

Dec. 13, 1955

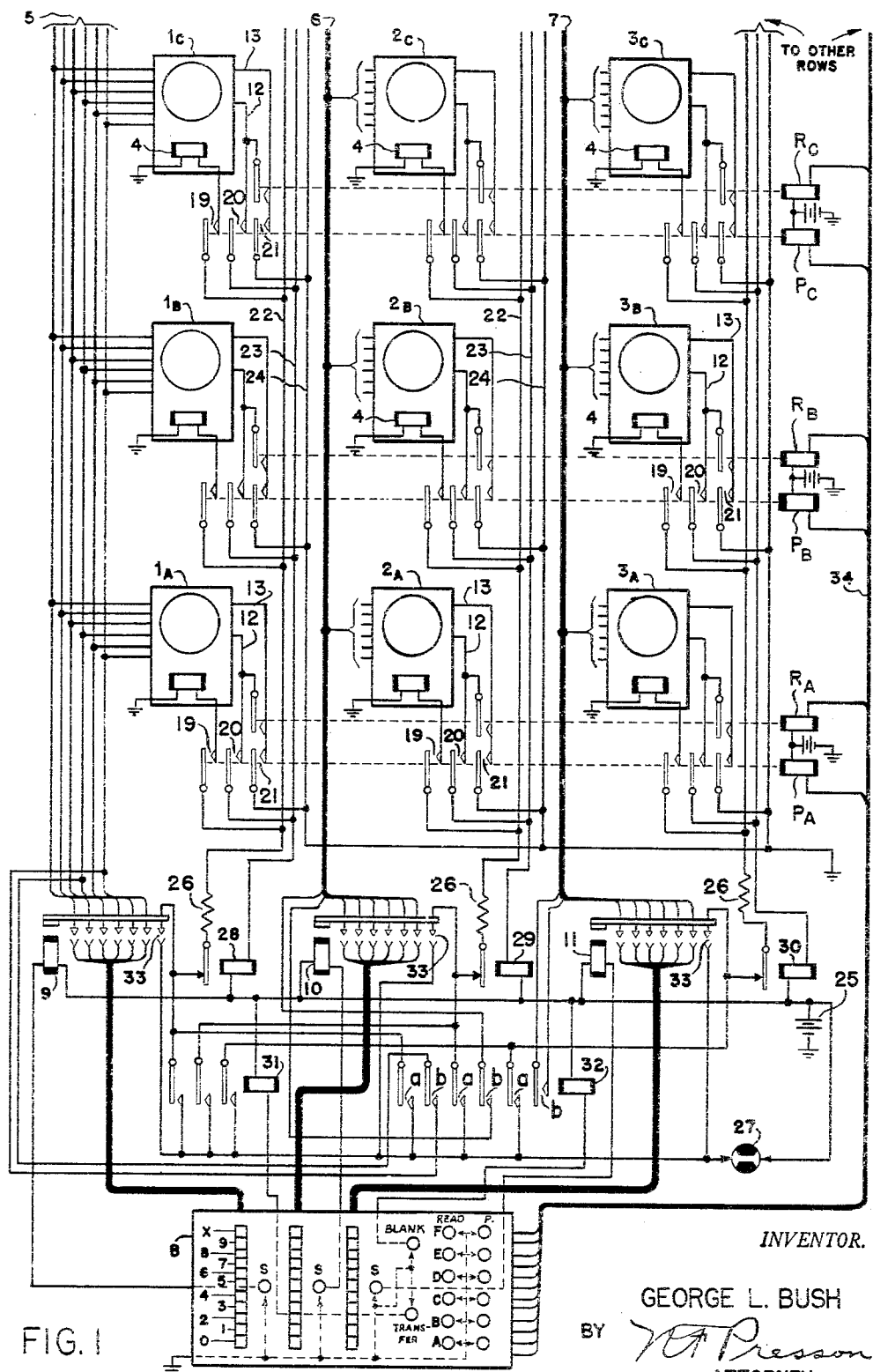
G. L. BUSH

2,727,222

INDICATOR DISPLAY TRANSFER CIRCUIT

Filed Nov. 22, 1952

3 Sheets-Sheet 1



Dec. 13, 1955

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INDICATOR DISPLAY TRANSFER CIRCUIT

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3 Sheets-Sheet 2

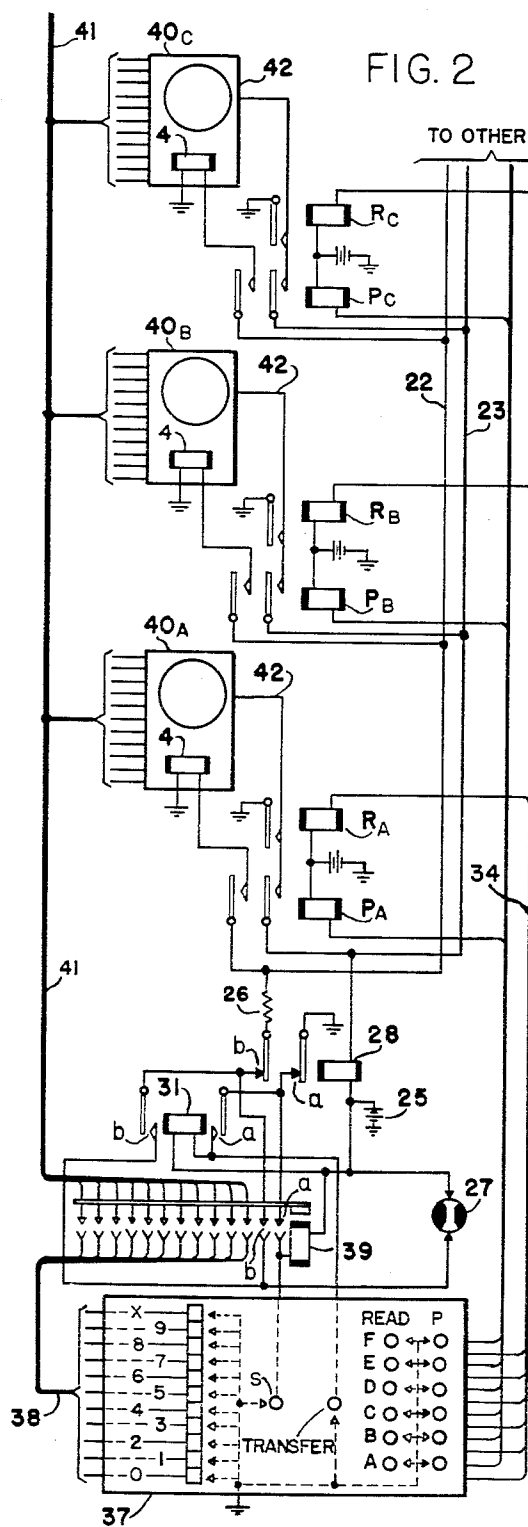


FIG. 2

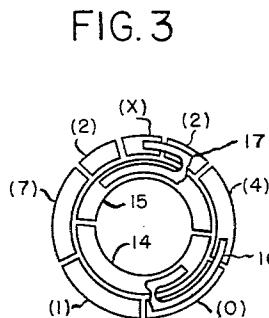


FIG. 3

NOTE: REFERENCE 18 APPLIES COLLECTIVELY TO ALL OUTER RING SEGMENTS.

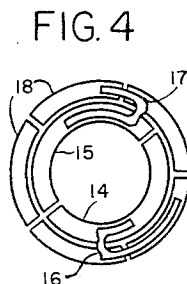


FIG. 4

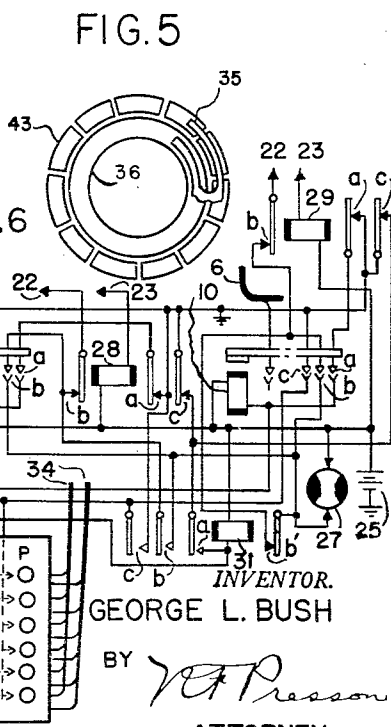


FIG. 5

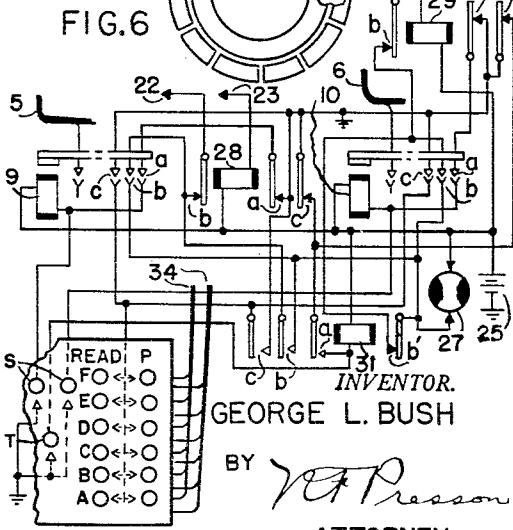


FIG. 6

INVENTOR.
GEORGE L. BUSH

BY *W. A. Presson*
ATTORNEY

Dec. 13, 1955

G. L. BUSH

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INDICATOR DISPLAY TRANSFER CIRCUIT

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3 Sheets-Sheet 3

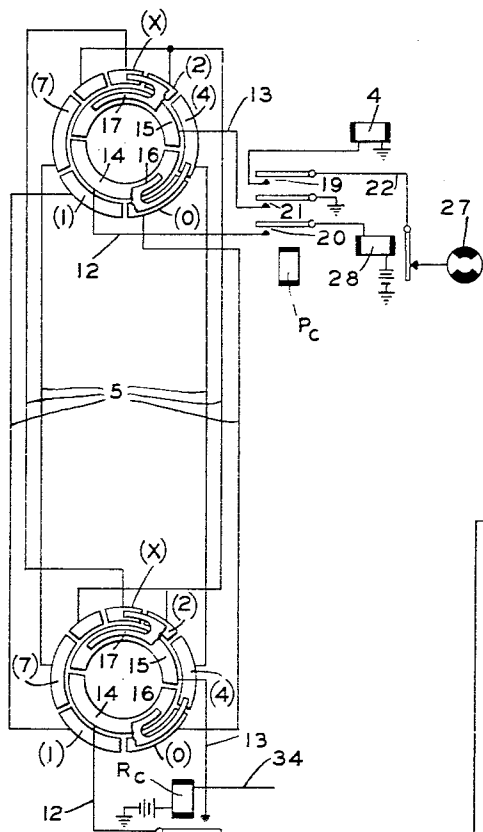


FIG. 7

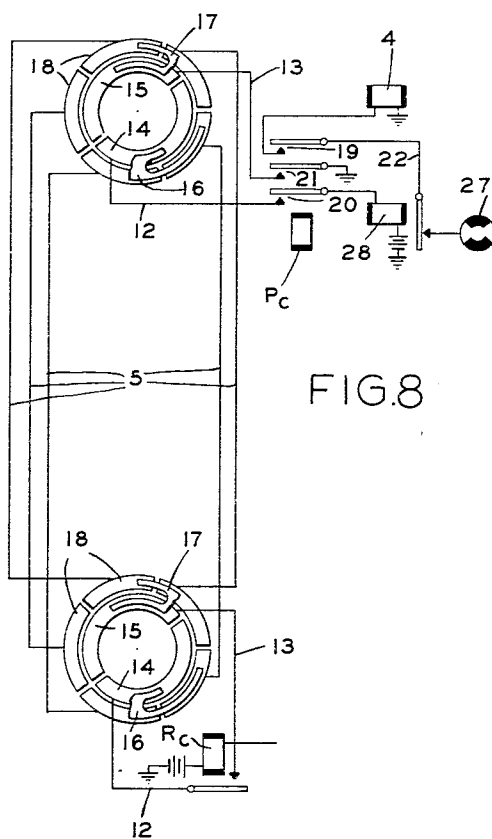


FIG. 8

INVENTOR.
GEORGE L. BUSH

BY

W. P. Presson

ATTORNEY

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2,727,222

INDICATOR DISPLAY TRANSFER CIRCUIT

George L. Bush, Flushing, N. Y., assignor to The Tele-register Corporation, New York, N. Y., a corporation of Delaware

Application November 22, 1952, Serial No. 322,085

10 Claims. (Cl. 340-154)

This invention relates to a circuit arrangement for controlling a plurality of indicator units and particularly for transferring a given character display from one to another unit. The initial set-up, or posting of any of the indicator units is an operation which is also provided for under remote control.

In carrying out my invention I intend to utilize drum-type indicator units such as are also used in large numbers in automatic stock quotation boards and the like. There are several species of indicator units, however, some of which are better adapted than others for carrying out my invention. For my purposes it is essential that a commutator and brush assembly be included as a part of the construction in order that the step-wise operation of setting an indicator may be suitably controlled from a remote point and also that read-out signals may be derived from any indicator unit and transmitted, say, to another indicator unit for setting the same to display a like indication.

It is a primary object of my invention to provide a circuit arrangement for use in the control of a plurality of indicator units, thereby to set and re-set the same, to blank out their indications, and to cause a given setting to be read out from one indicator and duplicated on another indicator.

Another object is to provide a relay circuit arrangement in combination with a multi-unit indicator panel and a suitable keyset or other source of control signals whereby selected indicator units may be caused to display numerals or other characters in any desired arrangement, such as by tabulation of related data according to the sense of the intelligence to be displayed. Other objects and advantages of my invention will be brought out or implied in the ensuing part of the specification.

The invention will now be described in more detail, reference being had to the accompanying drawings wherein Fig. 1 shows a circuit arrangement of one form which is adapted to utilize 6-element safety code signals for setting the indicator units. Fig. 2 shows a modified circuit arrangement wherein suitable means are provided for use in combination with indicator units which are settable in response to pulses transmitted over an individually selected one out of eleven signaling conductors. Fig. 3 is a diagrammatic representation of a commutator-and-brush arrangement the use of which is preferred when the indicator units are to be made responsive to 2-element permutations of a 6-element code. Fig. 4 shows diagrammatically a commutator-and-brush arrangement which is useful in combination with a 5-element code, wherein different 2-element permutations are used to obtain corresponding selections of an indicator unit setting. Fig. 5 shows still another form of commutator-and-brush arrangement for use with an 11-position indicator drum, individual settings of which are to be obtained by single selection of one out of eleven signal conductors of the control circuit arrangement. Fig. 6 shows a locking circuit detail which may be used for automatically restoring the system to normal after com-

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pletion of a posting operation. Figs. 7 and 8 are schematic wiring diagrams of the follow-up circuits of the indicators for the 2-out-of-6 and 2-out-of-5 codes utilized with the commutator-and-brush arrangements of Figs. 3 and 4, respectively.

Signaling codes of the 6-element and 5-element species have been described in a co-pending application filed as joint inventors by John W. Cornwell and myself, Ser. No. 299,706 dated July 18, 1952 and assigned to the assignee of the instant application. That case was entitled "Indicator Device and Analogue Computer Circuit." The safety codes described therein are preferable for use in connection with the present invention because each selection of an indicator display position is obtainable by a choice of two out of six or two out of five signaling conductors in the circuit arrangement. I do not wish, however, to be limited to the use of the paired circuit permutations for selection of the different indicator display positions, since, according to the modified circuit of Fig. 2 a selection can be had when one out of eleven signaling conductors is chosen.

The species of invention which utilizes two out of six conductors in a signal channel, taken permutatively, to obtain the selective setting of an 11-position indicator unit

Referring first to Fig. 1 I show therein an indicator display panel having three vertical columns of indicator units 1, 2 and 3 with lettered sub-scripts to designate their grouping in horizontal rows. Each horizontal row may be designated according to the category of information which it displays. In different vertical columns the indicators may represent, for example, the several denominational orders of plural digit numbers, such as hundreds, tens and units.

Each of the block diagrams 1, 2 and 3 contains a circle which represents the indicator drum, and a magnet 4 which is operative to drive a ratchet-and-pawl mechanism for rotating the drum. The indicator structure will be understood to be conventional. For this reason it appears unnecessary to delineate it for the instant disclosure. The ratchet-and-pawl mechanism operates stepwise in response to pulse-actuation of the magnet 4, there being a retractive spring to return the pawl to its normal position upon cessation of the magnetizing pulse. Rotation of the indicator drum occurs during the retractive stroke. This mode of operation is essential, since the brush arrangement (hereinafter described) is attached to and rotates with the drum and sweeps over commutator segments in search of a control signal whereby the flow of pulses to the stepping magnet is cut off. The brush must not be swept onto a live segment except during a space interval following a stepping pulse.

As explained in the aforementioned co-pending application of Bush and Cornwell, ten or eleven characters are delineated on the periphery of each drum. These characters appear singly through a window in the casing of the indicator unit. If the signaling code is of the so-called "additive" significance type wherein the nominal designations of any two code elements when added together are equal to the numeral to be displayed on the indicator, then such numerals may be arrayed on the periphery of the drum in the following order, "1," "7," "8," "3," "0," "9," "6," Blank, "2," "4," "5." Other sequences of the numerals are also possible, according to the aforementioned co-pending application, assuming that the indicator units have eleven display positions and that a commutator-and-brush arrangement such as shown in Fig. 3 is used. The showing of Fig. 3 and its mode of utilization is more fully described in said co-pending application. In the commutator of Fig. 3 it will be noted that three

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of the segments are dimensioned each to subtend substantially $\frac{1}{11}$ of the circumference and the remaining four segments are dimensioned each to subtend substantially $\frac{1}{11}$ of the circumference. In the short segment group the outermost segments are interconnected. The remaining five segments of the commutator have individual connections to separate conductors in signaling cables 5, 6 or 7. In each vertical column of indicator units corresponding segments of their commutators are interconnected. Any desired number of horizontal rows of indicators may be provided. For example, as shown by the keys A to F inclusive in the keyset 8, selective means are provided for directing the effects of the indicator control signals into any one of six horizontal rows of indicators, rows D, E and F being assumed to be disposed above rows A, B, and C, although not shown.

Each of the cables 5, 6 and 7 is extended to digit-representing key strips in the keyset 8, there being a separate key-strip comprising eleven keys associated with each cable. The function of each key is to interconnect permutatively two of the six conductors in one of the cables in order to compose a 2-element signal for controlling the position at which a connected indicator is to be set. The method of control will be described hereinafter.

Only when posting new items in any of the indicators is it necessary to use the numerical key-strip keys in the keyset 8. Therefore, I have provided gang-relays 9, 10 and 11 which are to be operated when making postings from the keyset and are to maintain normally open-circuit conditions between the key-strips and the cables 5, 6 and 7 at other times. In these gang relays six individual connections are made corresponding with the six conductors of each cable. A seventh circuit closure is also provided for transmitting stepping pulses to any stepping magnet of a selected indicator.

Each horizontal row of indicators is conditioned for obtaining a read-out of their settings by means of a gang relay such as relays R_A, R_B, and R_C. The contact pairs on these relays interconnect conductors 12 and 13 when the relay operates, these conductors being connected respectively to inner-ring segments 14 and 15 of a commutator on a given indicator unit. Fig. 3 shows the commutator-and-brush arrangement now being described. Brushes 16 and 17 have diametrically opposed points of contact with the segments 15 and 16, so as to transfer their connections with the semi-circular inner-ring segments simultaneously when rotating with the indicator drum. These brushes, moreover, have contact leaves for engagement with the outer-ring segments 18 and so designed that brush 17 trails brush 16 by $\frac{1}{11}$ of the circumference in sweeping over segments 18.

The circuit arrangement and commutator-brush structure as described in the preceding paragraph is such that for each setting of an indicator unit its character display can be denoted by an exclusive choice of two conductors out of the six conductors in cable 5, for example, where these conductors are interconnected through to two segments 18 on which brushes 16 and 17 rest, and through conductors 12 and 13 which are interconnected by closure of relay R_C, for example. Since the cables 5, 6 and 7 have branches, as heretofore described, which interconnect corresponding segments 18 in all the indicator units of a given vertical column, it will be seen that in order to utilize a read-out signal as derived in the manner above described and to duplicate the posting of an item display on some other indicator unit it becomes necessary to complete the read-out signal circuit through the commutator-brush arrangement of the indicator unit which is to receive the posting, and to supply operating potential and a stepping control function of a cut-off relay, as will now be explained.

Each horizontal row of indicators is made subject to reception of a posting signal either as derived from the keyset 8, or as obtained from a read-out operation in respect to indicators of another horizontal row, the particular row wherein a posting is to be made being selected

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by operation of its gang relay P_A, P_B, or P_C. For each of the indicator units in a given horizontal row there are three pairs of make contacts 19, 20 and 21. The movable contacts of these pairs are connected respectively with bus conductors 22, 23 and 24. The front contacts of the same pairs are used to make connections thus, from a stepping magnet 4 to bus conductor 22, and from inner-ring commutator segments 14 and 15 and through relay contacts 20 and 21 respectively to bus conductors 23 and 24.

The potential source or battery 25 is grounded at one pole and at the other it has a plurality of feeder circuits. One of these circuits is extended to a circuit interrupter 27 which may, conventionally, be motor driven in any suitable manner, not shown. The battery 25 and circuit interrupter 27 in combination constitute a source of stepping pulses for any selected ones of the stepping magnets 4 of the indicator units. These pulses are carried through different branch circuits as closed selectively for operation of the posting means, depending upon the posting requirements and the source of the signals used to control the setting of an indicator.

Three alternative posting requirements are met as follows: (a) The information is initially set up on the key-strips of the keyset 8, the individual keys being labeled 0, 1, 2, . . . 9, and X. As briefly mentioned in the foregoing description, each of these keys when depressed causes a selected two of the six conductors of cables 5, 6 or 7 to be interconnected, provided that the associated gang relays 9, 10 and 11, or any of them, are operated. The item to be posted, as determined by fingering the keys, one in each key-strip, and the horizontal row selection as made by the depression of one of the row-selecting keys, lettered A through F, as shown furthest to the right in the keyset 8 and as headed "P" for "posting,"—these selection should be made before operating any of the gang relays 9, 10 and 11. The latter respond to the depression of individual start keys S, the contacts of which simply provide ground connections for the relay circuits where, on the other terminal of each relay, there is a connection to the ungrounded pole of the source 25. Then upon operation of the gang relays 9, 10 and 11, or any of them, the necessary conditions are established for pulsing selected indicators to selected display positions. This operation is further explained as follows: Individual conductors in cable 34 interconnect different row-selecting relays P_A, P_B, P_C, etc. with the lettered keys in column P of the keyset 8 where the connections are grounded for relay operation, the relays themselves having battery connections through their coils. The pulse generator 27 supplies pulses through contact 33 of any of the operated gang relays 9, 10 and 11 and thence through normally closed contacts of relays 28, 29, 30, or any of them, through current limiting resistors 26 to bus conductors 22, through closed contacts 19 of the selected relay of the P-group, and thence to the winding of selected ones of the stepping magnets 4 and to ground.

If the indicator to be made receptive to posting signals did not stand previously so as to show the same character display as called for by the new posting, then the stepping pulses will be effective in rotating the indicator drum as far as is necessary to establish a circuit closure through the cut-off relay 28, for example. For simplicity of description further explanation of the setting operation will be restricted to indicators in the column furthest to the left, these indicators displaying, possibly, hundreds digits of a number. If it should happen that the old setting of the indicator and the new posting of the same are in correspondence, then either there will be no steps to be taken by the stepping magnet 4 before the cut-off relay 28 operates, or else the indicator drum will be driven through a complete revolution and come to rest in position to retain the previous display, with which the new posting is found to correspond. In any case the new posting is arrived at, whatever is required for response to the set-up of the numeral keys of the keyset 8, by continuing the

application of stepping pulses until the two brushes 16 and 17 come into contact with the particular segments 18 which have been electrically interconnected through the closure of contacts of the selecting signal key and through conductors of cable 5 with which those particular segments are connected. This agreement between code signal conductor selections and resting points of the brushes 16 and 17 on segments 18 results in the completion of the cut-off circuit through bus conductor 23 and through the winding of relay 28 to source 25, where this circuit is traced in that direction from one of the brushes and in the opposite direction from the other of the brushes through conductor 13, contacts 21, conductor 24 and thence to ground. So when the desired setting of the indicator has been reached the stepping magnet 4 will cease to be supplied with pulses, its circuit being opened by the cut-off relay 28. The start key S can then be released, thus restoring the gang relay 9. In order to relieve the operator of the task of holding the start keys S depressed until completion of a stepping movement by the last of the indicators to arrive at its new posting, it is preferable to incorporate certain locking circuits into the system. These have not been shown in Fig. 1, but could be added thereto partly according to the showing of locking circuits for relays 31 and 39 in Fig. 2 and partly according to the locking circuit detail shown in Fig. 6. A more detailed explanation of locking circuit techniques will be found in a subsequent part of this specification.

The six conductors of any of the cables 5, 6 and 7 have a signal code significance which enables any of the eleven setting positions of the drums to be determined merely by permutational interconnection of two conductors through any one of the numeral keys of the different key-strips. It was explained in the above cited Cornwell-Bush application that there are several alternative patterns of characters that may be sequentially arrayed around the periphery of the drums, and corresponding alternatives in the composition of the code element designations as applied to the six conductors of the signaling cables 5, 6 and 7. Preferably these alternative patterns give the paired code elements for each display position an additive significance. This is shown, for example, in the following tabulation of resting points of the two brushes 16 and 17 on different segments 18 of the commutator in relation to the several display positions for different numerals and for the blank position called "X." This tabulation is in conformity with Fig. 7 of the cited Cornwell-Bush application. In Fig. 3 of the instant application, however, the commutator segments which are collectively referenced 18 are also referenced by numerals and X parenthetically enclosed, and in agreement with this tabulation:

Display	Segments Simultaneously Contacted By Brushes	
1	0	1
7	0	7
8	1	7
3	1	2
0	7	X
9	7	2
6	2	4
Blank	X	4
2	2	0
4	4	0
5	4	1

The three preceding paragraphs have been devoted to an explanation of how a posting requirement (a) under control of the keyset is taken care of. It is now in order to explain the alternative posting requirement (b).

An indicator unit representing a digit of any denominational order may be singly stepped to the blank position if desired. This may be done by depression of the "X" key, the proper row-selecting key in column P, and a single start key S corresponding to the denominational order of the indicator to be blanked. The operation would

then be according to the above given description relating to the posting of any desired display, which meets the posting requirement (a). Occasionally, however, all the indicator units of a selected horizontal row may need to be blanked in one operation. This operation I will designate as posting requirement (b) and will explain it as follows:

The winding of a blanking relay 32 has one terminal connected to battery and the other terminal may be grounded through a circuit leading to the key which is labeled "Blank," one contact of this key having a ground connection. There are two pairs of contacts a and b which are associated with each vertical row of indicators. Contacts a provide for the extension of the stepping pulses through the normally closed contacts of the cut-off relays 28, 29 and 30 to bus conductors 22 and thence to any of the stepping magnets 4 which are selected by operation of a given relay P. Contacts b of relay 32 when closed provide for the interconnection of the same two conductors in each of cables 5, 6 and 7 which are also interconnected by keys X in the key-strips. These two conductors are connected respectively with commutator segments (X) and (4) as shown in Fig. 3. It will be apparent, therefore, that by simply depressing the proper row-selecting key in column P, and then depressing the "Blank" key the necessary stepping pulses will be directed into the stepping magnets of all indicators of the selected horizontal row and when the indicators reach the blank position their brushes will contact simultaneously the segments (X) and (4) now interconnected through contacts b of relay 32. Hence relays 28, 29 and 30 will operate to terminate the stepping of magnets 4 so as to obtain the blanking of the selected indicators.

The third posting requirement (c) will now be explained. Here the function to be performed involves a read-out from any selected indicator unit and the use of the read-out signal thus obtained for controlling the posting of another indicator unit so that the same information may be simultaneously displayed, at least momentarily, in both indicators. Afterwards, if desired, the posting in the first indicator unit may be replaced by a new posting, or it may be blanked out as explained above.

The operating procedure for posting requirement (c) has already been explained in part, particularly with regard to the selection of one of the read-out relays RA, RB, etc. in accordance with the particular horizontal row from which it is desired to obtain the read-out signals. When one of the read-out relays is operated its several contact pairs are caused to short-circuit conductors 12 and 13 which are respectively connected to inner ring segments 14 and 15 (Figs. 3 and 7). This short-circuiting operation is the same as if a selected two of the signaling conductors in each of cables 5, 6 and 7 were to be short-circuited. The particular selection of conductors short-circuited in any case is determined by the resting points of brushes 16 and 17 on the outer ring segments 18, since these resting points are a function of the character display and are, therefore instrumental in composing the read-out signal which is appropriate to the display position of the indicator.

Let it be assumed that all the indications displayed by indicators in the bottom row A are to be transferred to row C. Then the keyset operator should depress key A in the key-strip headed "Read" and key C in the key-strip headed "P." Relays RA and PC will operate so as to prepare for the transfer of the displays, or, stated more accurately, for the setting of indicator units in row C to correspond with the displays of row A. In row A the bridging of the brush pairs composes the proper signal for causing the termination of stepping pulses which will be directed into the stepping magnets 4 for indicator units of row C, these magnets being selected by the closure of contacts on relay PC. Transmission of the pulse train, however, must await the operation of relay 31 under control of the key labeled "Transfer." Relay 31 has as

many contact pairs as there are indicator units in any horizontal row. Upon operation of relay 31, therefore, the pulse output from the interrupter 27 is fed simultaneously through the normally closed contacts of relays 28, 29 and 30 to conductors 22 and thence to each of the magnets 4 of row C, relay Pc having been operated. Although the setting operation step-by-step in respect to the several indicator units will be initiated simultaneously, the number of steps necessary to bring each indicator unit into position to make the desired display will vary. So the cut-off relays 28, 29 and 30 will operate at different times dependent upon the number of steps which the indicator drums of row C must take to display the same characters as are displayed in row A. The response in the transfer operation is similar to that which was explained above in describing a new posting operation from the keyset. The performance of posting requirement (c) differs from that of posting requirement (a) only in respect to the source of the posting control signals. After all of the indicator units have reached their desired settings the row-selecting keys and the transfer key will be released and the transferred postings will remain until supplanted by new postings.

The modification which uses 10-position indicator drums

This modification requires a minimum of explanation in view of the foregoing description of the system which uses the 11-position drums. Let it be assumed that Fig. 1 provides a proper showing of a suitable circuit arrangement, allowing for the omission of one of the six conductors in each of the signaling cables 5, 6 and 7, and allowing also for the elimination of keys X in the numerical key-strips. In other respects the circuit diagram is entirely suitable for control of ten-position indicators.

Since there is no blank position on a 10-position drum the key labeled "Blank" in the keyset 8 might be eliminated as having no useful purpose. If this key were re-labeled "0," however, its utility would be retained because contacts b of relay 32 could be wired to control the interconnection of two of the five signaling conductors in each of the cables 5, 6 and 7, where the pairs so selected would represent the proper code signal for setting all indicators to the "0" position simultaneously.

The above-cited Cornwell-Bush application disclosed several alternative 5-unit codes and correlated arrays of numerical character sequences that might be disposed around the peripheries of 10-position drums. I would prefer to follow the teachings of that application if a 10-position drum were to be adopted for carrying out my invention. Figs. 4 and 8 of the instant application show a suitable commutator-and-brush arrangement for use with a 5-unit code which would be serviceable in the remote control of 10-position indicators.

The modification which utilizes eleven conductors in the signaling channel for controlling 11-position drums

Fig. 2 of the instant application shows a circuit diagram which possesses sufficient detail for duly supporting the following explanation of the structure and mode of operation of this modification. Fig. 5 is also referred to for showing the use of a commutator having eleven outer ring segments 43 which are swept over by a single brush 35. This brush also rests continuously on an unbroken slip ring 36.

In the keyset 37 each of the keys labeled "0," "1" . . . "9" and "X" has sole control of an individual signaling circuit and when depressed it applies ground potential thereto. The signaling conductors in cable 38 lead from said keys to contacts of a gang relay 39 and thence to a bus cable which comprises eleven individual conductors that are branched to commutator segments 18 in different indicator units 40A, 40B, 40C, as shown in Fig. 5.

A full panel of indicator units 40 may comprise as many horizontal and vertical rows of such units as are needed to display a desired tabulation of statistical data

or other information. Only one vertical row is shown in Fig. 2, but, practically, the information to be displayed may comprise a number of categories of items concurrently showing in each horizontal row, with, possibly, a plural digit number representing each item.

The read relays RA, RB, RC, etc. (Fig. 2) are like those of Fig. 1, which have the same reference letters. In this case, however, one contact of each pair is grounded, and the other contact is connected through conductor 42 to the slip-ring 36 (Fig. 5). The read relays have control circuits extending from battery as directly connected to their windings and thence through bus conductors 34 to keys A, B . . . F labeled "Read" in the keyset 37. Posting relays PA, PB, PC, have similar control circuits extending to keys of the keystrip headed "P." These posting relays have two pairs of contacts for each denominational order of indicators in a given horizontal row.

The contacts of the posting relays PA, PB, etc. comprise only two pairs per vertical row of indicator units. One pair is used to interconnect bus conductor 22 and the stepping magnet 4 which is selected for a posting operation. The other pair interconnects bus conductor 23 and a conductor 42 leading to the slip ring 36 of the unit which is to respond to posting signals.

The pulse generator 27 is fed from source 25. The stepping pulses may then be transmitted to normally closed contacts b of cut-off relay 28 via either of two paths. One path is effective when posting an item of keyset origin, relay 39 being operated and its pulse feeder contacts b closed. The other path is effective when transferring an item from one to another indicator. Then relay 31 is operated by the "Transfer" key (so labeled) and the stepping pulses are fed through its contacts b to the normally closed contacts of relay 28.

The stepping pulses are applied through bus conductor 22 and through closed contacts of a selected posting relay P to the stepping magnet 4 for stepwise rotation of the selected indicator unit.

Assuming that the indicator display is to be changed by a posting operation either in response to control by the depression of a numerical key in the keyset or by a read-out from another indicator unit, the stepping pulses will flow from the time they are first applied by operation of relay 39 or relay 31 and will be terminated only upon operation of cut-off relay 28.

Relay 28 has a control circuit which may be traced from potential source 25 through bus conductor 23 to contacts of an operated P-relay, through conductor 42, slip-ring 36, brush 35, one of the segments 43, a conductor in cable 41, and thence via one of two alternative paths to ground, but only after the brush 35 has scanned its associated segments to find one that has been grounded. One of the grounding paths is provided by grounding a key in the keystrip which corresponds to the number (or X for blank) to be posted. The other grounding path is obtained when a read-out relay R is operated. In this case there is only one grounded segment 43 in the commutator of the indicator from which the read-out signal is to be derived, because the brush 35 which is grounded through contacts of the R-relay and conductor 42 stands on one segment 43 only, and gives read-out significance to the grounding of a particular conductor in the signaling cable 41. Thus for a transfer operation the brush of the indicator to be posted must find that grounded signal conductor during the stepping process. When it does, the circuit of the cut-off relay will be energized and the stepping pulses will cease. The display now made by the newly posted indicator unit will then be in agreement with that of the unit having a grounded brush.

It was mentioned above that locking circuits might be provided for holding certain relays operated without requiring more than a momentary depression of the keyset keys. Such locking circuits are illustrated in Figs. 2 and 6. Relay 39 may be considered to have the same

function as any of relays 9, 10 and 11 in Fig. 1. Contact pairs *a*, *b*, *b'*, and *c*, have, however, been added. Relay 39 may be energized by momentary depression of start key *S* and will thereafter be locked up through its contacts *a* and the normally closed contacts *a* of relay 28. The function and operation of relay 28 has already been described. Relay 39 is unlocked upon operating relay 28, whereat the ground connection through contacts *a* of relay 28 is broken.

In like manner the relay 10, having supplemental contact *a*, *b* and *c*, as shown in Fig. 6, will be locked upon its selection, and automatically unlocked when a posting cycle has been completed. The locking circuit includes the normally closed grounding contacts *a* of relay 29. It will be recalled that after any indicator drum has been stepped to a desired new position its brush-and-commutator arrangement will be conditioned to supply operating potential to either of relays 28, 29 or 30.

In the circuit arrangement of Fig. 6 the row-selecting keys "Read" and "P" do not have the direct ground connections that are shown in Figs. 1 and 2, but instead, their common ground lead is carried to ground through parallel circuits which include contacts *c* of relays 39 (or 9), 10, 31, etc. By this circuit arrangement the operation of relays *R* and *P* (having different subscripts for each horizontal row) is deferred until one of the start keys *S* or *T* is operated to select and operate a relay 9, 10, 11, 31 or 32. Furthermore, after any of the latter relays have been locked up, they will hold the selected *R* and *P* relays operated until the indicator setting steps have been completed. The complete restoration to normal of all relays will thus follow the final one of the steps taken by the indicator drum for which the greatest number of stepping pulses is required.

When it is desired to change the settings of all the indicators of a selected horizontal row to agree with corresponding indicators of another selected horizontal row, such operation can be performed in the manner above described, that is, by use of a row-selecting key "P" to designate the source of the information. Then key *T* (for transfer) will be momentarily depressed to operate relay 31. In Figs. 2 and 6 this relay is shown to be self-locking. In Fig. 6, however, a supplementary holding circuit for the row-selecting relays is shown to be under control of relay 31. A similar holding circuit could be operatively associated with relay 32 (Fig. 1) which is used for blanking.

With regard to the self-locking feature of relay 31 it will be noted that its own locking contacts *a* when closed supply ground potential to one side of the winding in relay 31, the grounding circuit being branched through several circuit breaking contacts, such as contacts *c* of relays 28 and 29, which must be concurrently opened in order to unlock this relay. The purpose of this arrangement is to insure that no relays will be released before all the indicators have reached their desired new settings. Each of the relays 28, 29 and 30 operates as soon as the indicator with which it is associated arrives at its new setting. But the row-selecting relays must be held operated until the final step is taken by all of the concurrently operated indicators. When the row-selecting relays release, the circuit-opening relays 28, 29 and 30 will be de-energized. Then the entire system will be restored to normal.

It may be assumed for purposes of illustration that conventional mechanical interlock-release latches are built into the key-strips of the keysets 8 and 37 and apply both to the numerical keys and the row-selecting keys but are not associated with the start keys *S*, nor with the transfer key *T*, nor with the blanking key. The interlock mechanism may be unlatched, if desired by means of a special key (not shown) which, if found on a conventional adding machine, would be known as an "error" key.

Summary

The foregoing description and the accompanying drawings are believed to be sufficient to fully disclose the nature of my invention and several illustrative variants of its embodiment. Essentially the invention is directed to novel means for remotely controlling indicator drums of the character described and for causing them individually to take up new character display positions in response to code signals as transmitted over selected signaling conductors. The permutative selection of two out of six, or two out of five signaling conductors for terminating a stepping operation is disclaimed as a novel feature of this invention when segregated apart from other aspects of the disclosure. This is true for the reason that similar techniques were disclosed in the above cited Cornwell-Bush application. In that application, however, no means were shown for transferring a character display from one to another indicator unit by means of an automatic read-out.

The several illustrative embodiments of my invention as hereinabove described may suggest other embodiments which would nevertheless come within the scope of the invention and might, under the teachings of this disclosure, be constructed by those skilled in the art. The scope of the invention may not, therefore, be limited to the precise constructions herein shown, but only according to the breadth of definition which appears in the claims.

I claim:

1. In an indicator panel having vertical and horizontal rows of settable drum-type indicators, where each indicator unit is equipped with a commutator-and-brush assembly the brushes of which rotate with their respective drums, apparatus for causing all the indicators in a selected horizontal row to be concurrently re-set so that each indicator unit will assume a display position corresponding to that of another indicator unit located in a different selected horizontal row, but in the same vertical row, said apparatus comprising step-by-step driving mechanism operatively associated with the drum of each indicator unit, a pulsing circuit for selectively activating said driving mechanisms, said pulsing circuit having branches individual to each vertical row of indicators and being selectively connectable to said mechanisms in any horizontal row the indicators of which are to be re-set, means for causing such connection of the pulsing circuit, means for breaking said circuit branches independently of one another and at different times, and a coincidence circuit control means having a plurality of conductors each of which commonly interconnects commutator segments of corresponding arcuate position in different indicator units of the same vertical row, the number of said conductors being less than the number of display positions of each of said indicator units and said coincidence control circuit being responsive to paths established through selected paths of permuted ones of said conductors, this control means including a selector relay individual to each horizontal row for determining a particular row in reference to which a read-out of display positions of all its indicator units is wanted, the same control means also including circuit connects through brushes and the particular commutator segments on which the brushes rest, and being operative to detect each coincidence of display positions of selected indicator units in the same vertical row and thereat to effect the operation of said circuit-breaking means so that the stepping of the indicators to be re-set shall be terminated.

2. The combination according to claim 1 and including a separate source of input signals having suitable circuit connections to the conductors of said coincidence circuit control means, and means operatively associated with said signal source for setting up code signaling conditions thereat and for initiating the transmission of pulses through selected branches of said pulsing circuit, thereby

to cause the simultaneous re-setting of all the indicators in a selected horizontal row.

3. The combination according to claim 2 and including locking circuit means and automatic release means for the locking circuits therein, whereby an indicator setting operation may be automatically carried through to completion, to be followed by restoration of the entire apparatus to normal.

4. A data posting and transfer system comprising a plurality of character display indicators of the type having electromagnetically stepwise settable indicator drums, said drums being arranged in a plurality of horizontal and vertical rows in a display panel, a commutator-and-brush assembly operatively associated with each indicator, the brush portion whereof is rotatable in fixed relation to its respective drum, multiconductor channels individual to each vertical row of indicators and providing mutual interconnection between corresponding commutator segments of said assemblies therein, the number of conductors in each of said multiconductor channels being less than the number of display positions of each indicator, step-by-step driving mechanism operatively associated with each drum, a pulsing circuit for selectively activating said driving mechanisms, selective means for conditioning said pulsing circuit to act upon one or more of said driving means thereby to effect a desired re-setting operation, a coincidence detector circuit device arranged and adapted to utilize pairs of permuted ones of the conductors in each of said multiconductor channels for controlling said pulsing circuit in such manner as to effect the arrest of said driving mechanisms whenever desired new character displays have been obtained, an input signalling device suitably connectable to said multiconductor channels, and selective relay means operatively associated with the components herein defined and effective to cause any desired re-setting operation to be performed upon one or a plurality of indicators in a selected horizontal row and in accordance with the functioning of said coincidence detector device, the latter being selectively operable either to compare the displays of each indicator as successively reached in a setting operation with a corresponding display concurrently made by another indicator in the same vertical column, or to effect new settings of selected indicators of a selected horizontal row under control of said input signaling device.

5. A system according to claim 4 and further characterized in that said input signalling device is of the type having key-strips individual to each vertical row of indicators, posting keys and associated control circuits for selecting a desired horizontal row of indicators to be re-set, keys and associated control circuits for selecting a desired horizontal row of indicators from which to obtain a read-out of their displays, and start-keys for initiating a posting operation.

6. A system according to claim 4 and further characterized in that said input signalling device includes relay control keys individual to different alternative modes of

performance of the posting operations, and circuits controlled thereby either for selecting the vertical row or rows of indicators in which postings are to be made, or to cause the blanking of all indicator settings in a selected horizontal row or to simultaneously re-set all the indicators in a selected horizontal row in accordance with a read-out of display positions of corresponding indicators in another selected horizontal row.

7. In combination with a plurality of stepwise settable character display indicators which are arrayed in a row, a pulse-operated actuator individual to each indicator for setting the same, an energy source for generating pulses to energize said actuators, a coincidence detector circuit including a commutator-and-brush assembly operatively associated with each indicator and a multiconductor channel having individual conductors which interconnect corresponding commutator segments of said assemblies, the number of conductors in said multiconductor channel being less than the number of display positions of the indicator, said circuit being responsive to paths established through selected pairs of permuted ones of said individual conductors and having relay means operable in response to a closed circuit condition through selected brushes in said assemblies whereby setting movements supplied by any of said actuators are suitably terminated for causing a selected indicator to stand in a desired display position, and selective means for causing said detector circuit to compare the settings of any two indicators of which one remains stationary while the other is being actuated, thereby to effect the operation of said relay means when the displays of the two indicators have been brought into agreement.

8. The combination according to claim 7 wherein said commutator-and-brush assemblies and said multiconductor channel are suitably constituted for utilizing permutative code signals and for directing any one of said signals serially through two brushes in each of the selected assemblies when coincidence detection is obtained.

9. The combination according to claim 8 wherein said coincidence detector circuit is arranged and adapted to distinguish between different permutative selections of two out of six available paths in said multiconductor channel for transmission of said signal.

10. The combination according to claim 8 wherein said coincidence detector circuit is arranged and adapted to distinguish between different permutative selections of two out of five available paths in said multiconductor channel for transmission of said signal.

References Cited in the file of this patent

UNITED STATES PATENTS

2,096,954	Bellamy et al.	Oct. 26, 1937
2,246,449	Marshall et al.	June 17, 1941
2,288,645	Quinby	July 7, 1942
2,410,540	Wight et al.	Nov. 5, 1956