

April 19, 1938.

E. FUNK

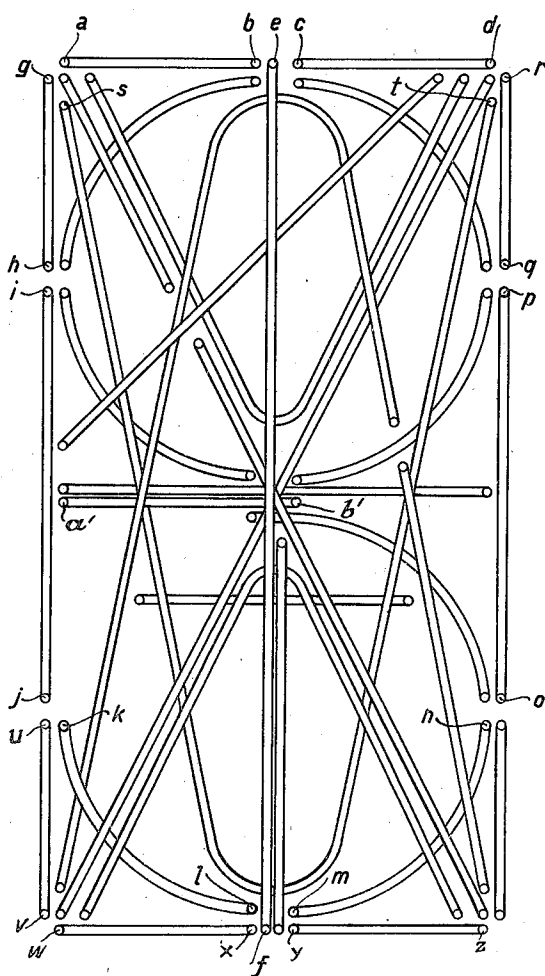
2,114,678

DEVICE FOR CONTROLLING A PLURALITY OF LUMINOUS TUBES

Filed Dec. 22, 1934

5 Sheets-Sheet 1

Fig. 1



INVENTOR  
ERWIN FUNK  
per Walter S. Bleistein  
ATTORNEY

April 19, 1938.

E. FUNK

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DEVICE FOR CONTROLLING A PLURALITY OF LUMINOUS TUBES

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5 Sheets-Sheet 2

Fig. 3

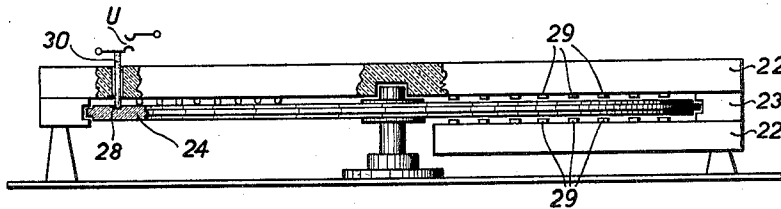


Fig. 2

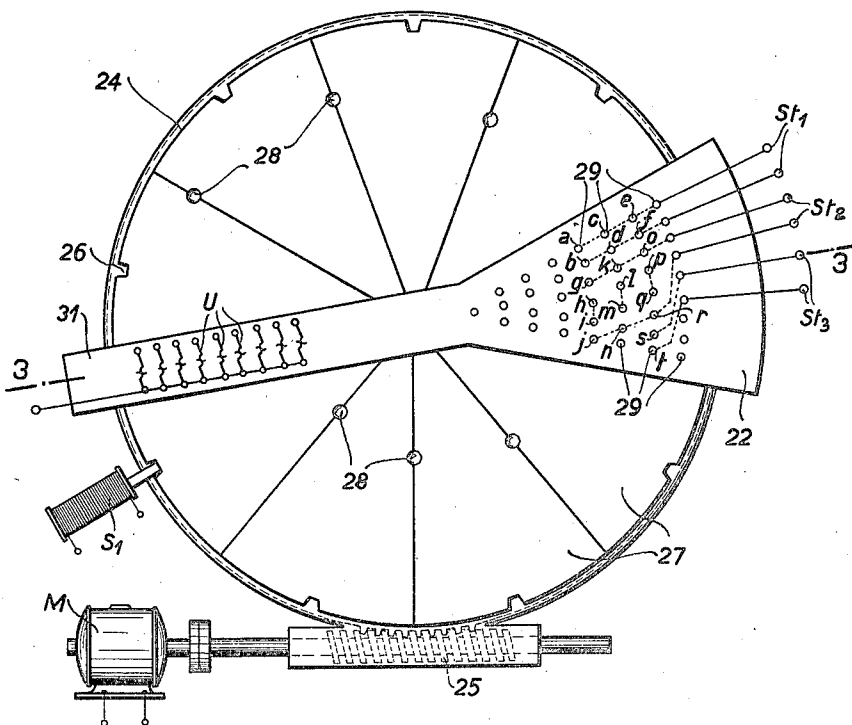
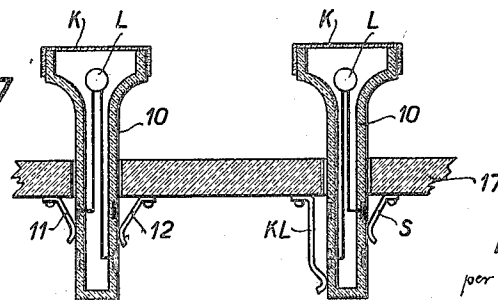


Fig. 7



INVENTOR  
ERWIN FUNK  
per Walter S. Blaisdell  
ATTORNEY

April 19, 1938.

E. FUNK

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DEVICE FOR CONTROLLING A PLURALITY OF LUMINOUS TUBES

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5 Sheets-Sheet 3

Fig. 5

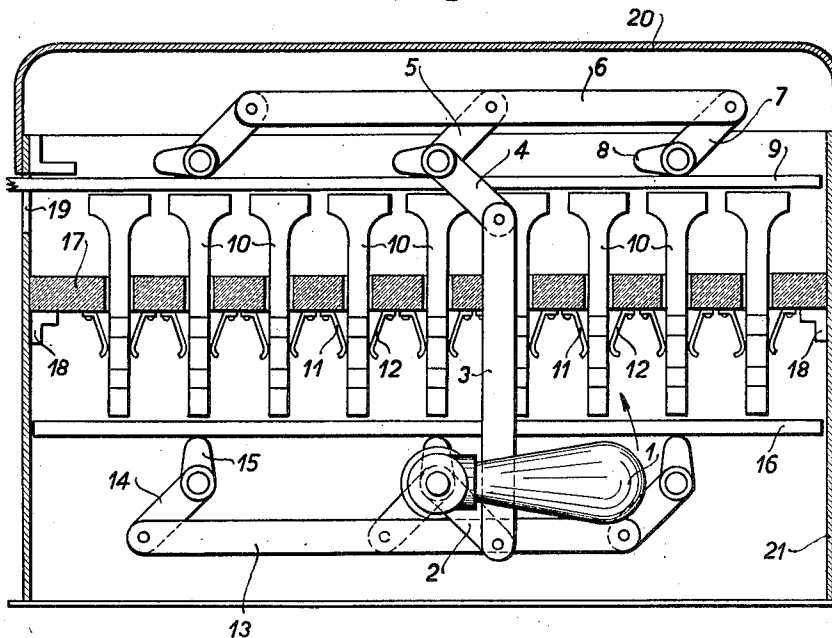
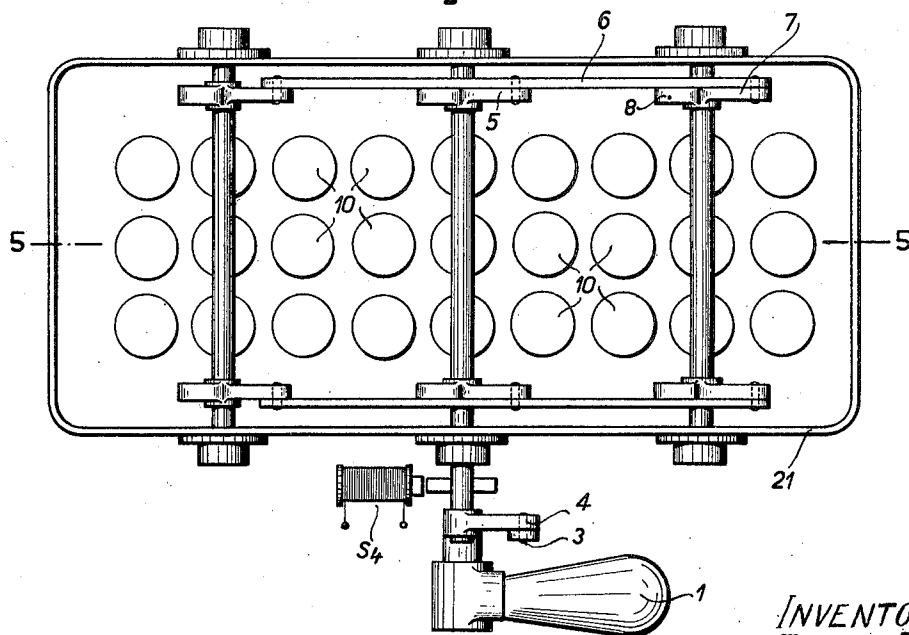


Fig. 4



INVENTOR  
ERWIN FUNK  
per Walter S. Bleistein  
ATTORNEY

April 19, 1938.

E. FUNK

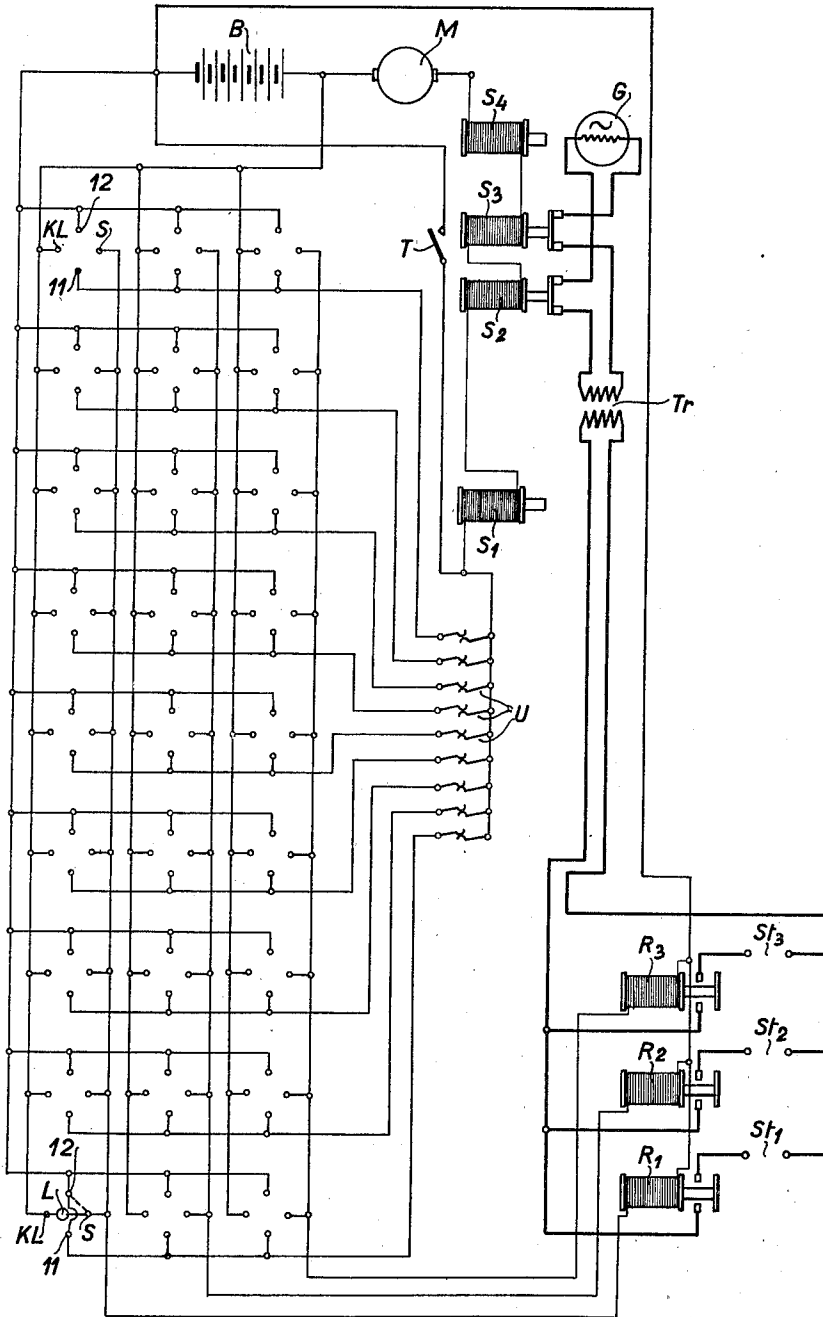
2,114,678

DEVICE FOR CONTROLLING A PLURALITY OF LUMINOUS TUBES

Filed Dec. 22, 1934

5 Sheets-Sheet 4

Fig. 6



INVENTOR  
ERWIN FUNK  
per *Halter S. Bleistein*  
ATTORNEY.

April 19, 1938.

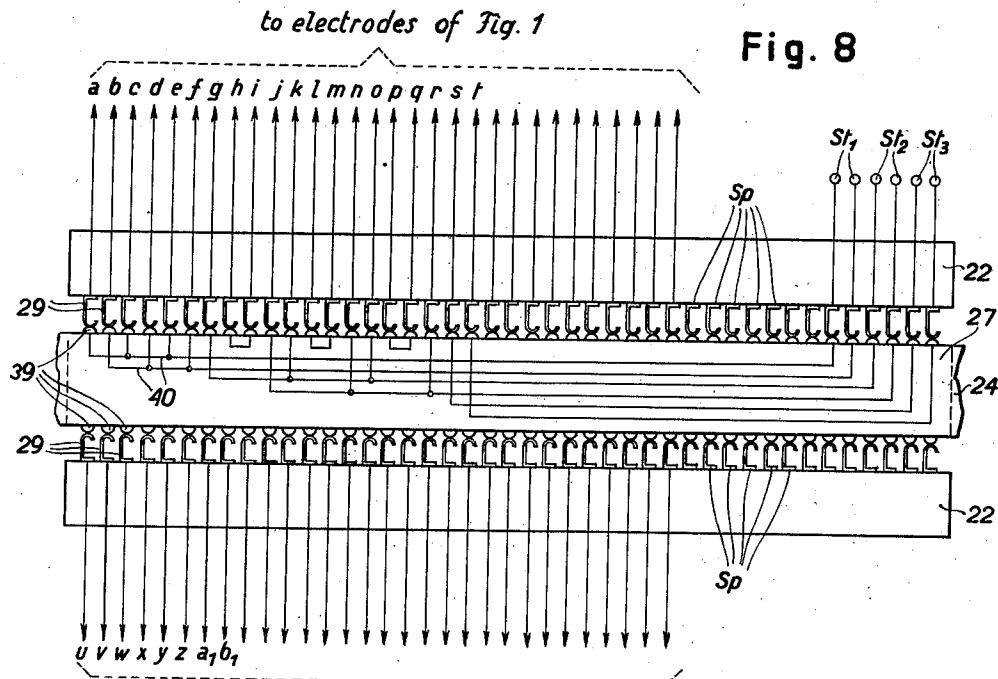
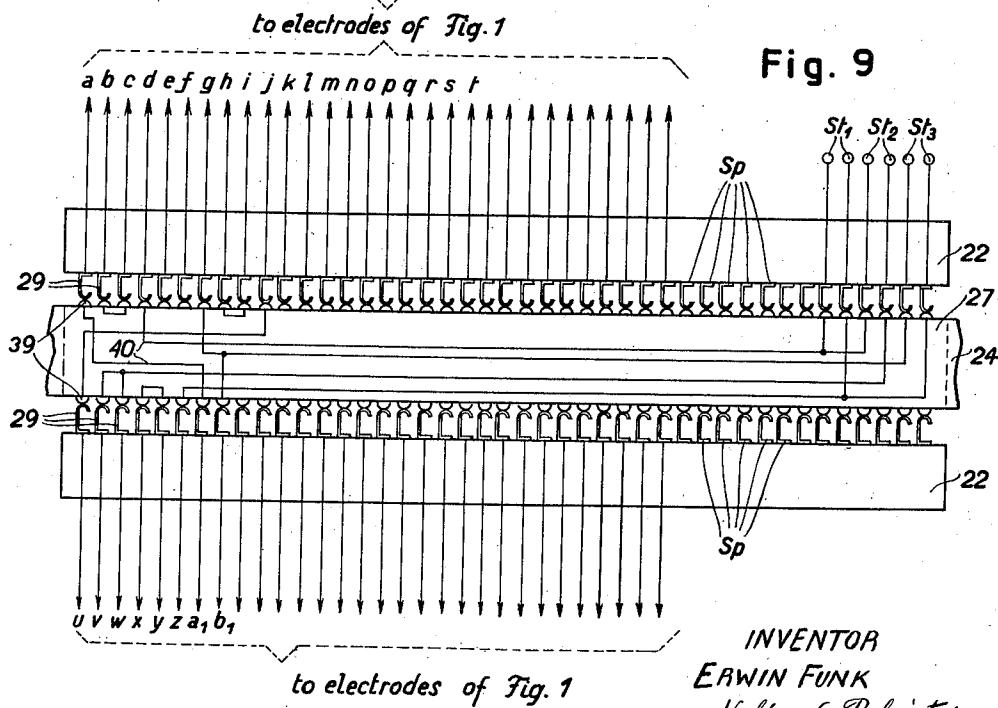
E. FUNK

2,114,678

DEVICE FOR CONTROLLING A PLURALITY OF LUMINOUS TUBES

Filed Dec. 22, 1934

5 Sheets-Sheet 5



INVENTOR  
ERWIN FUNK  
by Walter S. Bleistein  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,114,678

DEVICE FOR CONTROLLING A PLURALITY  
OF LUMINOUS TUBES

Erwin Funk, Vienna, Austria

Application December 22, 1934, Serial No. 758,716  
In Austria April 23, 1934

4 Claims. (Cl. 177—346)

My invention relates to luminous tubes for advertising and signalling purposes, filled with rare gases, such as neon, and operated by high tension and it has for its object to allow displaying of varying scripts or pictures of any desired design even of the most complex kind. It is also the object of my invention to provide a control system for a plurality of luminous tubes, avoiding all the dangers and difficulties involved in the use of high tension currents, thus rendering it possible to obtain a great variety of the picture or script displayed and a rapid change of the luminous tubes employed.

Although my invention is not limited to any particular type of system or group of luminous tubes, my invention is especially adapted to be used in connection with the so-called universal letters. Such letters, as is well known are built up by a plurality of incandescent lamps or luminous tubes arranged in such a way that by switching on particular groups of said lamps or tubes it is possible to display different letters, figures etc.

The invention relates, more particularly, to a control system for such universal letters or other changing pictures equipped with luminous tubes which may be operated by hand or from any desired distance by means of a remote control device. My invention further relates to a keyboard device connected with said remote control device by a few low tension wires or an ordinary telephone cable and operable by hand or with the aid of stencil-sheets. My invention also includes a device for signalling to the operator the letter, figure or design which has been made luminous. The remote control device according to my invention may be combined with the group of luminous tubes forming the universal letter or changing picture and the transformer or other source of high tension to form a single unit, which may be fixed to the wings of an aircraft or inserted into a closed box, which may be grounded, if desired, and which is mounted on the front or roof of a building.

According to my invention, the control device switching on the high tension to the different groups of luminous tubes in accordance with the particular letter, figure or the like to be made luminous comprises a switching means capable of a step by step movement over a bank of contacts connected to the individual electrodes of the luminous tubes and to the high tension supply; said switching means moreover bears a plurality of contacts, cooperating with the bank contacts. Thereby the individual electrodes of the luminous

tubes, in the different positions of the switching means, are connected with the high tension supply in such a manner that the desired character, figure or the like is rendered luminous.

The switching means above referred to is preferably a flat disc of insulating material rotatable step by step by hand or by any mechanical, pneumatic, hydraulic or pneumatic remote control device or preferably by the electric remote control device described with reference to the drawings. The flat disc bears on both sides contacts and the wires interconnecting said contacts are preferably concealed within the disc.

A preferred modification of my invention shows a contact bank provided with a number of associated contacts supplying high tension to the tubes; in each position of the disc or other switching means a number of combinations, corresponding to an equal number of characters are ready to be switched in on the completion of the circuit of the desired character. This completion is effected by means of one of a number of high-tension switches or relays.

An example of my invention will now be fully described in detail with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of a universal letter built up by luminous tubes. This type of universal letter is well known in itself and the invention relates, as above stated, to the control of groups of luminous tubes, as shown in Fig. 1 by way of example.

Fig. 2 is a plan view and Fig. 3 a vertical section along the line 3—3 in Fig. 2 of the switching means operated by remote control and of the cooperating contact bank and the associated parts.

Fig. 4 is a plan view and Fig. 5 a partial vertical section along the line 5—5 of Fig. 4 of the keyboard of the remote control device.

Fig. 6 is a complete wiring diagram of the remote control device and

Fig. 7 is a sectional view of two operating keys with built in pilot lamps.

Figs. 8 and 9 are diagrammatic sections through the switching means and the double contact bank cooperating with the same.

In Fig. 1 the electrodes of the tubes to be connected in a circuit for the formation of the letter T are designated by *a, b, c, d, e, f*, those for the letter U by *g, h, i, j, k, l, m, n, o, p, q, r* and those for the letter V by *s* and *t*. Said electrodes are connected by high tension wires to the contacts 29 of a double contact bank 22 (Fig. 2), the corresponding individual contacts being designated

by the same reference letters. Each tube electrode is connected to an individual contact of the bank. The electrodes of the tubes corresponding to the desired letter, picture, character or the like are connected to high tension supply terminals  $St_1$ ,  $St_2$ ,  $St_3$  connected to contacts also arranged on the bank 22. For this purpose, a switching means passing over the contact bank 22 is provided which consists in a rotatable flat disc 24. This particular shape requires only a minimum of space and may be combined with the universal letter to form a very compact unit adapted to be inserted into the interior of the wing of an airplane, the surface of said wings being preferably covered with translucent material. The form of the switching means may also be that of a drum, an endless belt or the like. The switching disc is subdivided into a plurality of sections 27 and by rotating it stepwise either by hand or by any suitable control means, each of the sections 27 may be brought in juxtaposition to the contact bank 22. This bank bears, besides the contacts 29 associated to the tube electrodes, a number of contacts supplying the high tension and each of the sections or sectors 27 carries a number of contacts cooperating with the contacts on the bank and connected in such a manner that the luminous tubes required for the formation of the letter, character, figure, picture, or the like can be switched into a high tension circuit. The necessary connections or cross connection wires are preferably concealed within the disc 24 and are indicated in Fig. 2 by dotted lines for the section 27 just in operation. It is obvious that the other sections 27 are also provided with a plurality of interconnected contacts not shown in the drawings for the sake of clearness.

In the embodiment of the invention shown in the drawings, a number of contact pairs on the bank 22 are connected to high tension terminals  $St_1$ ,  $St_2$ ,  $St_3$  and in each position of the disc 24, or on each section 27, three different combinations, according to three different letters or the like, are ready for service and are rendered effective by applying high tension to one of the pairs of the terminals  $St_1$ ,  $St_2$ ,  $St_3$ .

As shown in Fig. 3, both sides of the disc 24 are provided with interconnected contacts, such as springs or studs and the contact bank 22 is also arranged at both sides of the disc 24, the two parts of the bank 22 being spaced by an insulating block 23. The disc and the contact bank may be made of highly insulating material capable of resisting to the high tension used.

In Fig. 8, the movable switching means is designated by 24 and the part of said switching means corresponding to the sector 27 in Fig. 3 by 27. 22 is the contact bank formed by an upper and a lower portion as shown in Fig. 3. In order to clearly explain the circuit, it has been assumed in the diagrammatic Figs. 8 and 9, that all the contact studs 39 of the disc or other switching means 24 and the cooperating contact springs or other contact-making means 29 on the bank 22 are located in one plane. The distribution of these contacts on the surfaces of the parts 24 and 22 has no importance for the invention and they may be arranged in arcuate paths, as shown in Fig. 2, or arranged in any other way to suit the particular form of the switching means employed. To the contact-making means 29 on the double contact-bank 22 wires are connected which are leading to the electrodes of the luminous tubes shown in Fig. 1.

$Sp$  are spare contacts which may be used if an increased number of tubes is employed. Six of the contact-making means 29 on the bank 22 are connected to three pairs  $St_1$ ,  $St_2$ ,  $St_3$  of high tension terminals. In each section 27 of the disc or other switching means 27, the contact-studs 39 are interconnected by means of cross-connection wires 40 imbedded in the disc 24 or other switching means. The circuit connection of these cross-section wires is such that three groups of luminous tubes are connected to the three high tension terminals  $St_1$ ,  $St_2$ ,  $St_3$  so that by applying high tension to any one of said three pairs of terminals, a selected group of tubes is made luminous. Each such group forms a letter or character. In the examples chosen for Fig. 8, the letters U, V and T may be displayed by applying high tension to the terminals  $St_1$ ,  $St_2$  and  $St_3$  respectively. Each group may comprise one or more luminous tubes connected in series or in parallel or in a combined series-parallel circuit. If tubes are connected in parallel, care should be taken that the three letters served by one and the same section 27 of the switching means do not have tubes in common, as for instance the letter-groups T U V or A B X or I J K or P Y Z. In the case of parallel tubes, the usual precautions should be taken to insure stable parallel working of the tubes, especially if they are of unequal length. These precautions are well known to anybody skilled in the art. For instance, resistances or impedances of appropriate values in series with each tube may be provided.

In most cases, however, each letter is formed by a single circuit of luminous tubes in series. In this case, they may be no tubes in common, or they may be common tubes, as for instance in the event of the letters E F L served by one sector 27, as illustrated in Fig. 9 in a similar manner to Fig. 8.

If for instance the letter "T" is to be displayed, the source of high-tension current is connected, in a manner to be described later, to the terminals  $St_1$ . The current flows from say the upper terminal to the bank contact 29 connected to said terminal. From said contact the current is distributed by means of the contact-studs, springs or the like on the disc 24 and by the cross-connection wires embedded in the disc 24 (shown by dotted lines in Fig. 2) to the other bank-contacts 29 connected to the individual electrodes  $a$ ,  $c$ ,  $e$  (Fig. 1). From the other electrodes  $b$ ,  $d$ ,  $f$  of said tubes the current flows back to the bank-contacts designated by the same letters in Fig. 2 and through the cross-connection wires in the disc 24 back to the lower terminal of the pair  $St_1$ . In this manner, the three luminous tubes forming the letter "T" (Fig. 1) are connected in parallel between the terminals  $St_1$ .

If it is desired to display the letter "U" or "V" no movement of the disc 24 is required and it is only necessary to connect the contacts  $St_2$  or  $St_3$ , respectively, to the high-tension supply. The current then flows from, say, the upper terminal of the pair  $St_2$  through the bank contacts 29 and the springs, studs or other contact-means on the disc 24 contacting with said contacts 29 and through the cross-connection wires embedded in the disc 24 to the other bank-contacts and to the electrodes  $g$ ,  $k$ ,  $o$  connected to the latter. The current proceeds through the tubes, causing a luminous discharge in the same and flows back from the opposite electrodes  $h$ ,  $l$ ,  $p$  to the bank

contacts connected with the same and designated by the same reference letters in Fig. 2. From the bank contacts *h*, *l*, *p* the current flows, through the contacts and the cross-connection wires on the disc 24 to the bank contacts *i*, *m*, *q* and to the tube-electrodes designated by the same reference letters in Fig. 1 connected therewith. As the other electrodes *j*, *n*, *r* of said tubes are connected, over their respective contacts and the contacts and cross-connection wires on the disc 24 to the lower terminal *St*<sub>2</sub>, the six luminous tubes forming the letter "U" are connected in three parallel groups between the pair of terminals *St*<sub>2</sub>, each group comprising two tubes arranged in series.

The letter "V" is formed for example by one single tube with the electrodes *s* and *t* (Fig. 1). The corresponding bank-contacts *s* and *t* (Fig. 2) are connected, by means of the contact-studs or the like and the cross-connection wires on the disc 24, to the bank-contacts connected to the pair of terminals *St*<sub>3</sub>.

The electrodes of the other luminous tubes in Fig. 1 are wired to other bank-contacts 29 on the double contact bank 22. In the example of a universal letter shown in Fig. 1, twenty-nine luminous tubes are used, having fifty-eight electrodes. Accordingly, a total number of fifty-eight contacts wired to said electrodes and six more contacts connected to the supply terminals *St*<sub>1</sub>, *St*<sub>2</sub>, *St*<sub>3</sub> are required. The double contact-bank 22 (Fig. 3) gives ample room for this number of contacts 29 and even for a number of spare contacts. For the sake of clearness, only the bank-contacts 29 and the corresponding electrodes of the luminous tubes which may be displayed in the position shown in Fig. 2 have been designated by reference letters *a*—*t*, but it may be understood that all the other contacts on both the upper and the lower section of the double contact bank 22 (Fig. 3) are also wired to the electrodes of the other luminous tubes.

If it is desired to display other letters or the like as U, T or V, the disc 24 is rotated to another position and another of the nine sectors 27 is brought in juxtaposition to the double contact bank 22. In each of these operating positions of the disc 24, three different letters or the like may be selected by connecting one of the terminals *St*<sub>1</sub>, *St*<sub>2</sub> or *St*<sub>3</sub>, respectively, to the source of high tension current.

If for instance the letters E F or L are to be displayed, the disc 24 or other switching means is brought in the position shown in Fig. 9. If now high tension is applied to terminals *St*<sub>1</sub> by means of a double-pole switch or a similar relay, the current flows through the tubes *dc*, *ba*, *aib*<sub>1</sub>, *gh*, *ij*, *uv*, *wx*, *yz* and these luminous tubes are forming the letter E. If high tension is applied to the terminals *St*<sub>2</sub> or *St*<sub>3</sub> by means of double-pole switches or relays, this series combination of luminous tubes is tapped at the points *d* and *v*, or *g* and *v* respectively and thus the letters F and L are displayed. It may be seen that by suitably grouping the letters of the alphabet and/or figures or the like, a great number of characters, say the 26 letters of the alphabet and two additional characters, may be displayed, using for instance nine sections on the switching means and three cases obtained by switching in each section or position of said switching means. I do not wish, however, to limit my invention to any particular grouping of letters etc. or to a certain number of sections or switching cases.

The step-wise rotation of the disc 24 may be effected by hand, by means of transmission ropes or otherwise by a pneumatic, hydraulic or electric remote control device. A remote control device operated by low tension is shown and described with reference to the drawings.

The disc 24 is provided with teeth on its rim or periphery and meshes with a pinion or a worm 25. Each of the sections 27 is provided with a notch 26, into which a locking pawl may fall which may be withdrawn by means of a solenoid or electromagnet *Si* so as to release the disc. Moreover, each of the sections is provided with a controlling element 28 which may be a cam, stop, or, as shown, a groove or indentation. The controlling elements are located at different radial distance and are so arranged from the center that they will not interfere with the contacts 29. Each controlling element operates as it passes below the bridge 31, one of the contacts of a multiple cut out switch U. The operation of the contacts takes place by means of rods 30 one of which is shown in Fig. 3, said rods entering into the indentation 28, whereby the respective contact is opened. Each of the individual contacts of the multiple cut out switch U is arranged in a circuit including a controlling contact or a group of such contacts connected in parallel and all these circuits are connected in series with the electric motor M, that drives the worm 25 and causes the disc 24 to be rotated and with the releasing magnet *Si*. If one of these circuits is completed, the disc 24 revolves, until the circuit is broken by one of the contacts U operated by the respective controlling member 28. As this circuit is interrupted, the magnet *Si* is deenergized and releases its armature, which falls into one of the notches 26 and locks the disc 24 against further rotation. In the position shown in Fig. 2, the letters T, U or V may be selected by applying high tension by means of the high tension relays *R*<sub>1</sub>, *R*<sub>2</sub>, *R*<sub>3</sub> to one of the pair of terminals *St*<sub>1</sub>, *St*<sub>2</sub>, *St*<sub>3</sub>.

In order to facilitate the selection of a letter, picture device, character or the like, a keyboard comprising a plurality of double pole switches arranged in several rows is provided in a central station (Figs. 4-6). Referring to Fig. 6, it will be seen from the wiring diagram that all the contact pairs KL, S aligned in one row are arranged in parallel. Likewise all the contact pairs 11, 12 aligned to form a column are also arranged in parallel. The contacts 11, 12 are arranged in series with the cut-out contacts of the multiple switch U and are determining the position of the disc 24. As already described, all the circuits comprising the contacts 11, 12 are arranged in the circuit of the motor M or of a relay operating said motor. In the same circuit is arranged the battery or other source of (low tension) current, the releasing magnets *Si* and two relay coils *S*<sub>2</sub> and *S*<sub>3</sub> cutting out the primary circuit of the high tension supply transformer *Tr* and/or the generator *G*. The function of a further coil *S*<sub>4</sub> in this circuit will be described later.

The contacts KL, S are controlling high tension relays *R*<sub>1</sub>, *R*<sub>2</sub>, *R*<sub>3</sub> selecting one of the three letters, pictures, devices or characters which are ready to be displayed in each position of the disc 24.

In order to display a particular letter, picture or character, it is only necessary to operate the double pole-switch allotted to it. In this case, KL is connected to S and 11 to 12 (or 12 to 11

and also to S, as shown by the dotted line in Fig. 6). Thereby the motor M is started and turns the disc 24 until it reaches the required position. Simultaneously one of the relays R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> is energized and selects the desired letter from the group of three letters arranged on the respective section 27. If another letter is to be selected, the previously closed double pole switch is opened and the other switch is closed. If the new letter is one of the same row, the disc 24 remains stationary and merely another relay R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> is actuated. If the new letter pertains to another transversal group, the motor is actuated and turns the disc 24 until it reaches the new position. The double pole switches are preferably constructed of the push button type 10, as shown in Figs. 4, 5 and 6. The push buttons 10 are moving in openings of a plate 17 of insulating material attached by means of brackets 18 to a casing 21. If the buttons 10 are pushed downwardly, they are short-circuiting the contact springs 11, 12 and KL, S respectively. In order to restore the buttons to original position a plate 16 is provided, which may be pressed by means of a handle 1 and a lever gear 13, 14, 15 against the ends of the buttons 10. This restoring device is locked by an electromagnet S<sub>4</sub> during rotation of the disc 24.

The solenoid S<sub>4</sub> (Fig. 4) is wired in series with the motor M, the primary cut-out switches S<sub>3</sub> and S<sub>2</sub>, the locking and releasing magnet S<sub>1</sub> of the switching means and the multiple cut-out switch U. During operation of the motor M, that is to say during the rotation of the disc 24, the solenoid S<sub>4</sub> is energized and attracts an armature, which actuates a suitable brake locking the operating handle 1 in its position. Said brake may be of any suitable construction and may comprise for instance a notched disc keyed to the shaft of the handle 1 and a pawl operated by the coil S<sub>4</sub> engaging the notches of said disc. If the switching means has attained its stationary operating position, the coil S<sub>4</sub>, as well as the motor M and the other parts of the circuit, are deenergized and the handle 1 may be operated to restore the buttons to normal position.

The push buttons may be operated by hand or they may be actuated by stencil sheets 9, having holes corresponding to all the buttons which are not to be actuated. The stencil sheets are shown in Fig. 5 only. To allow the use of stencil sheets, a device 4, 5, 6, 7, 8 very similar to the restoring device is provided in the casing 21 which may be closed by a lid 20. The said device is operated by a handle 1 connected to said device by means of a linkage 2, 3, 4. The stencil sheet is inserted through a slot 19 (Fig. 5) and pressed against the buttons by means of the cams 8 when the handle is turned, as indicated by the arrow in Fig. 5. By this movement the individual button 10, which corresponds to a non-perforated part of the stencil sheet, is depressed, the other buttons passing freely through the perforations. Several stencil sheets may be combined to form a disc or an endless belt and they may be fed in succession to the keyboard.

The push buttons may be equipped with pilot lamps L, which are switched in by means of the contact KL. In this case, the cap K of the button 10 may contain a transparent picture of the corresponding letter, picture, device or character to indicate what letter was chosen even in the darkness. Alternatively, an annunciator may be employed to indicate the letter or character displayed. Such an annunciator may be

provided with pilot lamps (incandescent lamps or luminous tubes) arranged in similar manner as the switches or buttons of the keyboard and operated by low tension in the case of incandescent lamps or by low or high tension, if tubes are used.

The modification illustrated is only chosen by way of example and many other modifications are possible without departing from the spirit of the invention. A switch T may be provided to enable the operator to cause the disc 24 to turn, should the remote control device fail to work properly.

What I claim is:—

1. In a device for controlling a plurality of luminous tubes, a number of luminous tubes, each having electrodes, a contact bank, contacts on said bank corresponding to said electrodes, means for connecting said contacts individually to their corresponding electrodes of said luminous tubes, groups of high-tension contacts on said bank, a number of high-tension switches corresponding to said groups, means operated by each of the last said switches to connect the corresponding group of high-tension contacts to a source of high-tension current, switching means movable stepwise past said contact bank, and contacts on said switching means engaging the contacts on said bank when the switching means is in stationary operating position, said contacts on the switching means being interconnected in a manner as to connect to said high-tension contacts, in each operating position of said switching means, a different combination of luminous tubes for each group of high-tension contacts on said bank.

2. In a device for controlling a plurality of luminous tubes, a number of luminous tubes, each having electrodes, a contact bank, contacts on said bank corresponding to said electrodes, means for connecting said contacts individually to their corresponding electrodes of said luminous tubes, groups of high-tension contacts on said bank, a number of high-tension switches corresponding to said groups, means operated by each of the last said switches to connect the corresponding group of high-tension contacts to a source of high-tension current, switching means movable stepwise past said contact bank, and contacts on said switching means engaging the contacts on said bank when the switching means is in stationary operating position, said contacts on the switching means being interconnected in a manner as to connect to said high-tension contacts, in each operating position of said switching means, a different combination of luminous tubes for each group of high-tension contacts on said bank, a remote control device for the switching means, comprising a multiple cut-out switch formed by a plurality of individual switches, the said switching means having elements for operating in different operating positions, a selected one of the individual switches forming the multiple cut-out switch, means for moving said switching means stepwise including a source of electricity, an electric motor operatively connected with said switching means, the individual switches of the multiple cut-out switches being arranged, each in series with an operating contact, in parallel in the circuit of said motor.

3. In a device for controlling a plurality of luminous tubes, a number of luminous tubes, each having electrodes, a contact bank, contacts on said bank corresponding to said electrodes, means for connecting said contacts individually to their

corresponding electrodes of said luminous tubes, groups of high-tension contacts on said bank, a number of high-tension switches corresponding to said groups, means operated by each of the last  
 5 said switches to connect the corresponding group of high-tension contacts to a source of high-tension current, switching means movable stepwise past said contact bank, and contacts on said  
 10 switching means engaging the contacts on said bank when the switching means is in stationary operating position, said contacts on the switching means being interconnected in a manner as to connect to said high-tension contacts, in each  
 15 operating position of said switching means, a different combination of luminous tubes for each group of high-tension contacts on said bank, a remote control device for the switching means, comprising a multiple cut-out switch formed by a  
 20 plurality of individual switches, the said switching means having elements for operating, in different operating positions, a selected one of the individual switches forming the multiple cut-out switch, means for moving said switching means  
 25 stepwise and locking the same in each operating position, said moving and locking means comprising a source of electricity, an electric motor operatively connected with said switching means, the individual switches of the multiple cut-out switch being arranged, each in series with an oper-  
 30 ating contact, in parallel in the circuit of said motor, said circuit also including an electromagnet operating a latch forming the locking means for the switching means.

4. In a device for controlling a plurality of  
 35 luminous tubes, a number of luminous tubes, each having electrodes, a contact bank, contacts on said bank corresponding to said electrodes, means for connecting said contacts individually to their corresponding electrodes of said luminous tubes,  
 40 groups of high-tension contacts on said bank, a number of high-tension relays corresponding to

said groups, means operated by each of the last named relays to connect the corresponding group of high-tension contacts to a source of high-tension current, switching means movable stepwise  
 5 past said contact bank and contacts on said switching means engaging the contacts on said bank when the switching means is in stationary operating position, said contacts on the switching means being interconnected in a manner as to connect to said high-tension contacts, in each  
 10 operating position of said switching means, a different combination of luminous tubes for each group of high-tension contacts on said bank, a remote control device for the switching means, comprising a multiple cut-out switch formed by  
 15 a plurality of individual switches, the said switching means having elements for operating, in different operating positions, a selected one of the individual switches forming the multiple cut-out switch, means for moving said switching means  
 20 stepwise, including a source of electricity, an electric motor operatively connected with said switching means, the individual switches of the multiple cut-out switches being arranged, each in series with a group of operating contacts, in  
 25 parallel in the circuit of said motor, a group of normally open double pole switches, each switch corresponding to a certain combination of luminous tubes to be displayed, the switches being arranged in rows, means to connect the contacts  
 30 of one pole of said last switches in parallel in longitudinal rows, each row connected to and controlling one of said high-tension relays, means to connect the contacts of the other pole of last said switches to a parallel group in transverse  
 35 rows, and each said group of contacts in series with one of said individual switches of the multiple cut-out switch in the circuit of said electric motor.

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