

Dec. 9, 1941.

H. M. LEWIS

2,265,848

SYNCHRONIZING-SIGNAL GENERATOR

Filed July 27, 1940

2 Sheets-Sheet 1

FIG. 1.

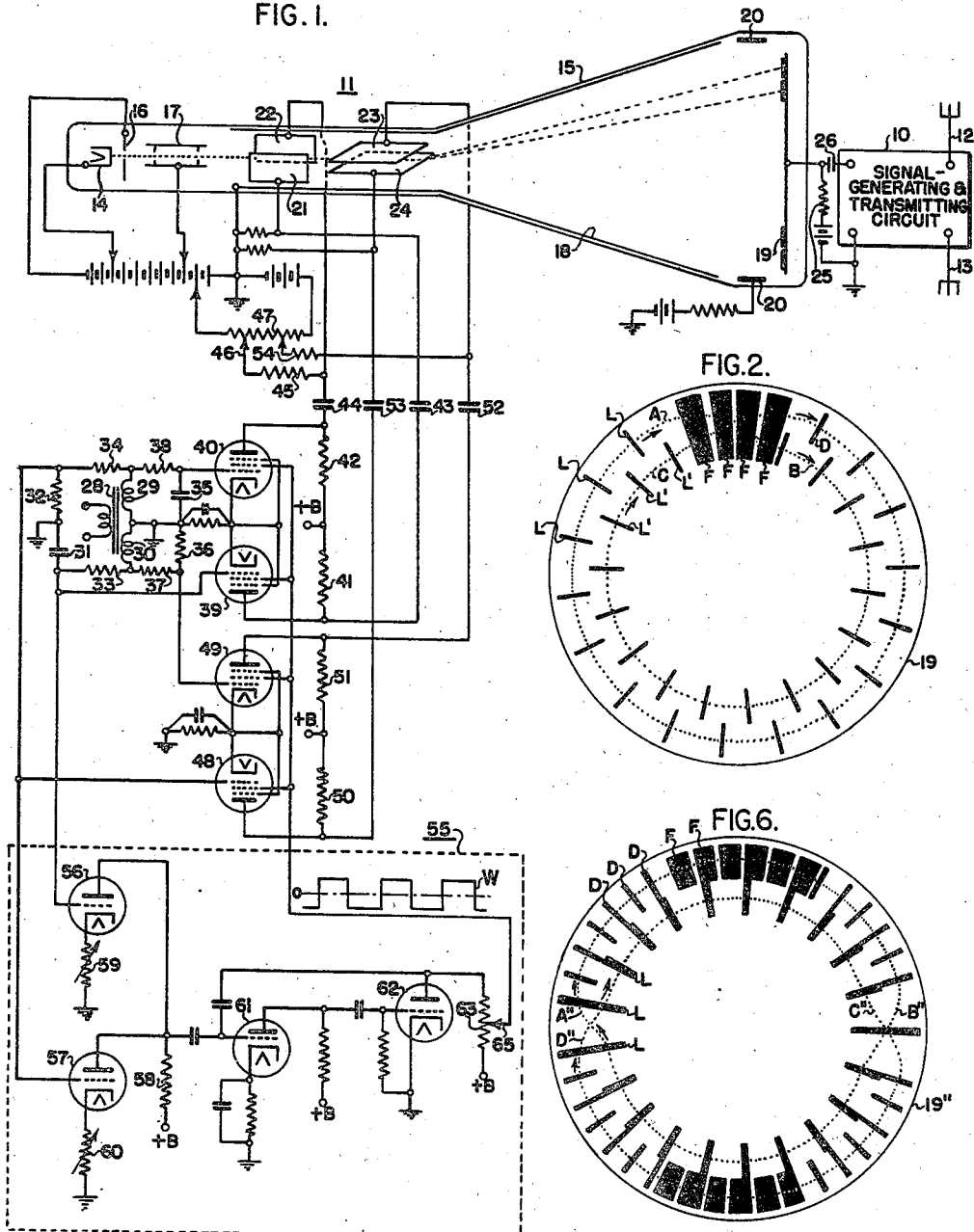


FIG. 2.

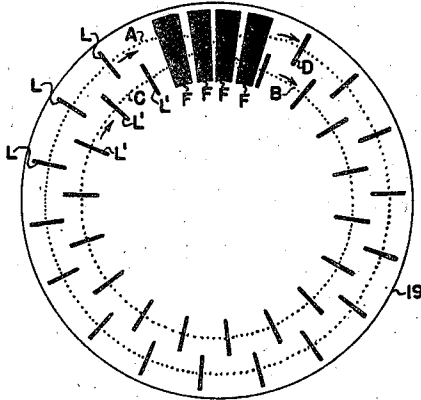
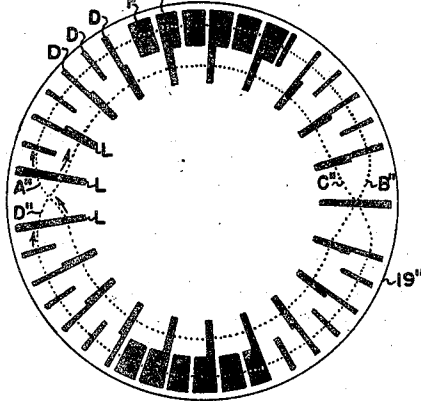


FIG. 6.



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2 Sheets-Sheet 2

FIG. 3.A

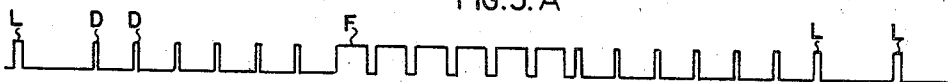


FIG. 3.B

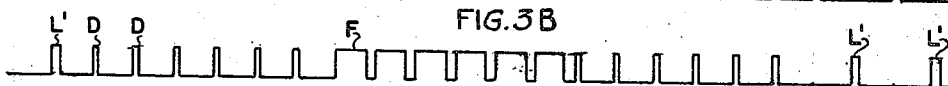


FIG. 3.C

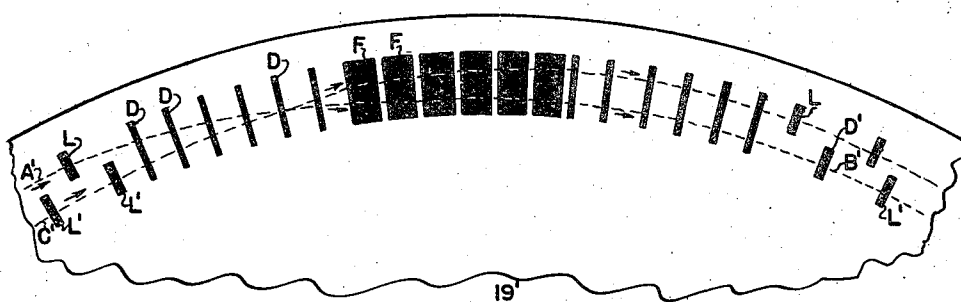


FIG. 5.

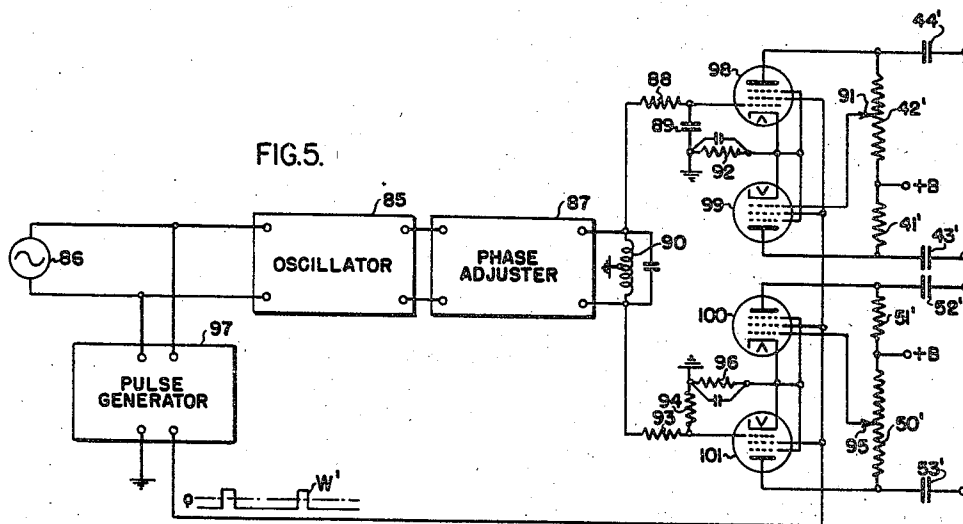
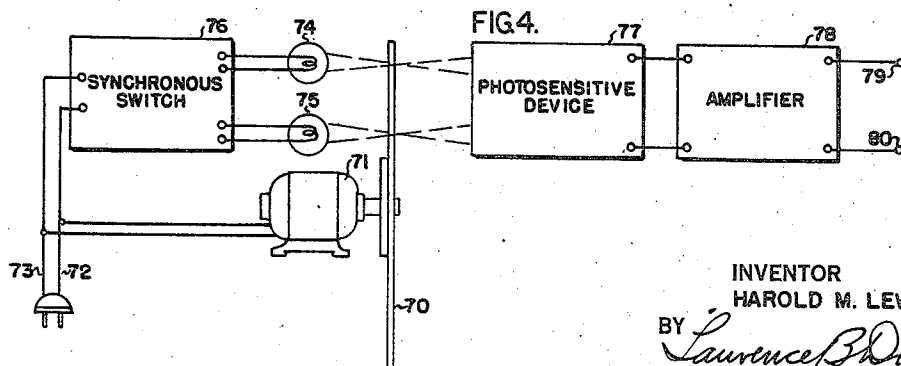


FIG. 4.



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SYNCHRONIZING-SIGNAL GENERATOR

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Application July 27, 1940, Serial No. 347,817

13 Claims. (Cl. 178-7.2)

This invention relates to synchronizing-signal generators for television transmitters and, while the generator of the invention is of general utility, it is particularly useful in a portable television transmitter because of the relatively small amount of apparatus comprised in the generator.

It is conventional to develop at a television transmitter a composite synchronizing signal including line-synchronizing components and field-synchronizing components for transmission with the video-signal components on a common carrier wave. Such a composite signal has conveniently been developed by the artifice of generating each of the required synchronizing-signal components in vacuum-tube circuits and combining the generated components in other vacuum-tube circuits to develop a composite synchronizing signal. Very complicated circuit arrangements have been provided for the purpose. Thus, it has been customary to provide a "timer chain" which is synchronized from the alternating current source for the transmitter and which develops oscillations of suitable frequencies for developing and keying the required pulses into the composite synchronizing signal. Also, the composite synchronizing signals generally utilized are suitable for effecting multiple-interlaced scanning, and such systems require synchronizing-signal components during one field period which are different from those during a succeeding field period. Thus, the feature of multiple interlace in a television system also adds materially to the complexity of the apparatus required for generating the required type of composite synchronizing signal. Furthermore, the composite synchronizing signals conventionally utilized for multiple-interlaced scanning systems comprise line-doubling components in the signal preceding and succeeding the field-synchronizing components of the signal. These line-doubling pulses have been provided in the same manner described above, rendering the apparatus required still more complicated.

Furthermore, the signal components of a composite synchronizing signal, developed in the manner described above, may require considerable shaping in order to procure satisfactory operation. It is, therefore, also desirable to provide a synchronizing-signal generator in which the individual components are of a uniform and precisely determined wave form.

It is an object of the invention, therefore, to provide an improved television synchronizing-signal generator which is effective to eliminate

one or more of the above-mentioned disadvantages of prior art generators.

In accordance with the invention, a synchronizing-signal generator for a television transmitter, adapted to generate a synchronizing signal for use in a multiple-interlaced scanning system in which synchronizing components thereof during one field period are different from those during a succeeding field period, comprises a device including a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated. Means are provided for continuously scanning the patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on the device and corresponding to the dissimilarity of the field periods of the desired synchronizing signal to develop an electrical effect corresponding to the pattern scanned.

In accordance with a preferred embodiment of the invention, the above-mentioned portions of the circumferential patterns correspond, respectively, to the portions of the signal to be generated including the line-synchronizing components, which line-synchronizing components of one field period are substantially differently spaced with reference to the field-synchronizing components than are the line-synchronizing components of a succeeding field period.

Also in accordance with a preferred embodiment of the invention, one of the above-mentioned radially displaced patterns comprises a portion corresponding to the field-synchronizing components to be generated and the other comprises a portion corresponding to the line-synchronizing components to be generated. In accordance with a preferred modification of this last-mentioned preferred embodiment of the invention, the pattern corresponding to the field-synchronizing components comprises substantially all of one of the above-mentioned circumferential patterns and another of the circumferential patterns, corresponding to the line-synchronizing components to be generated, is scanned a plurality of times for each scan of the pattern corresponding to the field-scanning period.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

Fig. 1 of the drawings is a circuit diagram, partly schematic, of a complete television signal-generating and -transmitting station including a synchronizing-signal generator in accordance with the present invention; Fig. 2 is a detail illustration of a portion of the synchronizing-signal generator of Fig. 1; Figs. 3a and 3b are graphs of wave forms developed by a modification of the generator of Fig. 1 while Fig. 3c is a detail illustration of a modification of the generator of Fig. 1 for generating the wave forms of Figs. 3a and 3b; Fig. 4 is a schematic diagram of a synchronizing-signal generator in accordance with the present invention which comprises a scanning disc; Fig. 5 is a circuit diagram of a further modification of the synchronizing-signal generator of Fig. 1; while Fig. 6 illustrates in detail a portion of the modified synchronizing-signal generator of Fig. 5.

Referring now more particularly to the drawings, in Fig. 1 there is shown a complete television signal transmitter in accordance with the invention. This transmitter comprises a conventional signal-generating and -transmitting circuit 10 adapted to be synchronized by, and to transmit a composite synchronizing signal developed by, a synchronizing-signal generator 11 constructed in accordance with the present invention; that is, a modulated-carrier signal is developed for radiation by an antenna circuit 12, 13 which comprises, as modulation components thereon, the video signals to be transmitted and the composite synchronizing signal generated by the synchronizing-signal generator 11.

The synchronizing-signal generator 11, which is adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components thereof during one field period are different from those during a successive field period, includes a cathode-ray tube 15 having therein an electron gun comprising a cathode 14, a control electrode 16, first and second accelerating anodes 17 and 18, a target electrode 19, and a collector electrode 20, together with suitable horizontal and vertical deflecting electrodes 21, 22 and 23, 24, respectively. Suitable unidirectional operating potentials are provided for cathode-ray tube 15 in a conventional manner. Target electrode 19 includes a surface having thereon a plurality of, or specifically two radially displaced circumferential patterns having predetermined angular and radial portions thereof corresponding to predetermined portions of the composite synchronizing signal to be generated. A plan view of target electrode 19 illustrating these patterns is shown in Fig. 2 of the drawings. The surface of target electrode 19 is preferably composed of a conductive secondary electron-emissive material and the patterns are formed thereon by means of carbon deposits having a substantially lesser coefficient of secondary electron emission. The target electrode 19 of Fig. 2 comprises a circumferential pattern including portions F, F' corresponding to the field-synchronizing components of the composite signal to be generated, a circumferential pattern including carbon deposits L corresponding to the line-synchronizing components of one field period of the synchronizing signal to be generated, and a radially displaced circumferential pattern including carbon deposits L' corresponding to the line-synchronizing components of the succeeding field period of the composite signal to be generated. That is, the composite synchronizing signal to be generated can

be considered to comprise field-synchronizing components and line-synchronizing components of one field period which are differently spaced with reference to the field-synchronizing components than the line-synchronizing components of the succeeding field period.

In order to develop a composite synchronizing signal by means of the cathode-ray tube synchronizing-signal generator of Fig. 1, the patterns of target electrode 19 are continuously scanned in successive substantially circumferential paths, having predetermined angular portions radially-displaced on the target electrode 19 and corresponding to the dissimilarity between successive field-periods of the desired synchronizing signal, to develop an electrical signal corresponding to the pattern scanned. Scanning circuits are provided for the cathode-ray tube 15 so that the cathode ray of the tube scans the patterns on target electrode 19 in substantially circular paths. In order to provide the required scanning potentials for cathode-ray tube 15, the primary winding of a transformer 28 is connected to a suitable sinusoidal alternating current source, for example, the 60-cycle supply circuit. Secondary windings 29 and 30 of transformer 28 are coupled to two suitable phase-splitting circuits in order to develop phase-displaced voltages. One of the phase-splitting circuits includes series-connected condenser 31 and resistor 32 coupled across windings 29 and 30 in series through resistors 33 and 34, while the other of the phase-splitting circuits includes a series-connected condenser 35 and resistor 36 connected across windings 29 and 30 in series through resistors 37 and 38. The coupling resistors 33, 34 and 37, 38 are sufficiently large so that the current in each phase-splitting circuit is substantially in phase with the secondary voltage of transformer 28. Therefore, the voltage across condenser 31 is in quadrature with that across resistor 32 and the voltage across condenser 35 is in quadrature with that across resistor 36. The voltages across condensers 31 and 35 are, however, of opposite polarity and are applied, respectively, to the control electrodes of tubes 39 and 40 to develop a balanced sinusoidal output voltage across load resistors 41 and 42 provided for tubes 39 and 40, respectively. This output voltage is applied to the horizontal deflecting plates 21 and 22 by way of coupling condensers 43 and 44. A resistor 45 is coupled between deflecting electrode 22 and a tap 46 of a potential divider 47 to provide horizontal centering of the cathode-ray beam of tube 15 prior to deflection.

The voltages across resistors 32 and 36 are also of opposite polarity and are applied, respectively, to the input electrodes of tubes 48 and 49 to develop a balanced sinusoidal output voltage for vertical deflection across load resistors 50 and 51 provided for tubes 48 and 49, respectively. This output voltage is applied to the vertical deflecting plates 23, 24 through coupling condensers 52, 53. A resistor 54 is coupled between vertical deflecting plate 23 and a tap on potentiometer 47 to provide vertical centering of the cathode-ray beam of tube 15 prior to deflection.

In order to provide for scanning of the patterns of target electrode 19 in a path, as represented by the dotted-line path A, B, C, D of Fig. 2, that is, in substantially circumferential paths having angular portions radially displaced on target electrode 19 and corresponding to the dissimilarity of the successive field periods of the desired synchronizing signal, there is provided

means for alternately increasing and decreasing the amplitude of the deflecting voltages at periodic intervals during the frame-scanning cycle of the system. This means comprises means for periodically varying the amplitudes of the scanning fields of the cathode-ray tube 15. For this purpose, a keying signal is developed by a unit 55 which is utilized alternately to increase and decrease the amplification of tubes 39, 40 and 48, 49. The unit 55 comprises tubes 56 and 57, to the input electrodes of which are applied, respectively, the voltage across condenser 31 and the voltage across resistor 32. These voltages are in quadrature and, therefore, a 60-cycle voltage having a phase determined by the relative amplification of tubes 56 and 57 is developed across a load resistor 58 which is common to tubes 56 and 57. Variable degenerative cathode resistors 59 and 60 are provided, respectively, for tubes 56 and 57 in order that the relative amplification of the tubes can be adjusted, thereby to develop an output voltage across load resistor 58 of any desired phase relationship with respect to the supply voltage to transformer 28.

The signal output of tubes 56 and 57 is utilized to synchronize a conventional multivibrator relaxation oscillator, having a frequency equal to half that of the supply voltage of the system, that is, 30 cycles per second, and comprising vacuum tubes 61 and 62 and a load resistor 63. The circuit constants of the relaxation oscillator are so proportioned that the signal output derived from resistor 63, comprising synchronous keying pulses, is of rectangular wave form with positive and negative pulses of equal duration, as indicated by the curve W shown adjacent thereto. The keying signal so derived is applied with a suitable amplitude, which is adjustable by means of a tap 65 on resistor 63, to the screen grids of tubes 39, 40 and 48, 49 to alter the gain of these tubes.

In considering the operation of the system just described, it will be seen that as the cathode ray beam of tube 15 is incident on various portions of the pattern of the target electrode 19, synchronizing-signal components are developed across a load resistor 25 in circuit with target electrode 19 and supplied to the signal-generating and -transmitting circuit 10 through a coupling condenser 26 for synchronizing the signal-transmitting circuit 10 and for modulating the generated carrier signal. Specifically, the current output derived from target electrode 19 through load resistor 25 varies as the scanning beam is, or is not, incident on one of the target patterns of target electrode 19. Furthermore, it will be seen that, if the scanning of target electrode 19 is in a path such as is indicated by A, B, C, D in Fig. 2, a composite synchronizing signal is developed for the transmitting circuit 10 of 18½ line-synchronizing pulses per field period, 37 line-synchronizing pulses per frame period, and 4 broad pulses during each field-retrace period, the generated synchronizing signal thus being suitable for double interlace scanning systems. Furthermore, it will be seen that neglecting the effect of unit 55, the quadrature space-displaced and time-displaced scanning fields developed by the deflecting plates of cathode-ray tube 15 due to the voltages applied thereto from tubes 39, 40 and 48, 49 would cause the cathode-ray beam of tube 15 to be driven in a circle at the frequency of the power supply source utilized to energize the primary winding of transformer 28. In considering the operation of the complete system just described, in view of the partial descriptions given above, it

will be seen that the amplitude of the quadrature space-displaced and phase-displaced scanning fields of cathode-ray tube 15 is periodically varied at a 30-cycle rate, thus causing the cathode-ray beam to travel in circular paths of different diameters on the surface of target electrode 19. Furthermore, it will be seen that resistors 59 and 60 provide a suitable means for manually adjusting the phase of the 30-cycle keying signal and that the system may be adjusted so that the radial change in the scanning of the patterns on target electrode 19 takes place during the scanning of the field-synchronizing patterns F, F. Therefore, the system described is effective to develop a suitable composite synchronizing signal across load resistor 25 for a double interlaced scanning cycle of 18½ lines per field and 37 lines per frame, 4 broad field-synchronizing pulses being developed during each field-retrace interval of the system. It will be understood that a suitable output voltage could also be taken from a load circuit coupled to collector electrode 20 rather than from target electrode 19, as described.

In Figs. 3a and 3b of the drawings, there are illustrated in detail portions of a composite synchronizing signal for successive fields conforming to the present standards of the Radio Manufacturers Association: This signal comprises line-doubling or equalizing pulses D and field synchronizing pulses F for each field period, line-synchronizing pulses L for one field period, and line pulses L' for the succeeding field period which are displaced one-half of the line period from the line pulses L of the first field period. A portion of a target electrode 19' corresponding to target electrode 19 of Fig. 1 is shown in Fig. 3c having patterns thereon suitable for developing a composite synchronizing signal conforming to the above-mentioned standards; portions of the pattern of element 19' which correspond to pattern portions of element 19 have similar reference numerals.

It is believed that the operation of the modification of the invention illustrated in Figs. 3a, 3b and 3c will be readily understood from the description given with reference to the operation of Fig. 1, and it will be understood that the patterns of element 19' are scanned in a path A', B', C', D', corresponding to path A, B, C, D of Fig. 2.

In Fig. 4 there is illustrated schematically a television synchronizing-signal generator in accordance with the invention utilizing a scanning disc in place of the synchronously-operated cathode-ray tube 15 of Fig. 1. The generator of Fig. 4 thus comprises a scanning disc 70 operated by a motor 71 through suitable supply leads 72, 73. The motor 71 is of the synchronous type and scanning disc 70 comprises thereon a series of slots arranged in a pattern corresponding to either of the target patterns described above. In order to develop a suitable synchronizing signal from the arrangement, a light source is provided including lamps 74 and 75, lamp 74 being disposed to transmit light through the apertures in the outer circumferential pattern path and lamp 75 being disposed to transmit light through the inner circumferential pattern path. A suitable synchronous switch 76 is provided for energizing lights 74 and 75 alternately, while a photo-sensitive device 77, responsive to light transmitted through the apertures in disc 70, is utilized to develop a composite synchronizing signal which is thereafter supplied to an amplifier 78, from the output terminals 79 and 80 of

which is derived the desired composite synchronizing signal. The synchronous switch 76 may be similar to the synchronous keying unit 55 of Fig. 1 and is so arranged that one of the lights 74, 75 is always energized and the switching is such as to effect a scanning path analogous to those described above. That is, it is immaterial whether the apertures are moved and the light-source means 74, 75 is maintained stationary or vice versa, and the arrangement of Fig. 4 thus comprises a means for scanning the patterns or apertures in substantially circumferential paths having predetermined angular portions radially-displaced.

In considering the arrangements which have so far been described, it will be seen that, in order to develop a signal in accordance with the above-mentioned standards, a pattern including 441 radial bars is required, the bars corresponding to the line-synchronizing pulses during a complete frame-scanning cycle. These bars must be resolved in the scanning process, which requires a cathode-ray beam having an extremely fine spot size at the target or a target electrode in the cathode-ray tube of a very large diameter. The modification of the invention illustrated in Fig. 5 is one in which these severe requisites are not present. In the arrangement of Fig. 5, the cathode-ray beam is caused to traverse the same circular path a plurality of times during each field period in order to generate line-synchronizing components and is then radially-displaced to scan another pattern to generate field-synchronizing components and line-doubling components so that a composite synchronizing signal in accordance with the R. M. A. standards is developed. In order to effect rotation of the cathode-ray beam at the relatively high frequency required, an oscillator 85 is provided for generating sinusoidal oscillations at a frequency of 630 cycles per second, the oscillator being synchronized from the power source 86, representing the alternating current source supplying the transmitter for which the synchronizing signal is to be generated. Phase-displaced voltages are supplied from oscillator 85 to the cathode-ray tube of the system, through a phase adjuster 87 and suitable phase-splitting circuits and amplifiers similar to those of Fig. 1. Circuit elements in Fig. 5 which are similar to those of Fig. 1 have identical reference numerals with the addition of a prime. Thus, the circuit of Fig. 5 comprises a phase-splitting circuit including a series-connected resistor 88 and condenser 89 coupled across a winding 90 which, in turn, is coupled to the output circuit of phase adjuster 87, for supplying a voltage of suitable phase to a tube 98 having a load resistor 42'. In order to develop a balanced output voltage, there is provided a phase-inverting tube 99, the control grid of which is connected to a tap 91 on resistor 42', while a common cathode resistor 92 is provided for tubes 98 and 99. Similarly, a resistance network including series-connected resistors 93 and 94 provides an input voltage for tube 100 in quadrature with that applied to a tube 98. In order to develop a balanced output voltage, there is provided a phase-inverting tube 101, the control grid of which is connected by means of tap 95 to load resistor 51' of tube 100. A common cathode resistor 96 is provided for tubes 100 and 101. In order to scan angular portions of the target electrode in circumferential paths which are radially-displaced, there is provided a pulse generator 97, the function of

which is analogous to that of generator 55 of Fig. 1 and which may be of a similar type. The pulse generator 97 is synchronized by the alternating current source 86 and is adapted to provide a rectangular-pulse wave form, the period of the pulses being 60 cycles per second. The output of pulse generator 97 is of rectangular wave form with the duration of the positive pulses $\frac{1}{20}$ that of the negative pulses, as illustrated by curve W' adjacent thereto. This pulse output of generator 97 is applied to the screen electrodes of tubes 98, 99, 100, and 101 in order to increase the amplification of these tubes during the positive pulses and decrease such amplification during the negative pulses.

In utilizing the modification of the invention illustrated by the circuit of Fig. 5, the cathode-ray tube is provided with a target electrode in accordance with that represented by target electrode 19' of Fig. 6. This target electrode comprises a pattern in which substantially all of the outer circumferential path corresponds to field-synchronizing components and line-doubling components of the signal which is to be generated, that is, to the field-retrace interval, while substantially all of the inner circumferential path thereof corresponds to line-synchronizing components to be generated. The signal to be generated can thus be considered to consist of line-synchronizing components, line-doubling components, and field-synchronizing components corresponding to one field period, and line-doubling and field-synchronizing components for a succeeding field period which are differently spaced with reference to the line-synchronizing components than those of the first-mentioned field period.

In considering the operation of the system of Fig. 5, it will be seen that quadrature phase-displaced sinusoidal voltages of 630 cycles are applied to the deflecting plates of the cathode-ray tube and that, in the absence of any further control, the cathode ray of the tube would be rotated in a circular path at a frequency of 630 cycles. However, as explained in connection with the circuit of Fig. 1, the amplitudes of the deflecting voltages supplied to the cathode-ray tube 15 are alternately increased and decreased by means of the applied pulse voltage.

The deflection potentials of the cathode-ray tube 15 of the modification of the invention illustrated in Fig. 5 are adjusted so that the cathode-ray beam of the tube scans a circular pattern corresponding to the inner path illustrated on the target electrode 19' of Fig. 6 during the negative pulses from generator 97, and, during a positive pulse from generator 97, the cathode-ray beam scans the outer circumferential path. The relative phase of the scanning potentials supplied to the deflecting plates and the pulses from generator 97 is adjusted by means of phase adjuster 87 so that the amplitude of the scanning potentials is caused to increase just before components corresponding to line-doubling and field-synchronizing components are to be generated and to decrease just after such components have been generated. Therefore, it will be seen that the cathode-ray beam of tube 15 is caused to scan the pattern illustrated by the dotted lines of Fig. 6. That is, beginning at point A'', a pattern is scanned corresponding to one set of field-synchronizing and line-doubling components while, at point B'', the scanning beam is switched back to the inner circle to scan portions of the pattern corresponding to

line-synchronizing components. The inner circle is thus scanned ten times in order to generate the line-synchronizing pulses of a complete field period and the scanning beam is thereafter switched back to the outer circumferential path at point C' in order to generate the succeeding line-doubling and field-synchronizing components corresponding to the next field-retrace interval. The scanning beam is again switched back to the inner circle at point D', after which time the inner pattern is again scanned a plurality of times in order to generate line-synchronizing components for the succeeding field period, after which the cycle repeats.

It will be noted that there are 21 line bars on the inner circle of target electrode 19" which also extend to the outer circle so that in 10 revolutions of the scanning beam on the inner circle and one-half revolution on the outer circle, a field of 220.5 lines is scanned, corresponding to a total of 441 lines for the complete frame cycle of 21 revolutions.

It will also be understood that the principle of the invention illustrated in Fig. 5 is not limited to the particular scanning frequencies and the particular pattern shown but that the modification of the invention illustrated in Fig. 5 may be utilized with other scanning patterns and different numbers of bars on the target pattern. Furthermore, it will be understood that the principle of the invention illustrated in Fig. 5 is equally applicable to a system using other types of interlaced scanning. For example, in a system utilizing triple interlaced scanning, the target electrode can be provided with three groups of patterns on the outer circle representing the field-synchronizing pulses together with their associated line-doubling pulses for each of the three successive field-retrace intervals, and each of these patterns would then cover an angular portion of 120 degrees of the outer circumferential path.

While there have been described what are at present considered to be the preferred embodiments of the invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components thereof during one field period are different from those during a succeeding field period comprising, a device having a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated, and means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the patterns scanned.

2. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components thereof during one field period are different

from those during a succeeding field period comprising, a device having two radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated, and means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the patterns scanned.

3. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal including line-synchronizing components and field-synchronizing components for use in a multiple-interlace scanning system in which synchronizing signals during one field period are different from those during a succeeding field period comprising, a device having a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding, respectively, to the portions of the signal to be generated including the line-synchronizing components, said patterns corresponding to the line-synchronizing components of one field period being differently spaced with reference to those corresponding to the field-synchronizing components than those corresponding to the line-synchronizing components of a succeeding field period, and means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the patterns scanned.

4. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal including line-synchronizing components and field-synchronizing components for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a device having a plurality of radially-displaced circumferential patterns having different predetermined portions thereof corresponding to the field-synchronizing components to be generated and to the line-synchronizing components to be generated, and means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the patterns scanned.

5. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal including line-synchronizing components, equalizing components, and field-synchronizing components for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a device having a plurality of radially-displaced circumferential patterns having predetermined portions thereof, respectively, corresponding to the field-synchronizing components and equalizing components to be generated and to the line-synchronizing components to be generated, and means for continuously scanning said

patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the patterns scanned.

6. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal including line-synchronizing components and field-synchronizing components for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a device having a plurality of radially-displaced circumferential patterns having predetermined angular portions corresponding to the field-synchronizing components to be generated and the remaining patterns corresponding to the line-synchronizing components to be generated, and means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods including means for scanning said pattern portions corresponding to the line-synchronizing components a plurality of times for each scan of said pattern portion corresponding to the field-synchronizing components to develop an electrical signal corresponding to the pattern scanned.

7. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal including line-synchronizing components and field-synchronizing components for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a device having a plurality of radially-displaced circumferential patterns having predetermined portions thereof, respectively, corresponding to the field-synchronizing components to be generated and to the line-synchronizing components to be generated, and means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods including means for scanning said pattern portions corresponding to the line-synchronizing components a plurality of times for each scan of said pattern portion corresponding to the field-synchronizing components to develop an electrical signal corresponding to the pattern scanned.

8. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal including line-synchronizing components and field-synchronizing components for use in a double-interlace scanning system in which synchronizing components during one field period are different from those of the succeeding field period comprising, a device having two radially-displaced circumferential patterns substantially all of one of which corresponds to the field-synchronizing components to be generated and substantially all of the other of which corresponds to the line-synchronizing components to be generated, means for continuously scanning said patterns in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal and

including means for scanning said other portion a plurality of times for each scan of said one portion to develop an electrical signal corresponding to the pattern scanned.

9. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a cathode-ray tube including a target having thereon a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated, means for continuously scanning said target in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the patterns scanned.

10. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a cathode-ray tube including a target having thereon a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated, means for generating quadrature space-displaced and time-displaced sinusoidal scanning fields, and means for periodically varying the amplitude of said fields for continuously scanning said target in successive substantially circumferential paths having predetermined portions radially displaced on said target and corresponding to the dissimilarity of said field periods to develop an electrical signal corresponding to the patterns scanned.

11. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components during one field period are different from those during a succeeding field period comprising, a cathode-ray tube including a target having thereon a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated, means for generating quadrature space-displaced and time-displaced sinusoidal scanning fields to scan said target in a circular path, means for generating synchronous keying pulses, and means for utilizing said keying pulses periodically to vary the amplitude of said scanning fields continuously to scan said target in successive substantially circumferential portions having predetermined paths radially displaced on said target and corresponding to the dissimilarity of said field periods to develop an electrical signal corresponding to the pattern scanned.

12. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components thereof during one field period are different from those during a succeeding field period comprising, a scanning disc having therein apertures forming a plurality of radially-displaced circumferential patterns having predeter-

mined angular portions thereof corresponding to predetermined portions of the signal to be generated, means including a photosensitive device and a light-source means for continuously scanning said apertures in successive substantially circumferential paths having predetermined angular portions radially displaced on said device and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the apertures scanned.

13. A synchronizing-signal generator for a television transmitter adapted to generate a synchronizing signal for use in a multiple-interlace scanning system in which synchronizing components thereof during one field period are different from those during a succeeding field period comprising, a scanning disc having therein

apertures forming a plurality of radially-displaced circumferential patterns having predetermined angular portions thereof corresponding to predetermined portions of the signal to be generated, means including a photosensitive device and a light-source means for continuously scanning said apertures in successive substantially circumferential paths, means for generating synchronous keying pulses, and means for utilizing said keying pulses to shift the scanning path so that said apertures are scanned in substantially circumferential paths having predetermined angular portions radially displaced on said target and corresponding to the dissimilarity of said field periods of the desired synchronizing signal to develop an electrical signal corresponding to the apertures scanned.

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