J. P. TARBOX.

METHOD AND SYSTEM OF SELECTIVE CHARACTER DISPLAY.

APPLICATION FILED FEB. 2, 1914.

1,218,015.

Patented Mar. 6, 1917.

5 SHEETS—SHEET 1.

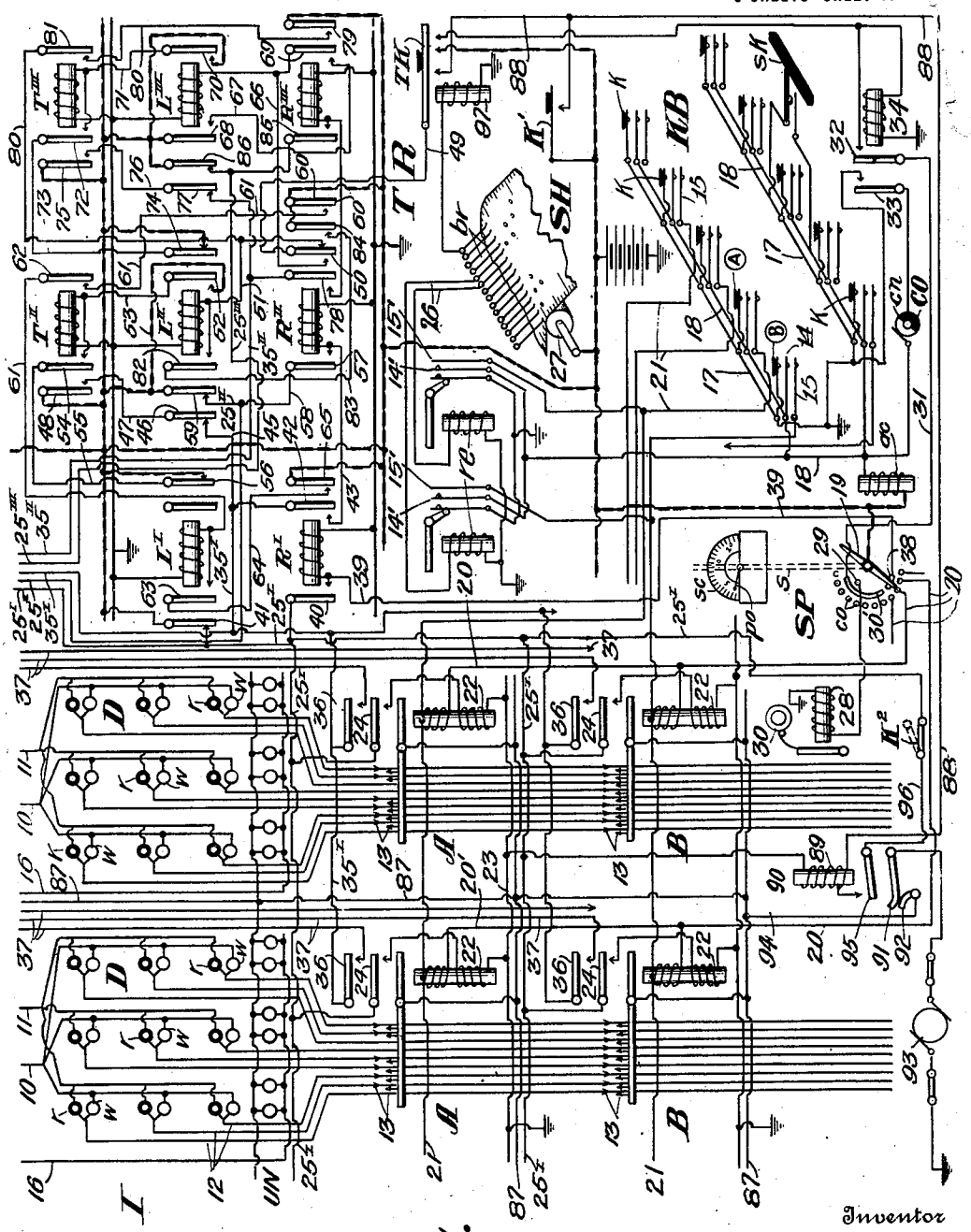


Fig. 1.

Witnesses

C. S. Drumheller.

J. Austin Stone

Inventor

John P. Tarbox

J. P. TARBOX.

METHOD AND SYSTEM OF SELECTIVE CHARACTER DISPLAY.

APPLICATION FILED FEB. 2, 1914.

1,218,015.

Patented Mar. 6, 1917.

5 SHEETS—SHEET 2.

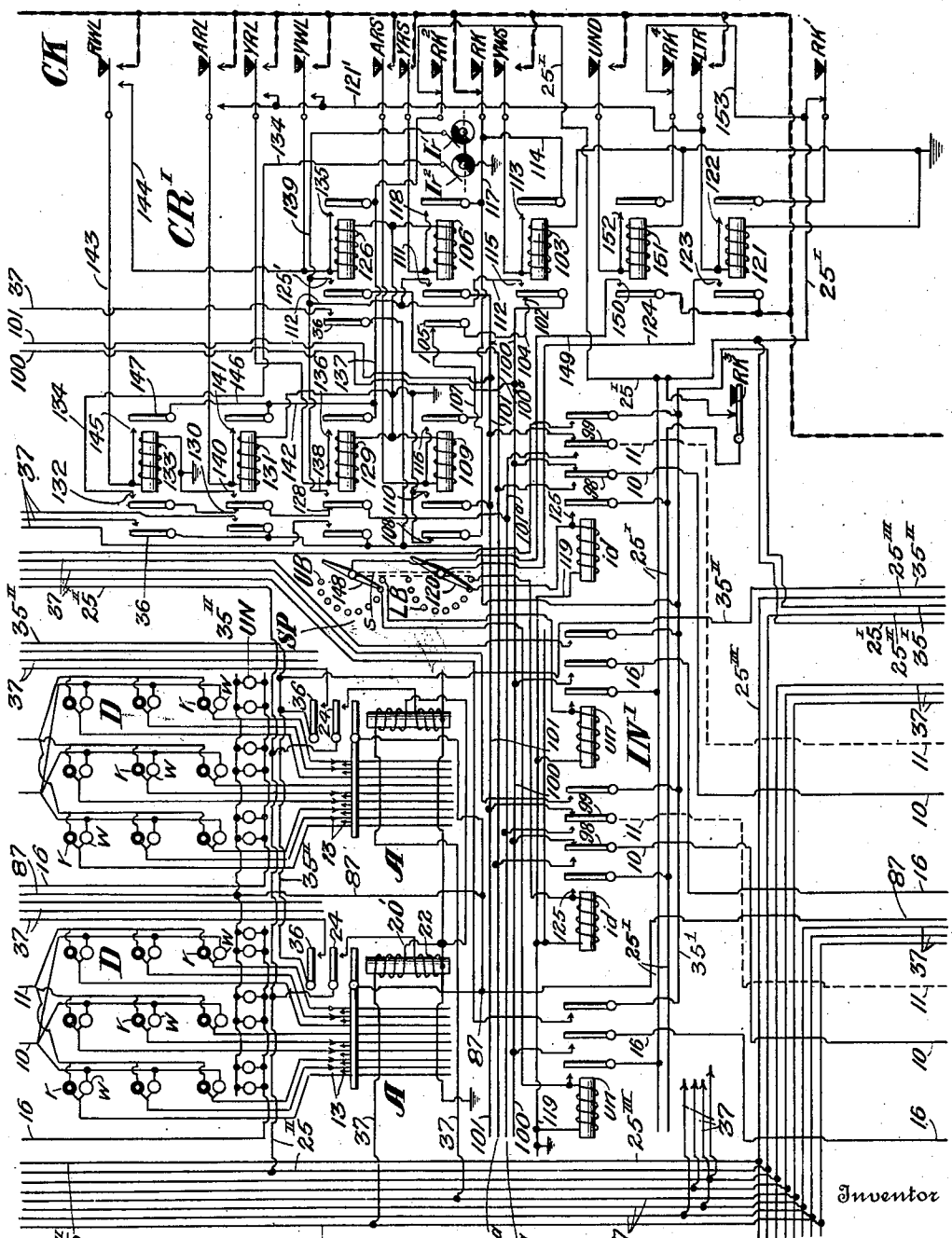


Fig. 2.

J. P. TARBOX.

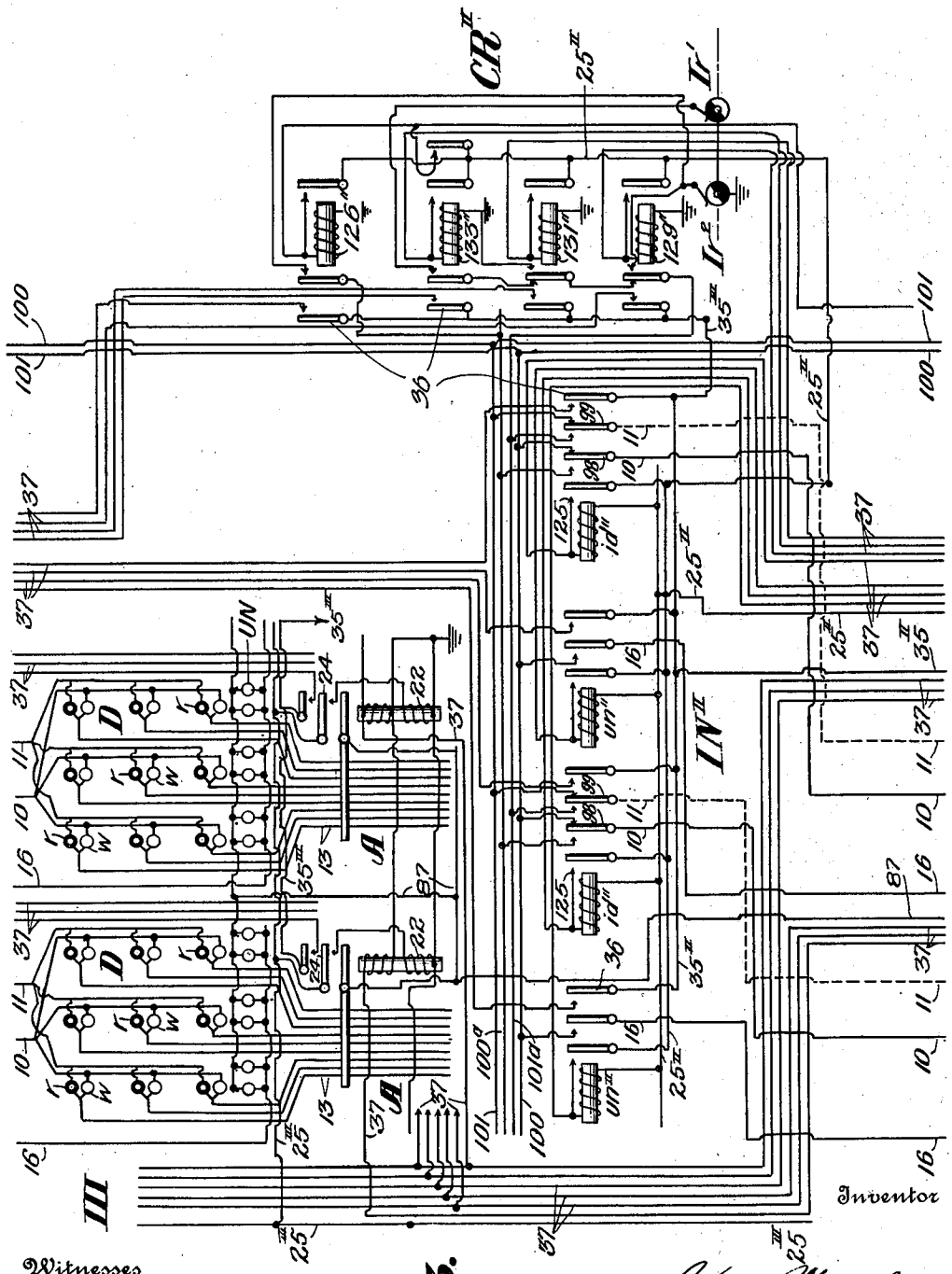
METHOD AND SYSTEM OF SELECTIVE CHARACTER DISPLAY.

APPLICATION FILED FEB. 2, 1914.

1,218,015.

Patented Mar. 6, 1917.

5 SHEETS—SHEET 3.



Witnesses

C. E. Drummond.

J. Austin Stone

Fig. 3.

John P. Tarbox

J. P. TARBOX.

METHOD AND SYSTEM OF SELECTIVE CHARACTER DISPLAY.

APPLICATION FILED FEB. 2, 1914.

1,218,015.

Patented Mar. 6, 1917.

5 SHEETS—SHEET 4.

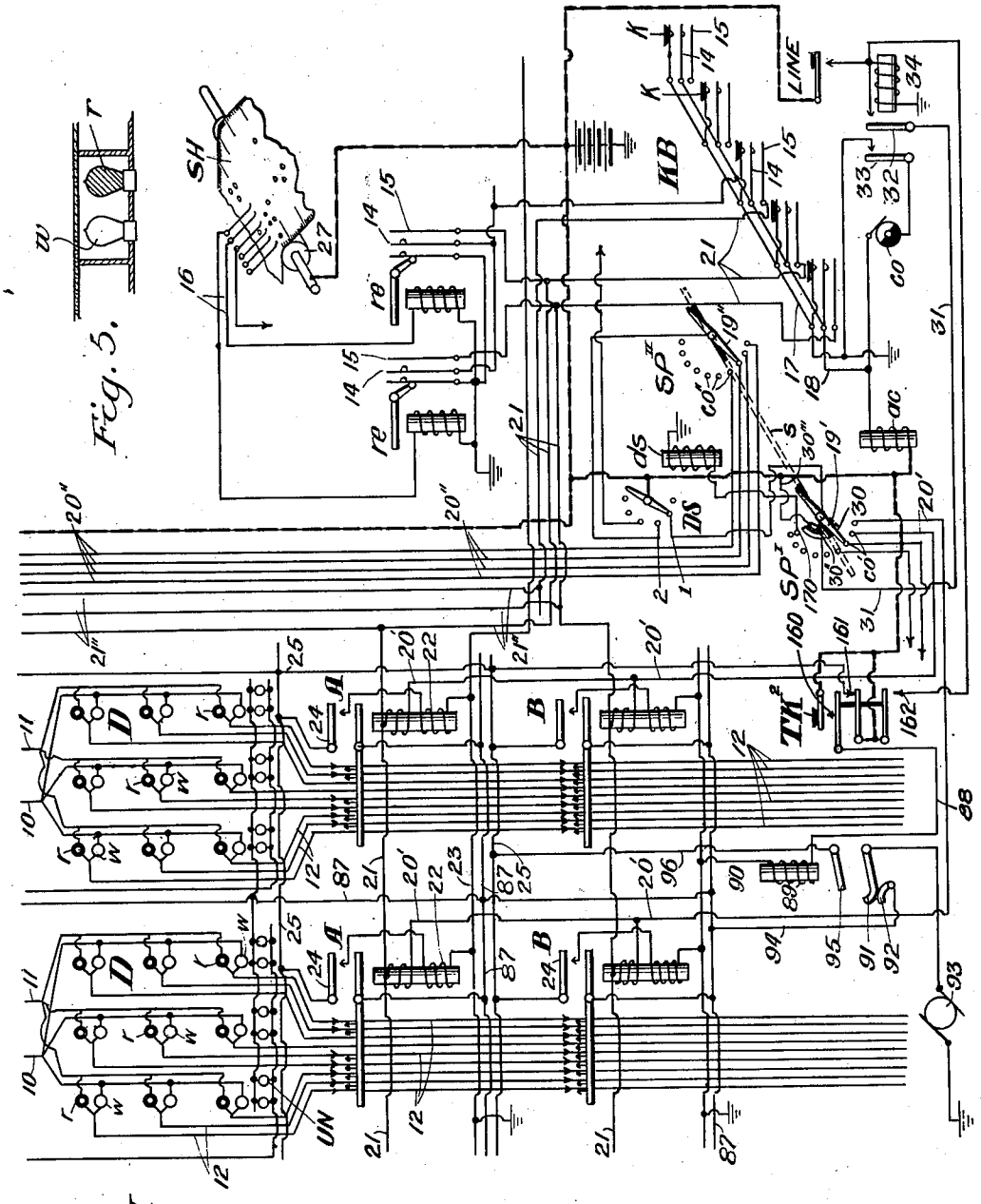


Fig. 4.

Witnesses

C. L. Grumman.

J. Austin Stone

Inventor

John P. Tarbox

J. P. TARBOX.

METHOD AND SYSTEM OF SELECTIVE CHARACTER DISPLAY.

APPLICATION FILED FEB. 2, 1914.

1,218,015.

Patented Mar. 6, 1917.

5 SHEETS—SHEET 5.

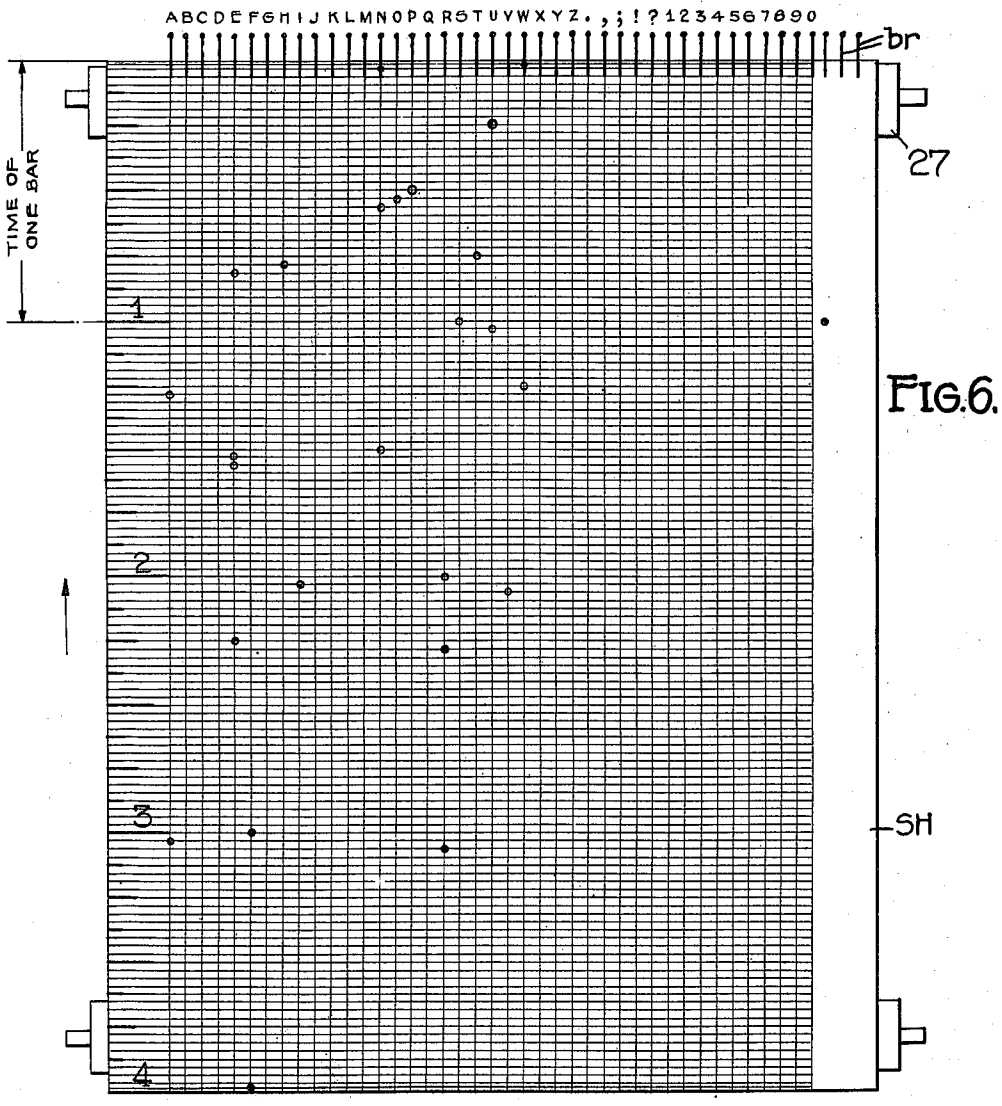


FIG. 6.

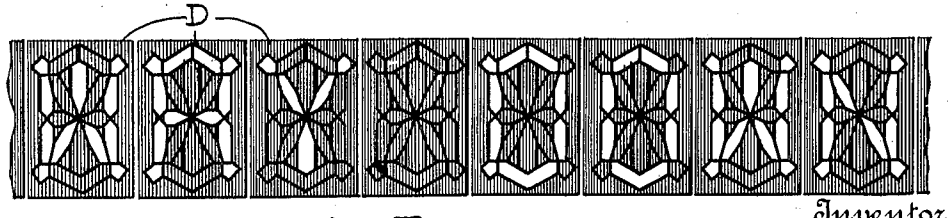


FIG. 7.

Inventor

John P. Tarbox

UNITED STATES PATENT OFFICE.

JOHN P. TARBOX, OF WASHINGTON, DISTRICT OF COLUMBIA.

METHOD AND SYSTEM OF SELECTIVE CHARACTER-DISPLAY.

1,218,015. Specification of Letters Patent. Patented Mar. 6, 1917.

Application filed February 2, 1914. Serial No. 816,080.

To all whom it may concern:

Be it known that I, JOHN P. TARBOX, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Methods and Systems of Selective Character-Display, of which the following is a specification.

My invention relates to that type of systems of display commonly known as flashing signs. It has for its principal object the production of a system possessing a sufficient degree of adaptability and flexibility. As at present constructed, such systems have a very limited field of use, both because of limitation in the number of advertisements displayed at any given time, and the limitations of the electrical and mechanical apparatus employed, these apparatuses being capable of going through the controlling operation in a cyclical manner only. Thus after the apparatus has once been set up according to any given advertising code, it is impracticable to modify that code without an entire readjustment of the apparatus, such readjustment entailing resetting for any new code, and such resetting being a very tedious and painstaking matter.

In contrast to this, the primary controlling elements of the system of my invention may and are intended to be operated upon at will to effect instantaneously the display, and the character of the display, of any desired subject-matter whatsoever. The primary controlling elements comprise a keyboard similar to the keyboard of an ordinary typewriter and a perforated sheet similar to the perforated note sheet of an ordinary automatic musical instrument. Not only may any desired subject-matter whatsoever be displayed in writing, but all the possible means of punctuation and emphasis which are used in writing upon commercial writing machines of today, may be here utilized, such means including quotation marks, underscoring, and change of color. Furthermore, emphasis and distinction of individual words, phrases or paragraphs may be accomplished by flashing or changing color on individual words, by delaying the display of a given word and suddenly flashing the entire word forth; on the other hand, by allowing a given word to remain in fixed display, and flashing the entire remainder of the sign, or by changing color on the word while the sign is being flashed, and many other similar variations. So also the underscoring may take place letter by letter, or after the display of a whole word has been completed. And through the perforated sheet, not only may display be made according to fixed forms or codes, but the words of songs or verses may be rendered in display, the words being displayed in exact musical time, and with all the effects of acceleration, retardation, accent, modulation, etc., that may be had from the voice of a singer. Every person of the nation is familiar with the popular as well as the old-time airs, and the effect of the display in the proper musical time of any one of these familiar airs is very striking. Advertising matter may be set to time of music in a wide variety of changes, and the effect produced upon the observer is rendered lasting through association with the air which runs through his mind at the same time.

I show the best form of my invention now known to me upon the accompanying sheets of drawing, upon which—

Figure 1 discloses one line of display devices and the associated primary and secondary control elements;

Fig. 2 discloses a second row of display devices above the first, together with its associated secondary controlling elements;

Fig. 3 discloses still a third row of display devices and its associated secondary controlling elements; and

Fig. 4 is a diagram of a modification.

Fig. 5 is the longitudinal section of one of the duplex lamp light cells, and including both a red lamp and a white lamp.

Fig. 6 is a plan of a portion of a preferred record sheet containing a musically arranged composition, and Fig. 7 is an elevation of a portion of a display board upon which has been displayed a number of the words of the musical composition.

Referring to the drawings, I (Fig. 1), II (Fig. 2), and III (Fig. 3), denote three rows of display devices located one above the other in the order named, in which order the figures of the drawings are to be read. The devices of each of these rows are each composed of a group of electric lamps D arranged in suitable light boxes and having circuits adapting them to be energized in various combinations to illustrate any letter of the alphabet, or any numeral or figure character, as is at the present time well known and well understood in the art. I

have chosen to show in each of the devices D only nine electric lamps of a given color, showing specifically nine white lamps designated by white circles, and nine red lamps designated by blackened circles. Any desired number, and any desired arrangement of such number may be provided in each device. So also sets of lamps of other colors besides the white and red disclosed may be used if desired. In each device all of the white lamps *w* have one terminal connected to common conductors 10, while all the red lamps *r* have all of their corresponding terminals connected to common conductors 11. The opposite terminals of each pair of elements *r*, *w* (which by the way are located in the same cell or box) are connected to a trunk wire 12, and the trunk wires of all the pairs *r*, *w* of a given device D are multipled to the contacts 13 of a plurality of relays A, B, etc.

There are provided as many of the relays A, B, etc., as there are letters in the alphabet, and numeral and other characters which it is desired to display in connection with any device D. There will thus be associated with trunks 12 of each device D approximately forty of these relays A, B, etc., counting twenty-six letters in the alphabet, ten numerals and four punctuation marks or other figure characters.

The contacts 13 of relays A, B, etc., are normally open, and when the relays A, B, etc., are energized only those contacts 13 associated with any relay which connect with those trunks 12 adapted to display the letter by which the relay is designated, are closed. The remainder are either dispensed with or corresponding trunks 12 are disconnected. As illustrated, the contacts have been dispensed with, and only those of trunks 12 adapted to display the character by which the relay is designated are connected with the contacts thereof. These relays are energized by operation upon the keyboard or primary controlling element.

This keyboard is designated KB. It comprises a plurality of keys K arranged as usual. Each key closes two contacts 14 and 15. The upper contact 14 controls the operation of a spacing switch SP, while the lower one 15 controls commonly in each case all the individual relays of the sets A, B, etc., which are designated by the same letter. Thus one key A will control the relays A of all the devices D, while the key B will similarly control the circuit of all of the relays B. In addition to keys K there is provided a spacing key *sk* which operates the spacing switch SP independent of the character keys K. The spacing switch is of the step-by-step type, having an actuating magnet *ac* and a plurality of contacts *co* through each of which is controlled all of the relays A, B, etc., belonging to a given device display D. Thus, speaking in geometrical terms, the control of switch SP is at right angles to the control of the keyboard KB, relays 22 being located in the intersections of the crossed control lines, and as a result of their conjunctive operation that one of the relays of any set which is at the point of intersection of the lines of control, is the relay energized.

Operating in multiple with the keyboard KB is the perforated control sheet SH which exercises its control not directly by brushes *br* but indirectly through relays *re*, but two of each are shown on Fig. 1, it being understood that there is one for each key.

Between rows I and II of the display devices D is a set of transfer relays TR, the function of which is to transfer from each lower line to the next upper line, the subject matter displayed on the lower line. By this means the similation of actual typewriting is obtained, the writing advancing from the lowermost line to the uppermost, as in moving the sheet for line spacing in an ordinary typewriting machine.

Reverting now to the common terminals 10 and 11 of the red and white lamps of each device D, there is provided (Fig. 2) a set of individual control relays IN^I, one *id* for each pair of the common terminals 10 and 11 of each device D. In the same group IN^I is provided for each device D a relay *un* controlling the circuit 16 of a group of underscoring elements UN.

Associated with individual relays IN^I is a group of control relays CR^I governed by a group of control keys CK bearing various designations indicative of their peculiar character. The function of these relays and control keys is to determine the particular character of the display in letters or groups of letters singled out by the relays IN^I.

It will be understood of course that the relays IN^I are duplicated in the second row II of devices D, and likewise duplicated for the third set III of Fig. 3. Certain of the control relays CR will be duplicated, as hereinafter shown, but on the other hand certain of them will not be duplicated.

The operation is as follows: The operator we will assume has before him a number of little cards upon each of which there has been typewritten (or handwritten) an advertisement or other subject matter of display. Preferably this is arranged on the card as to line and spacing in precisely the way it is desired to have it displayed, underscoring, change of color, flashing, etc., being appropriately marked. The operator sits down at the keyboard and operates upon it in the same manner in which he would operate the keyboard of a typewriter in copying the advertisements before him. They are displayed precisely in accordance with this operation. Or, having a number of adver-

tising forms in code form upon the perforated sheet SH, a feed motor for the sheet (this is not shown but may be any of the well known sheet feeders) is started and there follows display precisely in accordance with the code upon the sheet. At the marginal portions of the sheet are shown graduations, indicative of musical time, and by placing the perforations with respect to these graduations (this may be done in a suitable machine) the words and syllables may be displayed in any desired musical time. This is shown in detail in Figs. 6 and 7, illustrating the placement upon the sheet in musical time as respects the graduations on the side thereof of "Way down upon the Suwanee river, far, far away." The words "way" and "down" have already been displayed as indicated in Fig. 7 and the next syllable "U" of the word "U-pon" is about to be displayed. Assuming that that portion of the sheet designated time of one bar is to pass brushes *br* in the usual time of one bar of music, with reference to the division into quarters and eighths it will readily be seen that the syllables are arranged to follow each other in the order of musical time. The letters of the syllables of course appear successively, but in so short an interval of time as compared with the duration of the interval between syllables (representing the length of the note dwelt upon) that the effect is precisely as if the words were pronounced as in song. Obviously the range of the system of my invention as an advertising device is unlimited. Advertisements may be changed from day to day, and indeed from hour to hour, without the slightest degree of inconvenience. In fact features of the business with such a system would be immediate and prompt display and change as and when desired. Obviously, an expert operator could operate the system without the use of form cards, and a person of advertising skill can operate the machine as he thinks of the subject in hand, and need be furnished only with the subject-matter.

The announcement of the time may be made at frequent intervals, and always constitutes an attractive feature.

When any key K of device KB is pressed, through contact 14 it closes from common conductor 17, which is connected to ground, the circuit 18 of actuating magnet *ac* of the spacing switch SP. This steps spacing switch SP one step forward, thus closing by contact *co* from battery through arm 19 of the circuit 20 of the relays A, B, etc., of that device D which is next to be operated to display the next letter. Switch SP is provided with an indicating pointer *po* moving over a scale *sc* and indicating the particular device D of any row I, II, III, being operated. Just after the closure of circuit 18, any key closes through contacts 15 from conductor 17, that one of the circuits 21 extending to the relays of the sets designated in common by the same letter which designates the key K which is closed. Positive battery is placed on conductors 20, while negative battery is placed on conductors 21. Hence that relay A, B, or the like designated by the particular key K which is pressed, and belonging to the particular device D picked out by the spacing switch SP, is energized. Upon energization it closes the circuits of the trunks 12 to which it is connected, thus displaying the character designated by the key pressed, and in addition locks itself up. This locking circuit for each relay comprises a winding 22, a negative battery connection 23 common to all the relays, a contact 24 individual to the relay, a positive battery connection 25^{I} or the like common to all the contacts 24 of a given display row. The battery connection 25^{I} extends to a group of transfer relays TR and is controlled by them in such a manner that the locking circuits remain closed until any completed line of display has been transferred to the next line above. Thus each character as it is displayed, remains displayed on a given line, until transferred. One by one, as quick as a flash, and as quick as the keys K can be operated, the characters are displayed, divided properly into words by the pressure of the spacing key *sk* (which steps switch SP past any given device D) and properly punctuated by the pressure of those of the keys K designated by the punctuation marks. The operation from record sheet SH is precisely the same as that described, the relays *re* being energized over circuits 26 from brushes *br* which make contact with a metallic cylinder 27, and the relays *re* in turn controlling contacts 14′, 15′ of the same order as the contacts 14, 15 of the keyboard KB.

The initial energizing circuit for the relays is from positive battery by way of arm 19 of switch SP, conductor 20, permanent winding of the relay, conductor 21, key K, ground, and to negative battery. The complete circuit for the relay when locked up is from positive battery by dotted line conductor to contact 41 of relay L^{I}, conductor 25^{I}, contact 24, winding 22, conductor 23 and ground to battery.

Upon approaching the end of a line, battery is placed upon the bell magnet 28 through arm 19 of switch SP and contact 29, and the bell 30 sounds, giving the operator warning that the end of the line is reached. Almost coextensive with contacts *co* of switch SP, is contact segment 30′ having a connection through conductor 31 with contact 32 of relay 34. This relay 34 is controlled by transfer key TK, and this key is pressed whenever the end of the display on any line is reached, and it is desired to trans-

fer to the next. Relay 34 when pulled up by the pressure of key TK locks up through contact 32, circuit 31, segment 30′ and arm 19 to battery. It therefore maintains closed contact 33 which applied ground from conductor 17 through a continuously rotating commutator CO to the actuating magnet *ac* of switch SP. Thereby switch SP steps over the contacts which remain between arm 19 and the end of the row of contacts *co*, at which point arm 19 leaves segment 30′, thus unlocking relay 34 and bringing switch SP to rest with the opposite end of arm 19 on the first contact *co* of its bank. This type of switch SP having a double ended switch arm 19 is well known in the arts, particularly in the art of telephony. Spacing switch SP is therefore ready to space the display upon a new line. This new line as respects the rows I, II, III, is the same line upon which the display has been previously made, the display upon line I when the key TK is pressed being automatically transferred to the display devices D of line II. This transfer is accomplished through the transfer relays TR.

The transfer relays TR control the battery connections of the transfer and locking circuits of the character relays A, B, etc., of the respective rows I, II, III. Each character relay A, B, etc., is provided, as heretofore stated, with a locking circuit including locking contact 24. These locking contacts are connected commonly to conductor 25^{I}, and transfer relays TR control the battery connection of this conductor. Commonly connected to conductor 35^{I}, the connection of which to battery is also controlled by transfer relays TR, is a transfer contact 36 on each relay A, B, etc., controlling in each case a transfer circuit 37 extending to the main energizing winding of relays A, B, etc., of the next row above, as clearly traceable in Figs. 1, 2 and 3. The transfer contacts are numbered 36 throughout the drawings, in connection with other groups of relays as well as the groups A, B, etc. The transfer relays TR function to apply battery to common conductor 35^{I}, whereby character relays in the second row II corresponding to those in the first row I are energized and locked up through there locking windings 22, and upon this energization to break the battery connection of the locking conductor 25 of row or line I. This they do in the following manner:

The set TR comprises three main relays R^{I}, R^{II}, and R^{III}, corresponding to the three rows I, II and III, and are respectively energized whenever the character relays of the corresponding row are energized. Preferably they have substantially the same time constants or periods of energization and de-energization, so that their action is indicative of the action of the corresponding sets of relays A, B, etc. Additionally, the set TR includes three relays L^{I}, L^{II}, and L^{III}, the function of which is the control of the locking circuits 25, and two transfer relays T^{II} and T^{III}, the function of which is to control the battery connection of the transfer conductors 35 extending in the one case from the character relays of row I to those of row II, and in the other case, from those in row II to those in row III. The control of the locking and transfer circuits 25 and 35 of a greater number of rows is had by simply adding other groups R, L and T to the set TR, as will readily appear.

When spacing switch SP steps to the first contact of its bank, it puts battery through contact 38 to conductor 39, resulting in the energization of relay R^{I}. Arm 19 of switch SP soon leaves contact 38, but relay R^{I} locks up by its contact 40 to locking circuit 25^{I} of the character relays of row I, the connection of which locking circuit to battery is controlled by normally closed contact 41 on locking relay L^{I}. Relay R^{I} closes by contact 42 corresponding to contact 36 of the character relays A, B, etc., the connection of transfer circuit 43 of relay R^{II} to the common transfer circuit conductor 35^{I}. This circuit may be connected to battery by conductor 45, normally closed contact 46 of relay L^{II}, conductor 47 and normally open contact 48 of relay T^{II}, by energizing relay T^{II}, but until relay T^{II} is energized, no such transfer can take place.

However, when display on row I is completed and key TK is pressed, as aforesaid, in addition to the closure of locking relay 34 of switch SP, there is closed circuit 49 extending, in case relay R^{II} is not energized (as it is not when only the first row I has been used in display) by way of contact 50 of relay R^{II} and conductor 51 to relay L^{II} which is thereby momentarily energized. Relay L^{II} closes by contact 52 the circuit 53 of transfer relay T^{II}, which upon energization locks up by its contact 54, conductor 55 and normally closed back contact 56 of locking relay L^{I}. Thus transfer relay T^{II} closes at contact 48 the circuit 48, 47, 46, 45, 42, 43 of relay R^{II} of the second row II of display devices D, thereby putting battery through conductor 45 upon the common transfer conductor 35^{I} connected with the transfer contacts 36 of character relays A, B. Thereupon relays A, B, of row II corresponding to those energized in row I become energized over conductors 37, and are locked up by locking windings 22 as aforesaid, and in all respects similarly to the locking of relays A, B, etc., of row I. This occurs simultaneously with the pulling up of the relay R^{II} of the transfer set TR. Pulling up of R^{II} is therefore indicative of the action of relays A, B, etc., in pulling up and if desired the time

of pulling up of relay R^{II} (or R^{III}, etc.) can be made in any one of several ways, well known to the relay art, such as dash pots, etc., just a little greater than the time required by the slowest of the relays A, B, etc., so that all of them will have been pulled up and locked up by the time relay R^{II} pulls up and locks up.

Relay R^{II} locks up by contact 57, conductor 58 connecting with conductor 25^{II}, and normally closed back contact 59 of locking relay L^{II} to battery. At the same time relay R^{II} closes by front contact 60 the circuit 61 of relay L^{I}, which circuit extends through the now closed front contact 62 of transfer relay T^{II}, which as aforesaid, is now locked up through back contact 56 of relay L^{I}. When relay L^{I} pulls up over circuit 61, however, the locking circuit 54, 55, 56 of relay T^{II} is broken at contact 56 and relay T^{II} falls back. At the same time relay L^{I} opens the connection of locking circuit 25^{I} to battery at contact 41, and all the character relays A, B, etc., of row I are unlocked and fall back, opening all circuits of devices D of row I. Relay L^{I} locks up momentarily by contact 63, conductor 64, and the then closed contact 65 of relay R^{I} indicative of the condition of the character relays of row I. But the moment that locking circuit 25^{I} is broken at contact 41, relay R^{I} falls back with the character relays, and thereby unlocks relay L^{I}, restoring the battery connection of locking circuit 25^{I} after relays A, B, etc., have fallen back, and their locking circuits are open at their contacts 24. Preferably the period of falling back of relay R^{I} (and relays R^{II} and R^{III} as well) is made in any one of the several ways well known in the relay art, such as copper sheathed cores, etc. equal to or greater than the period of falling back of the slowest of the character relays.

In this manner is the display of the lower row I transferred to the next upper row II in precisely the same form which it had on row I. Thus if the display be for instance "The Underwood typewriting machine", the same display now appears in line II, whereas the display of line I has been extinguished.

The same is true irrespective of the subject matter of the display.

Now, assuming that line II has been used, and line I again in addition, the writing, so to speak, having been carried on continuously, at the time the end of line I is again reached key TK is again pressed, with the same result as respects the spacing switch SP, relay R^{I} having been again energized at the beginning of the new line. Not so however, with respect to the transfer relays TR. Contact 50 of relay R^{II} is at this time closed upon conductor 66 from which relay L^{III} is energized instead of relay L^{II}, as was formerly the case (L^{II} being energized over conductor 51 alternate to conductor 66). Relay L^{III} pulls up momentarily (locking circuit 67 closed by contact 68 being opened at contact 69 of relay R^{III}) but long enough to close by contact 70 the circuit 71 of transfer relay T^{III}. This relay pulling up locks to battery by contact 72, conductor 73, and back contact 74 of relay L^{II}, and at the same time by contact 75 places battery by way of conductor 76, and back contact 77 of relay L^{III} upon transfer conductor 35^{II} of the character relays A, B, etc., of row II. The circuit of relay R^{III} indicative of the condition of the character relays A, B, etc., of row III (Fig. 3) has been connected to this conductor 35^{II} by front contact 78 of relay R^{II} and relay R^{III} therefore pulls up simultaneously with those relays A, B, etc., of row III (Fig. 3) which correspond to those of row II which are already pulled up. Thus the display originally of row I, and then of row II, is now shifted to the upper row III. As relay R^{III} pulls up it closes by its contact 79 the circuit 80 of relay L^{II} by way of the now closed front contact 81 of transfer relay T^{III}. Relay L^{II} pulls up and breaks the locking circuit 25^{II} of the relays A, B, etc., of row II at contact 59, also breaking the locking circuit 72, 73, 74 of relay T^{III}, which now falls back, and locks itself to battery by contact 82, conductor 83, and now closed front contact 84 of relay R^{II}. This latter contact, however, is almost immediately broken, whereupon relay L^{II} is again deënergized. In its operation, however, relay L^{II} has closed the circuit 52, 53 of transfer relay T^{II}, which as in case of the original transfer from row I to row II, again puts battery by contact 48, 47, 46 and 45 upon the common transfer conductor 35^{I}, which results in the immediate transfer of the display then upon line I to line II, whereupon the relays A, B, etc., of line I all fall back, leaving line I blank as before. But now the two lines of display which have been written are displayed at the top of the board, on lines numbered III and II respectively, and line I is ready again to be written upon. Obviously this may be carried on *ad infinitum*, use being made of as many lines upon the single display board as are desired, the display writing proceeding in all substantial respects precisely as the writing upon an ordinary letter sheet in a visible typewriter, with the single exception, that there is no lateral movement thereof corresponding to the lateral travel of the typewriter carriage.

Assuming all three lines of the three-line apparatus illustrated to have been written upon, the uppermost line is extinguished upon each succeeding operation of the transfer key TK, whereby the next lower line may be accommodated when the transfer takes place. The locking circuit 25^{III} to

which relay R^{III} is locked by contact 85 is opened by relay L^{III} at back contact 86. In case there are provided more lines than three, and a greater number of relay groups in the set TR, obviously there should be provided in each relay R of the order following the relay R^{II} contacts corresponding to contacts 50 and 84, contacts corresponding to 50 being arranged to close either the circuit of the relay L corresponding, or the one succeeding, depending upon whether the relay R to which it belongs is energized or not. Thus conductor 49 enters set TR at relay R^{II}, but in case of a set TR made up of say ten groups of relays R^{II}, L^{II}, T^{II}, etc., in case all ten corresponding rows of the display board were written upon, when key TK was pressed, relay L^{x} of the tenth row would be first energized, the circuit of 49 having been extended by the conductors similar to 66 and contacts similar to 50, all the way back to the tenth group R^{x}, L^{x}, T^{x}.

In order that the contacts of the preferably small powered character relays may not be deteriorated by breaking current at the rather high lighting voltage which is preferably employed in illuminated display systems of this character, the lighting power circuits 87 (Fig. 1) are preferably separated from the battery circuits from which the relays are controlled, and whenever transfer key TK is pressed, to effect a transfer, it closes also the circuit 88 of the actuating magnet 89 of contactor 90, the circuit controlling blades 91 and 92 of which are normally closed, applying current from the generator 93 or other source over circuit 94 to conductor 87. The power circuit is therefore broken immediately the transfer key is pressed, and when the relays A, B, etc., of the successive rows fall back, they open the circuits at zero potential and there is no arcing at the terminals. Blades 91, 92 in the contactor 90 are made quite heavy to take care of the large total current, and may be provided with any of the so well known forms of magnetic blow-out, if desired. Contactor 90 locks up to battery by contact 95, conductor 96, connecting with the locking circuit 25^{I} of the first row I. The power current is therefore not again applied to the conductors 87 until relays A, B, etc., of all the rows have successively fallen back, and the transfer of the display is complete. The time of this transfer takes only a fraction of a second, despite what appears to be the large number of circuits entering into the control exercised by the transfer set TR. Relays of this type operate with extreme rapidity, and the transfer will have been made almost before the glow of the incandescent lamps of the display has subsided, thus giving the impression to the eye of a bodily movement of the entire display board upwardly, as if it consisted of an endless scroll studded with electric lights and showing in part through an aperture of the dimensions of the display board.

When the perforated sheet SH is being used to display the codified advertisements or render songs, etc., it is of course understood that there is provided one of the brushes *br* which may actuate a relay 97 to actuate key TK at the proper intervals. Any ordinarily manually controlled devices or parts of the system, may be similarly controlled from the perforated sheet, certain of these devices being the color change and emphasizing relays, as will be hereinafter shown.

During the operation aforesaid, the conductors 10 and 11 connected with the opposite terminals of the lamps *w* and *r* from the trunk conductors 12, have been connected to the opposite terminal of the source of power through back contacts 98 and 99 respectively of relays *id*, connecting when the relays are deënergized with conductors 100 and 101, common to the relays *id*. Conductors 100, 101 are not connected directly to the source of power, but are connected therewith through contacts of the relays of the control group CR^{I}. Conductor 100 connects thereto by way of back contact 102 of relay 103, conductor 104, back contact 105 of relay 106, conductor 107, and back contact 108 of relay 109. The white lamps *w* of all of the devices D are therefore those normally in circuit, all of the common conductors 10 being normally connected to the conductor 100. Conductor 101 which connects with the common conductors 11 of the red lamps *r* is not normally connected to the source of power, its circuit extending by way of normally open contact 110 of relay 109 to the source of power. A branch connection with conductor 101 may also be made through normally open contact 111 of relay 106 to conductor 112 connected with a source of power through commutator interrupter Ir'. Through this system of connections, and those now to be described, are accomplished the extensive series of changes in color and time of illumination which are enumerated above. Normally, as the keys A, B, etc., are operated, the display takes place in fixed white, or other fixed color. By simply pressing keys YWS relay 103 is energized and locks up by contact 113, conductor 114 and normally closed release key RK. This opens contact 102 of conductor 101 and closes contact 115 which makes connection with interrupter Ir', which results in flashing the entire sign in white. This may be continued as long as desired, and upon pressure of key RK, the locking circuit 114 of 103 is open, 103 is unlocked, contact 115 opened, and contact 102 again closed, resulting in display in fixed white once more. By pressing key ARS the circuit of relay 109 is closed di-

rectly from battery to ground, opening contact 108 through which conductor 100 is connected by way of 102, 104, 105, 107 to the source of power by way of ground, and closing contact 110, thereby connecting conductor 101 of the red lamps r to the source of power by way of ground, whereupon the display appears in fixed red. Relay 109 locks up by front contact 116 and conductor 117 through normally closed release key RK, upon the pressure of which relay 109 may be released in the same manner as relay 103 and the display again transferred to fixed white. Upon the pressure of key YRS, however, the connection of conductor 100 of the white lamps w is broken at contact 105 and the circuit of 101 made at contact 111 through conductor 112 and commutator interrupter Ir', relay 106 locking up upon energization by contacts 118 and through the release key RK as before. Thus the entire display may be accomplished in flashing red or other color than white for as long a period as desired. Obviously by using additional sets of colored lamps in conjunction with those r, w, such for instance as green and blue lamps, and connecting them with special conductors of the order of conductors 100, 101, through additional contacts on individual relays *id*, and providing special keys and control relays in the group CR, similar to those just described, the quality of the display may be still further varied, any color whatever represented in the devices D being used for the display in fixed or flashing form.

For each character device D of each row of display devices there is provided an individual relay *id*, individually controlling the connection of the common conductors 10, 11, and the like to the source of power through the relays CR. These relays are normally deënergized, one terminal thereof being permanently connected to ground by way of conductor 119, but the other terminal being connected each to an individual contact in bank LB swept over by arm 120 on extension of the spindle s of the spacing switch SP of Fig. 1. On account of the diagrammatic showing of the system, it has not been practicable to show the bank LB in connection with the bank *co* of Fig. 1, but the identity is clearly indicated by the same reference letter designations. Normally arm 120 of switch SP is not connected to battery, but may be so connected at will by pressing key LTR (Fig. 2) which energizes relay 121, which relay locks up by contact 122, and normally closed release key RK′ to the locking conductor 25^{I} of the first row I of devices D. Through contact 123, and conductor 124, this relay connects arm 120 to the source of power. Thereafter each time switch SP spaces, one of the relays *id* is energized. Upon energization, each relay *id* locks up by contact 125 to common locking conductor 25^{I} of row I. This results in the transfer of the connection of common conductors 10 and 11 of devices D from power conductors 100 and 101 to power conductors 100^{a} and 101^{a}. Since this takes place individually for each display device D, obviously any single letter of the display may be individually connected irrespective of the remainder with conductors 100^{a} and 101^{a}. The connection of power conductor 100^{a} to the source is by way of normally open contact 125′ of relay 126 and conductor 139 to interrupter Ir'. The connection of the companion conductor 101^{a} is by way of normally closed contact 128 on relay 129, normally closed contact 130 on relay 131, and normally open contact 132 on relay 133, and conductor 134 to a second interrupter Ir^{2} similar to the first interrupter, but arranged as clearly indicated to interrupt the circuit of conductor 134 at a different angular point from the interrupter Ir'. Preferably both of these interrupters are mounted upon a common shaft and thereby driven at the same rotative speed with the result that the angular displacement at the time of circuit closure is preserved. By closing key YWL, the relay 126 is energized direct from battery at key YWL to ground, connecting power conductor 100^{a} to the source by the path just described, including contact 125′ and interrupter Ir', whereupon display of those devices D singled out and segregated through the energization of the individual relays *id* takes places in flashing white as distinguished from the fixed white or other quality of display which may at the time characterize the remainder of the sign. Relay 126 locks up by contact 135 and normally closed release key RK^{2}, upon the pressure of which this relay 126 is released through the opening of this locking circuit, and the display of that letter or letters heretofore made in flashing white is obliterated altogether, relays *id* remaining energized. Thereupon, upon the pressure of key YRL, relay 129 is energized and locks up by contact 136 and conductor 137 through key RK^{2}, the connection of conductor 101^{a} being completed to the source of power by front contact 138, and conductor 139, to commutator interrupter Ir'. The display of the selected group of devices now takes place in flashing red. Relay 129 being released by pressure of key RK^{2}, this display may be in turn obliterated, leaving a blank word space in the midst of an otherwise complete display. Key ARL may now be pressed, whereupon the connection of power conductor 101^{a} is completed by back contact 128 of relay 129, and front contact 140 of the now energized relay 131 and the adjacent ground connection to the source of power independently of the commutators. The selected letter, word, or group of words

of the display is now illuminated in fixed red. Relay 131 locks up by contact 141 and conductor 142, connecting with conductor 137 and key RK^2, by the pressure of which it may also be released. Finally, the key RWL may be pressed, energizing relay 133 over conductor 143 and relay 126 over conductor 144, the first named relay locking up by contact 145 and conductor 146 to key RK^2, as previously traced, and the second by contact 135, as previously traced. Power conductor 100^a is thereby connected to the source by front contact 125 of relay 126 and commutator Ir', while on the other hand power conductor 101^a is simultaneously connected to the source through back contact 128, back contact 130, now closed front contact 132 and conductor 134, the circuit of which is controlled from interrupter Ir^2. The selected letter or word is therefore now displayed in alternating red and white. Obviously the number of such quality variations of any selected letter, word, or group of words, is practically unlimited, it being only necessary to provide additional colored lamps and additional circuits and control relays therefor, as aforesaid, in connection with the display as a whole.

Now will be fully appreciated the great utility of this invention. Assuming that emphasis is to be given, or particular attention attracted to any given letter, word, or group of words, the operator has simply to press the key LTR before operating his key board KB to effect the display of characters, whereupon when the keyboard KB is operated, the particular devices D, upon which the letter, word, or group of words, are to be displayed, are segregated from the remainder of the display by the simultaneous energization of the individual relays *id*. If at the same time the operator has pressed the key LTR, he has pressed the key ARL, for instance, the selected letter, word, or group of words will be written in red as distinguished from the white of the remainder of the display, the words appearing letter by letter in red as they are written. If, on the other hand, he delays pressing key ARL or the like until the keyboard KB has been operated in the proper manner, and then presses this key, the selected letter, word, or group of words will appear suddenly as a complete whole in red, as distinguished not only from the white of the remainder of the display, but also from the letter by letter appearance of the remainder of the display. This operation I call one of "delayed" display and instead of fixed red, flashing white, flashing red, or alternating white and red, may all be had at will by simply pressing the proper key either just after operating key LTR, or just after operating the keyboard KB. The display may then be continued in the normal manner, by simply pressing key RK′ (thereby opening the locking circuit of 121, heretofore closed through its contact 122), and proceeding with the writing on keyboard KB as usual. The continuation of the display is in the normal or other chosen quality of the sign as a whole. Relays *id* of course remain locked up, thus continuing to emphasize or attract special attention to the chosen letter, word, or group of words. If it is desired to discontinue such emphasis, the operator has only to release key RK^2 (thereby unlocking the controlling relay 126, 129, 131, or 133, as the case may be), whereupon the letter, word, or group of words will be obliterated entirely, or he may press release key RK^3 in that branch of the locking conductor 25^1 extending to relays *id*, whereupon the relays fall back, and the selected letter, word, or group of words partakes of the quality of the whole, whereupon another group of characters in the same row may be emphasized in a similar manner. During this time of special emphasis of any group of characters, the quality of the display as a whole may be freely changed with reference thereto from the fixed white to flashing white, fixed red to flashing red, or if desired, alternating red and white, and so on.

The advertising value of such an arrangement can hardly be overestimated. It is possible to display the first letter of each sentence, or indeed each word, in a special color. It is possible to omit certain words altogether until the remainder of the display has been completed, and thereupon suddenly display them in a special color. It is possible further, by simply retaining control relay 121 of the group relays *id* continuously energized, energizing it by pressure of key LTR and maintaining its locking circuit through RK′ closed as described heretofore, to delay the display of a whole line, and then suddenly flash the whole line, or indeed a whole group of lines by simply releasing the locked up relays *id* of the sign as a whole by pressing release key RK^3. On the other hand the same may be accomplished by pressing one of the keys of the group beginning with YWL, the relays *id* remaining energized. Riddles may be set up, blanks being left to be filled in by the observing public, and after a few moments the correct answer suddenly flashed out in a characteristic color. Two or more groups of characters may be so emphasized in the same line, there being no confusion of the operation on this account, it being simply necessary to press key LTR at the beginning and release key RK′ at the end of the writing of each chosen group upon the keyboard KB.

Going still further, my invention includes an essentially similar system of connections

for emphasizing by means of underscoring. The relays *un* which control the connection of conductors 16 to the power conductor 100, like the relays *id* may be individually energized to segregate any group of underscoring elements UN. One terminal of relays *un* is connected normally through the ground connection indicated on the left to battery, while the other terminal of each relay is connected with an individual contact in a bank UB of switch SP. Arm 148 sweeping over these contacts may, like arm 120, be connected to the source of power by conductor 149 closed to the source through normally open contact 150 of relay 151, the circuit of which is controlled by key UND. Relay 151 locks up by contact 152, key RK^4 and conductor 153 to locking conductor 25^I of row I. Upon the pressure of key UND, relay 151 pulls up, and the groups of underscoring elements UN are thereupon illuminated as the characters are displayed for as long a period as desired, common conductor 16 being individually connected by relays *un* with power conductor 100, connected with the source of power. The switch arms 19, 120, and 148, of switch SP are connected to a common spindle and are therefore stepped in synchronism, and each at all times connects with corresponding contacts.

Inasmuch as the switch SP steps slightly in advance of the energization of the character relays A, B, etc., any selected individual or underscoring relay *id* or *un* is energized before power is applied to trunk conductors 12, whereupon breaking of the power current at the relay contacts is prevented. The relays of the group CR^I or the like controlling the power circuits may of course themselves be of substantial size, taking the form, if necessary, of contactors, commonly known in the railway and other arts, or on the other hand these relays may themselves control the power circuits through contactors, the energization of which they control. This is a well known expedient.

So much for the display upon a single line as the system is organized in the present embodiment. The manner of the transfer of the display from one line to another has already been described as respects the devices D. Not only does this transfer take place in identity of character, but also in identity of quality, transfer contacts 36 being provided on each of the relays *un* and *id*, and on each of the relays of the group CR, controlling over transfer conductors 37, as in case of the character relays, the circuits of corresponding relays of the groups IN^{II} and CR^{II} of the second row II. Moreover, as inspection will show, the relays of the groups IN^I and CR^I and the like containing the transfer contacts 36 are each locked up to the same common locking conductor 25^I of the character relays of the first row. The corresponding relays of groups IN^{II} and CR^{II} of the second row II (see Fig. 3) lock up to common conductor 25^{II}, whereby a complete duplication of the accomplished energization in groups IN^I and CR^I of row I takes place in the corresponding groups of row II at the same time the duplication of the character display takes place. Referring further to Fig. 3, it will be seen that transfer contacts 36 are also provided on these relays, controlling transfer conductors 37 extending to the relays of groups IN and CR of row III (these latter two groups being not shown, being in all respects similar to the groups shown for row II in Fig. 3). These transfer contacts 36 are connected to common conductor 35^{II}, the same to which the transfer contacts 36 of the character relays of row II are connected. These transfer circuits have already been fully explained as between Figs. 1 and 2 and selecting devices D, but for clearness sake one may be traced from common transfer conductor 35^{II} having its origin in the transfer group TR through normally open contact 36 of relay 133 for instance, conductor 37, and to corresponding relay 133 of group CR^{III} (not shown, but like CR^{II}), Fig. 3, thereby energizing this relay and continuing the determined quality in the third line of the display. The same arrangement is continued throughout the provided number of rows. Thereby the display is transferred from line to line in precisely the same form in which it occurred originally, and the emphasis or other special characterization of any chosen groups may be retained throughout the display from line to line.

This system meets fully every requirement as an announcer for news bulletins. It further meets every requirement for an announcer of the time of day. Both of these uses may be interpolated during the period the system is being used for advertising purposes, thus greatly enhancing the utility as an advertising device. With a special news wire, and the time before him, an operator cannot lack at any time material with which to attract and hold the attention of the observing public.

My invention is capable of many modifications without departing in any wise from its generic spirit.

In the accompanying Fig. 4 I show one such modification. According to this modification, instead of transferring the display from one line to another, the display may be commenced at the top line of a plurality of lines and continued to the bottom, and thereupon the entire display wiped out and a new display commenced. This of course follows naturally from the preceding system, since any row of display devices might be split up into a plurality of rows. Ac-

cording to the modification, however, more than one spacing switch is used, such as SP′, SP², etc. They are all actuated by the same stepping magnet *ac*, but battery is connected with only one of them at a time. This battery connection is controlled by a distributing switch DS having an actuating magnet *ds* which is energized once each time arm 19′ of switch SP′ sweeps over its bank, its circuit being completed by way of contact 170. By its contact No. 1, switch DS puts battery on spacing switch SP′, by contact No. 2 on SP″, etc., there being provided as many switches SP as there are rows of display devices. The contacts *co′* of switch SP′ control circuits 20′ of the character relays A, B, etc., of the first row, while contacts *co″* of switch SP² control the circuits 20″ of the second row of character selecting relays A, B, etc. The circuits 21 from the control keys KB are multipled as shown at 21″ to the character relays A, B, etc., of the other rows. This effects a saving in apparatus.

Referring to Fig. 2 it is to be noted that when any one of the keys ARL, YRL or YWL is pressed, the relay 121 is energized over conductor 121′. Thereby the key LTR does not have to be pressed, when it is desired to immediately display a given group of characters in an emphasizing quality.

The power conductors 100 and 101, normally in circuit with the lamps *r*, *w* of devices D, are extended as clearly indicated throughout the several rows of display devices D, whereby one set of relays 103, 106 and 109 suffices to control all those devices not segregated for individual emphasis by the relays *id*.

By connecting conductors 16 through contacts of relays *un* to conductors of the like of 101ª and 100ª, it is obviously possible to change the quality of the underscoring in the same manner as the quality of the characters segregated by relay *id* is changed. As at present connected, the quality will be changed synchronously with the change in quality of the characters of devices D connected with conductor 100.

It will be observed in connection with Figs. 2 and 3, that there are provided in Fig. 3 a set of relays 129″, 131″, 133″ and 126″, having functions as respects conductors 100ª and 101ª entirely similar to the functions of relays 129, 131, 133, and 126 of Fig. 2. This second group of relays controls the quality of the segregated characters of row II, and is designated CR^{II}. The relays of this group are controlled over transfer circuits 37 closed by contacts 36 on the corresponding relays of the group CR^{I}, and the circuits are readily traceable.

The operation of contactor 90 may be at any time controlled independently of transfer key TK, by circuit closing key K′, and circuit opening key K^2 in the locking circuit 96.

The control of relay 90 is effected somewhat differently in the modification of Fig. 4, a special transfer key TK^2 being provided. This key consists of three contacts, the one 160 through which the circuit 88 of contactor 90 is adapted to be closed, and which is a make-before-break contact as respects contact 161 which retains normally closed the locking circuit 25 of character relays A, B, etc., and the third of which 162 is adapted to close the circuit of the new-line relay 34 of switch SP^1. Thus when key TK^2 is pressed, relay 90 is energized, breaking the power circuit at contacts 91 and 92 and immediately afterward, the circuit 25 is broken at 161 thereby unlocking the relays A, B, etc., with the same advantage as set forth in connection with the description of contactor 90 of Fig. 1. Simultaneously with the opening of circuit 25, relay 34 has its circuit closed and steps switch SP^1 to the beginning of a new line.

It is to be observed that segment 30 and switch arm 19′ function in the same manner to commence a new line irrespective of the particular bank of contacts *co′*, *co″*, etc., which may be at the time energized in connection with the corresponding lines.

With this understanding of the system of my invention, it will be apparent that this system but carries out the several methods of selective character display set forth in the annexed claims. Inasmuch as these claims are most plainly interpretable from the foregoing description of the operation of the system, and inasmuch as the system has been described with a view to setting forth the various steps of these methods of my invention, description thereof to a further extent is deemed unnecessary. It need only be said that my invention includes the methods herein disclosed as well as the system as a whole and the individual apparatuses of which it is composed.

I claim—

1. The method of selectively operating electric display boards which comprises selectively determining the characters to be displayed, operatively segregating individually from the remainder those characters it is desired to emphasize, and separately determining the quality of the display thereof independently of the determination of the quality of the remainder.

2. The method of selectively operating electric display boards which comprises selectively determining one by one the characters to be displayed, as they are selected, individually segregating operatively from the remainder those characters which it is desired to emphasize, and separately determining the quality of the display thereof inde-

pendently of the determination of the quality of the remainder.

3. The method of character display from a number of consecutively arranged display positions which consists in selectively determining the characters to be displayed always in the same position, and thereafter progressively transferring the selected display from position to position in the order of succession of the same and producing new displays in the preceding positions.

4. The method of selective character display from a plurality of lines of display arranged in vertical succession which method consists in selectively determining the characters to be displayed always upon the bottommost line, and progressively transferring said display from line to line in order of vertical succession of the lines.

5. The method of selective character display from a plurality of display positions, which consists in initially selectively determining the characters to be displayed always in the same position, as they are selected, segregating from the remainder those characters it is desired to emphasize, determining the quality of display thereof independently of determination of quality of the remainder thereof, and thereafter progressively transferring the display from position to position in the order of succession thereof, and in the same quality as initially determined.

6. In a selective character display system in combination, a plurality of character display devices, a set of character determining switches associated with each of the said devices primarily to determine the character displayed, a character keyboard having a key for each character and a spacing means, jointly controlling the said character switches.

7. In a selective character display system, in combination, a plurality of character display devices, a set comprising a plurality of character determining switches one for each character to be displayed permanently associated with each display device primarily to determine the character displayed, a character keyboard each character key of which controls commonly all like character switches of the sets, and a step by step spacing switch also controlled from said keyboard and selectively controlling each set of character switches and coöperating with said keyboard to progressively space the selected characters.

8. In a selective character display system, a line of changeable character display devices, a group of selective switching means connected therewith to determine the characters displayed, means for operating the same, a second line of character display devices, a group of selective character determining switches therefor, transfer connections between said groups of selective switching means established by the first named switching means, and control means for said connections to effect transfer of the display from the first line of devices to the second.

9. In a character display system a plurality of groups of changeable character display devices, character selective means connected with the devices of one group to determine the display thereof, and switching means intermediate the devices of the one group and the devices of another interconnecting the two switching means arranged to effect a transfer of the selected display upon the one group to the other.

10. In a character display system, a plurality of changeable character display devices, selective switching means to determine the display thereon, and a traveling body having code control formations arranged in order of musical time and connected with said selective switching means to control the same through its control formations, together with a character key board, also connected with said selective switching means to control the same and having a key for each character.

11. In a character display system, a plurality of changeable character display devices, a source of power, selective switching means to determine the character of the display, and an individually operable segregating switch controlling the connection of each device with said source of power independently of the selective switching means.

12. The method of operating a selective character display system, which method consists in selectively determining the characters to be displayed one by one but in groups according to syllables and separated by intervals related to each other in musical time, whereby the air of a displayed composition is suggested to and supplied by the mind of the observer.

13. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the display thereon, two independently operable sets of controlling means through which said display devices may be connected with a source of power, and switching means individual to each display device arranged to switch the power connection of the device from one of said sets of control means to the other.

14. In a system of the character described a plurality of changeable display devices, switching means connected therewith for controlling the character of the display thereon, means to vary the quality of the display independently of the character thereof, ad-

ditional switching means arranged to determine the quality of the remaining characters, and a traveling body bearing code control formations arranged to control in its travel both the said switching means, together with a character key board, also connected with said selective switching means to control the same and having a key for each character.

15. A character display system comprising a plurality of changeable display devices, each device including a plurality of independently energizable translating elements adapted to be energized in combinations to represent various characters and having individual and common terminals, selective switching means connected with individual terminals of said translating elements to determine the characters displayed, means to vary the quality of the display independently of the character thereof, and additional switching means connected with common terminals of the translating elements of each device to determine the quality of display.

16. The method of selectively operating electric display boards which comprises (1) selective, progressive, and individual determination of the characters to be displayed, (2) independently of the character selection operatively segregating individually from the remainder those characters which it is desired to emphasize, and (3) changing the quality of display thereof independently of the quality of the remainder of the display.

17. The method of selective character display from a plurality of lines of display arranged in a numerical series which method comprises primarily displaying the characters to be displayed always upon a given line, and progressively transferring said display bodily from line to line of the series in determinate successive order.

18. The method of operating a selective character display system comprising the selection and operation of the characters to be displayed in syllabic groups, and displaying the characters of each group substantially simultaneously, and separating the groups from each other according to musical time of the words of a musical composition display, whereby the air of a displayed composition is suggestive to and supplied by the mind of the observer.

19. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the display thereon, a plurality of differently characterized power transmission connections, and switching means individual to each display device arranged to switch said display device from one of said power connections to the other.

20. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the display thereon, a source of power, and switching means individual to each display device arranged to control the connection thereof with the source of power individually and independently of said character selective switching means and of the remainder of the display devices.

21. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the character display, an emphasis display means associated with each display device, and individually operable switching means individual to each device and arranged to control the energization of said emphasis display means.

22. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the character display, an emphasis display means associated with each display device, and individually operable switching means individual of each device and arranged to control the energization of said emphasis display means together with means to vary the quality of said emphasis display.

23. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the display thereon, and underscoring means associated with each of the aforesaid devices together with individual control means therefor.

24. In a selective character display system, a plurality of changeable display devices, an underscore display associated with each of said display devices and arranged together to form a continuous line, selective switching means to determine the character display on said first mentioned devices together with individual control means for said underscore display.

25. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the display thereon, separate and differently characterized connections to a source of power, individually controlled locking relays individual to the display devices arranged to connect the same alternately to said power connections together with commonly controlled locking circuits for said relays.

26. In a selective character display system, a plurality of changeable display devices, selective switching means to determine the display thereon, differently characterized power connections, a spacing means associated with said switching means, and individual switches controlling the connections of said display devices to said power con-

nections and themselves actuated through said spacing mechanism.

27. In a selective character display system, a plurality of changeable character display devices comprising a display board, a set of character determining switches associated with each of the said devices individually to determine the characters displayed on said board, a character key board common to all of said sets of switches and having its individual keys controlling commonly respectively determining switches of like character, and a spacing means having successive switching positions in which it controls successively each set of character determining switches as a whole.

28. In a selective character display system in combination, a plurality of character display devices arranged in a plurality of lines, a set of character determining switches associated with each of said devices to determine the character displayed and arranged in groups according to the lines to which they pertain, a character key board arranged to control the character determining switches of one line only, together with display transfer connections between the character determining switches of the respective lines.

29. In a selective character display system in combination, a plurality of character display devices arranged in a plurality of lines, a set of character determining switches associated with each of said devices to determine the character displayed and arranged in groups according to the lines to which they pertain, a character keyboard arranged to control the character determining switches of one line only, together with display transfer connections between the character determining switches of the respective lines, a step by step spacing device normally operable one step at a time, over a determinate range, together with additional means to step said switch continually from an intermediate point of said range to one terminus thereof.

30. In a selective character display system in combination, a plurality of character display devices, a set of character determining switches associated with each of the said devices to determine the character displayed, a character key board having a key for each character, and a spacing means jointly controlling the said character switches, said spacing means normally operable one step at a time, together with additional operating devices for said spacing means arranged to carry it without stop throughout its range of steps.

31. In a selective character display system, two groups of display devices, one group of primary control selective switching means, two groups of quality determining devices arranged respectively to determine the quality of the display upon the groups of display devices, transfer connections established upon the energization of the selective switching means and of a quality determining means to effect the transfer of electric display in the same quality from one group of display devices to the other, and a controller for the transfer circuits.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN P. TARBOX.

Witnesses:
N. CURTIS LAMMOND,
N. C. LOENTAL.