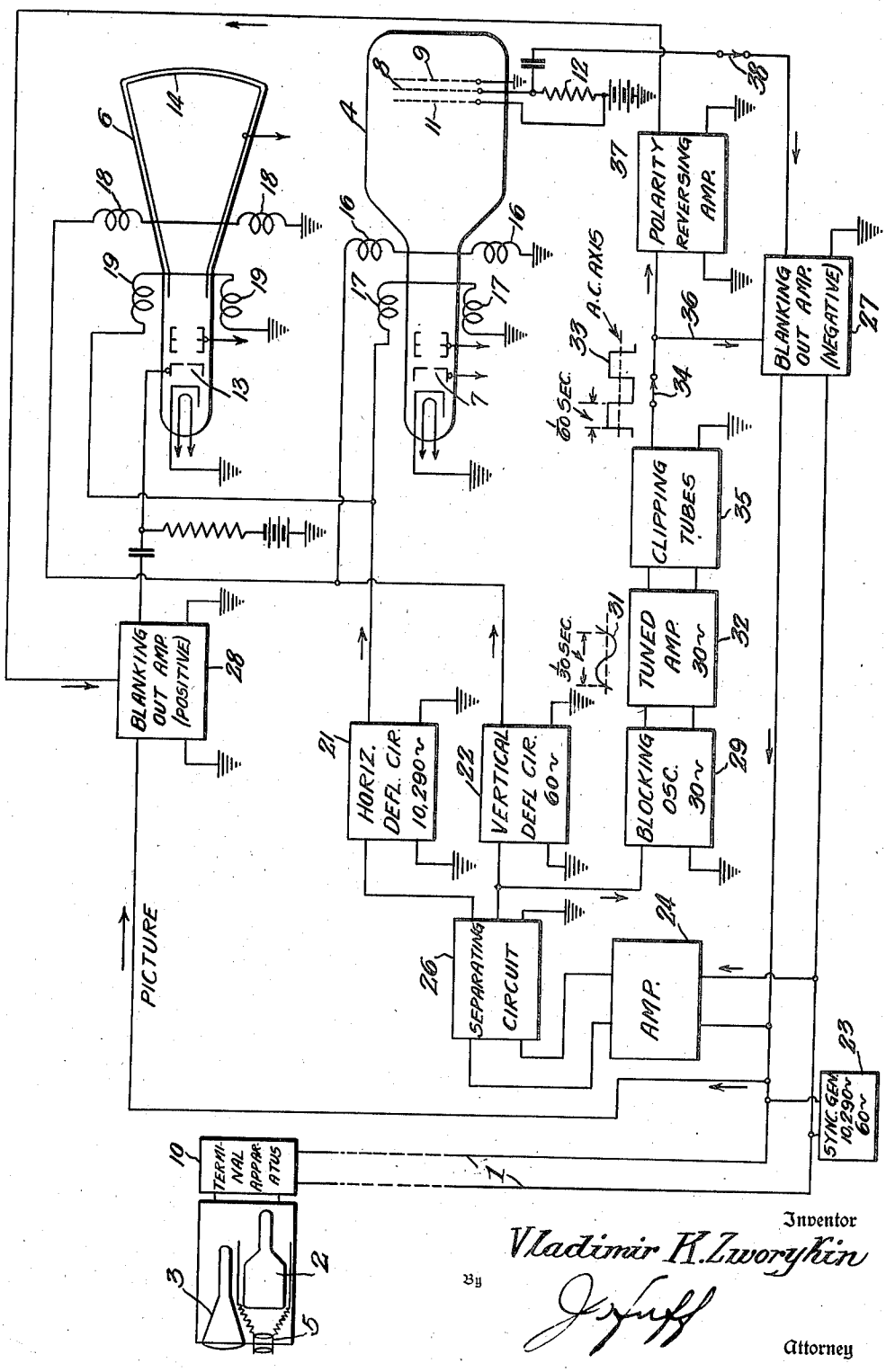
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TELEVISION SYSTEM

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TELEVISION SYSTEM

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4 Claims. (Cl. 178—6.8)

My invention relates to television systems and particularly to television systems for two-way transmission and reception.

An object of my invention is to provide an improved two-way television system which requires only a single transmission channel.

A further object of my invention is to provide an improved single channel two-way television system in which cathode ray tubes are employed for both transmission and reception.

A still further object of my invention is to provide an improved television system which may be employed either for two-way transmission of pictures of reasonably good quality or for one-way transmission of pictures of excellent quality.

In practicing my invention, similar apparatus is employed at each end of a single communication channel. Preferably the apparatus at one end of the channel is identical with the apparatus at the other end of the channel. The apparatus at each end of the channel includes a cathode ray transmitter tube, a cathode ray receiver tube and terminal equipment comprising deflecting circuits, amplifiers, etc. Synchronization of the cathode ray deflection at each end of the channel is maintained by means of impulses supplied from a synchronizing generator which may be included in one set of terminal equipment. Preferably, the synchronizing generator supplies horizontal synchronizing impulses and vertical synchronizing impulses having such frequency relation to each other that interlaced scanning is produced as described in U. S. Patent No. 2,178,218, issued Oct. 21, 1939, to Alda V. Bedford and assigned to the Radio Corporation of America.

At each end or terminal of the communication channel, the terminal apparatus includes means for producing blanking impulses which are supplied in the proper time relation to "blanking out" amplifiers for causing the cathode ray transmitter and receiver tubes to be ineffective for alternate picture frames, the transmitter tube at one terminal and the receiver tube at the other terminal being effective to transmit and reproduce pictures while the other transmitter tube and receiver tube are ineffective.

The invention will be better understood by referring to the single figure of the drawing where s single communication channel, such as a wire line, is indicated at 1. At one end of the line the transmitter and receiver tubes are indicated at 2 and 3, respectively, the transmitter tube being provided with a suitable camera 5. Terminal apparatus is indicated at 10.

At the other end of the line a complete transmitting and receiving unit is shown in more detail, the terminal apparatus being shown by a block diagram. This unit includes a cathode ray transmitter tube 4 and a cathode ray receiver tube 6. The transmitter tube may be any one of several well known types, such as the tube described in British Patent No. 369,832, issued March 31, 1932, this being the tube illustrated in the drawing. It includes an evacuated envelope having therein an electron gun 7 for producing a cathode ray, a light sensitive mosaic 8 and screen electrodes 9 and 11. When a picture is projected upon the front side of the mosaic 8 while the back side of the mosaic is being scanned by the cathode ray picture, signals appear across an output resistor 12. The receiver tube 6 may be of a well known type including an evacuated envelope having therein an electron gun 13 and a fluorescent screen 14.

Each cathode ray tube is provided with suitable means for deflecting the cathode ray both horizontally at a comparatively high frequency and vertically at a comparatively low frequency simultaneously for effecting scanning. In the specific apparatus illustrated, the transmitter tube 4 is provided with vertical deflecting coils 16 and horizontal deflecting coils 17, while the receiver tube 6 is provided with vertical deflecting coils 18 and horizontal deflecting coils 19. The two pairs of horizontal deflecting coils may be supplied from a single horizontal deflecting circuit 21 which may be of any suitable type, such as the deflecting circuit described in Tolson Patent 1,999,378. Likewise, the vertical deflecting coils may be supplied from a single vertical deflecting circuit 22 which also may be of the type described in the above-mentioned Tolson patent.

Synchronous deflection of the cathode rays in the two cathode ray tubes 4 and 6 is maintained by means of apparatus including a synchronizing generator indicated at 23. This synchronizing generator may be of the type described and claimed in the above-mentioned Bedford application. In order to make the invention more easily understood, specific frequencies have been assumed for the horizontal and vertical synchronizing impulses as indicated on the drawing. As previously mentioned, it is preferred that these synchronizing impulses bear such a relation to each other that interlaced scanning is produced. As pointed out in the above-mentioned Bedford application, this frequency relation preferably is such that the vertical deflecting frequency goes

into the horizontal deflecting frequency a whole number of times plus one-half.

The synchronizing impulses are supplied through a suitable amplifier 24 to a filtering or separating circuit 26 such as described in British Patent 407,409, whereby horizontal synchronizing impulses are supplied to the horizontal deflecting circuit 21 and vertical deflecting impulses are supplied to the vertical deflecting circuit 22.

It will be understood that the synchronizing impulses are also transmitted over the communication channel 1 to maintain the cathode ray deflection in the transmitter and receiver tubes 2 and 3 at the other end of the line in synchronism. Thus it will be seen that the deflection in such cathode ray tube is in synchronism with the deflection in the other cathode ray tubes. Also it will be understood that the system described up to this point would produce pictures in which the lines of one picture frame are spaced half-way between the lines of a preceding picture frame whereby the number of lines in a picture appears to be double the actual number of lines.

In accordance with my invention, I provide means for rendering the transmitter tube 4 ineffective to transmit picture signals when the receiver tube 6 is effective to receive picture signals. For the transmitter tube this may be accomplished by supplying the picture signal appearing across the output resistor 12 to the input circuit of a "blanking out" amplifier 27 which may be of the type described in U. S. Patent No. 2,092,496, issued Sept. 7, 1937, to Harry Branson and assigned to the Radio Corporation of America. The output circuit of the blanking out amplifier 27 is connected to the line 1 whereby picture signals may be transmitted to the receiver at the other end of the line except during the periods that a blanking impulse is being impressed upon the amplifier 27 to render it ineffective for transferring a signal.

The receiver tube 6 may be rendered ineffective for receiving signals in a similar manner by supplying picture signals from the line 1 to the input circuit of a blanking out amplifier 28, which also may be of the type described in the Branson application. The output circuit of the amplifier 28 is coupled to the input electrodes of the cathode ray tube 6.

Suitable "blanking out" impulses may be produced by supplying sixty cycle vertical synchronizing impulses to a blocking oscillator 29 adjusted to produce impulses at the rate of 30 per second in synchronism with the sixty cycle impulses. Such a blocking oscillator is described in the above-mentioned Tolson patent. The thirty cycle impulses may be converted into a thirty cycle sine wave as indicated at 31 by passing them through a tuned amplifier 32. The sine wave may then be converted into rectangular impulses as indicated at 33 by passing it through clipping tubes 35. The clipping tubes may consist of two tubes connected in cascade, each tube being biased beyond cut-off. Or, if preferred, the rectangular impulses may be produced by impressing upon amplifier tubes sine waves of such amplitude that the tubes are driven to plate current saturation.

It will be apparent that with respect to the alternating current axis of the rectangular impulses 33 there is a positive rectangular impulse lasting for one-sixtieth of a second and a negative rectangular impulse lasting for the same period. The period of one-sixtieth of a second is, of course, the period of one picture frame. Therefore, these rectangular impulses may be employed for making the blanking out amplifiers 27 and 28 ineffective for transferring signals for the duration of one picture frame. These impulses may be applied through a switch 34 and a conductor 36 to the blanking out amplifier 27 in the transmitter output circuit. Each negative impulse applies such negative polarity to the amplifier 27 as to block it and prevent the transmission of picture signals.

The blanking signals indicated at 33 are passed through a polarity reversing amplifier 37 and supplied to the blanking out amplifier 28 in the receiver channel whereby those impulses which are positive at the transmitter amplifier 27 are negative at the receiver amplifier 28 and of sufficient amplitude to block it and thereby prevent the transmission of picture signals. It will be evident that this causes the blanking out amplifiers 27 and 28 to be rendered ineffective alternately, whereby the receiver tube 6 may receive picture signals from the transmitter at the other end of the line without simultaneously receiving picture signals from the transmitter tube at its own end of the line.

From the foregoing description it will be understood that two persons at opposite ends of the line may see each other simultaneously, each person seeing a picture made up of thirty picture frames per second.

It will be understood, of course, that when two views are being seen simultaneously, the view is not an interlaced picture and will, therefore, be of poorer quality than the system is capable of providing.

However, it is a simple matter to so adjust my system that an interlaced picture may be transmitted in one direction when a high quality picture is desired. This may be accomplished by rendering the blanking impulses ineffective at each end of the line as by opening a switch, such as the switch 34, in the line supplying the blanking out amplifiers with blanking signals. If it is desired to transmit a picture from the terminal apparatus 3 to the receiver tube 6, the output circuit of the transmitter tube 4 is opened as by opening a switch 38. In this position, a person at the receiver tube 6 will see the person at the transmitter tube 2 and the person at that transmitter tube will be able to see himself in his receiver tube 3. Obviously, an interlaced picture may be transmitted in the opposite direction if the person at the transmitter tube 2 will render that transmitter tube ineffective to transmit a picture.

While it is preferred to employ "blanking out" amplifiers in my system as described, satisfactory results may be obtained by applying the "blanking out" impulses to the control grids of the transmitter and receiver tubes. By driving the grids negative a sufficient amount, the cathode ray is cut-off and the tubes are ineffective for transmission or reception.

It will be apparent that various other 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 placed thereon as are necessitated by the prior art and are set forth in the appended claims.

I claim as my invention:

1. In a television system, a single communication channel, a cathode ray transmitting tube and a cathode ray receiving tube at one end of said channel, a second cathode ray transmitting

tube and a second cathode ray receiving tube at the other end of said channel, means including a generator of synchronizing impulses for so deflecting the cathode rays in said tubes that the lines scanned during one picture frame fall between the lines scanned during the preceding picture frame to produce interlaced scanning, blanking means for rendering said first transmitting tube and said second receiving tube ineffective for transmitting and receiving pictures and effective for transmitting and receiving pictures alternately at a rate at least equal to that of persistence of vision and for simultaneously rendering the other of said tubes alternately effective and ineffective for transmitting and receiving pictures, said first transmitting tube and said second receiving tube being ineffective when said other tubes are effective, means for making said blanking means ineffective and for making one of said transmitting tubes ineffective for transmission for the duration of a one-way transmission whereby an interlaced picture is transmitted and received.

2. In a television system for picture transmission, a single communication channel, terminal apparatus for one end of said channel, said apparatus comprising a cathode ray transmitting tube and a cathode ray receiving tube, two blanking out amplifiers, said transmitting tube being connected to said channel through one of said amplifiers, said receiving tube being connected to said channel through the other of said amplifiers, means for deflecting the cathode rays in said tubes horizontally at a comparatively high frequency and vertically at a comparatively low frequency to effect scanning, means for producing rectangular electrical impulses occurring in fixed time relation to said vertical deflection, and means for so impressing said rectangular impulses upon said blanking amplifiers that they are rendered ineffective alternately to transmit picture signals.

3. In a television system for picture transmission, a single communication channel, a terminal unit at each end of said channel, each unit comprising a cathode ray transmitting tube and a cathode ray receiving tube, a plurality of coupling circuits, said tubes being connected through said coupling circuits to said channel for the transmission and reception of picture signals thereover, means for so deflecting the cathode rays in said tubes that the lines scanned during one picture frame fall between the lines scanned during a preceding picture frame to produce interlaced scanning, means for producing rectangular electrical impulses occurring in fixed time relation to said scanning, and means for so impressing said rectangular impulses upon said coupling circuits that said tubes are rendered ineffective alternately to transmit and receive picture signals.

4. The invention according to claim 3 characterized in that additional means is provided to make said rectangular impulses ineffective and for making said transmitting tube ineffective for transmission for the duration of a one-way transmission whereby an interlaced picture is transmitted and received.

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