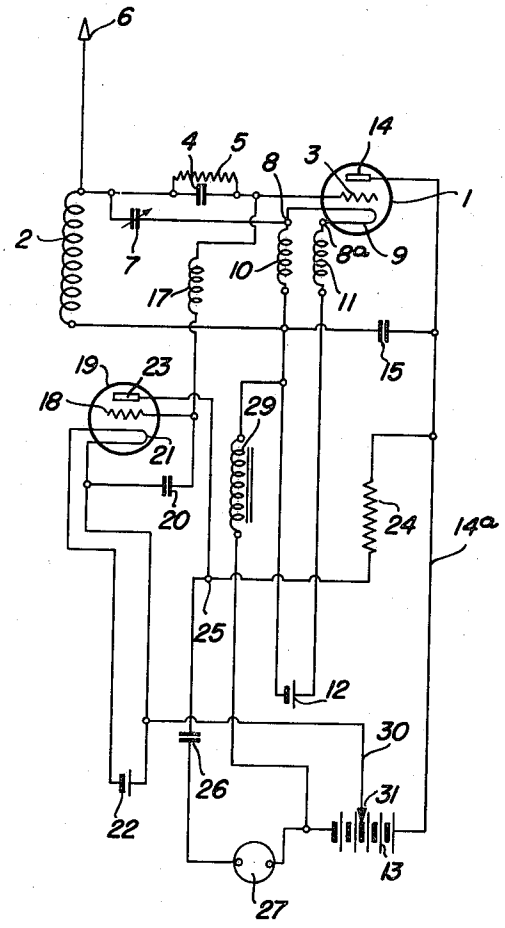
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OSCILLATOR-THYRATRON CIRCUIT

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OSCILLATOR-THYRATRON CIRCUIT

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This invention relates to radio apparatus and more particularly to a novel oscillator-thyratron circuit of simple construction which is operable by a disturbance in the excitation of the oscillator to trigger the thyratron and thereby operate an electrical device. The new circuit is adapted for various uses, but because of its simplicity it may be employed to particular advantage in radio-controlled projectiles. Accordingly, for illustrative purposes, the invention will be described in a form suitable for use in a radio-controlled proximity fuze of the type disclosed in a copending application of M. A. Tuve et al., Serial No. 471,388, filed January 6, 1943, although it will be understood that the invention may take other forms as well.

One object of the invention resides in the provision of a novel oscillator-thyratron circuit which is positive, sensitive and reliable in operation. A circuit made in accordance with the invention comprises an oscillator connected to an antenna and including a vacuum tube, a thyratron connected to the output of the oscillator, and an electrical device such as a detonating squib, connected to the output of the thyratron. The positive side of a "B" battery is connected to the plate of the oscillator tube to supply plate voltage thereto and is also connected to the plate of the thyratron, preferably through a resistor. In the preferred construction, the negative side of the "B" battery is connected through a load, such as an inductance, to one terminal of the filament or other cathode in the oscillator tube, and the cathode of the thyratron is connected to the "B" battery between the positive and negative sides thereof. When the loading of the oscillator increases, due to radio action on the antenna, the oscillator grid becomes less negative relative to the oscillator filament or other cathode, with the result that the latter becomes more positive relative to the negative side of the "B" battery. The resulting shift in the grid bias of the thyratron is in such a direction that these two changes, which are additive, cause the thyratron to ionize and operate the electrical device.

This and other objects of the invention may be understood by reference to the accompanying drawing illustrating one form of the new oscillator-thyratron circuit for use in a proximity fuze.

The new circuit, as shown, comprises an oscillator vacuum tube 1 and an oscillator tank coil 2 connected at one side to the grid 3 of the tube through a grid condenser 4 and a grid leak 5 shunting the condenser. An antenna 6 is connected to the grid side of the tank coil 2 between the coil and the grid leak. The grid side of the tank coil is also connected adjacent the antenna through a variable loading condenser 7 to one terminal 8 of the cathode, here shown as the filament 9 in the oscillator tube, the other side of the tank coil being connected through a radio frequency choke coil 10 to the filament terminal 8. The other terminal 8a of the filament is connected to a similar choke coil 11 and the filament is energized through the choke coils from an "A" battery 12. A "B" battery 13 supplies plate voltage to the plate

14 of the oscillator tube through a wire 14a, the latter being connected to the filament choke coil 10 through a bypass condenser 15.

The output of the oscillator is conducted from a point between the grid 3 and grid condenser 4 through a choke coil 17 to the grid 18 of a thyratron 19. A bypass condenser 20 is connected between the grid 18 and one side of the thyratron cathode, here shown as the filament 21 which is connected across an "A" battery 22 for energizing the filament. Plate voltage is supplied to the thyratron plate 23 from the positive side of "B" battery 13 through wire 14a, a dropping resistor 24 and a terminal 25.

The output of the thyratron is conducted from the plate 23 and terminal 25 through a firing condenser 26 to one side of an electrically operable squib 27, which may be mounted in the projectile (not shown) in position to cause detonation of the main charge therein, as by means of the usual booster. The other side of the squib 27 is connected to the negative side of "B" battery 13, which is also connected through a reactance 29, preferably in the form of an inductance, to the choke coil 10 leading to one end of the oscillator filament.

The operation of the circuit is as follows: The filament 9 of the oscillator tube is normally above ground potential, that is, the potential at the negative side of "B" battery 13, to a degree equal substantially to the IR drop in the load inductance 29, and the oscillator grid 3 is normally more negative than the oscillator filament 9. When the loading of the oscillator coil 2 changes due to electro-magnetic disturbances from the antenna 6, the oscillator grid 3 becomes less negative with respect to the oscillator filament 9, and, therefore, the filament 9 becomes more positive with respect to the negative side of "B" battery 13. Since these two effects are additive and the shift in the bias on the thryratron grid 18 is in the proper direction, the thyratron is thus ionized so that current flows between the thyratron plate 23 and filament 21 to cause operation of the squib 27.

In the preferred construction, the ionization of the thyratron 19 is prevented when the oscillator is working in a lightly loaded condition, and to this end the thyratron filament 21 may be connected through a conductor 30 and a tap-off 31 to a sufficiently positive potential of the "B" battery 13. An inductance load 29 for the oscillator filament is preferred to a pure resistance load because of the decreased D.C.–IR drop.

The new circuit is simple and compact in form and positive and reliable in operation. Because of its high degree of sensitivity, it may be used in a proximity fuze of the type referred to previously without the usual amplifier between the oscillator and the thyratron.

What is claimed is:

1. An oscillator-thyratron circuit for an explosive projectile, which comprises an oscillator vacuum tube having a grid which is normally maintained more negative than the cathode of the tube, an oscillator tank coil connected between said grid and cathode, an antenna connected to the tank coil, a thyratron having a grid connected to said oscillator grid, a current source connected at its positives ide to the plate of the oscillator tube, an electrically operable detonator having one side connected to the output circuit of the thyratron and its other side connected to the negative terminal of said current source, and inductive reactance connected between the negative side of the current source and said oscillator cathode to cause the oscillator cathode normally to be above the negative potential of said source to a degree equal substantially to the voltage drop across said inductive reactance, whereby disturbances in the excitation of the oscillator due to radio action on the antenna cause the oscillator grid to become less negative relative to the

oscillator cathode, and the oscillator cathode to become more positive relative to the negative potential of said source, said last two changes being additive and the resulting thyratron grid bias shift being in a direction to cause the thyratron to ionize and operate the detonator.

2. An oscillator-thyratron system including first and second electronic tubes each having a cathode, a control grid and an anode, said second tube being a thyratron, an oscillation circuit associated with the electrodes of said first tube, said circuit including a tank coil coupling the grid and the cathode of said first tube, an antenna connected to said tank coil, an inductive reactance connected to the cathode of said first tube, said reactance being traversed by the anode-cathode current of said first tube, a conductor connecting the grid of said first tube to the grid of said second tube, and an electrically operable detonator in the anode circuit of said second tube, whereby changes in the loading of said oscillator due to electromagnetic disturbances from the antenna cause the potential of the grid of said first tube to become less negative relative to the cathode of said first tube and the potential of said last named cathode to become more positive relative to the potential at the low side of said reactance, said changes being in a direction to cause said thyratron to become conducting thereby actuating said detonator.

3. In an explosive projectile, a proximity fuze comprising first and second electronic tubes, each having a cathode, a control grid, and an anode, said second tube being a thyratron, an oscillation circuit associated with the electrodes of said first tube, said circuit including a tank coil connected between the grid and cathode of said first tube, an antenna connected to said tank coil, a source of current having its positive terminal connected to the anode of said first tube, an inductive reactance coupling the negative terminal of said source to the

cathode of said first tube, said reactance being traversed by the anode-cathode current of said first tube, a conductor connecting the grid of said first tube to the grid of said second tube, and an electrically operable detonator having one terminal connected to the anode of said second tube and its other terminal through said source of current to the cathode of said second tube, whereby changes in the loading of said oscillator due to electromagnetic disturbances from the antenna cause the potential of the grid of said first tube to become less negative relative to the cathode of said first tube and the potential of said last named cathode to become more positive relative to the potential at the negative terminal of said source, said changes being in a direction to cause said thyratron to become conducting thereby actuating said detonator.

4. A proximity fuze as in claim 3, including a choke coil inserted in the conductor that connects the grid of said first tube to the grid of said second tube.

5. A proximity fuze as in claim 3 including means for adjusting the potential of the cathode of said second tube relative to that of the anode of said first tube.

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