June 1, 1926. 1,587,156

W. G. HOUSKEEPER

VACUUM INSULATOR

Filed Nov. 26, 1920

Fig. 1.

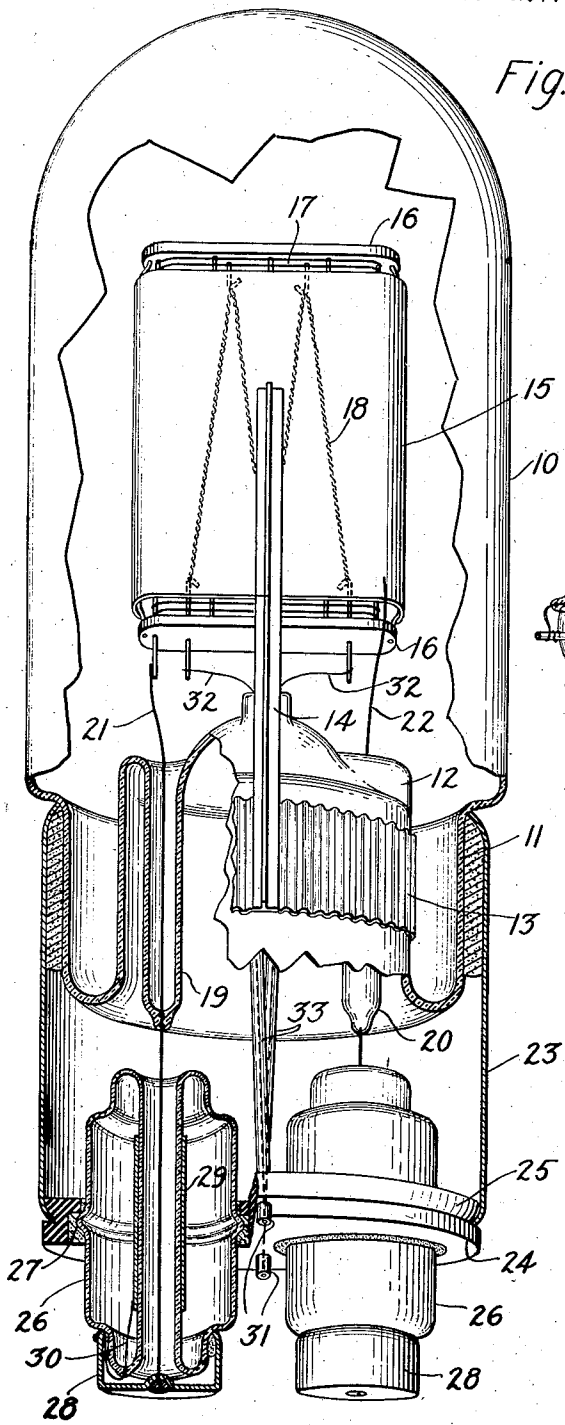
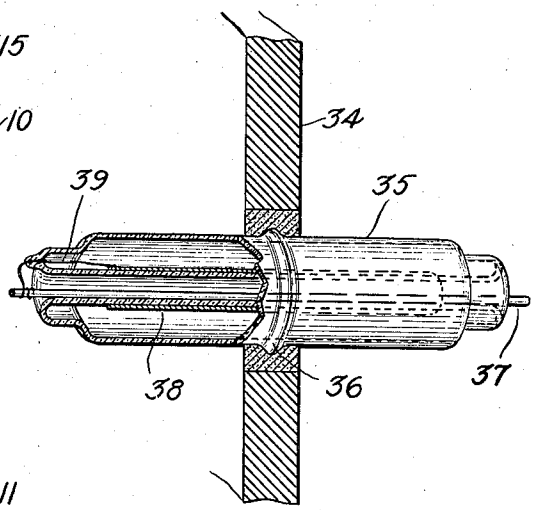


Fig. 2.



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UNITED STATES PATENT OFFICE.

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VACUUM INSULATOR.

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This invention relates to devices for insulating conductors of high voltage, high frequency circuits and pertains more especially to insulating devices adapted for use in conducting the lead wires of the grid and anode electrodes of a high power vacuum tube through the base thereof.

In employing a vacuum tube in certain installations, particularly in high voltage, high frequency circuits, it is necessary to provide special means for preventing corona effects along and discharges from the lead wires of the grid and anode electrodes of the tube. Heretofore, attempts have been made to prevent these defects by surrounding the lead wires with bodies of insulating material extending through the disc forming a portion of the base for the tube. However, the dielectric losses due to the high voltage, high frequency currents produced sufficient heating of these bodies to quickly destroy their insulating property and thus render the tube inoperative.

It is an object of this invention to provide an insulator for use in the base of a high power vacuum tube for conducting the grid and anode lead wires therethrough which will effectively prevent discharges from and corona effects along said lead wires and in which there will be no injurious heating of the dielectric.

A further object of the invention is to provide an insulator for general use in high voltage, high frequency circuits which is simple in construction and highly efficient in operation.

To accomplish these objects and to improve generally upon devices of this character, the insulators comprise two concentrically arranged cylinders joined together at their extremities to form a toroidal space which is evacuated. The conductor to be insulated passes through the inner cylinder and the evacuated space provides the necessary insulation. This device may be mounted wherever it is desired to utilize its insulating property. For example, it may be mounted in the base of a vacuum tube and a lead wire for an electrode thereof may be passed through the inner cylinder.

Other objects and advantages of this invention will be apparent in the following specification and appended claims.

This invention will be better understood by reference to the following specification and accompanying drawings wherein Figure 1 discloses a vacuum tube having a base equipped with insulators made in accordance with the invention and Figure 2 discloses the insulator adapted for general use.

In Figure 1 the vacuum tube comprises the bulb 10 having a cylindrical neck 11 and a re-entrant stem 12. Encircling the stem 12 is a metallic collar 13 equipped with supports 14 extending into the interior of the bulb. Carried by the supports 14 is the cylindrical anode 15 from which are supported the blocks 16 of insulating material between which are mounted the grid 17 and the cathode 18 according to the manner disclosed in applicant's Patent No. 1,536,855, dated May 5, 1925.

Extending from the stem 12 to the end of the neck 11 are the tubular members 19 and 20, the inner ends of which are in communication with the interior of the bulb. Arranged in said tubular members are the grid and anode lead wires 21 and 22 to which are sealed the outer ends of said tubular members. Mounted on the neck 11 of the bulb and cemented thereto is the metallic shell 23 in the lower end of which is carried the disc 24 of insulating material having a groove 25 in its periphery into which the lower edge of the shell 23 projects. In the disc 24 are provided two apertures wherein are arranged the insulators 26 which are cemented to the disc. Each of these insulators comprises a vessel of insulating material preferably glass, which is composed of inner and outer cylinders joined together at their ends to form a toroidal space. A flange 27 is provided on the vessel by means of which the vessel may be located relative to the disc. The ends of the vessel are of considerably less diameter than the mid portion thereof and on the exposed end of the vessel is mounted a cap 28. The insulators 26 extend below the disc 24 a relatively great distance and the caps 28 are of as large diameter as is consistent with the size of the insulators. The large diameter of the caps prevents corona effects and the distance between the caps and the disc prevents flashing from the caps to the shell or the cathode electrode. The lead wires 21 and 22 pass through the inner tube of these vessels and through apertures in the caps 28 to which they are soldered. Arranged around the inner cylinder of each vessel is a shell 29 of conducting

material which is electrically connected with the cap 28 by means of the wire 30 which is sealed into the wall of the vessel and which is led under the edge of the cap and soldered to the exterior thereof. The vessel 26 is evacuated and sealed off in any well-known manner. The disc 24 is also provided with contact members 31 having apertures through which pass the lead wires 32 of the cathode 18 which are soldered to the members 31, said lead wires being enclosed in the glass tubes 33.

The base is assembled with the bulb of a vacuum tube as follows: The contact members 31 and the insulators 26 with the caps 28 mounted thereon and the wires 30 joined to the caps are placed in the disc.

Next the disc is attached to the shell 23 by spinning the edge thereof into the groove 25. The base is then slipped on to the neck of the bulb, the lead wires 21 and 22 of the grid and anode being threaded through the inner cylinders of their respective insulators 26 and the lead wires 32 of the cathode being threaded through the contact members 31, after which the ends of the lead wires are soldered to the caps and contact members and are flushed off. The operation of attaching the base to the bulb is performed in the open air and, therefore, the pressure against the inner and outer walls of the inner and outer cylinders respectively of the insulators is approximately atmospheric.

In Figure 2 wherein the insulator is disclosed in its adaptation for general use, 34 designates a support or member from which the conductor is to be insulated, for example, a partition or the like. The vessel 35 is of the same general configuration as 26 and is provided with a similar flange 36. The conductor 37 passes through the inner cylinder and is electrically connected to the shield 38 arranged around said inner cylinder by the wire 39.

These insulators when used in the bases of vacuum tubes allow the tubes to be operated in high voltage, high frequency circuits. The evacuated space between the two tubular members comprising the vessel prevents the high voltage, high frequency currents from causing a heating of the dielectric and thus preserves the insulating property thereof. The electrostatic field between the shield and the ground potential of the member supporting the outer tube is not effective to produce discharges from or corona effects along the shield as there is no gas between them to be ionized. The shield and the conductor to be insulated are electrically connected in order to maintain them at the same potential. As a result of their both being at the same potential there is no electrostatic field between them and, consequently, there is no ionization of the gas surrounding the conductor. The possibility of corona effects along the conductor is thus effectively prevented.

It is to be understood that modifications may be made in the structure of this device without in any way departing from the spirit of the invention as defined in the appended claims.

What is claimed is:—

1. A device of the character described comprising an evacuated vessel composed of inner and outer coaxial cylinders of insulating material joined together at their ends, means for supporting said vessel and an electrical conductor passing through said inner cylinder.

2. A device of the character described comprising an evacuated vessel composed of inner and outer coaxial cylinders of insulating material joined together at their ends, means for supporting said vessel, an electrical conductor passing through the inner cylinder, a thin shell of conducting material in said vessel surrounding said inner cylinder, and means electrically connecting said shell and said conductor.

3. In an electrical device, a glass bulb, a metallic shell surrounding a portion of said bulb, an insulating disc mounted in said shell, an evacuated vessel of insulating material supported by said disc, said vessel comprising inner and outer coaxial cylinders of insulating material joined together at their ends, and a leading-in wire for said device passing through said inner cylinder.

4. In an electrical device, a glass bulb, a metallic shell surrounding a portion of said bulb, an insulating disc mounted in said shell, an evacuated vessel of insulating material supported by said disc, said vessel comprising inner and outer coaxial cylinders of insulating material joined together at their ends, a leading-in wire for said device passing through said cylinder, a thin shell of conducting material in said vessel surrounding said inner cylinder, and means electrically connecting said shell and said leading-in wire.

5. In an electrical device, a glass bulb, a metallic shell surrounding a portion of said bulb, an insulating disc mounted in said shell, an evacuated vessel of insulating material supported by said disc, said vessel comprising inner and outer coaxial cylinders of insulating material joined together at their ends, a leading-in wire for said device passing through said inner cylinder, a metallic cap mounted on the end of said vessel and electrically connected to said leading-in wire, a thin shell of conducting material surrounding said inner cylinder, and means electrically connecting said shell and cap.

In witness whereof, I hereunto subscribe my name this 19th day of November A. D., 1920.

WILLIAM G. HOUSKEEPER.