

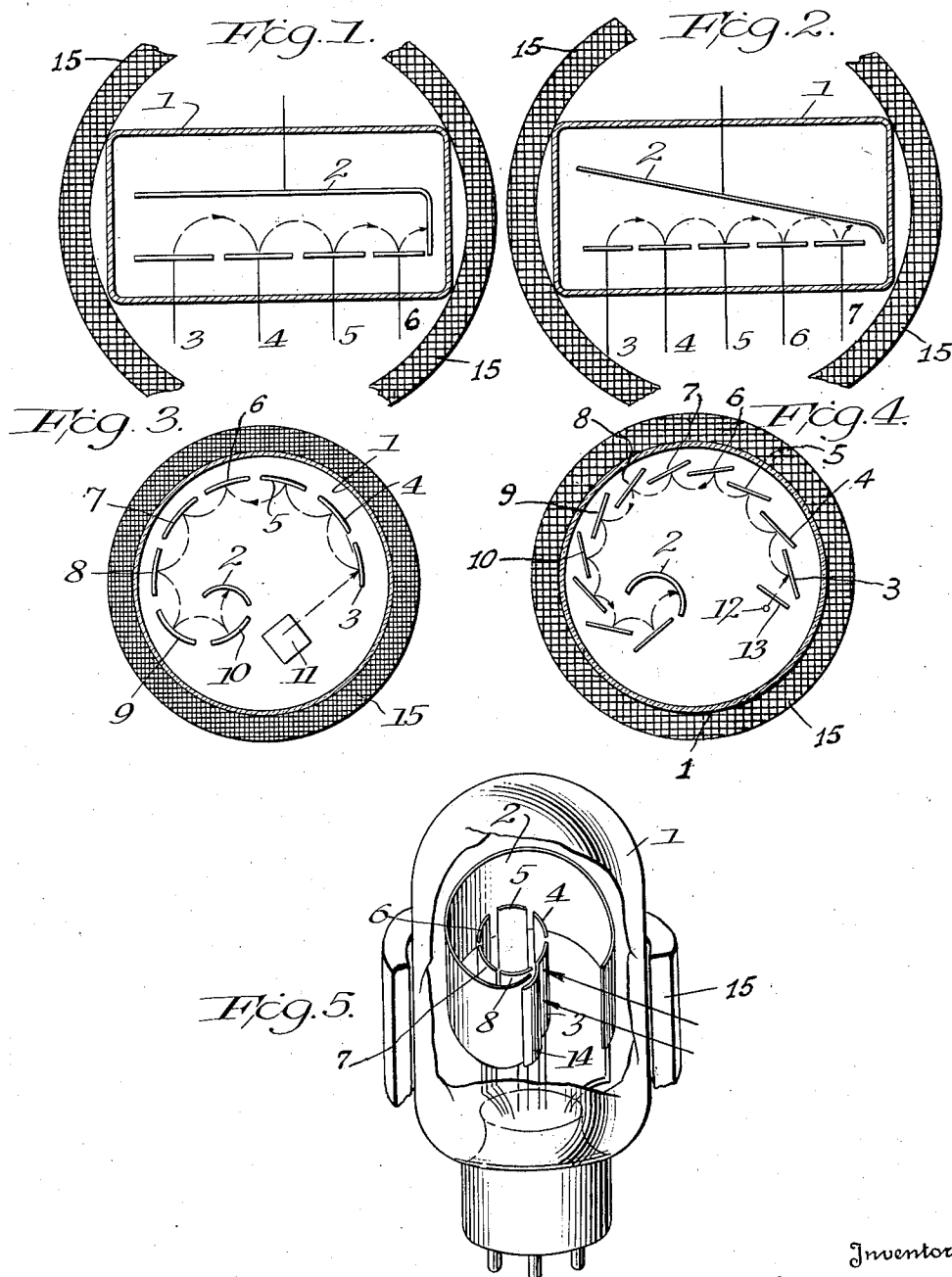
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HANS-WOLFGANG LANGENWALTER ET AL

SECONDARY EMITTING TUBE

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Inventor

Hans-Wolfgang Langenwaller  
Ernst Rucka

By Lippincott + Metcalf Attorney

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## SECONDARY EMITTING TUBE

Hans-Wolfgang Langenwalter, Klein-Machnow,  
and Ernst Ruska, Berlin-Zehlendorf, Germany,  
assignors to the firm of Fernseh Aktiengesell-  
schaft, Zehlendorf, near Berlin, Germany

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6 Claims. (Cl. 250-175)

This invention relates to tubes which serve the multiplication of electrons by secondary emission.

It is known in the art that an electron beam can be guided in a vacuum tube from one emitting electrode to the next by means of an electrostatic and a magnetic field. Accelerating electrodes are disposed opposite the emitting electrodes in order to draw the secondary electrons away from the surface of the emitting electrodes. Under the effect of the magnetic field, the lines of force of which run parallel to the surfaces of the emitting electrodes, the electrons do not impact the accelerating electrode, but are guided to the neighboring emitting electrode where they emit new secondaries when impacting.

The accelerating electrodes as well as the emitting electrodes are held at potentials which are increased in steps. In order to reduce the number of leads, it has been suggested to connect each accelerating electrode with one emitting electrode. In order to achieve a further simplification of the construction and to use only one accelerating electrode, this invention provides one common accelerating electrode disposed opposite several emitting electrodes. It is preferable to decrease the distance between the accelerating electrode and the emitting electrodes with increasing positive potential of the emitting electrodes.

An especially compact construction is obtained if the emitting electrodes are arranged in a spiral, in the center of which the accelerating electrode is placed. A similar compactness of the construction is obtained if the accelerating electrode is formed as a spiral, in the center of which the emitting electrodes are placed forming a cylinder. The drawing shows several embodiments of the invention.

Figures 1 and 2 each show a side view of a tube. Figures 3 and 4 show a cross-section of a tube with electrodes arranged in a spiral.

Figure 5 is a perspective view of a tube.

The tube 1 of Figures 1 and 2 contains a number of emitting electrodes 3 to 7 which are placed next to each other in a straight line with increasing potentials. The accelerating electrode 2 is placed opposite thereto with a potential higher than that of the last emitting electrode. This accelerating electrode is at the same time the collector. A magnetic field, the direction of which is vertical to the plane of the drawing, forces the electrons which start from the emitting electrodes to travel along the paths indicated by the dotted lines. The magnetic field may be generated by a permanent magnet or a coil.

Figure 3 shows a tube in which the electrodes 3 to 10 are arranged along a spiral. The accelerating electrode 2 is placed in the center of the spiral. It has the shape of a cylinder, open at the side, and is kept at the highest potential in the system. The magnetic field is preferably generated by a coil 15 which surrounds the tube. The intensity of the field may be adjusted to the desired value by variation of the direct current in the coil. The direction of the magnetic field is parallel to the axis of the spiral and is also parallel to the surfaces of the emitting electrodes, which are preferably elongated in this direction. Primary electrons are liberated from the first emitting electrode 3, for instance, by photoaction. A mirror 11 in the interior of the tube deflects the incident light upon the emitting electrode 3.

The emitting electrodes which are arranged in a spiral may also be plane and mutually overlapping so that they form a closed body, as shown in Figure 4. In this case the tube has a thermionic cathode. The cathode is a filament or ribbon 12 parallel to the axis of the spiral. It is preferable to provide a control element, for instance, an aperture in the form of a slit 13 between the cathode and the first electrode 3.

According to Figure 5, the emitting electrodes 3 to 8 form the outside of a cylinder which is surrounded by a spiral-shaped accelerating electrode 2. The part 14 of the first emitting electrode overlaps the part of the accelerating electrode 2 which is nearest to the interior of the tube for the reason that the accelerating field for the first emitting electrodes may not be disturbed by the neighboring part of the accelerating electrode. The tube may be, for instance, used as a photoamplifier. A slit which is parallel to the axis of the spiral is illuminated by a variable light source. This slit is projected upon the first emitting electrode. The tube lies in the interior of a coil, which is not shown, which creates a deflecting magnetic field parallel to the axis of the spiral.

We claim:

1. An electron multiplier comprising an evacuated envelope having therein a plurality of secondary electron-emissive cathode surfaces forming a cylinder, an accelerating electrode spirally mounted about said cathode surfaces, said cathode surfaces being adapted to be positively energized and said accelerating electrode being adapted to be positively energized relative to all of said cathode surfaces, means for initiating the flow of electrons at the one of said cathode surfaces

farthest from said accelerating electrode, shielding means adjacent said one cathode surface and the nearest portion of said accelerating electrode, and means for setting up a magnetic field parallel to the axis of said spiral.

5 2. An electron multiplier device comprising a plurality of secondary electron-emissive surface areas adapted to be energized at increasingly higher positive potentials, and a uni-potential  
10 accelerating electrode having two portions, one portion being common to said secondary electron emissive areas and spaced a different distance from each of said surface areas and the second  
15 portion being positioned in proximity to the emissive surface of highest positive potential and constituting a collector of the electrons emitted by said emissive surface of highest positive potential.

3. An electron multiplier device comprising a  
20 plurality of secondary electron-emissive surface areas adapted to be energized at increasingly higher positive potentials, and a uni-potential accelerating electrode having two portions, one  
25 portion being common to said secondary electron emissive areas and disposed closer to that surface area of highest positive potential than to the others of said surface areas and the second portion constituting a collector of the electrons emitted by said emissive surface of the highest  
30 positive potential.

4. An electron multiplier device comprising a plurality of secondary electron-emissive surface areas adapted to be positively charged at increas-

ingly higher positive potentials, and an accelerating electrode having two portions, one portion being common to said surface areas and spaced therefrom by distances which decrease in accordance with such positive potentials on said areas  
5 and the second portion constituting a collector of the electrons emitted by said emissive surface of highest potential.

5. An electron multiplier device comprising a  
10 plurality of secondary electron-emissive surface areas adapted to be positively charged at increasingly higher positive potentials, a uni-potential accelerating electrode having two portions, one  
15 portion being common to said surface areas, and spaced therefrom by distances which decrease in accordance with the increasing positive potentials of said areas and the second portion constituting a collector of the electrons emitted by said  
emissive surface of highest potential.

6. An electron multiplier device comprising a  
20 plurality of successive secondary electron-emissive surface areas adapted to be positively charged at increasingly higher positive potentials, a uni-potential accelerating electrode having two portions, one portion being common to  
25 said surface areas and spaced therefrom by distances which vary from surface area to surface area in succession and the second portion constituting a collector of the electrons emitted by  
30 said emissive surface of highest potential.

HANS-WOLFGANG LANGENWALTER,  
ERNST RUSKA.