

Feb. 7, 1939.

M. L. HASELTON ET AL

2,146,576

ANNUNCIATOR

Filed Dec. 28, 1935

5 Sheets-Sheet 1

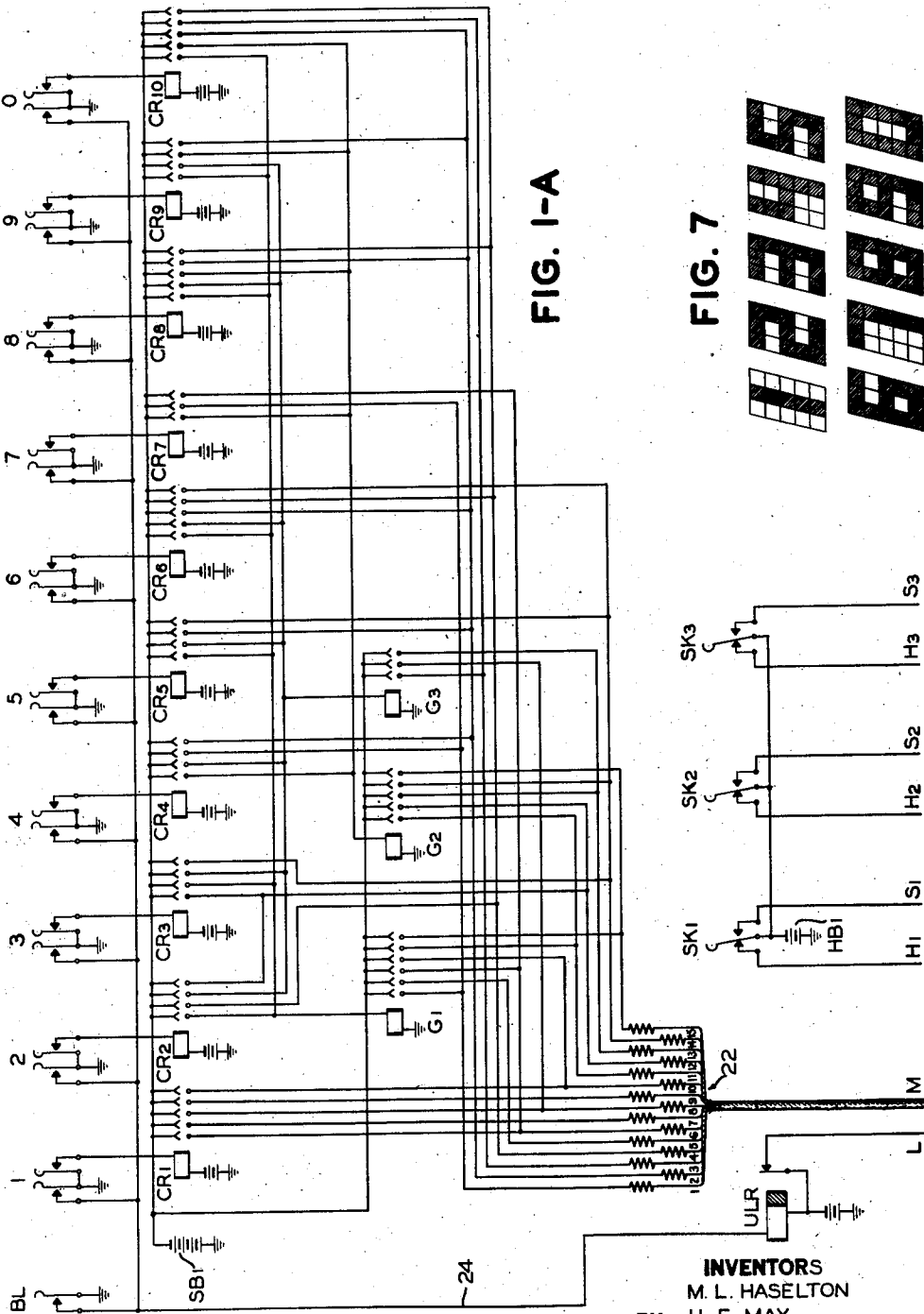


FIG. 1-A



FIG. 7

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5 Sheets-Sheet 2

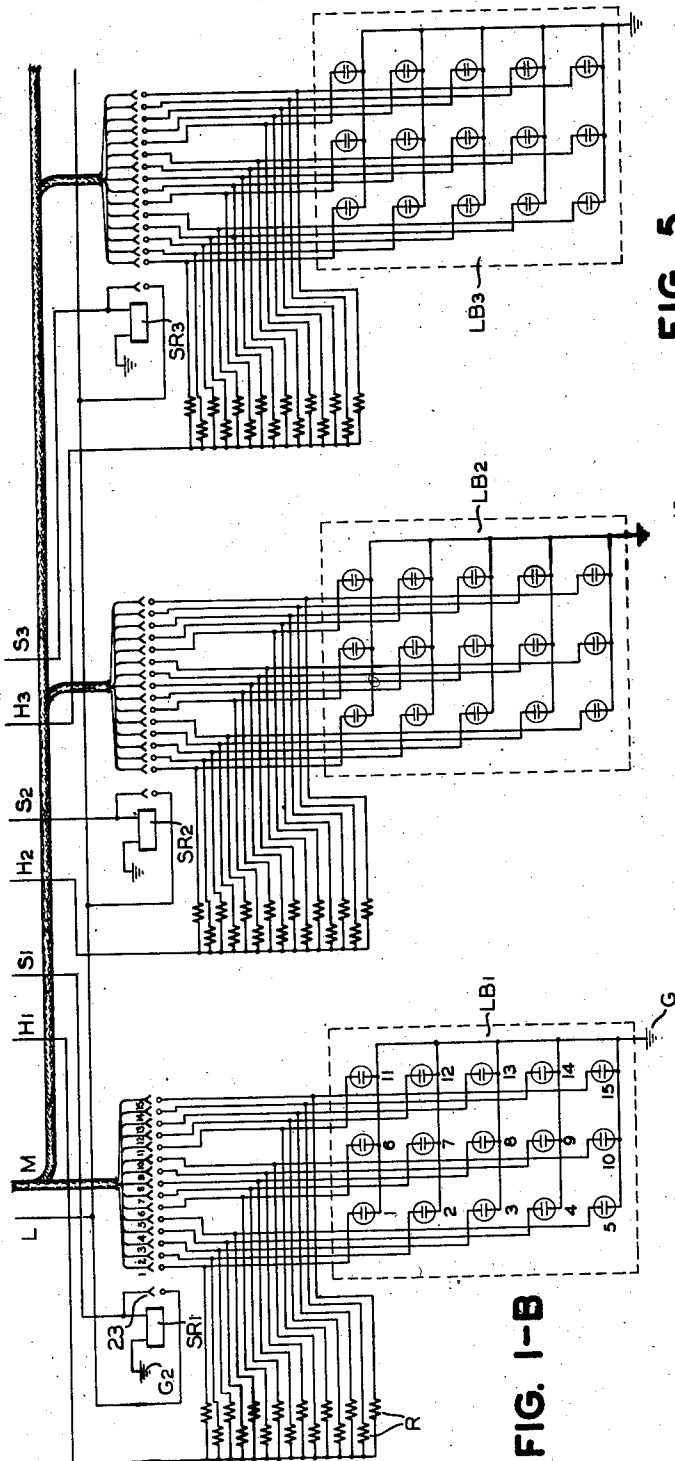


FIG. 1-B

FIG. 5

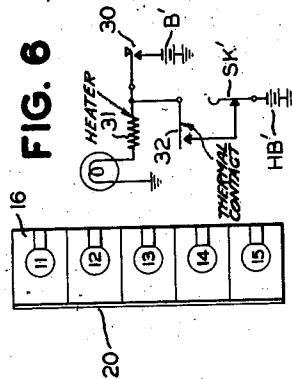


FIG. 6

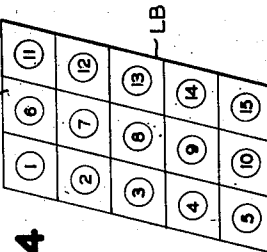


FIG. 4

FIG. 3

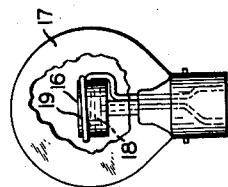
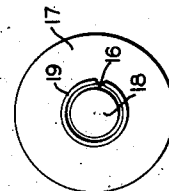


FIG. 2



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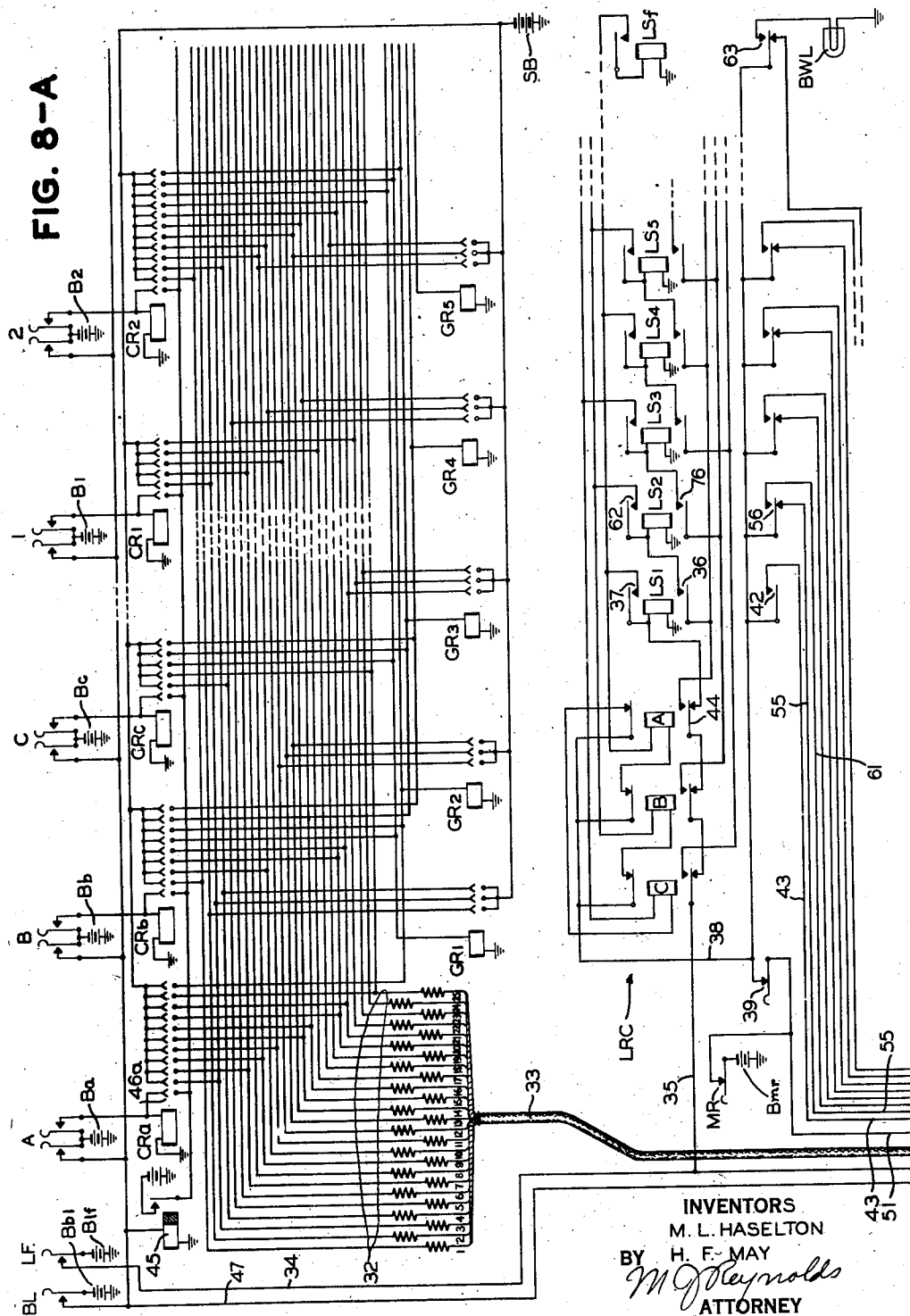
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5 Sheets-Sheet 3

FIG. 8-A



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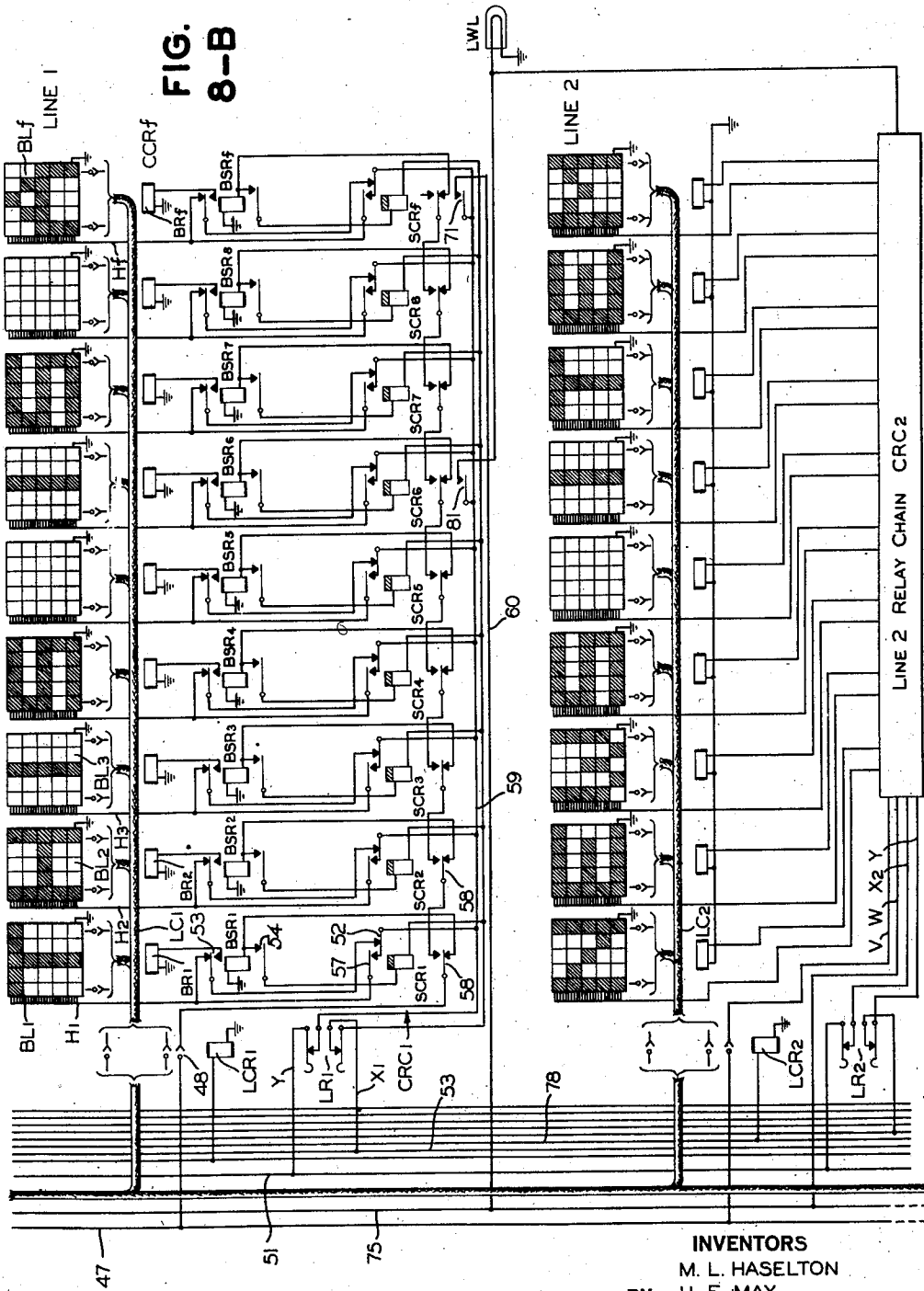
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FIG. 9

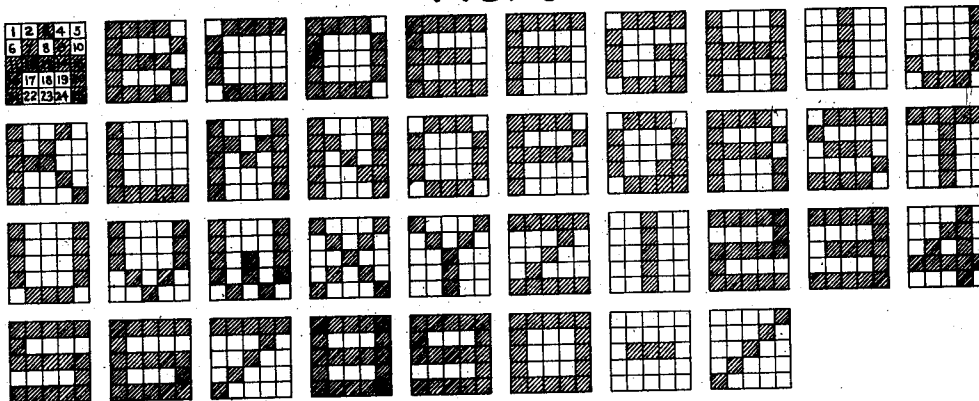
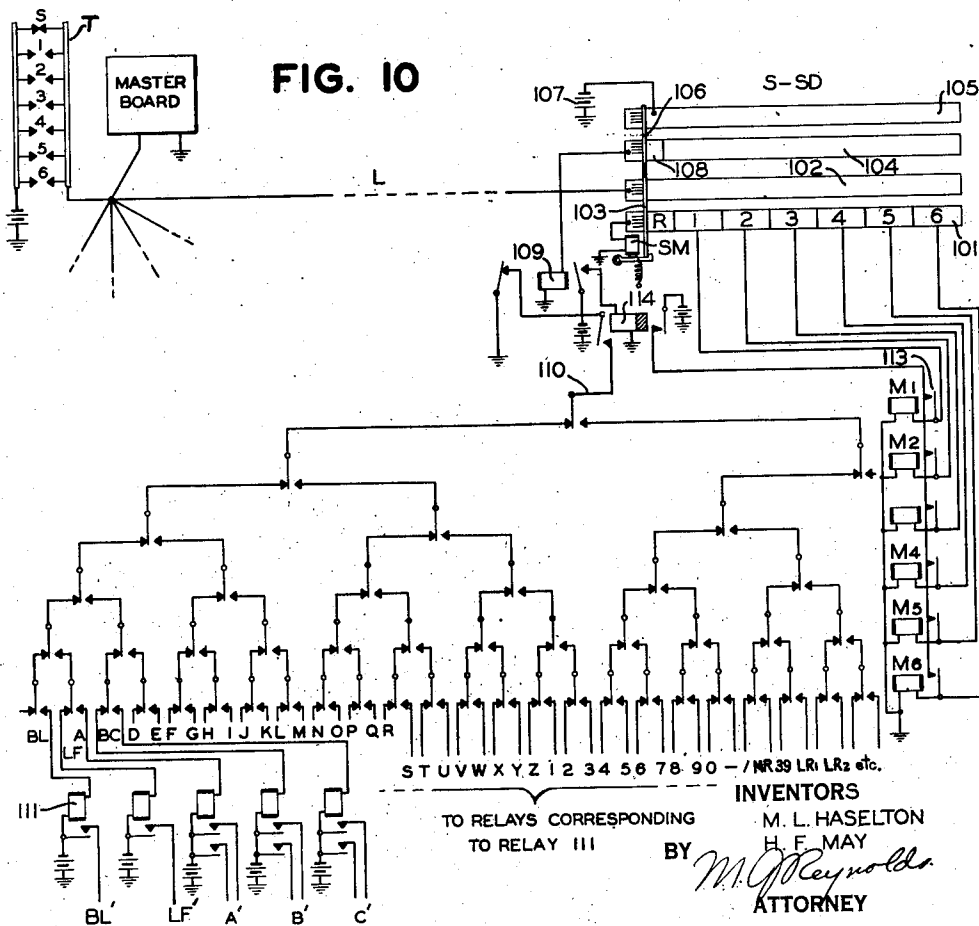


FIG. 10



UNITED STATES PATENT OFFICE

2,146,576

ANNUNCIATOR

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Application December 28, 1933, Serial No. 704,246

3 Claims. (Cl. 177-349)

This invention relates to an indicator or annunciator and more particularly to such a device for displaying information in illuminated characters and to the various circuit arrangements for controlling the same.

One of the objects of the invention is to enable a plurality of characters to be posted by means of a common control mechanism and to permit said characters to be maintained while companion characters are being deleted or changed.

Another object is to produce an annunciator having characters composed of various combinations of lamps in which any desired combination may be set up, deleted or changed from a remote point and in which each combination of lamps selected may be retained independently of the remote control apparatus.

A further object is to produce a bulletin board composed of a number of lines of characters, each character being formed by a predetermined combination of a number of elements selectively controlled from a remote point.

A still further object is to provide means for automatically selecting successive characters in successive lines for response to the character selecting conditions.

Still another object is to enable an entire line of characters to be deleted simultaneously and independently of other lines or to enable the entire board to be deleted simultaneously.

Other objects are to enable the recording to occur in any one of a number of lines, to control such recording either remotely or by a locally operated selecting mechanism and to provide such a system which is simple, inexpensive to install and operate, reliable in operation and unique in appearance.

Other objects and advantages of the invention will appear hereafter.

In accordance with our invention we provide a bank of lamps for each character to appear in the annunciator or sign, individual characters being formed by selecting predetermined combinations of the lamps of each bank, for operation. Where numerals only are to be displayed, as for instance in baseball score boards, racing results, election returns, etc., we prefer to employ a bank of fifteen lamps arranged in three vertical rows. If both numerals and letters are to be displayed, as in displaying news items, train announcements and the like, we prefer to employ a unit composed of twenty-five lamps disposed in five vertical rows. The lamps employed may be of the gaseous discharge type,

such as negative glow neon lamps in which the voltage required to hold the lamp in operation once it has been started is materially less than the voltage required to start a discharge through the lamp, but other types of lamps having materially different operating characteristics from their starting characteristics may also be employed. Ordinary incandescent lamps may be used by providing means in circuit therewith which while not effective to start the lamp will hold it in operation once it has been started by some auxiliary means.

A common control mechanism is provided for the entire board, the function of which is (1) to select a lamp bank or unit for the display of a character; (2) to remove the holding condition from all the lamps of the selected unit so as to extinguish the lamps thereof; (3) to apply a starting condition to predetermined ones of the lamps, depending upon the character to be posted; (4) while maintaining such starting condition, to reapply said holding condition so as to retain the selected lamps in operation independently of the starting condition; and (5) to remove the starting condition from the selected lamps.

The manner in which these various operations may be accomplished will best be understood by reference to the accompanying drawings, in which:

Figures 1A and 1B comprise a circuit arrangement for controlling an indicator or annunciator, in accordance with the present invention;

Figure 2 is a plan view of a preferred type of lamp employed in the indicator units;

Figure 3 is a side elevation of the lamp shown in Fig. 2;

Figure 4 is a front elevation of one form of indicator unit;

Figure 5 is a side elevation of the indicator unit shown in Fig. 4;

Figure 6 is a diagrammatic arrangement showing a manner of employing a modified form of lamp;

Figure 7 shows one manner of forming numerals using a unit composed of 15 lamps;

Figures 8A and 8B comprise a modified circuit arrangement for controlling a bulletin board;

Figure 9 shows a manner of forming the various characters utilizing a bank of 25 lamps for each character, and

Figure 10 is a circuit diagram of a telegraph control for the annunciator or bulletin board.

Referring first to Figure 4, we have shown a bank LB comprising 15 lamps numbered 1 to 15,

arranged in three inclined rows with five lamps in each row. Each lamp is mounted in a separate compartment 16, the front or exposed side of which may be open so that the lamp may be viewed end on, or covered by a transparent or translucent plate or sheet 20. In the preferred embodiment each lamp comprises an envelope 17 (Figs. 2 and 3) containing a cathode 18 and anode 19, the former comprising a disk disposed within an insulating cup 16 and arranged transversely to the envelope and the latter comprising a ring spaced above and substantially encircling the insulating cup 16. The envelope contains a filling of a gas such as neon, argon, or a mixture of such gases at a pressure such as to cause a negative glow to cover the exposed face of the cathode when an appropriate voltage is applied between the electrodes.

It is a characteristic of such lamps that a discharge may be maintained therein at a voltage considerably lower than that required to start the discharge therethrough. For the purpose of the present invention we prefer to employ a neon lamp having a minimum starting voltage of approximately 90 volts and an operating voltage of approximately 70 volts.

By producing discharges through predetermined of the lamps in each group, the various numerals from 1 to 9 and zero may be formed. In Figure 7 we have shown diagrammatically the lamps required to be operated to display each digit. It is to be understood that any desired number of banks LB may be employed side-by-side, one over the other, or in any other arrangement, so as to enable a plurality of characters to be displayed.

In general the formation of the various characters is effected by momentarily applying a voltage to the particular lamps of a bank comprising the character, sufficiently high to start the discharge therethrough and maintaining on all the lamps a voltage somewhat above the minimum operating voltage of the lamps, thereby maintaining the discharge through the lamps to which the higher voltage has been applied, after the starting voltage has been removed.

Reference will now be had to Figures 1A and 1B for a description of one manner of controlling the application of both the starting and operating voltages to the lamps. The control is effected through a keyboard comprising the digit keys 1 to 9 and zero, a blank key BL and a number of bank or unit selecting keys SK1, SK2, SK3, etc., one of which is individual to each of the banks of lamps LB1, LB2, LB3, etc.

Each of the digit keys has a code relay, CR1, CR2, etc., associated therewith, the contacts of each of the code relays either applying a starting voltage from the grounded starting battery SB1, to one or more of the conductors 22, or controlling the operation of one or more of a number of group relays G1, G2, G3, which in turn apply a starting potential from the grounded battery SB to predetermined ones of the conductors 22. Group relay G1 has six contacts controlling the operation of lamps numbered 1, 6, 11, 5, 10 and 15. Group relay G2 controls the operation of lamps numbered 11 to 15 and relay G3 controls the operation of lamps 3, 8 and 13. These particular groups of lamps enter into the formation of a number of characters and materially reduce the number of contacts required on the code relays CR1 to CR10.

The individual conductors 1 to 15 of group 22 are extended by a common cable M to correspond-

ing contacts of the bank selecting relays SR1, SR2, etc. When one of these relays, such as SR1, is operated, the conductors are extended to the terminals of the lamps of the corresponding lamp bank LB1. The opposite terminal of each lamp is grounded at G. Each of the relays SR1, SR2, etc. has a pair of locking contacts 23, one of which is connected to ground G2, through the winding of the associated bank selecting relay and the other of which is connected by the common conductor L to the back contact of the slow operating unlocking relay ULR. Relays SR1, SR2, etc. have their ungrounded terminals joined through individual conductors S1, S2, etc. to one contact of the digit selecting keys SK1, SK2, etc. respectively. The opposite or left contact of each of the selecting keys is joined by conductors H1, H2, H3, etc. through individual resistances R to the ungrounded terminal of each of the lamps of the associated bank and serve, when the keys SK1, SK2, etc. are resting on their left hand sides, to apply a normal operating or holding potential from the grounded holding battery HB1 to the individual lamps.

The unlocking relay ULR has one terminal of its winding connected to grounded battery and the opposite terminal connected by conductor 24 to one side of each of the keys BL and 1 to 9 and 0.

The operation of the system is as follows:

Assuming it is desired to post the numeral 3 on lamp bank LB1, the operator first operates the key SK1 to the right thereby interrupting the circuit from holding battery HB1 over conductor H1 to the lamps of bank LB1, extinguishing any of the lamps which may be operating at the time. As the key SK1 engages its right hand contact battery is applied over the conductor S1 to the winding of gang relay SR1 which operates and locks up from ground through the relay winding, contacts 23, conductor L and back contact of the unlocking relay ULR to battery. The key SK1 is immediately released returning to its left hand side and again applying holding battery to the lamps of bank LB1, but since this battery is not sufficient to start a discharge therethrough, none of the extinguished lamps operate. The digit key 3 is now operated to apply ground to both its left and right hand contacts, the latter causing the operation of code relay CR3 which upon closure of its contacts applies the battery SB1 to conductor 12 of group 22, group relay G1, group relay G3 and conductor 14 of group 22. Group relay G1 being thus operated, applies the battery SB1 to conductors 1, 6, 11, 5, 10 and 15 of group 22, and relay G3 applies the same battery to conductors 3, 8 and 13 of group 22. Since gang relay SR1 is operated at this time, the battery SB1 is applied directly across the lamps 1, 6, 11, 12, 13, 8, 3, 14, 15, 10 and 5, which lamps collectively comprise the numeral 3. The battery SB1 is of a voltage sufficiently high to start a discharge through these lamps.

The closing of key 3 against its left hand side applied ground over conductor 24 to the unlocking relay ULR. Since this relay is slow to operate, it does not open its contact until a sufficient time has elapsed to assure that the voltage from battery SB1 has been applied to the various selected lamps. Upon operation of the relay ULR the locking circuit for gang relay SR1 is broken, causing this relay to release, thereby removing the high voltage from the enumerated lamps. However, since the holding battery HB1 is applied to these lamps at this time, they continue

to operate independently of subsequent operations of the controlling mechanism, until extinguished by a subsequent movement of the key SK1.

In this same manner any of the numerals may be set up upon any of the lamp banks. Should it be desired at any time to delete the character on any bank, this may be done by momentarily moving the key SK associated with such bank from its left contact to interrupt the holding battery. If in this operation the key is not permitted to engage its right contact, the gang relay SR1 associated with the bank will not be operated, but should the gang relay be so operated it may be released by closing the blank key BL for a period sufficient to operate the unlocking relay ULR.

It will be noted from the foregoing that we have provided a system whereby various characters may be set up in illuminated form and each digit maintained, deleted or changed independently of the others, through a common keyboard mechanism. We have found that by inclining the digits as shown in Figure 4, they are rendered more legible.

Obviously in place of using neon lamps, any type of lamp may be employed in which a different condition is required to start the lamp from that required to maintain it in operation and in Figure 6 we have shown diagrammatically a modification employing an incandescent lamp. In this modification the lamp is started into operation by closure of a key 30 which corresponds to the operation of one of the code relays CR1 of Figure 1A. The starting current produced on closure of key 30 flows through the heating element 31 of a thermal contact 32, thereby closing the contact 32 and enabling the lamp to continue in operation from the holding battery HB' through the key SK' which corresponds to the key SK1, SK2, etc. of Figure 1A. The current from the battery HB' maintains the contact 32 closed until interrupted by manual operation of the key SK'. The manner in which this arrangement may be incorporated in the system shown in Figures 1A and 1B will be obvious.

In Figures 8A and 8B we have shown a bulletin system in which a number of lines of characters comprising both letters and figures may be displayed. In order to form properly the various letters of the alphabet we prefer to employ a bank of twenty-five lamps arranged in five vertical rows. An arrangement of the various lamps to form each letter and numeral is shown in Figure 9.

Banks of lamps BL1 to BL7 are arranged in a number of successive lines, indicated as line 1 and line 2, in Figure 8B, each line comprising any desired number of lamp banks. The form of the character appearing in each lamp bank is controlled from a common keyboard, comprising a blank key BL, line feed key LF, letter character keys A, B, C, etc., numerical keys 1, 2, etc., and a number of special function keys which will be referred to hereinafter. The system is so arranged that the successive lines and the successive lamps in each line are automatically selected in succession, as the various character and special function keys are operated. For this purpose we employ a line selecting relay chain LRC common to the board and a bank selecting relay BSR and a slow acting controlling relay SCR individual to each bank of lamps. The line selecting relay chain LRC has an individual line selecting relay LS1, LS2, LS3, etc., for each line of the board and three prime relays A, B, and C.

The individual lamps of each bank are con-

trolled over a group of conductors 32 numbered 1 to 25 (Figure 8A) which are extended over a cable 33, multiplied to each line of lamps through the contacts of gang relays LCR1, LCR2, etc.; and thence by way of line cables LC1, LC2, etc., and contacts of bank gang relays BR1, BR2, etc., associated with each line of units, to one side of each of the lamps in each of the banks. The opposite side of each lamp is grounded.

Each of the conductors 1 to 25 of group 32 controls an individual one of the lamps in each bank under the selective control of the gang relays mentioned and the keyboard mechanism, as will presently appear. The common holding circuit for each bank of lamps is indicated by the conductors H1, H2, H3, etc., the circuits of which will be subsequently traced.

Each character key A, B, C, etc., has associated with it an individual code relay CRA, CRB, etc., the contacts of which when closed apply potential from the grounded battery SB to predetermined ones of the conductors of group 32, and/or to one or more of the group relays GR1, GR2, GR3, GR4 and GR5, which in turn place potential from the battery SB on predetermined ones of the conductors 32. The relays GR1 to GR5 represent combinations of lamps in the lamp bank which occur frequently in the formation of the various characters. Referring to the numbering of the lamps in each bank as shown in Figure 9, relay GR1 controls the application of battery to lamps numbered 2, 3 and 4; relay GR2 applies battery to lamps 12, 13 and 14; relay GR3 applies battery to lamps 22, 23, and 24; relay GR4 controls the operation of lamps 6, 11 and 16; and relay GR5 applies battery to lamps 10, 15 and 20.

The system will be best understood by reference to a specific example. Assume it is desired to post the characters A and B on the first two banks of line 1 of the bulletin board: the operator first operates the line feed key LF connecting battery B1/ over conductors 34 and 35, through the lower back contacts, in series, of relays C, B, and A of relay chain LRC to the winding of relay LS1 and thence to ground. Relay LS1 upon operating prepares a circuit through its lower contact 36 to the second relay LS2 of the chain. It also prepares a locking circuit for itself over contact 37, the winding of relay A and the back contact of relay B and thence over conductor 38, key 39 and master release key MR to battery Bmr. Current does not flow, however, through the winding of relay A until operating battery at the key LF is removed by releasing key LF. A third circuit extends from battery Bmr through the keys MR and 39 and lower contact 42 of relay LS1 and thence by conductor 43, to the winding of the line control relay LCR1 which upon operation connects the conductors 1 to 25 of the cable 33 to the line cable LC1, thereby selecting the lamp banks of line 1 for operation in response to the succeeding actuations of the keyboard. Upon the release of the line feed key LF current flows from the source Bmr through the locking relay A and the line selecting relay LS1 to ground, operating the relay A and locking up these relays. The operation of relay A at its contact 33 further prepares the circuit from conductor 35 to the second relay LS2 of the chain LRC.

The character key A is now operated to apply battery Ba to both its left and right hand contacts. The closing of the right hand contact operates coding relay CRA and the closing of the left hand contact energizes relay 45 which locks up the coding relay CRA through one of the con-

tacts 46a of the latter relay. The remaining contacts of relay CR4 apply battery from the source SB to conductors numbered 3, 7, 9, 11, 15, 16, 20, 21 and 25 and also energize group relay GR2 which applies the same battery to conductors 12, 13 and 14. These conductors are associated with the lamps forming the letter A. The closure of left contact of key A also applied the battery Ba by way of conductor 47, through the lowermost contact 48 of line controlling relay LCR1 and the lower back contact of relay SCR1 to the winding of relay BSR1 to ground. Relay BSR1 interrupts the holding circuit H1 for the lamps of bank BL1, this holding circuit normally extending from battery Bmr, key MR, conductor 51, upper contacts of line release key LR1, contact 52 of relay SCR1 and the armature 53 and its back contact of relay BSR1 to conductor H4, which extends through resistances to each of the lamps of bank BL1 in parallel to ground. The energization of relay BSR1, as stated, interrupts the holding circuit at its armature 53 thereby causing any operated lamps in this bank to be extinguished. The armature 53 at the same time connects the battery Bmr, through its make contact, to the winding of bank gang relay BR1 to connect the conductors of cables LC1 to the lamps of bank BL1. Since conductors numbered 3, 7, 9, 11 to 16, 20, 21 and 25 were connected to the high potential starting battery SB by operation of key A, the corresponding number of lamps of bank BL1 are started. Relay BSR1 closes a locking circuit through its contact 54, winding of relay SCR1, lower contacts of the line release key LR1, conductor 55, break contact and armature 56 of line selecting relay LS2 and keys 39 and MR to battery Bmr. Relay SCR1 being short circuited does not pick up, however, until key A is released. Upon operation relay SCR1 closes its upper contact 57 thereby reapplying the holding battery from the upper contacts of the line release key LR1 and contacts 57 to the conductor H1 thereby holding operated the selected lamps. Immediately thereafter contacts 52 open removing battery from the bank relay BR1 to disconnect therefrom the cable LC1. The lower armature 58 of relay SCR1 operates to its make contact thereby preparing a circuit from contact 48 of relay LCR1 to the bank selecting relay BSR2 of the next bank of lamps BL2. The release of key A releases relay 45 which releases coding relay CR4. The relay 45 being slow releasing does not release CR4 before SCR1 reconnects holding battery to the bank of lamps BL1.

The key B may now be depressed to set up this character upon bank BL2 of line 1. When this occurs relay CRb is operated and locks up through relay 45 and at the same time applies the battery SB to conductors 1, 10, 20 and 21 and operates group relays GR1, GR2, GR3 and GR4. These latter relays in turn apply the starting battery SB to additional conductors 2, 3, 4; 12, 13, 14; 22, 23, 24; and 6, 11 and 16. The conductors enumerated correspond to the numbers of the lamps forming the letter B. The operation of key B also applies the battery Bb over conductor 47, contact 48 of relay LCR1, armature 58 and make contact of relay SCR1 and the armature 59 and break contact of relay SCR2 to ground to the winding of relay BSR2. This relay upon operating functions similar to relay BSR1, first removing the holding battery from conductor H2 and applying it to the winding of relay BR2 to connect the cable LC1 to the lamps of bank BL2 which thereupon operate in accordance with the

starting potential applied thereto from battery SB. Relay BSR2 locks up through relay SCR2 and upon operation of this latter relay holding battery is reapplied to the lamps of bank BL2 and removed from the winding of relay BR2. The armature 58 of relay SCR2 on engaging its make contact prepares the circuit for relay BSR3.

In this manner any desired characters may be set up on each successive lamp bank until the end of the line is reached. The final relay SCRf has an extra contact 71 which upon closure incident to the posting of a character in bank BLf, completes a circuit from holding battery Bmr over the upper contacts of the line release key LR1 and conductor 59 through contacts 71, conductors 60, 75 and 35, the lower armatures and the break contacts of relays C and B and the armature 44 and make contact of relay A of the line counting chain LRC and thence through the armature 36 and make contact of relay LS1 to the winding of relay LS2. This relay upon operating prepares for the operation of the second line of characters, and at its armature 56 interrupts the locking circuit for the relays BSR and SCR of line one causing all these relays to restore to normal. As this occurs the holding circuit for the lamps of line one is maintained from the upper contacts of line release key LR1 first through armature 57 of relays SCR as relays BSR release and as relays SCR, which are slow releasing, subsequently release the circuits are completed through contacts 52 of relays SCR and contacts 53 of relays BSR. The character set up on line one are therefore maintained. The armature 56 of relay LS2 and its make contact applies battery over conductor 61 to the winding of the line control relay LCR2 of the second line of lamp banks thereby connecting the cable 33 to the cable LC2. Relay LS2 locks up over its upper contact 62 through winding of relay B and the break contact and upper armature of relay C and by keys 39 and MR to battery Bmr. The operation of relay B interrupts the locking circuit for relays LS1 and A so that these relays release. The release of relay LS1 interrupts the circuit to the line control relay LCR1 to disconnect the cable LC1 from cable 33. Relay LS2 at its lower armature 76 prepares the circuit for the third relay of the chain LS3.

The character keys may now be depressed to set up line two in the same manner as line one and upon the operation of the last relay of line two a circuit is established for relay LS3 in the same manner as the circuit for relay LS2 was completed thereby connecting the cable 33 to the third row of lamp banks. Relay LS3 locks up over its upper contact through winding of relay C and the break contact and upper armature of relay A and thence through keys 39 and MR to battery Bmr, the operation of relay C interrupting the locking circuit for relays LS2 and B so that these relays release. The operation of relays LS3 and C also prepares the circuit for the fourth relay LS4 of the chain. During the successive operating periods of the next three relays LS4, LS5 and LS6 the above described cycle of operation of the prime relays A, B and C is repeated, and so on throughout the series of LS relays in the counting chain LRC.

The operation of the final relay LSf upon completion of the last line completes the circuit over its contact 63 for the board warning lamp BWL, this circuit extending from the battery Bmr over keys MR and 39 and contact 78 to the lamp BWL. This lamp serves to indicate to the op-

erator that the entire board is filled. The relay LS/ at its armature 63 interrupts the locking circuit for the relays BSR and SCR of the last line to restore these relays to normal. Relay LS/ locks up in series with one of the prime relays A, B or C, depending on the number of preceding relays of the counting chain LRC. The operation of key 39 extinguishes lamp BW1 and releases relay LS/ thereby preparing the counting chain LRC for another cycle of operation.

In case it is not desired to post a complete line before proceeding to the succeeding line, as at the end of a paragraph or where it is not desired to divide the word between two adjacent lines, we provide the blank key BL. Referring again to line 1 of the bulletin board and assuming the last character to be recorded thereon was displayed in bank BL6. Following the posting of the character in bank BL6, the blank key BL would be operated three times in succession to transfer the cable 33 to the next lower line of lamp units. The first operation of the blank key BL applies battery Bb1 over conductor 47 to contact 48 of relay LCR1 and the lower armatures 58 and their make contacts of relays SCR1, to the winding of relay BSR1. Operation of this relay removes holding battery from the lamps of bank BL7 extinguishing any lamps therein which may have been operated in a previous cycle. Relay SCR1 locks up in series therewith and prepares a circuit to the succeeding relay BSR8. The next two operations of the blank key BL actuate relays BSR8 and BSR/, extinguishing the lamps, if previously lighted, in banks BL8 and BL/. Relays BSR8 and BSR/ lock up in series with the windings of relays SCR8 and SCR/. The operation of relay SCR/ operates the relay LS2 of chain LRC to effect the transfer of cable 33 to the next lower line of lamp units.

In order to indicate to the operator when the end of a line is being approached, one of the relays, as SCR6 in the present embodiment, is provided with an additional contact 81 which upon operation of the relay completes a circuit for the line warning lamp LWL. This circuit extends from the battery Bmr, key MR, conductor 51, upper contacts of key LR1, conductor 59 and contact 81 of relay SCR6 to lamp LWL and to ground.

If it is desired to blank out an entire line being posted at any time, as for instance when an error has been made in posting a character, the line release key, LR1, LR2, etc., of the line may be operated. This key at its upper contacts removes holding battery Bmr from all the lamps in the bank, extinguishing the same, and at its lower contacts removes locking battery from each of the relays BSR and SCR, causing all of these relays to be released. If the error occurs before the character is posted in the last bank BL/ of any line, the operation of the counting chain relay LS associated with such line is not affected. If the last character in the line has been posted and contact 71 of relay SCR/ of the line closed, causing operation of the counting chain relay LS and line control relay LCR corresponding to the next succeeding line, the key 39 may be operated. This key removes the battery Bmr from the line relay chain LRC, deenergizing all relays in the chain and restoring them to normal, after which the line relay chain may be operated by successive actuations of the line feed key LF, each actuation of the key applying battery B1/ over conductors 34 and 35 to successive relays of the chain LRC thereby successively operating the

relays LS1, LS2, etc., and their associated line controlling relays LCR1, LCR2, until the line is reached in which the error occurred. Since none of the line release keys LR except the one associated with the line to be rewritten has been operated, the characters previously posted in the other lines are not affected. The operator may then proceed to rewrite the line.

Again if the operator desires to leave blank any part of the line, this may be accomplished by operation of the blank key BL as each lamp bank is selected by means of the relay chain CRC, at which time the characters of the preceding display are automatically deleted.

If it is desired to delete the entire board simultaneously, this may be accomplished by operation of the master release key MR. Opening the contacts of this key interrupts the holding battery Bmr to the entire board causing all the lamps to be extinguished. It also interrupts the circuit to both the line relay chain LRC and the bank controlling relays BSR and SCR restoring all of these relays to normal.

If it is desired to return to the first line to change the characters thereon before completing the entire board, the key 39 may be operated. This key removes the battery Bmr from the line relay chain LRC, deenergizing all relays in the chain and restoring the same to normal. Thereafter line feed key LF may be operated to energize relay LS1 of the chain and thus prepare the lamp units of the first line for subsequent operation.

If it is desired to omit a line or a number of lines, line relay chain LRC may be operated down to the proper line on which posting is to again start by successive operations of the line feed key LF. Each operation of this key applies to battery B1/ over conductors 34 and 35 to successive relays of the chain LRC, thereby successively operating the gang relays LCR1, LCR2, etc., until the desired line is reached.

Again if it is desired to provide a number of blank characters at the beginning of a line as in paragraphing or tabulating, the blank key BL may be operated a number of times to actuate and lock up the relays BSR and SCR of the line in question up to and including the relays associated with the last blank space to appear before starting the line.

It will be observed from the above that an extremely flexible system has been provided in which a number of successive lines may be posted by operation of the character keys only and in which any part of a line may be deleted or recorded on. Moreover the entire board or a single line thereof may be simultaneously deleted and recording may occur on any line independently of the others.

While the various function keys BL, LF, MR, 39, and LR1, LR2, etc., are shown remote from the character keys, this is for simplicity in illustration, it being understood that these keys form part of a single key board mechanism.

In place of manual operation of the key control contacts, these contacts may be controlled telegraphically from a remote point. In Figure 10 we have shown one form of remote control for this purpose. The signals originate at a telegraph transmitter T which may be a keyboard transmitter or an automatic transmitter, such as a perforated tape or metallic storage transmitter. Any suitable code may be employed; in the specific embodiment illustrated the transmitter T has a start contact S and six code contacts num-

bered 1 to 6, corresponding to a six unit permutation code. At the receiving terminal we provide a start-stop distributor S—SD having a pair of receiving rings 101 and 102 traversed by a brush 103 and a pair of local rings 104, 105 crossed by a brush 106. The line L is connected to the solid receiving ring 102. Ring 101 has a rest segment R and six code segments 1 to 6, connected individually to the six selecting magnets M1 to M6. The rest segment R is connected through the stop magnet SM to ground.

The local ring 105 has battery 107 applied thereto and the companion ring 104 has a single local segment 108 connected to ground through the control magnet 109.

The contacts of selecting magnets M1 to M6 are fanned as shown, so as to enable a circuit to be completed from conductor 110 to any one of a plurality of relays 111, each of which corresponds to an individual key of the manual keyboard shown in Figures 8A and 8B. The contacts of relays 111 correspond to the contacts of the keys BL, LF, A, B, C, etc. and are indicated by similar reference characters primed. In Figures 8A and 8B twenty-six letter keys, ten numeral keys, four special function keys, BL, LF, MR, and 39, and a key LR for each line are shown. This comprises a total of forty keys exclusive of the line release keys LR. The number of keys, relays and relay contacts, and the circuit arrangements, may vary within wide limits, depending upon the number of combinations or available selections desired. With a six unit code in the arrangement shown in Fig. 10, sixty-four magnets 111 may be selected thus providing an individual magnet for each of the forty keys and for twenty-four line keys.

The conductor 110 is connected through the front contact and armature of relay 114, to the front contact of relay 109, the armature of which is grounded.

Each of the relays M1 to M6 is provided with a locking contact 113 connected to the front contact of relay 114 and thence to grounded battery.

The operation of the remote control system is as follows. If it is desired to operate the line feed relay LF' to prepare the board for posting characters on the first line of lamp banks or units, a code combination consisting of spacing, spacing, spacing, spacing, marking, spacing impulses is transmitted from the transmitter T. A start impulse also of spacing character precedes this combination thereby releasing the start magnet SM and causing the brushes 103 and 106 to pass over their respective rings in synchronism with the received signals. As the brush leaves segment 108, the relay 109 releases and operates relay 114. The first four impulses being of spacing character do not operate the relays M1 to M6 and all the armatures thereof remain on their back contacts. The fifth impulse being marking operates the armatures of relay M5, this relay locking up through its contact 113 to the front contact of relay 114 which is operated at this time. The sixth impulse being spacing, relay M6 remains unoperated. This operation of the selecting relays prepares a circuit from conductor 110 to the winding of relay 111 controlling the contacts LF', which circuit is completed as the brush 106 passes on to local segment 108 to energize relay 109 and as relay 114 is slow releasing ground is applied through the front contacts of relays 109 and 114 to the conductor 110 and thence to the winding of relay 111 controlling the contact LF'. At the same time oper-

ating battery is removed from the relay 114 which releases and opens the locking circuit for the operated selecting magnet M5 but since the relay 114 is slow releasing, the relay M5 does not release until relay 111 has been operated. The release of relay 114 permits its contacts to drop back to their spacing position, thereby opening the circuit to conductor 110 and interrupting the energization of relay 111 to thereby open the contacts LF' thereof.

The momentary operation of contacts LF' prepares the first line of lamp banks for response to the succeeding characters as described in connection with Figures 8A and 8B. The code combinations corresponding to the various characters to be posted may now be transmitted in succession, each combination operating one of the relays 111, the contacts of which control the posting of an individual character. The special function contacts controlled by the keys BL, LF, MR, 39, LR1, etc. (Figs. 8A and 8B), are each provided with an individual relay 111 so that any of the functions described with reference to Figures 8A and 8B may be controlled from a remote station.

While we have described a number of specific embodiments of the invention, it is to be understood that the invention may take still other forms and that various modifications and changes may be made therein without departing from the invention, and therefore we do not desire to be limited to the specific details shown and described but contemplate all such variations and modifications as come within the terms of the appended claims.

What we claim is:

1. A signaling system comprising a plurality of units each comprising a plurality of electro-responsive visual signaling elements arranged to form a number of different characters upon energization of selected ones of the elements, said units being arranged in a plurality of rows, means operable at will for selecting and controlling the energization of selected signaling elements of each unit including means for selecting the units in succession, means including a selecting relay chain common to said units for automatically selecting the rows of units in succession as the units in each row are energized, said selecting chain being provided with a plurality of switching relays, less in number than the relays in the chain, having contacts thereof arranged in chain relationship for causing the successive operation of the relays of the chain and connections from the relays of the chain to the switching relays for causing the switching relays to repeatedly operate to perform their switching operations as successive relays of the chain are energized.

2. A signaling system comprising a plurality of units each comprising a plurality of electro-responsive visual signaling elements arranged to form a number of different characters upon energization of selected ones of the elements, said units being arranged in a plurality of rows, means operable at will for selecting and controlling the energization of selected signaling elements of each unit including means for selecting the units in succession, means including a selecting relay counting chain common to said units for automatically selecting the rows of units in succession as the units in each row are energized, said selecting relay chain being provided with a plurality of switching relays, less in number than the relays of the chain, having contacts thereof arranged in chain relationship for causing the successive operation of the relays of the chain,

connections from the relays of the chain to the switching relays for causing the switching relays to repeatedly operate to perform their switching operation as successive relays of the chain are energized, means for deleting the characters displayed in a row prior to the posting of a character in the last signaling unit of the row, and means responsive to said deleting means for controlling the operation of said selecting relay chain to enable the display of characters to be repeated in said row from which they were deleted, said last named means operating to prevent inadvertent skipping of any row due to operation of said selecting relay chain.

3. A signaling system comprising a plurality of units each comprising a plurality of electro-responsive visual signaling elements arranged to form a number of different characters upon energization of selected ones of the elements, said

units being arranged in a plurality of rows, means operable at will for selecting and controlling the energization of selected signaling elements of each unit including means for selecting the units in succession, means for automatically selecting the rows of units in succession as the units in each row are selected, means for deleting the characters displayed in a row prior to the posting of a character in the last signaling unit of the row, and means responsive to said deleting means for controlling the operation of said means for selecting the rows to enable the display of characters to be repeated in said row from which they were deleted, said last named means operating to prevent inadvertent skipping of any row due to operation of said means for selecting the rows.

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