In summary, this invention is a gaseous reservoir which utilizes a thin molybdenum member having a large open area therein, disposed intermediate and in contact with the reservoir element on one side and the heater element on the other.

Other objects of this invention will be pointed out in the following discussion considered with the attached drawings in which:

FIGURE 1 is a sectional view of a gaseous discharge device.

FIGURE 2 is a plan view of an important element of this invention.

FIGURE 3 is a sectional view of the preferred embodiment of this invention.

FIGURE 4 is a sectional view of a modification of the invention.

Referring first to FIGURE 1, a gaseous discharge device in the form of a hydrogen thyatron is shown as a typical environment for the subject invention. The reservoir 4, which constitutes the essence of the invention, is shown disposed beneath the cathode electrode 5. This hydrogen thyatron may be, for example, the type described in U.S. Letters Patent No. 3,175,114, issued on Jan. 22, 1963, to K. G. Germshausen, and assigned to the assignee hereof. The electrode elements include a cup-shaped anode 1, an inverted cup-shaped control electrode 3 and a vane cathode 5. Three of these electrodes have externally extending flanges 1', 3' and 5' respectively, which pass through ceramic wall sections 2. The control electrode 3 may be apertured at 7 and a grid baffle 9 overlying the aperture 7 may also be provided. A cathode baffle is shown at 11. This description is provided to indicate the environment in which the subject invention resides. A further description of this gaseous discharge device and its internal features is omitted so as not to detract from the significance of the present invention.

FIGURE 2 shows separation member 20, preferably of molybdenum, which is employed in reservoir 4 to separate the reservoir material 8 from the heating element 10 and yet maintain them in close proximity. A large number of small openings 15 are made according to a predetermined pattern on member 20. The purpose of these openings is to facilitate the radiation of heat from heating element 10 to reservoir material 8. These openings 15 may be made in any suitable manner, I have found, however, that photostamping is the most suitable means for accomplishing this end. A complete disclosure of a satisfactory photostamping technique is found in my copending application for U.S. Letters Patent Ser. No. 273,819, filed Apr. 18, 1963.

These openings 15 may also be obtained by using a wire mesh or grid-iron screen or by machining or stamping metal plates. Wire screens are less desirable because they have raised areas at the wire intersections which produce abrasion of the heater during the slight movement therebetween caused by shock and vibration. Machining or stamping of metal plates tends to produce burrs which may also cause abrasion and the percentage of open area obtainable in this way is limited. These other methods for producing the openings 15 may be employed but they are not preferred because they introduce disadvantages which shorten tube life.

The size of the openings 15 are preferably very small, particularly if the reservoir material 8 is in granular or powder form as shown in FIG. 4. In which case, the openings 15 must be smaller than the size of the reservoir material to maintain it in position. In the case of reservoir plates as shown in FIG. 3, openings 15 must be small enough to prevent contact even with slight warping or bowing of either the heater or the reservoir plate. In any event, the percentage of open area of member 20, rep-
represented by openings 15, should be as great as possible in order to permit maximum heat transfer. The upper limit is dictated by the need to prevent any possible contact between the insulating heater and the active reservoir material. We have found for particular purposes, that the open spaces between 60 and 75 percent of the total space provide sufficient heat transfer and maintain the desired physical separation of the heater and the reservoir material. It is desired to maintain member 20 uniformly thin to effect separation of the reservoir material 8 and the heater 10 without adding appreciably to the mass or bulk of the reservoir construction. Excessive mass results in undesirably long warm-up times. Excessive bulk cannot be tolerated in a miniaturized device. A plurality of tabs 13, preferably four as shown in FIGURE 2, are made a part of member 20 by the photoetching process. During the formation of member 20, slots 14 are produced in each tab 13. These slots provide a means for securing member 20 in position.

Referring now to FIGURE 3 a reservoir constructed in accordance with the teachings of this invention, shows a reservoir 4 constructed of stacked plates of active reservoir material 8 disposed on either side of an insulated metallic heater 10 and separated from by the aforesaid separation members 20. Such a reservoir configuration without member 20 is disclosed in U.S. Letters Patent No. 3,222,561, issued Dec. 7, 1965 to the applicant hereinafter pointed out above, members 20 have a large number of openings 15 to allow the heat produced by heater 10 to radiate directly to reservoir material 8. The reservoir material 8 may be slightly copped, or an extra ring of inactive material may be disposed about the periphery of heater 10 to prevent loss of heat out the side of the structure.

Although shown slightly expanded vertically in FIGURE 3 for clarity, the entire structure 4 is clamped tightly together by wedge-type ears 18 on legs 17 passing through slots 14 of tabs 13, thus supporting and aligning the reservoir structure 4 within the body of the thyatron shown in FIGURE 1. In this preferred embodiment of this invention, member 20 is a thin molybdenum plate, separating the alumina coated heater from the gas-loaded titanium reservoir material. At the normal reservoir operating temperatures, that is 750°C, the molybdenum of member 20 is inert to both alumina and titanium, thus eliminating any dangers of fusion, contamination or breakdown.

In FIGURE 4, a reservoir is shown constructed in accordance with a modification of this invention. Reservoir chamber 6 has a top protective cover 21, which is partially open to permit the gas to flow from the reservoir through screen 22. The reservoir chamber 8 is held within chamber 6 by the aforesaid separator member 20 which is maintained firmly against chamber 6 by holding pin 19 which passes through chamber extension 18, member 20 and base plate 12. A metallic heating element 10 covered with a thin insulative coating, such as alumina, is shown disposed between and in contact with member 20 and base plate 12. Base plate 12 is solid and may have an upper reflective surface to radiate heat toward reservoir material 8. As pointed out above, member 20 has a large number of openings 15 to allow the heat produced by heater 10 to radiate to reservoir material 8. A side wall may be disposed about the outer edges of the space between member 20 and base plate 12 to prevent loss of heat and to increase the heating efficiency. It should be noted that the heating element 10 may be formed in a number of different configurations, for example, spiral, zig-zag, rectangular, solid, reticulated, triangular or non-geometric free-form convolutions. It is not essential, although it is preferred, that the heating element be maintained in contact with member 20.

Although I have disclosed my invention in the terms of its preferred embodiment, it will be evident to those skilled in the art of gaseous reservoirs that it has greater scope and such scope is deemed to fall within the spirit of this invention.

I claim:

1. A reservoir for a gaseous discharge device comprising:
   a reservoir material having an absorbed quantity of the fill gas of the discharge device;
   a heating element having a thin insulating coating thereon disposed in close proximity to said reservoir material; and
   a member disposed intermediate the reservoir material and the heater and having a plurality of openings therein to permit heat transfer from the heater to the reservoir, said member being composed of a substance that does not react to the reservoir material or heater insulation at operating temperature.

2. A reservoir for a gaseous device comprising:
   a zirconium or titanium reservoir material having an absorbed quantity of the fill gas of the discharge device;
   an alumina-coated heating element disposed in close proximity to the reservoir material for raising the temperature thereof; and
   a thin molybdenum member disposed intermediate the reservoir material and the heater and having a plurality of openings therein to permit heat transfer from the heater to the reservoir material.

3. A reservoir as claimed in claim 2 in which said member is in contact with the reservoir material and the heater.

4. A reservoir as claimed in claim 2 in which said openings in said member form a greater percentage of the member's area than the closed sections.

References Cited

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