

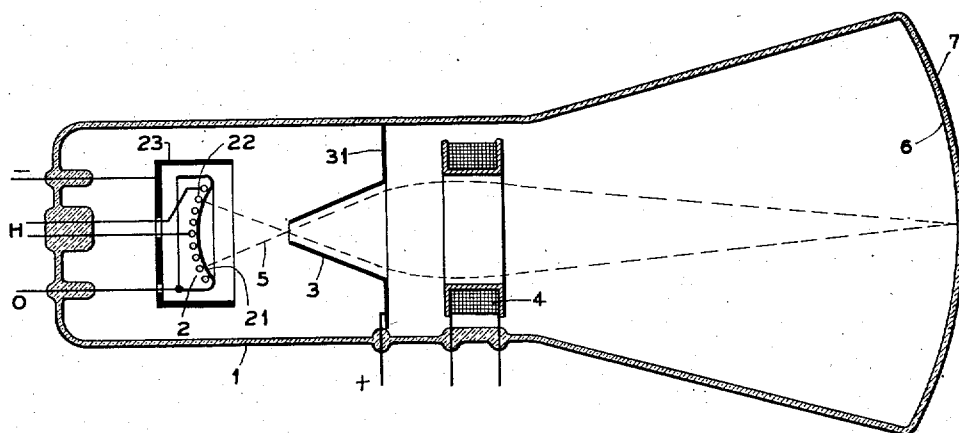
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E. LÜBCKE

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CATHODE RAY TUBE

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INVENTOR
ERNST LÜBCKE
BY *H. Grover*
ATTORNEY

UNITED STATES PATENT OFFICE

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CATHODE RAY TUBE

Ernst Lübecke, Berlin-Siemensstadt, Germany, assignor to Siemens & Halske, Aktiengesellschaft, Siemensstadt, near Berlin, Germany, a corporation of Germany

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In cathode ray tubes operated with a heated cathode, it is frequently difficult in practice to obtain a sharp spot upon the fluorescent or luminescent screen when using high vacuum type tubes so that the cathode ray pencil constriction produced by a gaseous atmosphere must be obtained in a different manner.

The cathodes of the cathode ray tubes used in the prior art are usually made of wires or ribbon placed edgewise, and they were predicated either upon purely metallic or an oxide emission of electrons. By the use of magnetic constriction coils only has it been feasible to secure an optical image of the cathode, that is, the wire or ribbon, upon the fluorescent or luminescent screen.

In order to obtain a sharp spot the cathode, according to the present invention, is so shaped that the cathode rays issuing therefrom will be concentrated and focused to result in a sharp spot without outside auxiliary means. The cathode ray pencil or spot is then projected upon the fluorescent or luminescent screen by the aid of suitable constriction coils. In order to concentrate the rays in one spot a cathode of the reflector or concave type is used according to this invention. The electric-emissive surface of the cathode preferably has the shape of a calotte (hemisphere) or as a part of a paraboloid. In the focus thereof, according to another object of this invention, is the open apex of a funnel-shaped anode to which is applied a positive potential which is high compared with the potential of the cathode, for example, a few hundred volts.

The foregoing and many other objects and advantages of the present invention will become apparent from a consideration of the following specification and claims in connection with the accompanying drawing which illustrates an exemplified embodiment of the basic ideas of the invention.

Referring to the drawing, the numeral 1 denotes the glass vessel of the cathode ray tube provided with a cathode member 2 and the funnel-shaped anode 3. The rectilinear rays issuing from the cathode 2, which are indicated at 5, are caused to pass through the apex of the anode 5. After the cathode ray pencil is passed through the anode it is subjected to the constrictive action produced by the magnetic field set up by the coil 4 with the result that a sharply contoured and focused spot is produced upon the luminescent or fluorescent screen 6 which coats the inner surface of the tube end wall 7.

The electron-emissive body proper of the cath-

ode which is of lenticular shape, that is, like a concave reflector, is indicated at 21. The emissive surface is made either by the paste or the distilling process, already well known in the art. The cathode 21 is heated indirectly by radiation from a tungsten spiral 22 to which suitable heating current is supplied.

The cathode is enveloped by radiation-protector means 23 on all sides save the side turned toward the anode. The radiation protection means may be insulated and maintained at a potential of a few volts negative relative to the cathode potential.

By using a form of cathode and anode as here disclosed the force-lines and thus also the paths of the electrons will be roughly radial and rectilinear from the cathode towards the anode.

In the marginal portions of the pencil of rays tapered in the direction of the anode, however, force-lines and thus also electron paths will arise that are not rectilinear. On the other hand, if the cathode and particularly the cathode edge are not made correctly, the rays will not converge into a focus, but in a somewhat spread focal line. By changing the angle of aperture in the funnel-shaped anode it is possible to cut off such electronic rays as fail to pass rectilinearly through the apex of the anode. In addition, and for the same object, the anode may be furnished with an annular screen 31 disposed at any desired place along the anode funnel. The screen 31 extends as far as the wall of the glass vessel in order to confine the cathode space relative to the other part of the tube and act as a shield means.

By the constrictive field provided in the rear of the anode, the cathode rays issuing from the anode funnel along divergent paths are deflected and are guided in the form of a concentrating ray pencil through suitable deflector plates or coils (not shown) to trace any desired pattern upon the observation screen 6 or upon a suitable photographic plate. In order that the shape of the field between cathode and anode may be disturbed as little as feasible, the constriction coils are disposed directly in the rear of the anode and are given a small diameter. Under certain circumstances it may be of advantage to connect conductively the radiation protector means with the cathode in order that also in this manner a further improvement of the field shape may be secured to result in a perfectly straight bundle of lines between the cathode and the anode giving a sharp focus or spot upon the screen.

As a further development of the basic idea of this invention the cathode ray tube may be ren-

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dered suitable for sound film work by making the emissive surface of the cathode constitute part of a circular or parabolic cylinder. The electronic rays are concentrated into a focal line which is located at right angles to their direction of travel in the apex of the roof-like anode funnel extending in longitudinal direction of the cathode cylinder. The focal line appears upon a film moved past the tube in the form of a strip of light. The width of this strip is varied by acting upon the electron ray pencil by means of an electromagnetic field oscillating at the rate of the audio frequency to be recorded.

In order to regulate the intensity of the produced observable effect upon the screen 6 any suitable means may be used. This may be grid control as shown by Nicolson Patent #1,470,696, or the control may be by variation of the rate of traversal of the fluorescent screen by the cathode ray pencil, as suggested, for example, by Rosing Patent #1,161,734, or by varying the cross section area of the electron stream, as suggested, for example, by Rosing British Patent 25,270 of 1907.

Having now described my invention, what I claim and desire to secure by Letters Patent is the following:

1. A cathode ray tube comprising a cathode member for producing an electron pencil, a cone-shaped anode having its apex through which the produced electron pencil is adapted to pass arranged substantially adjacent the cathode, a fluorescent screen upon which the electron pencil is adapted to impinge to produce luminous effects, and a magnetic coil positioned adjacent the base of the cone-shaped anode for producing under the influence of current flowing there-through a magnetic field to cause a convergence upon the screen of the diverging electron stream issuing from the anode.

2. A cathode ray tube comprising a cone-shaped anode member, a curved cathode member having its focus substantially at the apex of the cone-shaped anode member so that electrons issuing from the cathode are adapted to pass through the apex of the said anode, a fluorescent screen adapted to emit light upon bombardment thereof by the cathode ray pencil issuing from the cathode member and projected beyond the anode, and a magnetic means adjacent the base of the cone-shaped anode for concentrating the electron stream passing through the anode to a sharply defined point upon the fluorescent screen.

3. A cathode ray device comprising a parabolic cathode member for emitting electrons, a hollow cone-shaped anode member having its apex at the focus point of the parabolic cathode so that substantially all electrons emitted from the cathode pass through the apex of the anode and issue

through the base portion thereof along a predetermined path, a fluorescent screen in the path of the electron stream passing beyond the base portion of the anode adapted to become luminescent upon bombardment thereof by the issuing electron stream, a shielding means adjacent the cone-shaped anode for screening electrons failing to pass through the apex of the anode from the portion of the tube between the anode base and the fluorescent screen, and a means for concentrating the electron stream to a sharply defined point upon the screen.

4. A cathode ray device comprising a parabolic cathode member for emitting electrons, a cone-shaped anode member having its apex at the focus point of the parabolic cathode so that substantially all electrons emitted from the cathode pass through the apex of the anode and issue through the base portion thereof along a predetermined path, a fluorescent screen in the path of the electron stream projected from the base portion of the anode adapted to become luminescent upon bombardment thereof by the issuing electron stream, and a magnetic means for concentrating the electron stream to a sharply defined point upon the screen.

5. A cathode ray device comprising a parabolic cathode member for emitting electrons, a cone-shaped anode member having its apex at the focus point of the parabolic cathode so that substantially all electrons emitted from the cathode pass through the apex of the anode and are projected through the base portion thereof along a predetermined path, a fluorescent screen in the path of the electron stream projected from the base portion of the anode adapted to become luminescent upon bombardment thereof by the electron stream, and shielding means adjacent the cone-shaped anode for cutting off all electron rays which fail to pass through the anode apex from the portion of the tube between the anode and the fluorescent screen.

6. A cathode ray device comprising a parabolic cathode adapted to emit a pencil cathode rays, radiation protection means substantially surrounding the cathode member for causing radiation along a predetermined path, a cone-shaped anode having its apex located substantially at the focus point of the electron stream issuing from the parabolic cathode, a fluorescent screen adapted to emit luminous rays upon bombardment thereof by the issuing cathode rays, and a magnetic ray concentrating means interposed between the anode and the screen for concentrating the diverging electron stream issuing through the base of the cone-shaped anode to a sharply defined spot upon the fluorescent screen.

ERNST LÜBCKE.

DISCLAIMER

1,979,392.—*Ernst Lübcke*, Berlin-Siemensstadt, Germany. CATHODE RAY TUBE. Patent dated November 6, 1934. Disclaimer filed June 16, 1936, by the patentee, the assignee, *Siemens & Halske, Aktiengesellschaft*, assenting.

Hereby enters disclaimer to that portion of claim 1 in the specification which is in the following words; to wit:

"a magnetic coil positioned adjacent the base of the cone shaped anode"

except where the words are interpreted to read:

"a magnetic coil contained within the tube envelope and positioned adjacent the base of the cone shaped anode."

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