

Sept. 29, 1942.

H. GOBRECHT

2,297,404

GRID CONTROLLED AMPLIFYING TUBE

Filed Oct. 30, 1939

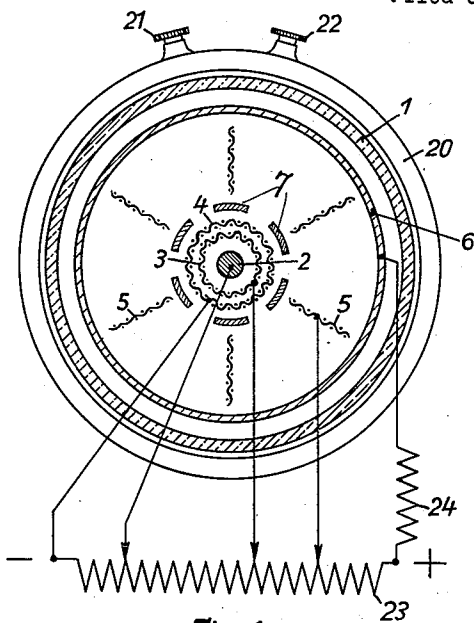


Fig. 1

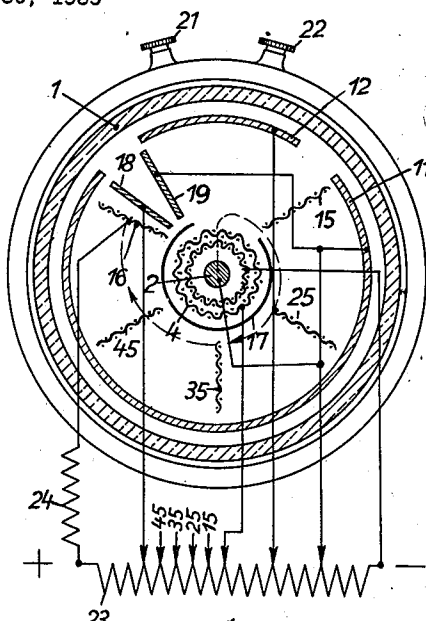


Fig. 2

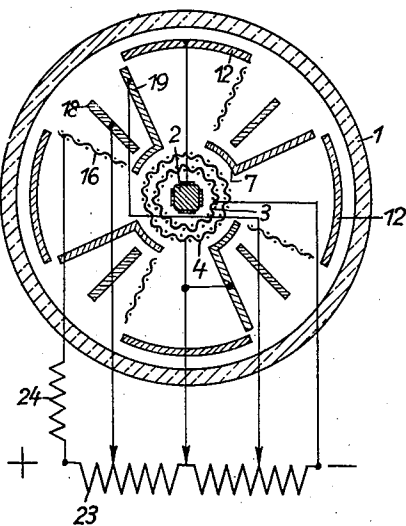


Fig. 3

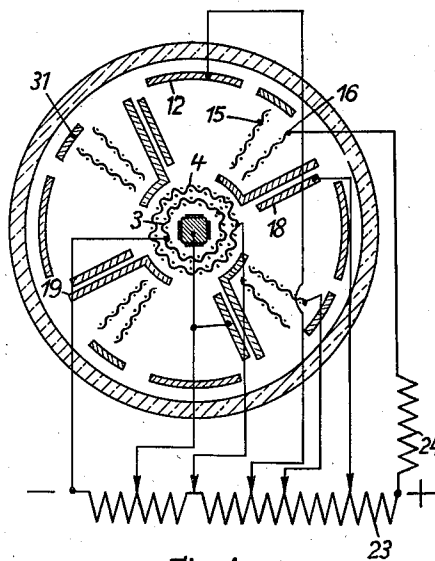


Fig. 4



Fig. 5

Inventor

Heinrich Gobrecht.

# UNITED STATES PATENT OFFICE

2,297,404

## GRID CONTROLLED AMPLIFYING TUBE

Heinrich Gobrecht, Berlin, Germany; vested in the Alien Property Custodian

Application October 30, 1939, Serial No. 302,019  
In Germany November 4, 1938

7 Claims. (Cl. 250-174)

It is known to provide grid-controlled amplifying tubes with secondarily emissive nets arranged concentrically with cathode and anode in order to obtain electron multiplication. This effect, however, diminishes slowly when a hot cathode is used, because atomic particles (probably of barium) damage the sensitive coating of the nets.

The object of the present invention is a construction of such tubes by which the above drawback is avoided. The secondarily emissive nets are mounted radially and are protected against said atomic particles by special screening plates whilst the electrons emitted by the cathode are so deflected by magnetic, electric or combined fields that are driven to the nets on curved paths.

In the drawing, Figs. 1 to 4 show cross-sections of tubes of the described kind, Fig. 1 illustrating the simplest arrangement, Figs. 2 to 4 some more complicated systems, whilst Fig. 5 is a cross-section of a cathode suitable for the tubes according to Figs. 3 and 4.

In Fig. 1, 1 is the glass bulb of the tube, 2 the thermionic cathode, 3 the control grid, 4 an accelerating grid which may be present or not, 6 the anode, all in concentric arrangement. Elements 5 are the radially arranged, secondarily-emissive nets each of which is protected against the atomic particles, by a screening plate 7. The latter may consist of an insulating material or, preferably, of a metal sheet having about cathode potential. A potentiometer 23 fed by the anode potential source serves for supplying grid 3, cathode 2, grid 4, nets 5 and anode with increasing potentials. A longitudinal magnetic field, generated by a coil 20, the terminals 21-22 of which are connected to a source of continuous current, deflects the electrons passing through the openings between the plates 7 so that they reach the anode by curved paths and penetrate or hit the nets 5 thereby being multiplied. The anode is coupled to the output by means of a high resistance 24.

The tube according to Fig. 2 is also surrounded by a magnetic coil 20. Only one screening plate 17 is provided which surrounds the grids and has only one slit 8 for passing the primary electrons. The magnet field deflects the electrons so as to describe the arrowed spiral and to pass the radially arranged secondarily emissive nets 15, 25, 35 and 45, thus being several times multiplied. Finally the electrons reach the secondarily emissive plate 18 and are rejected to anode 16. By means of potentiometer 23 the

nets are connected to increasing potentials. In order to support electrostatically the magnetic deflection the electrodes 11, 12 and 19 are provided, 11 and 19 having cathode potential or a more negative one, 12 having a weak positive potential.

According to Fig. 3 the electrons pass the openings 28 in 4 bundles. The electrodes 17 and 19 of Fig. 2 are here united to angular shields 19 having about cathode potential. By the electrostatic field formed between the electrodes 19, 12 and 16 having potentials like the correspondent electrodes of Fig. 2 the electrons are governed through nets 16 upon plates 18 and are finally absorbed by the anode 16.

According to Fig. 4 the electrons, before arriving at the nets 16, pass activated nets 15. In order to hold together the electrons preferably additional electrodes 31 are provided. The potentials may be

Electrodes.....	2	31	12	15	18	16
Volts.....	0	0	50	100	200	250

For the sake of simplicity, in Fig. 4 the circuits are shown only for one of the four multiplying systems. It should be noted that all corresponding electrodes of the four systems are connected in parallel.

In all described arrangements the indirectly heated cathode 2 is preferably covered with an emissive layer not on its whole circumference but only where emission is necessary. In the four-sided arrangements of Figs. 3 and 4 the cathode 2 has preferably a square cross section (Fig. 5) and is covered with oxide 36 on the middle of the side surfaces only. The cathode of Fig. 2 is covered with oxide only opposite to the opening 8.

I claim:

1. A grid-controlled amplifying tube comprising a thermionic cathode, a cylindrical grid surrounding said cathode, a plurality of planar secondarily emissive nets mounted radially outside of said grid, an anode, and means for screening said nets against volatilized particles emitted by said cathode.

2. A grid-controlled amplifying tube comprising a thermionic cathode, a cylindrical grid surrounding said cathode, a plurality of planar secondarily emissive nets mounted radially outside of said grid, an anode, means consisting in shield plates provided on the cathode side of each of said nets for screening said nets against volatilized particles emitted by said cathode, and means for driving the electrons emitted by said

cathode on curved paths through said nets towards said anode.

3. A grid-controlled amplifying tube comprising a thermionic cathode, a cylindrical grid surrounding said cathode, a plurality of secondarily emissive nets mounted radially outside of said grid, a shield surrounding said grid and having an axial slit, for screening said nets against volatilized particles emitted by said cathode, and an anode mounted radially outside of said shield, and means for generating an axial magnetic field to drive the electrons leaving said slit on curved paths through said nets towards said anode.

4. A grid-controlled amplifying tube comprising a thermionic cathode, a grid surrounding said cathode, a plurality of secondarily emissive nets mounted radially outside of said grid, a shield surrounding said grid and having an axial slit for screening said nets against volatilized particles emitted by said cathode, a net-shaped anode mounted radially outside of said shield, and a secondarily emissive plate mounted radially and, in circular succession, behind said anode, and means for generating an axial magnetic field to drive the electrons leaving said slit on curved paths through said nets towards said plate.

5. A grid-controlled amplifying tube comprising a thermionic cathode, a cylindrical grid surrounding said cathode, a plurality of net-shaped anodes mounted radially outside of said grid, a plurality of secondarily emissive plates, each of said plates being mounted radially and, in circular succession, behind one of said anodes, electrostatic means for generating an electric field to drive the electrons emitted by said cathode on curved paths through said anodes towards said plates, said means comprising a plurality of screen plates, each of said screen plates being mounted radially and behind one of said secondarily emissive plates and bent at its cathode side to form a shield for screening one of said nets against volatilized particles emitted by said cathode.

6. A grid-controlled amplifying tube comprising a thermionic cathode, a cylindrical grid surrounding said cathode, a plurality of net-shaped anodes mounted radially outside of said grid, a plurality of secondarily emissive plates, each of said plates being mounted radially and, in circular succession, behind one of said anodes, a plurality of secondarily emissive nets, each of said secondarily emissive nets being mounted radially and in front of one of said anodes, electrostatic means for generating an electric field to drive the electrons emitted by said cathode on curved paths through said nets towards said plates, said means comprising a plurality of screen plates, each of said screen plates being mounted radially and behind one of said secondarily emissive plates and bent at its cathode side to form a shield for screening one of said nets against volatilized particles emitted by said cathode.

7. A grid-controlled amplifying tube comprising a thermionic cathode, a cylindrical grid surrounding said cathode, a plurality of net-shaped anodes mounted radially outside of said grid, a plurality of secondarily emissive plates, each of said plates being mounted radially and, in circular succession, behind one of said anodes, a plurality of secondarily emissive nets, each of said secondarily emissive nets being mounted radially and in front of one of said anodes, electrostatic means for generating an electric field to drive the electrons emitted by said cathode on curved paths through said nets towards said plates, said means comprising a plurality of screen plates, each of said screen plates being mounted radially and behind one of said secondarily emissive plates and bent at its cathode side to form a shield for screening one of said nets against volatilized particles emitted by said cathode, said cathode being covered with an emissive layer only at the parts of its surface lying opposite to the interstices between said shields.

HEINRICH GOBRECHT.