

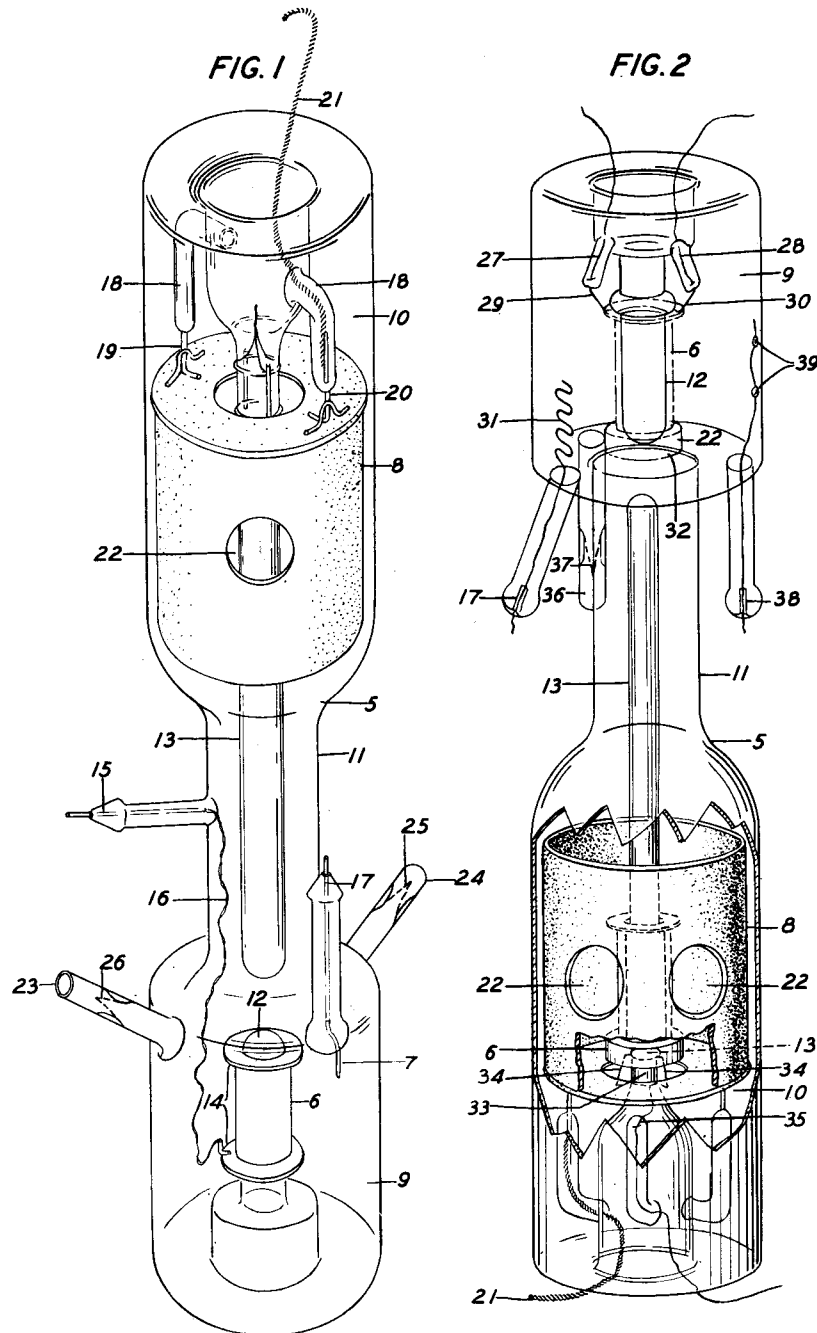
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ELECTRIC DISCHARGE DEVICE

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ELECTRIC DISCHARGE DEVICE

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This invention relates to electric discharge devices and more particularly to such devices having movable electrodes.

An object of the invention is to provide an improved electric discharge device with a movable electrode.

Another object is to provide a photoelectric tube with an improved form of movable cathode.

10 An example of practice selected for illustrative purposes is a photoelectric tube comprising two glass enclosing chambers connected by a tubular portion with an anode in each chamber and a cathode movable from one
15 chamber to the other. The cathode is a hollow metal cylinder surrounding and slidable along two reentrant tubes, one from each chamber, which nearly meet each other end to end. A flexible conductor connects the cathode with a sealed-in terminal. A soot-coated
20 cylindrical cup-shaped anode is secured in the chamber with the longer stem, and a small wire anode is located in the other chamber. Activation of the cathode takes place in this
25 latter chamber. The cathode is then moved to the other chamber within the cup-shaped anode for use. This tube functions as a perfect rectifier for ordinary working voltages.

In another illustrative embodiment of the
30 invention the cathode is secured in the activating chamber by two sealed-in conductors of small cross-section. After activation a source of current is connected between these conductors to sever them by fusion. The
35 cathode is then moved to the other chamber and dropped gently over three knife-edged contactors, which are in turn connected to a sealed-in conductor. These contactors act
40 also as a support for the cathode during use.

The invention is not confined to photoelectric devices but may find use in other types of electric discharge apparatus.

A more detailed description of the invention follows, having reference to the accompanying drawing.

Fig. 1 shows one embodiment of the invention in the form of a photoelectric tube;

Fig. 2 illustrates a modified form of the
50 tube of Fig. 1.

Like reference characters in the two figures designate similar elements.

The photoelectric tube shown in Fig. 1 comprises an enclosing vessel 5 of glass, a cathode 6, an activating anode 7 and a cylindrical cup-shaped anode 8. The enclosing
55 vessel 5 comprises a tubular activating chamber 9 and another tubular chamber 10. Adjacent ends of chambers 9 and 10 are connected by a smaller tubular member 11. The
60 chamber 9 has a short reentrant hollow stem 12, while chamber 10 has a longer reentrant hollow stem 13. These stems are coaxial and nearly meet end to end near the junction of
65 the activating chamber 9 and the connecting member 11.

Cathode 6 is a hollow nickel cylinder adapted to surround and slide along stems 12 and 13. At each end of the cathode 6 there is a collar 14. Electrical connection with the
70 cathode 6 is provided by sealed-in conductor 15 and flexible conductor 16. The conductor 16 is sufficiently long to allow the cathode 6 to move from the chamber 9 to the chamber 10
75 near the base of stem 13.

The activating anode 7 in chamber 9 is a nickel wire connected to sealed-in conductor 17.

The cylindrical cup-shaped anode 8 in chamber 10 is of nickel which is coated with
80 soot on both its inside and outside surfaces. It is supported from glass projections 18 and sealed-in metallic supports 19 and 20. Conductor 21 is connected to sealed-in support 20 and provides an external connection to the
85 anode 8. A window 22 in the anode 8 permits of illumination of the cathode 6 when it is moved to chamber 10 within the anode 8.

The cathode 6 is moved from chamber 9 to chamber 10 preferably by inclining the tube
90 so that the cathode will slide along stems 12 and 13.

The cathode 6 may be provided with any desired photoelectrically active coating. The preparation of a highly sensitive sodium-sulphur coating will be described by way of example. In the preparation of such a coating the chamber 10 and a portion of the connecting member 11 is maintained at a low temperature. A vacuum pump station and so-
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dium distillation tubulation is connected to the side tube 23, another side tube containing flowers of sulphur and a liquid air trap is connected to the side tube 24. Pure sodium is distilled onto the cathode 6 to form an opaque coating. Vapor obtained by heating the flowers of sulphur and allowing the liquid air trap to warm up, is admitted in suitable amounts to the chamber 9. The sensitivity of the cathode 6 is observed by a test circuit connected between the terminals 15 and 17 in well known manner. Upon completion of the vapor treatment the side tube 24 is sealed off as indicated by the dotted lines 25 and upon completion of the activating process, the side tube 23 is sealed off as indicated by the dotted lines 26. For further details regarding this process of activation, reference is made to a copending application of A. R. Olpin Serial No. 353,176, filed April 6, 1929.

The activated cathode 6 may now be moved in vacuo to within the chamber 10 and anode 8 to function as a central cathode photoelectric tube. When so used the anode is entirely insensitive to light and the device functions as a perfect rectifier. The coating of soot on the anode 8 assures that the anode is completely insensitive to light by absorbing any stray particles of light sensitive material which may get into the chamber 9 during the activating process.

It should be noted that this device makes possible the accurate determination of the stopping-potential of the electron emitting cathode.

During the activation of the cathode one portion of the cell 5 is cooled considerably below room temperature, while the other portion is heated considerably above room temperature. The two stems 12 and 13 are provided to obviate the strain which would be produced by this condition if a single guiding stem were employed. By the use of two stems breakage due to this heating and cooling process is practically avoided.

The photoelectric tube shown in Fig. 2 is quite similar to the tube of Fig. 1 as is obvious from the drawing. It is shown in reversed position, the activating chamber being at the top and the other chamber at the bottom. The flexible conductor 16 has been eliminated. Contact with the cathode 6 during the activating process is provided by either one of sealed-in conductors 27 and 28, from which wires 29 and 30 of small cross section are connected respectively to the cathode 6. The activating anode is in the form of a nickel wire grid 31 having an external sealed-in connection 17. Upon completion of the activating process a source of current such as for example a storage battery is connected to conductors 27 and 28 to fuse wires 29 and 30, thus releasing the cathode 6 so that it can be moved along stems 12 and 13 into the chamber 10. During the fusing process the cell 5 is preferably in

such a position that the cathode will not move to the chamber 10 until the cell is sufficiently tilted to cause it to slide by gravity.

The cathode 6 of Fig. 2 differs from that of Fig. 1 in that a comparatively heavy collar 32 is provided at the end toward the chamber 10. At the base of stem 13 there is provided a collar 33 fitted with three steel knife edges 34 adapted to engage the inside of the collar 32. By a short rapid longitudinal movement of the tube 5, the activated cathode 6 may be caused to drop upon the knife edges 34 with sufficient force to make good contact between the knife edges 34 and the cathode 6 and also to rigidly hold the cathode in fixed position with respect to the stem 13. Contact with the cathode 6 is provided by sealed-in conductor 35 which is connected to collar 33.

A single side tube 36 is shown connected to the activating chamber 9 in the modification of Fig. 2. This tube being sealed off after activation of the cathode at the point indicated by the dotted lines 37. The anode 8 is provided with two windows 22, 22 in the modification of Fig. 2 instead of one in the modification of Fig. 1.

In the modification of Fig. 2 a further connection is provided to any deposited material on the inside walls of chamber 9 by means of sealed-in conductor 38 which is connected to the inside surface of chamber 9 by glass beads 39 fused to the glass wall of the chamber.

The position of the cathode 6 in chamber 9 during the activation process is indicated by dotted lines. It is to be understood, however, that there is only a single cathode 6 in this modification, its ultimate position being shown in chamber 10.

The tubes illustrated in both figures are so formed that the activating material does not pass from chamber 9 to chamber 10 during the activating process. The connecting member 11, however, may assume other forms provided only that it permits of accomplishing the same result.

This invention is not limited to the specific embodiments shown in the drawing, but may assume a variety of forms within the purview of this invention. The scope of the invention is defined by the accompanying claims.

What is claimed is:

1. An electric discharge device including an enclosing vessel comprising two portions connected by a smaller tubular portion, an anode in each of said two portions, and a cathode movable from within one of said two portions to within the other, while the vessel remains intact.

2. An electric discharge device including an enclosing vessel comprising two portions connected by a third portion, an anode in each of said two portions, two rods located end to end and coaxially but out of contact, said rods being secured one within each of

said two portions of said vessel and at least one of said rods extending into the said third portion, and a cathode surrounding and movable along said rods from within one of said two portions to within the other, while the vessel remains intact.

3. An electric discharge device including an enclosing vessel comprising two portions connected by a third portion, an anode in each of said two portions, a guide member within each of said two portions, said members extending toward each other through said third portion, and a cathode guidable by said members and movable from within one of said two portions to within the other while the vessel remains intact.

4. A photoelectric tube comprising an activating chamber, an anode and a light sensitive cathode in said chamber, another chamber, an anode in said other chamber, and means to move said cathode from one chamber to the other in vacuo.

5. A photoelectric tube comprising an activating chamber, an anode and a light sensitive cathode in said chamber, another chamber, an anode in said other chamber, means to maintain said second anode photoelectrically insensitive to light, and means to move said cathode from one chamber to the other in vacuo.

6. A photoelectric tube comprising an activating chamber, an anode and a light sensitive cathode in said chamber, another chamber, a cup-shaped anode in said other chamber, and means to move said cathode from within said activating chamber to within said cup-shaped anode in vacuo.

7. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, and an anode in each of said two chambers.

8. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, means to obtain conductive electrical connection with said cathode while located in either of said two portions, and an anode in each of said two chambers.

9. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, a flexible conductor connecting said cathode to a sealed-in terminal, said conductor being long enough to permit said cathode to be moved from one chamber to another, and an anode in each of said two chambers.

10. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, means to obtain conductive electrical connection with said cathode while located in one of said two portions, other means to obtain conductive electrical connection with said cathode while located in the other of said two portions, and an anode in each of said two portions.

11. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, a pair of conductors extending from outside said vessel to said cathode in one of said two portions, other means to obtain conductive electrical connection with said cathode while located in the other of said two portions, and an anode in each of said two chambers.

12. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, a pair of conductors extending from

outside said vessel to said cathode in one of said two portions and a knife-edged connector making conductive electrical connection with said cathode when located in the other of said two portions, and an anode in each of said two portions.

13. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, a pair of conductors extending from outside said vessel to said cathode in one of said two portions, a plurality of knife-edges surrounded by said cathode and making conductive electrical connection therewith when said cathode is located in the other of said two portions, and an anode in each of said two portions.

14. A photoelectric tube including an enclosing vessel comprising two tubular portions and a third tubular portion of smaller diameter, said portions being joined end to end with said third portion in the middle, a reentrant stem at the outer end of each of said two tubular portions, said stems extending toward one another and leaving a small gap between their inner ends, a photoelectrically active cathode surrounding and movable along said stems from one chamber to another, a pair of conductors extending from outside said vessel to said cathode in one of said two portions, a knife-edged connector making conductive electrical connection with said cathode when located in the other of said two portions, an anode in the form of a grid in one of said two portions, and another anode in the form of a soot-coated metal cup in the other of said two portions.

In witness whereof, I hereunto subscribe my name this 4th day of June, 1930.

ALBERT R. OLPIN.

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