

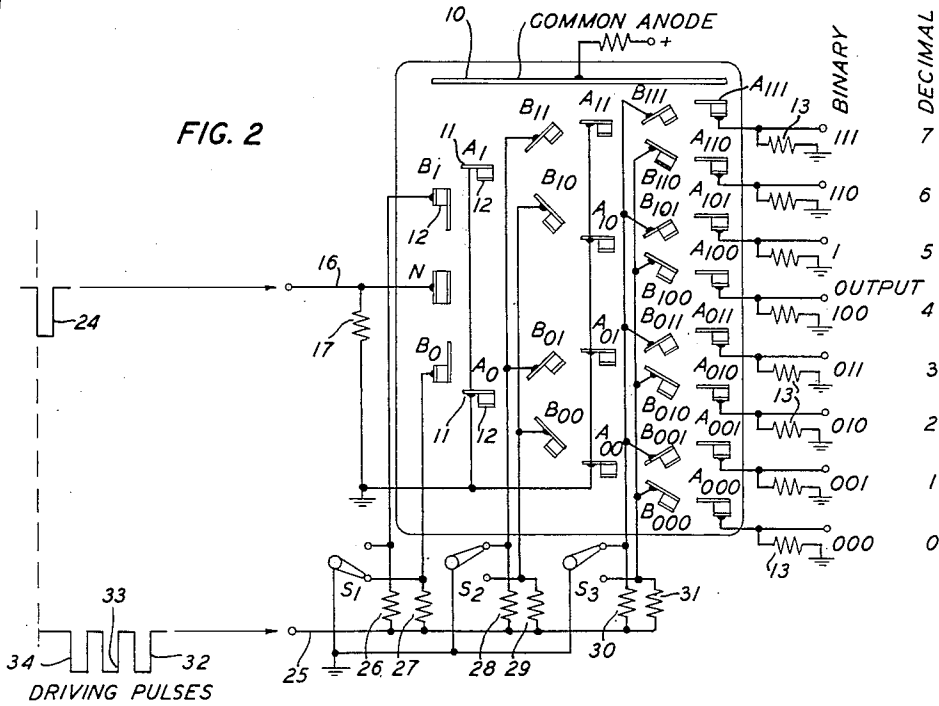
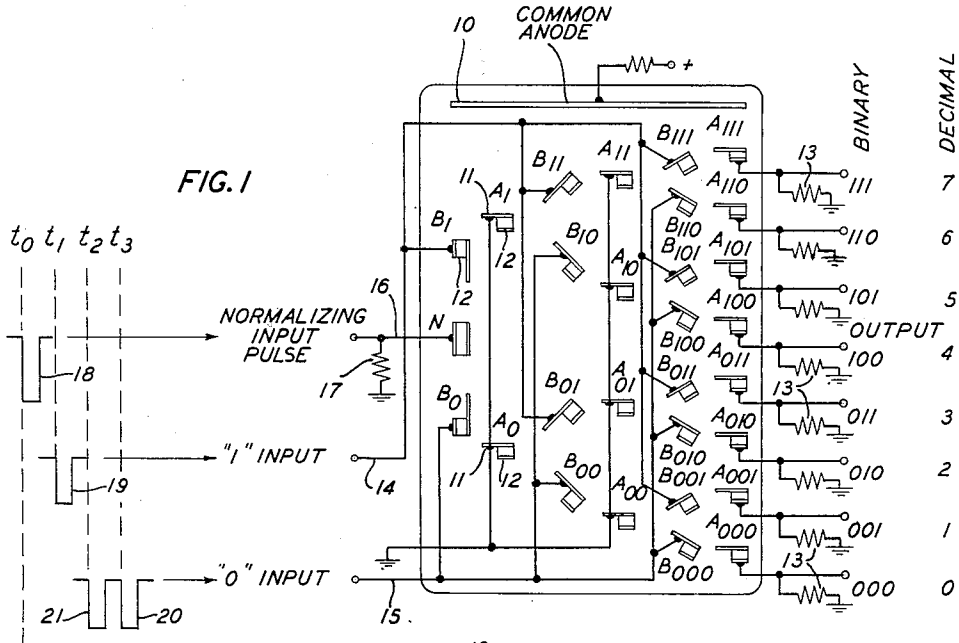
Aug. 5, 1952

M. A. TOWNSEND
GLOW DISCHARGE DEVICE

2,606,309

Filed June 15, 1950

3 Sheets-Sheet 1



INVENTOR
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Aug. 5, 1952

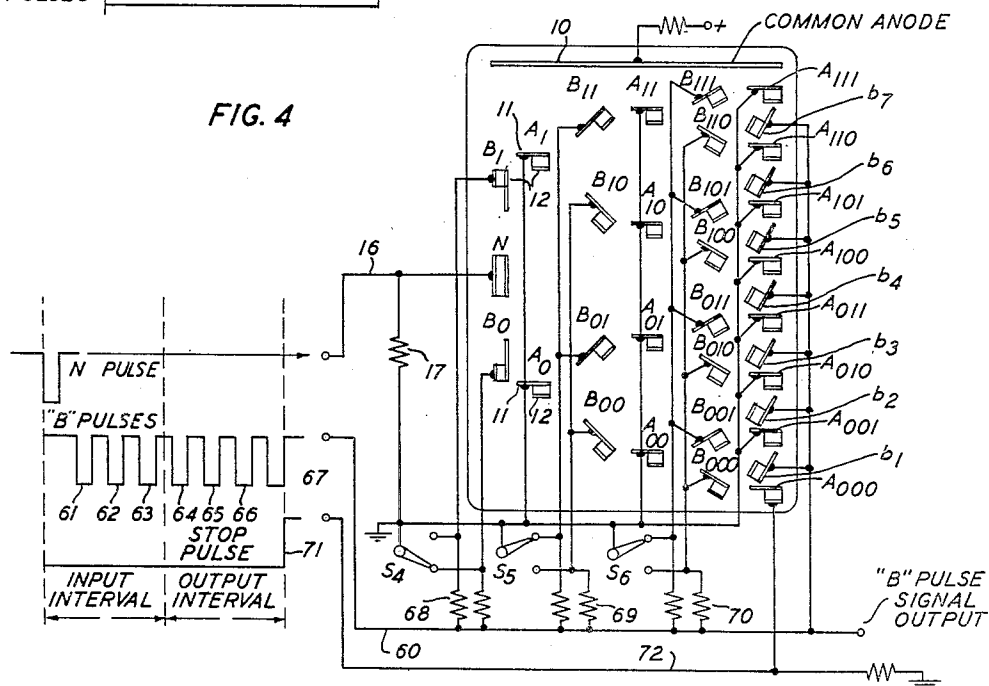
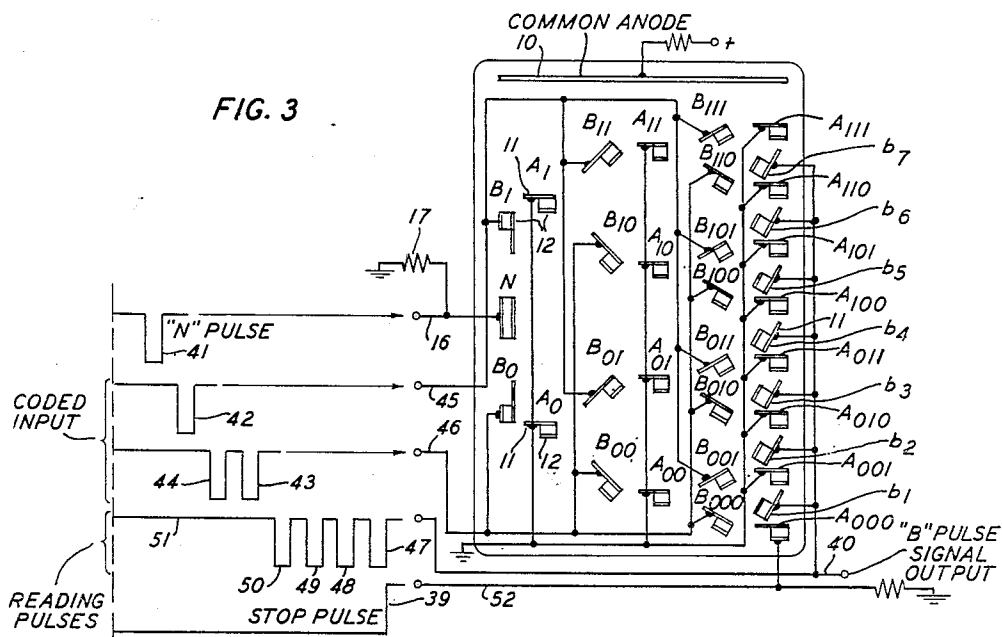
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GLOW DISCHARGE DEVICE

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3 Sheets-Sheet 2



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FIG. 5

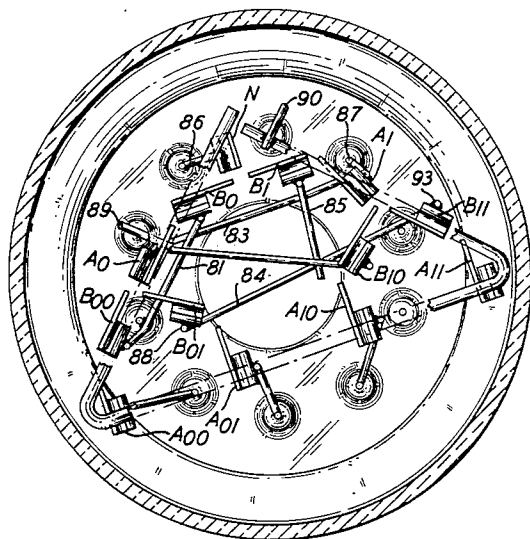


FIG. 6

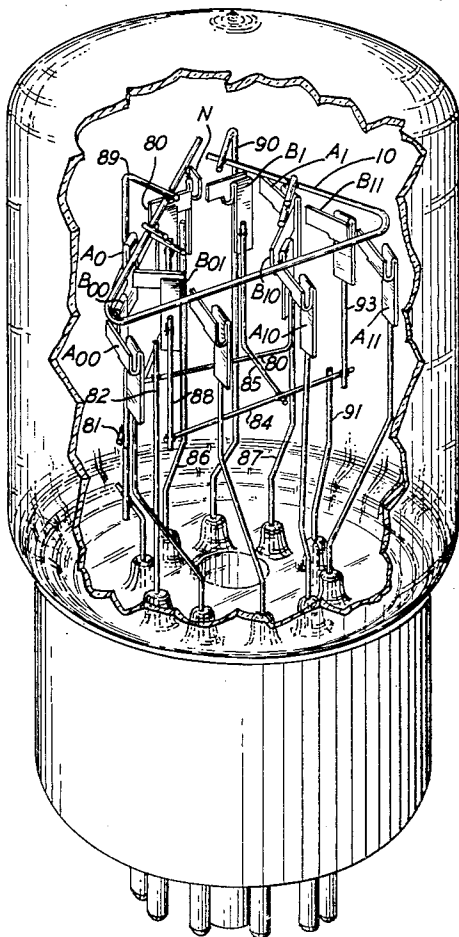


FIG. 7

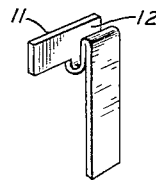
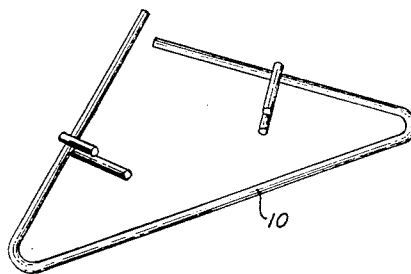


FIG. 8



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UNITED STATES PATENT OFFICE

2,606,309

GLOW DISCHARGE DEVICE

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Application June 15, 1950, Serial No. 168,227

17 Claims. (Cl. 315—323)

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This invention relates to glow discharge devices and more particularly to such devices which comprise a plurality of cold cathodes and are especially suitable for utilization in switching or translating systems.

There are in the prior art devices capable of performing the same general types of switching and translating functions as devices constructed in accordance with the present invention. Some of such devices are punched card translators, relays, groups of conventional cold cathode or hot cathode triodes or pentodes, and cathode-ray tubes. The arrangements described herein are faster than mechanical or electromechanical devices and are less complicated than other electronic devices capable of performing similar functions, especially where codes are used involving numbering systems having a base greater than two.

One general object of this invention is to improve the performance and speed of operation of translating and switching devices.

Another object is to simplify the construction of electronic translating and switching devices.

More specific objects of the invention are to assure stepping of the glow discharge in one direction only along one of a plurality of paths, reduce the number of external connections necessary to cause stepping of the glow discharge from one electrode to another, and lessen the number of electrodes necessary to electronically perform translating or switching functions.

A further object of the invention is the improvement of electronic translating and switching apparatus in general.

The invention embodies a cold cathode glow discharge device having branching rows of cathodes therein and an anode common to all the cathodes. The rows begin from an apex and each beginning row is then subdivided one or more times into two or more branches. Each cathode is divided into two portions having different electron discharge sustaining efficiencies. These different portions are alternately arranged in each of the rows thus providing a preference with respect to the transfer of a glow discharge from one cathode to an adjacent cathode. For a more detailed description of the glow discharge stepping mechanism reference is made to M. A. Townsend application Serial No. 101,322 filed June 25, 1949, now Patent Number 2,575,370, issued November 20, 1951.

The cathodes are interconnected so that a particular series of input code pulses will cause the glow discharge to step along from one cathode

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to another, following a particular path in accordance with the particular series of input code pulses. Only every alternate cathode defining one group, designated as the B group of cathodes, is capable of receiving an input pulse, the remaining cathodes, designated as the A group of cathodes and normally biased negatively with respect to the B group of cathodes, being rest cathodes to which a glow discharge will transfer from the preceding cathode upon termination of the input code pulse which, upon initiation, had caused the glow discharge to transfer to the preceding cathode.

In one embodiment of the invention, the selection of the particular branching rows which a glow discharge traverses is determined by the time sequence application of a series of input code pulses on a plurality of input conductors each connected to different groups of cathodes in accordance with the code.

In another embodiment, the selection of the glow discharge path is determined by the pre-setting of switches which are capable of selectively connecting various groups of the B cathodes to the input conductor in accordance with a code.

One of the features of this invention involves branching rows of cathodes wherein a glow discharge can be stepped along one particular path to one of a plurality of outputs, in accordance with a particular series of input code pulses, the output code pulse being determined by the final position of the discharge. The number of final positions is determined by the number of times each original row branches into two or more other rows. In one embodiment of the invention, two rows of cathodes branch out from an apex and each is subdivided twice again into two more rows so as to form a total of eight rows, corresponding to eight output positions.

In accordance with another feature of the invention, the glow discharge is transferred along the branching rows in a particular path to a particular output position by means of a particular series of input code pulses. A series of stepping pulses is then applied to cause the glow discharge to step across from row to row until it reaches the last row, at which time a stop voltage pulse is initiated which terminates the stepping pulses. The number of stepping pulses constitutes the output signal. This feature is applicable to both embodiments of the invention mentioned hereinbefore.

These and other objects and features of the invention will be more clearly understood from

the following detailed description when read in conjunction with the drawings in which:

Fig. 1 illustrates one form of the invention wherein a binary code is impressed upon two input conductors connected to a three-stage tube and the decimal code translation is obtained from one of eight possible output positions;

Fig. 2 is a diagram of an embodiment of this invention including a three-stage tube wherein a binary code may be applied to one input conductor and the translating of the binary code into a decimal code is accomplished by selecting the path through the tube in advance by means of switches;

Fig. 3 illustrates another embodiment including a three-stage binary decoding tube wherein the tube is arranged to produce output pulses on a single output lead, the number of pulses corresponding to a decimal equivalent of the binary input information;

Fig. 4 illustrates an embodiment having the same type of output as that of Fig. 3 but embodying the advance selection of the path by means of coding switches similar to the method utilized in Fig. 2;

Fig. 5 is a top view of a two-stage tube illustrative of one embodiment of this invention;

Fig. 6 is a perspective view of the tube shown in Fig. 5;

Fig. 7 illustrates one type of cathode that may be used in the tube shown in Figs. 5 and 6; and

Fig. 8 illustrates a form of common anode that may be utilized in the device.

Referring now to Fig. 1 the cold cathode gas tube is schematically shown as being comprised of a normalizing cathode N, a plurality of other cathodes divided into a B group of transfer cathodes and an A group of rest cathodes and arranged in branching rows, and an anode 10 common to all the cathodes. Each cathode, such as A₀, is divided into two portions having different glow discharge sustaining efficiencies. The part having the greater of these efficiencies is represented by the portion such as 12 and that having the lesser is represented by a portion such as 11. This is true of all the cathodes except the normalizing cathode N which may have but just one electron discharge sustaining efficiency throughout its length. Each row of cathodes is composed alternately of cathodes from the A and B groups of cathodes beginning with a cathode from the B group and ending with a cathode from the A group. The A or rest cathodes are arranged in successive stages with B or transfer cathodes positioned between these stages.

Cathodes A₁, A₀, A₁₁, A₁₀, A₀₁ and A₀₀ are all connected together to ground. Cathodes A₁₁₁, A₁₁₀, A₁₀₁, A₁₀₀, A₀₁₁, A₀₁₀, A₀₀₁ and A₀₀₀ are all connected to ground through individual resistances such as resistance 13, the output being taken from across these resistances. Cathodes B₁, B₁₁, B₀₁, B₁₁₁, B₁₀₁, B₀₁₁ and B₀₀₁ are connected electrically to conductor 14. The remaining B cathodes B₀, B₀₀, B₁₀, B₀₀₀, B₀₁₀, B₀₁₀₀ and B₁₁₀ are connected electrically to conductor 15. Normalizing cathode N is connected to conductor 16 which is grounded through resistance 17.

The tube is normalized by a negative voltage pulse applied to cathode N through conductor 16, which initiates a glow discharge between cathode N and the anode 10. The code to be translated, in this instance a binary code, is applied to the electrodes of the gas tube through conductors 14 and 15; the "1" input being applied to conductor 14 and the "0" input being applied

to conductor 15. The time sequence of the application of a series of "1" and/or "0" input pulses determines the final position of the electron discharge. Pulses to the "1" input select the upper of the two "B" cathodes in any given branch while pulses to the "0" input select the lower of the two "B" cathodes in any given branch.

For example, consider the operation when the binary code pulse 100 is sent in, corresponding to the decimal number 4. The starting pulse, at time t_0 , initiates a glow discharge between the anode 10 and the normal cathode N. At time t_1 a pulse 19 applied to the "1" input causes transfer of the discharge to the cathode B₁ and the release of this pulse 19 causes transfer of the discharge to the A₁ cathode because upon termination of said pulse, the A₁ cathode assumes the potential negative with respect to the B₁ cathode and the glow discharge thereupon transfers from the higher efficiency portion 12 of the cathode B₁ to the lower efficiency portion 11 of cathode A₁. The glow discharge will immediately move over to the greater efficiency portion 12 of cathode A₁, thus placing the lesser efficiency portions of cathodes B₁₁ and B₁₀ in close proximity to said glow discharge. The next input pulse 21 at time t_2 is applied to the "0" input lead 15 and causes transfer of the glow discharge to B₁₀, since the input pulse is negative and drives cathode B₁₀ negative with respect to cathode A₁. Upon termination of the first "0" input pulse 21 the glow discharge transfers to cathode A₁₀. The second "0" input pulse 20, which is the third input pulse, transfers the glow discharge to cathode A₁₀₀ in a similar manner.

In the embodiment of the invention described above binary coded input signals are supplied to either one or the other of two leads 14 or 15, the time sequence of the input pulses determining the final position reached by the glow discharge. It is also possible to do the decoding by selecting the path through the tube in advance. Fig. 2 shows a way of accomplishing this by means of switches. The tube construction is the same as that shown on Fig. 1. However, in Fig. 2 the connections of the B group of cathodes B₁ and B₀ are connected to conductor 25 through the resistances 26 and 27 respectively. It is possible to connect either cathode B₁ or B₀ to ground through switch S₁. Cathodes B₁₁ and B₀₁ and cathodes B₁₀ and B₀₀ are connected to conductor 25 through resistances 28 and 29 respectively. Either pair of these four cathodes may be connected directly to ground through switch S₂. Cathodes B₁₁ and B₁₀₁, B₀₁₁, and B₀₀₁ are connected to conductor 25 through resistance 30 and cathodes B₁₁₀, B₁₀₀, B₀₁₀ and B₀₀₀ are connected to conductor 25 through resistance 31 and cathodes B₁₁₀, B₁₀₀, B₀₁₀ and B₀₀₀ are connected to conductor 25 through resistance 31. Either of these latter groups of cathodes may also be connected to ground through switch S₃.

The normalizing pulse 24 is applied to normalizing cathode N through conductor 16 which is grounded through resistance 17. It is to be noted that the switches S₁, S₂ and S₃ allow either the lower or the upper of each pair of B cathodes to be grounded. As illustrated in Fig. 2, the switches are in positions which ground cathode B₀ in the first stage, B₀₁ and B₁₁ in the second stage, and B₀₀₁, B₀₁₁, B₁₀₁ and B₁₁₁ in the third stage. This represents the binary code 100. The input pulse 34 will cause the glow discharge to transfer from the normalizing cathode N to cath-

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ode B₁ and upon termination of said first pulse 34 will cause the glow discharge to transfer to cathode A₁. The second input pulse 33 will cause cathode B₁₀ to become negative with respect to cathode A₁ and thus effect a transfer of the glow discharge to cathode B₁₀, and upon the termination of pulse 33 the glow discharge will transfer to cathode A₁₀. The third driving pulse 32 will transfer the glow discharge to cathode B₁₀₀ and thence to cathode A₁₀₀.

Referring now to Fig. 3, there is shown therein an arrangement whereby the output pulses are produced on a single output lead 40; said output corresponding to the decimal equivalent of the binary input code information. The tube can be identical with that shown in Fig. 1 except that additional B cathodes b₁, b₂, b₃, b₄, b₅, b₆ and b₇ are used in the final row. This group of b cathodes is normally biased positively with respect to the A cathodes in the final eight positions. The normalizing input pulse 41 is applied to normalizing cathode N through lead 16 which is grounded through resistance 17. The coded input pulses 42, 44, and 43 are applied to different groups of B cathodes through conductors 45 and 46. Since the glow discharge is transferred from one A cathode to another A cathode by the application of a negative input pulse to a B cathode positioned thereinbetween in exactly the same way as was described with respect to Fig. 1, such descriptions of that part of the operation of the tube illustrated in Fig. 3 will not be repeated. However, the similarity ends when the glow discharge reaches the last A cathode in one of the eight possible rows. In Fig. 1 the output position is determined by the final row wherein the glow discharge is stepped, whereas in Fig. 3 the output is determined by the number of pulses applied to conductor 40. This number of pulses is determined in the following manner. The input code pulses 42, 44, and 43 cause the glow discharge to transfer to anode A₁₀₀ in a manner described hereinbefore. After the glow discharge has reached the last anode A₁₀₀ a series of reading pulses such as 47, 48, 49, 50, etc. are applied to conductor 51. The stepping or reading pulse 50 causes the glow discharge to transfer to cathode b₄ since portion 11 of cathode b₄ constitutes the only portion of all the b group of cathodes close enough to the glow discharge to cause it to transfer thereto. Upon termination of reading pulse 50, cathode b₄ will become positive with respect to cathode A₀₁₁ and the glow discharge will transfer to cathode A₀₁₁. The second reading pulse 49 will cause the glow discharge to transfer to cathode b₃ and thence to cathode A₀₁₀. In a similar manner reading pulses 48 and 47 will cause the glow discharge to transfer to the cathode A₀₀₀ at which time a stop pulse 39 will be transmitted through conductor 52 back to the source of the reading pulses and will cause a cessation of transmission of said reading pulses. It will be noted that the number of reading pulses applied to conductor 40 is determined by the position of the glow discharge in the final column of A cathodes.

In Fig. 4 there is shown the same type of output as is shown in Fig. 3 combined with the advance selection of the glow discharge path by means of coding switches S₄, S₅ and S₆. The B cathode input code pulse lead 60 serves the dual purpose of transmitting the input code pulses such as 61, 62 and 63 to the B cathodes as well as transmitting the reading pulses such as 64, 65, 66 and 67 to the "B" pulse signal output. The

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switches S₄, S₅ and S₆ are preset to operate in the same manner as described with respect to Fig. 2. In Fig. 4 pulse 61 is transmitted through resistance 68 to advance the glow discharge from normalizing cathode N to cathode A₁, pulse 62 through resistance 69 advances the electron discharge to cathode A₁₀ and pulse 63 transmitted through resistance 70 advances the glow discharge to cathode A₁₀₀. The reading pulses are then transmitted; reading pulses 64 stepping the electron discharge down to cathode A₀₁₁ and in a similar manner stepping pulse 65, 66, 67 stepping the electron discharge down to cathode A₀₀₀ at which time a stopping pulse 71 is transmitted over conductor 72 to the source of the reading pulses to cause cessation of the transmission of said reading pulses.

In Figs. 5, 6, 7, and 8 there is illustrated one construction of a two-stage tube. The top view, Fig. 5, illustrates the branching rows arrangement of the cathodes which are divided into two main groups, the B cathode group and the A cathode group. Normalizing cathode N is the apex of the arrangement. Cathodes B₀ and B₁ comprise the beginning of two main rows, each of which is followed by an A cathode. Each of these two A cathodes is followed by two B cathodes each of which forms the beginning of a new row. Following each of these latter B cathodes is another A cathode which in the design shown in this drawing constitute the four final possible positions of electron discharge. Anode 10 is common to all of the cathodes.

In Fig. 6, element 10 is the anode common to all the cathodes. Cathodes B₀₀ and B₀ are supported on wire 81 which is in turn supported by lead-in conductor 82. Cathode B₁₀ is supported by conductor 80 which is secured to conductor 82. Cathodes B₀₁, B₁ and B₁₁ are supported on conductors 88, 85 and 93, respectively; the three latter conductors being in turn supported by conductor 84 and lead-in conductor 91. Conductors 83 and 87 support cathodes A₀ and A₁, respectively. Cathode N is supported by conductor 83. The anode 10 has for its support conductors 89 and 90 which are shown only in part.

Fig. 7 shows one of the cathodes used in either the A or B groups of cathodes. Portion 11 has a lesser electron discharge sustaining efficiency than does portion 12 since an electron discharge will normally concentrate in a geometric surface such as exemplified by portion 12 rather than on the surface embodied in portion 11.

Fig. 8 illustrates the anode which is common to all the cathodes. It may be constructed of any suitable anode material.

Although the tube construction shown in Figs. 5 and 6 has only two stages therein, it is apparent that a three or four-stage tube can be constructed merely by adding another row of B cathodes and another row of A cathodes.

It is to be understood that the form of the invention herewith shown and described, is to be taken as preferred examples of same, that various changes in shape, size, arrangement of parts and/or substitution of circuit elements may be resorted to, without departing from the spirit or scope of the invention.

What is claimed is:

1. A glow discharge device comprising a plurality of cathodes therein and an anode common to all of said cathodes, said plurality of cathodes comprising an A group of cathodes, a B group of cathodes, and a starter cathode, each cathode of said A and B groups of cathodes having a

greater and a lesser discharge sustaining efficiency portion, said A and B groups of cathodes arranged in rows beginning from an apex, each row comprised of cathodes of said A and B groups of cathodes alternately arranged, each row further having lesser and greater glow discharge efficiency portions alternately arranged therein, said starter cathode comprising said apex.

2. A glow discharge device comprising a plurality of cathodes arranged in branching rows, a starter cathode forming the apex of said branching rows, and an anode common to all of said cathodes, each of said plurality of cathodes comprised of a lesser and a greater glow discharge sustaining efficiency portion alternately arranged in each row, said plurality of cathodes being divided into an A group of cathodes and a B group of cathodes, cathodes from said A and B groups of cathodes being alternately arranged in each row, a first two of said rows branching from said apex, each of said first two rows branching into a pair of second rows, and each of said second rows branching into a pair of third rows to form eight rows, each of said first, second, and third rows beginning with a B cathode, and each of said eight rows being terminated by an A cathode.

3. A glow discharge device in accordance with claim 2 comprising a second plurality of cathodes alternately arranged with said terminating A cathodes so that one of said second plurality of cathodes is positioned between each two adjacent terminating A cathodes, each of said second plurality of cathodes having a lesser and a greater glow discharge sustaining efficiency portion, said lesser and greater glow discharge sustaining efficiency portions of said terminating A cathodes and said cathodes of said second plurality of cathodes being alternately arranged.

4. Translating means comprising a glow discharge device having a plurality of cathodes therein, each of said cathodes having two portions of different glow discharge sustaining efficiencies, and an anode common to all said cathodes, said cathodes arranged in first branching rows having an apex, each of said branching rows comprising second branching rows, said cathodes being arranged in said rows so that the lesser efficiency portions and the greater efficiency portions are alternately arranged, said plurality of cathodes being divided into a plurality of groups, the first of said groups being electrically connected together, said cathodes of said first of said groups being arranged alternately with cathodes of the other of said groups of cathodes in each of said rows, circuit means to apply input code pulses to said other of said groups of cathodes to cause a glow discharge to step from one cathode to another from said apex, selecting its path along said branching rows of cathodes in accordance with said input code pulses.

5. Translating means comprising a glow discharge device having a plurality of cathodes, a starter cathode, and an anode common to all of said cathodes, each of said plurality of cathodes other than said starter cathode having two portions of different glow discharge sustaining efficiencies, said plurality of cathodes arranged in branching rows with said starter cathode at the apex of said branching rows, the lesser and greater glow discharge sustaining efficiency portions being alternately arranged in each row, each of said branching rows being subdivided into second branching rows, said plurality of cathodes being divided into a B group of cathodes

and an A group of cathodes, each row of cathodes being composed of cathodes of said A and B groups alternately arranged, said A group of cathodes being connected together, a circuit means, switch means connecting said B cathodes to said circuit means in accordance with a code, means to initiate a glow discharge between said starter cathode and said main anode, means to apply a series of input pulses to said circuit means in accordance with said code to cause said glow discharge to step along said branching rows in a path in accordance with said code.

6. A translating device comprising a plurality of cathodes arranged in branching rows, a starter cathode forming the apex of said branching rows, and an anode common to all of said cathodes, each of said plurality of cathodes comprised of lesser and greater glow discharge sustaining efficiency portions alternately arranged in each row, said plurality of cathodes being divided into an A group of cathodes and a B group of cathodes, cathodes from said A and B groups of cathodes being alternately arranged in each row, said A group of cathodes being connected together, each new branching row being started by a B cathode, a first circuit means for applying a normalizing pulse to said starter cathode, a first and second input means, a first two of said rows branching from said apex, each of said first two rows branching into a pair of other second rows, and each of said second rows branching into a pair of other third rows, each of said first, second, and third rows beginning with a B cathode, one each of the pair of the B cathodes starting each new pair of rows being connected to one of said first and second input means, and means for applying input pulses in accordance with a code to cause a glow discharge to step from cathode to cathode along a particular path.

7. A translating device comprising a plurality of cathodes arranged in branching rows, a starter cathode forming the apex of said branching rows, and an anode common to all of said cathodes, each of said plurality of cathodes composed of lesser and greater glow discharge sustaining efficiency portions alternately arranged in each row, said plurality of cathodes being divided into an A group of cathodes and a B group of cathodes, cathodes from said A and B groups of cathodes being alternately arranged in each row, said A group of cathodes being connected together, each new branching row being started by a B cathode, a first pair of said plurality of rows of cathodes branching from said apex, each of said first pair of rows branching into a pair of second rows, and each of said pair of second rows branching into a pair of third rows, a common conductor, each of said first, second, and third rows beginning with a B cathode, each of said B cathodes starting a row being connected to said common conductor through a resistance switching means to selectively connect in accordance with a code either B cathode of said first, second, or third pairs of B cathodes starting a row to a potential adapted to render said B cathodes incapable of causing a glow discharge to transfer thereto, means for applying input pulses to said common conductor in accordance with said code to cause a glow discharge to step along the branching rows in a particular path.

8. A translating device comprising an A group of cathodes, a B group of cathodes, a b group of cathodes, a normalizing cathode, and an anode common to all of said cathodes, each cathode of said A, B and b groups of cathodes having a

greater and a lesser glow discharge sustaining efficiency portion, said A and B groups of cathodes arranged in branching rows from an apex, said normalizing cathode being positioned at said apex, each row of cathodes being comprised of cathodes from said A and B groups of cathodes alternately arranged, the greater and lesser glow discharge sustaining efficiency portions being alternately arranged in each row, a first pair of said rows branching from said apex, each of said first pairs of rows branching into a second pair of rows, each of said second pairs of rows branching into a third pair of rows to make eight rows, each of said eight rows of cathodes being terminated by an A cathode, a b cathode positioned between every two adjacent terminating A cathodes, the greater and lesser glow discharge sustaining efficiency portions of said b cathodes and said terminating A cathodes being alternately arranged, a first circuit means to initiate a glow discharge between said main anode and said starter cathode, first and second input conductors, a second circuit means selectively connecting said B cathodes to said first and second input conductors in accordance with a code, means to apply input pulses to said first and second input conductors in accordance with the said code to cause a glow discharge to step along the branching rows of cathodes in a particular path, a third input conductor connecting said b cathodes in parallel, means to apply a series of second pulses to said third input conductor to step said glow discharge along said terminating A cathodes, and circuit means to terminate said second pulse when said glow discharge reaches a predetermined one of said terminating A cathodes.

9. A translating device comprising an A group of cathodes, a B group of cathodes, a b group of cathodes, a normalizing cathode, and an anode common to all of said cathodes, each cathode of said A, B, and b groups of cathodes having a greater and a lesser glow discharge sustaining efficiency portion, said A and B groups of cathodes arranged in branching rows from an apex, said normalizing cathode being positioned at said apex, each row of cathodes being comprised of cathodes from said A and B groups of cathodes alternately arranged, the greater and lesser glow discharge sustaining efficiency portions being alternately arranged in each row, a first pair of said rows branching from said apex, each of said first pair of rows branching into a second pair of rows, each of said second pair of rows branching into a third pair of rows to make eight rows, each of said eight rows of cathodes being terminated by an A cathode, a b cathode positioned between each two adjacent terminating A cathodes, the greater and lesser glow discharge sustaining efficiency portions of said b cathodes and said terminating A cathodes being alternately arranged, a common conductor, each B cathode being connected to said common conductor through a resistance, one said resistance individual to each of said B cathodes, a plurality of switches adapted to selectively connect certain of said B cathodes in accordance with a code to a potential which will render them incapable of causing a glow discharge to transfer thereto upon application of an input pulse thereto, means for applying input pulses to said common conductor in accordance with said code to cause said glow discharge to step along the branching rows in a particular path, a first circuit means for initiating a glow discharge between said common anode and said starter cathode, a second

conductor connecting said b cathodes in parallel, means to apply a series of second pulses to said second conductor to step the glow discharge along said terminating A cathodes, and circuit means to terminate said second pulses when said glow discharge reaches a predetermined one of said terminating A cathodes.

10. A glow discharge device comprising a plurality of cathodes arranged in a branching array, said cathodes comprising a starter cathode at the initial point of said array, a plurality of stages of rest cathodes in order in said array each having twice the number of cathodes of the preceding stage, said plurality of stages including a first stage of two rest cathodes, alternative transfer cathodes between said starter cathode and said first stage of two rest cathodes, and alternative transfer cathodes between each rest cathode and two rest cathodes of the succeeding stage, and an anode adjacent all of said cathodes.

11. A glow discharge device in accordance with claim 10 wherein one group of said alternative transfer cathodes are electrically connected together and the other group of said alternative transfer cathodes are electrically connected together.

12. A glow discharge device in accordance with claim 10 wherein each of said rest and transfer cathodes has a greater and a lesser discharge sustaining efficiency portion, the portion of lesser efficiency being adjacent the preceding cathode in the array.

13. A glow discharge device in accordance with claim 10 wherein a terminating cathode is positioned adjacent each of the rest cathodes in the last stage of said array.

14. Translating means comprising a glow discharge device having a plurality of cathodes arranged in a branching array, said cathodes comprising a starter cathode at the initial point of said array, a plurality of stages of rest cathodes in order in said array including a first stage of two rest cathodes, each stage having twice the number of cathodes of the preceding stage, alternative transfer cathodes between said starter cathode and said first stage of two rest cathodes, and alternative transfer cathodes between each rest cathode and two rest cathodes of the succeeding stage, said alternative transfer cathodes being electrically connected together in two groups, an anode adjacent all of said cathodes, and circuit means to apply input code pulses to said alternative transfer cathodes to cause a glow discharge to step from said starter cathode at the initial point of said array to rest cathodes in successive stages, selecting its path in accordance with said input code pulses applied to said transfer cathodes.

15. Translating means in accordance with claim 14 wherein each of said rest cathodes except those in the last stage in said array is connected to ground and each of said rest cathodes of said last stage is connected to ground through a resistance and comprising output means individually connected to each of said rest cathodes of said last stage.

16. Translating means comprising a glow discharge device having a plurality of cathodes arranged in a branching array, said cathodes comprising a starter cathode at the initial point of said array, a plurality of stages of rest cathodes in order in said array including a first stage of two rest cathodes, each stage having twice the number of cathodes of the preceding stage, alternative transfer cathodes between said starter cathode and said first stage of two rest cathodes,

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and alternative transfer cathodes between each rest cathode and two rest cathodes of the succeeding stage, said alternative transfer cathodes being electrically connected together in two groups, each of said rest and transfer cathodes having a greater and a lesser discharge efficiency portion, the portion of lesser efficiency being adjacent the preceding cathode in the array, and an anode adjacent all of said cathodes, a first input means connected to one group of said alternative transfer cathodes, a second input means connected to the other group of said alternative transfer cathodes, means for applying a normalizing pulse to said starter cathode, and means to apply input pulses to said first and second input means in accordance with a code to cause the glow discharge to step from said starter cathode along a particular path.

17. Translating means comprising a glow discharge device having a plurality of cathodes arranged in a branching array, said cathodes comprising a starter cathode at the initial point of said array, a plurality of stages of rest cathodes in order in said array including a first stage of two rest cathodes, each stage having twice the number of cathodes of the preceding stage, alternative transfer cathodes between said starter

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cathode and said first stage of two rest cathodes, and alternative transfer cathodes between each rest cathode and two rest cathodes of the succeeding stage, said alternative transfer cathodes being electrically connected together in two groups, each of said rest and transfer cathodes having a greater and a lesser discharge efficiency portion, the portion of lesser efficiency being adjacent the preceding cathode in the array, and an anode adjacent all of said cathodes, a common conductor, a plurality of resistances connecting said alternative transfer cathodes to said common conductor, switching means adapted to selectively connect certain of said alternate transfer cathodes in accordance with a code to a potential which will render them incapable of transferring a glow discharge upon application of an input pulse, and means for applying input pulses to said common conductor in accordance with said code to cause a glow discharge to step from said starter cathode at the initial point of said array to rest cathodes in successive stages, selecting its path in accordance with said input code pulses applied to said transfer cathodes.

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No references cited.