

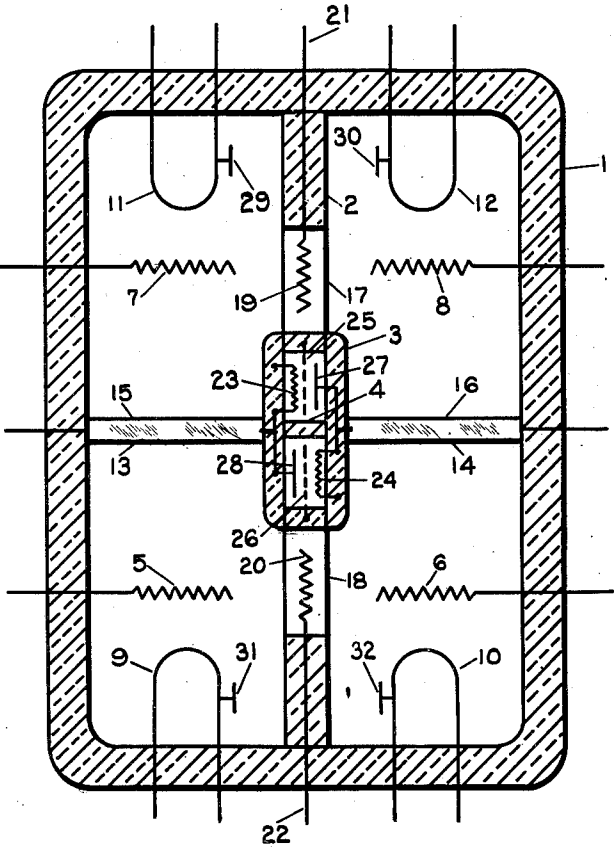
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ELECTRONIC SWITCH

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ELECTRONIC SWITCH

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13 Claims. (Cl. 250—27.5)

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This invention relates to electronic switches and is a division from my co-pending application Serial No. 573,366, filed January 18, 1945, which has matured into Patent No. 2,432,260.

An object is to provide an electronic double throw switch for use in any suitable electrical circuit for making, breaking, or reversing circuits rapidly.

Another object is to provide an electronic double pole double throw switch for opening or closing circuits rapidly.

A further object is to provide a double throw electronic switch with common anode and separate cathodes.

An additional object is to provide an electronic switch with means for electrically connecting or disconnecting elements of the switch.

A further object is to provide an electronic switch with a plurality of electronic paths and associated control members which can be charged in varied combinations to connect or disconnect various combinations of paths or circuits.

Other objects will be apparent in the description.

The drawing shows a combination electronic switch of great flexibility and of wide application in electrical circuits, especially where high speed of operation is desired. Envelope 1 has partition 2 having passages 17 and 18 on either side of anodes 13—15 and 14—16 which can be connected or separate. Grid 19, with connected lead 21, is provided in passage or opening 17. Similarly, grid 20 is placed in opening 18 and has lead 22 sealed in partition 2 and envelope 1. Lead 21 is likewise sealed in partition 2 and envelope 1.

Partition 2 may be enlarged in thickness near its mid-point to form container 3 and in conjunction with insulating cross partition 4, two small chambers containing respectively, filament 23 connected to anode 13—15, grid 25, and plate 27 connected to anode 14—16, and filament 24 connected to anode 14—16, grid 26, and plate 28 connected to anode 13—15. The filaments and grids are provided with suitable leads, not shown, brought out of the envelope through partition 2 similarly to lead 21.

In operation, if grid 19 is made negative with respect to grids 7 and 8 or with respect to filaments 11 and 12 which may be connected, then electrons from filament 12 will not pass through opening 17 to anode 13—15 and electrons from filament 11 will likewise not pass through opening 17 to reach anode 14—16. If, however, in conjunction with positively charged grids 7 and 8

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grid 19 is made positive, then electrons from both cathodes 11 and 12 can reach both anodes 13—15 and 14—16; or grid 19 may be made positive with respect to grid 7 or cathode 11 so that electrons from that cathode will pass through opening 17 to reach anode 14—16 and at the same time grid 19 can be made negative with respect to grid 8 or cathode 12 so that no electrons from cathode 12 will reach anode 13—15. It is assumed here that the anodes are connected or that the anodes are biased with respect to the proper cathode. At the same time, however, grid 8 can be positively charged with respect to filament or cathode 12 so that electrons from that cathode will reach anode 14—16 which is suitably charged.

The same considerations hold for the elements on the opposite side of anodes 13—15 and 14—16. Grids 5, 6, 7, and 8 may be placed in any desired positions relative to openings 17 and 18 or with relation to the cathodes or anodes. A positively charged grid is, in this description, considered as a grid not sufficiently negative to stop flow of electrons to the designated anode or electron receiver. A negatively charged grid is considered as a grid charged negatively substantially to the point of cut-off.

Other combinations of charged elements can be employed.

If it is desired to connect anodes 13—15 and 14—16 for the conventional passage of current from the former to the latter, then filament 24 will be energized to emit electrons and grid 26 can be used to control the electron flow from that filament to positively biased plate 28 and connected anode 13—15. Conversely if current flow is desired from anode 14—16 to anode 13—15, then filament 23 is energized and grid 25 can be charged to control electron flow to positively biased plate 27 connected with anode 14—16. If current flow in both directions is desired, either intermittently or constantly, both filaments can be energized and the electron flow in both directions can be controlled or stopped altogether. By the above described means, the anodes can be electrically connected and disconnected very rapidly for any desired purpose such as for conditions in which a common potential source might be used, for switching operations, or for other circuit adaptations. Anodes or plates 27 and 28 may be positively charged with relation to the proper cathodes 23 or 24 by any suitable means.

Similar electronic bridging or connecting means can be placed between cathodes 11—12 or between cathodes 9—10 when it is desired to join them electrically.

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Openings 17 and 18 could be extended or placed near the cathodes so that electrons from one cathode could be attracted to the adjacent cathode through the openings, the flow being controlled by grids 19 and 20. Small metal or graphite elements 29 and 30, and 31 and 32 may be attached to cathodes 11, 12, 9, and 10, respectively, in order to receive electrons from the adjacent cathodes. These elements may be of such size and so positioned that they will receive the electrons in order to prevent cathode disintegration. Either cathode may be made positive with respect to the adjacent cathode by means of a battery or other potential source or an electronic switch similar to that shown for the anodes may be used for one or both pairs of cathodes in order to connect them rapidly either positively or negatively with respect to each other.

It is apparent that this electronic device furnishes switching or relay means of exceptional simplicity, flexibility, and versatility, and can be operated at great speed.

Many variations of detail and many combinations, sub-combinations and altered arrangements of the devices described, can be readily made without departing from the principles I have disclosed.

What I claim is:

1. An electron discharge device comprising, an envelope, a cathode adjacent one end of said envelope, another cathode adjacent the opposite end of said envelope, anode means forming a partition intermediate said cathodes, and control means intermediate said cathodes and said anode means.
2. An electron discharge device comprising, an envelope, a first cathode adjacent a first end of said envelope, a second cathode facing said first cathode and adjacent the opposite end of said envelope, a third cathode adjacent said first end, a fourth cathode facing said third cathode and adjacent said opposite end, partition means forming a first chamber including said first and second cathodes and a second chamber including said third and fourth cathodes, anode means for said first and second cathodes directly therebetween, anode means for said third and fourth cathodes directly therebetween, and a plurality of grids intermediate said cathodes and anodes to control electron flow from a plurality of said cathodes.
3. An electron discharge device comprising, an envelope, a first cathode adjacent a first end of said envelope, a second cathode facing said first cathode and adjacent the opposite end of said envelope, a third cathode adjacent said first end, a fourth cathode facing said third cathode and adjacent said opposite end, partition means forming a first chamber including said first and second cathodes and a second chamber including said third and fourth cathodes, anode means for said first and second cathodes directly therebetween, anode means for said third and fourth cathodes directly therebetween, and a grid adjacent each said cathode for controlling electron flow therefrom.
4. An electron discharge device comprising, an envelope, a first cathode within said envelope, a second cathode within said envelope facing said first cathode, a third cathode within said envelope adjacent said first cathode, a fourth cathode within said envelope adjacent said second cathode and facing said third cathode, partition means forming a first chamber including said first and second cathodes and a second chamber including said third and fourth cathodes, anode

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means for said first and second cathodes directly therebetween, anode means for said third and fourth cathodes directly therebetween, and grid means intermediate at least one said cathode and the anode receiving electrons therefrom for controlling electron flow from at least said one cathode.

5. An electron discharge device comprising, an envelope, a first cathode within said envelope, a second cathode within said envelope facing said first cathode, a third cathode within said envelope adjacent said first cathode, a fourth cathode within said envelope adjacent said second cathode and facing said third cathode, partition means separating said first cathode from said third cathode and separating said second cathode from said fourth cathode, said partition means having an opening therein, and a control element adjacent said opening.

6. An electron discharge device comprising, an envelope, a first cathode within said envelope, a second cathode within said envelope facing said first cathode, a third cathode within said envelope adjacent said first cathode, a fourth cathode within said envelope adjacent said second cathode and facing said third cathode, partition means separating said first cathode from said third cathode and separating said second cathode from said fourth cathode, said partition means having an opening therein adjacent said first and third cathodes and another opening therein adjacent said second and fourth cathodes, and control elements adjacent said openings.

7. An electron discharge device comprising, an envelope, a first cathode within said envelope, a second cathode within said envelope facing said first cathode, a third cathode within said envelope adjacent said first cathode, a fourth cathode within said envelope adjacent said second cathode and facing said third cathode, partition means separating said first cathode from said third cathode and separating said second cathode from said fourth cathode, anode means between said first and second cathodes on one side of said partition means, other anode means between said third and fourth cathodes on the opposite side of said partition means, said partition means having an opening therein on one side of said anode means and an opening therein on the opposite side of said anode means, and control elements adjacent said openings.

8. An electron discharge device comprising, an envelope, a first cathode within said envelope, a second cathode within said envelope facing said first cathode, a third cathode within said envelope adjacent said first cathode, a fourth cathode within said envelope adjacent said second cathode and facing said third cathode, partition means separating said first cathode from said third cathode and separating said second cathode from said fourth cathode, anode means between said first and second cathodes on one side of said partition means, other anode means between said third and fourth cathodes on the opposite side of said partition means, said partition means having an opening therein on one side of said anode means and an opening therein on the opposite side of said anode means, control elements adjacent said openings, and control elements between said cathodes and said anodes.

9. An electron discharge device comprising, an envelope, a first pair of opposed cathodes within said envelope, a second pair of opposed cathodes within said envelope, first anode means between said first pair of cathodes, second anode means

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between said second pair of cathodes, a fifth cathode electrically connected with said first anode means, an anode electrically connected with said second anode means and positioned to receive electrons from said fifth cathode, a control element intermediate said fifth cathode and associated anode, a sixth cathode electrically connected with said second anode means, an anode electrically connected with said first anode means and positioned to receive electrons from said sixth cathode, and a control element intermediate said sixth cathode and its associated anode.

10. An electron discharge device comprising, an envelope, a first pair of opposed cathodes within said envelope, a second pair of opposed cathodes within said envelope, first anode means between said first pair of cathodes, second anode means between said second pair of cathodes, a fifth cathode electrically connected with said first anode means, an anode electrically connected with said second anode means and positioned to receive electrons from said fifth cathode, a control element intermediate said fifth cathode and associated anode, a sixth cathode electrically connected with said second anode means, an anode electrically connected with said first anode means and positioned to receive electrons from said sixth cathode, a control element intermediate said sixth cathode and its associated anode; and means within said envelope forming a container for said fifth cathode and associated anode and control element, and forming a container for said sixth cathode and associated anode and control element.

11. An electron discharge device comprising,

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an envelope, partition means within said envelope forming a plurality of chambers, cathode and anode means in each of a plurality of said chambers, an auxiliary cathode connected with one of said anodes, an auxiliary anode connected with another of said anodes to receive the electrons from said auxiliary cathode, and means intermediate said auxiliary cathode and anode for controlling electron flow therebetween.

12. Same as in claim 11, and including control means intermediate said cathodes and anodes in said chambers.

13. An electron discharge device comprising, an envelope, partition means within said envelope forming a plurality of chambers, cathode and anode elements in each of a plurality of said chambers, another cathode connected with one of said elements in one chamber, another anode connected with a like element in another chamber, said other anode being positioned to receive electrons from said other cathode, and means intermediate said other cathode and said other anode for controlling electron flow therebetween.

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