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STABILIZED AND GATED MULTIVIBRATOR

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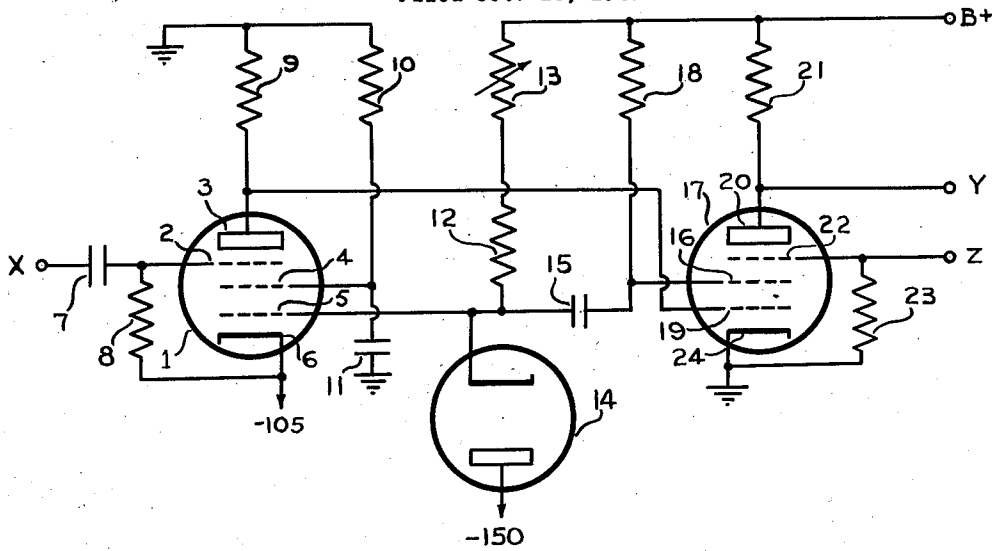


FIG. 1

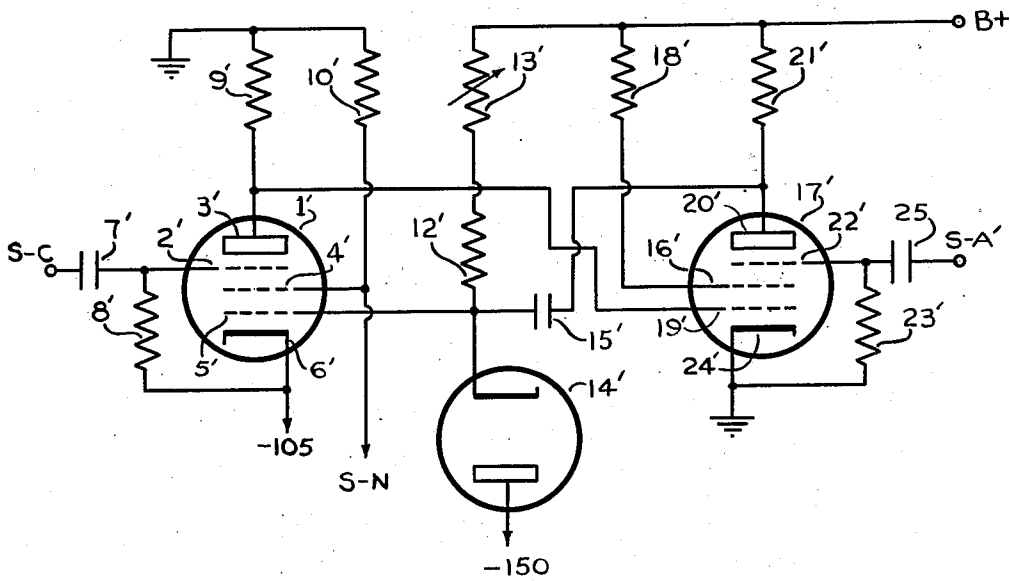


FIG. 2

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STABILIZED AND GATED MULTIVIBRATOR

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6 Claims. (Cl. 250-27)

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This invention relates to generators for generating synchronizing signals that are particularly useful for television. Many pulses of varied shapes and sizes accurately timed with respect to one another are required in television systems. Multivibrators are used to generate these pulses. The object of this invention is to provide a stabilized multivibrator to generate timed pulses with provision for accurately gating its output in accordance with signals from a timer unit. This invention is particularly useful in the system described in co-pending application, Ser. No. 780,638, filed of even date herewith entitled "Television Synchronizing Signal Generator," although its use is not restricted to that system. The signals referred to in this application by reference characters are the same as those shown and designated by the same reference characters in said co-pending application.

The invention may be understood from the description in connection with the accompanying drawing in which:

Fig. 1 is a diagram of an embodiment of the invention, and

Fig. 2 is a diagram showing a modification of the invention.

In Fig. 1 two pentode vacuum tubes 1 and 17 are shown with the plate 3 of the first one connected to the control grid 19 of the second and the screen grid 16 of the second pentode 17 coupled by a condenser 15 to the control grid 5 of the first pentode. Triggering and gating pulses are applied respectively to the suppressor grids 2 and 22 of the two pentodes and the output is taken from the plate 20 of the second tube.

The suppressor grid 2 of pentode 1 is coupled to a source of a delayed signal X, such as the signals S—D, S—F, or S—G shown in said co-pending application, through capacitor 7 and across resistor 8 which is connected between suppressor grid 2 and cathode 6. The cathode 6 is connected to a source of negative potential. The plate 3 is connected to ground through resistor 9. The screen grid 4 is also connected to ground through resistor 10 and capacitor 11 connected in parallel. The control grid 5 is connected to the juncture of a resistor 12 and the cathode of a diode 14 the plate of which is connected to a source of negative potential more negative than that to which the cathode 6 of tube 1 is connected. The other end of resistor 12 is connected through variable resistor 13 to a source of positive potential.

The cathode of diode 14 is also coupled to the screen grid 16 of a pentode 17 through capacitor

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15. The screen grid 16 of pentode 17 is also connected to said source of positive potential through resistor 18. The control grid 19 of pentode 17 is connected to the plate 3 of pentode 1. The plate 20 of pentode 17 is connected through a resistor 21 to a source B of positive potential. The output Y, corresponding to signals S—K, or S—Q shown in said co-pending application, is taken off from the plate 20. A signal Z of gating potential, corresponding to signals S—I, S—J or S—O shown in said co-pending application is connected to the suppressor grid 22 across the resistor 23 that is connected to the cathode 24 and ground.

The operation is as follows:

When the control grid 5 of the pentode 1 is at a positive potential with respect to the cathode 6 due to the positive voltage B, notwithstanding drop of voltage through resistors 12 and 13, space current flows through pentode 1 and the potential of plate 3 drops, causing the potential of the control grid 19 of pentode 17 to decrease, so that this pentode 17 is cut off, whereupon the potential of the screen grid 16 of tube 17 rises placing a positive charge on the right hand side of capacitor 15. Inasmuch as grid 5 of pentode 1 is at approximately the same potential as cathode 6, the voltage across condenser 15 is the sum of —105 plus the potential at the screen grid 16 of pentode 17.

The flow of space current in tube 1 is reduced when the negative triggering pulse X is applied to the suppressor grid 2. This causes the potential at the plate 3 to rise and with it the potential of the grid 19 of pentode 17. This causes the screen 16 of pentode 17 to conduct lowering the potential of the screen grid 16 and causing grid 5 to become negative thus lowering the plate current through pentode 1 still more. This continues until pentode 1 becomes non-conducting. Thus grid 5 is cut off and remains so until the charge on condenser 15 leaks off through R12, 13 and 18 at a rate determined by their effective time constant and grid 5 rises to a potential such as to cause pentode 1 to conduct again. The circuit is then ready to repeat the cycle with application of another trigger to suppressor 2 of tube 1.

Resistor 10, which may be in the order of 22,000 ohms, connected to screen grid 4, gives stability to the multivibrator and tends to adjust for any difference in the supply voltage by maintaining the operating grid base at a very low value. The suppressor grid 2 is used to determine the initiation of the multivibrator and suppressor grid 22

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is used to gate or key the multivibrator output to circuit Y.

With a given time constant, the time interval of the output of a single impulse multivibrator is affected by the extent of swing of the grid potential of the originally conducting tube. This may vary with fluctuations in the line voltage, the aging of components, and the difference in characteristics between the original and replacement tubes. Such differences are counter-balanced with the present invention by the diode 14 that is located between the control grid 5 of pentode 1 and a source of negative potential. This diode limits the negative swing at this grid 5 to a substantially constant value.

A modification of this device used to produce timed pulses of variable duration is shown in Fig. 2, where corresponding elements are referred to by the same reference characters as in Fig. 1, with the addition of primes. It comprises two pentodes 1' and 17' with the plate 3' of one connected to the grid 19' of the other one. The plate 20' of the second pentode 17' is coupled to the grid 5' of the pentode 1' through a capacitor 15'. An initiating pulse S—C, such as is shown in the above mentioned application, is inserted at the suppressor grid 2' of the first pentode and a terminating pulse S—A' is inserted at the suppressor grid 22' of the second pentode 17'. The output S—N is taken off at the screen grid 4' of the first pentode.

The suppressor grid 2' of the pentode 1' is connected to the source of signal S—C through capacitor 7' across resistor 8' connected to the cathode 6'. The plate 3 is connected to ground through a resistor 9'. The screen grid 4' is also connected to ground through a resistor 10'. The output S—N is taken off from the screen grid 4'. The control grid 5' is coupled to the plate 20' of the pentode 17' through capacitor 15'. The control grid 5' is also connected to a source B of positive potential through fixed resistor 12' and variable resistor 13' in series and to the cathode of a diode 14' the plate of which is connected to a source of negative potential. The cathode 6' of tube 1' is connected to a source of negative potential which is less negative than that to which the plate of diode 14' is connected.

The plate 20' of the pentode 17' is connected to a source of positive potential B through a resistor 21'. The plate 3' of the pentode 1' is connected to the control grid 19' of the pentode 17'. The suppressor grid 22' of pentode 17' is coupled to a source of gating signals S—A' (shown in application mentioned above) through a capacitor 25 that develops a signal across resistor 23' connected to ground. The cathode 24' of tube 17' is also grounded. The screen grid 16' is connected to the source B of positive potential through resistor 18'.

The operation of the multivibrator shown in Fig. 2 is as follows:

Since the control grid 5' is connected to a positive potential through resistors 12' and 13', space current flows in pentode 1' and the potentials of plate 3' of pentode 1' and grid 19' of pentode 17' decrease to the same extent. This holds pentode 17' at cut off and the potential of the plate 20' of this pentode increases, placing a positive potential on the right hand side of the capacitor 15'. Since grid 5' tends to be at cathode 6' potential, the voltage across 15' is the sum of -105 and the B+ potential. When a negative trigger is applied to 2', the potential at plate 3' rises causing 17' to conduct (with suppressor 22' at

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ground potential) reducing the potential of plate 20' and grid 5'. This effect continues by virtue of regeneration until 5' is lowered below cutoff, at which time tube 1' is cut off and tube 17' is conducting. Condenser 15' then loses its charge through R12' and R13' at a rate determined by the product of (R12'+R13' plus a small resistance determined by R21' in parallel with R_p of tube 17') C15' until grid 5' rises to a point of conduction again.

The absolute time when pentode 1' comes into conduction again is uniquely determined by means of a negative trigger applied to suppressor 22' of pentode 17', if (R12'+R13' plus a small resistance determined by R21' in parallel with R_p of tube 17') C15' is just barely larger than that required for desired gate length.

Diode 14' limits the swing of grid 5' to approximately 50 volts. This stabilizes the operation of the circuit by insuring that the voltage swing of grid 5' will be nearly independent of the voltage swing of the plate 20' of tube 17' if the voltage swing is enough to cause the diode 14' to conduct.

The signal S—C on the suppressor grid 2' of pentode 1' controls the initiation of operation of tube 1' and the signal S—A' on the suppressor grid 22' of pentode 17' controls cessation of operation of tube 17'. The output from the screen grid 4' is in the form S—N shown in said co-pending application. It is the blanking signal for positioning the vertical synchronizing signals in the center of the combined vertical synchronizing pulse.

The advantage of taking the output off at the screen grid of this tube 1' is that any variation of potential at this point caused by variations in the load circuit will have a minimum effect on the triggering and gating circuits.

What is claimed is:

1. A multivibrator comprising two electron discharge devices each having a plate, a cathode, and a control grid, a screen grid and a suppressor grid with the cathode of the first electron discharge device connected to a source of negative potential and the plate of this device connected to the control grid of the second such device and a capacitor coupling the screen grid of the second such device to the control grid of the first said device, a resistor connecting the plate of said first device to the cathode of said second device, a resistor connecting the control grid of the first said device to a source of positive potential, a source of triggering pulses connected to the suppressor grid of the first said device, a source of gating pulses connected to the suppressor grid of the second said device and means for taking off the output from the plate of said second device.

2. The device of claim 1 in which there is an electron discharge device having a cathode and an anode with its cathode connected to the control grid of the first said device and its anode connected to a source of negative potential.

3. An electrical pulse generating circuit comprising a first thermionic tube having an anode, a cathode, a control grid, a screen grid, and a suppressor grid, and a second thermionic tube having an anode, a cathode, a control grid, a screen grid, and a suppressor grid, the cathode of said first tube being connected to a source of negative potential, and the anode of said first tube being connected to the control grid of said second tube, the screen grid of said second tube being coupled to the control grid of said first

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tube through a capacitor, a resistor connecting the anode of said first tube to the cathode of said second tube and a resistor connecting the control grid of said first tube to a source of positive potential, a third thermionic tube having the cathode thereof connected to the control grid of said first tube and the anode thereof connected to a source of negative potential, the suppressor grid of said first tube being connected to a source of electrical triggering pulses, and the suppressor grid of said second tube being connected to a source of electrical gating pulses.

4. A pulse generating circuit as in claim 3 in which the output is taken from the anode of said second tube.

5. A gated multivibrator comprising a pair of multi-electrode tubes each of said tubes having a cathode, an anode electrode, means producing an electron stream between each of said cathodes and its corresponding anode, and a plurality of grid electrodes disposed in the path of said electron streams; an anode load connected to the anode electrode of each of said tubes; a direct current coupling from the anode electrode of a first one of said tubes to a first grid electrode of said second tube; a second coupling from a different one of said electrodes in said second tube to a first grid electrode in said first tube, said last named coupling comprising a condenser; means for applying a triggering voltage to a second grid electrode of said first electron tube to initiate the electron stream to the anode electrode of said second tube, and means for applying a voltage to cut off the electron stream to the anode of said second tube, said means comprising one of said grid electrodes in said second tube; and a third tube having a cathode connected to said first grid of said first tube, and an anode thereof connected to a source of negative potential.

6. A gated multivibrator comprising a first

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electron discharge device having a cathode, an anode, and a plurality of grids, and a second electron discharge device having a cathode, an anode, and a plurality of grids, the anode of said first device being connected to a first grid of said second device, a second grid of said second device being connected through a capacitor to a first grid of said first device, a resistor connecting the anode of said first device to the cathode of said second device, a resistor connecting said first grid of said first device to a source of positive potential, a third electron discharge device having the cathode thereof connected to said first grid of said first device, and the anode thereof connected to a source of negative potential, a third grid of said first device being connected to a source of first electrical signals, and a third grid of said second device being connected to a source of second electrical signals, the output from said multivibrator being taken across the anode of said second device.

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