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2,145,332

TELEVISION SYSTEM

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5 Claims. (Cl. 172-281)

My invention relates to television apparatus and particularly to a system for generating synchronizing impulses.

In my application Serial No. 728,147, filed May 29, 1934, and assigned to the Radio Corporation of America, I have described and claimed a television transmitter in which synchronizing impulses of a certain character are generated by means of a rotating disc and photoelectric cell. These synchronizing impulses comprise vertical synchronizing impulses, which occur at a comparatively low framing frequency and horizontal synchronizing impulses which occur at a comparatively high line frequency. The vertical synchronizing impulses are "slotted", that is, gaps are produced therein, and groups of impulses occurring at twice the line frequency are mixed with the slotted impulses.

A vacuum tube generator, free of moving parts, which produces synchronizing impulses of the above-described character, is described and claimed in Patent 2,132,655, issued to John P. Smith and assigned to the Radio Corporation of America.

An object of the present invention is to provide an improved method of and means for producing synchronizing impulses of the general character described in the above-mentioned applications.

A further object of my invention is to provide an improved method of and means for producing "slotted" vertical synchronizing impulses.

A still further object of my invention is to provide an improved method of and means for doubling or further multiplying the frequency of occurrence of voltage impulses.

In practicing my invention, I produce a "slotted" rectangular impulse by generating a comparatively narrow rectangular impulse and passing it through a delay network. The narrow impulse is taken off different sections of the delay network whereby a plurality of narrow impulses occurring at different times are obtained. These impulses are then combined to give the desired slotted impulse.

I double the frequency of rectangular impulses in a similar manner by delaying one group of impulses and combining them with a group of impulses which either are not delayed or which are delayed a less amount. The delay of the one group of impulses is sufficient to make them fall half way between the other group of impulses, whereby the effect of doubling the frequency is obtained.

Other objects, features and advantages of my

invention will appear from the following description taken in connection with the accompanying drawing in which the single figure is a circuit diagram of one embodiment of my invention.

The synchronizing impulse generator illustrated in the drawing is designed for a television system employing interlaced scanning, the interlacing being produced by the "odd line" method. Referring to the drawing, the impulse generator preferably includes a vacuum tube oscillator, such as the multivibrator indicated at 1, for producing voltage impulses occurring at the desired frequency, this being 10,290 per second in the specific embodiment being described. These impulses, after being narrowed the proper amount, or otherwise reshaped and/or delayed, are mixed with other impulses as hereinafter described and applied to the deflecting circuits of the cathode ray transmitter tube and cathode ray receiver tube for maintaining the horizontal deflection at the transmitter and receiver in synchronism, these deflecting circuits and tubes not being shown in the drawing.

In order to obtain synchronizing impulses for maintaining the vertical deflection of the cathode ray at the receiver in synchronism with the vertical deflection of the cathode ray at the transmitter, the 10,290 cycle impulses are supplied to a frequency divider indicated at 2, which may consist of several multivibrators connected in cascade, to produce voltage impulses occurring at the rate of 60 per second.

The multivibrator 1 and the frequency dividers 2 may be of the type described in the above-mentioned Smith application. Preferably, the multivibrator 1 is caused to operate in synchronism with a 60 cycle power line, indicated at 3, as described in the said Smith application.

The 60 cycle impulses are passed through a wave shaper 4, which may include a differentiating network and vacuum tube peak clippers as described in the above-identified Smith application, in order to produce a comparatively narrow rectangular voltage impulse indicated at 6. It will be understood that any other suitable means for producing a rectangular voltage impulse of the desired characteristic may be utilized.

The voltage impulse 6 is passed through a vacuum tube 7 into a delay network 8. The delay network 8 may be of conventional design comprising a plurality of delay sections, each section consisting of a series inductance coil 9 and a shunt capacity 11. The delay network is suitably terminated by a resistor 12.

At various points along the delay network 8,

the 60 cycle voltage impulse 6 will be delayed different amounts. In the circuit illustrated, the voltage impulse is taken off the delay network at three points by means of the circuits or channels 13, 14 and 16. These circuits include the resistors 17, 18 and 19, respectively, whereby the three circuits may be connected to a common circuit 21 without short-circuiting the coils 9. The circuit 13 also includes a switch 25 which, when closed, short-circuits a wave shaper 40 provided for purposes hereinafter described.

The voltage impulse supplied to the common circuit 21 through the channel 13 is indicated at 22. The voltage impulse supplied to the common circuit 21 from the second channel 14 is indicated at 23, and the voltage impulse supplied to the common circuit 21 from the third channel 16 is indicated at 24. As indicated by the dotted line 26, which represents zero time, the impulses appearing in the separate channels are delayed different amounts whereby, when combined in the common circuit 21, they produce the described "slotted" vertical synchronizing impulse represented at 27.

The "slotted" impulse is only one specific example of many complex electrical waves which may be produced by practicing my invention. If desired, a wave shaper such as the one indicated at 40 may be included in one of the channels leading from the delay network whereby the impulse supplied by the one channel may be narrowed any desired amount, rounded at the top, or otherwise shaped. Such an impulse may be combined with the impulse from the channel 14 only, the delay of the two impulses being such that one impulse begins the instant the other impulse ends. Thus a solid or unslotted impulse of the desired irregular wave form is produced.

As described in the two above-mentioned applications, in an interlaced scanning system it is desirable to have each vertical synchronizing impulse preceded by a group of voltage impulses which occur at a higher frequency than the horizontal deflecting or line frequency. An improved way of obtaining impulses which occur at double the line frequency will now be described. The 10,290 cycle impulses are passed through a wave-shaper 28, which may be of any suitable type for narrowing and "squaring up" the voltage impulses. After these impulses have been passed through an amplifier tube 29, they appear as shown by the curve 31.

The frequency of these impulses is doubled by passing them through a delay network 32, which may be of the type described above, and the impulses are taken off the delay network at two different points. From the first point, the impulses pass through a circuit 30 including a resistor 33, and from the second point they pass through a circuit 34 including a resistor 35. The two circuits are connected to a common conductor 36 which supplies signal to a clipping circuit 37. The voltage impulses appearing in conductor 36 and supplied to the clipping circuit 37 are double frequency impulses as indicated by the curve 38.

The result of doubling the frequency is obtained by causing the impulses which are supplied from the second circuit 34 to have a delay sufficient to make them fall exactly half way between the impulses supplied by the circuit 30. It will be understood, of course, that only one group of the 10,290 cycle impulses need be delayed; the only reason for delaying impulses supplied by the circuit 30 being that it may be de-

sirable to delay the complete group of double frequency impulses to make them occur in the proper time relation to the slotted vertical synchronizing impulses.

The double frequency impulses supplied to the clipping circuit 37 occur continuously, and as described in the above-mentioned applications, it is desired that they occur only in the region of the vertical synchronizing impulses. A group of double frequency impulses may be caused to occur periodically by resorting to various circuits.

In the specific circuit being described, the desired result is accomplished by means of the clipping circuit 37 which may be the same as the circuit described in the above-mentioned Smith application for accomplishing the same purpose. The clipping circuit 37 passes only voltage impulses which are raised above a certain level. The group of double frequency impulses which are to appear in the output of the clipping circuit 37 are raised above this level by means of a rectangular voltage impulse 39 of comparatively long duration, which is obtained by passing the 60 cycle impulse from frequency divider 2 through a suitable wave shaper 41. The resulting group of double frequency impulses is indicated at 42.

Referring now to the horizontal synchronizing impulses, the 10,290 cycle impulses, after being passed through a suitable wave shaper 43 to produce the narrowed impulses indicated at 45, are supplied to a clipping circuit 44 by means of which a group of the 10,290 cycle impulses is removed to provide room for the insertion of the double frequency impulses.

The desired group of impulses may be removed, in the manner described in the above-mentioned Smith application, by mixing a 60 cycle rectangular impulse of comparatively long duration with the 10,290 cycle impulses to depress the group of undesired impulses below a certain level; only the impulses above this level being passed by the clipping circuit 44. The 60 cycle impulse which is supplied to the clipping circuit 44 is indicated at 46, this impulse being obtained by passing the 60 cycle impulses from frequency divider 2 through a suitable wave shaper 47. The curve 48 indicates how three of the 10,290 cycle impulses have been removed in the circuit 44.

The final synchronizing signal, consisting of slotted vertical synchronizing impulses, the double frequency impulses, and the horizontal synchronizing impulses is obtained by combining the three groups of impulses in a common circuit in the proper time relation as described in the above-identified Smith application. The resulting signal, after it has been passed through a peak clipper 51 to cause all the voltage impulses to have the same amplitude, is indicated at 52.

It will be apparent from the foregoing description that various modifications may be made in my invention without departing from the spirit and scope thereof, and I desire, therefore, that only such limitations shall be imposed thereon as are necessitated by the prior art and are set forth in the appended claims.

I claim as my invention:

1. Apparatus for generating a slotted wave which comprises means for generating a substantially rectangular electrical wave, means for delaying said wave by an amount greater than the width of said wave to produce a delayed rectangular electrical wave, and means for com-

binning said two electrical waves to produce said slotted wave.

5 2. The method of producing a slotted wave which comprises producing a substantially rectangular electrical impulse, delaying said electrical impulse by an amount greater than the width of said impulse to produce a delayed rectangular impulse, and combining said two im-
10 pulses to produce said slotted wave.

10 3. In a television system, the method of producing a slotted vertical synchronizing impulse which comprises producing a comparatively narrow substantially rectangular impulse and passing it through at least two circuits, delaying said
15 impulse in one of said circuits by an amount greater than the width of said impulse, and adding the outputs of said circuits.

20 4. A television system synchronizing impulse generator comprising means for producing a comparatively narrow substantially rectangular

electrical impulse occurring at the framing frequency, means for passing said impulse through a plurality of channels having different time constants, the difference between said time constants being sufficient to prevent overlapping of said impulses when they are added, and means
5 for adding the output of said channels.

5. In a television system, means for producing in one channel periodically recurring substantially rectangular impulses which occur at
10 widely spaced intervals as compared with the width or duration of each impulse, means for delaying said impulses in a second channel by an amount greater than the duration or width of
15 one of said impulses and by an amount which is small compared with said widely spaced intervals, and means for adding the outputs of said two channels whereby slotted impulses are produced which recur at widely spaced intervals.

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