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CATHODE-RAY TUBE CONTROL CIRCUITRY

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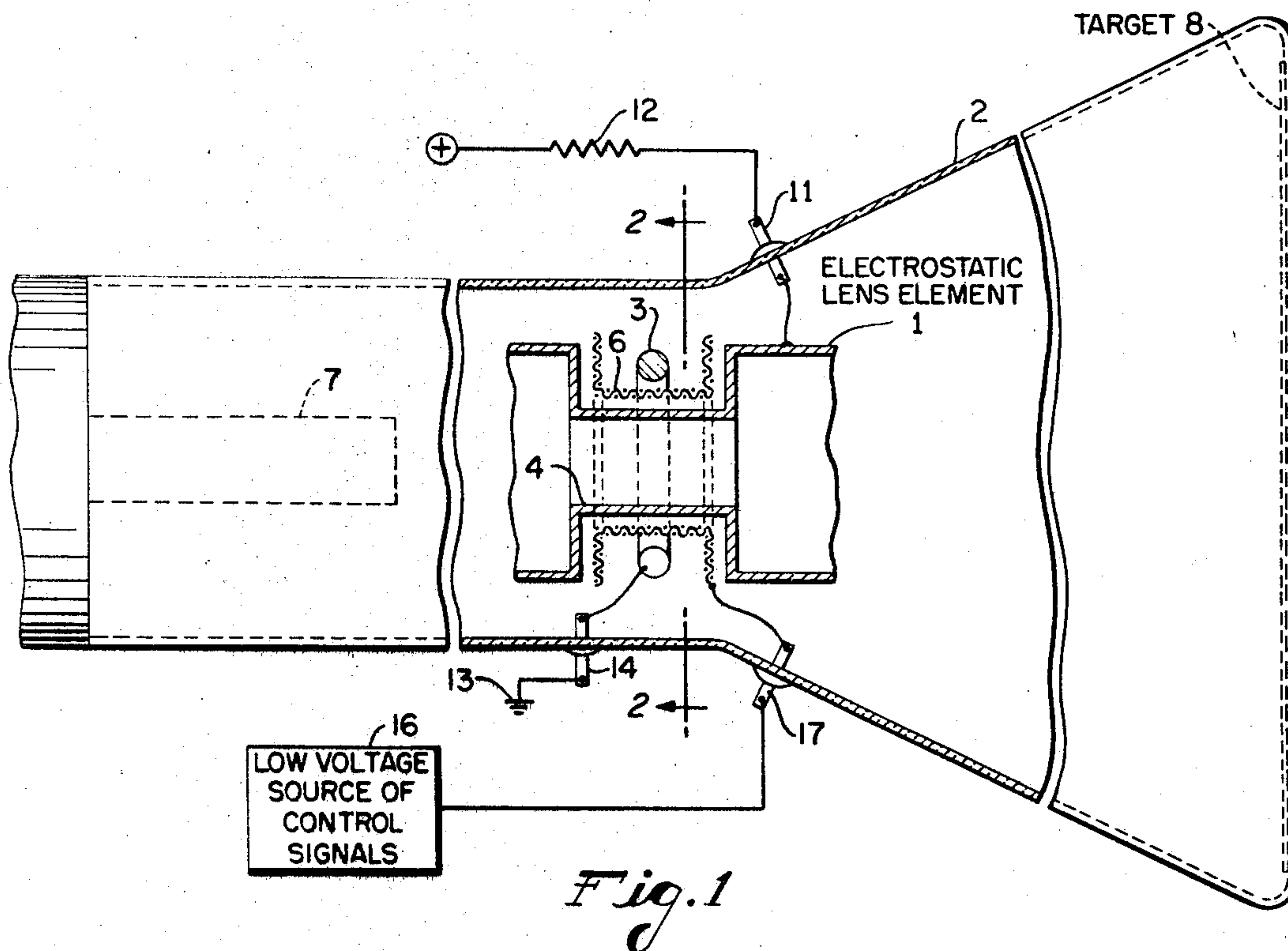


Fig. 1

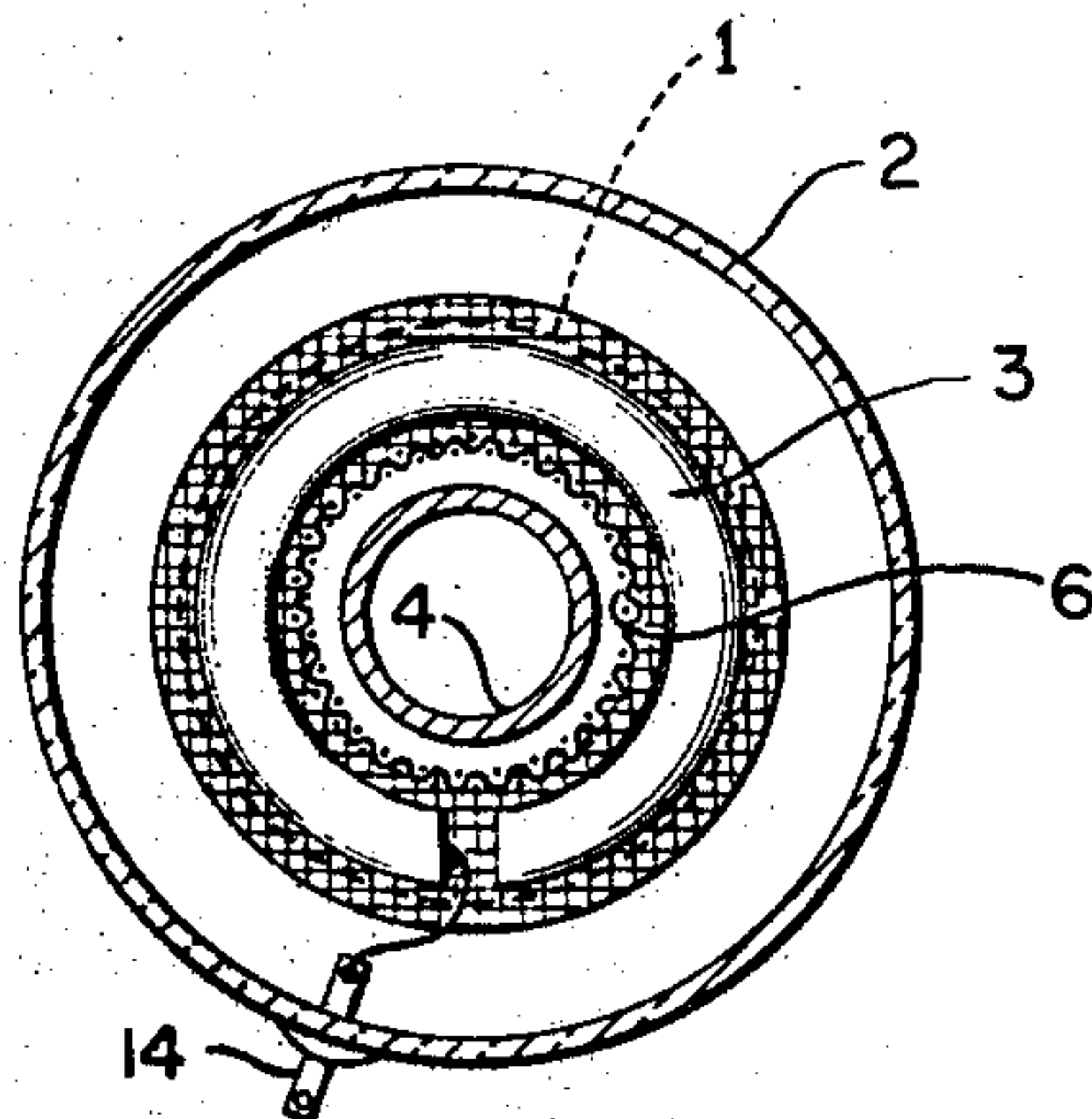


Fig. 2

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CATHODE-RAY TUBE CONTROL CIRCUITRY
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15 Claims

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ABSTRACT OF THE DISCLOSURE

A cathode-ray tube including, in addition to the electron gun, a triode amplifier electrode structure enclosed within the evacuated envelope, the plate of the triode amplifier being a generally cylindrical metal electrode which serves also as an element of an electrostatic lens for focusing the main beam of the cathode-ray tube, so that small signals applied to the grid of the triode amplifier cause large voltage swings of the electrostatic lens electrode.

The present invention relates to cathode-ray tube control circuitry and, more particularly, to control circuitry for applying various voltage levels to control elements within the tube.

In cathode-ray tubes, such as shaped-beam tubes, it is often necessary to apply control signals having high voltage swings to elements, such as electrostatic lenses positioned within the tube. One method of applying these high high voltage control signals is to provide a high voltage switching circuit external to the cathode-ray tube, which circuit is connected to one or more associated beam control elements by means of high voltage leads. Since the voltage levels on these leads rapidly swing through large ranges, the charge distribution on the outside of the tube envelope may be affected which could have adverse effects on the beam within the cathode-ray tube. In addition, these high voltage swings may feed back unwanted signals into various portions of the control circuitry. Also, the aforesaid high voltage switching circuit would generally have a high output impedance which would permit stray capacitances to have a greater effect on the beam control signals as far as frequency distortion is concerned. If the external high voltage switching tube could be eliminated, the control circuitry would take up less space.

Accordingly, it is the principal object of the present invention to provide a novel device for impressing high voltage control signals upon electron beam control elements within a cathode-ray tube without providing high voltage switching circuitry external to the tube.

This and other objects and advantages of the present invention will become more apparent from the following detailed description, taken together with the accompanying drawing, in which:

FIG. 1 discloses a preferred embodiment of the present invention; and

FIG. 2 discloses a sectional view of a portion of FIG. 1.

In accordance with the present invention, an electrostatic lens or other electron beam control element situated within a cathode-ray tube is connected to a first point of high voltage reference potential through a resistor. A cathode is positioned within the tube in proximity to the electron beam control element, and is connected to a second point of reference potential considerably less positive than the aforesaid first point of reference potential. A space discharge control mesh is positioned between the cathode and the control element and is connected to a source of low voltage control signals, and, thus, the quantity of electrons emitted by the cathode and collected by the control element is a function of these low voltage control signals. These current changes cause large voltage swings to be manifested upon the control element owing

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to the "IR" drop across the aforementioned resistor, and as a result high voltage switching circuitry external to the cathode-ray tube is eliminated.

In FIG. 1, a portion of an electrostatic lens element 1 is shown situated within a cathode-ray tube 2, which is, of course, evacuated. A ring-shaped cold cathode 3 surrounds a neck portion 4 of the cylindrical lens element 1. A cylindrical control mesh 6 is interposed between ring cathode 3 and neck portion 4 of lens element 1. Support structure for the foregoing elements has been omitted for the purpose of clarity. The aforesaid structure is suspended within the tube between electron gun 7 and a target 8. The electron beam produced by gun 7 will be affected by various voltage levels applied to lens element 1 in a manner which has nothing to do with the present invention and in a manner well known to those skilled in the art. Electrostatic lens element 1 is connected to a first point of reference potential 9 through terminal 11 and resistor 12 which has a high impedance. Ring cathode 3 is connected to a second point of reference potential 13 via terminal 14. It should be understood that the second point of reference potential 13 may be ground or the cathode potential. In any case, this second point of reference potential should preferably be considerably less positive than the first point of reference potential 9. Control element or mesh 6 is, in like manner, connected to a low voltage source of control signals 16 via terminal 17.

It may now be seen that small variations in the control voltage applied by source 16 to control mesh 6 will change the current collected by lens element 1. These changes in collected current cause large swings in the voltage levels manifested upon lens element 1 owing to the "IR" drop across high impedance resistor 12. It should therefore be apparent that by virtue of the present invention, the aforesaid high voltage switching circuit which is external to the tube has been eliminated to yield the advantages set forth hereinabove. Also, the space occupied by the prior art high voltage switching tube is saved.

Although it is preferable that ring cathode 3 be a cold cathode, it is conceivable that a thermionic cathode may also be utilized.

While there has been shown and described a specific embodiment of the invention, other modifications will readily occur to those skilled in the art. It is not, therefore, desired that this invention be limited to the specific arrangement shown and described, and it is intended in the appended claims to cover all modifications within the spirit and scope of the invention.

What is claimed is:

1. In a cathode-ray tube having an evacuated envelope, an electron gun including a first cathode, a target, a first control element positioned within said envelope between said electron gun and said target for controlling the beam generated by said gun, which first control element is to be varied between a first voltage level and a second voltage level; a second cathode positioned within said envelope adjacent said first control element, a second control element positioned between said cathode and said first control element, a power supply having a first and second voltage terminal, an impedance element, means for coupling said first control element to the first terminal of said power supply through said impedance element, means for coupling said cathode to the second terminal of said power supply, a source of control signals, and means for coupling said source of control signals to said second control element to control voltage level swings on said first control element.

2. The combination as set forth in claim 1 wherein said first control element comprises an electrostatic lens.

3. The combination as set forth in claim 1 wherein said cathode is a cold cathode.

4. In a cathode-ray tube having an evacuated envelope,

an electron gun including a first cathode for generating an electron beam, a target, a first control element positioned within said envelope between said electron gun and said target and substantially surrounding said electron beam, which first control element is to be varied between a first voltage level and a second voltage level; a second cathode positioned within said envelope adjacent said first control element, said first control element being positioned between said cathode and said beam, a second control element positioned between said cathode and said first control element, a power supply having a first and second voltage terminal, an impedance element, means for coupling said first control element to the first terminal of said power supply through said impedance element, means for coupling said cathode to the second terminal of said power supply, a source of control signals, and means for coupling said source of control signals to said second control element to control voltage level swings on said first control element.

5. The combination as set forth in claim 4 wherein said first control element comprises an electrostatic lens.

6. The combination as set forth in claim 4 wherein said cathode is a cold cathode.

7. In a cathode-ray tube having an evacuated envelope, an electron gun for generating an electron beam, a target, a first control element positioned within said envelope between said electron gun and said target and substantially surrounding said electron beam, which first control element is to be switched between a first voltage level and a second voltage level; a cathode positioned within said envelope substantially surrounding said first control element, a second control element positioned between said cathode and said first control element, a power supply having a first and second voltage terminal, an impedance element, means for coupling said first control element to the first terminal of said power supply through said impedance element, means for coupling said cathode to the second terminal of said power supply, a source of control signals, and means for coupling said source of control signals to said second control element to control voltage level swings on said first control element.

8. The combination as set forth in claim 7 wherein said first control element comprises an electrostatic lens.

9. The combination as set forth in claim 7 wherein said cathode is a cold cathode.

10. In a cathode-ray tube having an evacuated envelope, an electron gun, a target, a first control element positioned within said envelope between said electron gun and said target for controlling the beam generated by said gun, which first control element is to be varied between a first

voltage level and a second voltage level; a cathode positioned within said envelope adjacent said first control element, said first control element being positioned between said cathode and said beam, a second control element positioned between said cathode and said first control element, a power supply having a first and second voltage terminal, an impedance element, means for coupling said first control element to the first terminal of said power supply through said impedance element, means for coupling said cathode to the second terminal of said power supply, a source of control signals, and means for coupling said source of control signals to said second control element.

11. The combination as set forth in claim 10 wherein said first control element comprises an electrostatic lens.

12. The combination as set forth in claim 10 wherein said cathode is a cold cathode.

13. In a cathode-ray tube having an evacuated envelope, an electron gun for generating an electron beam, a target, a first control element positioned within said envelope between said electron gun and said target and substantially surrounding said electron beam, which first control element is to be varied between a first voltage level and a second voltage level; a cathode positioned within said envelope adjacent said first control element, a second control element positioned between said cathode and said first control element, a power supply having a first and second voltage terminal, an impedance element, means for coupling said first control element to the first terminal of said power supply through said impedance element, means for coupling said cathode to the second terminal of said power supply, a source of control signals, and means for coupling said source of control signals to said second control element to control voltage level swings on said first control element.

14. The combination as set forth in claim 13 wherein said first control element comprises an electrostatic lens.

15. The combination as set forth in claim 13 wherein said cathode is a cold cathode.

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