Jan. 15, 1929.

E. G. MURPHY

1,699,011

VACUUM TUBE

Filed Dec. 7, 1925

2 Sheets-Sheet 1

Fig. 1

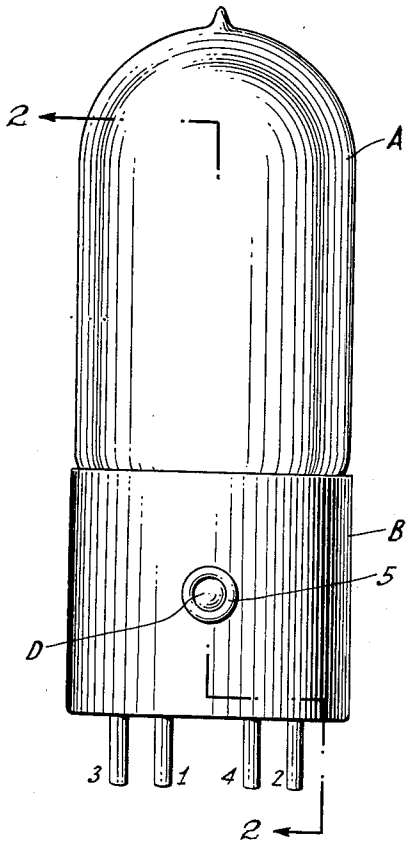


Fig. 2

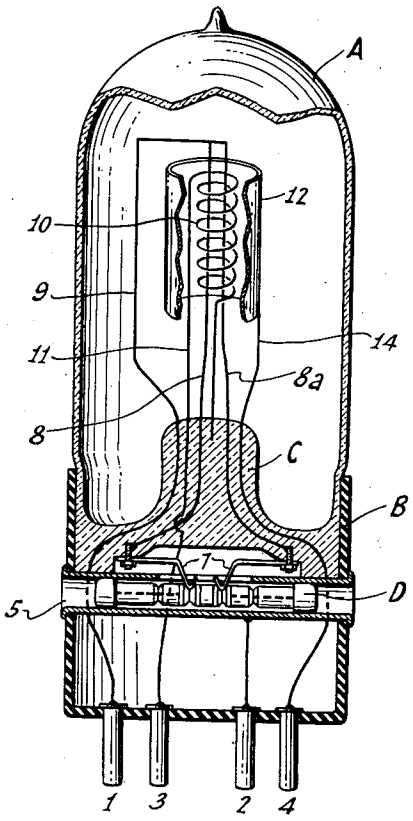


Fig. 3

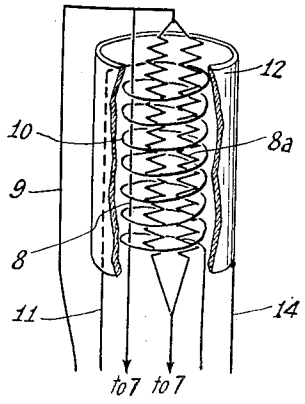
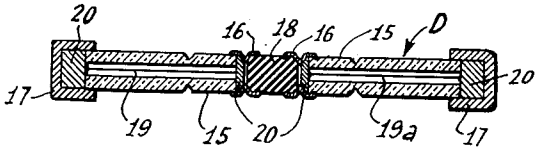


Fig. 4



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Fig. 5

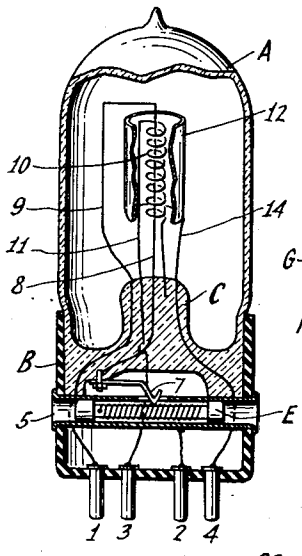


Fig. 8

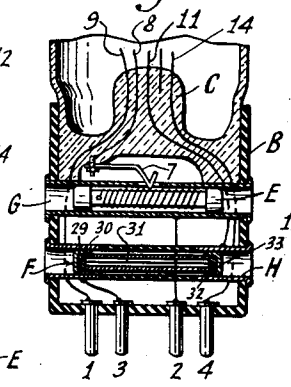


Fig. 9

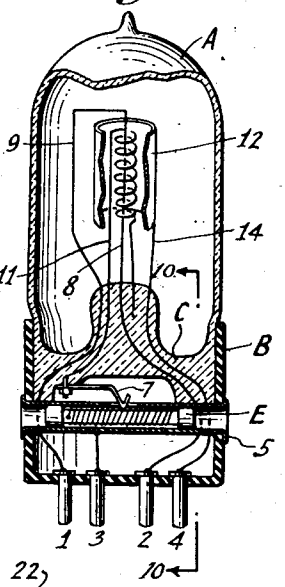


Fig. 6

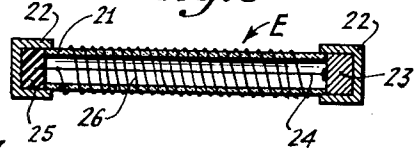


Fig. 10

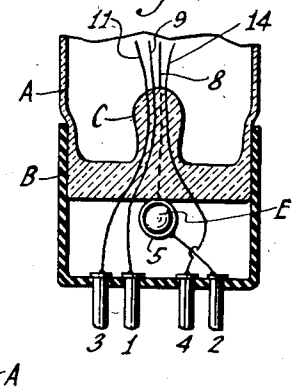


Fig. 7

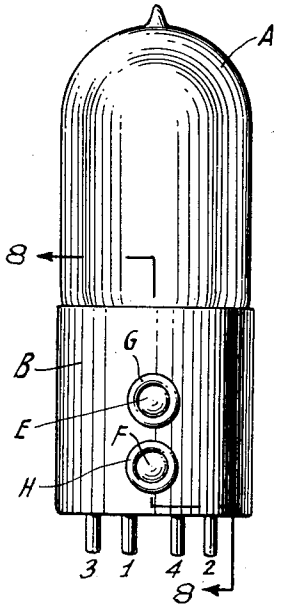
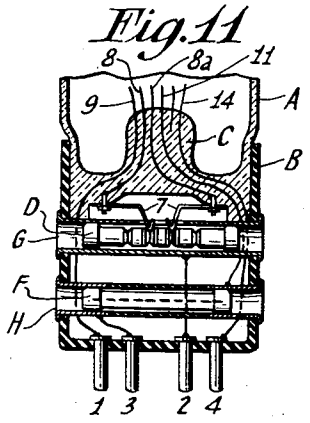


Fig. 11



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Patented Jan. 15, 1929. 1,699,011

UNITED STATES PATENT OFFICE.

EDMUND GUYER MURPHY, OF BROOKLYN, NEW YORK.

VACUUM TUBE.

Application filed December 7, 1925. Serial No. 73,822.

This invention relates to improvements in vacuum tubes and more particularly to a mode of construction of vacuum tubes whereby the electrodes of a vacuum tube may be simultaneously regulated and conserved independently of outside control apparatus.

One of the objects of this invention is to provide means in a vacuum tube whereby a plurality of cathodes may be energized and deenergized simultaneously or each cathode may be individually energized and deenergized as selected.

Another object of the invention is to provide means in a vacuum tube whereby a vacuum tube of the dry cell or low power and voltage type may be instantaneously converted into a vacuum tube of the storage battery type or alternating current type of comparatively high power and output.

Another object of the invention is to provide means in a vacuum tube whereby the cathode and grid electrodes may be controlled independently of outside attachments and the cathode safeguarded against excessive current applications.

A further object of my invention is to effect neatness and economy of construction in radio signalling apparatus by the elimination of as many external control attachments as possible.

Other objects and advantages of my invention will be more fully understood when considered in connection with the following detailed description and the accompanying drawing in which:

Fig. 1 is a side elevation of a vacuum tube embodying my invention.

Fig. 2 is a cross section taken on line 2—2 of Fig. 1 with the upper part of the tube partly broken away and showing the plurality of cathodes.

Fig. 3 is a cross section of a modification of the form shown in Fig. 2.

Fig. 4 is a detail view of the element used for energizing and deenergizing the cathodes by completion of the feed circuits.

Fig. 5 is a cross section of a vacuum tube wherein one cathode is employed with the regulating element shown in the base of the tube.

Fig. 6 is a detail view of the regulating element used in the tube shown in Fig. 5.

Fig. 7 is a side elevation of a modification of my invention wherein means are incorporated for regulating the cathode and grid electrodes of a vacuum tube simultaneously.

Fig. 8 is a cross section taken on line 8—8 of Fig. 7.

Fig. 9 is a cross section of a vacuum tube wherein the grid electrode alone is regulated by means embodied within the tube.

Fig. 10 is a cross section taken on line 10—10 of Fig. 9.

Fig. 11 is a cross section view of a modified form taken on line 8—8 of Fig. 7 wherein a plurality of cathodes and the grid is regulated simultaneously.

Referring more particularly to the drawing wherein similar reference characters refer to similar elements in the several figures, the character A represents a vacuum tube, B the base thereof and C the flare supporting the interior elements. 1, 2, 3 and 4 are the contact prongs of the tube of which filament prong 1 is permanently connected to the conducting rod 9 supporting the cathodes, while filament prong 2 is connected to a metal tube within the base of the tube by means of which the circuit is completed through element D, contacts 7 and filaments 8 and 8^a. Prong 3 is connected to the grid electrode 10 and prong 4 is connected to the anode 12 of which 11 and 14 are the supporting rods respectively.

In the modification shown in Fig. 3, cathode 8 may be a filament suitable for energization by voltages approximating 1½ volts, while cathode 8^a may be a filament suitable for voltages approximating 6 volts in connection with storage batteries. Or filament 8^a may be adapted for alternating current energization.

In Fig. 4, one of the circuit completing elements D is shown in detail. 15—15 are two tubes of insulating material sealed at each end by metal caps 16 and 17 and with a plug 18 of non-conducting material separating the two tubes. Within the tubes 15—15 electrical resistances consisting of strips of metal 19 and 19^a of comparatively low fusing temperature are imbedded in plugs of metal 20 in contact with the metal caps 16 and 17. When the element D is used with the modified form of the tube shown in Fig. 3, the impedances will be chosen of different values suitable for safeguarding the dissimilar filaments 8 and 8^a in view of the different voltages required, since it is obvious that a current suitable for energizing a filament requiring six or more volts would probably destroy a filament of the 1½ volt type.

In Fig. 5, a single cathode is shown with a

regulating element E by means of which the filament may be variably energized and deenergized by merely altering the position of E and without the necessity of external regulation.

In Fig. 6, the regulating element E is shown in detail in which the tube 21 of insulating material is closed at each end by metal caps 22. To the conducting fuse strip 24 which is imbedded in fusible metal 23 at one end and in insulating material 25 at the other end, a resistance wire 26 is attached. The circuit, in this instance, will be completed through cap 22, metal plug 23, fusible strip 24, resistance wire 26 and thence to contact 7 attached to the cathode 8 illustrated in Fig. 5.

In the modification shown in Fig. 8 wherein the cathode and grid may be simultaneously controlled, the element F may be a grid leak of conventional type. The grid circuit is completed through prong 3, left side of the divided metal tube H, metal cap 29, metal plug 30, resistance 31, metal plug 32, right hand side of the divided tube H thence to wire leading to grid element.

In the construction shown in Fig. 9 wherein the grid alone is controlled, the grid lead 11 is shown in electrical contact with prong 7, the circuit in this case being completed through tube 5 and element E in the manner indicated in the drawing.

With reference to the construction shown in Fig. 2, it will be at the option of the user to vary the electronic emission betweeen wider limits than has heretofore been possible in vacuum tubes. If desired, one filament at a time may be used up to the period of the expiration of the natural life of the filament after which the other filament may be brought into use by merely changing the position of the slidable element D. In this form, both filaments may be energized simultaneously with consequent augmented electronic emission. It is obvious that instead of single filaments, groups of filaments may be substituted therefor and these groups may by the same means be simultaneously or separately and selectively energized and deenergized. Should excessive current be applied either or both of the resistances 19 and 19^a will be melted and the circuit broken whereby the filament is preserved against accidental destruction. In this case, it will then merely be necessary to insert another element D in order to place the tube in operative condition. When using one cathode only, the element D is slid to the right or left of its middle position whereupon prong 7 engages in one of the notches completing the circuit in the manner above indicated.

In the modification shown in Fig. 3, the tube may be employed as a dry cell tube requiring 1½ volts or by a mere shift of element D the tube may be converted into a power type tube requiring storage batteries of six or more volts, or alternating current may be employed for energization. The advantages offered by this arrangement for experimental use, high power amplification, adaptability to working conditions where either one or the other source of electrical energy may not be available, are apparent.

In Fig. 5, a single cathode is employed. In this form the element E comprises a variable resistance whereby the filament may be energized and deenergized variably without recourse to the customary external resistance and regulating units. Here also, a fuse strip safeguards the filament against destruction through excessive current. By sliding the element E transversely of the prong 7 which contacts with resistance wire 26, the current fed to the cathode may be regulated. The circuit is completed through filament prong 2, metal tube 5, metal cap 22, metal plug 23, fusible resistance 24, resistance wire 26 thence through prong 7, filament 8, rod 9 to prong 1.

In the modification shown in Fig. 11, a plurality of filaments 8 and 8^a are controlled in the manner shown in Fig. 2 of the drawing and additional means are also provided to control another electrode, in the present instance the grid, as follows:—Prong 3 being connected to a source of electromagnetic energy, the current will flow from prong 3 to left side of lower metal tube H centrally divided by an insulating strip, through metal cap on left hand side of element F, interior resistance strip joining both ends, right hand metal cap, to wire 11 leading to grid.

It will be understood that the details of the methods and arrangements herein set forth may be varied and that the general principles set forth may be embodied in other analogous organizations widely different from those illustrated without departing from the spirit of my invention or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patents is:

1. A vacuum tube having a plurality of cathodes within the tube and a single means removably mounted on said tube whereby the cathodes may be simultaneously energized and deenergized, separately and selectively energized and deenergized and safeguarded against destruction through excessive current applications.

2. A vacuum tube having a plurality of cathodes within the tube and a single means slidably and removably embodied within the base of said tube whereby the cathodes may be simultaneously energized and deenergized, separately and selectively energized and deenergized and safeguarded against destruction through excessive current applications.

3. In a vacuum tube, the combination of a

cathode suitable for comparatively low voltage energization, a second cathode suitable for comparatively high voltage energization and a single means optionally engageable whereby said cathodes may be separately and selectively energized and deenergized and safeguarded against destruction through excessive current applications.

4. In a vacuum tube, the combination of a cathode suitable for comparatively low voltage energization, a second cathode suitable for comparatively high voltage energization and a single means removably embodied within the base of the tube whereby said cathodes may be separately and selectively energized and deenergized and safeguarded against destruction through excessive current applications.

5. In a vacuum tube having a plurality of electrodes adapted to be separately, selectively and simultaneously energized, means whereby said electrodes may be energized, said means consisting of a tubular member containing a plurality of resistances and means within the vacuum tube whereby the resistances may be selectively chosen to energize the electrodes.

6. A vacuum tube having a plurality of cathodes and means removably embodied within the base of the tube whereby said cathodes may be safeguarded against destruction through excessive current applications.

7. Within the interior of the base of a vacuum tube, circuit making and breaking means in combination with circuit overload preventing means, said circuit making and breaking means and said circuit overload preventing means being embodied in a single unit removably insertible in said base.

8. In a vacuum tube having a plurality of electrodes adapted to be separately and simultaneously energized and deenergized, means whereby the energization and deenergization of said cathodes may be effected through a series of resistances in the base of said tube.

9. A vacuum tube having an envelope containing a plurality of dissimilar cathodes adapted to be separately, selectively and simultaneously energized and deenergized, a base having an orifice, and means to safeguard said cathodes from destruction through excessive current applications, said means consisting of a tubular element removably insertible within said orifice and containing a plurality of resistances, and means to selectively place the resistances separately in series with the cathodes and simultaneously in parallel with the cathodes.

10. In a vacuum tube comprising an upper envelope and a base, a plurality of electrodes within the envelope, an orifice within the base, a tubular element removably insertible within said orifice, said tubular element having a plurality of internal resistances connected to a plurality of external contacts on the tubular element, and means to separately, selectively and simultaneously energize and deenergize said electrodes by the shifting of said tubular element whereby the resistances and the contacts are engaged with and disengaged from said electrodes.

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