

Oct. 10, 1939.

R. ANDRIEU

2,175,335

TELEVISION SYNCHRONIZING CIRCUITS

Filed May 6, 1937

Fig. 1

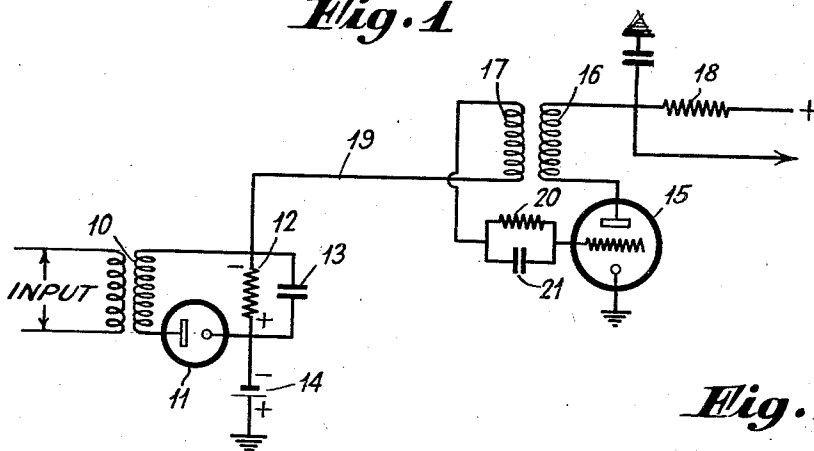


Fig. 2

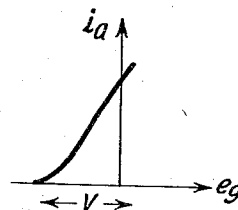


Fig. 3

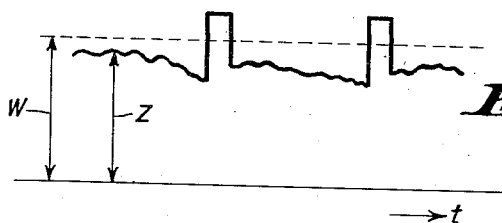
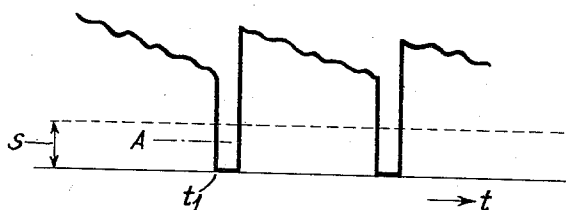
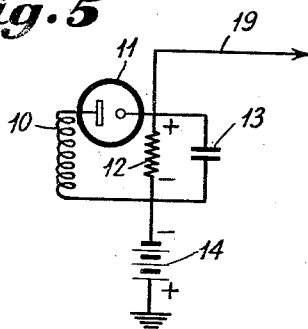


Fig. 4

Fig. 5



INVENTOR
ROBERT ANDRIEU
BY *H. S. Swann*
ATTORNEY

UNITED STATES PATENT OFFICE

2,175,335

TELEVISION SYNCHRONIZING CIRCUITS

Robert Andrieu, Berlin, Germany, assignor to
Telefunken Gesellschaft für Drahtlose Tele-
graphie m. b. H., Berlin, Germany, a corpora-
tion of Germany

Application May 6, 1937, Serial No. 141,082
In Germany May 6, 1936

6 Claims. (Cl. 178—44)

In the transmission of television images in which the synchronizing impulses and the image content are sent out by the modulation of the same carrier wave, a special tube has hitherto always been connected to the detector circuit supplying the modulation potential, i. e. the so-called low-frequency potential, and with the said tube the line impulses have been filtered out of the image content. This tube and its associated circuits have been termed the amplitude selection stage. In connection with this amplitude selection stage, a separate so-called automatic relaxation device was used which is either a tube connected in a blocking oscillator or a grid controlled discharge vessel with gas or vapor filling and arc discharge, serving to amplify the line impulses and to convert them into impulses having the same energy content.

In accordance with the invention the separation of the line impulses from the image content, as well as the amplification and conversion into impulses having the same energy content will be obtained by means of a single tube. This can be achieved with a combination of a tube in blocking oscillator circuit and suitable connection of the detector circuit as will be seen from the examples of construction described in the following, wherein

Fig. 1 is an embodiment of my invention,

Figs. 2, 3 and 4 are explanatory curves, and

Fig. 5 is a modification of a portion of Fig. 1.

In the mode of construction represented in Fig. 1, the secondary winding 10 of a high-frequency transformer has connected thereto a detector 11 and a resistance 12, the latter having the condenser 13 placed in parallel thereto. The lower end of the resistor 12 is joined to the negative pole of a direct potential source 14 whose positive pole is grounded. The blocking oscillator consists of a tube 15 whose plate circuit contains the primary winding 16 of a transformer which winding may be joined with a condenser connected in parallel thereto, while the secondary winding 17 of the said transformer is very closely coupled to the said primary winding. Furthermore, the plate circuit of the tube 15 also contains a resistor 18. One end of the secondary winding 17 is connected by means of line 19 with the upper end of the resistor 12, while the other end of the secondary winding is connected to the grid of the tube across a resistor 20 having the condenser 21 placed in parallel thereto. The condenser 21 must be large as compared with the ground capacity of the control grid, and it is furthermore advisable to choose as tube 15 a screen grid tube or pentode.

The circuit represented in Fig. 1 is suited for the known transmission method in which the amplitude of the carrier wave is controlled by the image content above the finite value designated

by S in Fig. 2, and controlled by the synchronizing impulses below said value. It is possible to assign the value S of the carrier amplitude to the black image parts, and a higher value for the carrier amplitude to the white image parts, or vice versa, to transmit at the value S the white image parts and at a higher value, the black parts. Furthermore, in each of the two cases, the synchronizing impulses can be transmitted by reducing the amplitude of the carrier wave to the zero value or to a value lower than the value S, yet still a finite value.

During the duration of the line there occurs a varying potential drop across the resistor 12 corresponding to the distribution of the brightness along the line, and having the direction indicated by the plus and minus signs. The voltage 14 must be lower than the negative grid bias potential V appertaining to the lower bend of the plate current grid voltage characteristic of tube 15 (see Fig. 3), such that the voltage drop through the resistor 12 is so high during the line duration and together with the potential 14 that no plate current can flow in the tube 15. The voltage at the condenser 21 placed at the grid circuit of tube 15 should for the first be assumed equal to zero, so that at the grid circuit only the voltage 14 and the voltage drop through the resistor 12 are effective. If in the moment t_1 in Fig. 2 the value S of the carrier amplitude has not been reached, then the potential of the control grid moves relatively to the cathode in the positive direction, and at the value A the voltage drop through the resistor 12 together with the voltage 14 may be assumed to have a smaller value than the value V in Fig. 3. Now, a plate current begins to flow in the tube, whereby a voltage appears at the secondary winding 17 which is positive as regards the control grid. The plate current once present will therefore be amplified until the control grid assumes cathode potential. At a slight increase beyond this value a grid current begins to flow producing a potential drop through the resistor 20, so that the grid potential remains constant for some time. As soon as the potential at the secondary winding 17 has exceeded its maximum value, the control grid potential will again be displaced in the negative direction so that the plate current begins to decrease again. This decrease entails a reversing of the voltage at the secondary winding 17 so that the control grid potential will even be more displaced in the negative direction, namely far beyond the lower bend of the plate current grid potential characteristic. The charge which the condenser 21 received previously through the grid current at first blocks the tube 15 whereafter it becomes slowly balanced across the resistor 20 which is for instance in the course of a duration of a line. Thus in the plate current of the tube 15 a current impulse appears whose energy con-

tent is independent of the interval between lines, and independent of the value to which the amplitude of the carrier wave has been reduced during the line interval. Consequently, also at the left end of the resistor 18, a voltage impulse appears having always the same pattern and always the same value and which can be utilized for synchronizing the saw-tooth line generator. The anode current impulse may however also be used to discharge a condenser inserted between the left end of the resistor 18 and ground. The resistor 18 operates then as charging resistor. The saw-tooth may, for instance, also be produced directly by means of the plate current impulse for instance in that a condenser is placed parallel to the resistor 18, and which will be charged by the plate current impulse and will again be discharged, during the duration of the line and across the resistor.

In the circuit arrangement described thus, the line impulses are separated from the image content, since during the duration of the line a voltage drop exists at the resistor 12 whose value is so high that the tube 15 cannot respond. Furthermore, in tube 15 the line impulse will be amplified very effectively, and converted at the same time into an impulse having constant energy content, since in fact the pattern of the plate current of tube 15 develops entirely independently of the pattern of the further line impulse as soon as the carrier amplitude has gone below the value A in Fig. 2. More especially the plate current does not depend on whether the line impulse lasts for a longer or shorter time, and is independent of the amplitude of said line impulse. A particular advantage of the described circuit arrangement is seen in that directly after the plate current impulse of the tube 15, the condenser 21 is being charged to a comparatively high potential representing a negative grid voltage for the tube 15, and that this voltage again disappears in a relatively slow manner across the resistor 20. The tube 15 therefore cannot be brought to response by disturbing impulses during the line deviation even where these impulses have a considerable amplitude. Not before the end of the line duration has the charge at the condenser 21 been able to become balanced to a fair degree across the resistor 20, so that then the reduction of the carrier wave amplitude below the value S and A (see Fig. 2) can again produce a flow of current in tube 15. Another embodiment of the idea of the invention relating to transmission methods according to Fig. 4 is shown in Fig. 5 of the drawing. In Fig. 4, the amplitude of the carrier wave W is controlled downwards by the image content, and upwards by the synchronizing impulses. During the duration of the line therefore, the carrier wave has for instance the amplitude value Z which is lower than the value W, and during the line interval the value W will be exceeded.

In Fig. 5, the reference characters 10 to 14 refer to the same means as in Fig. 1. However, during the duration of the line a voltage drop occurs through the resistor 12 which contrary to the circuit of Fig. 1 has the direction opposite to that of the potential source 14. The value of the potential source 14 is so dimensioned that the upper end of the resistor 12 also still retains at the value W of the amplitude of the carrier wave a negative potential relative to ground, and which is higher than the value V in Fig. 3. Only

when the carrier wave amplitude exceeds the value W in Fig. 4 does the upper end of the resistor 12 assume a negative potential relative to ground whose value is lower than the value V, so that across the line 19 the blocking oscillator circuit 15 to 17, 20, 21 can be operated in the same manner as was explained on hand of the Figs. 1 and 3.

It should also be remarked that in arrangements according to the invention also the vertical impulses can be separated from the image content, and can cause the response of the line generator. This condition need not be explained in detail herein, since the synchronizing of the generator for the vertical deviation can be carried out in various ways when utilizing the invention.

What I claim is:

1. Apparatus for separating sets of electrical signals having differing amplitudes comprising means for rectifying said impulses, a normally conductive path joined to said rectifying means, means for normally maintaining said conductive path at a point on its conductivity characteristic close to its cut-off point, and means for superimposing the rectified signals onto said latter means for controlling the conductivity of the conductive path.

2. Apparatus for separating sets of electrical signals having differing amplitudes comprising means for rectifying said impulses, a time constant circuit connected to said rectifying means, a normally conductive path joined to said rectifying means, means for normally maintaining said conductive path at a point on its conductivity characteristic close to its cut-off point, and means for superimposing the rectified signals onto said latter means for controlling the conductivity of the conductive path.

3. Apparatus for separating sets of electrical signals having differing amplitudes comprising a rectifier, a time constant circuit connected to said rectifier, a thermionic vacuum tube having anode, cathode and at least one control electrode, means for electrically connecting a control grid of the thermionic tube to the time constant circuit whereby increasing amplitudes of signals impressed on the rectifier bias the grid of the thermionic tube increasingly negative, and means for normally maintaining the thermionic tube at a point on its conducting characteristic close to its cut-off point.

4. Apparatus for separating sets of electrical signals having differing amplitudes comprising a rectifier, a time constant circuit connected to said rectifier, a thermionic vacuum tube having anode, cathode and at least one control electrode, means for electrically connecting a control grid of the thermionic tube to the time constant circuit whereby increasing amplitudes of signals impressed on the rectifier bias the grid of the thermionic tube increasingly positive, and means for normally maintaining the thermionic tube at a point on its conducting characteristic close to its cut-off point.

5. Apparatus in accordance with claim 3 wherein there is provided in addition a second time constant circuit connected serially with a control grid of the thermionic vacuum tube.

6. Apparatus in accordance with claim 4 wherein there is provided in addition a second time constant circuit connected serially with a control grid of the thermionic vacuum tube.

ROBERT ANDRIEU.