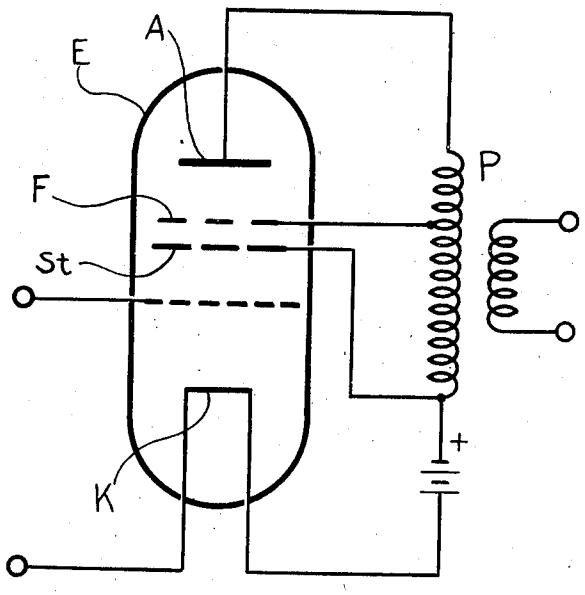
Aug. 20, 1940. R. TAMM 2,212,215

ELECTRON DISCHARGE DEVICE

Filed July 8, 1939



INVENTOR
RUDOLF TAMM
BY Charles McClair
ATTORNEY

Patented Aug. 20, 1940 2,212,215

UNITED STATES PATENT OFFICE

2,212,215

ELECTRON DISCHARGE DEVICE

Rudolf Tamm, Berlin-Siemensstadt, Germany, assignor to "Fides" Gesellschaft für die Verwaltung und Verwertung von gewerblichen Schutzrechten m. b. H., Berlin, Germany

Application July 8, 1939, Serial No. 283,381
In Germany July 14, 1938

5 Claims. (Cl. 250—27)

My invention relates to electron discharge devices, more particularly such devices employing a suppressor electrode to neutralize the effect of secondary electrons which may be generated during operation of such devices.

As is known in screen grid tubes the secondary electrons have a detrimental effect as soon as during the operation of the tube the plate potential drops below the screen grid potential. At this potential distribution the secondary electrons leaving the anode pass to the screen grid thereby causing an undesirable decrease of the plate current.

It is known to eliminate this effect by introducing a retarding grid maintained at cathode potential. Such tubes are designated as pentodes. These pentodes however have the disadvantage that the zero potential of the retarding grid not only retards the secondary electrons but to a certain extent also the primary electrons.

It is the principal object of my invention to provide an electron discharge device employing a suppression grid and a circuit therefor which provides improved characteristics.

In accordance with the present invention the disadvantages noted above are overcome in that the auxiliary grid placed between the screen grid and the anode instead of having cathode or zero potential has an alternating potential applied thereto which is so chosen that the potential of the auxiliary grid is when the anode is in operation, positive relative to the potential of said anode. As a result thereof the auxiliary grid no longer acts as a retarding grid in the pentode but as an absorption grid for the secondary electrons. Owing to the potential increase in the direction from the anode to the auxiliary grid the secondary electrons liberated from the anode are absorbed by the auxiliary grid in order to be passed again into the plate circuit. The auxiliary grid is suitably connected to a tap on the primary winding of the output transformer and it is so designed that the primary electrons coming from the cathode and passing through the openings of the screen grid arrive at the anode instead of at the absorption grid since in the opposite case they would produce detrimental secondary electrons on the absorption grid. This can be accomplished if the rods or wires of the absorption grid are in the shadow of the rods or wires of the screen grid as viewed from the cathode. The formation of the secondary electrons, the geometrical arrangement, the tap on the transformer and the operating potentials can be so matched that a high through control of the plate potential is obtained.

Screen grid tubes having absorption grids between the screen grid and the anode are known as such. In the known arrangement however, the individual rods or windings of the absorption grid were connected individually inside the tube with the anode. As a result of this arrangement the absorption grid was always given the potential of the anode. Aside from the much more complicated assembly of the grid structure the action of the absorption grid had to be obviously lower than in the case of the arrangement according to the present invention since the secondary electrons are not attracted by the absorption grid.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself will best be understood by reference to the following description taken in connection with the accompanying drawing in which the single figure of the drawing is a schematic diagram of an electron discharge device and its associated circuit made according to my invention.

Aside from the control grid St and screen grid S there is placed between the cathode K and the anode A the absorption grid F. The absorption grid is connected to a tap on the primary winding P of the output transformer. With this connection the auxiliary grid F is rendered positive relative to the anode during operation. Therefore, the auxiliary grid does not retard the secondary electrons but on the contrary it attracts them. In the space between the absorption grid F and the anode A there exists a field which is directed upon the absorption grid. The electrodes are housed in envelope E. Since the alternating potential impressed upon the absorption grid is in phase with the alternating plate potential, the desired potential relationship between the anode and the absorption grid exists at all times. Through suitable geometrical dimensioning of the screen grid and absorption grid and through proper choice of the tap at the output transformer the action of the secondary electrons can be reduced to a point at which they practically cause no disturbance. The solid portions such as the rod wires of the absorption grid may be chosen for instance narrower than those of the screen grid and may be so arranged as viewed from the cathode that they come to lie directly in back of the rods of the screen grid. As a result of this measure the primary electrons passing through the openings of the screen grid at a

high velocity do not reach the absorption grid at all or only in small numbers.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

What I claim as new is:

1. An electron discharge device having a cathode, a control grid, screen grid and anode, and positioned between the screen grid and an auxiliary electrode, an input circuit connected to said control grid and an output circuit connected to said anode, and means included in said output circuit for applying to said auxiliary electrode an in phase alternating potential higher than that applied to the anode during operation of the tube.

2. An electron discharge device having a cathode, control grid, screen grid and anode in the order named, and an auxiliary electrode positioned between the screen grid and anode, an input circuit connected to said control grid and an output circuit connected to said anode, means for biasing said auxiliary electrode positively with respect to said cathode, and other means included in said output circuit for applying an in phase alternating potential to the auxiliary electrode positive with respect to the alternating voltage on said anode during operation of said electron discharge device.

3. An electron discharge device having a cathode, signal grid, screen grid and anode, and an auxiliary electrode positioned between the screen grid and anode, the solid portions of said auxiliary grid being aligned with the solid portions of said screen grid, an input circuit connected to said signal grid and an output circuit connected to said anode, and means included in said output circuit for applying to said auxiliary grid an in phase alternating potential positive with respect to the alternating potential on said anode during operation of said tube.

4. An electron discharge device having a cathode, a signal grid and screen grid, an anode and an auxiliary grid positioned between said screen grid and said anode, the apertures in said screen grid being aligned with the apertures in said auxiliary grid, an input circuit connected to said signal grid, an output transformer having a primary winding connected between the cathode and the anode, and a connection between said auxiliary grid and an intermediate point on the primary winding of said output transformer.

5. An electron discharge device having a cathode and an anode and a signal grid, screen grid and auxiliary grid positioned between said screen grid and anode, the apertures in said screen grid being aligned with the apertures in the auxiliary grid whereby primary electrons from said cathode will be focused through the apertures of said auxiliary grid, an input circuit connected to said signal grid means for maintaining said screen grid, auxiliary grid and anode at a positive potential with respect to said cathode, an output transformer having a primary and a secondary, said primary being connected between the anode and the means for biasing said screen and auxiliary grids positively with respect to the cathode, and a connection between the auxiliary grid and an intermediate point on said output transformer.

RUDOLF TAMM.

CERTIFICATE OF CORRECTION.

Patent No. 2,212,215. August 20, 1940.

RUDOLF TAMM.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 17, claim 1, for the words "and an" read --and anode an--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of November, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)