

Jan. 20, 1959

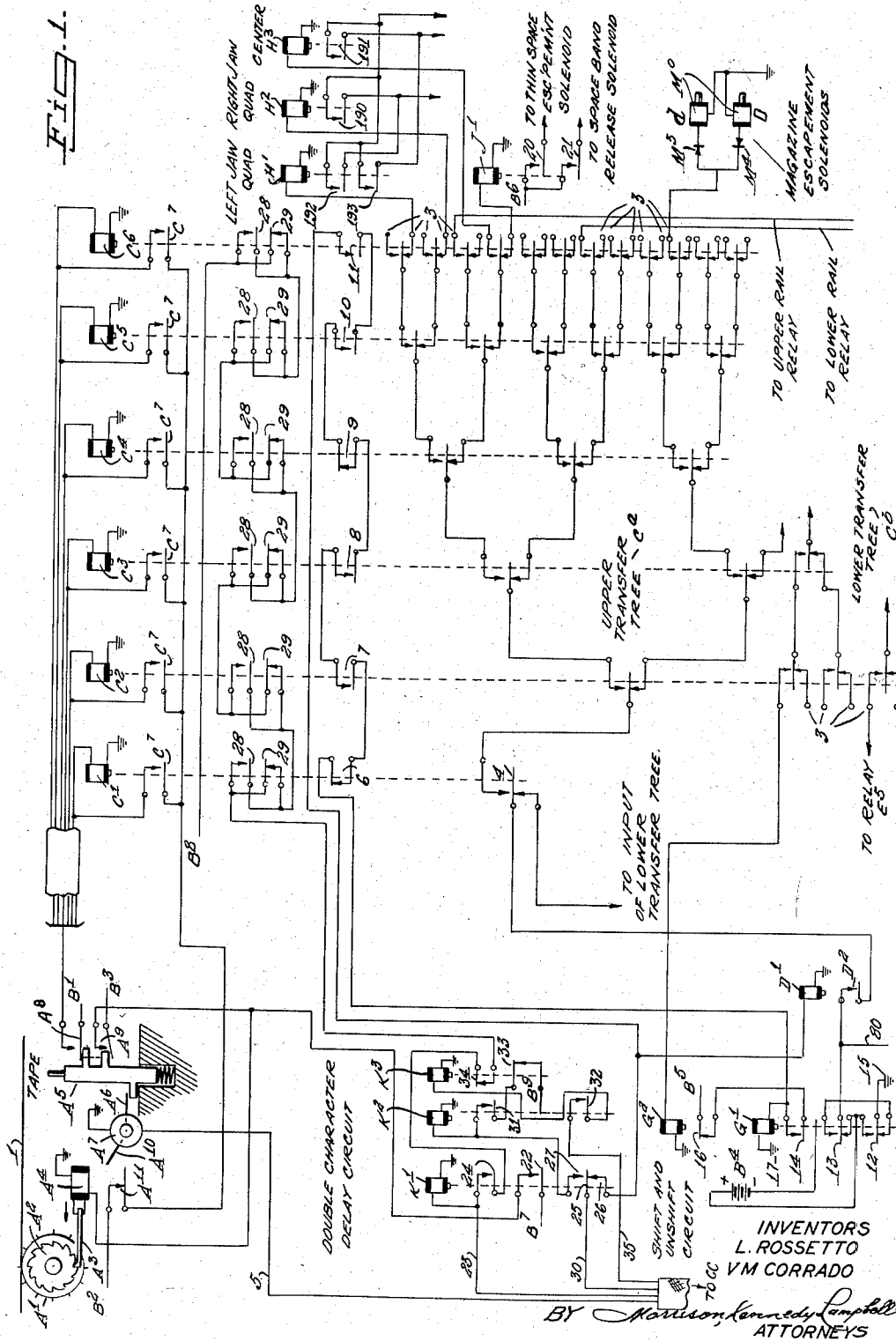
L. ROSSETTO ET AL

2,869,717

TYPOGRAPHICAL COMPOSING MACHINE

Filed June 24, 1953

3 Sheets-Sheet 1



Jan. 20, 1959

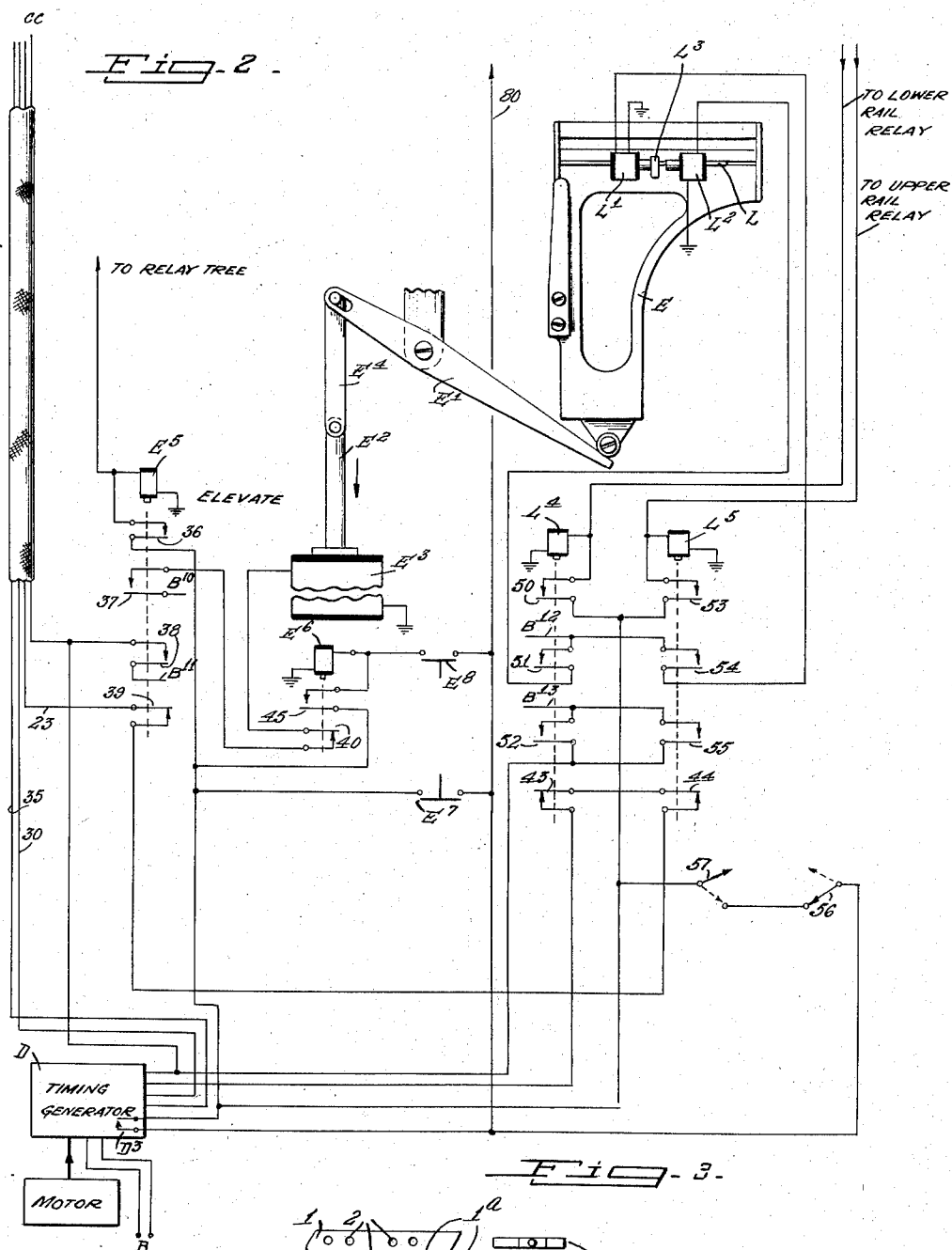
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TYPOGRAPHICAL COMPOSING MACHINE

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 4.

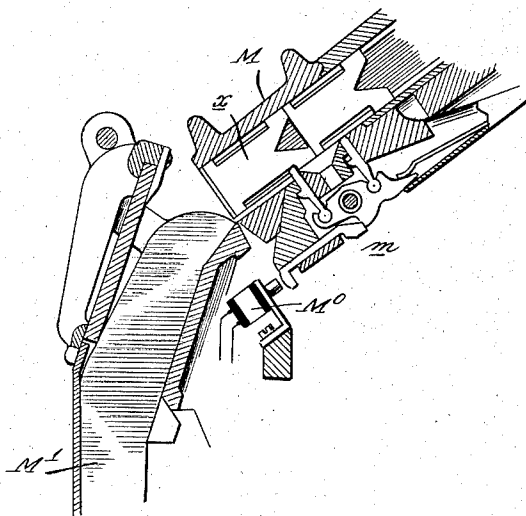
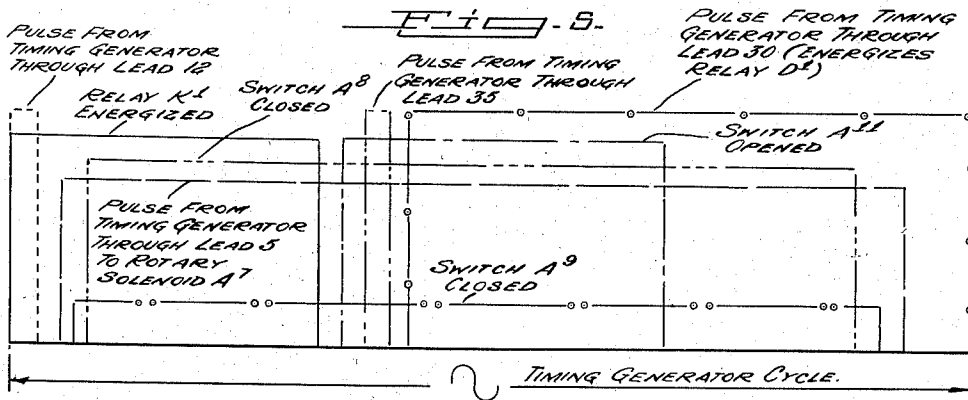


Fig. 5.



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TYPOGRAPHICAL COMPOSING MACHINE

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Application June 24, 1953, Serial No. 363,755

10 Claims. (Cl. 199—18)

This invention relates to automatic control units for typographical composing machines.

In conventional Linotype machines, such as, for example, machines of the general organization represented in U. S. Letters Patent, No. 436,532 to O. Mergenthaler, character bearing matrices and justifying spacebands are selectively released from storage magazines by the operation of a keyboard and then composed in line in an assembler. When an entire line has been composed, the assembler is raised and the line transferred therefrom to a casting mechanism, where molten metal is introduced into a mold and up against the composed line to form a type bar or slug. The matrices and spacebands are then transferred to a distributing mechanism whereby they are returned to their respective storage magazines for further use.

It is becoming the trend to operate these machines automatically. Various expedients (electrical, mechanical and pneumatic) have been heretofore proposed, and one automatic unit, a tape control unit known and sold under the trademark "Teletypesetter," has met with wide acceptance. Generally speaking, these automatic units are made so as to be easily applied to the keyboard of the regular Linotype machine, and their function is primarily to operate the keyboard to compose a line of matrices and spacebands and to raise the assembler to transfer the line after composition, all of the other usual steps in the machine cycle being entirely automatic and following in sequence the raising of the assembler.

The keyboard of the conventional machine is connected to the matrix and spaceband releasing escapements by means of a series of mechanical elements, and previous automatic control units have been specially designed for application to the keyboard in order to make it possible to apply the units to machines in the field, as well as to make it possible to operate the machines manually when desired. Today, however, many of the machines are destined to be employed in the field of automatic operation exclusively, so that the control units need no longer be mere keyboard attachments.

It is an object of the present invention to make possible the elimination of the keyboard and the long mechanical connections between the keyboard and the magazines by providing a greatly simplified and automatically operated machine in which the matrix and spaceband releasing mechanism is operated directly by electrical solenoids selectively controlled in their operation by a perforated control tape. The present invention also provides automatic means for raising the assembler and for performing many other machine operations.

In the present control system, the matter to be composed is prepared in code signal form and then transmitted to a reader or decoder which controls the various automatic operations. The code may be received in any suitable form, such as transmitted electrical input signals or from a magnetic tape, but for present purposes it may be assumed that the code signals are in the usual Teletypesetter perforated tape form.

The perforated tape is advanced to the reader in a step

2

by step fashion and the code signals contained therein are transmitted to a bank of code relays which, in turn, select the proper output or work circuits for operation. The six unit code, in the present arrangement, makes possible the selection of any of sixty-four different output circuits, and the output circuits are each further subdivided into two circuits, each sensitive to a different polarity, so that by reversing the polarity of the power supply, a total of one hundred twenty-eight different operations are possible. Code signals are reserved for shifting and unshifting the polarity of the power supply.

Provision is made in the control system for recognizing successive identical code signals in order that the second operation will be delayed to allow time for a full response of the actuated mechanism to the first code signal. The delay prevents the advance of the control tape for one or more complete cycles of a timing generator.

Time control is one of the features of the present invention. All of the various operations of the machine and the operating unit are controlled in the proper sequence by a constantly rotating timing generator which may be driven by or independently of the machine driving mechanism. During each revolution of the timing generator, a series of electrical pulses is sent out to the control unit to initiate the various operations thereof.

One of the more important functions of the timing generator is to control the duration of the work pulses, for example, those pulses which serve to energize the solenoids which actuate the matrix and spaceband releasing escapements. It is essential that these solenoids be operated for a long enough time to insure the release and discharge of the matrices and spacebands from their magazines by gravity.

The above and other features of the present invention will be described in detail in the specification which follows.

Referring to the drawings:

Figs. 1 and 2 illustrate a circuit diagram of the improved control system, Fig. 2 being a continuation of Fig. 1;

Fig. 3 is a top plan view showing the control tape and the sensing elements for reading the tape;

Fig. 4 is a vertical section taken through the discharge end of a matrix magazine and the escapement mechanism thereof; and

Fig. 5 is a time sequence chart illustrating the normal order of certain operations, but it is not necessarily intended to truly represent the actual time durations of the operations illustrated.

Referring to Fig. 4, the character bearing matrices x are stored in individual channels of a magazine M , and the matrices are adapted to be released therefrom by the operation of an escapement mechanism, generally designated by the reference character m . Upon release from the magazine, the matrices fall by gravity through an assembling mechanism M^1 , and ultimately they are delivered to and composed in line in the order of their release in an assembler elevator E (see Fig. 2). When a full line has been thus composed, the elevator is raised and the line transferred therefrom for transportation to a casting mechanism (not shown). The matrix releasing escapements are adapted to be operated directly by individual electrical solenoids M^0 , which solenoids are selectively operated by the new control system.

According to the present invention, all of the various operations of a typographical composing machine are controlled in their proper sequence by a constantly rotating timing generator D (see Fig. 2). The timing generator may be driven from the intermediate drive shaft of the machine, but preferably it is independently driven. The timing generator may be of the usual variety, and its function is to produce, during each cycle of operation, a

3

series of time-measured control pulses, to be described in detail below. The control pulses are produced by periodically completing a plurality of circuits from a primary voltage source B for a predetermined time duration measured by a fraction of a cycle of the timing generator.

Referring to Figs. 1 and 2, and especially to Fig. 1, the perforated tape 1 containing the code is advanced in a step by step manner by a solenoid operated sprocket wheel A¹. The points of the sprocket wheel engage holes 1^a in the tape for feeding (see Fig. 3). Mounted on the same shaft with the sprocket wheel is a ratchet wheel A² which is adapted to be rotated by a reciprocatory ratchet arm A³. The reciprocation of the arm A³ is, in turn, controlled by a solenoid A⁴.

The tape, in its step by step movement, passes over a group of six sensing fingers A⁵ which "read" the code perforations 2 (see Fig. 3) in the tape. The sensing fingers are capable of upward and downward vertical movement, but are normally held in their downward inoperative position by the pivotal arm A⁶ of a rotary type solenoid A⁷. The tape is first advanced to position the code signal above the sensing fingers, and then the rotary solenoid is actuated by a pulse transmitted from the timing generator D through the lead 5. The operation of the rotary solenoid rocks the arm A⁶ in a counter-clockwise direction to release the sensing fingers, and those fingers which register with perforations in the tape are permitted to rise, whereas the others are prevented from rising by the tape.

The code signal thus read is transmitted to a relay bank comprising six relays C¹, C², C³, C⁴, C⁵, C⁶. Each of the relays is associated with and adapted to be operated by the rising of one of the sensing fingers. There are two contact switches A⁸ and A⁹ associated with and adapted to be closed by each of the sensing fingers. Each sensing finger which detects a perforation in the tape completes a circuit from a voltage source B¹ to energize one of the relays. The relays thus energized are locked in operation. There is a contact C⁷ associated with each of the relays, and the contact is adapted to be closed by the energization of the relay, thereby completing a locking circuit from the voltage B² through the operated relay to ground. The locking circuits maintain the selected relays operative even after the return descent of the sensing fingers A⁵ permits the switches A⁸ to open.

The closing of any one of the switches A⁹ by the rising of one of the sensing fingers completes a circuit from voltage B³ to the tape advancing solenoid A⁴. When the solenoid is thus operated, the ratchet arm A³ is cocked or moved to the right, as viewed in Fig. 1, preparatory to the deenergization of the solenoid which actually advances the tape.

The rotary solenoid A⁷ is provided with another operating arm A¹⁰ disposed at an oblique angle in relation to the releasing arm A⁶. The function of the arm A¹⁰ is to momentarily open the normally closed switch A¹¹ and to thereby break the locking circuits for the relays C¹ to C⁶. It should be noted, however, that the opening of the switch A¹¹ is merely to erase the preceding code signal from the relays, but it does not erase the new code signal, since the switches A⁸ which serve to impress the new code signal on the relays are maintained closed by the sensing fingers until the switch A¹¹ is closed.

The sequence of operation is illustrated in Fig. 5 and is as follows: The operation of the rotary solenoid A⁷ is relatively slow to permit the sensing fingers A⁵ to close the appropriate switches A⁸ before the arm A¹⁰ of the solenoid has opened the switch A¹¹. For the instant between the closing of the switches A⁸ and the opening of the switch A¹¹, relays corresponding to two code signals on the tape are imposed on the relays, viz., the instant signal in the process of being read or decoded and the preceding signal. As soon, however, as the switch A¹¹ is opened, the locking circuits are broken and the old signal is wiped out. The new signal is not

4

lost because the switches A⁸ remain closed until after the return movement of the arm A¹⁰ of the solenoid permits the switch A¹¹ to close, thereby giving the relays corresponding to the new code signal an opportunity to be locked in before the arm A⁶ restores the fingers A⁵ to their downward inoperative position. Similarly, the relays corresponding to the instant code signal will remain locked in operation until the switch A¹¹ is again opened during the next operation of the rotary solenoid A⁷.

There are a plurality of contacts adapted to be operated by each of the relays C¹ to C⁶, and the vertical dotted lines in Fig. 1 trace the contacts controlled by each. These contacts are arranged in several groups, each group being delegated to a specific function. The group of contacts C¹, as we have already seen, is for locking-in the particular relays selected for operation. A second group, later to be described, is associated with the recognition of successive identical code signals. A third group is set aside for the purpose of operating a shift circuit, later to be described. And finally, a fourth group, the contacts comprising a transfer tree, selects the particular work function to be performed.

The fourth group, the transfer tree or selecting system, is divided into an upper transfer tree, generally designated by the reference character C^a, and a lower tree, generally designated C^b. The lower tree is reversed with respect to the upper tree, that is, to say, the contacts of the upper group increase from left to right, whereas the contacts of the lower tree increase from right to left for the purpose of more evenly distributing the work load on the relays. The particular arrangement of the transfer tree herein employed has not been shown in its entirety in the drawings, but it is illustrated and described on page 52 of "The Design of Switching Circuits" by Keister, Ritchie, and Washburn, published by D. Van Nostrand Company, Inc., New York.

When a code signal read from the tape is impressed on the relay bank, all of the contacts associated with each of the energized relays are operated accordingly. The positions of the contacts of the upper and lower transfer trees set up an electrical connection or path to a selected one of a plurality of output terminals 3. A contact 4 controlled by the relay C¹ determines whether the electrical path set up will be through the upper or lower transfer tree. The various circuits which perform the actual work operations of the machine are connected to the output terminals 3.

There are thirty-two output terminals 3 in each of the upper and lower transfer trees, making a total in all of sixty-four. The number of work functions, however, which are necessary to automatically operate a line casting machine greatly exceeds sixty-four. In the present invention, rather than further complicate the relay bank by adding another relay and expanding the transfer tree, many of the output terminals are further subdivided into two work circuits, each sensitive to a different polarity. Two of the code combinations are set aside to operate "shift" and "unshift" circuits which change the polarity of the work pulse transmitted through the transfer tree from the battery B⁴. Thus, a given code combination will, in every case, set up for operation the same electrical path through the transfer tree, but it may perform either of two different work functions depending on the polarity of B⁴. For example, a particular code combination may be designated for the lower case "d" in the unshifted position, and the upper case "D" in the shifted position, as is the custom in the code systems now in use. Since the automatic operation of line casting machines would not require utilization of all of the available code signals, certain signals, such as the release of matrices bearing common punctuation marks and quadding and centering signals, are insensitive to polarity in order to decrease the frequency of the shift and unshift operations.

As explained above, the matrices are released from the magazine (Fig. 4) by the operation of escapement devices *m* actuated by solenoids M^0 . Standard Linotype magazines are usually of the 72 or 90 channel variety, and there is an escapement mechanism *m* and a corresponding solenoid M^0 for each channel of the magazine. It is a feature of the present invention that the escapement mechanisms are actuated directly by solenoids, thereby eliminating the need for a keyboard and the mechanical linkages connecting the keyboard and the magazine escapements.

The solenoids M^0 are selectively operated through the transfer tree. As illustrated in Fig. 1, two of the solenoids M^0 are connected to a single one of the output terminals 3 but through reversed selenium rectifiers M^3 and M^4 , the rectifier M^3 , for example, being conductive to the polarity of the battery B^4 only in the unshift condition, and the rectifier M^4 being conductive to the polarity of the battery B^4 only in the shift condition. Thus, the same code combination is put into the transfer tree for operating either of the matrix releasing solenoids, although only one or the other is operated at any given time and that depending upon the polarity of the battery B^4 .

The timing of the operation of the magazine escapements *m* is a somewhat critical factor in that the operation must be slow enough to insure release of the matrix from the magazine and, at the same time, fast enough to achieve maximum speed. Thus, an electrical pulse must be sent to the magazine escapement solenoid M^0 of proper time-measured duration. It may be pointed out that in standard line casting machines, the timing of the operation of the escapements is controlled by a constantly rotating keyboard roll, and inasmuch as all control units heretofore proposed have taken the form of keyboard attachments to the machine, there has been no need to provide means independent of the keyboard to time the operation of the escapements. In the present control mechanism, special provision is made for operating the escapement operating solenoids M^0 for the proper time duration. Accordingly, one of the functions of the timing generator D is to regulate the duration of operation of the solenoids M^0 . At the proper time (see Fig. 5) in the machine cycle and after the code combination has been set up in the transfer tree, a pulse is transmitted from the generator D over the lead 30 to energize a relay D^1 (see Fig. 1). The energization of the relay closes a switch D^2 controlled thereby, and a circuit is completed from the battery B^4 through the transfer tree to the appropriate matrix releasing solenoid M^0 . The pulse to the relay D^1 is measured by the generator, and the length of the pulse corresponds to the length of time for which the solenoids M^0 are to be operated. Near the end of the generator pulse, the relay D^1 is deenergized, and the switch D^2 is opened, thereby breaking the power to the operated solenoid M^0 .

As explained above, the work circuits, e. g. those operating the matrix releasing solenoids M^0 , are made sensitive to polarity by placing reversed rectifiers in their respective circuits, and by such means a particular code combination can operate either of two work circuits merely by reversing the polarity of the battery B^4 . The arrangement for shifting is such that one of the code combinations completes a circuit to a shift relay G^1 through a plurality of switches 6 to 11 in series, there being one switch associated with each of the code relays C^1 to C^6 . The switches 6 and 9 are normally closed but are adapted to be opened if their corresponding code relays C^1 and C^4 , respectively, are operated. The switches 7, 8, 10 and 11 are normally open but are adapted to be closed by the operation of the corresponding code relays C^2 , C^3 , C^5 and C^6 . When all of the switches 6 to 11 are closed by the proper code combination, the pulse from the timing generator D which normally energizes the relay D^1 operates the shift relay G^1 .

There are three contacts 12, 13 and 14, which are adapted to be controlled by the operation of the shift relay G^1 . The contact 12 is connected to ground and the contact 13 leads to the transfer tree through the switch D^2 . Normally, in the unshift condition, the negative terminal of the battery is grounded through the contact 12 and the polarity of the battery B^4 with respect to the transfer tree is determined by the positive terminal through the contact 13. When the shift relay G^1 is operated, the contacts 12 and 13 are shifted to a different set of terminals, so that the positive terminal of the battery is grounded through the contact 12, and the contact 13, which leads to the transfer tree, is connected to the negative side of the battery. The function of the contact 14 is to lock the relay G^1 in operation once it has been operated. The contact 14 is normally open in the unshift condition but, when closed by the operation of the relay G^1 , it completes a locking circuit for the relay from B^5 through the normally closed contact 16 to ground 17. Once shifted, the polarity of the battery B^4 remains fixed with respect to the relay tree until unshifted.

The unshift operation is accomplished by a code combination setting up the transfer tree for the selection of the relay G^2 . The energization of the relay G^2 opens the contact 16 in the locking circuit for the relay G^1 , and the deenergization of the relay G^1 causes the other contact 14 of the locking circuit to open and the contacts 12 and 13 to again reverse the polarity of the battery B^4 . It may be noted that the power to energize the relay G^2 for the purpose of reversing the polarity of the battery B^4 actually comes from the battery B^4 , but this is of no consequence, since the function of the relay G^2 is complete as soon as it breaks the locking circuit of the relay G^1 . When thus restored to the unshift condition, the polarity of the battery B^4 remains fixed until the shift relay G^1 is operated in the manner above described.

Code combinations are set aside for quadding and centering operations. "Left jaw quadding," "right jaw quadding" and "centering" code signals operate one of the relays H^1 , H^2 and H^3 , respectively (Fig. 1). Since operations of this nature are frequently required in both the shift and unshift conditions, they are operable by both polarities of the battery B^4 . The code combination for quadding with the left-hand jaw energizes relay H^1 which closes switches 192 and 193; the operation of the relay H^2 closes switch 190 for right jaw quadding; and the operation of the relay H^3 for centering closes the switch 191. For an understanding of the manner in which the above switches 190 to 193 control the quadding and centering operations, reference may be had to the copending application of L. Rossetto et al., Serial No. 184,071, filed September 9, 1950. For purposes of easy comparison, identical reference numerals (viz., 190 to 193) are used in the cited application and in the present application to designate the same switches.

In certain cases, especially where the number of spacebands in the composed line is incapable of fully justifying the line, it is customary to insert a thin blank spacer element next to each spaceband in the line. When the length of the composed line is increased in this manner, the amount which the line has to be expanded in justification is accordingly decreased, so that full justification can be accomplished. The thin spacer elements are stored in the matrix magazines and are released by a solenoid in the same manner as the character bearing matrices. In the present invention, a code signal or combination is set aside for releasing a thin spacer element in addition to a spaceband. A relay J^1 is operated through the transfer tree, which relay closes contacts 20 and 21. The contact 20 completes a circuit from the voltage supply B^6 to the thin spacer escapement solenoid (not shown), and the contact 21 closes a circuit to the spaceband release solenoid (not shown).

As a further feature of the present invention, the feed of the tape between successive identical code combina-

tions is delayed to insure return of the various operated mechanical parts of the machine to normal position in order to prevent the loss of the second operation. Toward this end, means are provided for stopping the tape for a complete cycle of the timing generator D when the second of two successive identical signals is recognized. As described above, the advance of the tape is effected by the operation of the solenoid A⁴ from the power source B³. The energization of the solenoid sets or cocks the arm A³, and the release or deenergization of the solenoid effects the actual movement of the tape. Thus, by delaying the release of the solenoid A⁴, or stated another way, by prolonging the energization thereof, it is possible to introduce a delay between successive identical characters. The energization of the solenoid A⁴, in the present instance, is prolonged by cutting in a circuit to the solenoid from the voltage source B⁷ (see Fig. 1) for one complete cycle of the timing generator D.

During each cycle of the timing generator, a pulse is sent through a lead 23 to energize the relay K¹ (see Figs. 1 and 5). The energization of this relay closes contacts 22 and 24 and shifts the contact 25 from the terminal 26 to the terminal 27. The closing of the contact 22 completes the circuit from B⁷ to the solenoid A⁴. The action of this circuit is merely to prevent the advance of the tape only in the event of identical double signals, and normally this circuit to the solenoid A⁴ will be broken at a time when the solenoid A⁴ is being energized from B³ through the closed switch A⁹, so that it has no delaying effect on the advance of the tape.

The closing of the contact 24 brings a locking circuit into operation for the relay K¹ from B⁸ through a network of identical code detecting switches 28 and 29 and a single normally closed contact 34 associated with a relay K³. The identical code detecting switches comprise a group of normally open switches 28 in series, one associated with each of the relays C¹ to C⁶, and a group of normally closed switches 29, one in parallel arrangement with each of the normally closed switches 28 and adapted to be controlled by the same relay. The switches 28 are adapted to be closed by the energization of their respective relays, while the switches 29 are adapted to be opened thereby. Thus, when two different code signals follow, one or more of the switches 28 and 29 will be either opened or closed, thereby breaking the locking circuit to the relay K¹, but the locking circuit will not be broken when successive code signals are identical.

When the locking circuit is not broken, indicating successive identical code signals, the relay K¹ remains in operative condition, and the solenoid A⁴ is prevented from advancing the tape during that cycle of the generator. With the relay thus energized, the contact 25 is shifted from the terminal 26 to the terminal 27 and the work pulse which is normally sent to the relay D¹ from the timing generator through the lead 30 is directed to the relay K², thereby closing the contacts 31 and 32. The contact 31 completes a locking circuit for the relay K² from B⁹ through a normally closed contact 33 associated with the relay K³. The relays K¹ and K² remain energized for the remainder of the timing generator cycle, and during the next cycle of operation of the generator, a pulse is transmitted by the lead 35 and through the closed contact 32 to energize the relay K³. The operation of the relay K³ opens the normally closed switches 34 and 33 and breaks the locking circuits to the relays K¹ and K². The contact 25 is then again shifted to the terminal 26, so that the generator pulse through the lead 30 will be directed, as usual, to the relay D¹ to permit a work pulse to be sent through the transfer tree from the battery B⁴ for the desired work operation.

In the usual course of operation of a line casting machine, the assembler elevator E (Fig. 2) is raised when a complete line has been composed therein. The precise means employed for raising the elevator is not important to the present invention, but for purposes of illustration

only, the assembler elevator E is depicted as being raised by the counterclockwise rotation of a lever E¹. The pivotal movement of the lever E¹ is controlled by the armature E² of a solenoid E³ and a link E⁴ connecting the lever and the solenoid armature.

A code combination corresponding to the elevator raising signal sets up the transfer tree accordingly for the operation of a relay E⁵. The operation of the relay E⁵ closes the normally open contacts 36, 37 and 38 and opens the normally closed contact 39. The closing of the contact 37 completes a circuit from B¹⁰ through a normally closed contact 40 of a relay E⁶ to the elevator raising solenoid E³. In practice, a time delay relay would be provided to insure ample time for the released matrices to be assembled, although that feature has not been shown in the drawings for the sake of simplicity. The closing of the contact 36 completes a locking circuit for the relay E⁵ from the battery B⁴, and through the closed switch D³ of the timing generator via the lead 80. The purpose of the switch D³ will be described below. As soon as the elevator begins to rise, the switch E⁷ is closed, establishing another locking circuit for the relay E⁵ for purposes to be explained below. The switch E⁷ is held open by the elevator in its matrix receiving or lowermost position, and the switch is adapted to be spring closed as soon as the elevator begins to rise.

While the elevator E is raised, the advance of the tape has to be stopped. Accordingly, the closing of the contact 38 by the energization of the relay E⁵ completes a circuit from B¹¹ to the rotary solenoid A⁷. It may be recalled that the advance of the tape is effected by the opening of the switch A⁹ by the downward movement of the sensing finger A⁵, and the downward movement of the finger A⁵ is in turn controlled by the deenergization of the rotary solenoid A⁷. Thus, the tape is prevented from advancing while the elevator is raised by maintaining the solenoid A⁷ energized.

Also, to avoid any misinterpretation of code signals, when the elevator is raised, the double character delay circuit is rendered inoperative by the opening of the contact 39. The pulse directed to the relay K¹ from the timing generator D via the lead 23 first passes through the normally closed contacts 43, 44 and 39. Thus, while the elevator is raised, the pulse to the relay K¹ usually sent out during each cycle of the generator is not transmitted. The contacts 43 and 44 will be explained below.

When the elevator E reaches its uppermost or line transfer position, where it is mechanically latched, it is adapted to close a normally open switch E⁸. The switch E⁸ completes a circuit from the battery B⁴ to the relay E⁶, thereby closing a switch 45 and opening the switch 40. The closing of the switch 45 completes a locking circuit for the relay E⁶ from B⁴ through the closed switch E⁷, whereas the opening of the contact 40 breaks the power to the solenoid E³ and permits the elevator E to descend as soon as it is mechanically unlatched in the usual manner by the transfer of the line therefrom. When the elevator begins to descend, it permits the switch E⁸ to open, although the relays E⁵ and E⁶ are still locked in through the switches E⁷ and D³. Finally, when the elevator has fully descended to the assembling position, the switch E⁷ is again opened, breaking one of the two locking circuits to the relays E⁵ and E⁶.

The switch D³, establishing the other locking circuit for the relays E⁵ and E⁶, is adapted to be closed shortly after the beginning of the timing generator's cycle and remains closed until just before the very end of the cycle. The purpose of the switch D³ is to maintain the relay E⁵ energized for the entire time that the elevator is raised and until very nearly the end of the cycle of the generator in which the elevator returns to line receiving position. It is evident, due to the fact that the timing generator is constantly rotating, that the assembler elevator might return to its lowermost position, thus opening the switch E⁷, in the middle of the timing generator's cycle.

To prevent the tape from prematurely advancing during that cycle, it is necessary to maintain the relay E⁵, controlling the contact 38, energized until just before the end of that cycle, and this of course is accomplished by the operation of the switch D³. In this way, if the elevator descends to line receiving position in the middle of a cycle of the timing generator, the automatic operation of the machine will not recommence until the beginning of the next cycle of the generator.

Turning now to another feature of the present invention, many of the matrices employed in casting are provided with two superposed characters in one edge thereof. In composing a line with these matrices, it is necessary to assemble them at either of two levels in order to make available one or the other of the two characters. Normally, the matrices are adapted to be assembled on a lower fixed rail (not shown) of the elevator, but an upper horizontal rail L (see Fig. 2) is provided and is selectively movable into or out of the path of travel of the matrices as they enter the elevator. Thus, as viewed in Fig. 2, when the rail L is in the rightward position, an incoming matrix will be assembled thereon, whereas if the rail is in its inoperative or leftward position, the matrix will be assembled, as usual, on the lower fixed rail. The upper rail, called the auxiliary or duplex rail, is standard equipment on line casting machines.

In the present invention, the movement of the rail is controlled by a pair of solenoids L¹ and L² attached to the front face of the assembler elevator E. The solenoids are arranged so that they operate in opposite directions against a forwardly projecting lug L³ of the rail L, the solenoid L¹ serving to shift the rail to the rightward or operative position and the solenoid L² serving to return it to the leftward or inoperative position.

Separate code signals are employed for moving the shiftable rail to the operative and the inoperative positions, and the code signals are set up in the transfer tree in the usual way for the selection of the relay L⁴ or the relay L⁵. Once the rail is shifted from one position to the other, it will remain in its shifted position until a subsequent code signal effects its return. The relay L⁴ closes contacts 50, 51 and 52 associated therewith and opens the contact 43, and the relay L⁵ closes corresponding contacts 53, 54, 55 and opens 44.

The contacts 50 and 53 each complete locking circuits from the battery B⁴ to their respective relays L⁴ and L⁵ through a pair of normally closed switches 56 and 57, which will be explained in greater detail below.

The closing of the contact 51 completes a circuit from B¹² to the solenoid L², and the contact 54 closes a like circuit from B¹² to the solenoid L¹. When either of the contacts 52 or 55 is closed, a circuit is completed from B¹³ to the rotary solenoid A⁷ to prevent the advance of the tape, much in the same manner as explained in connection with the closing of the contact 38 associated with the relay E⁵.

The contacts 43 and 44 are in series with the contact 38, so that the opening of any one of them stops the pulse to the relay K¹.

Returning now to the normally closed switches 56 and 57, these switches are intended to insure the operation of the locking circuits of the relays L⁴ and L⁵ throughout the entire shifting operation. The switch 57 is held open by the rail L in its inoperative or leftward position, and the switch 56 is held open by the rail in its operative or rightward position. Assume, for purposes of illustration, that the rail is in its inoperative position, maintaining the switch 57 open, the switch 56 being closed. The energization of the relay L¹ shifts the rail to the right, and as soon as it begins to move, the switch 57 is permitted to close. The locking circuit is then completed and remains so until the rail has shifted to its operative position, where it opens the switch 56 to break the locking circuit. The condition of the switches is illustrated by the broken lines in Fig. 2, the switch 57 being closed and the switch

56 open. Similarly, in traveling from the operative to the retracted positions, the switch 56 is first closed to make the locking circuit and it is not broken until the rail has reached the leftward position and has opened the switch 57. In each case, the pulse to the relays L⁴ and L⁵ is of sufficiently long time duration to insure the closing of whichever switch 56 or 57 happens to be open.

The invention has been shown in but a single preferred form and by way of example only, and, of course, many modifications and variations may be made therein and in its mode of application which will still be within the spirit of the invention. It is to be understood, therefore, that the invention is not to be limited to any specific form or embodiment, or in any other respect, except insofar as such limitations are specified in the claims.

What is claimed is:

1. In a typographical composing machine adapted for automatic operation, the combination of means for reading a control tape containing code signals, means for translating the code signals into machine control operations, a timing generator for sending forth a series of electrical pulses during each cycle thereof to control the timed sequence of machine operations, tape advancing means, means for rendering the tape advancing means inoperative, means controlled by one of the pulses from the timing generator for conditioning said last mentioned means for operation, means for recognizing successive identical code signals, and means controlled thereby for preventing the advance of the tape for at least one cycle of the timing generator.

2. In a typographical composing machine adapted for automatic operation, the combination of means for reading a control tape containing code signals, means for translating the code signals into machine control operations, a timing generator for sending forth a series of electrical pulses during each cycle thereof to control the timed sequence of machine operations, tape advancing means, means for rendering the tape advancing means inoperative, means controlled by one of the pulses from the timing generator for conditioning said last mentioned means for operation, a relay controlled transfer tree upon which the code signals are imposed, and means associated with the transfer tree for recognizing successive identical code signals.

3. In a typographical composing machine adapted for automatic operation, the combination of a magazine containing character bearing elements, a plurality of escapements associated with said magazine and adapted to release individual character bearing elements, a corresponding plurality of electrical solenoids for actuating said escapements directly and by their own power, input code signals to electrically condition a selected solenoid for operation, work circuits in which the electrical solenoids are included, and a power driven timing generator for pulsing said circuits and having a definite cycle of operation, said timing generator acting during each cycle of operation to send forth an electrical pulse which energizes the work circuit for the selected solenoid at a predetermined time after it has been conditioned by the appropriate input code signal.

4. A combination as set forth in claim 3, wherein the electrical pulse from the timing generator also predetermines the time-duration of operation of the selected solenoid.

5. In a typographical composing machine adapted for automatic operation, the combination of a magazine containing character bearing elements, a plurality of escapements associated with the magazine, each to release one of the character bearing elements, a corresponding plurality of electrical solenoids to actuate said escapements directly and by their own power, work circuits in which the electrical solenoids are included, and a power driven timing generator for pulsing said circuits and having a definite cycle of operation, said timing generator acting during each cycle of operation to send forth an electrical

pulse which energizes the work circuit for a selected solenoid at a predetermined time and for a predetermined time-duration to insure the proper actuation of the corresponding escapement.

6. In a typographical composing machine adapted for automatic operation, the combination of means for reading code signals in a tape, means for advancing the tape from one code signal to the next, electrically controlled means for preventing the advance of the tape, a timing generator, a pulse from said timing generator serving to condition said electrically controlled means for operation, means for recognizing successive identical code signals in the tape, and means controlled by said recognizing means for rendering the electrically controlled means operative to prevent the advance of the tape in the event of successive identical code signals in the tape.

7. A combination as set forth in claim 6, wherein the advance of the tape is prevented for one complete cycle of the timing generator.

8. In a typographical composing machine adapted for automatic operation, the combination of means for reading code signals in a control tape, means for effecting intermittent feeding of the control tape through the reader, electrically controlled means for preventing the feed of the tape, means for impressing the code signals on a relay controlled transfer tree in order to translate the code signals into machine operations, means to retain a particular code signal impressed on the relay controlled transfer tree until a subsequent code signal is impressed thereon, a plurality of switches associated with the transfer tree controlling relays, said switches being associated with said means for preventing the feed of the control tape, the arrangement being such that different successive code signals will cause at least one of said switches to open, thereby rendering ineffective said means for preventing the feed of the tape, whereas identical successive code signals will produce no change in the switches and so prevent the advance of the control tape.

9. In a typographical composing machine adapted for

automatic operation, the combination of means for reading code signals in a tape, a solenoid for controlling the intermittent movement of the tape through the reader, said solenoid effecting the movement of the tape upon deenergization, means for impressing the code signals on a relay controlled transfer tree in order to translate the code signals into machine operations, means to retain a particular code signal impressed on the relay controlled transfer tree until a subsequent code signal is impressed thereon, a circuit for said solenoid, including a relay controlled switch for preventing the advance of the control tape, a timing generator adapted to transmit an electrical pulse to said switch controlling relay during each cycle of the generator, a locking circuit to maintain said relay in operative condition, said locking circuit including a plurality of switches associated with the transfer tree controlling relays, the arrangement being such that different successive code signals will cause at least one of said switches to open, thereby breaking the locking circuit for said relay, whereas identical successive code signals will maintain said relay locked in operation to prevent the advance of the control tape during the cycle of the timing generator.

10. A combination as set forth in claim 9, characterized in that a pulse from the timing generator during the next cycle thereof breaks the locking circuit for the relay.

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