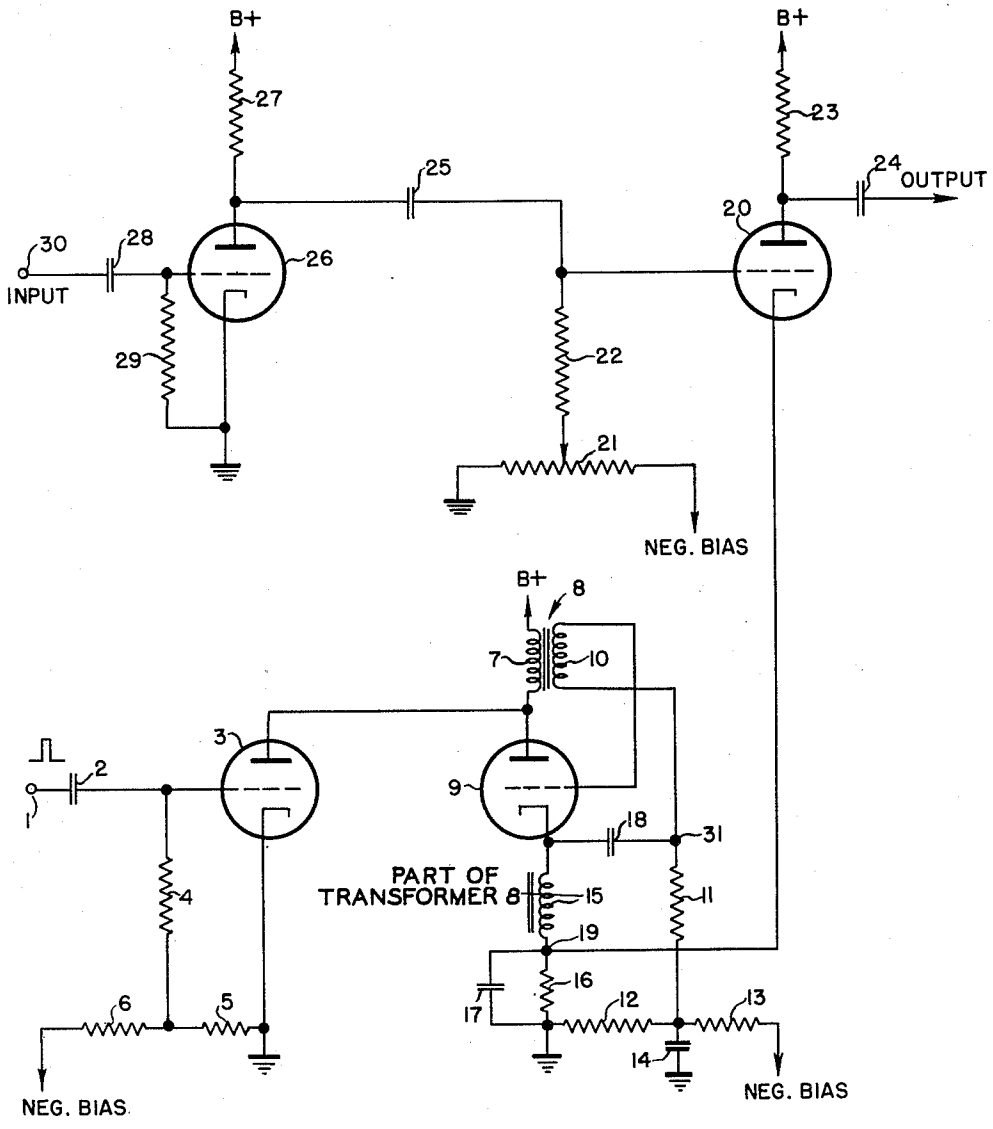
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ELECTRON TUBE CIRCUIT

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ELECTRON TUBE CIRCUIT

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This invention relates in general to pulse generators and more particularly to an electrical circuit for generating a relatively strong output pulse of long duration. The pulse, for example, may be used for blanking a receiver.

In radio detecting and ranging apparatus and in television, it is sometimes very important to have a circuit able to generate pulses of relatively large amplitude and long duration. The circuit should be capable of being triggered by a relatively weak trigger pulse. It is therefore an object of this invention to provide a pulse generator which can be readily triggered and which will produce pulses of relatively long duration and large amplitude.

One means for obtaining pulses of this shape is the blocking oscillator. The blocking oscillator in this invention is triggered by small relatively weak pulses which need not have a special shape. The production of such trigger pulses is relatively simple and may be accomplished by any one of several well known means. In the preferred embodiment of this invention, the trigger pulse is supplied from a nearby radio transmitting apparatus through a coaxial cable and the blocking oscillator output pulse is used to blank a receiver associated for instance with a beacon. This is necessary, for example, where a beacon is in the vicinity of radio transmitting apparatus and it is not desired to have the beacon respond to that transmitter. If desired, the transmitted pulse may be picked up by means of a directional antenna which can be pointed toward the transmitter which is not desired to trigger the beacon.

Another object of the invention is to devise a simple blocking oscillator circuit, using standard tubes, which will produce a strong, well shaped pulse of relatively long duration.

A still further object is to provide a blocking oscillator with an input amplifier to permit the use of weak trigger pulses.

Other objects and advantages will become readily apparent from the hereinafter described specification.

The invention in general contemplates the use of two vacuum tubes using the primary winding of a transformer as a common plate impedance. One of the secondary windings is connected to the grid of the first tube in such a way that an increase in primary current places a strong positive bias on the grid. A second secondary winding is connected to the cathode of said first tube in such a way that when the primary current increases, the cathode becomes more positive. The output voltage pulse from

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the first tube is taken from a resistor in series with the cathode. The output pulse produced by the blocking oscillator is relatively long due to having windings in both the grid and cathode circuits. The duration of the pulse may be changed by adjusting the capacitance of a capacitor between the cathode and grid circuit or the resistance of a resistor connected between the grid circuit and ground. The action of this blocking oscillator is initiated by a relatively weak positive pulse on the grid of the amplifier tube, which acts as an amplifier for the pulse. The pulse causes a sudden increase in plate current of the amplifier tube. This sudden increase in current through the primary of the transformer induces a pulse of voltage in each of the secondary windings. This pulse in the secondary windings will change the bias on the blocking oscillator tube in such a way as to increase its anode current and initiate the blocking oscillator action.

The invention will be best understood by referring to the simple figure which shows one embodiment of the invention.

The figure shows a terminal 1, to which a pulse is applied. Terminal 1 is connected, through capacitor 2, to the grid of tube 3. The grid of tube 3 is connected through resistor 4 to a voltage divider, consisting of resistors 5 and 6 connected between ground and a source of negative potential. This places a negative bias on tube 3. The cathode of tube 3 is connected directly to ground. The anode of tube 3 is connected to a source of positive potential through the primary winding 7 of a transformer 8. The anode of tube 9 is also connected through winding 7 in said source of positive potential. A secondary winding 10 has one terminal connected to the grid of tube 9 and the other to a resistor 11. The other side of resistor 11 is connected to a voltage divider consisting of resistors 12 and 13 connected between ground and a source of negative potential. This places a negative bias on tube 9. Common junction of the two resistors is bypassed to ground through capacitor 14. The cathode of tube 9 is connected to ground through a secondary winding 15 of the transformer 8 and a resistor 16. The resistor 16 is bypassed by capacitor 17. The purpose of capacitor 17 is to prevent an initial very short negative pulse at point 19. The negative pulse is very undesirable when the main pulse is used to blank a receiver. Capacitor 18 is connected between the cathode of tube 9 and one terminal of the winding 10.

The positive output pulse of the blocking os-

cillator is taken between point 19 and ground. This pulse is applied to the cathode of tube 20. The grid of tube 20 is connected to an adjustable potentiometer 21 through a resistor 22. The adjustable potentiometer is connected between ground and a source of negative potential to provide a variable negative bias for the grid of tube 20. The anode of tube 20 is connected to a source of positive potential through resistor 23. The output is taken off through capacitor 24. The signal applied to the grid of tube 20 is taken, through capacitor 25, from the anode of tube 26. The anode of tube 26 is connected to a source of positive potential through resistor 27. The grid of tube 26 receives the signal through capacitor 28. The grid is connected to ground through resistor 29. The receiver input is connected to terminal 30.

The positive trigger pulse, which may be any shape, is applied to terminal 1, and through capacitor 2 to the grid of tube 3, which serves to amplify the pulse. The grid is held at a negative potential by being connected to the voltage divider through resistor 4. The positive pulse causes tube 3 to draw a pulse of anode current through winding 7 of the transformer. This causes a pulse of voltage to be induced in transformer windings 10 and 15. The polarity of these windings is so arranged that both the grid and the cathode of tube 9 receive positive pulses. Point 31, the junction of capacitor 18 and resistor 11, is tied to the cathode of tube 9 through capacitor 18. Point 31 will therefore initially rise in potential substantially as much as the cathode. The positive pulse applied between point 31 and the grid produces a change in bias on tube 9 which causes its anode current to increase through the winding 7 and thereby initiates the blocking oscillator action. The grid is very rapidly driven sufficiently far positive so that grid current flows, charging capacitor 18 in such a manner that point 31 will be much less positive than the cathode. The positive pulse on the grid also causes the anode current to increase very rapidly in the typical blocking oscillator regenerative action. Capacitor 18 is also charged, with the same polarity, by current flowing from the cathode through the capacitor, through resistors 11, 12 and 16 and winding 15.

The anode current of tube 9 will continue to increase very rapidly until saturation takes place. The saturation may be either in the tube or the transformer or both. When saturation takes place the current remains relatively constant for a period of approximately 2 to 25 microseconds, depending on the tube, the value of capacitor 18 and the value of resistor 11. At the expiration of this time, the degenerative action of the blocking oscillator takes place and the current very rapidly decreases. The duration of the pulses can be varied by changing the value of capacitor 18 and resistor 11.

The output voltage pulse from the blocking oscillator is taken across resistor 16. This pulse may be applied directly to the cathode of another tube without an intermediate blocking capacitor. This permits almost instantaneous recovery of the blanked tube after the blanking pulse.

The use of resistor 16 in series with the cathode to provide the pulse substantially eliminates any overshoot in the output pulse.

The cathode of tube 20 is connected to point 19 to receive the blanking pulse. The grid of tube 20 is connected to an adjustable potentiometer 21 to provide a variable source of negative bias for the tube. The positive pulse on the cathode of tube 20 makes the bias on the tube sufficiently negative to completely cut off the tube. Tube 20 is coupled to tube 26 by a conventional resistance-capacitance coupling. The input signal is applied to the grid of tube 26 through blocking capacitor 28.

The type of tube used is not critical. Two tube types which are well suited for use in this circuit are the 7F8 and the 6SN7. These tubes are mentioned merely by way of example and it is not intended that the invention should be considered limited to these specific tubes or even to the class of twin triodes in general.

The following typical values are given for the components of the blocking oscillator portion of the circuit using a type 7F8 tube:

Resistor 11	ohms	1,000
Resistor 12	do	15,000
Resistor 13	do	100,000
Resistor 16	do	1,000
Capacitor 14	microfarads	.00025
Capacitor 17	do	.00025
Capacitor 18	do	.1

Using the above listed values with 105 volts as the source of negative potential and 250 volts as the source of positive potential, a pulse of approximately 9 microseconds was obtained.

The aforementioned values are given solely for illustrative purposes and are not intended to limit the invention in any way.

It will be apparent that there may be deviations from the invention as described which still fall fairly within the spirit and scope of the invention. For example, the output pulse of the blocking oscillator need not be used for blanking a tube but could be used any place where a pulse of relatively long duration is desired.

Accordingly, I claim all deviations which fall fairly within the spirit and scope of the invention as identified in the hereinafter appended claims.

What is claimed is:

1. A blocking oscillator comprising a vacuum tube having an anode, a cathode and at least one grid, a transformer, a first winding of said transformer for electrically connecting the anode of said tube to a source of positive potential, a second winding of said transformer for electrically connecting a grid of said tube to a source of negative potential, a third winding of said transformer electrically connected to the cathode of said tube, a capacitor electrically connecting the cathode of said tube to said second winding, and resistor means electrically connecting said third winding to a source of reference potential.

2. A blocking oscillator as set forth in claim 1 in which the common junction of said third winding and said resistor means is electrically connected to the cathode of a second tube.

3. In a blocking oscillator, a vacuum tube having an anode, a cathode and at least one grid, a transformer having a primary winding for connecting said anode to a source of positive potential and at least two secondary windings, a first secondary winding for connecting a grid of said tube to a source of negative potential, a second secondary winding connecting the cathode of said tube to a source of reference potential, a capacitor means connecting said cathode to said first secondary winding, and resistor means connected between said second secondary winding and said source of reference potential.

4. A circuit for producing a blocking pulse comprising at least two vacuum tubes each having an anode, a cathode and at least one grid, a transformer, a first winding of said transformer for electrically connecting the anodes of said tubes to a source of positive potential, a second winding of said transformer for electrically connecting a grid of the first tube to a source of negative potential, a third winding of said transformer electrically connected to the cathode of the first tube, a capacitor electrically connecting the cathode of said first tube to said second winding, and resistor means electrically connecting said third winding to a source of reference potential.

5. A circuit for producing a blocking pulse as set forth in claim 4 in which the common junction of said third winding and said resistor means is electrically connected to the cathode of a third tube.

6. In a blocking oscillator, a vacuum tube having at least a cathode, an anode and a grid, a transformer having a primary winding and two secondary windings, a source of positive potential, and a source of negative potential, means connecting said primary between said anode and said source of positive potential, means connecting one of said secondary windings between said grid and said source of negative potential, means connecting said other secondary winding to said cathode, a capacitor coupling said cathode to said one secondary winding, and a resistor means electrically connecting said one secondary winding to a source of reference potential.

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