

Aug. 27, 1940.

E. L. C. WHITE

2,212,967

TELEVISION AND LIKE TRANSMITTING SYSTEM

Filed April 16, 1938

2 Sheets-Sheet 1

Fig. 1

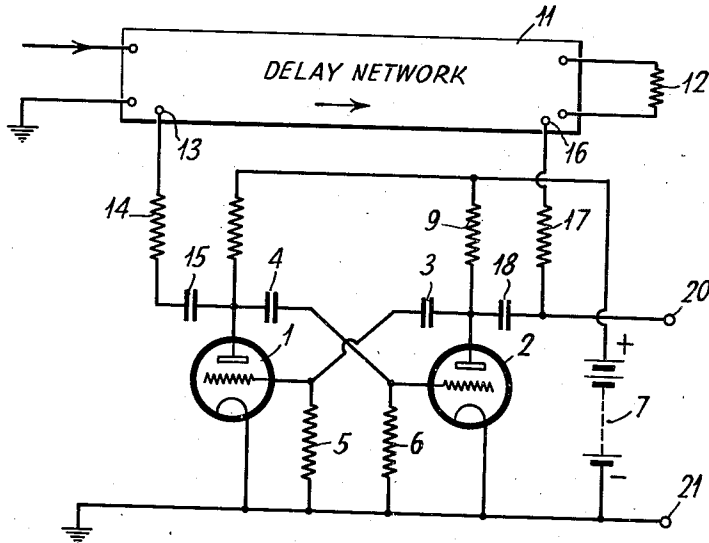
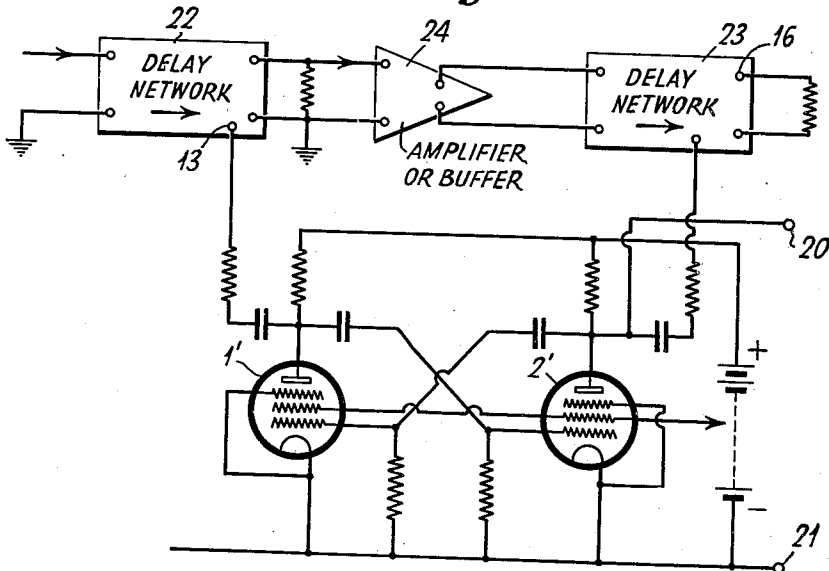


Fig. 2



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2 Sheets-Sheet 2

Fig. 3

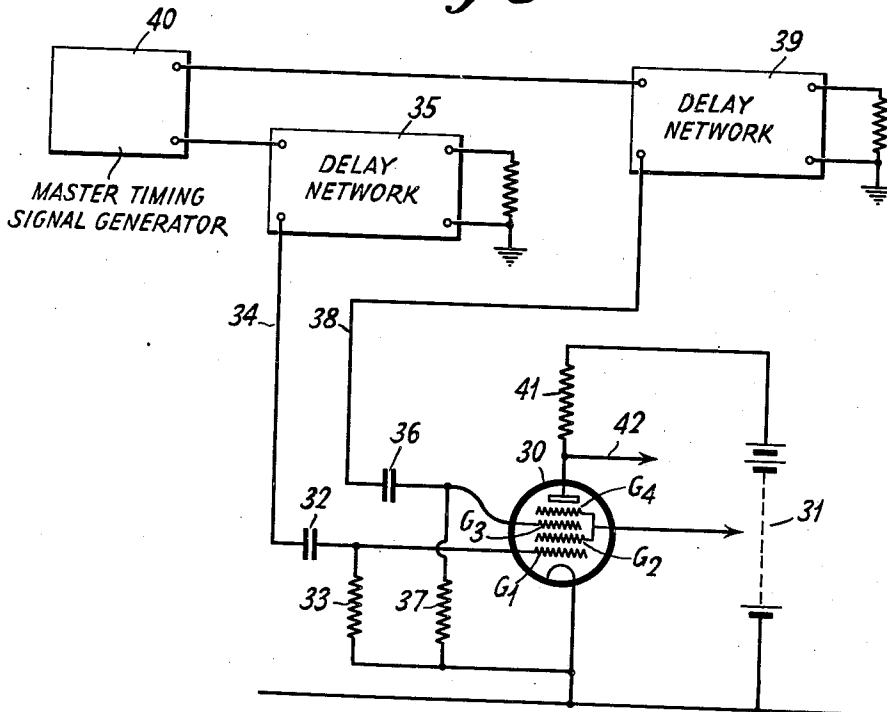
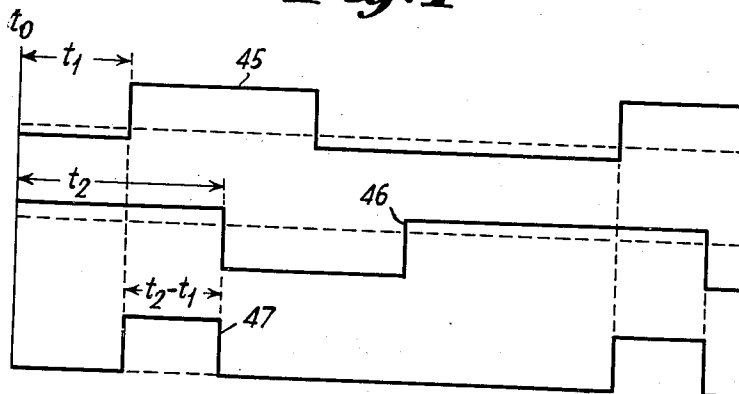


Fig. 4



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UNITED STATES PATENT OFFICE

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TELEVISION AND LIKE TRANSMITTING
SYSTEM

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The present invention relates to television and like transmitting systems of the kind in which synchronising signals are transmitted in the intervals between trains of picture signals.

5 In such systems it is usual to provide a generator of master timing signals, these signals being used both to control the scanning process at the transmitter and for producing synchronising signals for combination with the picture signals
10 to be transmitted, these synchronising signals being used to control scanning at a receiver.

As described in the specification of prior British Patent No. 456,650, it is sometimes inconvenient to arrange that the scanning should take place
15 at a point close to the master timing signal generator or to the point at which synchronising signals derived from the master signals are superimposed upon the picture signals. Usually the
20 superimposition of the synchronising signals upon the picture signals is effected a point close to the master generator, and as the picture signals have to travel to and from the scanning point, it will be realised that they will be delayed
25 relatively to the synchronising signals. This delay would result in the synchronising signals becoming superimposed upon the picture signals.

To overcome this difficulty, it has already been proposed as described in specification of prior British Patent 456,650, to send the synchronising
30 pulses along a delay network off which connections are taken at suitable delays to cause one or more than one multivibrator to operate to produce a square topped pulse, such as is required
35 for synchronising purposes. In accordance with the previous proposals, as described in British patent specification 456,840, the multivibrator or multivibrators is or are arranged to be started
40 at definite times by master timing signals, and each multivibrator itself is arranged to control the duration of the square topped pulse. Thus, the duration or length of the square topped pulse produced by a given multivibrator was a function of the multivibrator circuit, and is thus
45 liable to small alterations due to ageing of valves or change of supply voltages.

It is the object of the present invention to control both the stopping and the starting of the square topped pulses produced by a multivibrator by means which operate independently of the
50 multivibrator.

According to the invention, a method of producing electrical pulses of a desired duration by means of a pulse generator is employed, consisting in applying a starting and a stopping control
55 pulse to the generator for initiating and termi-

nating respectively, the generation of a pulse. Preferably, in carrying the invention into practice controlling pulses are set up due to master timing signals, each of which produces a starting pulse, followed with a predetermined delay by a stopping pulse. Conveniently the starting and the stopping control pulses may be derived either by applying the master timing signal to a delay network from different points of which the required control pulses are derived, or by applying the master timing signal to one delay network, from which one control pulse is derived, the master timing signal then being amplified and applied to a second delay network from which the other control pulse is derived. The generator may take the form of a multivibrator comprising two thermionic valves, an output electrode of each of which is coupled through a reactive coupling to an input electrode of the other. Successive control pulses are applied of which the time separation is small compared with the natural period of the multivibrator, said impulses changing the condition of the multivibrator by rendering conducting that valve which is at the moment non-conducting (or vice versa). Alternatively, the generator may comprise a multi-grid valve to separate control electrodes of which starting and stopping pulses which render the valve conducting and non-conducting respectively, are applied.

The method of carrying the invention into practice will be more clearly understood from the following description in detail reference being made to the accompanying drawings of which Figs. 1 to 3 are circuit diagrams of different embodiments of the invention, and Fig. 4 is a graphical diagram illustrating the mode of operation of the arrangement of Fig. 3.

Referring to Fig. 1, it will be seen that the arrangement therein shown comprises a generator of current pulses in the form of a multivibrator constituted by two triode thermionic valves 1 and 2, the anode of each of which is connected to the control grid of the other through condensers 3 and 4 respectively, valve 1 being provided with grid leak resistance 5 and valve 2 being provided with grid leak resistance 6. Potential is applied to the anodes of valves 1 and 2 from a suitable high tension source represented by battery 7 through resistances 8 and 9 respectively. The cathodes and grid leak resistances are shown as earthed to lead 10 in accordance with usual practice. A delay network 11 with terminating impedance 12, shown as a resistance, is arranged to have suitable master timing signals applied

to it and has a connection to the valve 1 from the point 13 through resistance 14 and condenser 15, and a connection to the anode of valve 2 from point 16 through resistance 17 and condenser 18.

In the above arrangement the values of condensers 3 and 4 and of the associated resistances 5 and 6 are made such that the time constants of the condenser 3 and resistance 5 and condenser 4 and resistance 6 are greater than the period of the square topped pulses produced by the multivibrator, under the control of the timing signals.

The values of the resistances 8 and 9 are chosen such that if either tube 1 or tube 2 become conducting the potential difference set up across the appropriate resistance 8 or 9 is such that the valve 2 or 1 respectively is driven to a point more negative than that corresponding to anode current cut-off. Initially it is arranged that valve 2 is conducting. On the application of a negative timing signal to the delay network 11, first a starting pulse is applied in the negative sense to the anode of valve 1 from the point 13 through resistance 14 and condenser 15 and through the condenser 4 to the grid of valve 2, so as to cause the tube 2 to become non-conducting, thus producing a potential rise over resistance 9 which is transferred over condenser 3 to the grid of valve 1 to cause the valve 1 to become conducting. Owing to the amplification in valves 1 and 2 the change over will be sharp and the arrangement will "kick-over" into the condition in which tube 2 is non-conducting and tube 1 conducting. After a time equivalent to the duration of a square topped pulse, which time, as the pulses are discrete, is less than the period of a pulse and is consequently small compared with the time constant of condenser 4 and resistance 6, the timing signal will have passed through the delay network 11 and will have reached point 16. Consequently, at this time a stopping pulse will be applied through resistance 17 and condenser 18 to the anode of valve 2 and through condenser 3 to the grid of valve 1, causing this valve to become non-conducting and valve 2 to become conducting, the change again being in the nature of a "kick-over." Thus, if an output circuit is connected at the terminals 20 and 21 across the output circuit of tube 2 as shown, a substantially square topped potential pulse will be obtained of which the duration is determined entirely by the time taken for the master timing signal to pass between points 13 and 16 of the delay network 11.

Fig. 2 shows a slightly modified arrangement according to the invention in which the delay network 11 is replaced by two delay networks 22 and 23 with a thermionic amplifier or buffer stage 24 inserted between them, and the valves 1 and 2 are replaced by valves 1' and 2' which are shown as screen grid pentodes. The arrangement of Fig. 2 is strictly analogous to that of Fig. 1, the duration of the square topped pulse being again defined by the time taken by the master timing signal to pass between the point 13 and the point 16 at which the connections from the delay networks 22 and 23 respectively to the valves 1' and 2' respectively are made, the only difference being that the points 13 and 16 are now located in separate delay networks with a buffer or amplifier stage 24 between them. By dividing the delay network in this way, excessive loading of the first delay network is avoided and attenuation of the pulse in the network is compensated.

Fig. 3 of the drawings shows an arrangement in which the pulse generator comprises a hexode

valve 30, having master control grid g_1 , secondary control grid g_3 and screening grids g_2 and g_4 . The valve is arranged with its anode connected to a source of high tension voltage such as battery 31, the screening grids g_2 and g_4 being maintained at suitable potential, for example, by being connected to a suitable tap point, on battery 31 as shown. Pulses of positive potential each corresponding to a master timing signal are applied to control grid g_1 through condenser 32 having associated grid leak resistance 33 from lead 34 connected to delay network 35, and further pulses controlled by the same timing signals but in negative sense and delayed in time with relation to the first control pulses are applied to control grid g_3 , through condenser 36 with associated grid leak resistance 37, from lead 38 connected to pulse delay network 39. The master timing signals are fed from a source 40 into delay networks 35 and 39 in parallel.

The anode circuit of valve 30 comprises load resistance 41 in series with battery 31 and potential pulses of substantially square topped waveform are derived from lead 42 connected to the anode of the valve.

The mode of operation of the arrangement of Fig. 3 will be understood from the following description with reference to Fig. 4 in which line 45 shows the potential variation with time on the control grid g_1 of valve 30, line 46 shows the potential variation with time on the grid g_3 , and line 47 shows the variation of anode current in valve 30 with time. The source 40 supplies positive pulses and negative pulses respectively to the networks 35 and 39, these pulses being of longer duration than any of the pulses which it is desired to obtain in the output 42 of the arrangement. The positive pulses delivered to network 35, arrive after a required starting delay t_1 , at the control grid g_1 of the valve 30 as shown by line 45 of Fig. 4. Likewise the negative pulses, delivered to network 39, appear after a delay t_2 on the control grid g_3 of valve 30, as shown by line 46 of Fig. 4. Electrons from the cathode of valve 30 are not able to pass either of the grids g_1 or g_3 unless the grid in question has a potential higher than the cut-off potential for that grid. When a pulse of series 45 arrives at grid g_1 , it will be seen that grid g_3 is in a condition to pass electrons, consequently on the arrival of a pulse at grid g_1 , anode current will start to flow through the valve which starts to generate a pulse. However, immediately the potential on grid g_3 falls below its cut-off potential, the electron stream in valve 30, and consequently the anode current, will be interrupted and generation of a pulse will be stopped. The variation of anode current with time in the valve 30 is shown by graph 47. The duration of the pulses of anode current produced through the valve 30 will be given by the interval $t_2 - t_1$.

The flow of anode current in the valve 30 will produce the required voltage pulses in the output 42.

The hexode valve 30 in the arrangement of Fig. 3 may be replaced by any other suitable mixing valve. For example, a pentode valve may be used as the mixing valve, with control pulses applied to its control and suppressor grids. Alternatively, instead of a single mixing valve, two triode or diode valves with their anode cathode-paths arranged in series might be used, the control pulses being applied to their grids or anodes respectively. Also, instead of the two delay networks 35 and 39, a single delay network may be

used with phase reversing valves inserted where required before the mixer stage.

Instead of using "square-top" control pulses as indicated in Fig. 4, in an arrangement according to the invention control pulses consisting of a potential or potentials varying continuously in a predetermined manner, preferably, proportionately with time in saw-tooth form, may be used, the bias potentials on the control grids on which the saw-tooth impulses are impressed to control the operation of the generator being adjusted so that the stopping pulse acts at the required interval after a starting pulse. With such an arrangement, by adjusting the bias potentials on the control grids, the duration of the pulses generated may be given different values as desired.

I claim:

1. A system for producing impulses of predetermined duration comprising a multi-vibrator including a pair of discharge tubes each having a cathode, a control electrode and an anode, means including a resistance for connecting each control electrode to the cathode of each tube, means including a condenser for connecting the control electrode of each tube to the anode of the other tube, means including a resistance for maintaining each anode positive with respect to each cathode, means for triggering one of the tubes with an impulse to render the tube con-

ducting, a delay network, and means including said delay network for triggering the other tube by the same impulse a predetermined time after the first tube is triggered, the time interval being determined by the delay network.

2. A system for producing impulses of predetermined duration comprising a pair of discharge tubes each including a cathode, a control electrode and an anode, a resistance and a condenser connected in series between the anode and the cathode of each tube, means for connecting the control electrode of each tube to the junction of the series connected condenser and resistance of the other tube, a resistance connected to the anode of each discharge tube and means including a source of potential and said last-named resistance for maintaining the anodes positive with respect to the cathodes, a delay network, means for applying an impulse to the delay network and to one of the discharge tubes in order to render said one discharge tube conducting, and means including said delay network for applying the same impulse to the other discharge tube after the impulse has been subjected to a time delay by said delay network, whereby the other tube will be rendered conductive a predetermined length of time after said one tube is rendered conductive whereby impulses of a predetermined duration may be developed.

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