

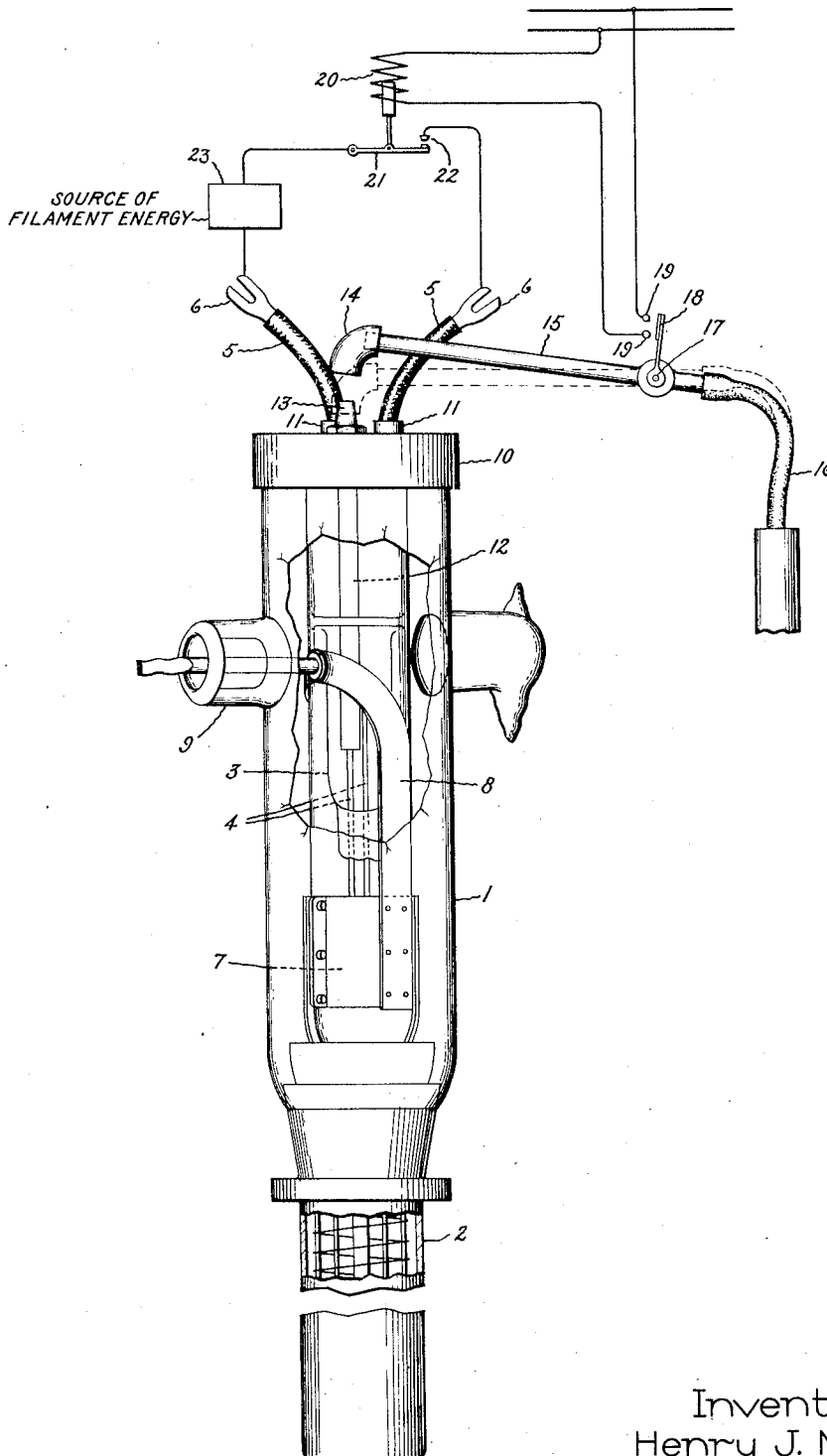
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PROTECTIVE COOLING SYSTEM FOR THERMIONIC APPARATUS

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PROTECTIVE COOLING SYSTEM FOR
THERMIONIC APPARATUSHenry J. Nolte, Schenectady, N. Y., assignor to
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The present invention relates to a power tube equipment, more particularly to a protective system for ensuring the application of a cooling fluid to the various heated parts of a thermionic device during operation.

In the operation of transmitter tube apparatus, it has been found that when the stem through which the filament leading-in conductors normally pass, tends to become heated fissures may form in the pinch seal and the vacuum fail. This condition is due, in some measure, to the fact that the heat produced in these conductors by current flow is more or less confined by the cylindrical glass wall forming the reentrant stem. It is therefore necessary to provide a means for cooling the pinch seal and in the past it has been customary to insert a rubber tubing into the reentrant stem in such a manner that a cooling fluid may be directed against the leading-in conductors and the pinch seal. However, as a practical matter, the detail of inserting the tubing is sometimes neglected at the time the filament circuit is initially energized whereupon the heat generated by the large filament current causes the seal to become unduly hot.

Among the objects of the invention is to provide a means which will ensure the insertion of the tubing into the reentrant stem at the time the tube is operated, thereby to provide a positive protection of the stem against high temperature, and, in general, to assure the maintenance of certain portions of the envelope, subject to considerable heat during operation, relatively cool.

These objects are attained by devising a combined mechanical and electrical arrangement which provides for the interlocking of the filament energizing means with that of supplying a cooling fluid, hence, the presence of the fluid is always assured when the tube is operating. This arrangement takes the form, in brief of a rigid conduit to which a device for closing the filament circuit is affixed and which device is brought into operation only when the conduit is placed in such a position with respect to the thermionic apparatus that a cooling fluid is properly directed against the heated parts. For a complete description of the invention, reference should be had to the accompanying drawing in which the figure is an elevational view of the improved tube and conduit for supplying cooling fluid, also showing by way of diagram the electrical circuits directly associated with the tube and conduit.

In the drawing, numeral 1 designates the glass

portion of an evacuated envelope, the lower end of which terminates in a cylindrical anode 2 and the upper end in a reentrant glass portion 3. Within the anode there is mounted in any suitable manner, a plurality of cooperating electrodes comprising a rectilinear filamentary cathode and a cylindrical grid or electrostatic control member. The upper end of the filamentary cathode is supported from the reentrant stem 3 by means of leading-in conductors 4, 4 which terminate in flexible cables 5, 5 carrying a plurality of terminals 6, 6. The grid is supported within the anode by means of a grid clamp 7, to which connection is made by a flexible strip lead 8 taken through the side of the envelope by means of a tubulation 9. In order to space the filament conductors rigidly from one another and to remove the mechanical stress at the seal due to the lever effect of the conductors at this point, there is provided a metallic cap 10 which fits over the upper end of the envelope and is secured thereto in any suitable manner. The cap 10 contains a plurality of symmetrically spaced apertures within which bushings 11 of insulated material are fitted; these bushings receive the filament cables 5, 5. Other apertures are also formed in the cap, one of which may be utilized for the reception of a flexible rubber tubing 12 which is employed for the purpose of directing a cooling fluid against the lower portions of the filament conductors, the pinch seal and other heated parts, and others of which (not shown) may serve as a means of egress for the cooling fluid from the interior of the stem. The tubing 12 extends a considerable distance along the reentrant stem and is bent to such a shape and constituted of such length as will most effectively perform this purpose. The upper end of the tubing 12 is carried through the aperture and terminates in a conical extension or bushing member 13, preferably of a phenolic condensation product such as bakelite having a function which will be explained hereinafter. The fluid conduit is continued through a nozzle 14 located in register with the bushing member and which, when in an operative position, may be seated on the said member. The nozzle 14 is carried by a piece of stiff tubing 15, preferably bakelite which is adapted at its free end to engage with a rubber air supply manifold 16. The tubing 15 is provided with a swivel joint 17 of any suitable design. A vane 18 is affixed rigidly to the swivel member, which vane is so positioned that when the nozzle 14 is firmly seated on the conical bushing 13, which position is indicated in dotted line, an electrical circuit is closed

across the contacts 19, 19 thereby to establish a circuit through a relay 20 energized preferably from mains of commercial voltage. The energization of relay 20 causes a circuit to be completed through an armature 21 and a contact 22 so that current from a source of electromotive force 23 will flow through the filament. It will be evident that the apparatus and circuit arrangement described provide a positive means for interlocking the operation of applying the air or other cooling fluid to the tubing which directs the fluid toward the filament conductors and the pinch seal with the operation of energizing the filament. It is further apparent that if desired, the position of the vane member 18 on the swivel joint may be adjusted to give any desired time relation between these operations. While I have shown and described by way of example the relay 20 as controlling the filament circuit, it is obvious that if desired, control may be exercised on the grid, plate or any other convenient electrode within the thermionic device so that when any of these electrodes are energized, a supply of cooling fluid is assured to the tubing 12. In addition to the necessity of providing an interlocking arrangement such as disclosed herein, it has been found desirable to synchronize by suitable switches, the operation of supplying the high voltage to the plate circuit with that of starting up the air pump motor so as to eliminate the possibility of the operator failing to start the pump.

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

1. The combination of thermionic apparatus and a cooling accessory, said apparatus including an envelope and a plurality of cooperating electrodes, said envelope terminating in a re-entrant stem, a leading-in conductor for one of said electrodes, said conductor passing through the stem, means for directing a cooling fluid against the stem in the region of said conductor, said means comprising a stationary conduit mounted within the stem and a fluid-supply conduit which is movable into and out of engagement with said stationary conduit, a source of

current connected to the leading-in conductor for energizing the said one electrode, and means for preventing energization of the said one electrode except when the fluid-supply conduit is moved into engagement with said stationary conduit.

2. The combination of thermionic apparatus and a cooling accessory, said apparatus including an envelope and a plurality of cooperating electrodes, said envelope terminating in a re-entrant stem, a leading-in conductor for one of said electrodes, said conductor passing through the stem, means for directing a cooling fluid against the stem in the region of said conductor, said means comprising a stationary conduit mounted within the stem and a fluid-supply conduit which is movable into and out of engagement with said stationary conduit, a source of current connected to the leading-in conductor for energizing the said one electrode, and means for preventing energization of the said one electrode except when the fluid-supply conduit is moved into engagement with said stationary conduit, said last-mentioned means comprising an electrical contact device mounted on the movable conduit.

3. The combination of thermionic apparatus and a cooling accessory, said apparatus comprising an envelope and a plurality of cooperating electrodes including a filament, said envelope terminating in a reentrant stem and provided with a cap, leading-in conductors for said filament, the conductors passing through the stem and cap, means for directing a cooling fluid against the stem in the region of said conductors, said means comprising a stationary conduit secured to said cap and extending into said stem, a fluid-supply conduit adapted to be moved into and out of engagement with said stationary conduit, a source of current connected to said conductors for energizing said filament, and means for causing the energization of the filament to occur simultaneously with the movement of the fluid-supply conduit into engagement with said stationary conduit.

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