July 7, 1925. 1,544,865

O. SCHALLER ET AL

GASEOUS CONDUCTION ELECTRIC HEATER

Original Filed March 16, 1921

Fig. 1

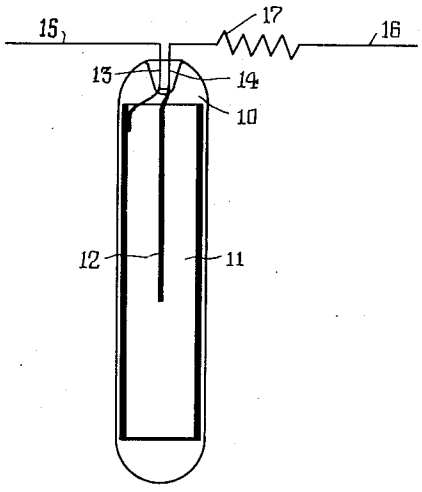
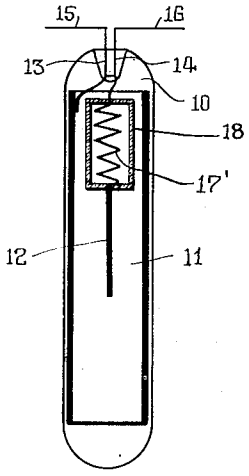


Fig. 2



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UNITED STATES PATENT OFFICE.

OTTO SCHALLER AND FRITZ SCHRÖTER, OF BERLIN, GERMANY, ASSIGNORS TO SAFETY CAR HEATING & LIGHTING COMPANY, A CORPORATION OF NEW JERSEY.

GASEOUS-CONDUCTION ELECTRIC HEATER.

Application filed March 16, 1921, Serial No. 452,781. Renewed September 18, 1924.

To all whom it may concern:

Be it known that we, OTTO SCHALLER, a citizen of the German Republic, and a resident of Berlin, Germany, and FRITZ SCHRÖTER, a citizen of the German Republic, and a resident of Berlin, Germany, have invented an Improvement in Gaseous-Conduction Electric Heaters (for which we have filed an application in Germany Jan. 5, 1918, Serial No. 36,324), of which the following is a specification.

This invention relates generally to electric heaters and more particularly to heaters dependent for their source of heat upon the conduction of an electric current through a gaseous atmosphere.

One of the objects of this invention is to provide a simple and effective electric heater that will avoid the disadvantages coincident with heaters employing resistance elements of various metals and alloys.

Another object of this invention is to provide an electric heater embodying a gaseous atmosphere conductive of electricity that will not require auxiliary starting devices, such as transformers for example, for producing a high starting voltage, or special heating circuits for bringing an electrode to incandescence as preliminary to the functioning of the heater.

Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists of the features of construction, arrangement of parts and combinations of elements, as will be exemplified in the structure hereinafter described and shown in the accompanying drawing and the scope of the application of which will be indicated in the following claims.

In the drawing,

Figure 1 represents diagrammatically a preferred embodiment of this invention, and Figure 2 is a modified form thereof.

Referring to the drawing and having reference particularly to Figure 1, a suitable vessel or container 10 is provided with a pair of electrodes 11 and 12 connected respectively by conductors 13 and 14 suitably sealed in the wall of the container 10 and connected to the conductors 15 and 16 of an electric circuit, a suitable resistance 17 being interposed in one of the conductors as 16, for example.

The vessel 10 contains an atmosphere at suitable pressure of a gas of the helium group or may contain a mixture of the gases of this group, together with a small quantity of ordinary gases. The electrodes 11 and 12 are composed of any suitable metal or alloy, and, when functioning as electrodes in an atmosphere of the above mentioned characteristics, permit of a sufficient ionization of the gaseous content and of themselves, so that upon the application of voltages of ordinary magnitudes, such as 110 volts for example, the conduction of electricity or gaseous discharge from one electrode to the other will at once be initiated without the necessity of an auxiliary or extraneous starting device. The resistance 17 in the circuit permits of the application of the terminal voltage of the circuit directly to the electrodes upon the closure of the circuit thereto and, upon the current flow having been established, functions to limit the current to an extent dependent upon the constants of the elements employed so that the elements may be properly safeguarded.

The electrode 11 is preferably in the form of a metallic sheet lining the interior walls of the vessel 10 and may, for example, be plated thereon in any suitable manner. The electrode 11 may also take the form of a grid or wire mesh and preferably forms the cathode where the heating element is intended for use with direct currents.

The electrode 12 preferably takes the form of a single conductor of suitable cross-section centrally positioned with respect to the electrode 11. Thus, for example, if the electrode 11 takes the form of a hollow cylinder as illustrated in the drawing, the electrode 12, in case direct currents are employed, forms the anode and substantially coincides with the axis of the cylindrical cathode 11.

Any suitable means, such as a socket of usual form, for example, may be employed for mounting the heating element or vessel upon a suitable receptacle and also for connecting the exterior circuit to the electrodes therein.

The vessel 10 may be made of glass, where only moderate amounts of heat or where only moderate temperatures are desired to be produced, in which case the vessel 10 may, if desired, be suitably provided with an exterior protective casing, preferably of metal or any other good conductor of heat.

Where higher temperatures are desired to be obtained, the vessel 10 may be made of quartz, porcelain or even also of metal. In the latter case, however, proper electrical insulation must be provided.

Upon the closure of the circuit to the electrodes 11 and 12, substantially full circuit voltage is applied to the electrodes, which voltage will be sufficient to initiate a discharge or current flow between the electrodes, the resistance 13 in the circuit thereupon functioning to cut down the operating voltage and resultant current to a value commensurate with the characteristics of the elements employed. The resistance 17 thus serves also to safeguard the heater from excessive currents.

The electrode 11 is preferably made the cathode, when a direct current is employed to operate the heater, whereupon a considerable proportion of the energy electrically transmitted to the heater is converted directly into heat substantially at the surface of the electrode 11. The cathode drop in potential is a substantially large proportion of the total potential applied to the electrodes 11 and 12, and hence the transformation into heat of a corresponding proportion of the energy takes place directly at the surface of the cathode 11 and in the immediate vicinity thereof, which greatly facilitates the rapid transmission of the heat so generated to the exterior medium which it is desired to heat through the walls of the container 10. It will be understood also that this heater may be operated with an alternating current.

In Figure 2 is illustrated a modified embodiment of this invention wherein the resistance 17′ inserted in one of the conductors 16 leading to the electrode 12, for example, is placed within the container 10. The electrical energy transformed into heat in the resistance 17′, suitably insulated as by the porcelain tube 18 may thus be concentrated within the container 10 so as to supplement the heating action of the electric heater proper as hereinbefore described, and without waste of the part of the energy consumed in the resistance itself.

In case the conduction of current through the gaseous content of the container 10 results in the production of light rays and where such light rays are undesirable, the container 10, if made of glass or other translucent material, may be made opaque by any suitable means so as to absorb or reflect the light rays so emitted.

It will be noted that there has been provided in this invention an electric heater of highly effective action and in which the generation of heat takes place or is concentrated in such close proximity to the walls of the container 10 that its transmission therethrough to the medium or region desired to be heated is effected in a highly efficient manner. It will also be noted that the objects hereinbefore noted, as well as others, are achieved and that many advantages are attained in the heater of this invention.

As many possible embodiments may be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth is to be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a device of the class described, in combination, a container provided with a gaseous content of a gas or gases of the helium group, and a pair of electrodes mounted within said container and adapted to maintain therebetween a gaseous discharge, said gaseous discharge being characterized by a relatively high drop in potential between one of said electrodes and the region of said gaseous content adjacent said electrode thereby to concentrate the transformation of electrical energy into heat substantially at said electrode.

2. In a device of the class described, in combination, a container having a gaseous content of a gas or gases of the helium group, an anode mounted within said container and a cathode associated with said anode, said cathode having a relatively high cathode drop in potential whereby a substantial proportion of the heat transformed from the electrical energy transmitted to said anode and cathode is concentrated substantially on said cathode.

3. In a device of the class described, in combination, a substantially cylindrical container having a gaseous content of a gas or gases of the helium group, an anode mounted within said container and coinciding substantially with the axis thereof, and a cylindrical cathode surrounding said anode and located in proximity to the interior walls of said container, said anode and said cathode being adapted to maintain a gaseous discharge therebetween and to concentrate a substantial proportion of the heat generated by said discharge substantially at the surface of said cathode.

4. In a device of the class described, in combination, a substantially cylindrical container having a gaseous content of a gas or gases of the helium group, an anode positioned substantially centrally within said container and a cathode forming an interior lining of said container, said anode and said cathode being adapted to maintain a gaseous discharge therebetween and said cathode substantially concentrating the heat transformed from said gaseous discharge substantially at its interior surface.

5. In an electric heater, in combination, a vessel composed of a material having a high heat conductivity and having a gaseous content of a gas or gases of the helium group,

and means mounted within said vessel and comprising a pair of electrodes for producing a gaseous discharge therebetween, said discharge forming a source of heat.

6. In an electric heater, in combination, a vessel composed of a material of high heat conductivity and having a gaseous content of a gas or gases of the helium group, means comprising an anode and a cathode mounted therein for producing a gaseous discharge therebetween, said cathode being mounted in close proximity to the interior walls of said vessel and having a relatively high cathode drop in potential to concentrate the heat generated by said discharge in close proximity to said cathode and to the walls of said vessel.

7. In a device of the class described, in combination, a vessel having a gaseous content composed of a gas or gases of the helium group, an anode mounted within said vessel and in operative relation to said anode, means for conducting an electric current to said anode and to said cathode, and a current limiting resistance connected in circuit with one of said means and contained wholly within said container.

8. In a device of the class described, in combination, a vessel having a gaseous content adapted upon ionization to support a gaseous discharge between a pair of electrodes, and a pair of electrodes mounted within said container and adapted to maintain therebetween a gaseous discharge, said gaseous discharge being characterized by a relatively high drop in potential between one of said electrodes and the region of said gaseous content adjacent said electrode, thereby to concentrate the transformation of electrical energy into heat substantially at said electrode.

9. In a device of the class described, in combination, a container having therein a gaseous content adapted upon ionization to support between two electrodes a gaseous discharge, a pair of electrodes mounted within said container for maintaining therebetween a gaseous discharge, means for conducting an electric current to each of said electrodes, a current limiting resistance connected in circuit with one of said means and contained within said container, and means for insulating said resistance from the conductive gaseous discharge within said container.

10. In a device of the class described, in combination, a container having therein a gaseous content adapted upon ionization to support between two electrodes a gaseous discharge, a pair of electrodes mounted within said container for maintaining therebetween a gaseous discharge, means for conducting an electric current to each of said electrodes, a current limiting resistance connected in circuit with one of said means and contained within said container, and means composed of a refractory material for insulating said resistance from the conductive gaseous discharge within said container.

In testimony whereof, we have signed our names to this specification this 20th day of January, 1921.

DR. OTTO SCHALLER.
DR. FRITZ SCHRÖTER.