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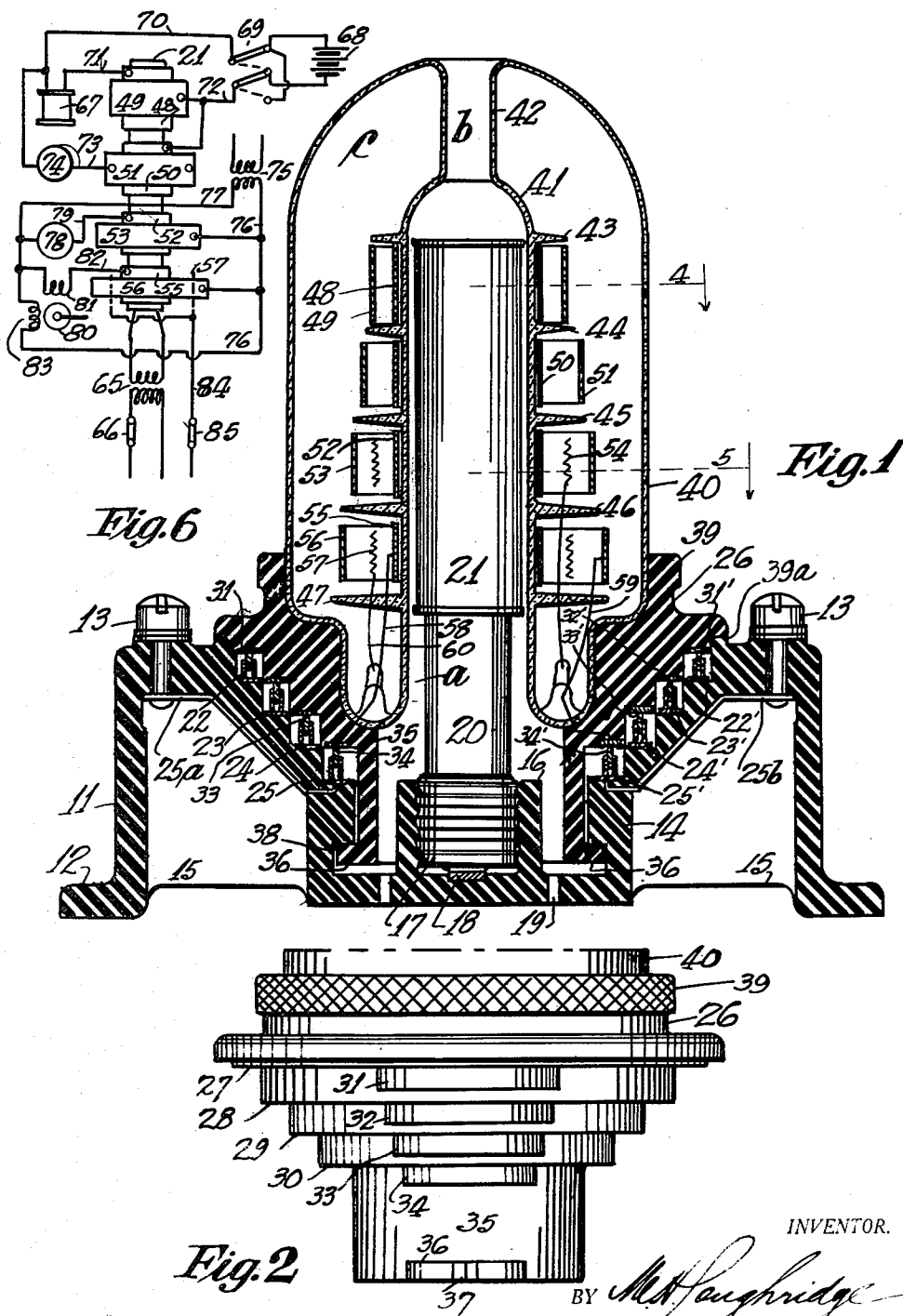
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2,048,129

ELECTRON TUBE

Filed May 31, 1929

2 Sheets-Sheet 1



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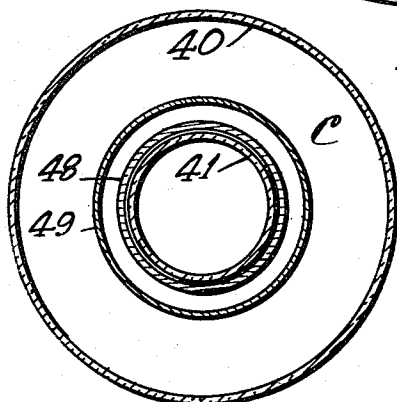
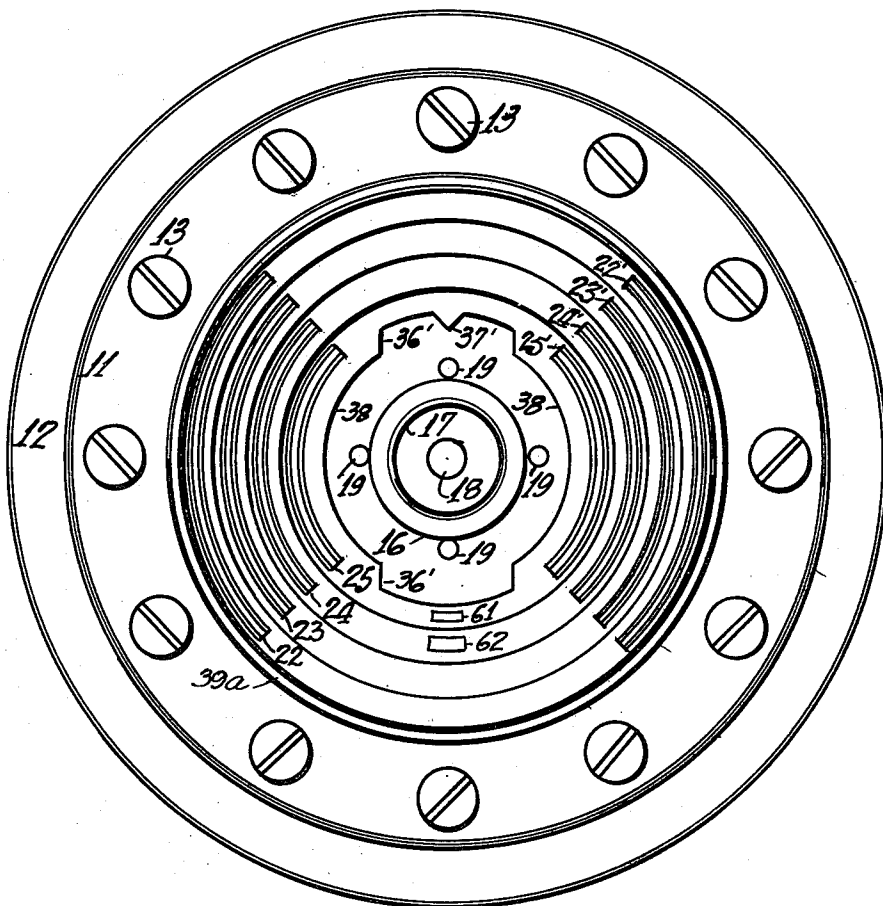


Fig. 4

Fig. 3

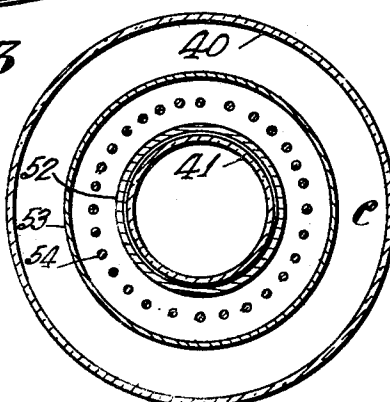


Fig. 5

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ELECTRON TUBE

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5 Claims. (Cl. 250—27.5)

This invention relates to electron tubes and has for an object to provide electron tubes for controlling a plurality of independent circuits; to control a plurality of independent circuits selectively and to introduce characteristics into said circuits.

Another object of the invention is to provide an electron tube controlling a plurality of independent circuits each of which operates at a different voltage, or has different current capacities. Another object of the invention is to provide an electron tube with a plurality of independent anodes and cathodes with supporting means therefor.

Other objects of the invention will appear from the following specification and the accompanying drawings forming part thereof, selected to show a form of the invention and, in which,

Fig. 1 is a sectional elevation of an electron tube or circuit closing device constructed according to this invention; Fig. 2 is an elevation of the base of the electron tube; Fig. 3 is a plan view of the mounting with the electron tube removed; Fig. 4 is a cross section on line 4 of the electron tube in Fig. 1; Fig. 5 is a cross section on line 5 of the electron tube in Fig. 1, and Fig. 6 is a circuit diagram showing one application of the invention.

The mounting is provided with a row of binding posts or terminals and having a conical depression in the center and a plurality of spaced contact members arranged in this depression which are electrically connected with the binding posts. This mounting is also provided with a socket located in the axial center of the depression which may be of the screw socket variety used for electrical outlets and which has its terminals connected with a pair of the binding posts.

The electron tube or circuit controlling device is provided with a conical base to match the conical depression of the mounting and is provided with spaced contact members to register with the contact members of the mounting. This base terminates in a cylindrical projection which has a locking engagement with the mounting as the tube is partially rotated. This rotation brings the contacting members into engagement and thereby establishes the circuit from the binding posts to the circuit controlling members within the tube. The base of the tube is cylindrical in form and is hollow to receive the projecting socket of the mounting and to receive the heating element of the tube when an exterior heating element is used.

In the tube an exterior heating element is used comprising a coil energized with alternating current which, by induction, heats the cathode of the tube; however, the invention is of general application and this mounting of the heating element is not confined to tubes of this particular type and may be used with other devices of a similar character.

One of the main purposes of this invention is to be able to control a plurality of independent circuits by the energy in another circuit similar, for instance, to a multicontact relay in which the energy in the relay coil controls an armature which in turn controls several contact fingers, each controlling independent circuits. For this purpose a plurality of cathodes with corresponding anodes are provided in the tube and suitably separated from each other, while all of the cathodes are heated by a common heating element.

Each of the sets of anodes and cathodes may be of different areas and may be differently spaced with the object of varying the resistance of the circuit controlled by the device and making the device selective in its control of various apparatus. This enables a single tube to secure results that heretofore have required several tubes and brings these results under a single control through the heating element. The present application is limited to the construction of the electron tube.

The mounting

In the drawings, 11 is the mounting which is preferably circular in shape and is supported on a flange 12. The binding posts 13 are provided around the top outer edge and a conical depression is formed in the center in steps or ledges as shown and upon which the channel contact members 22, 23, 24, and 25, are provided at one side and corresponding contact members 22', 23', 24' and 25' are provided at the opposite side of these ledges. These contact members are connected with the binding posts 13 as indicated at 25a and 25b, Fig. 1. The conical depression terminates in the cylindrical projection 14 which may be connected with the walls 11 of the mounting by the webs 15. In the center of this projection the socket 16 is provided having a screw shell 17 and a central contact 18 connected with a pair of the binding posts by means not shown in the drawings. Apertures are provided in the mounting at 19 for ventilating the space *a* and providing an air circulation through the outlet *b* in the center of the device. The heating coil or induction coil 21 mounted on the stem 20 is screwed into the

socket 16 and is thus independently supported by the mounting.

The electron tube

The circuit controlling device is provided with a conical shaped base 26 which matches the conical depression in the mounting being provided with ledges 27, 28, 29, and 30, upon which the contact members 31, 32, 33, and 34, are mounted on one side and diametrically opposite these contact members similar contact members 31', 32', 33' and 34' are mounted on these ledges.

The base of the tube terminates in a cylindrical projection 35 which is provided with a pair of diametrically opposed lugs 36 which enter the apertures 36' in the mounting and engage the under cut section of the mounting as indicated at 38. When in this position the base is supported by the annular ledge 39a and the tube is vertically positioned in the mounting as the lugs 36 engage the inclined face of the mounting at 38. Each tube device may be constructed with certain internal characteristics which make it desirable that all replacement tubes shall have corresponding characteristics and, for this purpose a ledge 37' may be provided in the mounting to register with the groove 37 in the lug 36 thereby preventing improper tubes from being used in replacements. It will be noted that the channel contact members on the mounting extend for approximately 90° of the circle and the contact members on the base 26 are somewhat less than 90° so that these contact members are brought into engagement with a knife-switch contact as the tube is inserted in the mounting and locked therein by a rotation of 90°. A knurled collar is provided at 39 for rotating the base.

The electron tube comprises the evacuated bulb 40 having an open central core 41 preferably opening by the tube 42 to the atmosphere at the upper end for ventilating purposes. This core is sectioned as shown by the flanges 43, 44, 45, 46 and 47 and between each of these flanges independent sets of electrodes are mounted. These comprise the cathode 48 and the anode 49 in the top section, the cathode 50 and the anode 51 in the second section; the cathode 52, the anode 53, in the third section, and the cathode 55 and the anode 56 in the bottom section. It will be noted that all the cathodes are aligned adjacent to the heating coil 21. These cathodes are preferably made of iron and are heated by eddy currents induced in this iron from the current in the coil 21. The cathodes are thus uniformly heated by the coil 21 and are preferably spaced from the core of the tube to avoid overheating this core.

It will be noted that the electrodes in the upper section are longer than those in the following section and correspondingly the length of the electrodes is reduced from the top to the bottom sections; also it will be observed that the electrodes in the upper section are spaced nearer to each other than in the following section and the spacing of the electrodes is correspondingly increased from the top to the bottom sections. This is a matter of choice in the design of the tube in which electrons and therefore a larger current while the larger areas provide for a greater emission of increased spacing between the electrodes increases the resistance and requires a higher voltage on the operating circuits. As the capacity of a tube of this kind is determined by the area of the cathode, by the distance between the cathode and the anode and by the material used in the man-

ufacture of the electrodes, it is apparent that circuits can be selectively controlled by each section of the tube. For instance, the smaller electrodes are not suitable for conducting a large current and a current of low voltage cannot be established between the widely spaced electrodes. These electrodes are connected to the contact members in the conical base as illustrated in Fig. 1, by conductor 58, connecting cathode 55 with 34; conductor 59, connecting anode 56 with the contact member 34' and conductor 60 connecting the grid 57 in the lower section with a contact in the base not shown but registering with contact 61 in the mounting when the tube is in place and similarly, the grid 54 connects with contact plate 62 when the tube is in place, contacts 61 and 62 being connected with the terminals 13. The grid is preferably made from a vertically arranged coil as indicated in Fig. 5.

The circuit diagram

In Fig. 6 the transformer 65 energizes the heating coil 21 and is controlled by switch 66. The translating device 67 is controlled from the battery 68 through the pole changing switch 69, wire 70, device 67, wire 71, cathode 48, anode 49, wire 72 to pole changing switch 69 and to battery 68.

The translating device 74 is controlled from battery 68 through pole changing switch 69, wire 70, device 74, wire 73, anode 51, cathode 50, wire 72, pole changing switch 69 and battery 68. It will be noted that wire 72 connected to one side of the battery connects to the anode 49 and to the cathode 50 so that when the pole changing switch 69 is in one position a circuit will be established to energize the translating device 67 and no circuit will be established to the device 74 until the pole changing switch is reversed when 67 is deenergized and 74 is energized. The device 74 may be more sensitive than the device 67 and therefore responsive to the lower current value between the electrodes 50 and 51.

The transformer 75 energizes the mains 76 and 77, the translating device 78 connects to 77 and by wire 79 connects to the cathode 52 and from the anode 53 completes the circuit to wire 76. The polyphase relay 80 has a winding 81 connected to the main 77 and is connected by wire 82 with the cathode 55 and through anode 56 connects to the opposite main 76. Another phase of this relay 83 connects between the mains 76 and 77 as shown. It will be observed from the arrangement shown that all the circuits controlled by the tube are controlled by the heating coil 21 and by opening switch 66 all of the circuits may be interrupted while the controlling circuits of 67 and 74 are selectively controlled by switch 69 when the switch 66 is closed; it will also be noted that the circuit of 81 is controlled by the grid 57, conductor 84 and switch 85 so that this circuit may be interrupted by opening switch 85 when the coil 21 is energized without affecting the operation of the other circuits controlled by the tube.

It will be noted that the combination of the mounting with the electron tube provides a device for controlling circuits which is comparatively low in cost, light in weight and which enables the mounting to be installed separately from the circuit controlling device. The space current device has no moving parts, will operate in any position, and is not influenced by vibration. The interruption of the circuit depends upon the cooling of the cathodes which may make the device 75

slow acting or the circuit may be controlled by the grid which is quick acting.

Having thus described my invention, I claim:

5 1. An electron tube comprising an evacuated vessel, a pair of cathodes and anodes in said vessel, a stepped conical base on said vessel diametrically opposed contact members on each step of said base and means electrically connecting each of said anodes and cathodes with one of said contact members.

10 2. An electron tube comprising an evacuated vessel having a central non-evacuated hollow stem, a plurality of pairs of annular anodes and cathodes spaced about said stem and a heating element located in said hollow stem.

15 3. An electron tube comprising an evacuated vessel having a tubular non-evacuated hollow stem with ledges on the tube projecting into said

vessel, cathodes located on said stem between said ledges and a heating element located in said non-evacuated stem.

4. An electron tube comprising an evacuated vessel having a hollow, non-evacuated stem of insulation, a plurality of pairs of annular anodes and cathodes spaced about said stem and formed in different diameters, ledges projecting from said stem between said pairs corresponding to said diameters and a heating element located in said hollow stem.

5. An electron tube comprising a cylindrical evacuated vessel formed in continuation with a non-evacuated hollow central stem, means on said stem for supporting a plurality of annular cathodes in said vessel and means in said hollow stem for heating said cathodes.

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