United States Patent

[11] 3,558,957

[72] Inventor **Richard B. Fehnel**
Basking Ridge, N.J.

[21] Appl. No. **813,257**
[22] Filed **Apr. 3, 1969**
[45] Patented **Jan. 26, 1971**

[73] Assignee **Burroughs Corporation**
Detroit, Mich.
a corporation of Michigan

[54] **MULTIPLE CATHODE INDICATOR TUBE HAVING IMPROVED ANODE AND MERCURY SOURCE**
7 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **313/109.5,** 313/174, 313/177, 313/217
[51] **Int. Cl.** **H01j 61/24,** H01k 7/04
[50] **Field of Search** 313/109.5, 174, 177, 179, 205, 206, 210, 217, 251, 251.1, 309, 356

[56] **References Cited**

UNITED STATES PATENTS

1,817,445	8/1931	Robinson	313/174X
3,230,027	1/1966	Mayer	313/174X
3,244,923	5/1966	Milliken	313/109.5
3,318,649	5/1967	Keller, Sr. et al.	313/109.5X

Primary Examiner—John Kominski
Assistant Examiner—David O'Reilly
Attorneys—Kenneth L. Miller and Robert A. Green

ABSTRACT: An indicator tube having a stack of cathodes and a cylindrical anode enclosing the stack of cathodes. The anode includes a rear plate and a front screen. The rear anode plate is provided with at least one projecting finger which extends toward the cathodes and facilitates cathode glow, and an annular mercury capsule is secured to the rear surface of the anode plate by means of metal tabs.

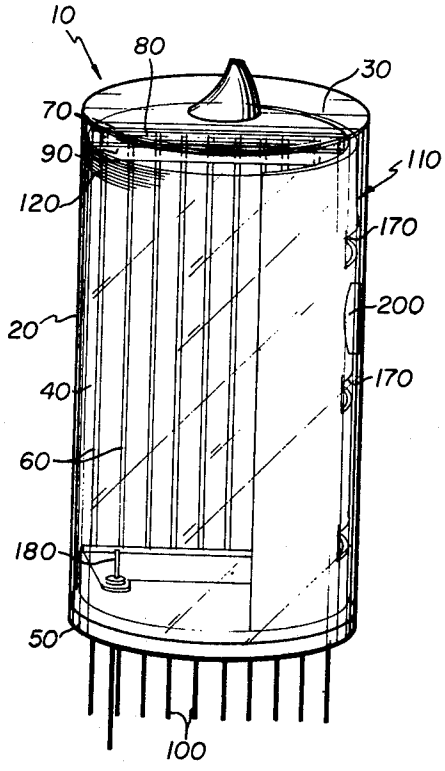


FIG. 1

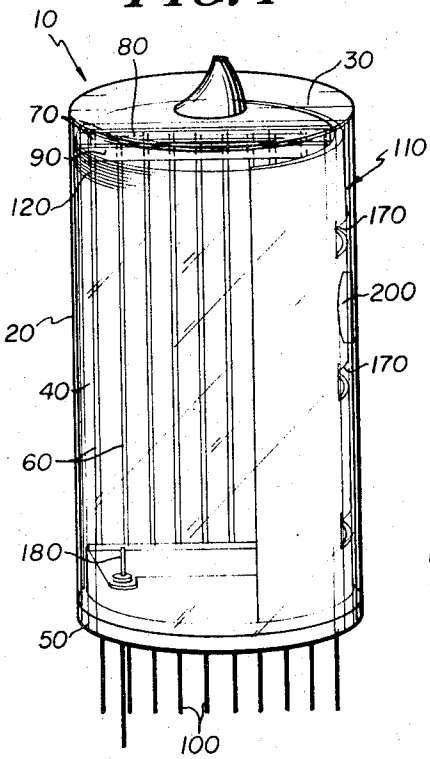


FIG. 2

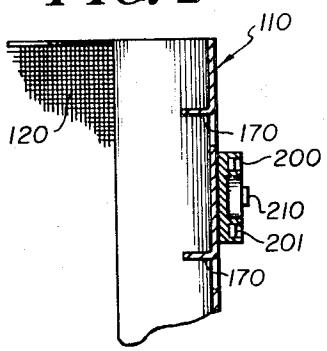
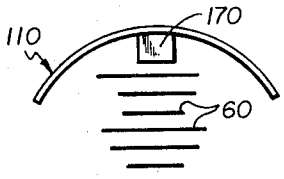
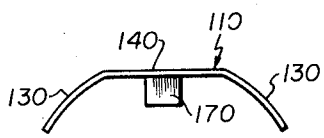


FIG. 3





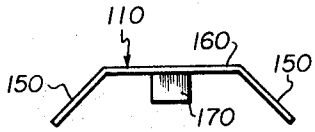


FIG. 4

FIG. 5

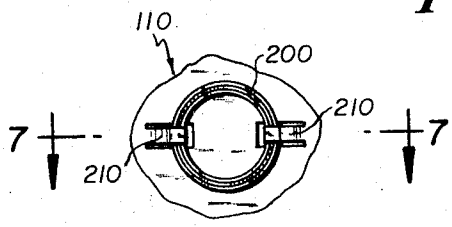


FIG. 6

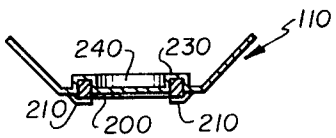


FIG. 7

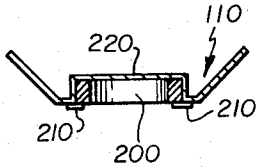


FIG. 8

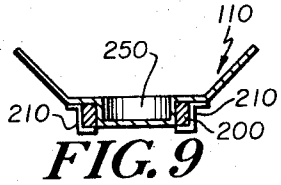


FIG. 9

INVENTOR.
RICHARD B. FEHNEL
BY Robert C. Green
ATTORNEY

MULTIPLE CATHODE INDICATOR TUBE HAVING IMPROVED ANODE AND MERCURY SOURCE

BACKGROUND OF THE INVENTION

Multiple cathode indicator tubes have been known for many years, and through the years, there has been a constant trend toward miniaturization. As the tubes have become smaller, it has become more and more difficult to provide suitable locations and to achieve secure mounting for all of its components. The mercury capsule is one of these problem components. The mercury capsule is a metal or glass container which is mounted in the tube envelope and carries the mercury which is released at a selected time in the manufacturing process, In the past, the mercury capsule has been mounted beneath or above the electrode assembly; however, in the smallest indicator tube now being made, the electrode assembly almost completely fills the envelope and none of the previous locations for the mercury capsule can be used.

In addition, for mass production and automated production, the mercury capsule must be of uniform size, and it must always be located in the same place in every tube. In addition, the capsule must be supported securely but simply and without requiring elaborate securing means.

DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a tube embodying the invention;

FIG. **2** is a side elevational view, partly in section, of a portion of the tube of FIG. **1**;

FIG. **3** is a plan view of a portion of the tube of FIG. **1**;

FIG. **4** is a plan view of a modification of the anode electrode shown in FIG. **3**;

FIG. **5** is a plan view of another modification of the anode electrode;

FIG. **6** is an elevational view of a portion of the structure shown in FIG. **2**;

FIG. **7** is a sectional view along the lines **7–7** in FIG. **6**;

FIG. **8** is a sectional view showing a modification of the portion of the tube shown in FIG. **7**; and

FIG. **9** is a sectional view showing another modification of the portion of the tube shown in FIG. **7**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An indicator tube **10** embodying the invention is shown as a side view tube and includes an envelope **20** having a flat dome **30**, a viewing window **40**, and a stem **50**. The envelope includes a gas such as neon, argon, or the like for sustaining cathode glow at a suitable pressure, for example, 20 to 80 mm.Hg at room temperature. A small quantity of mercury is also provided in the gas atmosphere.

The tube includes, as its electrode assembly, a stack of cathode electrodes **60** in the form of numerals and having upper mounting tabs **70** which are embedded in a body of insulating material **80** carried in an insulating or metallic tray **90** suitably secured to the anode assembly to be described. The cathodes have lower tabs which are secured to tube pins **100** which extend through the stem of the envelope.

The anode assembly in tube **10** comprises a rear anode plate **110** and a front anode screen **120**, the screen and plate comprising a tubular anode which encloses the stack of cathodes. The front screen **120** and rear plate **110** are welded together at their side edges, and their lower ends rest on the stem. The plate and screen are also secured to tube pins for mechanical support and to permit the application of voltages thereto. The rear anode plate may be curved (FIG. **3**), or it may have curved side panels **130** and a flat rear panel **140**, (FIG. **4**), or it may have that side panels **150** and a flat rear panel **160** (FIG. **5**), the panels **150** and **160** being at angles to each other. The front screen may also be completely curved, or it may have flat portions.

In order to improve anode operation, particularly with respect to the cathode electrode at the rear of the stack, the inner surface of the anode plate is provided with one or more projecting fingers **170** which extend toward the last cathode at the rear of the stack. The projecting fingers may be formed by metallic tabs or rods welded to the rear plate, or they may be formed by punching tabs out of the rear anode plate and bending them toward the cathodes. Preferably, a series of fingers **170** are provided arranged in a vertical column and extending from top to bottom along the central vertical axis of the anode plate.

The tube **10** also includes auxiliary cathode electrodes **180** in the form of decimal points, commas, or any other character. Each auxiliary electrode is secured to a tube pin and is suitably positioned in the tube with respect to the numeral cathodes.

According to the invention, a mercury capsule **200** is provided which comprises a metallic ring having a suitable recess in which a quantity of mercury **201** in a suitable binder is carried. The capsule **200** is of relatively large diameter and small thickness and is secured to the rear surface of the rear anode plate **110** in any suitable fashion. In one arrangement, the ring capsule **200** is held in place by tabs **210** which are welded to the anode plate or are punched out of the anode plate and are bent over the ring to hold the ring against the anode plate. Two or more such tabs are provided.

In one embodiment of the invention which provides particularly good support for the mercury ring, an annular depression **220** (FIG. **8**) is formed in the rear surface of the anode plate, and the ring is held in place in this depression by the tabs **210**.

The depression may also be shaped as shown in FIG. **7** so that it includes an annular trough **230** in which the ring fits and a central projection **240** which enters the central opening of the capsule ring.

In still another arrangement (FIG. **9**), the anode plate **110** is provided with a button **250** which rises above the rear surface of the anode plate and enters the central opening of the annular capsule.

During the manufacture of tube **10**, mercury is released from the ring capsule **200** by heat generated therein, for example, by means of a radio frequency heating coil positioned adjacent to the capsule, as is well known in the art.

I claim:

1. A multiple cathode gas-filled display tube comprising:
- an envelope filled with a gas capable of sustaining cathode glow;
- said envelope having a dome at its upper end and a stem at its lower end and a viewing window between the dome and stem;
- an electrode assembly in said envelope including a stack of cathode electrodes facing said viewing window and a cylindrical anode enclosing said stack of cathodes;
- said anode electrode including a rear anode plate and a front anode screen; and
- said rear anode plate having at least one projecting finger extending toward the last cathode at the rear of the stack of cathodes to facilitate the initiation of glow of said last cathode.

2. The tube defined in claim **1** wherein said rear anode plate includes a plurality of said projecting fingers extending toward said last cathode.

3. The tube defined in claim **2** wherein a plurality of said projecting fingers are provided extending vertically from top to bottom of said rear anode plate and oriented along the vertical axis thereof.

4. A multiple cathode gas-filled display tube comprising:
- an envelope filled with a gas capable of sustaining cathode glow;
- said envelope having a dome at its upper end and a stem at its lower end and a viewing window between the dome and stem;
- an electrode assembly in said envelope including a stack of cathode electrodes facing said viewing window and a cylindrical anode enclosing said stack of cathodes;
- said anode electrode including a rear anode plate and a front anode screen; and

a capsule containing a substance to be released into the atmosphere in said envelope, said capsule being secured to said rear anode plate.

5. The tube defined in claim 4 wherein said rear anode plate includes a depression in which said capsule is seated.

6. The tube defined in claim 4 wherein said capsule is a metal ring and the rear surface of said rear anode plate is provided with an annular depression in which said capsule is seated and secured.

7. The tube defined in claim 4 wherein said capsule is secured to said rear anode plate by a plurality of tabs carried by said rear anode plate and engaging said capsule.