

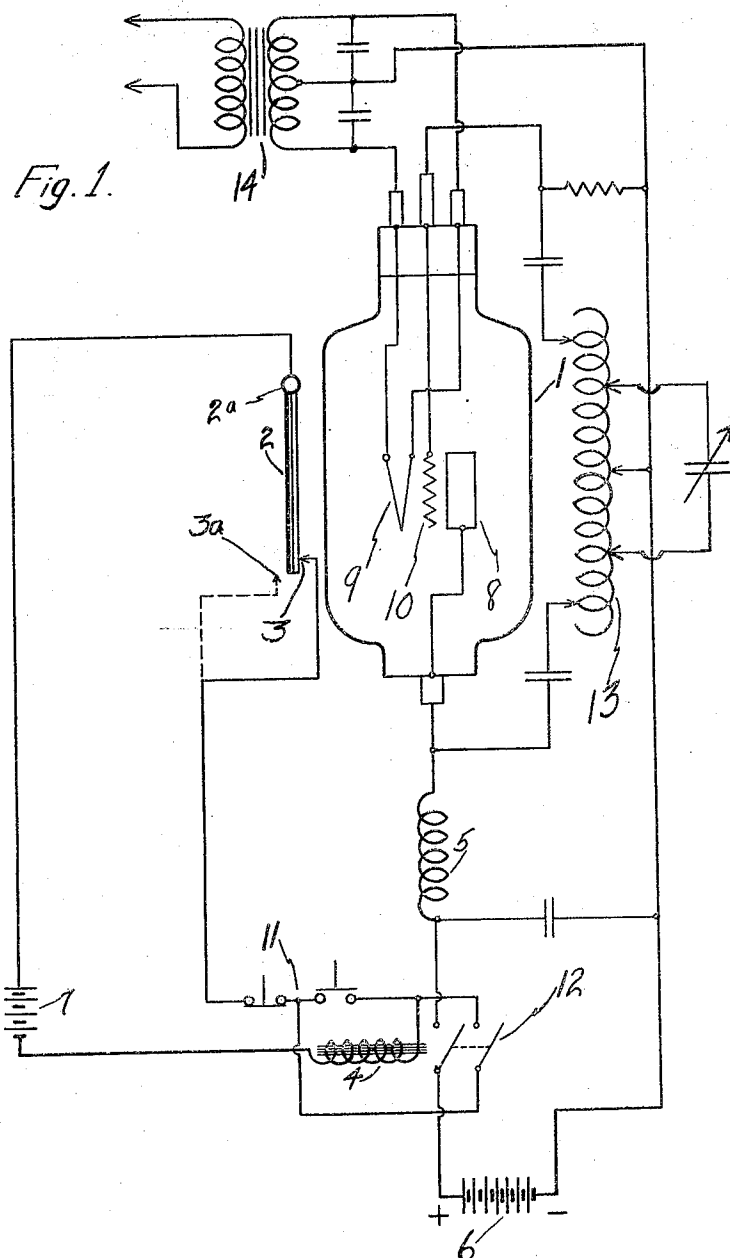
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L. A. GEBHARD
TRANSMITTING SYSTEM

1,873,837

Filed Dec. 22, 1928

2 Sheets-Sheet 1



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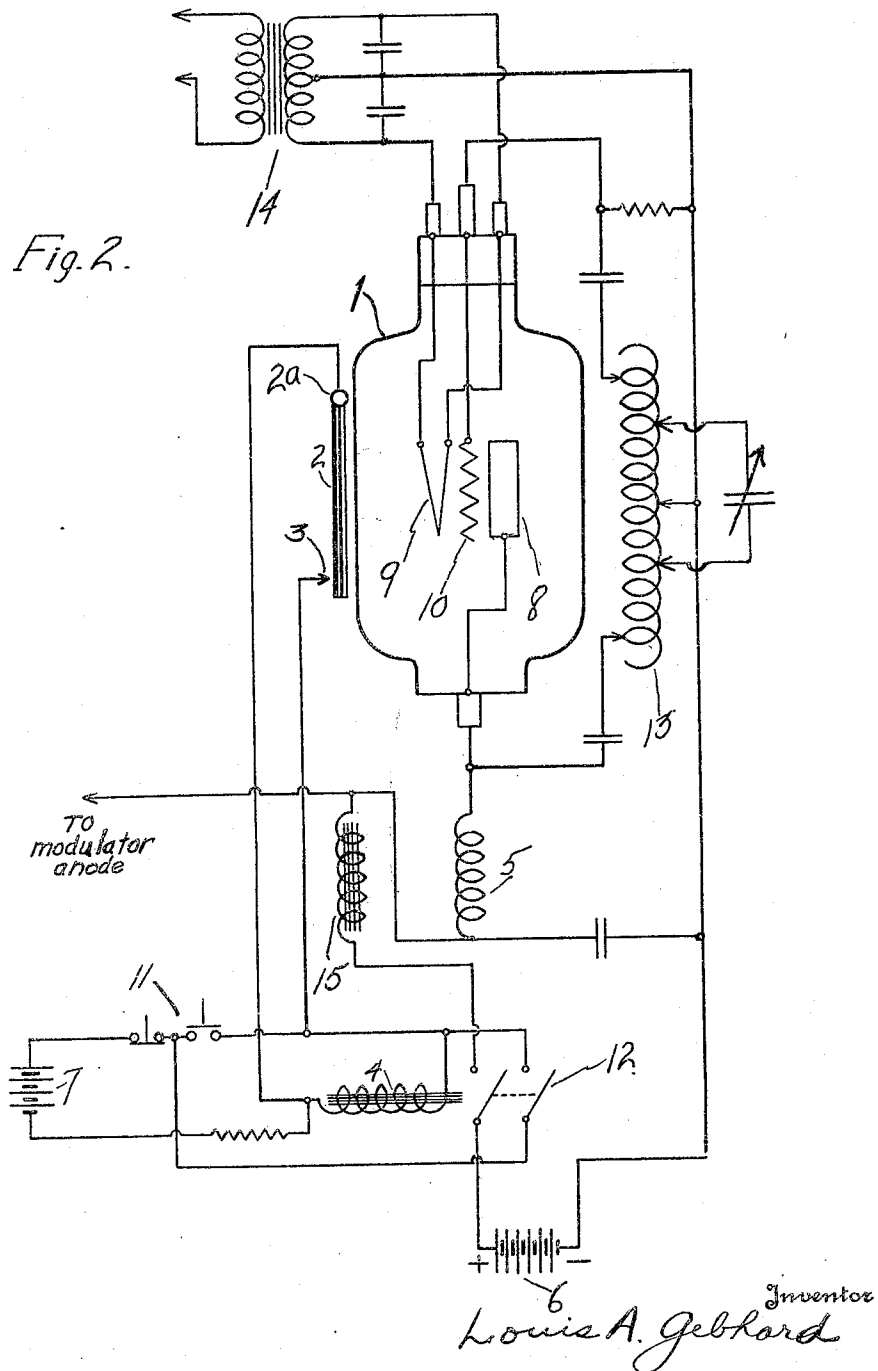
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UNITED STATES PATENT OFFICE

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TRANSMITTING SYSTEM

Application filed December 22, 1928. Serial No. 327,986.

My invention relates to transmitting systems in general and more specifically to transmitting systems of the type employing thermionic tubes.

An object of my invention is to provide a control system for thermionic tubes.

Another object of my invention is to provide a control system for thermionic tubes whereby the correct potentials may be supplied to a thermionic tube in a predetermined sequence.

Still another object of my invention is to provide a control system for thermionic tubes whereby the operating temperature of thermionic tubes may be controlled.

Other and further objects of my invention reside in a protective system for electron tubes as set forth in the following specification and shown in the accompanying drawings wherein:

Figure 1 is a schematic illustration of a circuit arrangement embodying the principles of my invention; and Fig. 2 is a diagrammatic showing of a modified circuit of my invention.

In transmitting systems of the type employing thermionic tubes, it is necessary to provide the proper operating potential for the respective electrodes of the tubes. It is important that the thermionic tubes be protected from a supply of potential greater than a safe operating potential. Overload circuit breakers have been employed in the several potential supply circuits and are caused to operate when the current in either or all of the circuits becomes excessive. In systems employing thermionic tubes the danger of the tubes being damaged arises from the increased temperature of one or all of the electrodes comprising the thermionic tube. Current operated devices are therefore provided for preventing an excessive supply of current from reaching the electrodes. It frequently happens that a fluctuating value of current is employed, which is effective in

causing the circuit breakers to operate. In many applications of the thermionic tube, such temporary increase of current can not be avoided without impairing the operation of the system. Many times the thermionic tube would not be seriously damaged from such temporary overloading and in some systems a temporary overload may be employed to advantage. The heat caused by the potential supplied the anode is usually the main cause of damage to thermionic tubes. In the system of my invention the foregoing difficulties are avoided.

In Fig. 1 of the accompanying drawings the improvements in transmitting systems of my invention are illustrated, wherein, thermionic tube 1 having an anode 8, cathode 9 and control electrode 10 is provided with energy supply circuits. A source of energy 14 is provided for energizing the cathode 9. Source of energy 6 is provided for energizing anode 8. A bi-metallic member 2 is placed adjacent to thermionic tube 1. Bi-metallic member 2 comprises two dissimilar metals having coefficients of expansion differing one from the other. Of the two dissimilar metals, the one having the greater expansion per degree increase of temperature is placed nearest the thermionic tube 1. One end 2a of bi-metallic member 2 may be carried upon any suitable support. A contact member 3 is provided adjacent to bi-metallic member 2. An increase in the temperature of thermionic tube 1, or radiation of heat therefrom, causes bi-metallic member 2 to swerve away from contact 3. Bi-metallic member 2 may be positioned with respect to thermionic tube 1, in such a manner that it will move toward thermionic tube 1. Contact member 3 would then be positioned, with respect to thermionic tube 1, on the opposite side of member 2 as shown at 3a. Bi-metallic member 2 and contact member 3 are electrically connected to source of energy 7 and momentary contact switch 11. The terminals of an electromagnet 4 are connected

to source 7 and switch 11 respectively. Switch 12 is electromagnetically controlled by electromagnet 4. Switch 12, when actuated by electromagnet 4, completes the supply of energy from source 6 through high frequency choke 5 to anode 8. Electromagnet 4 is actuated by source 7 through bi-metallic member 2, contact 3 and momentary contact switch 11. A high frequency oscillatory circuit 13 is associated with anode 8, cathode 9 and control electrode 10.

The operation of the improvements in transmitting systems of my invention is as follows. A source of suitable potential 14 is connected to the terminals of cathode 9. The potential supply circuit to anode 8 is completed by closing momentary contact switch 11. Under normal conditions the circuit for energizing electromagnet 4 is complete which allows switch 12 to close. The temperature of anode 8 affects the bi-metallic member 2. When this temperature is not excessive, bi-metallic member 2 is not moved and the control circuit for energizing electromagnet 4 remains complete. An excessive temperature of anode 8 causes a corresponding transfer of heat energy to bi-metallic member 2 and bi-metallic member 2 is accordingly actuated by the increase in heat energy from anode 8 and swerves away from contact member 3, thereby opening the circuit which controls the energization of electromagnet 4.

Fig. 2 of the accompanying drawings shows a modification of the improvements in transmitting systems of my invention. In this circuit arrangement the same reference characters as employed in Fig. 1 apply. Bi-metallic member 2 is employed, in combination with source of energy 7 and electromagnet 4, in such a manner as to short-circuit electromagnet 4 when an excessive temperature is reached. The short-circuiting and de-energization of electromagnet 4 causes switch 12 to open the circuit which supplies potential from source 6 to anode 8. An audio frequency choke coil 15 is shown connected in series with the energy supply to anode 8. A connection from choke coil 15 may be associated with a source of current variations, such as the anode supply circuit of a thermionic tube employed as a modulator. In radio broadcasting systems the current variations produced by modulation are excessive. Excessive modulation may cause the ordinary current operated circuit breaker to operate and interrupt the energy supply circuits. As heretofore mentioned, a temporary overload is not dangerous and may only be avoided by reducing the value of energy supplied the several electrode circuits of the thermionic tubes. Such a momentary overloading many times causes no excessive temperature of the anode. Again, when thermionic tubes are employed in certain circuit arrangements, the temperature of the anode may rise

to excessive values without a corresponding increase of current in the circuits supplying the respective anodes.

Three electrode thermionic tubes are illustrated in the accompanying drawings. It is obvious that the improvements in transmitting systems of my invention may be employed with any type of thermionic tube. Any number of bi-metallic members and associated contact members may be employed in combination with a thermionic tube. I realize that many modifications of the improvements in transmitting systems of my invention are possible without departing from the spirit of my invention and it is to be understood that my invention shall not be restricted to the foregoing specification or to the accompanying drawings but only as defined in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A protective system comprising an electron tube including an envelope and grid, filament and plate electrodes therein in fixed spacial relation, a plate power supply circuit, a movable armature and contact therefor disposed in series with said plate power supply circuit, a solenoid arranged to close said movable armature into engagement with said contact when said solenoid is energized, a control circuit connected with said solenoid, a thermostat mounted adjacent the exterior wall of said envelope, contacts for said thermostat mounted to maintain closed a circuit through said thermostat so long as a predetermined temperature is not exceeded but to open said circuit when said temperature is exceeded, said solenoid being connected to the contacts of said thermostat, a momentary contact switch connected in series with said source of energy, said contacts of said thermostat and the actuating winding of said circuit breaker, and a holding switch having its contacts connected in parallel with the contacts of said momentary contact switch and mounted to be actuated cooperatively with said circuit breaker.

2. In a protective system for high power electron tubes including an envelope with grid, filament and plate electrodes disposed therein in fixed spacial relation, a plate power supply circuit, a relay device having an actuating winding, an armature and contact system for said relay disposed in series between said plate power supply circuit and said plate electrode, said relay being adapted to place said armature into engagement with said contact when said actuating winding is energized, a thermally expansive element disposed exteriorly of the envelope of said tube, contacts for said thermostat mounted to maintain a circuit through said thermostat open so long as a predetermined temperature is not exceeded but to close said circuit when

said temperature is exceeded, and a source of electrical energy connected to the terminals of said solenoid, the contacts of said thermostat being connected in shunt with said solenoid.

3. In a protective system for high power electron tubes including an envelope having grid, filament and plate electrodes therein, a source of plate potential, a circuit interconnecting said source of plate potential with said plate electrode, a circuit interrupter disposed in said connection, a relay device operating to close said circuit interrupter when said relay device is energized, and a thermal element disposed adjacent the envelope of said electron tube and movable according to the temperature of said electron tube connections for deenergizing said relay device when the temperature of said thermal element exceeds a predetermined value, a momentary contact switch connected in series with said source of energy, said contacts of said thermostat and the actuating winding of said circuit breaker, and a holding switch having its contacts connected in parallel with the contacts of said momentary contact switch and mounted to be actuated cooperatively with said circuit breaker, for correspondingly controlling the connection or disconnection of the plate electrode of said electron tube with respect to said source of plate potential.

4. In a protective system for an electron tube, a plate power supply circuit an electromagnetically actuated circuit breaker having its contacts connected in series in said plate supply circuit and arranged to close its contacts when its actuating winding is energized, a thermostatic element adjacent said tube but on the exterior of said tube, contacts for said thermostat mounted for opening a circuit when the temperature of said thermostat exceeds a predetermined value but maintaining said circuit closed when said predetermined value is not exceeded, a source of energy for actuating said circuit breaker, a momentary contact switch connected in series with said source of energy, said contacts of said thermostat and the actuating winding of said circuit breaker, and a holding switch having its contacts connected in parallel with the contacts of said momentary contact switch and mounted to be actuated cooperatively with said circuit breaker.

5. In a protective system for an electron tube, a plate power supply circuit, an electromagnetically actuated circuit breaker having its contacts connected in series in said plate supply circuit and arranged to close its contacts when its actuating winding is energized, a thermostatic element adjacent said tube but on the exterior thereof, contacts for said thermostat mounted for closing a circuit when the temperature of said thermostat exceeds a predetermined value but maintain-

ing said circuit open when said predetermined value is not exceeded, a source of energy for actuating said circuit breaker, a momentary contact switch connected in series with the actuating winding of said circuit breaker and said source of energy, the contacts of said thermostat being connected in shunt with the actuating winding of said circuit breaker, and a holding switch having its contacts connected in parallel with the contacts of said momentary contact switch and mounted to be actuated cooperatively with said circuit breaker.

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