Oct. 11, 1966 J. BURNS 3,278,781

STORAGE TUBE FLOOD GUN WITH SEGMENTED ANODE

Filed Aug. 21, 1963 2 Sheets-Sheet 1

FIG. 2

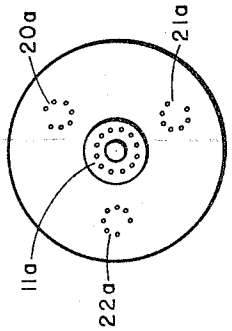


FIG. 4

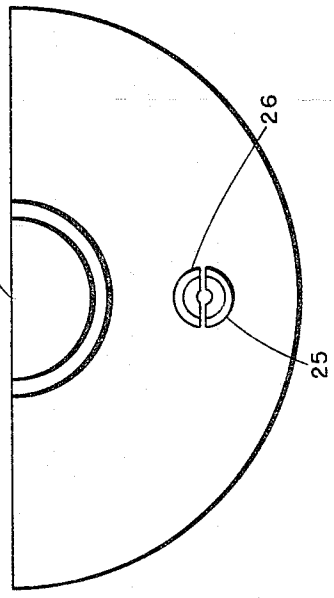


FIG. 1

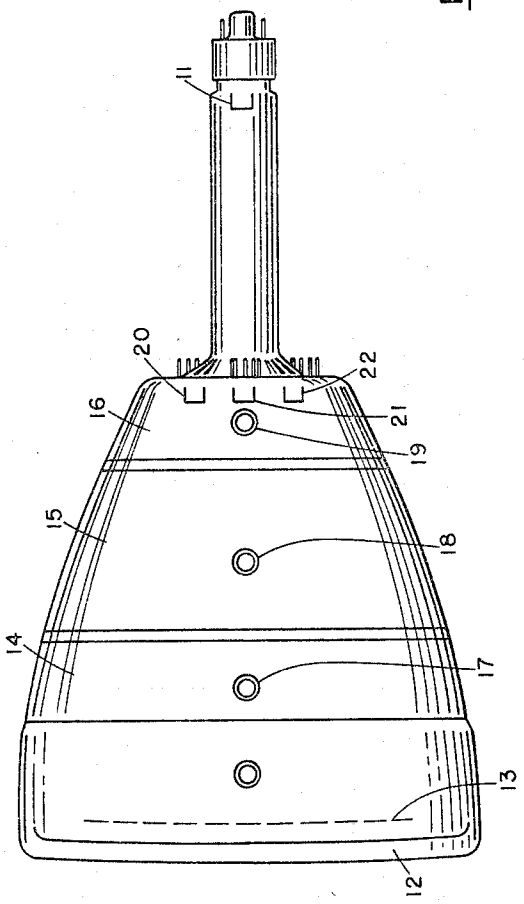
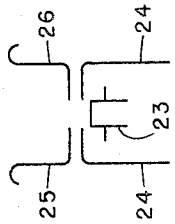


FIG. 3



INVENTOR.
JOSEPH BURNS
BY Richard Franklin

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Filed Aug. 21, 1963 2 Sheets-Sheet 2

FIG. 5

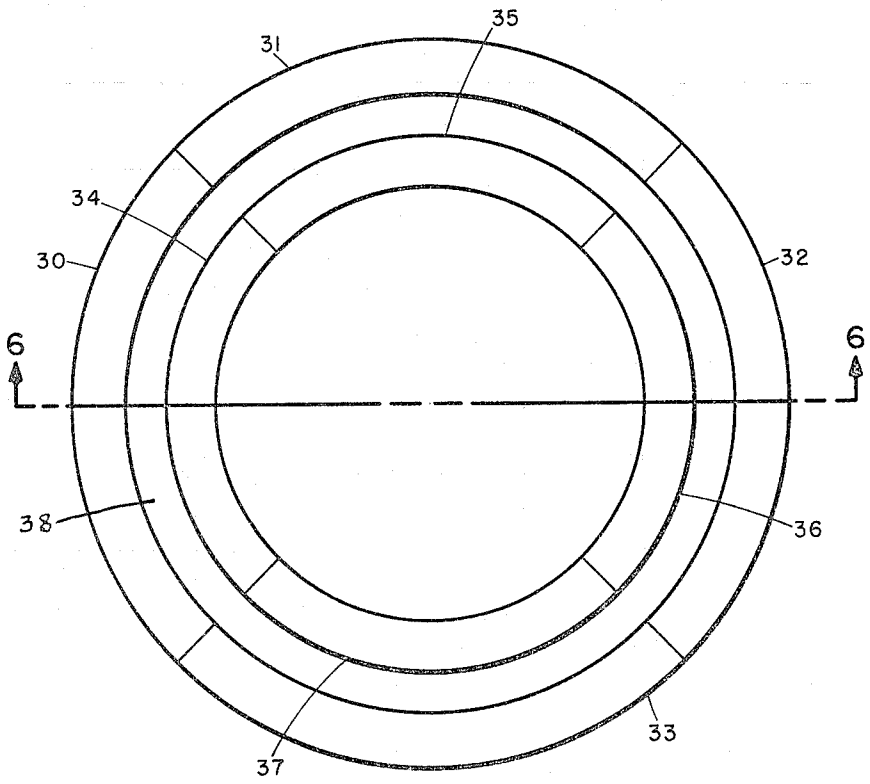
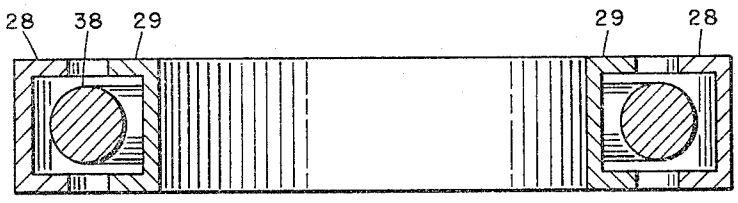


FIG. 6



INVENTOR.
JOSEPH BURNS
BY Richard Franklin

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STORAGE TUBE FLOOD GUN WITH SEGMENTED ANODE

Joseph Burns, Pequannock, N.J., assignor to Fairchild Camera and Instrument Corporation, a corporation of Delaware

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6 Claims. (Cl. 313—71)

This invention relates to the field of cathode ray storage tubes. More particularly it relates to a cathode ray storage tube of the "flood" type wherein the information to be stored is first written on a target and then, when it is desired to retrieve the information the entire tube is flooded with electrons from the flood system reproducing on the tube screen the stored information.

In tubes of this type it is important that the flooding of the tube screen be as uniform as possible to facilitate data display and to prevent any ambiguities or errors from being introduced on that account. Prior means to achieve this included use of ring flood guns and off axis multiple flood systems. The ring flood gun approach suffered non-uniformity due to the inability to collimate the complexity of electron paths and beam velocities involved, and the multiple flood gun system invariably produced critical non-uniformities due to combined electrostatic and mechanical variables which were not fully predictable.

Accordingly, it is an object of this invention to provide a novel storage tube flood system.

It is a further object of this invention to provide a storage tube flood system which avoids the difficulties encountered by the prior art.

Briefly stated, in accordance with this invention there is provided a storage tube of the cathode ray type having a controllable source of electrons, referred to in the art and hereinafter as a gun, in this instance a write gun. The write gun may be located on the central axis of the envelope, and near one end thereof, a screen of electro-luminescent material is located near the end of the envelope remote from the write gun, a target located intermediate the write gun and the screen and at least one collimator band formed inside the tube. The flood system of the tube includes at least one flood gun located off the central axis of the tube. Each of the flood guns has an anode consisting of a plurality of sections the potentials at which may be separately controllable to enable the steering of the electron beam provided by each of the guns.

For a better understanding of the invention together with other and further objects and advantages thereof reference is had to the following description to be read in conjunction with the accompanying drawing. The scope of the invention will be pointed out in the appended claims.

In the drawing:

FIGURE 1 is a diagrammatic view of a cathode ray storage tube constructed in accordance with the invention.

FIGURE 2 represents the stem connections for the various guns used in the embodiment of the invention shown in FIG. 1.

FIGURE 3 is a detailed view of one of the flood guns used in the embodiment of FIG. 1.

FIGURE 4 is a further detail of the structure of the embodiment illustrated in FIG. 1.

FIGURE 5 shows an alternate embodiment of the flood gun system constructed in accordance with the invention.

FIGURE 6 is a cross-sectional view along the line **6—6** of the structure shown in FIG. 5.

Referring now to FIG. 1, a cathode ray storage tube constructed in accordance with the invention includes an envelope **10** conventionally formed of glass. A write

gun is indicated at reference numeral **11**, a screen of electroluminescent material such as phosphor at reference numeral **12** and the target at reference numeral **13**. A plurality of collimator bands are shown at reference numerals **14, 15,** and **16**. External connections to the collimator bands are indicated at reference numerals **17, 18** and **19**. The structure shown by reference numerals **11** through **19** are conventional. They are included here for the sake of completeness and are not believed to require any discussion. The operation of these elements is the same in this as they are in other storage flood tubes whether they be of the ring type or of the off axis multiple flood gun type mentioned above. This invention is concerned with the means for providing a uniform, collimated flood of electrons from the flood system.

In the embodiment of FIG. 1 the flood system includes three separate flood guns represented by reference numerals **20, 21** and **22**. As may be seen in FIG. 2 wherein the stem connections of the various guns are designated by the same numeral used to designate the guns themselves with the addition of the letter *a*, the write gun **11** is on the central axis of envelope **10** and the flood guns **20, 21** and **22** are off the central axis radially spaced thereabout and lying in a plane substantially normal to the central axis and substantially parallel to screen **12** and target **13**. In practice guns **20, 21** and **22** are aimed toward the electron-optical center of target **13** to reduce the magnitude of steering voltages required.

As may be seen in FIG. 3 each of flood guns **20, 21** and **22** has a cathode **23** and a control grid **24**, though it has been found practical to construct flood guns **20, 21** and **22** without the control grid. Each of the flood guns further includes an anode having at least two sections **25** and **26**. In the embodiment actually reduced to practice it was found that adequate control could be achieved with a two-section anode though this is not to be construed as a limitation on the invention, since anodes of three or four, etc., sections could be used depending on the degree of control desired and the permissible manufacturing cost.

Each of the anode sections can be separately controlled by the relative magnitude of voltages applied thereto through the appropriate ones of the stem pin connections illustrated in FIG. 2 at reference numerals **20***a*, **21***a* and **22***a*.

FIG. 4 illustrates a preferred disposition of the flood gun anode relative to the central axis of envelope **10**, the central axis being indicated at reference numeral **27**. In the embodiment wherein two anode sections were used as is indicated in FIG. 4 anode sections **25** and **26** were disposed normal to the tube axis to permit radial displacement and focusing of the flood cones developed by each of flood guns **20, 21** and **22**.

The disposition of the flood guns illustrated in FIG. 2 would be preferred for an application wherein the envelope **10** has a generally circular cross-section. Where a rectangular configuration is desired each of the flood guns employed could be used to flood a segment of the target and screen. The guns might be disposed in a plane substantially normal to a line bisecting the target along the major dimension thereof. In this case the most useful adjustment would be one shifting the area flooded by each gun toward or away from the area flooded by the adjacent gun or guns. Thus, if a two section anode were used in such an embodiment the sections would lie on either side of a line which would be substantially normal to the major axis of the target.

It will be appreciated that the anode sections need not be part of separate flood guns but instead could be sections of an annular anode of a ring-type flood gun. Such

an embodiment is shown in FIGURES 5 and 6. Referring to those figures a standard ring-type flood gun anode is illustrated having two discrete portions **28** and **29** (FIG. 6) with a generally cylindrical cathode **38** disposed within the channel designed by portions **28** and **29**. Anode portion **28** is shown as segmented into four sections **30–33** (FIG. 5) and anode portion **29** is also shown as segmented into four corresponding sections **34–37**. Each of these sections are electrically isolated from one another and different potentials may be applied to them to steer or control the electron flood provided.

Though each of anode portions **28** and **29** is shown as being segmented this is not essential and, for example, only portion **28** need be segmented into sections **30–33**, portion **29** being a continuous unit. Again, it should be appreciated that the number of sections shown in the illustration, i.e., four for each of portions **28** and **29**, is not a limitation on the invention, a lesser or greater number could be used depending upon the degree of control required. Where both of portions **28** and **29** are to be segmented it is preferred that the sections of each of the portions be aligned as illustrated.

It is obvious from the above that extensive computation of many of the mechanical and electrostatic variables which might affect the uniformity of the electron flood provided by the flood system need not be undertaken nor is the construction of the flood system extremely critical. When the tube is ready for use the flood system is activated and the uniformity of the electron flood can be adjusted by adjusting the potentials applied to the various anode sections, i.e., **25** and **26**, of each of the anodes of flood guns **20**, **21** and **22** shown in FIG. 1. Of course, if three or four anode sections are employed then more complete and precise adjustment may be had though this was not deemed necessary for the application required of the embodiment illustrated. It should also be noted that the invention is not limited to three separate flood guns.

While what has been shown and described herein is believed to be the best mode and a preferred embodiment of the invention, variations and modifications may be made, as will be clear to those skilled in the art without departing from the spirit of the invention. Accordingly, the scope of the invention is intended to be limited solely by the appended claims.

What is claimed is:

1. In a storage flood tube of the type having an envelope, a write gun within said envelope near one end thereof, an electroluminescent screen near the other end of said envelope, a target between said write gun and said screen, at least one collimator band about the inside of said envelope, and means for applying desired levels of potential to elements within said tube from potential sources without said tube; at least one flood gun within said envelope located between said target and said end of said envelope adjacent said write gun, said flood guns being disposed radially about the central axis of said envelope, each of said flood guns having at least a cathode, and an anode, said anode of each of said flood guns having at least two electrically isolated sections thereof, thereby enabling the adjustment of the relative potential applied to each section of each of said flood gun anodes.

2. A cathode ray storage tube including in combination

an envelope adapted to maintain an internal pressure different than the ambient atmospheric pressure, a write gun within said envelope, an electroluminescent screen within said envelope near one end thereof, a target within said envelope intermediate said write gun and said screen, at least one collimator band located within and about the sides of said envelope, a plurality of flood guns within said envelope between said target and said end of said envelope near said write gun, said flood guns being radially disposed about the central axis of said body portion, means for connecting elements within said envelope to potential sources external to said tube, each of said flood guns including at least a cathode and an anode, each of said flood gun anodes including at least two sections electrically isolated from one another whereby the relative magnitude of the potential applied to each section of each of said flood gun anodes from an external potential source may be controlled to steer the electron flood provided therefrom.

3. The cathode ray storage tube defined in claim **2** wherein each section of each of said flood gun anodes is disposed normal to radials through said central axis.

4. A cathode ray storage tube including in combination an envelope adapted to maintain an internal pressure different than the ambient atmospheric pressure, a write gun within said envelope, an electroluminescent screen within said envelope near one end thereof, a target within said envelope intermediate said write gun and said screen, at least one collimator band located within and about the sides of said envelope, a plurality of flood guns within said envelope between said target and said end of said envelope near said write gun, said flood guns being radially disposed about the central axis of said body portion, means for connecting elements within said envelope to potential sources external to said tube, each of said flood guns including at least a cathode, a control grid and an anode, each of said flood gun anodes including at least two sections electrically isolated from one another whereby the relative magnitude of the potential applied to each section of each of said flood gun anodes from an external potential source may be controlled to steer the electron flood provided therefrom.

5. The cathode ray storage tube defined in claim **4** wherein each of said flood gun anodes is disposed normal to radials through said central axis.

6. A flood system for a cathode ray storage tube including a ring-type flood gun disposed substantially concentric to the major axis of the tube, said flood gun having at least an anode and a cathode, said anode having a plurality of electrically isolated portions and means for applying desired potentials to each of said portions whereby an electron flood emanating therefrom may be steered.

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JAMES W. LAWRENCE, *Primary Examiner.*

R. SEGAL, *Assistant Examiner.*