

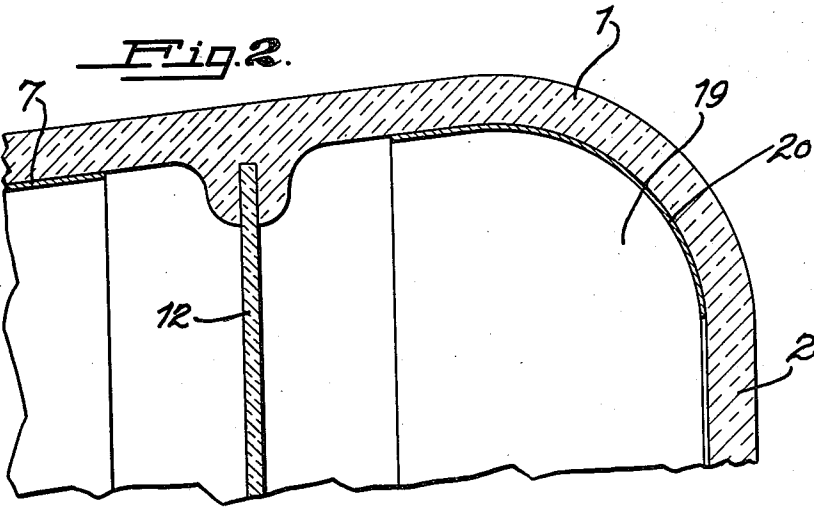
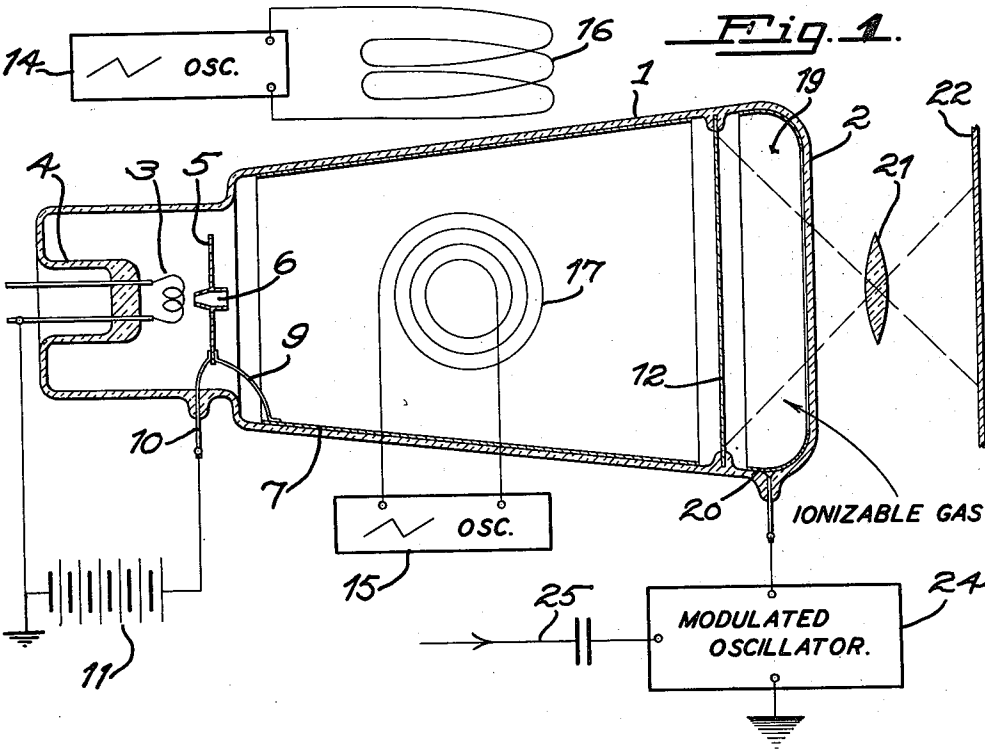
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P. T. FARNSWORTH

2,213,070

IMAGE SOURCE

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2,213,070

IMAGE SOURCE

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9 Claims. (Cl. 178—7.5)

My invention relates to a projection light source which is particularly adapted for use with oscillographic tubes, such as those used in television reception.

5 The main object of my invention is to provide an oscillographic tube capable of forming a visual image of such intensity that it may be used as a primary light source and, in conjunction with a lens system, to project an enlarged image on a viewing screen.

10 Among the other objects of my invention are: To provide a cathode ray tube giving an extremely brilliant visual image; to provide a cathode ray tube wherein the luminous agent is a gas; to provide a means and method for obtaining a luminous image in an ionizable gas; to provide an efficient and brilliant cathode ray receiving tube; and to provide a means and method of obtaining an enlarged, brilliant image created by a train of television signals.

20 My invention possesses numerous other objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing my novel method. It is therefore to be understood that my method is applicable to other apparatus, and that I do not limit myself, in any way, to the apparatus of the present application, as I may adopt various other apparatus embodiments, utilizing the method, within the scope of the appended claims.

25 In my prior application, Serial No. 614,501, filed May 31, 1932, now abandoned and replaced by United States Patent No. 2,098,000 issued Nov. 2, 1937, I have described a means and method of producing an incandescent image of high intensity by employing a cathode ray beam of high power, or a refractory material so constructed and arranged that the points of contact of the cathode ray beam are raised to incandescence during scanion of the screen. The incandescent image produced on the screen is then projected in enlarged form on a surface from which it may be viewed.

30 The present application deals with the same problem as that above set forth, but solves this problem in a slightly different manner; and broadly, my present invention comprises forming a luminous image by the selective ionization of a gas, the gas being selectively ionized and thereby illuminated in accordance with the motion of a cathode ray beam during scanion of a picture field. The image formed in the luminous gas is then preferably projected onto a viewing screen, and preferably in enlarged form.

Other broad aspects of my invention may be more fully understood by direct reference to the drawing, in which:

Figure 1 is a longitudinal sectional view of a cathode ray tube embodying my invention, with a circuit diagram showing the connections to the tube for proper operation thereof; and

Figure 2 is an enlarged sectional view of a portion of Figure 1.

Referring directly to Figure 1, I prefer to provide an envelope 1 with a flattened, transparent end window 2, and at the opposite end of the tube mount an electron gun comprising an electron-emissive cathode 3 mounted on a stem 4, and having associated therewith a gun anode 5 which is provided with a beam aperture 6. The electron flow from the cathode 3 is directed into the gun aperture 6 to form a beam projected toward the opposite end of the tube, preferably traveling in an equi-potential space created by a film 7 deposited on the walls of the tube, this film 7 being attached by a link 8 to anode 5 which is energized through lead 10 by anode battery 11. For simplicity, the cathode excitation is omitted, and this cathode may be either a directly or indirectly heated emitter.

35 The electron gun thus formed will project a beam of electrons toward the window 2, but before it arrives at window 2 I prefer to intercept the beam by a dielectric barrier 12. This dielectric barrier 12 is positioned across the tube, preferably parallel to window 2, and spaced therefrom, and may comprise a thin glass or quartz diaphragm. Other thin insulating materials having a high susceptibility together with negligible conductivity, are fully equivalent thereto, and are equally suitable. This diaphragm is impacted by the beam.

40 The beam is moved across the gun side of the diaphragm by means of scanning oscillators 14 and 15, preferably having a saw-tooth wave form, and the beam is exposed to the fields of scanning coils 16 and 17 in such a manner that a picture area is scanned by the beam on diaphragm 12 in a manner well known in the art, and in the same manner as if diaphragm 12 were a fluorescent screen.

45 Inasmuch as I prefer to seal the circumference of diaphragm 12 directly to the walls of the envelope 1, and to form therewith a gas-tight seal, there will be a chamber 19 formed between window 2 and diaphragm 12. I prefer to fill this chamber with an ionizable gas, such as, for example, the monatomic gases, either with or without the addition of caesium, sodium or potassium

vapor. Other combinations of ionizable gases and metallic vapors are well known to those skilled in the art for producing an ionizable medium capable of producing light.

5 Around the periphery of the chamber 19 I prefer to position a ring-shaped electrode 20, this electrode being positioned in such a manner that it will not interfere with any light rays emanating from diaphragm 12. An optical system represented by lens 21 is positioned to focus luminosity on the window side of diaphragm 12 onto a viewing screen 22.

Ring electrode 19 is connected to the output of a modulated oscillator 24, this oscillator preferably operating at from one to twenty megacycles and being modulated with, for example, a television signal provided from input line 25.

The operation of the device is as follows: The gun anode 5 is energized to an anode potential of from 500 to 5000 volts, and the cathode 3 is energized to produce electrons. The resultant beam of electrons is then projected against diaphragm 12 and is moved in two directions thereover by the action of the field of scanning coils 16 and 17. The beam projected against diaphragm 12 is so adjusted as to maintain the point of contact of the beam at a fixed positive potential at all times by the emission of secondary electrons on impact, and this potential should be equivalent to a radio-frequency ground for the modulated oscillator 24. The secondaries emitted are collected by film 7. The surface opposite the area bombarded will become negative and a glow spot will be found.

35 Under these circumstances, the energy fed to the gas through ring 19 will cause the spot on the opposite side of the diaphragm to that contacted by the beam to become highly luminous by the creation of a cathode glow, the energy, of course, being provided by the modulated oscillator 24; and as the luminosity of the gas will be proportional to the energy supplied, and as the oscillator will be modulated in accordance with, for example, television signals, the luminosity of the gas illuminated on the face of the diaphragm 12 will vary in accordance with the modulations as the beam is moved over the opposite side of diaphragm 12. In this manner a luminous image is produced in the gas adjacent the surface of diaphragm 12, and this image is then projected on a viewing screen 22 through the optical system 21.

It will be seen, therefore, that I have provided the equivalent of a roving electrode, and only those portions of the diaphragm 12 which are being impacted by the beam will become illuminated. The beam, therefore, may trace in the gas any image desired, and of course I do not wish to be limited in the application of my invention to television tubes, as the method and apparatus is obviously adaptable for the broad field of visual trace production.

I have succeeded, therefore, in obtaining high-intensity images produced in a gas due to the action of a cathode ray beam which, as is well known, has no inertia and therefore can be moved to provide high-definition images. The images, being brilliant, may be used for projection purposes, thus giving a large image which may be viewed by a plurality of persons at the same time.

I claim:

1. The method of producing a luminous trace in an ionizable gas enclosed in a container having a dielectric wall having high susceptibility

and a negligible conductivity, which comprises directing a defined beam of electrons against the outer surface of said wall with a velocity sufficient to cause emission of secondary electrons by impact therefrom with consequent change in potential of the area contacted by said beam, and passing a current through said gas to the inside surface opposite the area contacted to cause ionization over said latter areas.

2. The method of producing a luminous trace in an ionizable gas enclosed in a container having a dielectric wall having high susceptibility and a negligible conductivity, which comprises directing a defined beam of electrons against the outer surface of said wall with a velocity sufficient to cause emission of secondary electrons by impact therefrom with consequent change in potential of the area contacted by said beam, and passing a current through said gas to the inside surface opposite the area contacted to cause ionization over said latter areas defined, and moving said beam to cause said area to vary its position on said wall.

3. The method of producing a luminous trace in an ionizable gas enclosed in a container having a dielectric wall having high susceptibility and a negligible conductivity, which comprises directing a defined beam of electrons against the outer surface of said wall with a velocity sufficient to cause emission of secondary electrons by impact therefrom with consequent change in potential of the area contacted by said beam, and passing a current through said gas to the inside surface opposite the area contacted to cause ionization over said latter areas, and varying said current to vary the degree of ionization.

4. The method of producing a luminous trace in an ionizable gas enclosed in a container having a dielectric wall having high susceptibility and a negligible conductivity, which comprises directing a defined beam of electrons against the outer surface of said wall with a velocity sufficient to cause emission of secondary electrons by impact therefrom with consequent change in potential of the area contacted by said beam, and passing a current through said gas to the inside surface opposite the area contacted to cause ionization over said latter areas defined, and moving said beam to cause said area to vary its position on said wall, varying said current to produce an image.

5. The method of producing a luminous trace in an ionizable gas enclosed in a container having a dielectric wall having high susceptibility and a negligible conductivity, which comprises directing a defined beam of electrons against the outer surface of said wall with a velocity sufficient to cause emission of secondary electrons by impact therefrom with consequent change in potential of the area contacted by said beam, and passing a current through said gas to the inside surface opposite the area contacted to cause ionization over said latter areas defined, and moving said beam to cause said area to vary its position on said wall, varying said current to produce an image, and projecting said image on a viewing screen.

6. The method of producing ionization in a gas contacting one face of a dielectric barrier having high susceptibility and a negligible conductivity, which comprises changing the potential of a surface area on the other side of said barrier by loss of electrons therefrom and passing a current through said gas to the barrier surface opposite the area changed in potential.

7. Means for producing a luminous image comprising an envelope, a dielectric barrier having high susceptibility and a negligible conductivity dividing the space enclosed by said envelope into a beam chamber and a gas chamber, an ionizable gas in said gas chamber, means in said beam chamber for producing an electron beam directed against said barrier to produce secondary electrons on impact, and means for introducing an ionizing current into said gas.

8. Means for producing a luminous image comprising an envelope, a dielectric barrier having high susceptibility and a negligible conductivity dividing the space enclosed by said envelope into a beam chamber and a gas chamber, an ionizable gas in said gas chamber, means in said beam chamber for producing an electron beam of elementary cross-section directed against said barrier, means for introducing an ionizing current into said gas, means for moving said beam over said barrier to cover a picture area, an electrode in said gas, and an oscillator modulated at picture element frequency connected to said electrode.

rent into said gas, means for moving said beam over said barrier to cover a picture area, and means for supplying a modulated ionizing current to said gas.

9. Means for producing a luminous image comprising an envelope, a dielectric barrier having high susceptibility and a negligible conductivity dividing the space enclosed by said envelope into a beam chamber and a gas chamber, an ionizable gas in said gas chamber, means in said beam chamber for producing an electron beam of elementary cross-section directed against said barrier, means for introducing an ionizing current into said gas, means for moving said beam over said barrier to cover a picture area, an electrode in said gas, and an oscillator modulated at picture element frequency connected to said electrode.

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