Oct. 28, 1941. M. P. WILDER 2,260,963

SELECTING CIRCUIT

Filed May 6, 1938

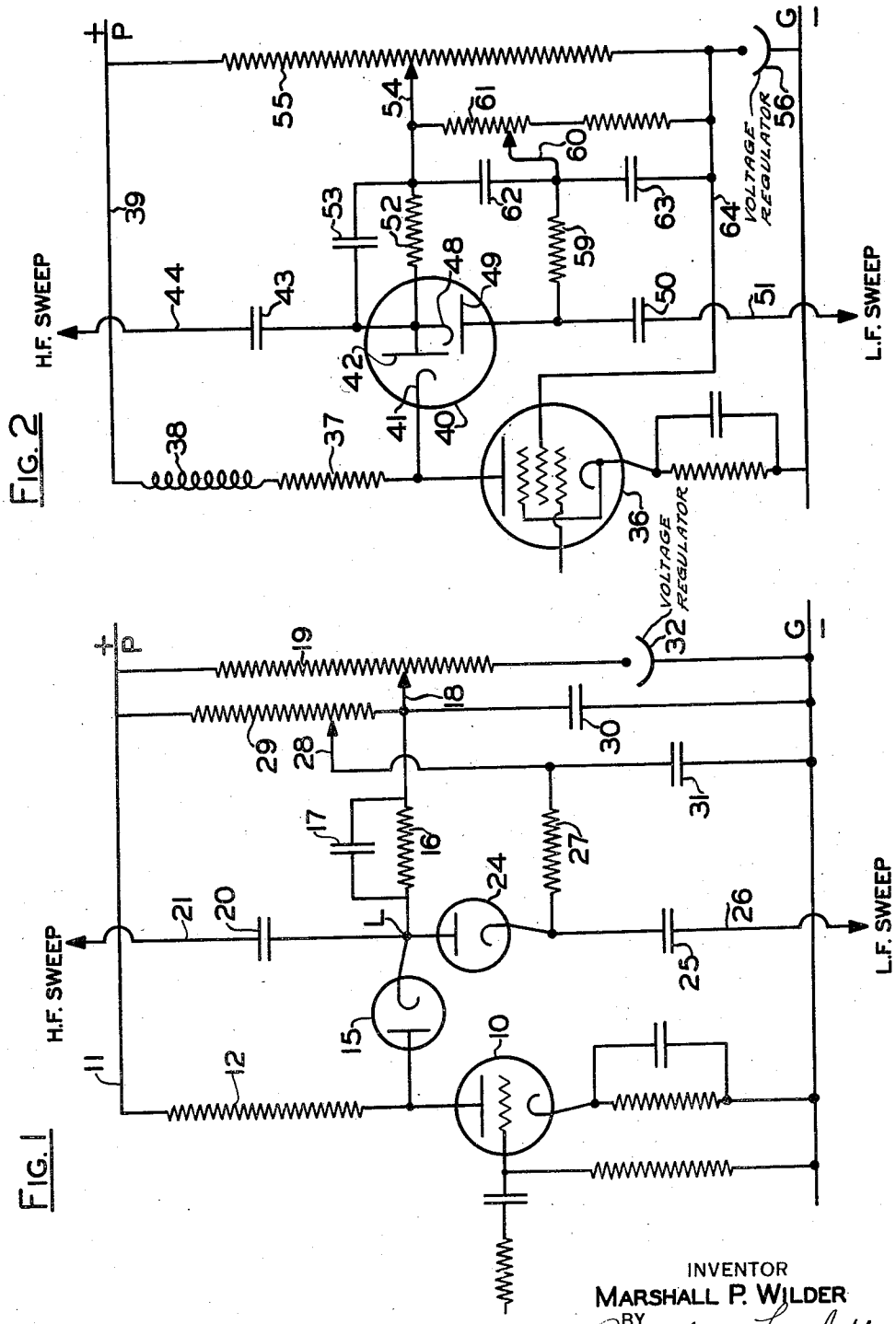

FIG. 2

FIG. 1

INVENTOR
MARSHALL P. WILDER
BY
Bohlebev & Fedbetter
ATTORNEYS

Patented Oct. 28, 1941

2,260,963

UNITED STATES PATENT OFFICE

2,260,963

SELECTING CIRCUIT

Marshall P. Wilder, Maplewood, N. J.

Application May 6, 1938, Serial No. 206,325

8 Claims. (Cl. 178—7.3)

The invention relates to a separation or selection circuit and is especially applicable for use with a television receiver for the purpose of separating or selecting a synchronizing signal or signals from the complex signal which includes the synchronizing blanking and picture signal. Selectors in general employ a means for separating one portion of a given complex signal, having a plurality of portions of different voltage amplitudes, from another portion of that signal by properly biasing a detector so that signals of an amplitude, either greater or less than that desired, will not pass through the detector, but the desired signal does pass therethrough.

An object of the invention is to produce a new and novel circuit for selecting synchronizing signals to control sweep circuits of television receivers which will separate the video signal and the synchronizing signal and also separate the synchronizing signal into its line and field synchronizing signals.

Another object of the invention is to produce a selecting circuit which utilizes an amplitude selector and a circuit having a time constant such that a predetermined frequency or amplitude of signal applied thereto will cause no building up of voltage therein, but a signal having a frequency or amplitude greater than the predetermined frequency or amplitude will cause an increase or building up of voltage in this circuit which controls a flow of current through the amplitude selector.

Another object is to devise a synchronizing circuit which will function to separate a compound signal into its parts irrespective of whether the signals differ as to amplitude or frequency.

A further object of this invention is to provide a means, simple and reliable, which will allow accurate phasing of an interlaced pattern to be reproduced in its original phase relation in the output circuit of the amplitude and frequency selector.

Other objects of the invention will be more apparent from the following description taken in connection with the accompanying drawing, illustrating preferred embodiments of the invention, in which:

Figure 1 is a circuit diagram of one simple form of the invention as applied particularly for a television receiver adapted to receive negatively modulated signals. The circuit illustrated therefore includes the final stage of a video amplifier and leads adapted to be connected with the low frequency and high frequency sweep circuits of a television receiver.

Figure 2 shows a circuit diagram as applied particularly for the selection of synchronizing signals for a television receiver adapted to receive positively modulated signals. This diagram also shows a video amplifier of the output pentode type, and connections which may be made with the low frequency and high frequency sweep circuits of the television receiver. The essential difference between the two circuits is that the diodes are reversed in one figure with respect to the diodes in the other figure.

The use of circuits hitherto for separating the video signal and the field and line synchronizing signals from a received television signal have been subject to certain difficulties. One important difficulty was that the characteristic curve of the network did not saturate deeply enough and it was difficult to determine the exact point where cut-out occurred. This difficulty in maintaining independent control of the various functions of a circuit through disadvantageous limitations introduces undesirable errors in the prior art frequency and amplitude circuits as they are generally employed.

The invention disclosed in Figure 1 takes the negatively modulated signal which is amplified in the tube **10** and separates it into its various component parts which, if it is a television signal, comprises the video, line and field synchronizing signals which are parts of a combined or complex signal. This tube may be of any desired type. The plate of the tube is connected to a source of potential through a wire **11** and a resistor **12**. As an example, for use with a television receiver, the resistor **12** preferably has a resistance of about 2000 ohms, or of such value that the voltage drop therethrough may be about 50 volts. A wide range of voltages is permissible.

A first amplitude selector **15**, which preferably is a diode, has its anode or plate connected directly with the plate of the tube **10**. The cathode of the diode is connected to a source of potential through a timing circuit which includes a resistance **16** and a condenser **17** connected in shunt therewith, an adjustable connection **18**, and a resistance **19**. The connection **18** enables the potential upon the cathode of the first diode to be adjusted to the proper value, as will appear more fully hereinafter. The cathode of the diode **15** is also connected through a condenser **20** and wire **21** to the circuit which will use the impulse passing through the first diode, such as a high frequency or line sweep circuit of a television receiver.

The cathode of the first amplitude selector or diode **15** is connected with the anode or plate of a second amplitude selector **24** which also is preferably a diode. The cathode of the diode **24** is connected with the low frequency or frame sweep of a television receiver through a blocking condenser **25** and wire **26**. The cathode of the diode **24** is connected through a resistance **27** to an adjustable connection **28** which contacts with a resistance **29** which is connected with a source of potential P. The adjustable connection **28** en-

ables the potential upon the cathode of the second amplitude selector or diode to be fixed at its proper value, as will appear hereinafter. A by-pass condenser 30 is connected between the variable connection 18 and ground G, and a by-pass condenser 31 is connected between the variable connection 28 and ground. The resistance 19 is connected to ground preferably through a voltage regulator tube 32.

The circuit described above and illustrated in Figure 1 operates in a manner now to be described. Suppose that the voltage of the source of potential which is connected with the output tube 10 is 250 volts and the dropping resistor 12 has a resistance of about 2000 ohms, the plate or anode current drawn through the resistor will cause a voltage drop so that the potential at the anode will be about 200 volts, or in other words, there is a drop of about 50 volts in the anode output resistance. The anode of the first diode 15 is joined directly to the anode of the output amplifying tube 10 so that the potential of the former is the same as and varies with the potential upon the plate of the tube 10. Now the voltage on the cathode of the first diode 15 is adjusted by the connection 18 to a value so that the cathode will be more positive or have a higher voltage than the anode of the diode which may be, say, 220 volts. In this condition no current can flow from the cathode to the anode of the first diode.

Now let it be assumed that a negative voltage arrives on the grid of the output amplifying tube 10 which causes less current to flow through the tube and resistor and hence will raise the anode voltage from 200 to about 220, or perhaps a little over. The cathode of the diode 15 is at 220 volts so that a voltage condition has been reached between cathode and plate of the diode which will just begin to allow current to pass therethrough. If the grid of the output tube becomes still more negative because of the received signal, this will further increase the voltage on the plate of the output tube as well as on the plate of the diode to something greater than 220 volts, and hence the cathode of this first diode will be sufficiently negative with respect to its anode, or the anode will be sufficiently positive with respect to its cathode that a current will flow through the first diode and the resistor 16. It will be seen, therefore, that only that portion of a signal, the amplitude of which is large enough, such as the synchronizing portion of a television signal, will get through this biased detector or first diode.

Now if the frequency of the signal which gets through the first diode 15 is of the order of 10,000 cycles and the time constant of the condenser 17 resistor 16 combination is calculated or selected short enough, the condenser will be completely discharged by the resistor, each time it is charged up, and the potential on either side of this circuit will remain substantially constant.

Now, if either the frequency or the duration of an impulse of the signal which passes through diode 15 is greater than that which will discharge through the resistor 16, this higher frequency or longer impulse duration will charge the condenser 17 faster than the resistor 16 can discharge it, and the signal will integrate or build up voltage in this timing circuit at the point L. In other words, the potential on the side of the capacity resistance or timing circuit at the junction of the first diode 15 and the second diode 24 will increase and hence increase the potential upon the plate of the second diode 24.

The cathode of the second diode 24 has its potential adjusted by a potentiometer, that is by the adjustable connection 28, higher than or more positive than the plate of the second diode so that normally no current will flow therethrough. However, by the integration or building up of voltage amplitude in the timing circuit 16, 17, the plate becomes more positive than the cathode and a current will then flow through this second diode, which current will control the low frequency or field synchronizing sweep of the television receiver.

The timing circuit 16, 17 functions in a way which enables the circuit to select the voltage at any point in the process of voltage integration or at any desired synchronizing signal. It has been described how the timing circuit builds up or integrates impulses from a signal either of greater magnitude or greater duration than the frequency or duration for which the timing circuit has been designed to discharge before the next impulse is received. This building up of voltage, however, is not uniform, that is would not be a smooth curve if plotted, but one impulse is received and is discharged to a certain extent and, because of the timing constant of the circuit, it is not completely discharged or dissipated when a second impulse is received which builds up the voltage to a still higher level, and this charge begins to discharge through the resistor 16, but before it is discharged a third impulse sends the voltage still higher and so on. The extent of the discharge for each impulse, which is, however, relatively unimportant, depends upon the timing constant of the timing circuit 16, 17, but by adjusting or setting the voltage upon the cathode of the diode 24 through the connection 28, this second diode can be set to pass current therethrough at any desired one of these integrations and hence at any desired synchronizing impulse. This gives extremely accurate control of the low frequency or field sweep circuit.

In some types of synchronizing systems, the synchronizing signal does not consist of impulses of different frequency as in one system, but consists instead of an impulse of greater or longer amplitude than others. The circuit described will function in the same manner as described above, and the second biased diode 24 will select this type of signal equally as well and with the same accurate control as for a signal of a different frequency, as described above.

The circuit illustrated in Figure 1 may be used for separating or selecting a signal, such as a positively modulated television signal, into its separate parts merely by reversing the connections with the diodes 15 and 24 and proper adjustment of the potentiometers for the diodes, as will be explained hereinafter. Figure 2 shows a circuit essentially like the circuit of Figure 1, but with the diodes reversed. A few other changes, which are not essential in order to convert the circuit of Figure 1 for positively modulated signals, are illustrated. These unessential changes are shown to illustrate some of the changes which may be made in the circuit without deviating from the invention. In Figure 2 the plate of an output pentode is connected with a source of potential P through a resistance 37, preferably a choke 38, and a wire 39. The circuit may use a double diode 40, in place of the separate didodes 15 and 24 illustrated in Figure 1, which functions identically the same as a pair of single diodes. The cathode 41 of the first diode is connected with the plate of the pentode

36. The plate 42 of the first diode is connected through a condenser 43 and wire 44 to the high frequency or line sweep of a television receiver.

The plate 42 of the first diode is also connected with the cathode 48 of the second diode, and the plate 49 of this second diode is connected through a condenser 50 and wire 51 to the low frequency or field sweep of the television receiver. The plate 42 of the first diode is connected to a resistance 52 which is shunted by a condenser 53 to form a timing circuit identical in function with the timing circuit 16, 17 of Figure 1. The value of condenser and resistance is determined or selected so that one signal, such as the line impulse of a television signal, will discharge through the resistance before a second line impulse is received, but an impulse of greater frequency or duration, such as a field signal, will not discharge before a second impulse is received and hence the potential between the diodes builds up. The resistance 52 is connected to an adjustable connection 54. The adjustable connection may be connected anywhere along the resistance 55 to form a potentiometer, and the resistance is connected between the source of potential P and ground preferably through a voltage regulator tube 56.

The plate 49 of the second diode is connected through the resistance 59 to an adjustable connection 60 which may be connected anywhere along a resistance 61 to form a potentiometer. A by-pass condenser 62 is connected between the variable connection 60 and the adjustable connection 54, and a second by-pass condenser 63 is connected between the adjustable connection 60 and a wire 64 connected between one of the grids of the pentode 36 and the positive side of the voltage regulator tube 56.

In the construction of Figure 2, the adjustable connection 54 is moved so that the plate 42 of the first amplitude selector or diode becomes more negative than the cathode 41, or has a potential lower than that upon the cathode. If now a signal having a positive potential is applied to the grid of the output pentode 36, an increased current passes through the pentode and resistance 37 which increases the voltage drop through the resistance, so that the cathode 41 becomes more negative than the plate 42 and a current passes through the diode to control the high frequency or line sweep circuit of the television receiver. The resistance capacity circuit 52, 53 has been calculated or selected so that the condenser will discharge through the resistance before a second impulse is received and hence no integration occurs.

Now if a positive potential is applied to the grid of the output pentode 36 which has a higher frequency or a greater amplitude than can be discharged by the resistance capacity circuit 52, 53, before a second impulse is received, these impulses integrate in the timing circuit 52, 53 in the same manner as described in connection with the timing circuit 16, 17 of Figure 1. The potential on the plate 49 of the second amplitude selector, or second diode, has been set through the adjustable connection 60 so that the potential normally thereon is more negative than the potential upon the cathode 48 and current normally does not pass therethrough. The higher frequency or greater amplitude signal, however, integrates in the resistor condenser circuit 52, 53 so that the cathode 48 of the second amplitude selector or diode becomes more negative than the plate 49 and a current passes therethrough which controls the low frequency or field sweep circuit of the television receiver.

It will be readily understood from the description of the circuit, in connection with Figure 1, that the potential upon the plate 49 may be set so that current passes therethrough at any desired integration of the signal, as described in connection with the circuit of Figure 1, and thereby the same very accurate control of the sweep circuits may be obtained.

This invention is presented to fill a need for improvements in a selecting circuit. It is understood that various modifications in structure, as well as changes in mode of operation, assembly, and manner of use, may and often do occur to those skilled in the art, especially after benefitting from the teachings of an invention. Hence, it will be understood that this disclosure is illustrative of preferred means of embodying the invention in useful form by explaining the construction, operation and advantages thereof.

What is claimed is:

1. A signal separating circuit comprising an amplifier, means to supply signals to said amplifier, a single integrating circuit, a rectifying device connected between said amplifier and said integrating circuit, means to render said rectifying device operative to pass to the integrating circuit only those signal outputs from said amplifier whose amplitude departs from a predetermined value in one direction only, a unilateral conducting device connected to said integrating circuit at the junction of said rectifying device and said integrating circuit, means to render said unilateral conducting device operative to pass energy from said integrating circuit only when said energy exceeds a predetermined value, terminal means to derive control signals from the signal output of said rectifying device, and terminal means to derive other control signals from the energy passed by the unilateral conducting device.

2. A signal separating circuit comprising an amplifier, means to supply signals to said amplifier, a single integrating circuit, a rectifying device connected between said amplifier and said integrating circuit, means to render said rectifying device operative to pass to the integrating circuit only those signal outputs from said amplifier whose amplitude exceeds a predetermined value, a unilateral conducting device connected to said integrating circuit at the junction of said rectifying device and said integrating circuit, means to render said unilateral conducting device operative to pass energy from said integrating circuit only when said energy exceeds a predetermined value, terminal means to derive control signals from the signal outputs of said rectifying device, and terminal means to derive other control signals from the energy passed by the unilateral conducting device.

3. A signal separating circuit comprising an amplifier, means to supply signals to said amplifier, a single integrating circuit, a rectifying device connected between said amplifier and said integrating circuit, means to render said rectifying device operative to pass to the integrating circuit only those signal outputs from said amplifier whose amplitude falls below a predetermined value, a unilateral conducting device connected to said integrating circuit at the junction of said rectifying device and said integrating circuit, means to render said unilateral conducting device operative to pass energy from said integrating circuit only when said energy exceeds

a predetermined value, terminal means to derive control signals from the signal outputs of said rectifying device, and terminal means to derive other control signals from the energy passed by the unilateral conducting device.

4. A circuit for television receivers for separating higher frequency or portions of longer amplitude durations from a signal having a plurality of different frequencies or amplitude durations comprising a first diode adapted to be connected in the television circuit and having a cathode and plate, said first diode being connected with the line control circuit of the receiver; a resistance capacity circuit having a time constant chosen to allow each pulse of a predetermined frequency and duration to build up a voltage therein and to discharge a portion thereof before the next pulse arrives, the resistance capacity circuit also having a time constant to discharge for pulses of other frequencies and durations without an increase of voltage including a resistance, and a capacity connected in parallel therewith, said resistance capacity circuit being connected to the output of the diode; a second diode having a cathode and plate one of which is connected to the input side of the resistance capacity circuit and the other is adapted to be connected with the frame control circuit of the receiver; and means to apply a biasing voltage between the cathode and plate of the first diode by which the cathode normally has a predetermined higher voltage than the plate so that current passes therethrough only when the voltage upon the plate increases over that of the cathode under the influence of a synchronizing impulse, the next aforesaid means also applying a biasing voltage between the cathode and plate of the second diode by which the cathode normally has a predetermined higher voltage than the plate so that current passes therethrough only when a predetermined number of the desired pulses has built up the voltage in the resistance capacity circuit sufficiently to bring the plate voltage higher than that of the cathode.

5. A signal separating circuit comprising an amplifier, means to supply a plurality of signals to said amplifier, two of said signals having a polarity opposite to the remaining signals, a single integrating circuit, a rectifying device connected between said amplifier and said integrating circuit, means to render said rectifying device operative to pass to the integrating circuit only said two signals from said amplifier, a unilateral conducting device connected to said integrating circuit at the junction of said rectifying device and said integrating circuit, means to render said unilateral conducting device operative to pass energy from said integrating circuit only when said energy exceeds a predetermined value, terminal means to derive control signals from the signals passed by said rectifying device, and terminal means to derive other control signals from the energy passed by the unilateral conducting device.

6. A signal separating circuit comprising an amplifier, means to supply signals to said amplifier, a single integrating circuit, a rectifying device connected between said amplified and said integrating circuit, biasing means to render said rectifying device operative to pass to the integrating circuit only those signal outputs from said amplifier whose amplitude departs from a predetermined value in one direction only, a unilateral conducting device connected to said integrating circuit at the junction of said rectifying device and said integrating circuit, biasing means to render said unilateral conducting device operative to pass energy from said integrating circuit only when said energy exceeds a predetermined value, terminal means to derive control signals from the signal outputs of said rectifying device, and terminal means to derive other control signals from the energy passed by the unilateral conducting device.

7. A circuit for television receivers for separating higher frequency or portions of longer durations from a signal having a plurality of different frequencies or durations comprising an amplifying tube, a resistance connected in the plate circuit of the amplifying tube, a first diode connected between the resistance and plate of the amplifying tube and having a cathode and plate, a resistance capacity circuit having a time constant chosen to allow certain desired frequencies to build up voltages therein and then to discharge a portion thereof, the time constant also being chosen to discharge for other frequencies or durations without an increase of voltage including a resistance, and a capacity connected in parallel therewith, said resistance capacity circuit being connected to the output of the diode; a second diode having a cathode and plate one of which is connected to the input side of the resistance capacity circuit and the other is adapted to be connected with the frame control circuit of the receiver; and means to apply a biasing voltage between the cathode and plate of the first diode by which the cathode normally has a predetermined higher voltage than the plate so that current passes therethrough only when the voltage upon the plate increases over that of the cathode under the influence of a synchronizing impulse, the next aforesaid means also applying a biasing voltage between the cathode and plate of the second diode by which the cathode normally has a predetermined higher voltage than the plate so that current passes therethrough only when a predetermined number of the pulses of the desired frequency and duration has built up the voltage in the resistance capacity circuit sufficiently to bring the plate voltage higher than that of the cathode.

8. A signal separating circuit comprising an amplifier, means to supply signals to said amplifier, a single integrating circuit, a first rectifier connected between said amplifier and said integrating circuit, biasing means to render said first rectifier operative to pass to the integrating circuit only those signal outputs from said amplifier whose amplitude departs from a predetermined value in one direction only, a second rectifier connected to said integrating circuit at the junction of said first unilateral conducting device and said integrating circuit, biasing means to render said second rectifier operative to pass energy from said integrating circuit only when said energy exceeds a predetermined value, terminal means to derive control signals from the signal outputs of said first rectifier, and terminal means to derive other control signals from the energy passed by the second rectifier.

MARSHALL P. WILDER.