Oct. 16, 1934. B. S. GOSSLING ET AL 1,976,778

ELECTRIC DISCHARGE TUBE OSCILLATION GENERATOR

Filed Oct. 3, 1933

Fig. 1.

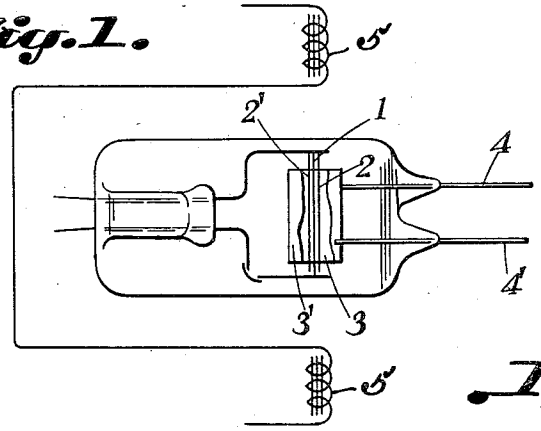
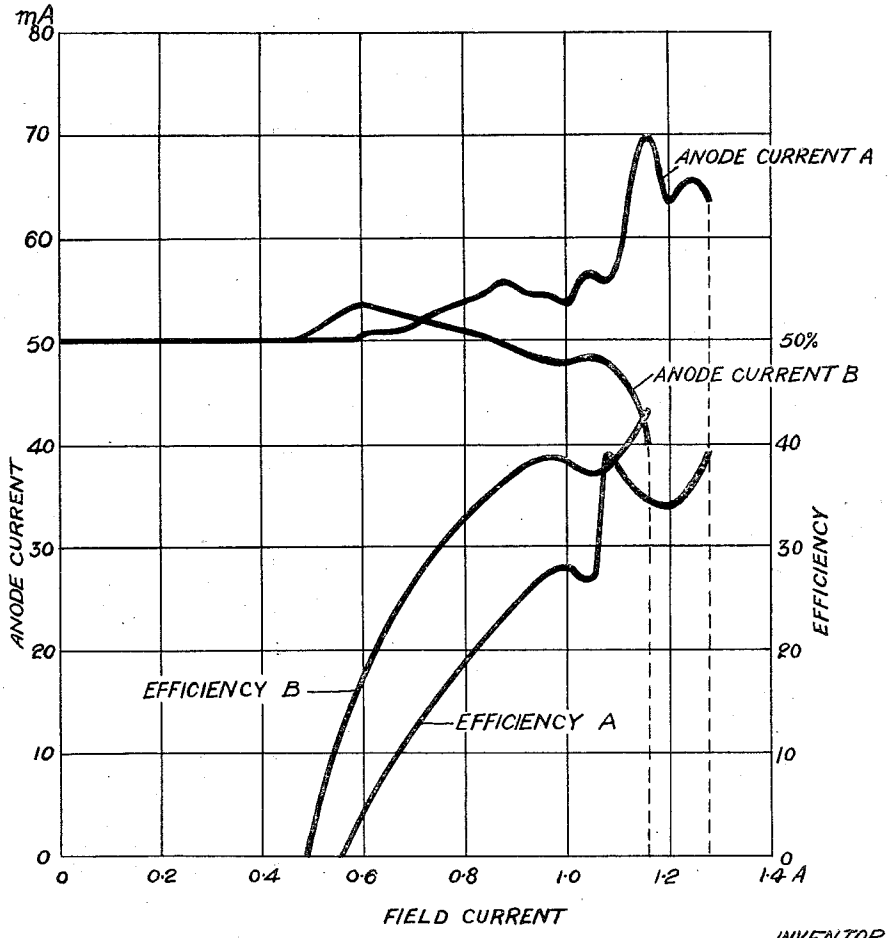


Fig. 2.



INVENTOR
Brian S. Gossling
and Eric C. S. Megaw
BY N. H. Lockwood
ATTORNEY

Patented Oct. 16, 1934 1,976,778

UNITED STATES PATENT OFFICE

1,976,778

ELECTRIC DISCHARGE TUBE OSCILLATION GENERATOR

Brian Stephen Gossling and Eric Christopher Stanley Megaw, London, England, assignors to The M-O Valve Company Limited, London, England

Application October 3, 1933, Serial No. 691,925
In Great Britain October 11, 1932

2 Claims. (Cl. 250—27.5)

This invention relates to electric discharge devices, for generating oscillations, of the type known as split-anode magnetrons. These devices are particularly suitable for generating oscillations of very high frequency.

The split-anode magnetron consists essentially of a thermionic cathode lying approximately along the axis of a cylindrical anode divided into two or more parts by axial planes or of an arrangement of conductors electrically equivalent to a divided cylinder, these electrodes lying in an approximately axial magnetic field. It differs from triodes, which are used for much the same purpose, in the absence of any grid-like electrode, intervening between the anode and cathode in such a way as to modify the electric field but not to hinder substantially the flow of electrons. It will be clear to those skilled in the art that the anode which may consist of an arrangement of conductors equivalent to a divided cylinder may be employed as the anode of the magnetron; and the phrase "a cylindrical anode divided into at least two parts" when used hereinafter, is to be understood as including equivalent arrangements of conductors as aforesaid.

We have discovered that, though a control grid is not essential to the operation of a split anode magnetron, the presence of a grid-like electrode maintained at a suitable potential may improve its operation. It enables both the static and the dynamic characteristics of the device to be modified at will within certain limits and it produces other beneficial results which might not have been anticipated. Thus it has been found that, in the absence of the grid, the performance curves relating output and anode current to magnetic field strength show peaks at certain values of the magnetic field strength the exact position of which varies erratically from one magnetron to another; in the presence of the grid these peaks can be eliminated or greatly reduced.

According to the invention, a split-anode magnetron is provided with a grid-like electrode, intervening between the cathode and anode, which may be connected either to an exterior lead separate from the anode and cathode leads or to one of the cathode leads inside the magnetron.

The form of grid that has hitherto appeared the most suitable consists of one or several pairs of wires parallel to the cathode and disposed symmetrically with respect to it. But other constructions familiar in triodes, such as spirals and mesh-cylinders, are occasionally desirable. In some circumstances it may be desirable to divide the grid electrically into several parts each connected to a separate exterior lead.

One form of construction according to the invention is shown, by way of example, in Figure 1 of the accompanying drawing. Here 1 is a straight filamentary cathode lying along the axes of the two semi-cylindrical portions of the anode 3, 3', the plane of division of the two portions in the drawing being parallel to the plane of the paper. Part of the portion 3 is cut away to show the grid wires 2, 2'. The two portions of the anode are connected to separate leads 4, 4'. The grid consists of two wires 2, 2' parallel to the cathode and attached at one end to one of its supports; the grid is thus at the potential of one end of the cathode. A magnetic field is produced in the space between the cathode and the two halves of the anode by means of the electromagnets 5 and 5' having their axes collinear with the axis of the cathode and supplied with direct current from a source not shown.

The advantage accruing from the invention is shown in Figure 2. Here the abscissæ are currents in the field magnets and are thus roughly proportional to the magnetic field between cathode and anode. The curves marked "anode current" have as ordinates the anode currents at a constant anode voltage marked on the left hand scale; the curves marked "efficiency" have as ordinates the efficiency of the magnetron as an oscillator marked on the right hand scale. The curves A refer to the magnetron shown in Figure 1 when the grid is absent, the curves B refer to the same magnetron when the grid there shown is present according to the invention.

It will be seen that the irregular humps in both A curves are greatly reduced when the grid is added in the B curves.

If a variable voltage is applied to the grid its frequency should be small compared with that of the oscillations generated.

We claim:—

1. Apparatus for generating electrical oscillations comprising a split-anode magnetron including means for establishing a magnetic field, a cylindrical anode divided into at least two parts by at least one axial plane and mounted with its axis extending in the direction of said magnetic field, a thermionic cathode lying approximately along said axis, and a grid-like electrode mounted between the cathode and the anode and connected to said cathode.

2. Apparatus for generating electrical oscillations comprising a split-anode magnetron including means for establishing a magnetic field,

a cylindrical anode divided into a plurality of symmetrically arranged parts and mounted with its axis extending in the direction of said magnetic field, a thermionic cathode lying approximately along said axis, a grid-like electrode between the anode and cathode and comprising a plurality of wires parallel to and symmetrically arranged with respect to said cathode, and means connecting said grid-like electrode with said cathode.

BRIAN STEPHEN GOSSLING.
ERIC CHRISTOPHER STANLEY MEGAW.