

Sept. 10, 1940.

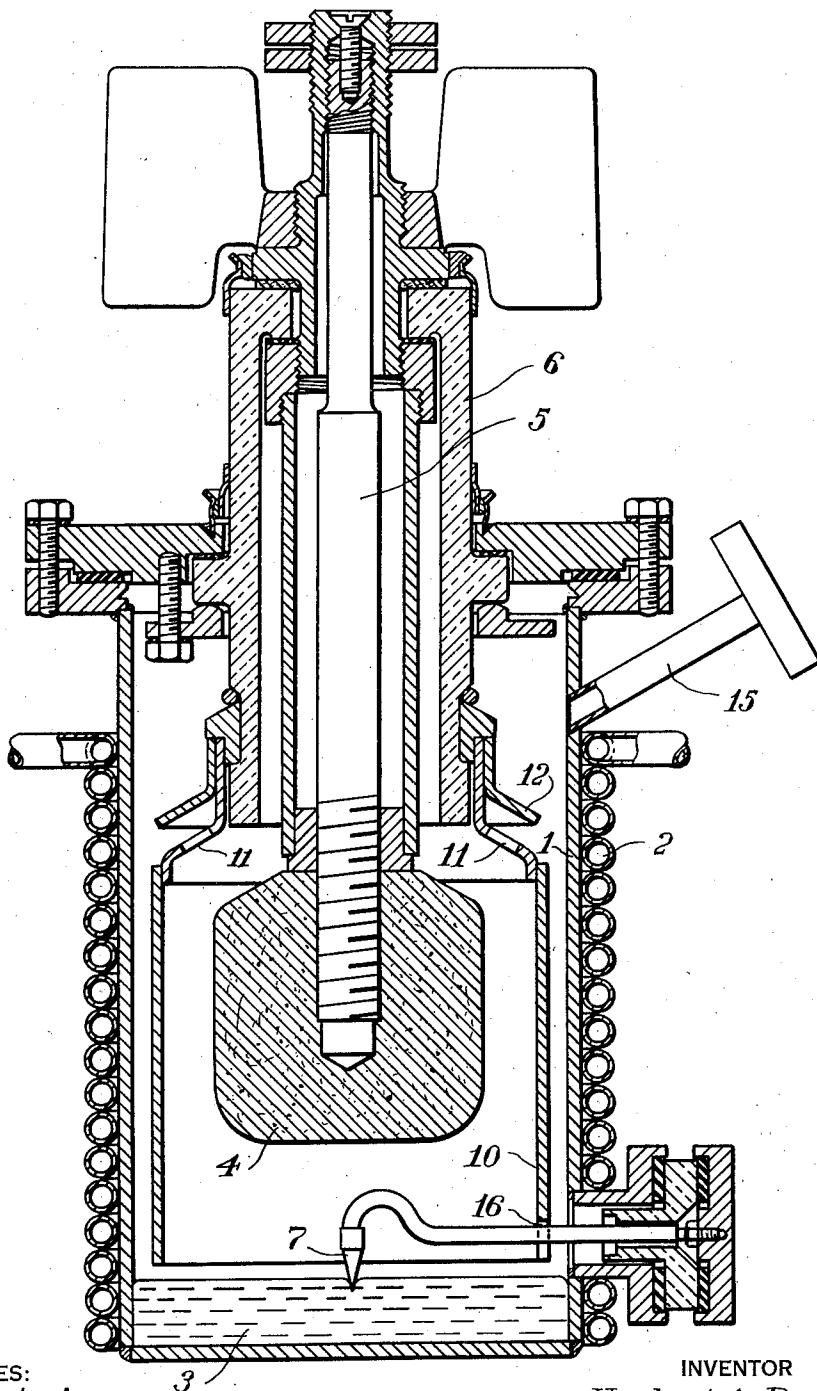
H. A. ROSE

2,214,596

VAPOR ELECTRIC DEVICE

Filed April 14, 1938

2 Sheets-Sheet 1



WITNESSES:
Edward Michaels
S. A. Strickland

Fig. 1.

INVENTOR
Herbert A. Rose.
BY *O. B. Buchanan*
ATTORNEY

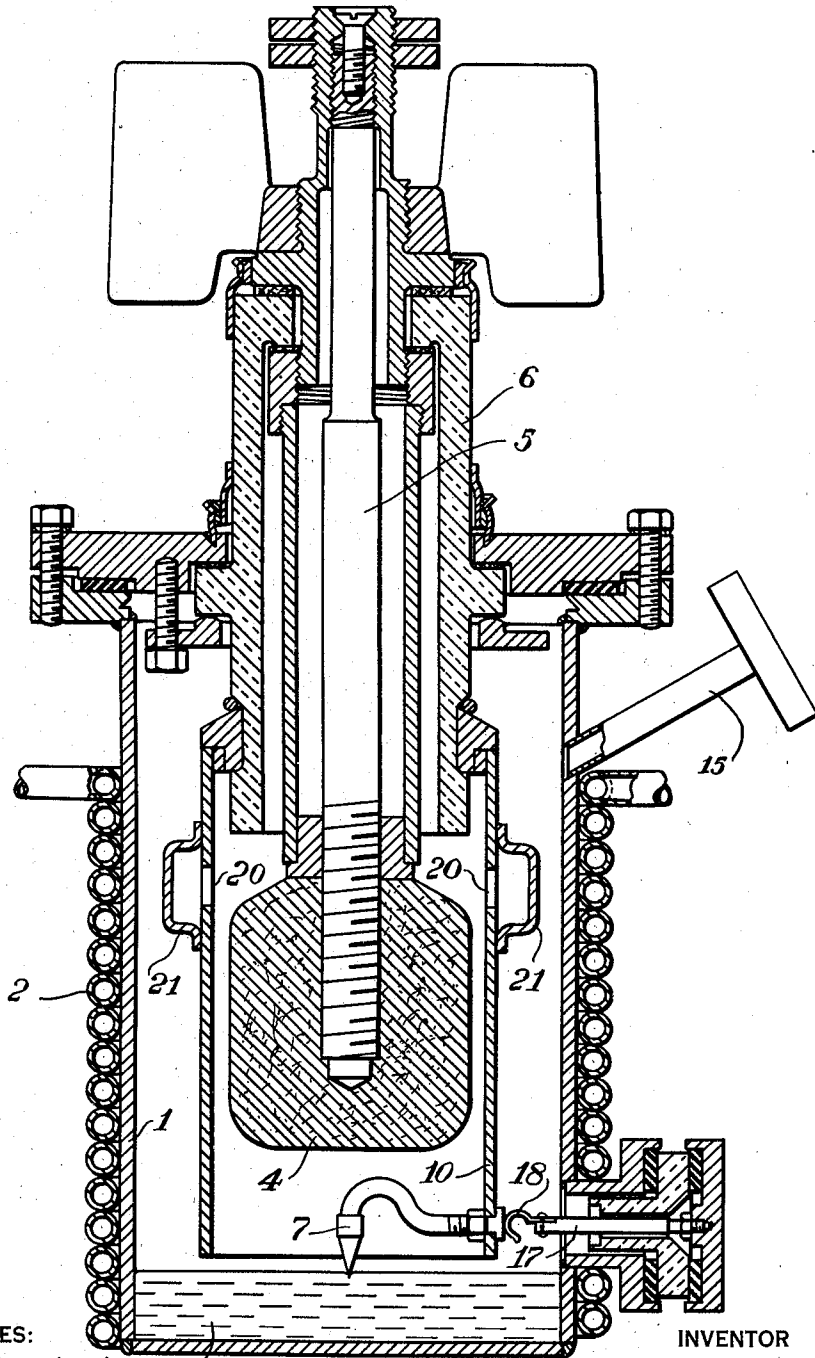
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WITNESSES:
Edward Michaels
S. A. Stuckler

Fig. 2.

INVENTOR
Herbert A. Rose.
BY *O. P. Buchanan*
ATTORNEY

UNITED STATES PATENT OFFICE

2,214,596

VAPOR ELECTRIC DEVICE

Herbert A. Rose, Leonia, N. J., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application April 14, 1938, Serial No. 201,955

2 Claims. (Cl. 250—27.5)

My invention relates to a vapor electric device and particularly to a hot shield for the anode of a make-alive type valve.

In the operation of make-alive type valves, as well as in the operation of normal mercury vapor devices, there occur random faults in the nature of arcbucks or backfires which have heretofore seriously affected the application of such devices. I believe that the presence of a cooled surface adjacent to the heated anode during operation of the device has in part been responsible for these disturbances.

According to my invention, I have provided a shield interposed between the anode and the cooled condensing surfaces so that the anode will not be directly exposed to a cooled surface, and further the shield is so positioned that any material thrown off or evaporated from the condensing surface will be separated from the immediate anode chamber. I have accomplished this by providing a shield intermediate the anode and the condensing surface. The shield, being in partial vacuum, is thermally insulated so that in operation of the device it assumes a temperature intermediate between that of the anode and the condensing surface, but nearer that of the anode. As vapor electric devices operate in a highly evacuated state, substantially all of the heat transferred from the anode must be transferred by radiation. Consequently, the heat received by the shield must be received by radiation and likewise disposed of by radiation. The shield therefore increases to a temperature determined by the radiant energy falling upon it and the area of its own radiating envelope exposed to other external energy absorbing surfaces, the cooled walls of the tube constituting the principal energy absorbing element. Positive ions also raise the temperature of this shield by continually depositing their charges upon it. By proportioning the shield so that its radiating envelope is comparable to that of the anode, account being taken of the positive ion heating effects, the shield can be made to operate at a temperature which is high in relation to that corresponding to the vapor pressure as determined by the cooled cathode and other condensing surfaces, at a temperature near that of the anode. By this arrangement, no condensation in the form of vapor droplets occurs on the shield.

In order to prevent accumulation of non-condensable gases within the anode shield, I prefer to construct the shield with openings adjacent the top thereof and to permit the working vapor

of the device to sweep through the shield to clear the anode space of any such foreign gases. In order to prevent condensed mercury dropping through these openings into the vicinity of the anode, suitable shields are provided over the aforementioned openings.

It is accordingly an object of my invention to provide an electric valve having a hot shield interposed between the anode surfaces and the condensing surfaces.

It is a further object of my invention to provide a shield structure maintaining clean surfaces adjacent the anode space.

It is a further object of my invention to provide an electronic valve of the ignitron type having a metallic shield between the anode and the cooled side walls of the tube, said shield being maintained at high temperature during operation of the valve by the heat losses of the valve.

It is a further object of my invention to provide a shield structure which maintains the cooled vapors in a compartment separate from the anode space.

It is a further object of my invention to provide a shield structure in which the foreign gases will be eliminated from the anode space.

Other objects and advantages of my invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a sectional elevation of a make-alive type valve according to my invention, and

Fig. 2 is a similar view showing a modification according to my invention.

In the illustrated embodiment of my invention according to Fig. 1, the vapor electric device or valve comprises a container 1, preferably of metal, having a suitable means such as a cooling coil 2 applied to the outside thereof so that the surface of the container acts as a condenser for the operating vapor of the device.

In the bottom of the container 1 is a suitable vaporizable reconstructing cathode 3, that is, the cathode 3 is comprised of a material which will evaporate to provide the working vapor of the device and which is condensed and returned to the cathode to maintain its volume substantially constant.

Cooperating with the cathode 3 is a suitable anode 4, preferably constructed of graphite, although any suitable material may be utilized, the anode being supported by a suitable conducting stem 5 which is sealed to the container 1 by means of a suitable insulating bushing, herein illustrated as a porcelain bushing 6.

A suitable make-alive type electrode 7 is supported in permanent contact with the cathode 3.

Interposed between the anode 4 and the condensing surface is a suitable shield 10 preferably of metal. The shield 10 may be supported in any desired manner, but I prefer to support the shield 10 on the insulating bushing 6 surrounding the anode stem 5 and to provide openings 11 adjacent the upper portion of the shield 10 so that vapor from the cathode 3 may pass through the anode space and out through the openings 11 to the condensing surface.

To prevent condensed mercury or other material from entering the anode space through these openings 11, a suitable shield 12 is interposed in spaced relation to these openings 11 and so positioned that any material falling or projected toward the openings will be deflected into the space between the shield 10 and the condensing surface.

Preferably, the shield 10 is projected into proximity with or even into contact with the cathode material.

In a pumped type tube, the pumping connection 15 is preferably made at a point to which the vapor flow will carry the non-condensing gases.

Preferably, the shield 10 is cut away to provide an opening 16 for the insertion of the make-alive electrode 7 so that the device may be assembled or disassembled without disturbing the make-alive connection.

However, as shown in Fig. 2, the make-alive electrode 7 may be permanently connected to a portion of the shield structure, and connection made thereto by a suitable conductor 17 having a spring contact 18 on the shield surface. When the make-alive electrode 7 is connected to the shield structure, it is necessary to provide sufficient distance between the bottom of the shield 10 and the cathode surface to prevent accidental grounding of the shield 10 by the agitation of the mercury surface during operation of the device.

In the operation of my device, the anode 4 will operate at an elevated temperature, since substantially the entire heat energy generated at the anode surface must be dissipated by radiation. A portion of the energy will be radiated to the shield 10 and will raise it to a temperature approaching that of the anode surface. Since the shield 10 too must lose its energy substantially by radiation because of the thermal heat insulation provided by the porcelain support 6, the temperature of the shield 10 is substantially dependent upon its radiating surface. Therefore, the shield 10 having a larger radiating area than the anode 4 and receiving energy substantially

only from the anode 4 will in most designs normally operate at an elevated temperature nearer that of the anode 4 and intermediate between that of the anode 4 and the condensing surface. Since the shield 10 is constantly in a heated condition during operation, the working vapor sweeps through the anode space carrying with it any foreign gases that may be present. In this way, the surfaces exposed to the anode 4 during operation will remain substantially clean and free of condensed material. Any condensed material will tend to be maintained in the space between the shield 10 and the condensing surface.

In the modification according to Fig. 2, the openings 20 are shielded by straps 21 spaced from and secured across the openings 20 instead of by a sloping annular shield 12 as in Fig. 1. The make-alive electrode 7 is shown supported directly from the shield structure 10 and a conductor having a suitable resilient connection 18 contacting with a portion of the shield surface.

While for purposes of illustration I have shown and described specific embodiments of my invention, it will be apparent to those skilled in the art that many changes and modifications can be made therein without departing from the true spirit of my invention or the scope of the appended claims.

I claim as my invention:

1. A single anode vapor-electric device comprising an anode, a cooperating vaporizing cathode, an evacuated metallic chamber enclosing said anode and cathode, the side walls of said chamber being in close proximity to the anode, a shield substantially enclosing the anode and extending adjacent the cathode, a make-alive electrode for initiating a cathode spot on said cathode within the confines of the shield, vapor passages in said shield adjacent the top of the anode and means for supporting said shield in thermal and electrical insulated relation to said anode and said chamber.

2. A vapor-electric device comprising an evacuated metallic container, a vaporizable cathode in said container, a single anode cooperating with said cathode, means for cooling the side walls of said container, a shield interposed between said anode and the cooled side wall of said container, said shield extending into proximity with the cathode surface, a make-alive electrode for initiating a cathode spot at a point within said shield, a thermal insulating support for said shield, vapor passages adjacent the top of said shield and means for preventing condensed cathode material from entering said vapor passages.

HERBERT A. ROSE.