanism 25 like that described in aforementioned U.S. Pat. No. 3,724,633. The erase ribbon handling mechanism 25 responds to counter-clockwise pivoting of a bail 26 from its position as shown to lift an erase ribbon 27 into alignment with the print point 13 while the printing mechanism 11 restrikes the image of the symbol 12 to be erased. The erase ribbon 27 is wound incrementally to present a new ribbon surface for each erasing operation. The erasing ribbon 27 can have either a white cover-up transfer layer for camouflaging an erroneous character or an adhesive layer for lifting the ink of the erroneous character from the page 14. In either case the symbol 12 is effectively erased by printing on the erase ribbon 27.

Since it is ordinarily desired to reprint a correct symbol 12 in the space from which an incorrect character was erased, the bail 26 is connected by link 28 to the escapement mechanism 15 to cripple the escapement mechanism 15 during an erase printing operation. An electromagnet 29 is connected to the bail 26 for pivoting the bail 26 to its active position upon receipt of a suitable electrical signal.

The system shown in FIG. 1 further includes a bulk information store or memory 40 for recording symbol information identifying bytes 41 corresponding to individual print positions and recalling these bytes 41 in ordered sequence according to the progression of print positions 13 along writing line 19. FIG. 2 shows a somewhat simplified example of the content of an individual byte 41 of storage within memory 40. Byte 41 includes eleven binary storage bits labeled respectively B1 through B11. The bits B1 through B9 are employed to identify the symbol 12 intended to appear on the page 14. Of these bits, bit B7 defines whether a character to be printed is in upper or lower case. Bits B1 through B6 identify the particular character within the selected case. Bit B8 identifies whether the character identified also includes an underline in the manner for example, as is disclosed in U. S. Pat. No. 3,630,336. Bit B9 indicates whether the character is to be printed or simply is a "space" such as an interword space. Bit B10 identifies whether the entire byte 41 contains useful information or is empty. Bit B11 indicates whether the identified symbol 12 currently appears on the page 14 or whether it has been erased and is awaiting reprinting. As indicated above, the configuration of byte 41 is somewhat simplified for purposes of explanation. While individual bit storage is shown for identifying whether useful information is present, whether the symbol 12 is a "space" and whether the symbol 12 is currently printed, it will be appreciated by those skilled in the art that this information can, if desired, be encoded to reduce the total number of bits required to store an equivalent amount of information. While we prefer to employ a monolithic memory that provides for byte storage in printed circuits, it will be understood by those skilled in the art that any form of bulk memory such as core memory, or even to a limited extent, magnetic tape can be employed in place of the monolithic memory we prefer.

The memory 40 includes sufficient capacity for the largest number of anticipated print positions within a selected text segment. We prefer to select the writing line as the text segment within which corrections are to be made and thus provide preferably 128 bytes of storage in the memory 40 which slightly exceeds the num-

ber of print positions in most normal writing lines. The memory 40 is coupled with a memory queue control or addressing device 42 which maintains control of the order of byte 41 within the memory 40. As the state of the art is well developed in the structure of a memory such as required for memory 40 and addressing systems as required for memory queue control 42 the details of these elements will not be developed herein. It is sufficient to know that the memory queue control 42 can identify the byte 41 in sequence and can progressively identify those bytes either in increasing order or decreasing order by corresponding changes of the numerical identification. To select different bytes, signals can be generated on line 43 to advance the queue control 42 by one and on line 44 to regress the queue control 42. The current status of queue control 42 can be read or a completely new status written through lines 45. The queue control 42 indicates its upper limits by a signal on line 46 and its lower limit by a signal on line 47.

To inter-relate the operation of typewriter 10 with the memory 40 there is provided a control system 50 constructed of interconnected circuitry which can be divided for the understanding of those skilled in the art into an operation sequencer or clock 51, a condition store 60 for temporarily retaining information concerning various conditions of operation necessary for control of the operation being processed, and combinational logic 52 for making sequential decisions and issuing sequential control commands in an order determined by the operation sequencer 51 based on information present in the typewriter 10, the memory 40, and the condition store 60. Suitable operational circuitry including output signal generating circuitry 53 for issuing the desired typewriter control command signals, and memory read-write circuitry 54 operating through lines 55 is also provided. As an object of our invention is to increase the versatility of the simple typing station, we prefer to employ self contained wired circuitry. As the details for configuring specific circuitry to accomplish prescribed decisional and command functions is well known to those skilled in the art and do not in and of themselves constitute part of our invention, such circuitry is not herein described. It is to be understood that instead of special purpose wired circuitry as we prefer, the functions to be performed could be accomplished through the use of a suitably programmed general purpose computer.

The condition store 60 portion of our interconnecting circuitry 50 includes so-called latch circuits capable of storing both mode control information and character identifying information. More specifically bistable erase latch circuit 61 is set to initiate an erase sequence in response to an electrical signal on primary erase switch line 61a. "Word" latch 62 is set in response to an electrical signal on secondary erase switch line 62a and indicates whether or not an erase sequence is to be of word unit length. "Line" latch 63 is set by an electrical signal on secondary erase switch line 62a being maintained through the completion of a word erasure to indicate that an erase sequence is to be of line unit length. An erase sequence of a single printed character only is indicated by setting of erase latch 61 without setting the word latch 62 or line latch 63. Latches 61, 62, and 63 thus combine to define three effective states, namely "line" erase if latches 61 and 63 are set, "word" erase if latches 61 and 62 are set and latch 63 is not set, and "character" erase if only

latch 61 is set. "Erase only" latch 64 is set by an electrical signal from "erase only" switch line 64a to indicate that characters erased from a page 14 are to be retained in memory 40 for later recall in order that they may be reprinted. The normal state of "erase only" latch 64 is to select "erase and delete" operation wherein characters erased from a page 14 are at the same time purged from memory 40. Retype latch 65 is set by an electrical signal on retype switch line 65a and indicates whether or not a retype sequence is in progress.

In addition to the individual condition latches 61 through 65 thus described, the condition store 60 further includes several registers for retaining multi-bit information required for control of the process. These registers include a keystroke store register 66, a memory Input/Output register 67, and a current print position register 68. Keystroke store register 66 is connected with keyboard data output lines 38 and records a byte of information corresponding at least to the information contained within bits B1 through B9 of the storage byte 41 in memory 40. Memory Input/Output register 67 is connectable with the memory 40 under the control of memory queue control 42 to receive a single byte 41 of character identifying information therefrom or to write a single byte of character identifying information thereinto. Memory Input/Output register 67 is further connectable to the output signal generating circuitry 53 to control the typewriter 10 to perform character print operations either for reprinting or for erasing and for controlling space operations. Current print position register 68 is connectable through read-write circuitry 54 with the memory queue control 42 to record the current print position of the typewriter 10 and to reset the memory queue control 42 as desired to correspond to the current print position.

The combinational logic 52 includes groups of circuitry for performing the various control sequences of our invention including decisional circuitry connected with the typewriter 10, the memory 40 the memory queue control 42, and the condition store 60 at discrete times as determined by connections with operation sequencer 51 to determine whether or not at that time a particular condition pertains. Circuitry is also provided for controlling the generation of control or command signals and conditions for causing the various operations of the typewriter 10, the condition store 60, the memory queue control 42 and the memory 40 to occur at times determined by connections with the operational sequencer 51. The specific electronic components and the internal wiring necessary to make these decisions and effect these commands is well within the state of the art and can be constructed with only routine design effort given knowledge of the decisions to be made, the operations to be effected, and the sequence of these decisions and operations. Accordingly, we have shown the circuitry as grouped into separate primary sequence control sections namely, keystroke record sequence control circuitry 56, erase sequence control circuitry 70 and retype sequence control circuitry 80. The keyboard record sequence control circuitry 56 further includes memory queue-out or advance sub-circuitry 57 and detection logic circuitry 58 for determining the presence or absence of "symbol not appear" bit B11 in memory I/O register 67. Erase sequence control circuitry 70 further includes memory update sequence control sub-circuitry 71 further in-

cluding memory queue-in or regression sub-circuitry 72, selective termination circuitry 73 and print sequence control circuitry 74. The selective termination circuitry 73 includes sequence repeat logic circuitry 75, "word" erase completion detection logic circuitry 76, "line" erase completion detection logic circuitry 77, character erase completion detection logic circuitry 78, and repeat inhibit logic circuitry 79. The retype sequence control circuitry 80 shares the print sequence control circuitry 74 with the erase sequence control circuitry 70 and further includes retype sequence repeat logic circuitry 81 and retype repeat inhibit logic circuitry 82.

The detail of the specific sequence control circuitry is determined by the sequences to be performed which are laid out in operational flow diagrams shown in FIG. 3.

A keystroke record (see FIGS. 3 through 5) is initiated by the typist depressing one of the character keys 31 or the spacebar 32 of the typewriter 10. While the typewriter 10 proceeds through its own independent print and spacing cycle the information keyed is delivered on output lines 37 and stored by operation 90 in keystroke store register 66. The current position of print point 13 along writing line 19 is stored by operation 91 in current print position register 68 by reading the current numerical status of the memory queue control 42 thereinto. It will be recognized that the current print position can be stored within the typewriter 10 itself by the provision of a print position transducer capable of indicating discrete identification of each printing position along the line. Operation 92 reads the information contained in the byte 41 of memory 40 indicated by memory queue control 42 as corresponding to the current print position of the typewriter 10 and delivers this information to memory I/O register 67.

When information is keyed initially in a new line, the operation 92 will place no significant information in memory I/O register 67. Having thus stored The essential conditions for keystroke recording control, the keyboard sequence control circuitry 56 determines at decision 93 by logic circuitry 58 whether the byte of information in memory I/O register 67 includes "symbol not appear" information or in other words, whether the byte of information taken from memory 40, if any, has been identified for later reprinting. Again, in the initial keying of a line, the determination based on the absence of information in the memory I/O register 67 is negative and the sequence proceeds to decision 100 (FIG. 4) wherein it is determined whether there is useful information of any type in the memory I/O register 67. In initial typing, no information will be in the memory I/O register 67 and the sequence proceeds to operation 101 wherein the keystroke identifying data in register 66 is written as significant information that appears on the printed page 14 into the byte 41 of memory 40 then identified by the memory queue control 42. Operation 102 advances the memory queue control 42 by one to correspond with the print point 13 of the typewriter 10 following the print and space operation thereof. The sequence is then terminated by operation 103 that resets the keystroke store register 66 so that no information is contained therein. Logic 52 responds to depression of carriage return key 35 or tabulation key 36 to reset the queue control 42 to its lower limit and all bytes 41 in memory 40 to empty. If the typewriter 10 includes a position transducer that will dis-

cretely identify all print positions within a line, tabulation reset is not required.

In the event that the initiating keystroke is adding characters to a portion of a writing line 19 having characters that were previously erased from the page 14 but was marked in bit B11 with "symbol not appear" information, decision 93 (FIG. 3) will direct the sequence to decision 94 (FIG. 3) wherein it is determined whether the memory queue control 42 is at its upper limit indicating that the capacity of memory 40 has been reached. A determination that the upper limit has been reached directs the sequence again to operation 101 (FIG. 4) to cause the keyed information to supersede the previously recorded information in the last available memory byte 41. If as is the usual case the memory queue control 42 is determined by decision 94 to be not at its upper limit, the sequence proceeds to a queue-out sub sequence controlled by circuitry 57 that is effected to advance the previously recorded but erased byte 41 to the next adjacent higher order within the memory 40. This sequence begins by shifting the highest order one of the previously recorded bytes to the next adjacent higher order, and repeating the shifting process until all bytes of a higher order than the current print position have been shifted. The sequence begins by operation 110 wherein the memory queue control 42 is set to its upper limit. Operation 111 regresses the memory queue control 42 by one to address the second highest order byte 41 in memory 40. In operation 112 the thus addressed byte 41 is read into memory I/O register 67 for temporary storage. Operation 113 advances the memory queue control 42 by one and operation 114 writes the temporarily stored byte in memory I/O register 67 into next higher order memory byte 41 of memory 40 now identified by the memory queue control 42. Operation 115 regresses the memory queue control 42 by one to readdress the byte 41 in memory 40 from which information has just been shifted upwardly. Decision 116 compares the memory queue control address with the current print position as stored in register 68 to determine whether the memory queue control 42 is then addressing the byte 41 corresponding to the current print position 13. If not, the sequence is returned to operation 111 wherein the next adjacent memory byte 41 is shifted upwardly in the memory order. Following each shifting, the sequence proceeds to decision 116 and ultimately that decision will indicate that the memory queue control 42 has become realigned with the current print point 13 as stored in register 68. Upon such determination, the queue-out sequence is completed and the sequence is returned to operation 101 (FIG. 4) whereby the key stroke information in register 66 is recorded into a now empty byte 41 of the memory 40.

If at decision 100 (FIG. 4) it is determined that useful information is present in the memory I/O register 67, the sequence proceeds to decision 104 wherein it is determined whether the keystroke store register 66 identifies a "space." If a space is identified the operator has simply advanced the print point 13 and the sequence proceeds directly to operation 102 to maintain the memory queue control 42 in proper alignment with the now advanced print point 13. If, on the other hand, the operator had struck a printing key, decision 104 would transfer the sequence to decision 105 wherein it is determined whether the information in memory I/O register 67 is simply a "space." If the sequence has pro-

ceeded to this point, the prior determinations indicate that the typist is typing a new symbol 12 over a previously recorded and not erased symbol 12. This is permissible only if the previously recorded and not erased symbol 12 is a "space" which, if so determined by decision 105, returns the sequence to operation 101 for recording of the key stroke. If, on the other hand, the typist is in fact attempting to type one printed character over a character already printed on the page 14, decision 105 will transfer the sequence to operation 106 to immediately operate the typewriter non-print mechanism 22 described above to inhibit the typewriter printing but not the spacing operation. The sequence is returned to operation 102 to advance the queue control 42 by one and to operation 103 to reset the register 66. The typist thus is prevented from spoiling the page 14 by keying new characters over previously recorded and not erased characters.

ERASE SEQUENCE (See FIGS. 6 through 10)

An erase sequence is initiated by the typist upon noting that an error has been committed within the current typing line. While in many instances the error will lie in the last typed character or symbol 12, our system enables the efficient correction of errors even within the middle of correctly typed text. Upon noting that an error has been committed, the typist first must decide whether the symbols 12 to be erased are to be retained in memory 40 or are to be deleted. The normal operation of the system is to both erase the symbols 12 from the page 14 and delete them from memory 40. Thus no action is required by the typist unless the symbols 12 to be erased are to be later reprinted under which circumstance the operator sets a mode control toggle switch 120 from its normal "Erase and Delete" position (See FIG. 1) to its "Erase Only" position, prior to depressing erase key 121 (See FIGS. 1 and 9).

Referring to FIG. 9, there is shown a preferred construction of erase key 121 including a key lever 122 that is biased upwardly by a leaf spring 123 against a stop 124 defining a normal inactive position. Beneath the keylever 122 is a primary erase key switch 125 and a secondary erase key switch 126. Also beneath the key lever 122 is a displaceable downstop 127 that is biased upwardly by a spring 128 to a position where it defines a clearance 129 through which key lever 122 can move without interference. This initial motion of key lever 122 is effective to close the primary erase key switch 125 but is not effective to close secondary erase key switch 126. Further depression of key lever 122 against the loading of spring 128 also closes secondary key switch 126. These key switches 125 and 126 are operatively connected with erase latch 61 and word latch 62 by lines 61a and 62a respectively. Closure of primary erase switch 125 sets erase latch 61 at operation 130 (FIG. 6) to activate electromagnet 29 within typewriter 10 to pivot bail 26 and thereby select effective lift and feed of the erase ribbon 27 during a subsequent print cycle. As mentioned above, link 28 from bail 26 also shifts the escapement mechanism 15 to a non-feed or dead key position so that forward space increments are not produced as part of a subsequent print cycle. Erase latch 61 also initiates the erase control sequence. Closure also of secondary erase switch 126 sets word latch 62 to indicate that the erase sequence is to be of an entire word unit length. The sequence proceeds to operation 131 where under the direction of memory queue

control 42 the symbol identifying byte 41 of information corresponding with the current print position of the typewriter 10 is read from the memory 40 into the memory I/O register 67. Decision 132 determines whether the symbol 12 thus read into memory I/O register 67 is a printable symbol 12 and if so the sequence proceeds to a print sub-sequence under the control of circuitry 74. The print sequence (FIG. 7) begins by decision 140 as to whether the information in the memory I/O register 67 is marked at bit B8 to indicate that it has been underlined. If the symbol 12 has not been underlined, the operation proceeds to decision 141 where it is determined whether or not the symbol 12 identified in the memory I/O register 67 is marked at bit B7 as being upper case. If an upper case character is determined, decision 142 determines whether the typewriter 10 is presently in upper case. If so, the sequence proceeds directly to operate 143 and magnet driving circuitry within the circuitry 53 effectively generates and issues a PRINT command to the typewriter 10 by instructing the typewriter 10 to print the symbol 12 retrieved from memory 40. Due to the prior setting of electromagnet 29 by erase latch 61, this PRINT command is effectively an ERASE command to the typewriter 10. If decision 142 had determined that the typewriter 10 was not in upper case, operation 144 would precede operation 143 to operate the typewriter shift mechanism 21 to bring the typewriter 10 to upper case before the PRINT-ERASE command is issued. In the same fashion, if the symbol 12 in the memory I/O register 67 was determined by decision 141 to not be upper case, decision 145 follows to determine if the typewriter 10 is currently in lower case. If so, the sequence proceeds to issue the PRINT-ERASE command at operation 143. If decision 145 determines that the typewriter 10 is currently not in lower case, operation 146 follows to operate shift mechanism 21 of the typewriter 10 and bring the typewriter 10 to lower case prior to issuance of the PRINT-ERASE command at operation 143.

Returning briefly to decision 140, it is seen that if this decision determines that the symbol 12 retrieved from memory 40 into memory I/O register 67 includes an underscore identification at bit B8, the sequence is diverted to decision 147 to determine if the typewriter 10 currently is in upper case since the underscore symbol 12 is normally printed as an upper case character. If the typewriter 10 is not in upper case, operation 148 is performed to operate the shift mechanism 21 of the typewriter 10 to shift the typewriter 10 to upper case. Otherwise, the sequence proceeds directly to operation 149 to issue an ERASE-PRINT underscore command to the typewriter 10 before proceeding to decision 141 described above.

Accompanying the erasure of symbols 12 from the page 14 by issuance of ERASE-PRINT commands as described above, our invention provides memory update Control Circuitry 71 for selectively writing "symbol not appear" information in bit 11 of the byte 41 or, where "erase and delete" operation is selected, writing "no useful information" into bit B10 of the byte 41 thus making that byte 41 available for other recording. Where a symbol is erased and deleted and higher order symbol identifying bytes 41 remain in the line, automatic queue-in circuitry 72 within the memory update circuitry 71 displaces the higher order bytes 41 to immediately adjacent lower order locations within the

memory 40. The memory update sequence begins with decision 150 (FIG. 8) as to the current state of "erase only" latch 64. The normal state of operation is "erase and delete" which produces a "not erase only" response to decision 150 and direction of the sequence to operation 151 which records bit B10 to indicate that the byte 41 identified then by the memory queue control 42 is empty and no longer contains useful information.

From operation 151 the queue-in sequence under control of circuitry 72 begins by operation 152 that advances the queue control 42 to the next higher order memory address. The memory byte 41 thus queued by the advanced memory queue control 42 is transferred in operation 153 to the memory I/O register 67. Decision 154 determines whether the queue control 42 has reached its upper limit indicating that there are no higher order bytes in the memory 40. If the queue control 42 is not at its upper limit, the sequence proceeds to decision 155 wherein it is determined whether the newly queued byte of symbol identifying information is marked at bit B10 as empty or containing no useful information. If decision 155 determines the presence of useful information, the sequence proceeds to operation 156 wherein the memory queue control 42 is regressed by one to the immediately adjacent lower order byte 41 which it will be recalled is the original byte emptied by operation 151. The byte 41 accessed at operation 153 is now written in operation 157 into the newly accessed byte 41 in memory 40 and operation 158 advances queue control 42 by one to the next higher order byte in memory 40.

The sequence is returned to operation 152 and repeated until either decision 154 indicates that the queue control 42 has reached its upper limit or decision 155 determines that an empty byte 41 has been accessed at operation 153. In either of these events, the queue-in sequence is terminated by diversion to operation 160 which returns the queue control 42 to the address identified by the current print position as recorded in register 68. The byte 41 of memory 40 now identified by the memory queue control 42 is written into the memory I/O register 67 at operation 161 and selective termination sub sequence is performed under the control of circuitry 73. Decision 170 (See FIG. 10) determines the state of line erase latch 63. If the "line" erase latch 63 has not been set, the sequence proceeds to decision 171 to determine the state of "word" erase latch 62. If the typist had depressed erase key 121 to its second position wherein both switches 125 and 126 were closed, "word" erase latch 62 would indicate selection of "word" erase operation and the sequence would proceed to decision 172 wherein queue control 42 is examined by line erase completion logic circuitry 77 to determine if it is at its lower limit as would indicate the beginning of a line. If the queue control 42 is not at its lower limit it is regressed by one at operation 173 to address the immediately adjacent lower order byte 41. Operation 174 reads the newly accessed byte 41 of memory 40 into the memory I/O register 67. Decision 175 again determines the state of "word" erase latch 62 and again, assuming full depression of erase key 121, the sequence proceeds to decision 176 wherein it is determined by "word" erase completion detection logic circuitry 76 whether the byte 41 retrieved from memory 40 in operation 174, which incidentally corresponds with the position immediately to

the left of the symbol erased at print point position 13 in response to the ERASE command issuing from operation 143, is a "space." If no "space" is detected in the memory I/O register 67, it is known that at least one further symbol must be erased within the word and erase sequence repeat logic circuitry 75 causes a BACKSPACE command to be generated at operation 177 (FIG. 6) to move the print point 13 of the typewriter 10 leftwardly by one position and the queue control 42 to be regressed by one at operation 178 to maintain its alignment with the current print position. The entire sequence is thus returned to operation 131 and repeated until decision 176 determines that a "space" was retrieved from memory 40 in operation 174 at which event the sequence proceeds to decision 180 wherein the current state of secondary erase key switch 126 is interrogated. If the typist has maintained key 121 in its fully depressed position throughout the erasure of all symbols and is continuing to hold the key 121 in its fully depressed position, detection of the closure of switch 126 in decision 180 directs the sequence to operation 181 wherein the "line" latch 63 is set. The sequence returns to operation 177 for further erase repeating. Thus it will be recognized that the "line" erase mode is selected by the typist by maintaining the key 121 depressed through complete erasure of an entire word.

If on the other hand, key 121 had been depressed fully to close both primary erase switch 125 and secondary erase switch 126 and then had been released, decision 180 determines that secondary erase switch 126 is not closed and repeat inhibit logic circuitry 77 causes operation 182 to reset "word" latch 62 to its normal state, operation 133 to reset if required "erase only" latch 64 to its normal "erase and delete" state, and operation 134 to reset erase latch 61 to its normal inactive state.

In the event the typist had depressed key 121 only until it was impeded by stop 127, only primary erase switch 125 would have been closed and "word" latch 62 would not be set. The initial sequence would proceed as already described until decision 171 is reached. Interrogation of "word" latch 62 at decision 171 would produce a negative response and the sequence would be diverted to decision 183 (FIG. 10) wherein the byte 41 corresponding to the current print position accessed in operation 161 is examined by character erase detection logic circuitry 78 to determine if it is a "space." If it is not a "space" then further operation is unneeded and the sequence is terminated by repeat inhibit logic circuitry 79 that causes operations 133 and 134. If the typist had decided to erase a single character after having printed the character and struck the spacebar 32, decision 183 would have determined the presence of a space at the current print position and repeat logic circuitry 75 effects operations 177 and 178 so that the single character will be erased by a repeat of the entire sequence.

If as described above the "line" erase latch 63 is set by operation 181, the entire sequence will be repeated with decision 170 directing the terminating sequence to bypass decision 171. Decision 172 thus will terminate the sequence when memory queue control 42 is determined by line erase completion logic circuitry 77 to have reached its lower limit whereupon repeat inhibit logic circuitry 79 effects operation 184 to reset the "line" erase latch 63 and terminate the sequence

through operations 182, 133 and 134. If desired, additional logic can be provided to respond to a second depression of key 121 during a line erase operation to reset "line" erase latch 63. With such provision, a line erase operation can be interrupted by the typist upon complete erasure of the word in which the key 121 is restruck.

If the typist elects to erase symbols that are correctly written in order to reach an earlier point in the typing line to insert an omitted word, "erase only" key 120 is depressed prior to striking the erase key 121, the erase sequence operates as previously described with the exception that "erase only" latch 64 is set. The state of "erase only" latch 64 is detected at decision 150 and the sequence is diverted to operation 163 which writes "symbol not appear" information into bit B11 of the byte 41 indicated by the memory queue control 42 to correspond with the print position of the symbol 12 erased in response to the ERASE PRINT command from operation 143. After operation 163 the queue-in sequence is bypassed and the selective termination sequence is performed by circuitry 73 as previously disclosed. It will be recalled that final termination of any sequence involves operations 133 and 134. Operation 133 resets the "erase only" latch 64 to its normal "erase and delete" operation.

In the event an erase sequence is initiated with the typewriter print point 13 at either a word space or an already erased character, decision 132 diverts the sequence to decision 185 which determines whether the byte in memory I/O register 67 is a "space" not requiring erasure and upon such determination, the sequence proceeds directly to decision 150. If decision 185 determines that the byte in memory I/O register 67 is not a "space" meaning it is empty the sequence is directed by sequence repeat logic circuitry 75 to operation 177 and 178 to backspace the print point 13, regress the queue control 42 and re-initiate the entire sequence with operation 131.

RETYPE SEQUENCE (See FIG. 11)

After an error has been corrected, retype key 190 may be struck to set retype mode latch 65 at operation 191 and initiate a retype sequence as shown in FIG. 11 under the control of retype sequence control circuitry 80. Operation 200 reads the byte 41 from memory 40 corresponding to the current print position under the control of memory queue control 42 and decision 201 determines by retype sequence repeating logic 81 whether the thus accessed byte contains significant information or by repeat inhibit logic 82 that the thus accessed byte is empty. If the error is corrected in the middle of a line which was either by-passed by backspacing or was erased and marked in memory 40 "symbol not appear," decision 201 will indicate that significant information has been accessed and the sequence will proceed to decision 202. At decision 202 bit B11 of byte 41 is interrogated to determine if the byte in memory I/O register 67 defines a symbol 12 that is not printed on the page 14 due to prior erasure. Detection of a "symbol not appear" passes the sequence to operation 203 wherein the "symbol not appear" notation is deleted from the byte 41 in the memory 40 as identified by the memory queue control 42 as corresponding to the current print position. The sequence proceeds to decision 204 wherein bit B9 of the byte 41 in memory I/O register 67 is interrogated to determine if the infor-

mation is not simply a "space." Determination that the byte is not a "space" initiates a print sub-sequence under the control of circuitry 74 that is identical with the print sub-sequence utilized in the erase sequence. This sequence begins with decision 205 which is identical to decision 140 to determine whether the byte in memory I/O register 67 contains an underline indicator in bit B8. The sub-sequence is completed by operation 206 which is identical with operation 143 except for the fact that the erase mode latch 61 is not set during a retype sequence and thus operation 206 will cause ordinary printing of a selected character on the usual ink ribbon. Since the intervening operations within the print control sub-sequence are identical to those previously described in connection with the erase sequence, they are not shown herein nor otherwise described.

PRINT CONTROL

Following operation 206, operation 207 advances the memory queue control 42 by one to queue the next higher order byte 41 from memory 40 and the sequence is returned to operation 200 wherein a newly queued information byte 41 is accessed. The sequence is repeated by circuitry 81 unless an empty byte is detected by repeat inhibit circuitry 82. If decision 202 determines that the significant information detected at decision 201 is not noted to be "symbol not appear" the information retrieved is understood to be either a blank space on the page 14 or a symbol 12 that remains printed on the page 14 from previous typing. In either event, the sequence proceeds to operation 208 which simply issues a SPACE-COMMAND to typewriter 10 and through operation 207 advances the memory queue control 42 to the next higher order byte 41 in memory 40 before returning the sequence to operation 200. The same operation occurs if decision 204 determines that byte 41 identified by decision 202 as containing "symbol not appear" information is determined by decision 204 to be simply a blank space on the page 14 requiring simply operation 208 instead of the print sub-sequence beginning with decision 205. It can now be understood that the typewriter 10 responding to depression of the retype key 190 will proceed incrementally along writing line 19 to reprint in order those symbols 12 previously erased but not deleted and will space over without reprinting any symbols 12 encountered which remain on the paper 14 from previous typing. This sequence is repeated until inhibited by circuitry 82 at decision 201 which determines by interrogation of bit B10 in the byte 41 placed in memory I/O register 67 at operation 200 that no significant information remains at the current print point 13. The sequence then is terminated by operation 209 which resets the retype latch 65 to its normal inactive condition.

While we have described a particular preferred illustrative embodiment employing a typewriter 10 of specific configuration and the use of permanently wired electronic logic and memory units that operate according to preferred sequences, those skilled in the art will recognize that various additions, deletions and modifications can be made to the illustrative embodiment shown without departing from the novel concept constituting our invention. Particularly it can be understood that our sequence could be programmed on a general purpose computer connected with a printer provided with suitable print and erase mechanism. While the typewriter erase mechanism we have dis-

closed erases symbols by reselecting the character to be erased, erasing devices such as power driven rotary rubber erasers are known which can erase a character indiscriminately without a re-typing sequence and it is apparent to those skilled in the art that our control system can usefully be applied to typewriters having such erasing devices. Accordingly, the subject matter sought to be patented is to be defined solely by the appended claims.

We claim:

1. In a system including a typewriter having means for printing visible symbols at a print point on a page, means for moving said print point to ordered print positions along a line of the page, including backspace means for moving said print point incrementally to immediately adjacent lower order print positions, a keyboard that is manipulated to control said symbol printing and print point moving means, signal output means for transmitting signals representative of typewriter operations, signal input means for receiving control signals for causing operations of said typewriter, and selectively operable symbol erase mechanism operable in response to ERASE command signals, the improvement comprising:

a memory capable of storing a plurality of symbol information identifying bytes each corresponding with an individual print position on a line of the page and each being at least capable of identifying the symbol intended to appear in the corresponding print position,

queuing means for identifying individual ones of said bytes in said memory in accordance with the order of print positions with which said bytes correspond, keystroke recording control means responsive to manipulation of said keyboard and to said queuing means for writing a byte of symbol identifying information into said memory and ordered therein in accordance with its corresponding print position, manually operable selection means including means to initiate an erase sequence

erase sequence control means responsive to said erase sequence initiation for producing erase control operations and comprising: signal generating means for issuing next ERASE command signals to said typewriter, and erase sequence repeating means operating following each erase control operation to cause operation of said typewriter backspace means, and producing a further one of said erase control operations.

2. A system as defined in claim 1 having the further improvement comprising:

said erase sequence control means further including erase sequence terminating means including means for detecting the completion of the erasure of all characters within a single word unit, and means responsive to said completion detecting means for inhibiting further operation of said erase sequence repeating means.

3. A system as defined in claim 1 having the further improvement comprising:

said erase sequence control means further including erase sequence terminating means including means for detecting the completion of the erasure of all characters within a single line unit, and means responsive to said completion detecting means for inhibiting further operation of said erase sequence repeating means.

4. A system as defined in claim 1 wherein the improvement further comprises:

said selection means including mode selecting means having a first state for defining an erase sequence of "character" length and a second state for defining an erase sequence of "word" length.

said erase sequence control means further comprising erase sequence terminating means including first detecting means for detecting the completion of the erasure of a single character, second detecting means for detecting the completion of the erasure of all characters within a single word unit, and means responsive to said further mode selecting means and to said first and second detecting means for inhibiting further operation of said erase sequence repeating means upon the completion of the erasure of a single character when said further mode selecting means defines a "character" length erase sequence and upon completion of the erasure of all characters within a single word unit when said further mode selecting means defines a "word" length erase sequence.

5. A system as defined in claim 1 wherein the improvement further comprises:

said selection means including mode selecting means having a first state for defining an erase sequence of "character" length and a second state for defining erase sequence of "word" length and a third state for defining an erase sequence of "line" length,

said erase sequence control means further comprising erase sequence terminating means including first detecting means for detecting the completion of the erasure of a single character, second detecting means for detecting the completion of the erasure of all characters within a single word unit, third detecting means for detecting the completion of the erasure of all characters within a single line unit and means responsive to said mode selecting means and to said first, second and third detecting means for inhibiting further operation of said erase sequence repeating means upon the completion of the erasure of a single character when said mode selecting means defines a "character" length erase sequence, upon completion of the erasure of all characters within a single "word" unit when said mode selecting means defines a "word" length erase sequence, and upon completion of the erasure of all characters within a single line unit when said mode selecting means defines a "line" length erase sequence.

6. In a system including a typewriter having means for printing visible symbols at a print point on a page, means for moving said print point to ordered print positions along a line of the page, a keyboard that is manipulatable to control said symbol printing and print point moving means, signal output means for transmitting signals representative of typewriter operations, signal input means for receiving control signals for causing operations of said typewriter, and selectively operable symbol erase mechanism operable in response to ERASE command signals, the improvement comprising:

a memory capable of storing a plurality of symbol information identifying bytes, each corresponding with an individual print position on a line of the page and each being at least capable of identifying

(i) whether it contains useful information, (ii) the symbol intended to appear in the corresponding print position, and (iii) whether the symbol intended to appear in the corresponding print position currently appears,

queuing means for identifying individual ones of said bytes in said memory in accordance with the order of print positions with which said bytes correspond, keystroke recording control means responsive to manipulation of said keyboard and to said queuing means for writing a byte of symbol identifying information into said memory and ordered therein in accordance with its corresponding print position, manually operable selection means including means to initiate an erase sequence and mode control means settable to define either an "erase only" operation or an "erase and delete" operation of said erase sequence, and

erase sequence control means responsive to said erase sequence initiation for producing erase control operations and comprising: signal generating means for issuing said ERASE command signals to said typewriter, and memory writing means responsive to said mode control means for selectively writing into the byte identified by said queuing means as corresponding with the relative print position from which said erase mechanism erases a symbol in response to issuance of said ERASE command, "symbol not appear" if said "erase only" operation has been defined or "no significant information" if said "erase and delete" operation has been defined.

7. A system as defined in claim 6 further comprising backspace means for moving said print point incrementally to immediately adjacent lower order print positions, and wherein the improvement further comprises: said erase sequence control means including erase sequence repeating means operating following each erase control operation to cause operation of said typewriter backspace means and producing a further one of said erase control operations.

8. A system as defined in claim 7, having the further improvement comprising:

said erase sequence control means further including erase sequence terminating means including means for detecting the completion of the erasure of all characters within a single word unit, and means responsive to said completion detecting means for inhibiting further operation of said erase sequence repeating means.

9. A system as defined in claim 7, having the further improvement comprising:

said erase sequence control means further including erase sequence terminating means including means for detecting the completion of the erasure of all characters within a single line unit, and means responsive to said completion detecting means for inhibiting further operation of said erase sequence repeating means.

10. A system as defined in claim 7 wherein the improvement further comprises:

said selection means including further mode selecting means having a first state for defining an erase sequence of "character" length and a second state for defining an erase sequence of "word" length, said erase sequence control means further comprising erase sequence terminating means including

first detecting means for detecting the completion of the erasure of a single character, second detecting means for detecting the completion of the erasure of all characters within a single word unit, and means responsive to said further mode selecting means and to said first and second detecting means for inhibiting further operation of said erase sequence repeating means upon the completion of the erasure of a single character when said further mode selecting means defines a "character" length erase sequence and upon completion of the erasure of all characters within a single word unit when said further mode selecting means defines a "word" length erase sequence.

11. A system as defined in claim 7 wherein the improvement further comprises:

said selection means including further mode selecting means having a first state for defining an erase sequence of "character" length and a second state for defining erase sequence of "word" length and a third state for defining an erase sequence of "line" length,

said erase sequence control means further comprising erase sequence terminating means including first detecting means for detecting the completion of the erasure of a single character, second detecting means for detecting the completion of the erasure of all characters within a single word unit, third detecting means for detecting the completion of the erasure of all characters within a single line unit and means responsive to said further mode selecting means and to said first, second and third detecting means for inhibiting further operation of said erase sequence repeating means upon the completion of the erasure of a single character when said further mode selecting means defines a "character" length erase sequence, upon completion of the erasure of all characters within a single word unit when said further mode selecting means defines a "word" length erase sequence, and upon completion of the erase of all characters within a single line unit when said further mode selecting means defines a "line" length erase sequence.

12. A system as defined in claim 6 wherein the improvement further comprises:

manually operable retype selection means, retype sequence control means operable in response to activation of said retype selection means and to the information contained within the memory byte identified by said queuing means corresponding with the current print position for producing retype operations and comprising: means for operating said typewriter to reprint the symbol identified by said byte and advance the print point to the next higher order print position in response to detection of "symbol not appear" information within said byte, and for operating said typewriter to advance the print point to the next higher order print position in response to detection of the presence of useful information within said byte if said byte does not contain "symbol not appear" information.

13. A system as defined in claim 12 wherein said retype sequence control means further comprises retype sequence repeating means operating following each advance of the print point and for producing a further one of said retype sequence control operations, and

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retype terminating means for inhibiting operation of said retype sequence repeating means when said byte contains no useful information.

14. A system as defined in claim 6, having the further improvement comprising

said erase sequence control means further comprising: memory regression sequence control means responsive to selection of an "erase and delete" operation of said erase sequence by said mode selecting means for successively regressing to a lower order, the bytes identified by said queuing means as being of a higher order than a byte into which has been written "no significant information."

15. A system as defined in claim 6 wherein said improvement further comprises:

said keystroke recording control means further including memory advance sequence control means comprising means responsive to said queuing means for detecting the prior recording of information having "symbol not appear" information within the byte of said memory corresponding to the current print position of the typewriter to advance to a higher order the byte corresponding to said current print position and those bytes of higher order than said current print position.

16. In a system including a typewriter having means for printing visible symbols at a print point on a page, means for moving said print point to ordered print positions along a line of the page, a keyboard that is manipulatable to control said symbol printing and print point moving means, signal output means for transmitting signals representative of typewriter operations, signal input means for receiving control signals for causing operations of said typewriter, and selectively operable symbol erase mechanism operable in response to an ERASE command signal, the improvement comprising:

a memory capable of storing a plurality of symbol information identifying bytes, each corresponding with an individual print position on a line of the page and each being at least capable of identifying (i) whether it contains useful information, and (ii) the symbol intended to appear in the corresponding print position,

queuing means for identifying individual ones of said bytes in said memory in accordance with the order of print positions with which said bytes correspond, keystroke recording control means responsive to manipulation of said keyboard and to said queuing means for writing a byte of symbol identifying information into said memory and ordered therein in accordance with its corresponding print position, manually operable selection means including means to initiate an erase sequence and mode control means settable to define either an "erase only" operation or an "erase and delete" operation of said erase sequence, and

erase sequence control means responsive to said erase sequence initiation for producing erase control operations and comprising: signal generating means for issuing said ERASE command signals to said typewriter, and memory writing means responsive to said mode control means defining said "erase and delete" operation for writing "no significant information" into the byte identified by said queuing means as corresponding with the relative

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print position from which said erase mechanism erases a symbol.

17. A system as defined in claim 16 wherein the improvement further comprises:

5 manually operable retype selection means, retype sequence control means operable in response to activation of said retype selection means and to the information contained within the memory byte identified by said queuing means corresponding with the current print position for producing retype operations and comprising: means for operating said typewriter to reprint the symbol identified by said byte and advance the print point to the next higher order print position.

15 18. A system as defined in claim 17 wherein said retype sequence control means further comprises retype sequence repeating means operating following each advance of the print point and for producing a further one of said retype sequence control operations, and

retype terminating means for inhibiting operation of said retype sequence repeating means when said byte contains no useful information.

19. A system as defined in claim 16, having the further improvement comprising:

said erase sequence signal generating means further comprising: memory regression sequence control means responsive to selection of an "erase and delete" operation of said erase sequence by said mode selecting means for successively regressing to a lower order, the bytes identified by said queuing means as being of a higher order than a byte into which has been written "no significant information."

20. The method of operating a typewriter system including a typewriter capable of printing visible symbols in ordered print positions along a writing line, signal input means for receiving control signals for causing operations of said typewriter, selectively operable symbol erase mechanism, a memory, addressing means for identifying symbol information in individual bytes within said memory in accordance with said order of print positions, and mode selecting means for selecting either an "erase only" or an "erase and delete" operation comprising the steps of:

a. conditioning said erase mechanism to perform an erase operation upon receipt of an ERASE command signal.

b. reading the symbol identifying byte from said memory corresponding to the current print position of said typewriter,

c. issuing said ERASE command to effect an erase operation of said erase mechanism to erase the symbol identified by the byte read from said memory, and writing "symbol not appear" information into the byte read from said memory if "erase only" operation is selected by said mode selecting means or writing "no useful information" into the byte read from said memory if "erase and delete" operation is selected by said mode selecting means,

d. backspacing the typewriter,

e. regressing said addressing means by one,

f. repeating steps b, c, d, and e.

* * * * *