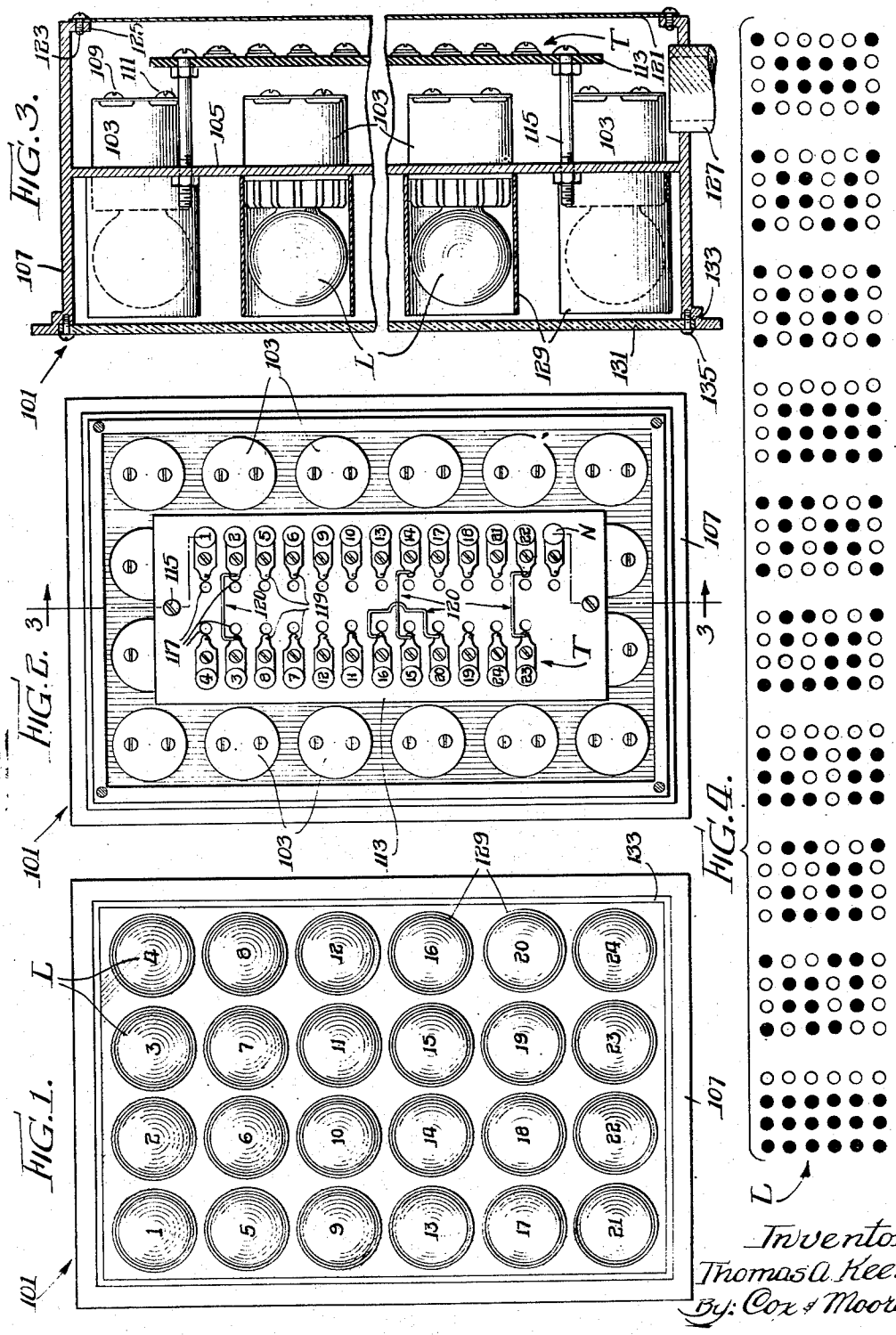
June 4, 1940. T. A. KEEN 2,203,630

ANNUNCIATOR

Filed Oct. 12, 1936 3 Sheets-Sheet 1



Inventor
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June 4, 1940. T. A. KEEN 2,203,630

ANNUNCIATOR

Filed Oct. 12, 1936 3 Sheets-Sheet 2

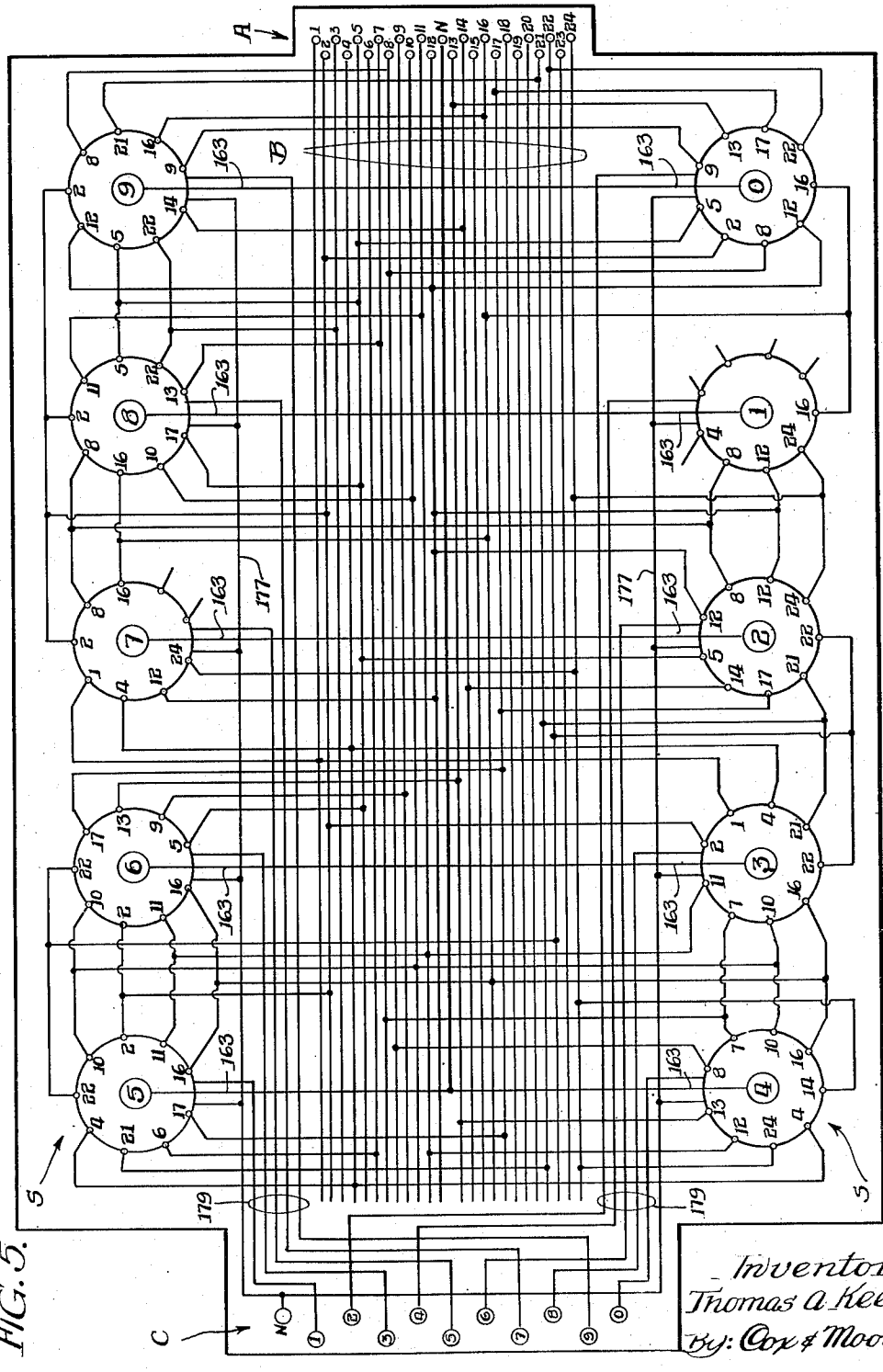


FIG. 5.

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ANNUNCIATOR

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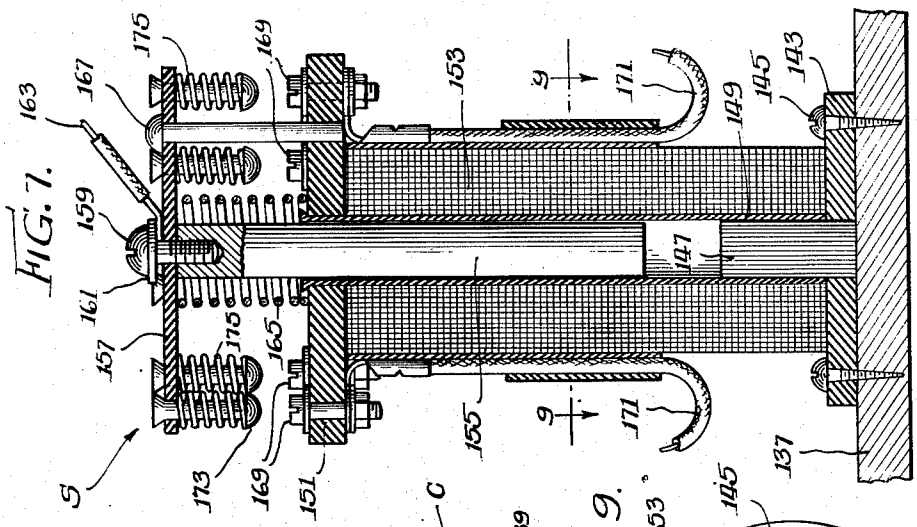


FIG. 7.

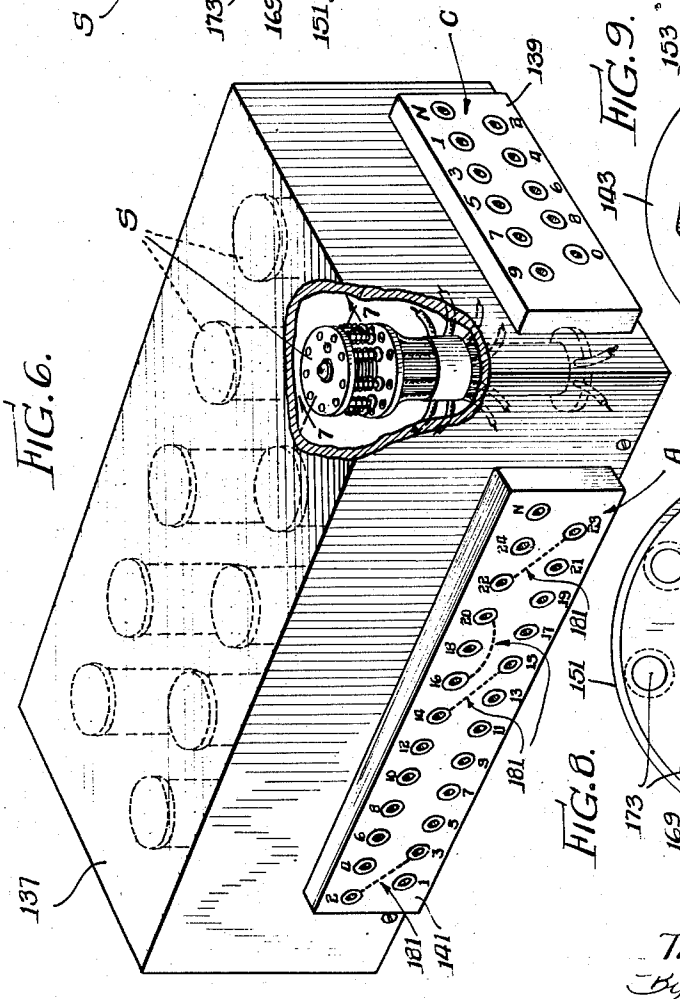


FIG. 6.

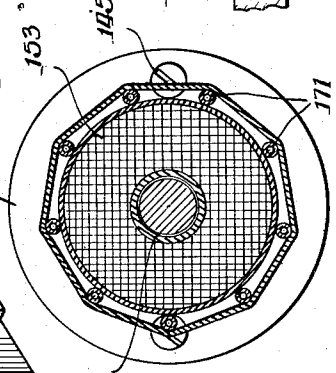


FIG. 9.

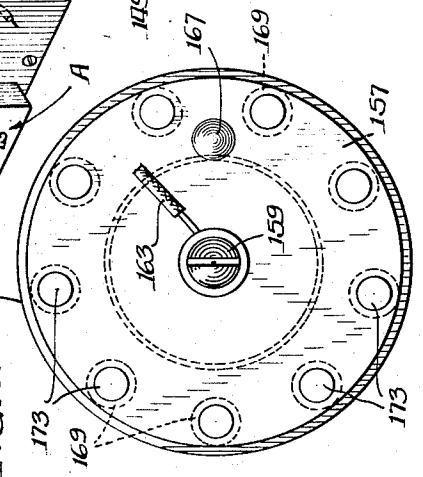


FIG. 8.

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UNITED STATES PATENT OFFICE

2,203,630

ANNUNCIATOR

Thomas A. Keen, San Mateo, Calif., assignor to Hannah M. Smith, River Forest, Ill.

Application October 12, 1936, Serial No. 105,222

3 Claims. (Cl. 177—349)

My invention relates in general to electrical switching systems and has more particular reference to an annunciator or signal device, more particularly a device for displaying any selected character by energizing appropriate lamps arranged in a panel.

An important object of the present invention resides in utilizing a minimum of lamp controlling circuits to energize selected lamps in a bank comprising several rows of lamps in order to outline a desired character on the lamp; a further object being to arrange a pair of adjacent lamps in said lamp bank for simultaneously operating through a single control circuit in order to minimize the number of control circuits required to produce desired characters.

Another important object is to provide means whereby numerical characters comprising all of the digits of the Arabic system of numerals may be displayed in readily interdistinguishable fashion on an annunciator comprising rows of lamps adapted for selective operation to outline the digits; a further object being to utilize a minimum number of control circuits for energizing the various lamps required in outlining the digits.

Another important object is to provide an improved circuit switching means whereby simultaneously to energize a plurality of circuits; a further object being to provide an improved multiple circuit control switch for remote control operation.

Another important object is to provide an improved solenoid switch for controlling a plurality of electrical circuits.

Another important object is to provide a neat and exact switch box containing a plurality of circuit controlling switches including the provision of simplified electrical connections within said switch box whereby the same may be utilized in controlling a bank of lamps to selectively energize desired lamps in said bank for the purpose of outlining a desired character in said bank.

Another important object is to provide an improved mounting for lamps forming a bank of selectively operable lamps; a further object being to provide an attractive casing adapted to function as an annunciator, the casing forming a mounting for the lamps arranged in spaced rows including panel means to facilitate the interconnection of the lamps in lamp actuating circuits.

Another important object is to provide an improved method of selectively energizing lamps to outline any desired character of the Arabic system of numerals; a further object being to provide for the production of any digit of the Arabic system in utilizing a minimum number of energizing circuits.

These and numerous other objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood from the following description which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

Figure 1 is a front view of an annunciator panel embodying my present invention;

Figure 2 is a plan view of the back of the device shown in Figure 1;

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 2;

Figure 4 is a diagrammatic view of the lamp bank illustrating the manner of selectively energizing the lamps thereof in the production of the digits of the Arabic numeral system;

Figure 5 is a schematic diagram of electrical connections and control switches utilized in the selective operation of the lamp panel shown in Figure 1 for the production of the digits of the Arabic numeral system in accordance with my present invention;

Figure 6 is a perspective view of a switch box embodying the connection shown in Figure 5;

Figure 7 is a sectional view taken substantially along the line 7—7 in Figure 6 to illustrate the details of a control switch embodying my present invention;

Figure 8 is a top plan view of the switch shown in Figure 7; and

Figures 9 is a sectional view taken along the lines 9—9 in Figure 7.

To illustrate my invention, I have shown on the drawings an annunciator system comprising a lamp bank 101 embodying a plurality of lamps arranged for selective operation in order to outline any one of the digits comprising the Arabic numeral system, although it will be apparent that my present invention is not necessarily restricted to the production of the particular characters mentioned. On the contrary, many features of the present invention may be utilized for the selective reproduction of characters of any sort, although the devices herein illustrated and described are particularly well adapted for the production of the numerical characters of the Arabic system.

In the illustrated embodiment the lamp bank 101 comprises twenty-four lamps L, said lamps being individually identified by the numerals 1 to 24. The lamps L are arranged in six rows

with four lamps in each row, since this arrangement permits all of the characters of the Arabic numeral system, and of course, many other characters to be outlined by energizing selected lamps in the bank. The lamps L are mounted each in a socket 103 which in turn is secured in a panel 105 forming a preferably integral part of a box 107, comprising preferably integral side and end walls, the top and bottom of the box 107 being open and the panel 105 being disposed in the box substantially midway between the top and bottom thereof. The bottom of the box may be closed in any suitable or preferred fashion. The side and end walls of the box and the panel 105 may be formed conveniently as a casing and I prefer to form the box and panel of aluminum in order to minimize weight. The lamp bases 103 may be of any suitable or preferred form and may be anchored in the partition 105 with the lamp receiving sockets thereof facing toward the upper or front open end of the box, the back of the bases 103 extending on the side of the partition 105 facing the bottom or back of the box.

The lamps L also may be of any suitable or preferred form and when mounted in the bases 103 make electrical contact through connections in said bases with terminals 109 and 111; there being a terminal 109 and a terminal 111 on each of the bases 103. The box also contains a connection panel 113 preferably supported on the panel 105 by means of support stems 115, which carry the panel 113 in the box adjacent the open back or bottom thereof so that the panel is readily accessible. The panel 113 carries a plurality of terminals T, there being twenty-four terminals corresponding each with a lamp L, said terminals being identified individually by numerals 1 to 24. There is an additional neutral terminal identified by the letter n.

The terminal 109 of each base 103 is connected electrically by means of a suitable conductor with one of the numerically identified terminals, while the terminals 111 of all of the bases 103 are electrically connected by means of a suitable conductor with the neutral terminal N. The conductors which thus interconnect the terminals of the bases with the terminals T preferably penetrate through openings 117 formed in the panel 113 and are connected on lugs 119 forming portions of the terminals T extending adjacent the openings 117. The back of the box 107 may be normally closed in any suitable fashion in order to protect the terminal panel 113 and I prefer to utilize a preferably sheet metal plate 121 secured at its edges by set screws 125 or other suitable fastening devices upon flanges 125 formed at the marginal edges of the box. The side walls of the box also may be formed with an opening or openings in which may be set suitable conduit means 127 for leading, from the box, conductors for interconnecting the terminals T in electrical circuits for the controlled operation of the lamps L from a point remote from the lamp bank 101.

Each of the bases 103 preferably carries a cylindrical shield 129 in position surrounding the lamp supported in the socket in order to contain and direct the rays of the lamp in a single direction through the open top or front of the box. The edges of the box walls defining the open front are preferably formed to receive and support a front closure panel 131 of translucent material, such as ground glass, for concealing the lamps L from view so that the characters to be produced in the lamp bank may become apparent on the screen 131 only when the appropriate lamps L are energized, said characters comprising spots of light produced upon the screen 131 in position to outline the character produced. The screen 131 may be secured on the box 107 in any suitable or preferred manner, the screen preferably being seated at its edges in a groove 133 formed in the edges of the box and held in place by means of screws 135 or other suitable fastening elements.

As shown in Figure 4 of the drawings, the twenty-four lamps L may be selectively energized to outline on the screen 131 any of the numerals of the Arabic system. The Arabic numeral one, for example, may be produced by energizing any one of the four vertical rows of lamps in the bank 101, but I prefer, for reasons hereinafter set forth, to energize either the lefthand or the righthand vertical row of lamps in the arrangement shown in Figure 1 and it is preferable to utilize the righthand row comprising the lamps L4, 8, 12, 16, 20, 24 in the arrangement shown in Figure 1. In similar fashion the Arabic numeral two may be outlined by energizing the lamps L2, 3, 5, 8, 12, 14, 15, 17, 21, 22, 23, 24.

The Arabic numeral three may be outlined by energizing the lamps L1, 2, 3, 4, 7, 10, 11, 16, 20, 21, 22, and 23.

The Arabic numeral four may be outlined by energizing the lamps L4, 7, 8, 10, 12, 13, 14, 15, 16, 20, 24.

The Arabic numeral five may be outlined by energizing the lamps L2 3, 4, 6, 10, 11, 16, 20, 21, 22, and 23.

The Arabic numeral six may be outlined by energizing the lamps L2, 3, 5, 9, 10, 11, 13, 16, 17, 20, 22 and 23.

The Arabic numeral seven may be outlined by energizing the lamps L1, 2, 3, 4, 8, 12, 16, 20, and 24.

The Arabic numeral eight may be outlined by energizing the lamps L2, 3, 5, 8, 10, 11, 13, 16, 17, 20, 22 and 23.

The Arabic numeral nine may be outlined by energizing the lamps L2 3, 5, 8, 9, 12, 14, 15, 16, 20, 21, 22 and 23.

The Arabic numeral zero may be outlined by energizing the lamps L2 3, 5, 8, 9, 12, 13, 16, 17, 20, 22, and 23.

Obviously many characters can be outlined by energizing selected lamps to produce the desired pattern on the screen 131 and my present invention is of course, not restricted to the production of only Arabic numerals. It will be noted, however, that in producing the Arabic numerals by energizing the specified lamps that certain of the lamps when operated to produce the characters operate together regardless of the character involved. For example, the lamp L2 is never energized in the production of the characters shown in Figure 4 unless the lamp L3 is also energized, and vice versa. For instance the lamps L2 and L3 are energized together in the production of the numerals 2, 3, 5, 6, 7, 8, 9, and 0, said lamps being inactive during the production of the numerals 1 and 4. Likewise, the lamps L22 and L23 are energized together in the production of numerals 2, 3, 5, 6, 8, 9, and 0, and both lamps remain inactive when the numerals 1, 4, and 7 are being reproduced. In like fashion, lamps L14 and L15 are utilized together in producing the numerals 2, 4, and 9 while both said lamps remain inactive when the other numerals are being produced. It will be noted, also, that the

lamps L16 and L20 are energized simultaneously in the production of numerals 1, 3, 4, 5, 6, 7, 8, 9, and 0, said lamps both remaining inactive when the numeral 2 is being reproduced.

I take advantage of the foregoing circumstances to reduce the number of lamp controlling circuits required to reproduce any one of the numeral sets on the screen 31 and although all of the numerals except 1 and 7 require more than nine lamps to be energized in reproducing the same on the screen 31, I am able to produce all of the numerals by utilizing only nine lamp controlling circuits.

I accomplish this simplification by interconnecting the lamp pairs L2—3, L14—15, L16—20, and L22—23 for simultaneous operation, the connection being preferably accomplished on the panel 13 by interconnecting the corresponding lamp terminals T2—3, T14—15, T16—20, and T22—23. This, of course, may be accomplished by suitable jumpers 20 interconnecting the appropriate terminals. With such an arrangement only twenty conductors and a neutral conductor need be connected to the appropriate terminals on the panel 13 to energize all of the twenty-four lamps comprising the bank 101. It will be noted, however, that the lamps L18 and L19 are not required in the production of any of the character sets illustrated in Figure 4. Consequently, when using the lamp bank in reproducing the Arabic numerals, the lamps L18 and L19 may be omitted entirely and no provision need be made for energizing the same. Consequently, but nineteen conductors, including the neutral conductor, need be required for making the connections on the panel 13. I have, nevertheless, illustrated the lamps L18 and L19 and their corresponding terminals T18 and T18 in assembly since these lamps may be needed when the lamp bank is used in producing other characters than the Arabic numerals illustrated in Figure 4. In fact, the lamp L19 would be required if it were desired to reproduce the letter "Q" on the lamp bank by energizing the lamps L2, 3, 5, 8, 12, 13, 16, 17, 20, 22, and 23 together with the lamps L19 and 24. Likewise the lamp L18 might be required in utilizing the lamp bank for the production of the letter "K" by energizing the lamps L1, 4, 5, 7, 9, 10, 13, 17, 18, 21, 23, and 24.

In order to selectively energize the lamps required in reproducing the desired characters, I have provided improved switching means adapted to be electrically connected with the terminals for the purpose of selectively connecting the lamps with a suitable source of electrical power for energizing the same. Of course, any suitable switching arrangement may be employed but I have shown on the drawings switching means of simple and rugged construction adapted to provide satisfactory, failure-free service over long periods of operation. In the illustrated embodiment, the switching device comprises a plurality of individual circuit controlling switches S, a separate switch S being provided for the control of the lamps in producing each character.

If alphabetical characters are to be reproduced, it will of course be necessary to provide a separate switch S for each alphabetical character and any additional characters, such as the ampersand, which it may be desired to reproduce in conjunction with the alphabetical characters. In the present embodiment, however, I have shown ten switches S, the same being the number required in reproducing the ten numerical characters shown in Figure 4. Each of the switches S is adapted, in the illustrated embodiment, to control nine circuits, the same being the maximum number of lamp-energizing circuits required in producing the numeral sets shown in Figure 4 as heretofore mentioned. It is obvious, however, that the switches S may be arranged to control any desired number of circuits. The switches S may be conveniently arranged in a switch box or container 137, preferably comprising a rectangular housing of sheet metal on which is or may be provided at one end thereof a terminal block 139 carrying connecting terminals C which, in the illustrated embodiment, are eleven in number, identified for convenience by the numerals 1–9, 0 and the letter n. Alongside of the switch box 137 is or may be arranged another terminal block 141 containing, in the illustrated embodiment, twenty-five conductor-attaching terminals, which for convenience are identified by the numerals 1–24 and the letter n.

As shown in Figure 7, each of the control switches S comprises a frame having a base 142 adapted for attachment on the bottom of the box 137 by means of the fastening screws 145 or other suitable fastening means. The frame 143 carries an upstanding pin 147 centrally thereof on which is mounted a sleeve element 149 extending upwardly of the pin and carrying a plate 151 of insulating material. Means 153 comprising the operating coil of a solenoid is arranged about the sleeve 149 between the base plate 143 and the plate 145, the solenoid coils, of course, being properly insulated from the frame 143 and sleeve 149.

Within the sleeve 149 is mounted for axially shiftable movement therein a stem 155 adapted to form the armature of the solenoid 153. This stem has an end abutting the end of the pin 147 within the sleeve 149, the other end of the stem 155 extending outwardly of the upper end of the sleeve in position to carry a plate 157 preferably formed of electrical conducting material. The plate 157 is secured to the end of the stem 155 by means of a screw 159 which also serves, by means of a washer 161, to electrically connect a conductor 163 with the plate 157. Means is provided for normally urging the stem 155 and the plate 157 in a direction away from the insulating element 151. Said stem urging means preferably comprises a helical spring 165. Movement of the plate 157 away from the insulating plate 151 is limited by means of the stop pin 167 which is mounted at one end in the insulating plate 151 and extends through an opening into the plate 157, said stop pin 167 having a head adapted to engage the upper side of the plate 157 and limit its outward movement away from the plate under the influence of the spring 165. The insulating plate 151 carries a plurality of switch contacts 169 of any suitable or preferred form and having contacting portions supported on the surface of the plate 151 facing toward the conducting plate 157. In the illustrated embodiment, I have shown nine switch contacts 169, the same corresponding with the maximum number of lamp energizing circuits required in producing the numerical characters illustrated in Figure 4 as heretofore mentioned. Each of these contacts 169 is provided with a suitable electrical conductor 171 by means of which the same may be connected for controlling the operation of one of the lamps L.

The peripheral portions of the conducting plate 157 extend opposite the switch contacts 169 which are preferably arranged circularly and in spaced-

apart relationship around the peripheral edges of the plate 155. The plate 157 carries a plurality of shiftable switch contacts 173 arranged circularly in spaced-apart relationship around the periphery of the plate 157 in position such that each of said contacts 173 registers with a corresponding contact 169. In normal condition, as when the solenoid 153 is in de-energized condition, the spring 165 will maintain the contacts 173 out of engagement with the contacts 169. As soon as the solenoid 153 is energized, however, the stem 155 will be drawn downwardly and into the solenoid against the tension of the spring 165 so that the several shiftable contacts 173 may be brought into engagement with the corresponding contacts 169. Each of the contacts 173 is electrically connected with the plate 157 and hence with the conductor 163 which functions as a neutral conductor commonly connected with all of the contacts 173. Each of the contacts 173 comprises a stud axially shiftable in an opening in the plate 157 and having spring means 175 normally urging the stud in a direction toward the corresponding contacts 169 so that when the solenoid 153 is energized and the plate 157 is drawn toward the plate 151, the elements 173 upon engaging the switch contacts 169 may yield and move axially into the plate 157 under the tension of the spring 175. The contacts 173 are thus yieldingly urged upon the contacts 169 by means of the springs 175 whenever the solenoid is actuated.

One end of the solenoids of the several switches S is connected by means of a suitable conductor means 177 with the neutral conductor terminal C*n* on the terminal block 139. The other end of each of the solenoids of the several switches S is connected with one of the numerically identified conductor terminals C by means of the conductors 179, the switch solenoids thus being each connectible in a separate operating circuit, each switch solenoid being connected to its corresponding numerically identified connecting terminal C. The neutral terminal C*n* may be connected to one side, by means of a suitable conductor, to a suitable source of electrical power for the operation of the switches S, and the numerically identified terminals C may each be connected through an individual control switch and suitable conductor means with the other side of said source of operating power whereby any of the solenoid switches S may be closed by operating the corresponding control switch. The neutral or common conductors 163 of the several solenoid switches S are or may be interconnected and connected with the neutral terminal A*n* on the panel block 141 while the conductors 171 which are connected with the stationary switch contacts 169 may be interconnected in any suitable fashion with the numerically identified terminals A so that upon energizing any one of the solenoid switches S, all of the numerically identified terminals A, which are connected with the contacts 169 of the solenoid switch, may be electrically connected with the neutral terminal A*n* upon the closure of the solenoid switch contacts 173 and 169.

Numerically identified contacts A may be connected by means of suitable conductors forming a cable with the corresponding numerically identified terminals of the lamp bank 101. The terminals T*n* and A*n* may be connected with the opposite sides of a suitable power source for energizing the lamps so that upon closure of a solenoid switch a selected number of the lamps L in the bank may be energized through the corresponding circuits completed by the closure of the solenoid switch; and thus by connecting the terminals 169 of each of the switches S with the appropriate terminals A, each of the switches S may be made to control the operation of a selected series of lamps L.

As heretofore pointed out, I may interconnect certain of the numerically identified terminals T by means of the jumpers 120 so that but one conductor need extend between an appropriate numerically identified terminal A of the block 141 and a corresponding numerically identified terminal T on the lamp bank panel 113 in order to energize both of the jumper connected lamps. It is, however, entirely feasible to omit the jumper 120 and to interconnect the lamp circuits on the panel 141 by joining appropriate terminals by means of jumpers as indicated in dotted lines at 181 in Figure 6.

In the illustrated embodiment, the contacts 169 of the several switches S are interconnected with the numerically identified terminals A of the terminal block 141 so that each of the switches S control circuits for energizing the lamps L in the manner indicated in Figure 4 to produce the numerals of the Arabic system. Interconnection is preferably accomplished in accordance with the schematic diagram of connections forming Figure 5 of the drawings and it will be noted that a plurality of bus conductors B are provided within the cabinet and connected each with a terminal A. These bus conductors B are numerically identified with the numerals 1–24 to correspond with the numerically identified terminals A with which the same are connected. One of the bus conductors B is identified by the letter n. Since this neutral conductor is connected with the neutral terminal A*n*, in making the connections illustrated in Figure 5 each of the conductors 163 of the several solenoid switches is connected with the neutral bus conductor B*n*.

The switch contacts 169 of the solenoid switch S*o* are connected with the conductors B2, 5, 8, 9, 12, 13, 16, 17, and 22 and hence may be connected through the corresponding numerically identified terminals A, and hence may be connected through the corresponding numerically identified lamps so that the lamps necessary in reproducing the Arabic numeral zero may be placed in operation when the solenoid switch S*o* is closed.

In like fashion the terminals of the solenoid switches S2, 3, 4, 5, 6, 8, and 9 are connected respectively with the bus terminals B as follows:

Switch	Terminal connections
B–2	A–2, 5, 8, 12, 14, 17, 21, 22, 24
B–3	A–1, 2, 4, 7, 10, 11, 16, 21, 22
B–4	A–4, 7, 8, 10, 12, 13, 14, 16, 24
B–5	A–2, 4, 6, 10, 11, 16, 21, 22
B–6	A–2, 5, 9, 10, 11, 13, 16, 17, 22
B–8	A–2, 5, 8, 10, 11, 13, 16, 17, 22
B–9	A–2, 5, 8, 9, 12, 14, 16, 21, 22

So connected, these switches may be connected to energize the corresponding lamps necessary to produce the Arabic numerals 2, 3, 4, 5, 6, 8, and 9. Only seven of the terminals 169 of the switch S—7 need be connected with the terminals A to energize the lamps necessary in producing the Arabic numerals 1 and 7 in the lamp bank 101. To this end, five of the terminals of the switch S—1 are connected respectively with the terminals A—4, 8, 12, 16, and 24 while seven of the terminals of the switch S—7 are connected respectively with the terminals A—1, 2, 4, 8, 12,

16, and 24. All of these connections, of course, may be made within the switch box 137. It will be apparent, however, that the terminals 169 of the several solenoid switches may be otherwise connected with the numerically identified terminals A in order to obtain any desired selection of lamps to be energized under the control of the switches. It is, of course, possible to arrange the switches S to control the lamps for the production of alphabetical characters although in the production of certain types of characters it may be necessary to utilize more than nine cooperating pairs of switch contacts 169 and 173 in the solenoid switches. This, however, may be readily accomplished by increasing the size of the plates 151 and 157 in order to accommodate additional switches where the same are found necessary.

The devices of my present invention are exactly arranged and provide means for controlling the lamps of the annunciator bank 101 conveniently from a remote control station. It is also possible by utilizing holding switches for the lamp circuits to utilize a single switch box 137 and the switches contained therein for controlling a plurality of lamp banks. This may be accomplished by providing switch means for connecting the terminals A with the corresponding terminals T of the several panels to be controlled by providing suitable circuit sustaining means for maintaining selected circuits in operation in a lamp bank 101 after the switching mechanism in the box 137 is disconnected.

The apparatus herein described may, of course, be used in various ways in order to meet the requirements of any particular annunciator problem and these will, of course, be suggested by the particular problem to be met and will fall within the present invention.

The apparatus is neat, exact, and will provide positive control of the lamps and further will furnish satisfactory and reliable service throughout extended operating life.

It is thought that the invention and its numerous attendant advantages will be understood from the foregoing description and it is obvious that numerous changes may be made in the form, construction, and arrangement of the several parts without departing from the spirit or scope of the invention and without sacrificing its attendant advantages, the forms herein described being preferred embodiments for the purposes of demonstrating the invention.

What I claim is new and desire to secure by Letters Patent of the United States is:

1. A signalling device for signalling Arabic numerals and adapted to provide an improved, simplified representation of the said Arabic numerals, said signalling device comprising elements adapted to be operated to give a localized visual effect, said elements being arranged in six horizontal rows of four, eight of said elements being connected in pairs and providing twenty independently actuable signal units, a plurality of control switches, one of said switches corresponding to each of the Arabic numerals, each of said switches having not more than nine contacts adapted to be coincidentally energized upon operation of the switch, conductors extending from the contacts of each switch directly to said signal units and operable when each said switch is actuated to energize said elements in the form of one of the Arabic numerals, said paired elements being disposed with two of said pairs centrally located in the top and bottom rows, a third pair being located in adjacent relationship in an intermediate row, and a fourth pair being situated in vertically adjacent relationship in a side column.

2. A signalling device for signalling Arabic numerals and adapted to provide an improved, simplified representation of the said Arabic numerals, said signalling device comprising elements adapted to be operated to give a localized visual effect, said elements being arranged in six horizontal rows of four, eight of said elements being connected in pairs and providing twenty independently actuable signal units, a plurality of control switches, one of said switches corresponding to each of the Arabic numerals, each of said switches having not more than nine contacts adapted to be coincidentally energized upon operation of the switch, conductors extending from the contacts of each switch directly to said signal units and operable when each said switch is actuated to energize said elements in the form of one of the Arabic numerals, said paired elements being disposed with two of said pairs centrally located in the top and bottom rows, a third pair being disposed centrally in the third row from the bottom, and a fourth pair comprising the second and third elements from the bottom in the right hand side column.

3. A signalling device for signalling Arabic numerals and adapted to provide an improved, simplified representation of the said Arabic numerals, said signalling device comprising elements adapted to be operated to give a localized visual effect, said elements being arranged in six horizontal rows of four, eight of said elements being connected in pairs and providing twenty independently actuable signal units, a plurality of control switches, one of said switches corresponding to each of the Arabic numerals, each of said switches having not more than nine contacts adapted to be coincidentally energized upon operation of the switch, conductors extending from the contacts of each switch directly to said signal units and operable when each said switch is actuated to energize said elements in the form of one of the Arabic numerals, said paired elements being disposed with a pair of adjacent elements in the top row connected for simultaneous operation, a pair of adjacent elements in the bottom row connected for simultaneous operation, and a third pair of elements in an intermediate row being connected for simultaneous operation.

THOMAS A. KEEN.