

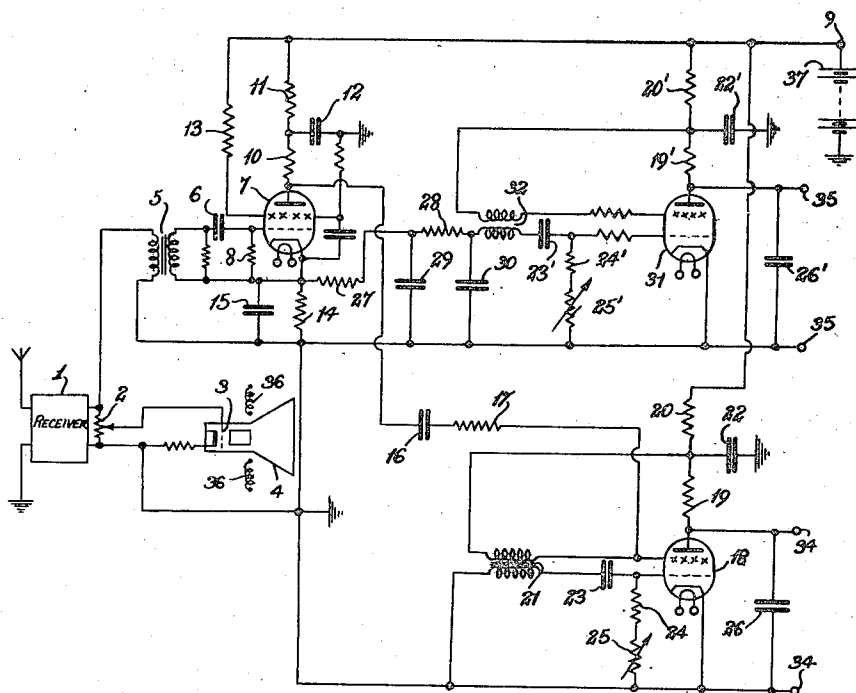
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TELEVISION AND LIKE SYSTEM

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TELEVISION AND LIKE SYSTEM

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The present invention relates to television and the like systems, and is particularly concerned with providing improved means for maintaining synchronism between scanning apparatus at a transmitting station and scanning apparatus at a receiver.

In many television and like systems, such for example as those in which a cathode ray tube is employed to reconstitute the transmitted image at the receiver, synchronization is accomplished by controlling the scanning operation at the receiver by means of signals generated in dependence upon the scanning operation at the transmitter. In such systems, the scanning movement of the cathode ray beam, for example, at the receiver is usually effected by means of electrical oscillations of substantially saw-tooth wave form, one set of oscillations being applied to one deflecting circuit and serving to sweep the beam in one direction over the fluorescent screen of the tube, and another set, which is usually of a widely different frequency, being applied to a further deflecting circuit and serving to cause deflection in another direction, usually at right angles to the first.

An oscillation having a suitable wave form is one comprising a substantially straight gradually rising portion, during which picture reproduction takes place, followed by a rapidly falling portion, or return stroke.

It is found very desirable in practice to generate the two sets of saw-tooth scanning oscillations at the receiver; synchronism with the corresponding scanning motions at the transmitter may then be maintained by generating at the transmitter two series of synchronizing signals of different characteristics, transmitting both series of signals, which may be of impulsive wave form, to the receiver, and employing one series to control the generation of one set of saw-tooth oscillations, and the other to control the generation of the other set of oscillations. The generators employed at the receiver may be of any suitable type in which the frequency of the generated oscillations may be made to depend upon the frequency of a series of controlling impulses or other suitable signals. Thus, for example, an impulse, known as a "line" impulse may be generated at the beginning or end of each line scanned at the transmitter, and a further series of impulses, generally referred to as the "frame" impulses, may be generated at the frequency at which complete scanings of the object or image to be transmitted take place.

The two series of synchronizing impulses, which

preferably have a peaked wave form, are generally mixed together at the transmitter, and transmitted over a suitable channel, such as a carrier wave for example; at the receiver they are separated from one another and applied to separate generators of saw-tooth oscillations. If desired, only one series of impulses may be transmitted, certain impulses or sets of successive impulses at regular intervals being of longer duration than the remainder; at the receiver, the whole of the series of impulses serves to control one scanning motion, while the impulses of longer duration are separated in a manner such as that described below and serve to control the other scanning motion.

The two series of impulses may be applied to impulse-controlled oscillation generators of any known or suitable form. The generators may be of a type which does not oscillate in the absence of the controlling impulses, or they may be of a type which oscillates freely in the absence of the impulses, the latter serving to determine the frequency of the generated oscillation. Preferably oscillation generators of the type known as blocking oscillators are employed; a description of such a generator, and an explanation of its manner of working, appears below.

Now some difficulty has been experienced in the past in completely separating one series of impulses from the other; the two oscillation generators at the receiver are both coupled to the same separating means, and the difficulty has also manifested itself in an undesirable interaction between the two generators. This difficulty may be in part overcome by the use of more or less complicated filtering arrangements, but these, if they are to be efficient, tend to be expensive and difficult to set up.

It is an object of the present invention to provide, for use in a television or the like system, improved means whereby two sets of signals, such for example as impulses, having different characteristics may be substantially entirely separated from one another. It is a further object of the invention to provide means whereby interaction between two oscillation generators, both of which are coupled to a common circuit, may be avoided or reduced.

According to the present invention, in synchronizing apparatus for television and like systems comprising an input circuit for receiving two sets of controlling signals having different characteristics, and two oscillation generators each adapted to be controlled by one of said sets of signals, separating means comprising a thermionic valve

are provided for separating the two sets of signals from one another, said input circuit being connected between two electrodes, such as the control grid and cathode, of said valve, and each of said oscillation generators being associated respectively with a different electrode of said valve.

Preferably, in a system such as is referred to above, the "line" impulses are taken off from between the anode of the valve and the negative terminal of the source of anode voltage, while the "frame" impulses are taken off from a circuit connected between the cathode of the valve and the negative terminal of the source. It is preferably arranged that in the absence of the controlling signals, no current flows in the valve. Other features of the invention will appear from the following description and the appended claims.

The invention will now be described, by way of example, as applied to a television system employing a cathode ray tube at the receiver to reconstitute the transmitted image. It will be assumed that only one series of controlling signals is generated at the transmitter, the signals being in the form of impulses of which certain sets at regular intervals are of longer duration than the remainder; the transmission channel will be assumed to be a carrier wave. It will also be assumed that the picture signals, which represent the light and shade values of the object to be transmitted, also modulate the same carrier wave, the carrier being modulated in one sense by the picture signals, and in the other sense by the synchronizing impulses.

In the following description, reference will be made to the accompanying drawing, which shows diagrammatically a part of a television receiver employing synchronizing apparatus according to the invention.

Referring to the drawing, the received carrier wave is amplified and detected in a suitable receiver 1, and the detected signal is established across a potential divider 2. A part of this signal is fed to the modulating electrode 3 of a receiving cathode ray tube 4 in such a sense and at such a level that the picture signals cause the potential of the modulating electrode to increase in the positive sense, while the synchronizing impulses, being in the opposite sense to the picture signals, serve wholly or partly to black out the cathode ray in the interval between the reconstitution of complete lines and complete pictures. The tube 4 is provided with two pairs of deflecting coils, of which only one pair, numbered 36, appear in the drawing for deflecting the cathode ray beam in two co-ordinate directions.

The detected signal is also applied to the primary winding of an iron cored transformer 5. One end of the secondary winding of this transformer is connected through a grid condenser 6 to the control grid of a screened grid valve 7, and the other end is connected directly to the indirectly heated cathode thereof. The control grid is also connected to the cathode through a leak resistance 8. The anode of the valve 7 is connected to the positive terminal 9 of a suitable source of current 37 through an anode resistance 10 and a decoupling resistance 11 in series, the junction point of the two resistances being earthed through a condenser 12, and the screening grid is also connected to the positive terminal 9 of the source through a feed resistance 13. The negative terminal of the source 37 is earthed. The cathode of the valve 7 is connected to earth through a coupling circuit comprising a resistance 14 and a condenser 15 in parallel.

The functions of the valve 7 are three in number; the first is to separate the synchronizing impulses from the picture signals, the second is to limit the amplitude of the synchronizing impulses to a substantially constant value, and the third is to separate one series of impulses from the other. The valve 7 will be referred to in this description as the separating valve. The synchronizing impulses and the picture signals are applied to the primary winding of the transformer 5 in such a sense that the synchronizing impulses tend to charge the grid side of the grid condenser 6 positively; each synchronizing signal accordingly tends to cause grid current to flow, and the grid consequently assumes a negative charge which leaks away slowly through the grid leak 8. This cycle of operation is repeated for each successive impulse. The value of the leak resistance 8 and the capacity of the grid condenser 6 are made such that the grid eventually acquires a mean negative bias which is more negative than that corresponding to zero anode current; the magnitude of this bias voltage varies in accordance with the peak amplitude of the synchronizing impulses, the variation being such that each impulse in turn just causes grid current to flow. Furthermore, the magnitude of the bias voltage is arranged to be such that synchronizing impulses of the smallest amplitude which is likely to occur in practice are able to cause grid current to flow. The picture signals, since they are in negative sense with respect to the synchronizing impulses, cannot cause current to flow in the anode circuit of the separating valve 7, and the synchronizing impulses are thus substantially freed from them. The first of the above-mentioned functions is thus performed. Moreover, the change of grid voltage due to any synchronizing impulse is always limited to the difference between the voltage corresponding to anode current cut-off, and the voltage at which grid current commences to flow, and the amplitude of the impulses set up in the anode circuit of the valve 7 is consequently substantially constant; the valve 7 thus clearly simultaneously performs the second function.

The third function, which will now be considered, and which is the one with which the present invention is mainly concerned, is the separation of one series of synchronizing impulses from the other. As has been stated, the synchronizing impulses are of peaked wave form, certain of them being of short duration, and sets of successive impulses being of longer duration. Each impulse produces a pulse of current in the anode circuit of the separating valve 7, and, on account of the anode resistance 11, there is a sudden fall in the potential of the anode each time a synchronizing impulse reaches the grid. There is thus set up, at the anode, and in relation to earth, a series of impulses at the line scanning frequency, the impulses being in the negative sense with respect to the mean anode potential. The anode of the separating valve is connected through a condenser 16 and a resistance 17 in series to the screening grid of a screened grid valve 18 which forms part of a blocking oscillator; the indirectly heated cathode of the valve 18 is earthed.

The anode of the blocking oscillator valve 18 is connected through an anode resistance 19 and a decoupling resistance 20 in series to the positive terminal 9 of the source of anode current, and the screening grid is connected through the secondary winding of an iron-core reaction transformer 21 to the junction of the two resistances.

The junction point is also earthed through a decoupling condenser 22. The control grid of the valve 18 is connected to the cathode through a grid condenser 23 and the primary winding of the transformer 21 in series, and a grid leak comprising a fixed resistance 24 in series with a variable resistance 25 is also connected between the control grid and the cathode. A reservoir condenser 26 of suitable capacity is connected between the anode and cathode of the valve 18.

The operation of the blocking oscillator is as follows:

Assume firstly that the grid side of the condenser 23 is negatively charged to such an extent that the potential of the control grid of the valve 18 is more negative than that corresponding to zero anode current. This charge is dissipated gradually through the leak 24, 25, and the resistance 25 is so adjusted that just before the control grid potential reaches the value at which anode current flows in the valve 18, a synchronizing impulse is received. The synchronizing impulse appears at the anode of the separating valve 7 and causes a pulse of current to flow in the decoupling condenser 22 and the secondary winding of the reaction transformer 21; the latter is connected in such a sense that the effect induced in the circuit of the control grid of the valve 18 by this pulse of current is such as to drive the control grid potential in the positive direction. Current thus commences to flow in the anode and screening grid circuits of the valve 18, and on account of the coupling provided by transformer 21, an oscillation is set up between the screening grid and control grid circuits. This oscillation, which may persist for a part of one half-cycle only, causes the control grid potential to increase very rapidly in the positive direction. Current eventually flows between the control grid and the cathode, and the grid condenser consequently assumes again a large negative charge. As already stated, the capacity of the grid condenser 23 is made such that this negative charge is effective in biasing the control grid to a point well below the point corresponding to zero anode current, and the anode-cathode path of the valve 18 becomes substantially insulating once more, and the cycle is complete.

While no current flows between the anode and cathode of the blocking oscillator valve 18, the reservoir condenser 26 charges up in a substantially linear manner through the anode resistance 19. The negative charge on the grid condenser 23 is dissipated gradually through the leak resistance 24, 25, and the value of the latter is such that a further synchronizing impulse arrives before the grid potential has fallen sufficiently to allow the valve 18 to become conducting. When anode current flows in the valve 18, the reservoir condenser 26 discharges rapidly through the anode-cathode path. A substantially saw-tooth voltage oscillation of the line frequency is thus established across the reservoir condenser. It should be pointed out here that, in the absence of the synchronizing impulses, the blocking oscillator would oscillate to generate a saw-tooth oscillation of a frequency slightly lower than that of the impulses. It will be appreciated from the above explanation that the impulses are effective in holding the blocking oscillator in synchronism.

Connected between the cathode of the separating valve 7 and earth is a circuit comprising a resistance 14 and a condenser 15 in parallel, and it will be seen that the anode current pulses due to the synchronizing impulses pass through

the resistance 14. The capacity of the condenser 15 is made such in relation to the value of the resistance 14 that its impedance to the impulses of short duration is negligible but its impedance to the impulses of longer duration is considerable, and each successive set of impulses of longer duration tends to be integrated by the condenser 15 to form a single impulse. Thus there is set up across this condenser a series of impulses at the frame scanning frequency. These impulses are applied through a filter circuit comprising two series resistances 27 and 28 and two parallel condensers 29 and 30, between the control grid and cathode of a further valve 31 which forms a part of the frame frequency blocking oscillator. This is similar in construction and manner of working to the line frequency blocking oscillator, except that it is found preferable in the case of the frame frequency oscillator to employ an air-cored reaction transformer 32 in place of the iron-cored transformer 21, but since, as will be apparent, the frame frequency impulses are in the positive sense with respect to the cathode potential in the absence of the synchronizing signals, they may be applied to the control grid of the blocking oscillator valve 31, as shown; it will be remembered that in the case of the line frequency blocking oscillator, the line frequency impulses are in the negative sense, and it is accordingly necessary to apply them to the screening grid of the line frequency blocking oscillator valve 18. Other elements of the frame frequency blocking oscillator which correspond to similar elements of the line frequency blocking oscillator are given the same references, but being primed.

The output of both blocking oscillators is applied to suitable thermionic amplifiers (not shown). Preferably, such amplifiers incorporate means for providing anti-regenerative feedback, such feed-back having been found to improve the wave form of the saw-tooth oscillations, and have the scanning coils of the cathode ray tube 4 connected in their output circuits. The input circuits of the amplifiers are connected respectively to the terminals 34 and 35.

Now as has been explained, the anode cathode path of the separating valve 7 is substantially insulating during the period between synchronizing impulses. The synchronizing impulses are all of durations which are short compared to the intervals between them, and it will thus be seen that, over the major portion of each cycle of oscillation thereof, the input circuits of both the line and frame frequency blocking oscillators are substantially completely insulated from one another. Interaction between the blocking oscillators, which may manifest itself as a triggering-off of the frame frequency oscillator by the impulses which control the line frequency oscillator, is thus reduced. By the provision in the input circuit of the frame frequency oscillator of the filter circuit 27, 28 and 29, 30 arranged to attenuate impulses and oscillations of the line frequency, as already described, interaction may be substantially completely eliminated.

It should be pointed out in conclusion that although the invention has been described with particular reference to a television system employing a cathode ray tube at the receiver to reconstitute the transmitted image, it is by no means so limited, but is applicable generally to synchronizing apparatus for use in television and

like systems of many types in which impulse-controlled oscillation generators are employed.

We claim:

1. Synchronizing apparatus for television and like transmission systems, comprising an input circuit for receiving two sets of controlling signals having different characteristics, two oscillation generators each adapted to be controlled by one of said sets of signals, separating means, comprising a thermionic valve having at least three electrodes, for separating the two sets of signals from one another, a coupling between said input circuit and two electrodes of said valve and couplings between each of said generators and different electrodes of said valve.

2. Synchronizing apparatus for television and like transmission systems, comprising an input circuit for receiving two sets of controlling signals having different characteristics, two oscillation generators each adapted to be controlled by one of said sets of signals, separating means, comprising a thermionic valve having an anode, a cathode and a control grid, for separating the two sets of signals from one another, connections from said input circuit to said control grid and cathode, a connection between one of said generators and said anode, and a connection between the other of said generators and said cathode.

3. Synchronizing apparatus for television and like transmission systems, comprising an input circuit for receiving two sets of controlling signals of different characteristics, the signals of each said set having intervals between them, two oscillation generators each adapted to be controlled by one of said sets of signals, separating means, comprising a thermionic valve having at least three electrodes, for separating the two sets of signals from one another, a coupling between said input circuit and two electrodes of said valve, couplings between each of said generators and different electrodes of said valve, and biasing means associated with said valve adapted to suppress any flow of current through said valve in intervals between said signals and to substan-

tially isolate said generators from each other.

4. Synchronizing apparatus for television and like transmission systems, comprising an input circuit for receiving two sets of controlling signals of different characteristics, the signals of each set having intervals between them, two oscillation generators each adapted to be controlled by one of said sets of signals, separating means, comprising a thermionic valve, having an anode, a cathode and a control grid, for separating the two sets of signals from one another, connections from said input circuit to said control grid and cathode, a connection between one of said generators and said anode, a connection between the other of said generators and said cathode, and biasing means, comprising a grid condenser and a grid leak, associated with said valve adapted to suppress any flow of current through said valves in intervals between said signals and to substantially isolate said generators from each other.

5. Synchronizing apparatus for television and like transmission systems, comprising an input circuit for receiving two sets of controlling signals having different characteristics, two oscillation generators each adapted to be controlled by one of said sets of signals, separating means, comprising a thermionic valve having an anode, a cathode and a control grid, for separating the two sets of signals from one another, a source of anode current having positive and negative terminals, associated with said valve, a circuit comprising a reactance element, connected between said cathode and said negative terminal, and being adapted to attenuate the signals of one set which are established across said reactance element, connections from said input circuit to said control grid and cathode, connections from one of said generators to said anode and said negative terminal, and connections from the second of said generators to said reactance element and said negative terminal.

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