Sept. 17, 1940. D. J. FEWINGS 2,215,175

TELEVISION SYNCHRONIZING IMPULSE SEPARATOR CIRCUIT

Filed Feb. 28, 1939 2 Sheets-Sheet 1

Fig. 1

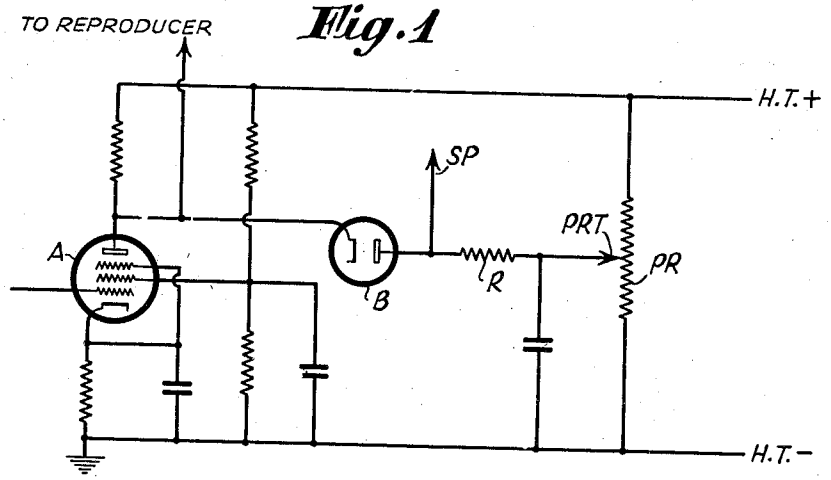


Fig. 2

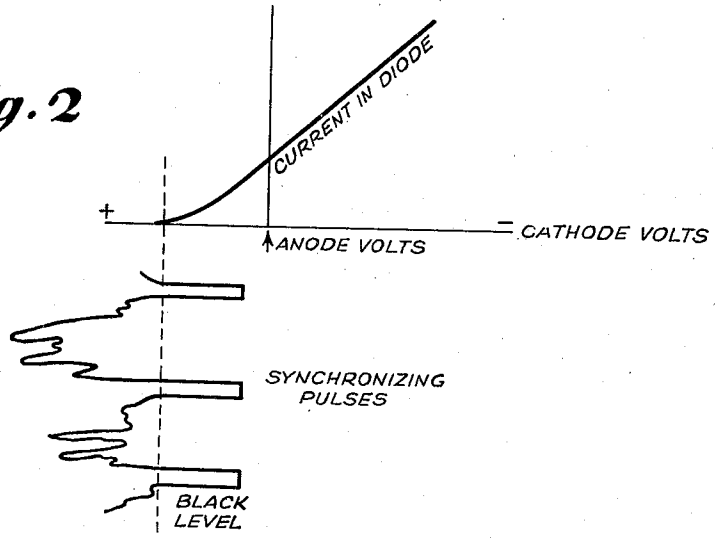
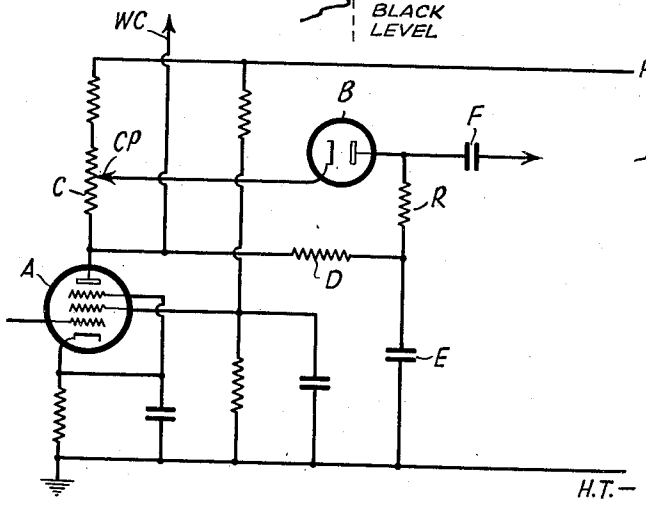


Fig. 3



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Fig. 4

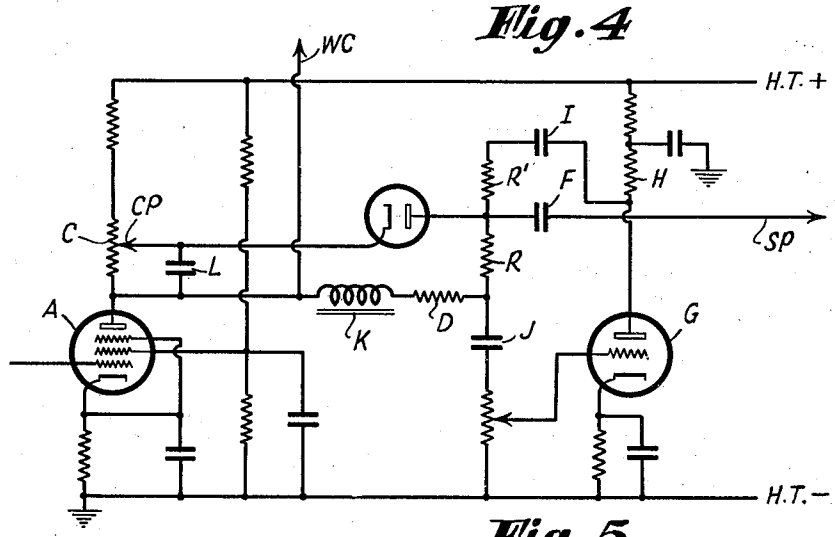


Fig. 5

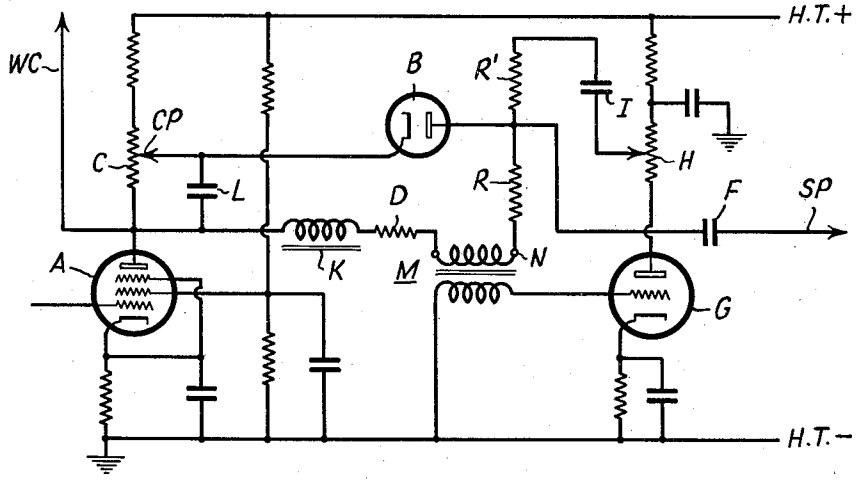
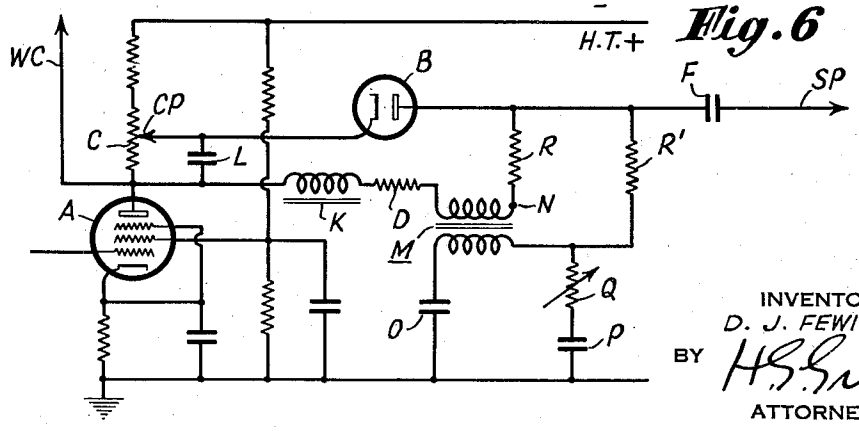


Fig. 6



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UNITED STATES PATENT OFFICE

2,215,175

TELEVISION SYNCHRONIZING IMPULSE SEPARATOR CIRCUIT

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Application February 28, 1939, Serial No. 258,863
In Great Britain March 4, 1938

3 Claims. (Cl. 178—69.5)

This invention relates to synchronizing impulse separator circuits for use in television receivers.

It is usual in modern television systems to effect synchronization of scanning action at transmitter and cooperating receiver, by transmitting synchronizing impulses at the ends of the scanning lines and at the end of the framing periods, these impulses being separated out from the video signals at the receiver and used to control the time base circuits or other means at said receiver for securing scanning action. In order to facilitate separation of the synchronizing impulses at the receiver it is usual to make them "blacker than black," i. e., to transmit them in the same direction as "black" video signals, but to make them of larger amplitude than "black" video signals. This enables the synchronizing signals to be separated out by amplitude separation methods and various known separating circuits, some employing biased diodes, others employing valves biased to cut-off or limiting valves, have been proposed for the purpose. The diode type of separating circuit is, however, the most satisfactory by reason of the fact that the characteristic curve of a diode is very steep in the region of cut-off and the cut-off is sharp.

The invention is illustrated in and explained in connection with the drawings wherein:

Figure 1 shows a known system for separating picture signals and synchronizing impulses.

Figure 2 shows a characteristic curve of a diode, and

Figures 3 through 6 show synchronizing impulse separator circuits in accordance with this invention.

Figure 1 of the drawings shows diagrammatically a known amplitude separating circuit of the diode type. Here A represents the last valve of the normally provided video amplifier of a television receiver. The anode of the valve A is D. C. coupled over lead WC to the Wehnelt cylinder (not shown) or equivalent control electrode of the normally provided cathode ray reproducer tube. The video signal at the anode of the valve A is such that "white" signals are in the positive direction and synchronizing pulses in the negative direction. The anode of the valve A is connected to the cathode of a diode B whose anode is connected through a resistance R to a point PRT on a potentiometer resistance PR connected across the high tension source. This arrangement will give a measure of separation since if the bias on the diode is such that it just cuts off on a "black" signal, a "blacker than black" signal, i. e., a synchronizing pulse, will cause current to flow through the diode whereas, for any signal between "black" and "white" the diode will pass no current. Separated synchronizing pulses can be taken off by way of lead SP and utilized in any known way. The action is represented in conventional graphical manner in Figure 2 of the drawings which shows a diode characteristic curve with cathode voltages varying from a few volts more positive to a few volts more negative than its anode voltage.

The serious defect of the known arrangement of Figure 1 arises from the fact that the video signals in modern television systems include a D. C. component (corresponding to "mean picture" brightness or "background") which varies very substantially from time to time so that a bias setting which is quite satisfactory for one scene may be badly wrong for the next, with the result that, when the bias is wrong, separation is incomplete and video signals may pass through the diode and interfere with the correct functioning of the time bases.

According to this invention in its broadest aspect, an amplitude separating circuit in a television apparatus for separating synchronizing pulses from video signals of smaller amplitude, said circuit being of the type wherein separation is effected by means including an electron discharge device arranged to operate over a sharply curved part of its anode current anode voltage characteristic and to which the video signals and synchronizing impulses are applied is characterized by the provision of means for rendering the voltage applied across said device substantially independent of slow variations in the video signals.

In Figure 3—this is not a preferred embodiment—the cathode of the diode B is tapped at CP upon a resistance C in the anode circuit of the valve A. The anode of valve A is connected to the anode of diode B through resistances D and R in series and the junction point between D and R is connected to the cathode of valve A (earth) through a condenser E. Separated synchronizing signals are fed to wire SP via condenser F.

With this arrangement the voltage drop in the resistance C causes the diode anode to be slightly less positive than the diode cathode i. e. the diode is "biased back". The condenser E is large enough to by-pass video signals to ground but not large enough materially to effect slow changes of voltage such as variations in the D. C. component of the video signals. The resistance D is

large enough to prevent any appreciable adverse effect of condenser E upon picture quality.

The circuit of Figure 3, though a marked improvement on that of Figure 1, has two defects which render it not to be preferred. First the condenser E is necessarily of such capacity as to present substantial reactance at the framing frequency—50 cycles per second (say)—with the result that modified framing pulses, which may disturb the working datum are passed on to the diode anode. Also this condenser, when smoothing video signals of large amplitude, assumes a positive charge which is passed on to the diode anode. When a scene is "faded out" this charge is lost, the positive bias on the diode anode is reduced and if the total video signal is not of sufficient amplitude synchronism may be lost. Both these defects are reduced to negligible proportions in the preferred arrangement of Figure 4.

In Figure 4 a choke K is inserted in series with resistance D between resistance R and the anode of valve A and the junction of D and R is connected to ground through a condenser J in series with a potentiometer resistance. The adjustable tap on the potentiometer resistance is connected to the grid of valve G in whose anode circuit is included a resistance H. The anode of valve G is connected to the anode of the diode through a condenser I in series with a resistance R'. As will be seen the valve G reverses the phase of the reduced video signals arriving at the anode of the diode by way of K, D and R and the reversed phase signals are applied to the diode anode by way of I and R' at such strength as just to cancel out the unreversed signals arriving at said anode through K, D and R. The strength of the compensating, reversed signals applied by way of I and J may be adjusted by adjusting the grid potentiometer through which the valve G is fed. The valve G will not effect slow changes of D. C. potential on the anode of the diode, which changes can occur freely with and will accompany corresponding changes on the diode cathode. The actual D. C. voltage across the diode will, therefore, remain substantially constant over normal fluctuations of anode current in the valve A. To give a practical case, resistance C may be about 100 ohms so that the change of bias due to fluctuations of anode current through it, will be very small. If the diode separator shown is followed by a limiter device (not shown but fed over wire SP) such changes as may occur will be of no consequence in any event. If desired, a large condenser L may be connected between the anode of valve A and the tap CP.

Figure 5 shows another preferred embodiment differing from Figure 4 mainly in that the capacity coupling provided by condenser J in Figure 4, is replaced by transformer coupling by means of a transformer M whose primary is inserted in series between D and R and whose secondary is in the grid circuit of valve G. The transformer connections are such that the phase at N and at the grid of valve G is the same. Another, but minor, difference between Figures 4 and 5 is that in the latter figure condenser I is adjustably tapped on resistance H instead of using a grid potentiometer for the valve G. The advantage of Figure 5 over Figure 4 is that the condenser J being eliminated there can be no D. C. bias developed at point N by virtue of video signals.

Figure 6 shows another preferred embodiment in which the valve G of Figures 4 and 5 is eliminated. Here a transformer M whose primary is, as in Figure 5, inserted between D and R, has its secondary connected at one end through resistance R' to the anode of the diode, the same end of the secondary being connected to earth through an adjustable resistance Q and a condenser P in series. The other end of the transformer secondary is earthed through condenser O. The connections of the transformer are such that the phase of the signals applied to R' is reversed as compared to the phase at point N. If the transformer turn ratio is of the order of 2 to 1 it is possible, by adjusting Q, to secure the result that the signals applied through R and R' to the diode anode cancel one another out.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:

1. A television system including an amplifier tube having a cathode, a control electrode and an anode, means including a load resistance for maintaining said anode positive with respect to said cathode, means for applying picture signals and synchronizing impulses to the control electrode of said amplifier tube, a resistance and a diode, means for connecting one end of the resistance to the anode of said amplifier tube, means for connecting the other end of the resistance to the diode anode, means for connecting the diode cathode to a point along said amplifier tube load resistance, a discharge tube including a cathode, a control electrode and an anode, means for coupling the control electrode of said discharge tube to a point along said resistance, means including another resistance for maintaining the anode of said discharge tube positive with respect to its cathode, means including a condenser for connecting the anode of said discharge tube to the diode anode, and an output circuit including the diode anode whereby synchronizing impulses alone may be present in the output circuit of substantially uniform intensity irrespective of the signal levels applied to said amplifier tube.

2. A television system including an amplifier tube having a cathode, a control electrode and an anode, means including a load resistance for maintaining said anode positive with respect to said cathode, means for applying picture signals and synchronizing impulses to the control electrode of said amplifier tube, a resistance and a diode, means for connecting one end of the resistance to the anode of said amplifier tube, means for connecting the other end of the resistance to the diode anode, means for connecting the diode cathode to a point along said amplifier tube load resistance, a discharge tube including a cathode, a control electrode and an anode, means including a condenser for coupling the control electrode of said discharge tube to a point along the resistance connected between the anodes of the amplifier tube and of the diode, means including another resistance for maintaining the anode of said discharge tube positive with respect to its cathode, means including a condenser and a still further resistance for connecting the anode of said discharge tube to the anode of said diode, and an output circuit including the anode of said diode whereby synchronizing signal impulses of substantially uniform intensity may be derived from the output circuit.

3. A television system including an amplifier tube having a cathode, a control electrode and

an anode, means including a load resistance for maintaining said anode positive with respect to said cathode, means for applying picture signals and synchronizing impulses to the control electrode of said amplifier tube, a resistance and a diode, means for connecting one end of the resistance to the anode of said multiplier tube, means for connecting the other end of the resistance to the diode anode, means for connecting the diode cathode to a point along said amplifier tube load resistance, a discharge tube including a cathode, a control electrode and an anode, means including a transformer for coupling the control electrode of said discharge tube to the current flow in the resistance connected between the anode of said amplifier tube and the anode of said diode, means including a further resistance for maintaining the anode of said discharge tube positive with respect to its cathode, means including a condenser for connecting the anode of said diode to a point along said further resistance, and an output circuit including the anode of said diode whereby synchronizing signals of substantially uniform intensity may be present in said output circuit.

DAVID JOHN FEWINGS.