Nov. 11, 1958 S. JEFFERSON 2,860,269

GAS DISCHARGE DEVICES

Filed July 2, 1954

FIG. 1.

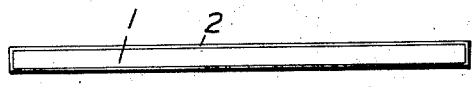


FIG. 2.

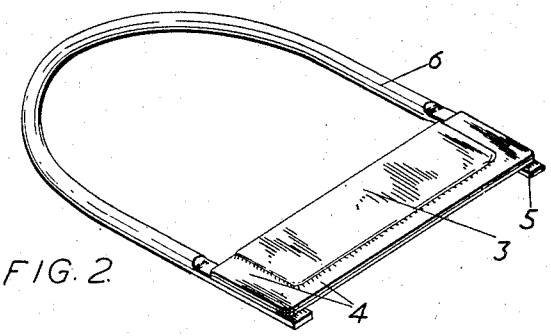


FIG. 3.

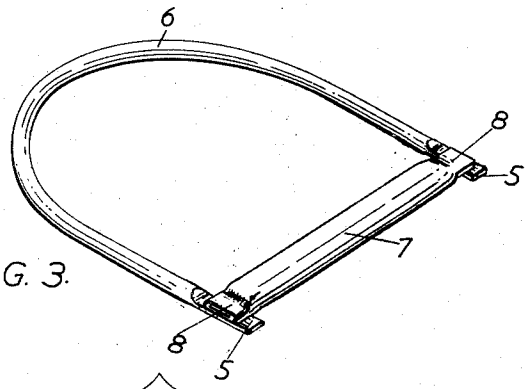
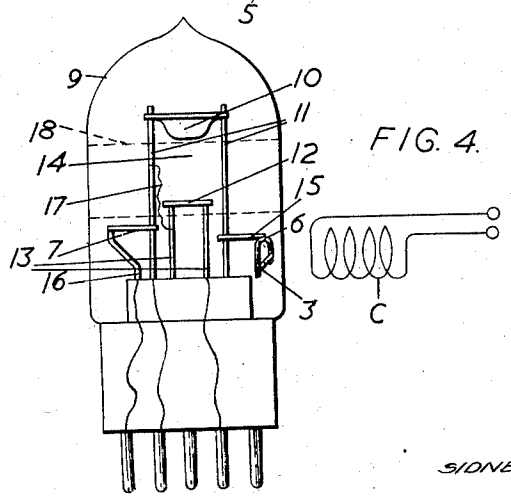


FIG. 4.



Inventor
SIDNEY JEFFERSON,

By Robert B Pearson

Attorney

United States Patent Office 2,860,269 Patented Nov. 11, 1958

2,860,269

GAS DISCHARGE DEVICES

Sidney Jefferson, Abingdon, England, assignor, by mesne assignments, to the United States of America as represented by the United States Atomic Energy Commission

Application July 2, 1954, Serial No. 441,080

5 Claims. (Cl. 313—54)

This invention relates to gas discharge devices such as cold cathode tubes and is concerned with a method and means for introducing tritium gas into the envelope of such a device for the purpose of maintaining the discharge path in an ionised condition.

According to the invention tritium gas is initially introduced into a gas discharge device in the form of a seed of metal wire strip or tube impregnated or containing said tritium gas and secured within the envelope of the device in a position such that after the device has been de-gassed and sealed it can be discretely heated by, for example, eddy-current heating, to effect release of the tritium gas into the envelope.

The tritium seed is preferably spot welded across the legs of a stirrup which is in turn welded to part of an electrode structure of the device in the manner of a getter.

The tritium released into the envelope will probably be deposited on the electrode structure and walls of the envelope. A means, in accordance with a feature of the invention, for causing the tritium to be deposited over a selected region of the electrode structure or walls consists in providing a deposit of tantalum or zirconium over said region. Such means may comprise a short length of zirconium or tantalum wire spot welded across the legs of a stirrup, welded to an electrode adjacent said region. By evaporating the wire by eddy-current heating after degassing of the discharge device, but before releasing the tritium, the required deposit is obtained in the selected region. Alternatively, the zirconium or tantalum wire may be spot welded across two insulated electrodes and fused by passing a current therethrough.

Embodiments of the invention will now be described with reference to the accompanying drawing wherein:

Fig. 1 is a side elevation partly in section of one form of tritium seed.

Fig. 2 is a perspective view of another form of tritium seed secured across the legs of a stirrup.

Fig. 3 is a view similar to Fig. 2 showing yet another form of seed and

Fig. 4 is a diagrammatic side elevation of a cold cathode diode tube embodying alternative forms of the invention.

In Fig. 1 the seed of the invention comprises a fine wire **1** of highly purified zirconium impregnated with tritium gas and provided with a coating **2** of copper. Another form of seed is shown in Fig. 2 and comprises a ribbon **3** of tungsten coated on one face with zirconium impregnated with tritium gas, folded in two along a longitudinal centre line with the coating inside, and sealed along the three open edges **4**. The tungsten ribbon is about .002 in. thick and the dimensions when folded are about 3 mm. long by .5 mm. wide. The coating of zirconium is about 2 microns thick and is deposited by the method of vacuum vaporisation.

Impregnation of the coating (or of the wire of Fig. 1) with tritium is achieved by heating the coated ribbon in an atmosphere of tritium for 2–3 minutes at about 400° C. before seam welding the edges **4**.

In Fig. 2 the seed is shown spot welded at each end to the flattened ends **5** of the legs of a nickel wire stirrup **6**. The spot welds are made through the end seam **4** to avoid puncturing the ribbon **3**.

Yet another form of seed in accordance with the invention is shown in Fig. 3 as comprising a nickel tube **7** filled with tritium gas. The tube has an internal diameter of .008 in. and a wall thickness of .001 in. The length is 2 mm. and is such as to hold about 150 micro curies of pure tritium. Such a seed may be manufactured by filling a long length of the tubing with tritium gas and cutting it into 2 mm. lengths with a blunt tool which flattens the ends **8** for a short distance. The seed **7** is shown attached to a nickel stirrup **6** similar to the stirrup **6** of Fig. 2. Spot welding of the ends **8** to the flattened ends **5** of the stirrup **6** is conveniently done in one operation.

Fig. 4 shows a typical cold cathode diode tube **9** embodying the invention. The electrode structure comprises a thimble shaped anode **10** supported on wires **11** and a disc-like cathode **12** supported on wires **13**. The anode-cathode space or discharge path which it is desired to maintain in an ionised condition is indicated at **14**. One method of embodying the invention in the tube **9** is to spot-weld a stirrup **6** fitted with a seed **3** as shown (or a seed **1** or **7**) to a wire **15** welded to one of the electrode support wires such as one of the wires **11** such that the stirrup **6** is well clear of the electrode structure and in a plane at right angles to the plane of said structure.

After the tube has been de-gassed and sealed in the normal manner, the loop formed by the stirrup **6** and seed **3** is then eddy-current heated by means of a coil C located outside the envelope and supplied with alternating current. At red heat the tube **3** bursts or leaks sufficiently to release the tritium into the envelope **9**.

An alternative method of embodying a seed in the tube **9** is to provide an additional lead **16** and to spot weld the seed **7** as shown (or a seed **1** or **3**) between said lead **16** and one of the main electrode supports **11**. The seed **7** may then be heated to red heat or fused by passing a current through it. This method can be used when the seed is required to be located in a position in which it cannot readily be heated by eddy-currents, such as within a hollow electrode structure.

The released tritium is found to be deposited on the electrode structure and the walls of the tube and it is desirable to locate the seed as near as possible to the discharge gap **14**. In order to encourage the tritium to be deposited in the region of the discharge gap, even if the seed is located some distance from the gap as shown in Fig. 4, a short length of tantalum or zirconium wire **17** is spot welded across two electrode leads such as the leads **11** and **13** and the wire is fused by passing a current therethrough prior to releasing the tritium. The result is a deposit of tantalum or zirconium **18** on the walls of the tube and on the electrode structure in the immediate vicinity of the gap **14**. When, thereafter, the tritium is released into the envelope it is selectively absorbed by the tantalum or zirconium in the region of the gap where it is mostly required.

I claim:

1. A gas discharge device comprising an envelope, an electrode structure comprising an anode and cathode within said envelope, a plurality of conductive supports, a metallic seed containing tritium gas connected between a first pair of said supports and disposed apart from said anode and cathode to form an independent electric circuit within said tube, a filament selected from the group consisting of zirconium and tantalum disposed adjacent said electrode structure and connected between a second pair of said supports to form a separate electric circuit

for vaporization of said filament prior to release of tritium from said seed.

2. A gas discharge device as claimed in claim 1 wherein said seed comprises a length of nickel tubing containing tritium gas and sealed at each end.

3. A gas discharge device as claimed in claim 1 wherein said seed constitutes a filament connected between said first pair of conductive supports, electrical terminals outside the envelope, and an electrical connection from each of said first pair of conductive supports to a separate one of said terminals to provide an electrical circuit for heating said filament from an external current source.

4. A gas discharge device comprising an envelope, an electrode structure comprising an anode and cathode within said envelope, a plurality of conductive supports, a metallic seed containing tritium gas connected between a first pair of said supports and disposed apart from said anode and cathode to form an independent electric circuit, said seed comprising a zirconium wire impregnated with tritium and coated with copper, and a filament selected from the group consisting of zirconium and tantalum disposed adjacent said electrode structure and connected between a second pair of said supports to form a separate electric circuit to vaporize said filament.

5. A gas discharge device comprising an envelope, an electrode structure comprising an anode and cathode within said envelope, a plurality of conductive supports, a tungsten ribbon coated with zirconium and impregnated with tritium, folded in half and sealed around the edges said ribbon being disposed apart from said anode and cathode and connected between a first pair of said supports to form an independent electric circuit and a filament selected from the group consisting of zirconium and tantalum disposed adjacent said electrode structure and connected between a second pair of said supports to form a separate electric circuit to vaporize said filament.

References Cited in the file of this patent

UNITED STATES PATENTS

2,354,786	Wall	Aug. 1, 1944
2,576,100	Brown	Nov. 27, 1951
2,617,956	Hamvas	Nov. 11, 1952
2,682,619	Landrey	June 29, 1954
2,689,918	Youmans	Sept. 21, 1954