

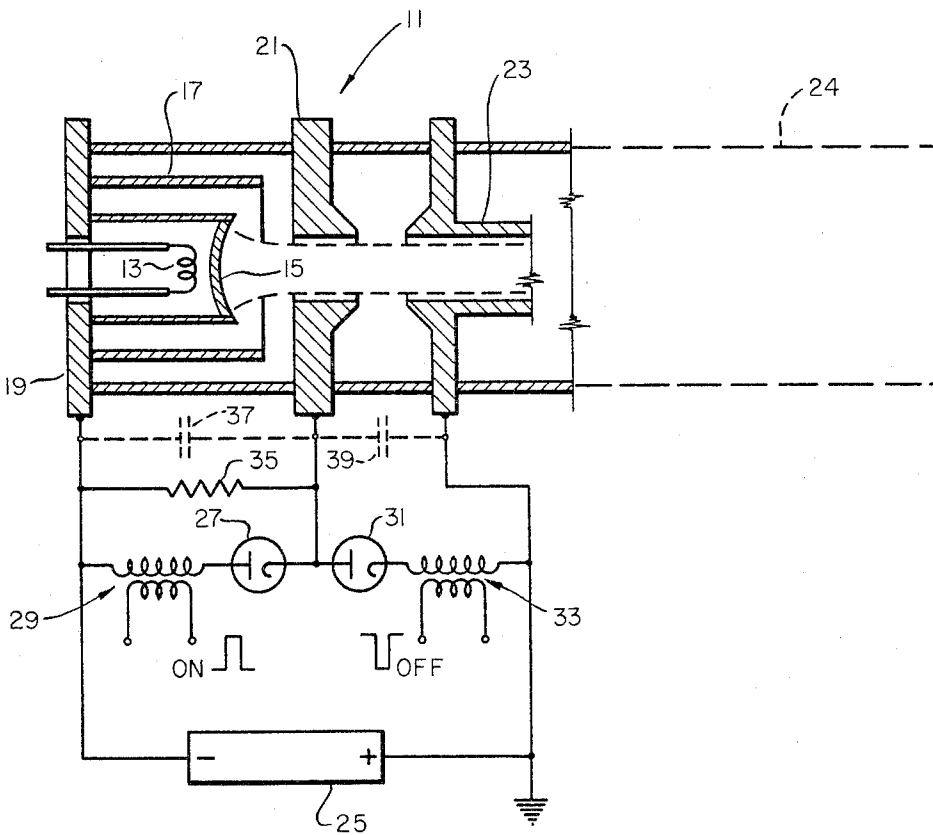
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PULSER FOR MODULATED ANODE TUBES

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PULSER FOR MODULATED ANODE TUBES

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This invention relates to pulsers for modulated anode tubes.

In pulsed operation of electron beam tubes of the type which include a modulating anode, there are required means for rapidly changing the potential of the modulating anode. This is ordinarily accomplished by a switch tube, such as a triode.

It is an object of this invention to provide improved means for pulsing modulated anode beam tubes.

It is a more particular object of this invention to provide an improved means for pulsing a modulated anode beam tube wherein switch tubes are not required.

It is still another object of this invention to provide a circuit for pulsing a modulated anode beam tube employing diodes and pulse transformers rather than the usual switch tubes.

These and other objects and features of the invention will become more clearly apparent upon a review of the following description in conjunction with the accompanying drawing which is a schematic diagram of a pulser for a modulating anode tube in accordance with this invention.

Referring to the figure, there is shown an electron gun 11 including a filament 13, a cathode 15, and a focusing electrode 17. The cathode 15 and the focusing electrode 17 are connected to a cathode terminal 19. In addition, there is shown a modulating anode 21 and an accelerating anode 23. The beam emerging from the accelerating anode 23 passes into the radio frequency section of the tube indicated by the dotted line 24. This section may be of the klystron type or others.

A source of potential 25 is connected between the cathode terminal 19 and the accelerating anode 23. A diode 27 and transformer 29 are connected in series between the cathode terminal 19 and the modulating anode 21. A second diode 31 and a second transformer 33 are connected in series between the modulating anode 21 and the accelerating anode 23. A resistor 35 may be connected across the series combination including the diode 27 and the transformer 29 to provide a leakage path so that when the tube is initially turned on, the modulating anode is essentially at the same voltage as the cathode. In this condition, the beam is cut off.

Interelectrode capacitances 37 and 39 of the gun are designated by dashed lines. Thus, the capacitor 37 represents the interelectrode capacitance between the cathode structure including terminal 19 and the modulating anode 21, while the capacitor 39 represents the interelectrode capacitance between the modulating anode 21 and the accelerating anode 23. It will be apparent from the description below that additional capacitance may be added externally if necessary for operation. In the case of each of the transformers 29 and 33, it should be noted that it is the secondary winding which is connected in series with the respective diode 27 and 31. The primaries of the individual transformers are connected to a pulse source which may be employed to turn the gun "on" and "off" in accordance with the invention.

It should be realized that it is the potential of the modulating anode 21 which controls the flow of current to turn the tube "on" and "off." The accelerating anode merely provides the acceleration to the electrons forming the beam. Thus, if the modulating anode 21 is at the potential of the cathode, the gun will be turned "off." On the other hand, if the modulating anode 21 is held at the

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potential of the accelerating anode 23 or at any potential positive with respect to the cathode, the gun will be turned "on."

In the quiescent state, the modulating anode 21 will be held at or near the potential of the cathode due to its connection through the resistor 35 to the cathode terminal 19. Consequently, in a quiescent state, the gun will be in its "off" condition.

In order to turn the gun "on," a positive pulse is applied to the primary of the pulse transformer 29. The turns ratio of the transformer and the amplitude of the input pulse are selected so that the voltage appearing across the secondary of the transformer 29 is a positive pulse of sufficient amplitude to cause the diode 27 to conduct. This brings the cathode of the diode 27 to the potential of the anode of the diode 27 which is the peak pulse voltage. This drives the modulating anode 21 to the pulse potential which, in the fully turned "on" condition of the gun, is the potential of the accelerating anode 23. The diode 27 conducts during the pulse interval and during this momentary conduction, it permits the interelectrode capacitance 39 to discharge. At the termination of the pulse, the modulating anode 21 will remain at the relatively high pulse voltage. The gun continues to inject an electron beam even though both of the diodes 27 and 31 are non-conducting.

In order to turn the gun "off," a pulse is applied to the primary of the pulse transformer 33. The pulse amplitude is such that it will cause the diode 31 to conduct whereby the plate and cathode of the diode 31 are at substantially the same potential. Again, the magnitude of the input pulse and turns ratio of the pulse transformer are selected to drive the diode into conduction. The interelectrode capacitance 37 is discharged through the diode 31. Upon termination of the pulse, the modulating anode 21 will be at substantially cathode potential and remain there until the next "turn-on" pulse.

Although there is shown and described conventional electronic type diodes, it is apparent that semiconductive diodes and other controlled rectifying means may be employed to carry out the function described above.

Thus, it is seen that switching of the tube from the "off" to the "on" condition and back is essentially performed by diodes in association with the pulse transformers. The amount of energy which is required to give the pulsed operation is minimal and, therefore, the efficiency of the system is relatively good.

I claim:

1. A pulser for a modulating anode tube of the type including a cathode, an anode and a modulating means comprising means for applying a source of accelerating voltage between the cathode and anode, a first series combination including a switching transformer and a diode connected between the cathode and modulating means, a second series combination including a second switching transformer and diode connected between the modulating means and a source of potential positive with respect to the cathode, and means for selectively applying switching pulses to said transformers whereby the modulating anode tube may be selectively turned "on" or "off."

2. A circuit as defined in claim 1 together with resistive means connected between said cathode and modulating means.

3. A pulser for a modulating anode tube of the type which include a cathode, a modulating anode and an accelerating anode comprising means for applying a source of potential between the cathode and the accelerating anode, a first series combination including uni-directional conducting means presenting relatively high impedance for current flow in one direction and a selective low impedance in the opposite direction connected between the cathode and modulating anode, means for selectively

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causing said first series combination including uni-directional conducting means to connect said modulating anode to the cathode, a second series combination including a uni-directional conducting means adapted to provide a high impedance to current flow in one direction and a relatively low impedance in the other direction connected between the modulating anode and a source of potential positive with respect to the cathode, and means for selectively applying switching voltages to said second series combination including unidirectional conducting means to connect the modulating anode to a source of positive potential.

4. A pulser as in claim 3 wherein said source of positive potential is the accelerating anode.

5. A pulser for modulated tubes of the type which include a cathode, a modulating electrode and an accelerating anode comprising means for applying a source of potential between the cathode and the accelerating anode, a first series combination including uni-directional conducting means presenting relatively high impedance for current flow in one direction and a selective low impedance in the opposite direction connected between the cathode and modulating electrode, a second series combination includ-

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ing a uni-directional conducting means adapted to provide a high impedance to current flow in one direction and a relatively low impedance in the opposite direction connected between the modulating electrode and accelerating electrode, and means for selectively applying switching voltages to said uni-directional conducting means whereby the modulating electrode is selectively connected to the cathode and anode to turn the tube "on" and "off."

6. A pulser as in claim 5 wherein said means for selectively applying switching voltages comprises a pulse transformer connected in series with each of said uni-directional conducting means.

7. A pulser as in claim 5 wherein said uni-directional conducting means comprises diodes.

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