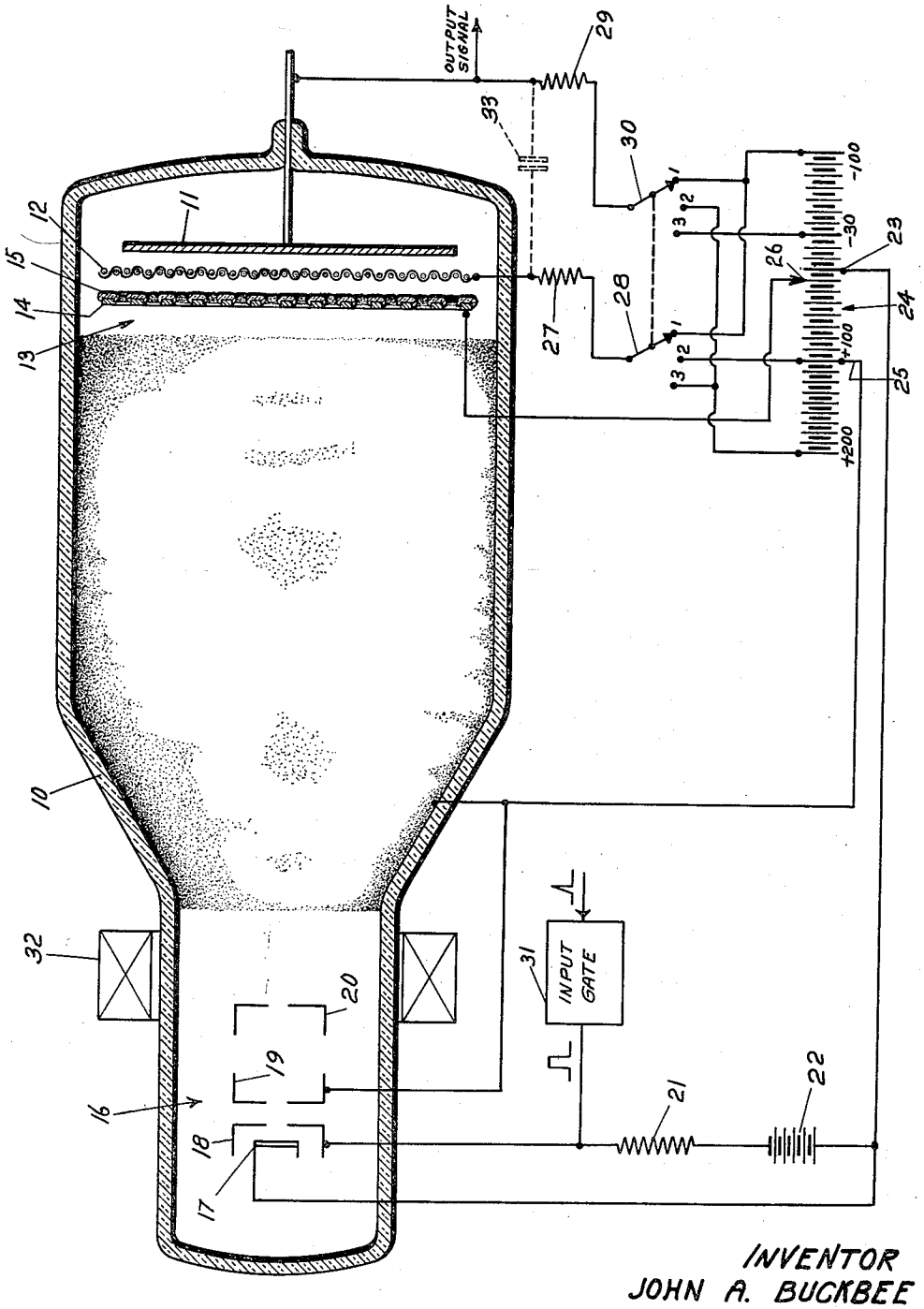
Dec. 1, 1953 J. A. BUCKBEE 2,661,442

INFORMATIONAL STORAGE DEVICE

Filed March 28, 1950



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Patented Dec. 1, 1953

2,661,442

UNITED STATES PATENT OFFICE

2,661,442

INFORMATIONAL STORAGE DEVICE

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Application March 28, 1950, Serial No. 152,467

6 Claims. (Cl. 315—12)

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This invention relates to informational storage devices, and more particularly to an electron discharge device having an electrode whereon charge patterns may be stored.

In informational storage devices of the type described in greater detail in copending application, Serial No. 66,083, filed December 18, 1948, which has matured into Patent No. 2,547,638, issued April 3 1951, entitled Image Storage Tube, a foraminous storage electrode is used which comprises a screen having a conductive side and an insulating dielectric side.

The aforesaid application discloses a structure whereby a single electron gun may be used for both storing the informational charges on the storage electrode and reading informational charges stored thereon. The charges stored on the storage screen by said device were negative with respect to the cathode of the gun.

This invention discloses methods and means whereby a single gun structure may store charges on the storage electrode which are either positive or negative with respect to the cathode of the gun. Briefly, this is accomplished by placing the gun on the conductive side of the storage electrode, placing a repeller electrode on the dielectric side of said storage electrode and spaced therefrom, and positioning an additional grid between and spaced from said repeller electrode and storage electrode. With the conductive portion of the storage electrode maintained somewhat positive with respect to the cathode of the gun, the repeller electrode maintained negative with respect to the cathode of the gun, and the auxiliary screen maintained more positive with respect to the cathode of the gun, electrons from the gun are caused to pass through the storage electrode and the auxiliary electrode, and, being repelled by the repeller electrode, will strike the dielectric surface of the storage electrode.

By adjustment of the potentials of the various electrodes, the electrons may be made to strike the dielectric surface with a velocity above the critical velocity. As used herein, the term "critical velocity" is the velocity at which electrons emitted from a surface by secondary emission just equal the electrons initially impinging thereon. Above critical velocity, more electrons are emitted by secondary emission from the surface than initially impinged thereon, while below critical velocity, less electrons are emitted by secondary emission from the surface than initially impinged thereon.

When the electrons impinge on the dielectric surface of the storage electrode at greater than

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critical velocity, the secondary emission electrons are attracted to the auxiliary electrode which is positive with respect to the dielectric surface, thereby causing a net loss of electrons by the dielectric surface and resulting in a positive charge thereon.

In addition, this invention discloses the use of relatively low velocity electrons to read the informational charges stored on the storage electrode. Since these electrons are below critical velocity, they cause little or no secondary emission, with the result that spurious unwanted signals, which could be generated during the readout process by secondary emission electrons, are eliminated. In addition, since these electrons are below critical velocity, they either strike the conductive portion of the storage electrode or pass through and are collected by the auxiliary electrode with very few of them impinging on the dielectric side of the storage electrode. As a result, the charge pattern on the storage electrode may be read many times without substantially altering said charge pattern.

Other and further advantages of this invention will be apparent as the description thereof progresses, reference being had to the accompanying drawing, wherein the single figure illustrates a longitudinal, cross-sectional view of an electron discharge device utilizing this invention and an accompanying circuit illustrating a use of said discharge device.

Referring now to the drawing, there is shown an evacuated envelope 10 having therein adjacent one end thereof a repeller electrode 11 which comprises a flat metallic plate perpendicular to the axis of envelope 10. Adjacent repeller electrode 11 is an auxiliary electrode 12 comprising a flat mesh screen having a mesh size, for example, of 400 meshes to the inch. Adjacent screen 12 is a storage electrode 13 comprising a thin flat sheet of metal 14 having holes punched therein, there being on the order of 400 holes per inch. The side of plate 14 adjacent electrode 13 is coated with a dielectric insulating material 15 which may be, for example, calcium fluoride or a variety of other materials, as set forth in greater detail in the aforementioned copending application.

Positioned at the other end of the envelope 10 from the electrode structure 11 through 15 is an electron gun 16 comprising a cathode 17, a control grid 18, a focusing anode 19, and an accelerating anode 20, all of any desired construction such as that used in standard cathode ray tubes.

The grid 18 is connected through a load resistor 21 and a bias battery 22 to the cathode 17 which is connected to a tap 23 on a battery 24, said tap being denoted, by way of reference, as zero volts. The focusing anode 19 is connected to a tap 25 on battery 24 having a potential of, for example, 300 volts. A conductive coating covers the inside of envelope 10 between the areas occupied by the electron gun and the storage electrode, said coating comprising conductive material, such as finely divided carbon in a binder. The conductive plate 14 of the storage electrode 13 is connected to a variable tap 26 on battery 24 which may be adjusted, for example, to a few volts positive with respect to cathode 17.

Auxiliary electrode 12 is connected through a load resistor 27 to the movable arm of a three-position switch 28, and the repeller electrode 11 is connected through a load resistor 29 to a movable arm of a three-position switch 30. The movable arm of switch 30 is ganged to the movable arm of switch 28. The three positions of switches 30 and 28 may be designated as follows. Position 1 is used to write negative charges on the storage electrode, position 2 is used to read charges on the storage electrode, and position 3 is used to write positive charges on the storage electrode. Operation of the device for each of the three positions will now be described.

With the switches 28 and 30 in position 1, a potential of minus 100 volts is applied to the repeller electrode 11 and the auxiliary electrode 12. Control electrode 18 is normally biased to below cutoff by the battery 22. However, in response to a positive input pulse to grid 18 from an input gate signal 31, which may be, for example, a pulse generator, the electron gun is turned on and the electron beam impinges upon a portion of the electrode structure. The position is determined by the beam deflection system in any well-known manner, for example, as shown hereby a set of deflection coils 32 positioned around the outside of envelope 10. The electrons are first accelerated by passing through the focusing electrode 19 and the accelerating electrode 20, which is attached to some suitable high potential source, not shown, to adequately focus the beam. The electron beam passes through the holes in the metallic plate 14 of the storage electrode 13 with some of the electrons of the beam impinging thereon and being carried off by the battery 24. The remaining electrons pass through the storage electrode and are reflected by the negative potentials on the auxiliary electrode 12 and the repeller electrode 11. These electrons return to the dielectric coating 15 of the storage electrode and impinge thereon, thereby building up a negative charge on the storage electrode at the point of impingement. It may be noted that, due to the negative potential of the repeller electrode and auxiliary electrode, electrons emitted from the dielectric surface 15 by secondary emission due to impingement of the initial electrons thereon will be reattracted to the storage electrode. Thus, a negative charge may be stored on any desired portion of the insulator 15 of storage electrode 13.

In order to store positive charges on the electrode 13, the switches 28 and 30 are placed in position 3. In this position, the repeller electrode is maintained at a negative potential of, for example, 30 volts, and the auxiliary electrode is maintained at a positive potential of, for example, 200 volts. When the electron gun 16 is gated on by a pulse from input gate 31, electrons

are beamed toward storage electrode 13 with the major portion thereof passing therethrough and being accelerated toward auxiliary electrode 12. The major portion of the electrons passes through electrode 12 and approaches repeller electrode 11 which is negative and is repelled thereby. The repelled electrons again pass through electrode 12 and a large portion thereof strikes the dielectric coating 15 of the storage electrode with the remainder passing through the storage electrode 13 and being picked up by the conductive coating on the inner surface of the envelope 10. The electrons which impinge on dielectric coating 15 of electrode 13 are traveling at greater than critical velocity, and therefore the number of electrons emitted from the dielectric coating 15 exceeds the number of electrons impinging thereon. The electrons emitted by secondary emission from coating 15 are attracted to auxiliary electrode 12, which is considerably more positive than the dielectric 15, resulting in a net loss of electrons to the dielectric coating 15 and thereby creating a positive charge on the portion of dielectric 15 upon which the electron beam impinges. A positive charge may be built up by this process upon dielectric coating 15 which approaches a potential substantially equal to the potential of auxiliary electrode 12.

In order to read informational charges stored on the storage electrode 13, switches 28 and 30 are placed in position 2. In this position, auxiliary electrode 12 is maintained at a potential of, for example, plus 100 volts, and the repeller electrode is maintained at a potential of, for example, plus 200 volts. When the electron gun 16 is turned on, electrons travel toward the storage electrode 13, and a portion of the electrons impinges on the conductive plate 14 thereof. The remaining electrons are either repelled by the negative charge on the dielectric 15 and are collected by the conductive shield on the inside of envelope 10 or pass through the storage electrode 13 and are picked up by the auxiliary electrode 12 or the repeller electrode 11. The number of electrons which passes through storage electrode 13 is proportional to the charge on the dielectric coating thereof and therefore the electron current from electrodes 11 and 12 is proportional to said charge. This electron current develops a voltage across resistors 27 and 29. Since there is a large stray capacitance between electrodes 11 and 12 as designated by condenser 33, the resistors 27 and 29 may be considered as a common load resistor, and the electrodes 11 and 12 may be considered as a common output electrode for read-out purposes if the reading beam is scanned across the storage electrode 13 at a reasonably fast speed, for example, scanning across one horizontal line of storage electrode holes in ten milliseconds.

This completes the description of the particular embodiment of the invention illustrated herein. However, many modifications thereof will be apparent to persons skilled in the art. For example, switches 28 and 30 could be replaced by electronic switches, and various other voltages could be applied to the electrodes to accomplish the desired results. Therefore, applicant does not wish to be limited to the particular details of the embodiment of the invention described herein, except as defined by the appended claims.

What is claimed is:

1. An informational storage device comprising a source of electrons, a foraminous storage electrode, means for beaming electrons from said

source to said storage electrode, a repeller electrode positioned on the opposite side of said storage electrode from said electron source, and a grid positioned between said repeller electrode and said storage electrode.

2. An informational storage device comprising a source of electrons, a foraminous storage electrode comprising a grid structure partially coated with insulating material, said insulating material being positioned in the path of electrons directed toward said storage electrode, a repeller electrode positioned on the opposite side of said storage electrode from said electron source, and a grid positioned between said repeller electrode and said storage electrode.

3. An informational storage device comprising a source of electrons, a foraminous storage electrode comprising a grid structure having a conductive side and a dielectric side, said insulating material being positioned in the path of electrons directed toward said storage electrode, a repeller electrode positioned on the opposite side of said storage electrode from said electron source, and a grid positioned between said repeller electrode and said storage electrode.

4. An informational storage device comprising a source of electrons, a foraminous storage electrode, means for producing charge areas on said storage electrode which are positive with respect to said source comprising a repeller electrode positioned on the opposite side of said storage electrode from said electron source, and a grid positioned between said repeller electrode and said storage electrode.

5. An informational storage device comprising a source of electrons, a foraminous storage electrode having a conductive side and a dielectric side, and means for producing charge areas on said storage electrode which are positive with respect to said source comprising a plurality of electrodes positioned on the dielectric side of said storage electrode.

6. An informational storage device comprising a source of electrons, a foraminous storage electrode having a conductive side and a dielectric side, means for producing charge areas on said storage electrode which are positive with respect to said source comprising a plurality of electrodes positioned on the dielectric side of said storage electrode, and means for causing electrons from said source to impinge on said dielectric side with greater than critical velocity.

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