Dec. 3, 1957 D. LODGE ET AL 2,815,470

COLD-CATHODE GAS-DISCHARGE TUBES AND CIRCUITS THEREFOR

Filed April 11, 1955 3 Sheets-Sheet 1

FIG. 1

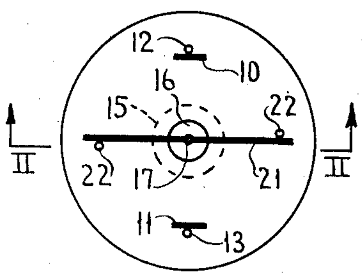


FIG. 2

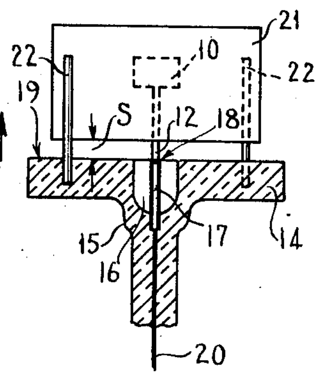
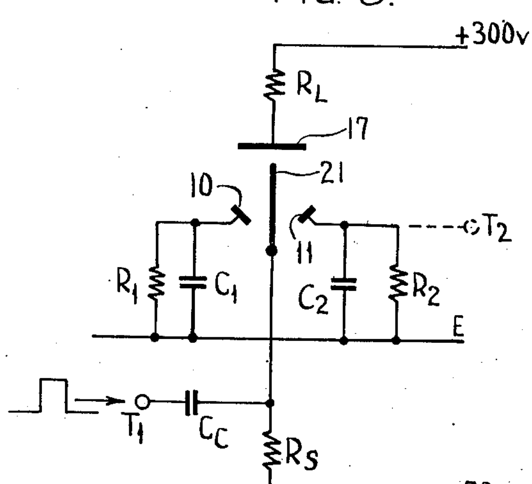


FIG. 3.



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Filed April 11, 1955 3 Sheets-Sheet 2

Fig. 4.

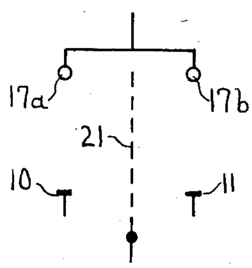


Fig. 5.

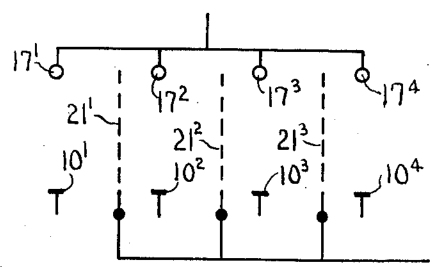


Fig. 6.

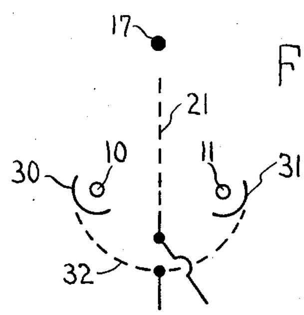


Fig. 7

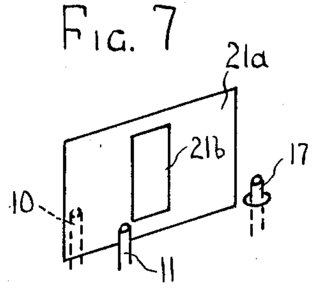
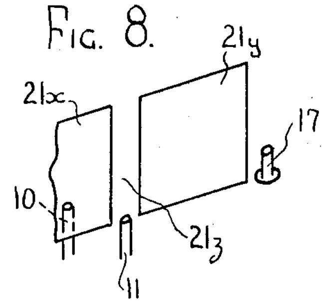


Fig. 8.



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Filed April 11, 1955 3 Sheets-Sheet 3

Fig.9.

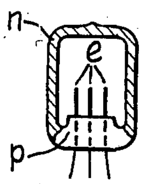


Fig.10.

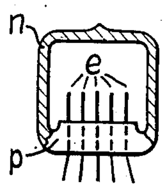


Fig.11.

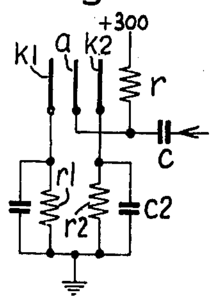


Fig.12.

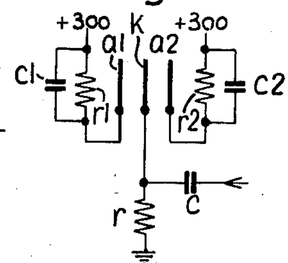


Fig.13.

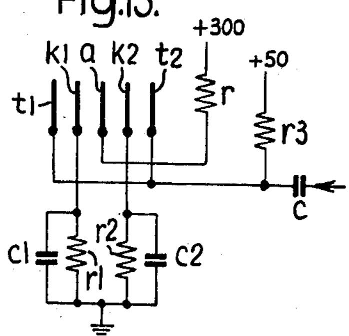


Fig.14.

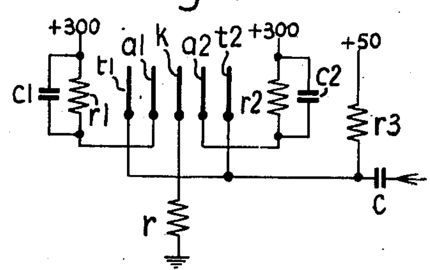


Fig.15.

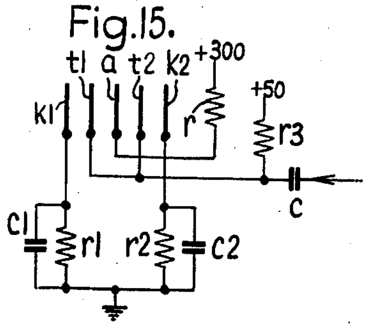


Fig.16.

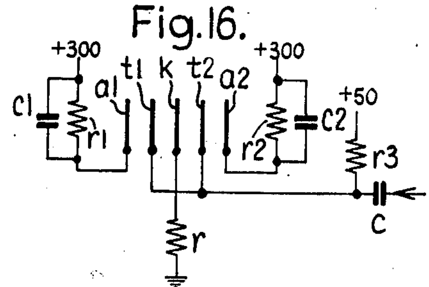


Fig.17.

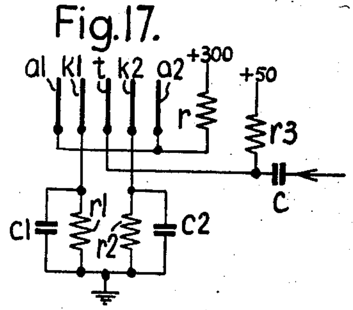
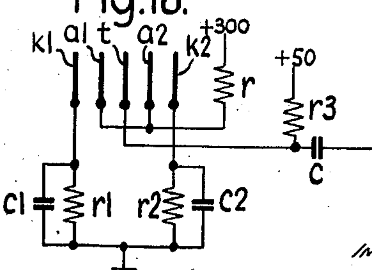


Fig.18.



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Patented Dec. 3, 1957

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COLD-CATHODE GAS-DISCHARGE TUBES AND CIRCUITS THEREFOR

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Application April 11, 1955, Serial No. 500,526
Claims priority, application Great Britain April 15, 1954
8 Claims. (Cl. 315—84.6)

This invention relates to cold-cathode gas-discharge tubes and circuit arrangements therefor and is more particularly concerned with tubes of the multi-electrode type in which at least two alternative glow-discharge paths are available between one or another of a plurality of separate electrodes and a common electrode structure and in which means are provided by which transfer of the glow-discharge may be effected from one path to another path by an applied control pulse.

Various forms of discharge tubes of this type are already known including a form having a plurality of cathodes spaced around and at a common distance from a central anode. Between each pair of adjacent cathodes is arranged at least one and usually two further, so-called, transfer electrodes; the similar transfer electrodes between each pair of cathodes are interconnected as a group and arrangements are provided for applying to such group of interconnected transfer electrodes a negative-going control pulse which serves to draw the discharge from the operating cathode to an adjacent transfer electrode, the cessation of such negative pulse being accompanied by the transfer of the discharge from such transfer electrode to the cathode which is next in order around the anode instead of back to the cathode which was originally operating whereby the discharge between the central anode and the cathode progressively moves around the series of cathodes visiting each cathode in turn. The control arrangements, which require the provision of a negative-going pulse of some appreciable current magnitude, are not entirely convenient in certain circuit applications since the negative polarity thereof necessitates the introduction of a polarity inverter stage if it is required to derive the control pulses for one discharge device from the (positive-going) pulse output available at a cathode of a previous similar discharge device as in a multi-stage pulse counter.

Objects of the present invention are to provide improved constructional forms of cold-cathode gas-discharge tube of the alternative discharge path type and circuit arrangements therefor in which transfer of the glow-discharge from between one pair of electrodes to between another pair of electrodes is effected by means of a control pulse which is of relatively small current value and which, moreover, may be of either positive or negative polarity according to the circuit arrangement employed.

In a circuit arrangement according to the invention the common electrode structure of the discharge tube is arranged to be connected to a terminal of appropriate polarity of a source of operating potential by way of a first load circuit having a predetermined time-constant value while each of said separate electrodes is arranged for connection to a terminal of appropriate opposite polarity of such source of operating potential by way of an individual load circuit which has a time-constant value substantially longer than that of said first load circuit.

According to another aspect of the invention a cold-cathode gas-discharge tube for use in a circuit arrangement as referred to in the preceding paragraph comprises an envelope containing a suitable low pressure gaseous filling and an electrode system consisting of a group of three or more rods or wires of substantially similar physical dimensions and having a substantially equal spacing distance between each pair of adjacent electrodes. One or more electrode/s located at or near the centre of the group is/are arranged for operation either as an anode or as a cathode while further electrodes at an equal spacing distance on opposite sides of such central electrode/s are arranged for operation as alternative separate cathodes or anodes as the case may be.

According to another aspect of the invention a cold-cathode gas-discharge tube for use in a circuit arrangement as referred to in the next to last preceding paragraph comprises an envelope containing a suitable low-pressure gaseous filling and an electrode system comprising a plurality of separate cathodes each co-operating with an anode, said cathodes each being arranged at a substantially similar distance from its co-operating anode, and a screen or transfer control electrode disposed between each pair of adjacent cathodes, said screen electrode or each of them being so shaped and positioned that it controls the degree of ionisation coupling between adjacent cathode-to-anode discharge paths whereby such coupling is low when the potential of such screen electrode is of similar value to that of an inoperative cathode but becomes high when the potential of such screen electrode is suitably raised.

In order that the nature of this invention may be more readily understood a number of embodiments thereof will now be described with reference to the accompanying drawings in which:

Fig. 1 is a plan view and Fig. 2 a longitudinal cross-section on the line II—II of Fig. 1 of the electrode structure of one form of discharge tube according to the invention.

Fig. 3 is a circuit diagram of one arrangement for using the tube shown in Figs. 1 and 2.

Figs. 4, 5, 6, 7 and 8 illustrate various modifications of the arrangements shown in Figs. 1 and 2.

Fig. 9 is a view of another, three-electrode, form of tube in accordance with the invention, while Fig. 10 is a similar view of a further, five-electrode, form of tube.

Figs. 11–18 illustrate a number of different circuit arrangements using tubes of the construction illustrated in Figs. 9 and 10.

Referring to Figs. 1 and 2 the form of tube construction shown comprises two cathodes **10, 11** in the form of small area rectangular plates secured to support rods **12, 13** sealed into a disc **14** of glass at the centre of which is provided a depending part-tubular stem **15** serving to define a recess **16** within which is located an anode rod **17** the uppermost surface **18** of which forms the active anode area and is substantially flush with the top surface **19** of the glass disc. The connecting wire **20** for such anode passes through the centre of the depending stem **15**. The two cathodes **10, 11** are disposed at diametrically opposed positions on the glass disc, such positions being located in a plane which includes the axis of the anode rod **17**, while in a plane which also includes the axis of such rod **17** and which is at right angles to that including the two cathodes **10, 11**, is disposed a rectangular screening plate **21** of relatively large area as compared with the cathodes. This screen plate **21**, which constitutes a transfer control electrode, is supported by rods **22** also sealed into the glass disc **14**.

A relatively small spacing distance S separates the bottom edge of the screening plate **21** from the surface **19** of the glass disc, such screening plate serving virtually to isolate the two alternative discharge paths, defined respectively as between anode rod **17** and cathode **10** and between anode **17** and cathode **11**, except for the small ionisation coupling space defined by the narrow gap S. By suitable shaping and positioning of the screen plate **21** with relation to the two cathodes **10**, **11** and the anode **17** it can be arranged that the stray ionisation coupling between the two discharge paths is almost zero when the screen plate is at the earth or cathode potential but rises to a high value when a suitably positive potential is applied to such screen plate.

A circuit arrangement for such a tube is shown in Fig. 3 wherein the anode **17** is connected to the positive terminal of a suitable source of operating potential +300 v. by way of a load circuit formed by series resistor R_L (300 kilohms) while each cathode **10**, **11** is connected to the earthed negative terminal of the operating potential source through individual load circuits comprising respectively resistors R_1 and R_2 (each 82 kilohms) which resistors are each shunted by capacitors C_1 and C_2 (each 0.001 microfarad). The screen or transfer control electrode **21** is connected by way of series resistor R_S (0.5 megohm) to a source of biasing potential +50 v. This screen electrode is also connected through capacitor C_C (0.1 microfarad) to an input terminal T_1 to which a source of positive-going transfer control pulses can be connected. An output terminal such as shown at T_2 can be connected to either one of the two cathodes or a separate terminal provided for each cathode.

The operation of the tube in the circuit illustrated in Fig. 3 is believed to be as follows. It will be seen that the tube is arranged with each cathode **10**, **11** having a load circuit whose time-constant is of relatively long value. Such time-constant value is complexly related to the deionisation time of each half of the tube, i. e. to each discharge path between the anode **17** and the related cathode **10** or **11**. The anode resistor R_L is unshunted by a capacitor and consequently has a relatively short time-constant value compared with that of the cathode load circuits.

A discharge is initiated between the anode **17** and one cathode, say the cathode **10**, when the source of operating potential +300 v. is connected to the anode provided, of course, such source of potential is higher than the striking voltage for either discharge gap. Upon the application of a positive pulse to the screen or transfer control electrode **21**, the ionisation coupling between the two halves of the tube, i. e. between the anode **17** and each of the two cathodes **10**, **11**, is increased to the point where the second cathode **11** starts to conduct. Initially there is no voltage across the load network R_2, C_2 of that particular cathode so that the conduction to this second cathode increases the total current through the anode load resistor R_L and thereby lowers the potential of the anode **17** below the point where the first discharge to the cathode **10** can be maintained. When the glow-discharge on the first cathode **10** collapses, the full discharge is then concentrated on the second cathode **11** and the voltage maintained across the load network R_1, C_1 of the first cathode, owing to its relatively long time-constant, holds up the potential of the cathode **10** and prevents re-establishment of the discharge to such first cathode whilst the gas around it is de-ionising. Subsequently when a second positive-going control pulse is applied to the screen or transfer control electrode **21**, the cycle of operation repeats but in the opposite direction. With such an arrangement the screen electrode **21** never carries more than a very small fraction of the current required by either cathode **10** or **11** and it can therefore be supplied from a relatively high impedance control circuit. Furthermore, the pulse polarity required for application to the screen electrode **21** in order to switch the glow-discharge from one cathode to the other is of the same sense as the output which can be derived from either of the cathode circuits, e. g. through terminal T_2, and in consequence the output pulse from one cathode of one tube can be used as

a controling or triggering pulse for another tube without the necessity for the interposition of a polarity inverter stage.

The screen electrode may be an imperforate thin sheet metal plate or a sheet of gauze or of perforated metal or even a system of parallel wires similar to the so-called grid electrodes of thermionic valves. The cathodes may likewise be of imperforate sheet metal or of gauze or even constituted by rods or wires. The cathodes are preferably uncoated but all connecting and support wires are desirably coated with glass or otherwise treated to prevent undesired discharge thereto. The gas filling used in the tube may be of various kinds, for instance, of neon, argon, helium or hydrogen or a mixture of certain of such gases, for instance, a mixture of neon, argon and helium.

Many variations of electrode arrangements are possible. For example a separate anode may be provided for co-operation with each cathode as illustrated in Fig. 4 where cathode **10** cooperates with an anode **17*a*** and cathode **11** with an anode **17*b***. The two anodes **17*a***, **17*b*** are both connected to a common output connection and thus form a common anode electrode structure. Similarly the screen or transfer control electrode **21** need not be placed symmetrically with respect to the adjacent cathode particularly when a directional characteristic is required in the transfer of glow-discharge from one cathode to another. As shown in Fig. 5 a plurality of cathodes $\mathbf{10}^1$, $\mathbf{10}^2$, $\mathbf{10}^3$, $\mathbf{10}^4$ . . . are each associated with a cooperating anode $\mathbf{17}^1$, $\mathbf{17}^2$, $\mathbf{17}^3$, $\mathbf{17}^4$ . . . and with screen or transfer control electrodes $\mathbf{21}^1$, $\mathbf{21}^2$, $\mathbf{21}^3$ . . . in between each pair of adjacent cathode/anode discharge paths with such transfer control electrodes disposed nearer to the right-hand discharge electrodes than to the left-hand discharge electrodes. All of the anodes are interconnected as a common electrode structure and joined to a common external connection as are also all of the screen electrodes.

The discharge and the glow transfer characteristics of the tube may be modified by the use of further shield or like electrodes in the immediate vicinity of the glow-discharge paths, for instance, by members partially embracing each cathode such as is shown at **30** and **31** in Fig. 6. Instead of or in addition to such members **30**, **31**, a further shield member **32** may be provided. Such shield electrodes are normally supplied with a permanent positive bias potential.

For the purpose of controlling or modifying the degree of isolation coupling between adjacent discharge paths the size, shaping or positioning of the guide or screen electrode **21** may be altered. Thus, as is shown in Fig. 7, a planar screen electrode **21*a***, situated between the respective discharge paths from cathodes **10**, **11** to anode **17**, is provided with an aperture **21*b*** which serves to increase the degree of ionisation coupling. A similar effect may be obtained by dividing such screen electrode into two parts **21*x***, **21*y*** as shown in Fig. 8 to leave a communicating gap **21*z***.

The disposition of the alternative glow-discharge paths within a common envelope allows the ionisation of the gaseous filling already present on account of an existing glow-discharge to be effective in assisting the initiation of the new glow-discharge upon transfer with consequent acceleration of the setting-up of the alternative discharge and improvement in the maximum rate of counting permissible in a counter device employing such tubes.

In the simplified discharge tube construction shown in Fig. 9 three substantially similar electrodes *e* of wire or rod form are arranged to project from a pinch region *p* of an enclosing envelope *n* containing a suitable low-pressure gaseous filling. The electrodes *e* are conveniently all arranged to lie parallel with one another in a common plane and the spacing distance between the centres of adjacent electrodes is substantially identical.

With such an arrangement the central electrode may, by suitable forming processes, be adapted for operation as an anode while the two outer electrodes on either side of such central anode may be arranged for operation as cathodes. With such a disposition of cathode and anode electrodes the circuit arrangement shown in Fig. 11 may be utilised, the anode *a* being connected to the positive terminal of a suitable source of operating potential, say +300 volts, through a load circuit of resistor *r* having a short time-constant value and the two cathodes *k***1**, *k***2** being each separately connected to the negative terminal of the source of operating potential (which negative terminal is conveniently earthed) through individual load circuits comprising respectively resistor *r***1** shunted by capacitor *c***1** and resistor *r***2** shunted by capacitor *c***2**. Such individual cathode load circuits each have a similar time-constant value which is appreciably longer than that of the anode load circuit.

With such an arrangement a glow-discharge set up over a path between the anode *a* and either one of the two cathodes *k***1**, *k***2** may be transferred to the alternative path between such anode and the opposite cathode by the application of either a short positive-going pulse or a short negative-going pulse to the anode *a*, for instance, by way of capacitor *c*. Output potentials may be derived from either or both of the cathodes in a manner similar to that shown in Fig. 3.

An alternative arrangement using two separate anodes *a***1**, *a***2** and a single central cathode *k* is illustrated in Fig. 12. In this instance the separate anode load circuits *r***1**, *c***1** and *r***2**, *c***2** each have a relatively long time-constant value and the single cathode has a load circuit *r* which has only a short time-constant value. In this example transfer of a discharge from one path between the cathode and one anode to the alternative path from between such cathode and the other anode can be effected by applying either a positive-going or a negative-going transfer pulse to the cathode, e. g. by way of capacitor *c*. Output potentials, in this embodiment, are normally derived from one or both anodes.

In the alternative discharge tube arrangement shown in Fig. 10, five wire or rod-like electrodes *e*, each of substantially similar shape and dimensions, are arranged to project from the pinch *p* of an envelope *n* containing a low-pressure gaseous filling, the electrodes again being conveniently disposed in parallel relationship and in a common plane and with a common spacing distance between adjacent electrodes.

One circuit arrangement for using the five-electrode tube structure shown in Fig. 10 is shown in Fig. 13 where the central electrode *a* is adapted for use as an anode and the two next adjacent electrodes *k***1**, *k***2** on either side thereof are arranged for operating as cathodes. The two outside electrodes *t***1**, *t***2** may then be used as screen or transfer control electrodes operating in a similar manner to that already described in connection with Figs. 1, 2 and 3. In this embodiment of the invention the single anode *a* has a load circuit consisting of resistor *r* with a short time-constant value while the two cathodes *k***1**, *k***2** each have separate load circuits *r***1**, *c***1** and *r***2**, *c***2** each with a similar but relatively long time-constant value. The two transfer electrodes *t***1**, *t***2** are interconnected as a single electrode structure and are provided with means, such as resistor *r***3** connected to a source of suitable positive potential, +50 volts, for providing a suitable standing bias voltage and with coupling capacitor *c* as shown for transmitting positive-going transfer control pulses thereto.

As with the arrangements described with reference to Figs. 11 and 12, the function of the anode and cathode-forming electrodes can be interchanged in the manner shown in Fig. 14 where the central electrode is arranged as a common cathode *k* and the two immediately adjacent electrodes *a***1**, *a***2** on either side thereof as separate anodes. In this case and as before the separate anode load circuits *r***1**, *c***1** and *r***2**, *c***2** each have a long time-constant value relative to that of the load circuit *r* of the single cathode.

Another arrangement for using the five-electrode tube is shown in Fig. 15 where the central electrode *a* is arranged as a common anode and the two outermost electrodes *k***1**, *k***2** on either side of such anode as separate cathodes while the two intermediate electrodes *t***1**, *t***2** form transfer control electrodes. As with the example of Fig. 13, the anode *a* is provided with a load circuit *r* of short time-constant value, the two cathodes *k***1**, *k***2** are provided with separate load circuits *r***1**, *c***1** and *r***2**, *c***2** each having a similar and relatively long time-constant value and the two transfer electrodes *t***1**, *t***2** are interconnected and supplied with a standing bias potential by way of resistor *r***3** and with transfer control pulses, which may be either poistive-going or negative-going, through capacitor *c*.

As with the examples of Figs. 13 and 14, the disposition of the anode and cathode electrodes can be interchanged in the manner shown in Fig. 16 where the central electrode *k* is a common cathode and the two outermost electrodes *a***1**, *a***2** form separate anodes provided with individual load circuits *r***1**, *c***1**, *r***2**, *c***2** each having a similar time-constant value which is long relative to that of the cathode load circuit *r*.

Yet another circuit arrangement is shown in Fig. 17 where the central electrode *t***1** is arranged to form a single transfer electrode flanked on either side by two separate cathodes *k***1**, *k***2** which in turn are flanked on their outer sides by anodes *a***1**, *a***2**. With this construction the two anodes *a***1**, *a***2**, although in the form of separate electrode wires or rods, are interconnected to form a common anode electrode structure which is fed through a load circuit of resistor *r* having a short time-constant value. The two cathodes *k***1**, *k***2** are each provided with separate load circuits *r***1**, *c***1** and *r***2**, *c***2** each load circuit having a similar and long time-constant value relative to that of the anode load circuit. The transfer pulses, which are applied to the central transfer electrode *t* may be either positive-going or negative-going. Conversely the two cathodes *k***1**, *k***2** may be interconnected as a common electrode structure and provided with a single load circuit having a short time-constant and the two anodes *a***1**, *a***2** kept separate and each provided with an individual load circuit, such load circuits each having a similar and long time-constant value relative to that of the cathode load circuit. The transfer pulses applied to electrode *t* through capacitor *c* may again be either positive-going or negative-going.

Yet a further circuit arrangement is shown in Fig. 18 in which a central transfer electrode *t* is again used but with the next adjacent electrodes on either side formed as anodes *a***1**, *a***2** and the outermost electrodes on either side as cathodes *k***1**, *k***2**. As with the embodiment of Fig. 17, the anodes *a***1**, *a***2** may be interconnected as a common anode structure and provided with a single load circuit *r* having a short time-constant and the separate cathodes *k***1**, *k***2** provided with individual load circuits *r***1**, *c***1** and *r***2**, *c***2** each having a similar and long time-constant value relative to that of the anode load circuit. Conversely the two cathodes *k***1**, *k***2** may be interconnected as a common cathode structure and provided with a load circuit of short time-constant while the two anodes *a***1**, *a***2** are kept separate and each provided with individual load circuits of long time-constant value. In either case the transfer pulses applied to the central electrode *t* may be either negative-going or positive-going.

Other variations of both the number and shaping of the electrodes used may obviously be made without departing from the scope of the invention.

We claim:

1. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and five parallel electrode rods arranged in a common plane, said electrode rods comprising a central rod, a first inner pair of electrode rods disposed one on each side of said central rod in equi-spaced relationship thereto and

a second outer pair of electrode rods disposed one on each side of said first pair of rods in equi-spaced relationship to said central rod, circuit means interconnecting each of the electrode rods of one of said first and second pairs of electrode rods whereby said tube is provided with a first electrode system comprising said central electrode, a second electrode system comprising said interconnected pair of electrode rods and third and fourth electrode systems comprising respectively said separate remaining electrode rods, circuit means including a first load circuit of predetermined time constant connecting one of said first and second electrode systems to a source of a first operating potential of predetermined polarity, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit connecting respectively said third and fourth electrode systems to a source of a second operating potential of polarity opposite to that of said first operating potential and circuit means including a load impedance for connecting the remaining electrode system of said first and second electrode systems to a source of a third operating potential intermediate those of said first and second potentials and for connecting said remaining electrode system also to a source of triggering pulses.

2. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and five parallel electrode rods, said electrode rods comprising a central rod, a first pair of electrode rods disposed one on each side of said central rod in equi-spaced relationship thereto and a second pair of electrode rods disposed one on that side of each of the rods of said pair of electrode rods which is opposite to said central rod, said second pair of rods being in equi-spaced relationship to said central rod, circuit means interconnecting each of the electrode rods of one of said first and second pairs of electrode rods whereby said tube is provided with a first electrode system comprising said central electrode, a second electrode system comprising said interconnected pair of electrode rods and third and fourth electrode systems comprising respectively said separate remaining electrode rods, circuit means including a first load circuit of predetermined time constant connecting one of said first and second electrode systems to a source of a first operating potential of predetermined polarity, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit connecting respectively said third and fourth electrode systems to a source of a second operating potential of polarity opposite to that of said first operating potential and circuit means including a load impedance for connecting the remaining electrode system of said first and second electrode systems to a source of a third operating potential intermediate those of said first and second operating potentials and for connecting said remaining electrode system also to a source of triggering pulses.

3. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and a group of five equi-spaced and aligned electrode elements, said group of electrode elements comprising a central electrode element, a first inner pair of electrode elements disposed one on each side of said central electrode element and a second outer pair of electrode elements disposed one on each side of said first pair of electrode elements, circuit means interconnecting each of the electrode elements of one of said first and second pairs of electrode elements whereby said tube is provided with a first electrode system comprising said central electrode element, a second electrode system comprising said interconnected pair of electrode elements and third and fourth electrode systems comprising respectively said separate remaining electrode elements, circuit means including a first load circuit of predetermined time constant connecting one of said first and second electrode systems to a source of a first operating potential of predetermined polarity, individual circuit means each including a load circuit of similar and predetermined time constant value which is greater than that of said first load circuit connecting respectively said third and fourth electrode systems to a source of a second operating potential of polarity opposite to that of said first operating potential and circuit means including a load impedance for connecting the remaining electrode system of said first and second electrode systems to a source of potential intermediate those of said first and second operating potentials and for connecting said remaining electrode system also to a source of triggering pulses.

4. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and a group of five equi-spaced and aligned electrode wires, said group of electrode wires comprising a central first electrode wire, second and third electrode wires disposed one on each side of said first electrode wire and fourth and fifth electrode wires disposed respectively one on that side of each of said second and third electrode wires which is opposite to said first electrode wire, circuit means including a first load circuit of predetermined time constant connecting said first electrode wire to a source of positive operating potential, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit connecting respectively said second and third electrode wires to a source of negative operating potential, circuit means interconnecting said fourth and fifth electrode wires and circuit means connecting said interconnected fourth and fifth electrode wires through a load impedance to a source of positive operating potential lower than that connected to said first electrode wire and for connecting said interconnected fourth and fifth electrode wires also to a source of triggering pulses.

5. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and a group of five equi-spaced and aligned electrode wires, said group of electrode wires comprising a central first electrode wire, second and third electrode wires disposed one on each side of said first electrode wire and fourth and fifth electrode wires disposed respectively one on that side of each of said second and third electrode wires which is opposite to said first electrode wire, circuit means including a first load circuit of predetermined time constant connecting said first electrode wire to a source of negative operating potential, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit connecting respectively said second and third electrode wires to a source of positive operating potential, circuit means interconnecting said fourth and fifth electrode wires and circuit means connecting said interconnected fourth and fifth electrode wires through a load impedance to a source of positive operating potential less than that connected to said second and third electrode wires and for connecting said interconnected fourth and fifth electrode wires also to a source of triggering pulses.

6. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and a group of five equi-spaced and aligned electrode wires, said group of electrode wires comprising a central first electrode wire, second and third electrode wires disposed one on each side of said first electrode wire and fourth and fifth electrode wires disposed respectively one on that side of each of said second and third electrode wires which is opposite to said first electrode wire, circuit means including a first load circuit of predetermined time constant connecting said first electrode wire to a source of positive operating potential, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit

connecting respectively said fourth and fifth electrode wires to a source of negative operating potential, circuit means interconnecting said second and third electrode wires and circuit means connecting said interconnected second and third electrode wires through a load impedance to a source of positive operating potential lower than that connected to said first electrode wire and for connecting said interconnected second and third electrode wires also to a source of triggering pulses.

7. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and a group of five equi-spaced and aligned electrode wires, said group of electrode wires comprising a central first electrode wire, second and third electrode wires disposed one on each side of said first electrode wire and fourth and fifth electrode wires disposed respectively one on that side of each of said second and third electrode wires which is opposite to said first electrode wire, circuit means including a first load circuit of predetermined time constant connecting said first electrode wire to a source of negative operating potential, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit connecting respectively said fourth and fifth electrode wires to a source of positive operating potential, circuit means interconnecting said second and third electrode wires and circuit means connecting said interconnected second and third electrode wires through a load impedance to a source of positive operating potential lower than that connected to said fourth and fifth electrode wires and for connecting said interconnected second and third electrode wires also to a source of triggering pulses.

8. An electronic switching system comprising a cold-cathode gaseous-discharge tube having an envelope and a group of five equi-spaced and aligned electrode wires, said group of electrode wires comprising a central first electrode wire, second and third electrode wires disposed one on each side of said first electrode wire and fourth and fifth electrode wires disposed respectively one on that side of each of said second and third electrode wires which is opposite to said first electrode wire, circuit means interconnecting said fourth and fifth electrode wires, circuit means including a first load circuit of predetermined time constant connecting said interconnected fourth and fifth electrode wires to a source of positive operating potential, individual circuit means each including a load circuit of similar and predetermined time constant value greater than that of said first load circuit connecting respectively said second and third electrode wires to a source of negative operating potential and circuit means connecting said first electrode wire through a load impedance to a source of positive operating potential less than that connected to said fourth and fifth electrode wires and for connecting said first electrode wire also to a source of triggering pulses.

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