

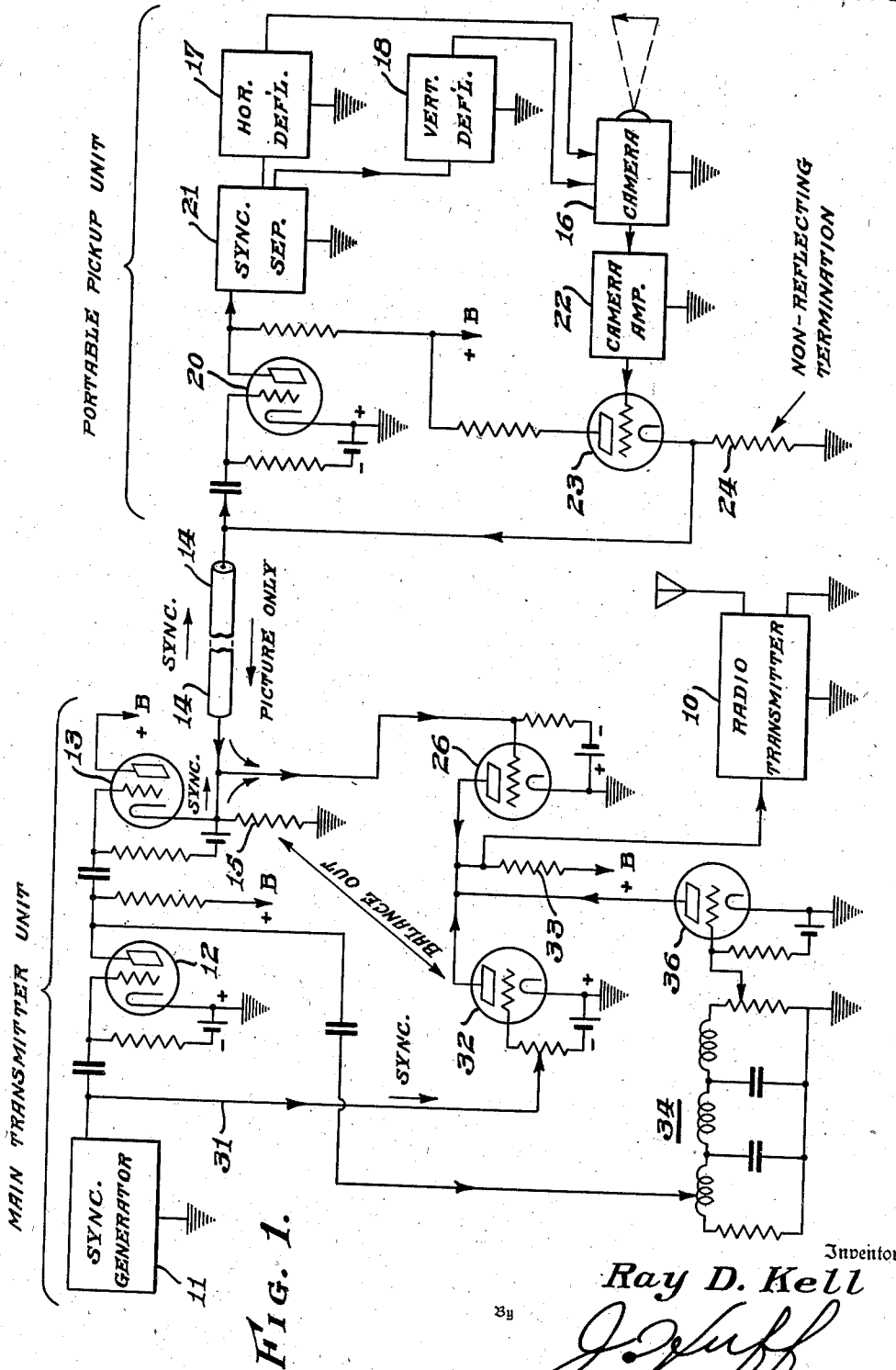
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R. D. KELL
TELEVISION SYSTEM

2,293,148

Filed Feb. 27, 1941

2 Sheets-Sheet 1



Ray D. Kell

Inventor

J. Huff

Attorney

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2 Sheets-Sheet 2

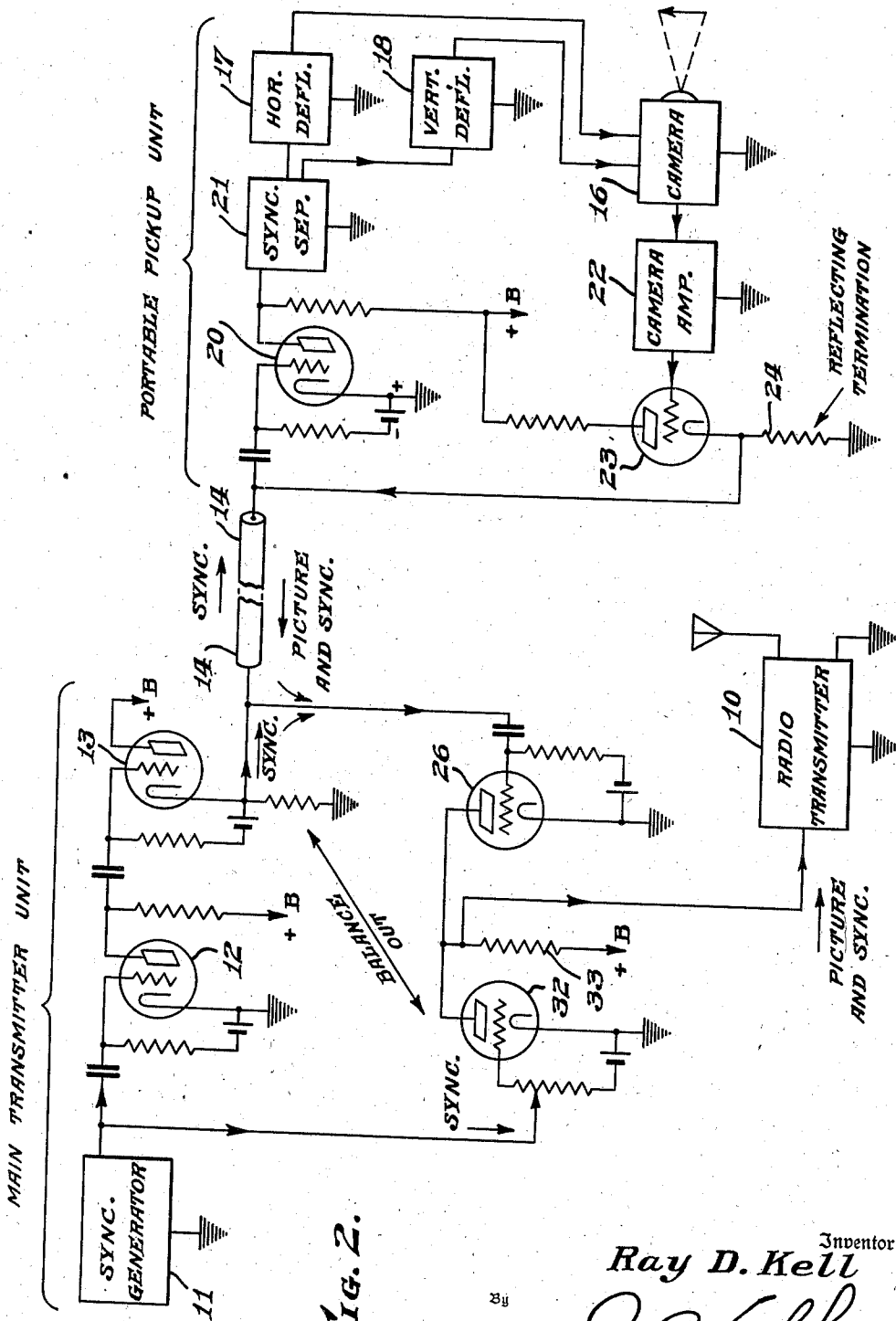


FIG. 2.

Ray D. Kell
Inventor
J. J. Huff
Attorney

UNITED STATES PATENT OFFICE

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TELEVISION SYSTEM

Ray D. Kell, Haddonfield, N. J., assignor to Radio Corporation of America, a corporation of Delaware

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7 Claims. (Cl. 178—69.5)

My invention relates to the transmission of television pictures and particularly to the transmission of pictures originating at a point remote from the main television transmitter.

In transmitting television pictures it is necessary to transmit synchronizing signals along with the picture signals in order to synchronize the scanning at a receiver with the scanning at the transmitter. This is usually accomplished by transmitting a composite signal consisting of picture signal and of recurring line frequency and frame frequency synchronizing pulses, a line frequency pulse occurring at the end of each scanning line and a frame frequency synchronizing pulse occurring at the end of each vertical deflection.

The main television transmitter unit of a television system includes a synchronizing pulse generator for producing the above-mentioned line frequency and frame frequency synchronizing pulses. These pulses are mixed in the proper time relation with the picture signals originating at the main transmitter unit. It will be understood that this main unit may consist of apparatus which is rather widely separated as in the case of a transmitter in one building and the studio in another building several blocks away. In this case, it is the practice to have the synchronizing pulse generator located adjacent to the studio.

When it is desired to pick up a television picture at some remote point, as for example, when it is desired to televise a baseball game, it has previously been the practice to utilize a portable transmitter or pickup unit which includes a synchronizing pulse generator. Such a generator supplies synchronizing pulses for driving or controlling the deflection of the cathode ray in the pickup tube of the portable unit, and it also supplies synchronizing pulses which are mixed with the picture signal in the portable unit for transmission to the main unit. The resulting composite signal, after being transmitted either over a radio link or over a cable or wire line to the main transmitter, is caused to modulate the carrier wave of the main transmitter. This use of a pulse generator at a portable pickup unit obviously complicates the design.

It is an object of the present invention to simplify the apparatus which is required for the pickup of a picture at a remote point.

A further object of the invention is to provide a means for and a method of transmitting picture signals from a remote pickup unit over a wire line or cable to a main transmitter unit

without the necessity of generating synchronizing or driving pulses at the remote unit.

In practicing the invention, picture signals are transmitted from a portable pickup unit over a cable or wire line to the main transmitter unit. Synchronizing pulses for controlling the deflection of the cathode ray in the pickup tube are transmitted over this line from the synchronizing pulse generator at the main transmitter unit to the portable pickup unit where they preferably are passed through a picture separating circuit and then applied to the horizontal and vertical deflecting circuits of the pickup tube.

In one embodiment of the invention, the connection between units is a coaxial cable which has a non-reflecting termination at each end, that is, it is terminated in its surge impedance. As a result, a picture signal only is transmitted over the cable from the portable pickup unit to the main transmitter unit, this picture signal being delayed a certain amount by its passage through the cable.

At the main transmitter unit, the synchronizing pulses which would normally become mixed with the picture signal are balanced out and there is mixed with the delayed picture signal the desired synchronizing pulses which have been delayed the same amount as the picture signal. Thus there is produced the desired mixture of picture signal and synchronizing pulses for modulating the main radio transmitter.

In another embodiment of the invention the cable is so terminated at the portable pickup unit that a portion of the synchronizing pulse voltage which is transmitted over the cable is reflected back to the main transmitter unit whereby there is transmitted from the portable pickup unit to the main transmitter unit the desired mixture of picture signal and synchronizing pulses. In this case also, it is necessary to balance out at the main transmitter unit the undelayed synchronizing pulses which would otherwise become mixed with the picture signal.

The invention will be better understood from the following description taken in connection with the accompanying drawings, in which

Figure 1 is a circuit and block diagram of a television transmitter system embodying my invention; and

Figure 2 is a circuit and block diagram of another embodiment of the invention.

Referring to Fig. 1, the television transmission system comprises a main transmitter unit and a portable pickup unit as indicated by the legends, these two units being connected by a

coaxial cable in the particular example illustrated.

The main transmitter unit, as previously mentioned, may consist of a main radio transmitter containing some of the terminal equipment and a studio located several blocks away and containing the rest of the terminal equipment, there being a coaxial line or the like connecting the two. So far as the present invention is concerned, this equipment, comprising the main transmitter unit, may be considered as located at one point. It comprises a radio transmitter indicated at 10 to which the modulating signal is to be applied and a synchronizing pulse generator indicated at 11.

The synchronizing pulses from generator 11 are suitably amplified as by means of amplifier tubes 12 and 13 and supplied over a line such as the coaxial cable 14 to the portable pickup unit at the remote point.

The portable pickup unit comprises a suitable pickup device or camera 16 which preferably comprises a cathode ray pickup tube such as the well known Iconoscope, or a low velocity beam pickup tube such as that described in Patent No. 2,213,175, issued August 27, 1940, to Iams et al.

The portable pickup unit also includes horizontal and vertical deflecting circuits 17 and 18 for applying the desired saw tooth waves to the cathode ray pickup tube for effecting the desired scanning.

The synchronizing pulses which have been transmitted over the cable are suitably amplified by means of an amplifier 20 and then applied to a synchronizing separator circuit 21 which is so designed as to prevent the passage of picture signals therethrough. The synchronizing pulses pass through to the deflecting circuits 17 and 18 whereby the scanning in the camera 16 is controlled by the synchronizing pulse generator 11 at the main transmitter.

The picture signal output of the pickup camera 16 is amplified by an amplifier 22 and supplied to an output tube 23 of the cathode follower type. The output impedance of the cathode follower 23 has the correct resistance for so terminating the cable 14 that it is a non-reflecting termination.

The picture signals appearing across the cathode resistor 24 are supplied through the cable 14 to an amplifier 26 in the main transmitter unit.

It will be evident that, at the portable unit, the picture signals supplied from the output tube 23 are unavoidably impressed upon the input circuit of the amplifier tube 20 as well as upon the cable 14. It is for this reason that the synchronizing pulse separator 21 is desirable for preventing these picture signals from being impressed upon the deflecting circuits 17 and 18.

It will also be evident that, at the main transmitter unit, the synchronizing pulses supplied from the output tube 13 to the cable 14 are also impressed upon the input circuit of the amplifier tube 26. Since these synchronizing pulses have been delayed a negligible amount, there being only the delay introduced by the amplifier 12-13, it is apparent that they must be removed from the delayed picture signal appearing at the input circuit of the tube 26, the picture signal having been delayed a substantial amount by the cable 14.

This is accomplished by balancing out the synchronizing pulses appearing at the input circuit of tube 26 by means of synchronizing pulses of opposite polarity which may be fed over a con-

ductor 31 to an amplifier 32, the amplifier tubes 32 and 26 having a common plate resistor 33.

With the circuit thus far described there would appear across the common plate resistor 33 only the delayed picture signal. The desired mixture of picture signal and synchronizing pulses is obtained by taking synchronizing pulses from the output of a suitable amplifier stage such as the amplifier stage 12 and feeding them through a delay network 34 to an amplifier tube 36 which has as its plate resistor the above-mentioned common plate resistor 33. By means of the delay network 34, the synchronizing pulses may be delayed exactly the same amount as the picture signals whereby these delayed synchronizing pulses and the delayed picture signal are combined at the output resistor 33 to produce the desired composite signal for transmission to a radio receiver by means of the transmitter 10.

It will be noted that in the example illustrated, the output tube 13, like the output tube 23, is of the cathode follower type, the output impedance 15 of the tube having the correct resistance to provide a non-reflecting termination for the cable 14. It will be understood that these output tubes are not necessarily of the cathode follower type, although this type of output tube circuit has certain engineering advantages.

In Fig. 2 there is illustrated an embodiment of the invention in which the cable or wire line has a reflecting termination at the portable pickup unit. In Figs. 1 and 2, like parts are indicated by the same reference numerals.

The portable pickup unit shown in Fig. 2 is the same as that shown in Fig. 1 except that the cable terminating cathode follower 23 is given a different resistance value whereby the synchronizing pulses which are supplied over the cable 14 from the output tube 13 are partially reflected. The result is that there is transmitted over the cable from the portable pickup unit to the main transmitter unit the desired correct mixture of picture signals and synchronizing pulses.

In this composite signal the picture signal and the synchronizing pulse have been delayed the same amount even though the picture signal passes through the cable only once, whereas the reflected synchronizing pulses pass through the cable twice. This is because the picture signal at the output of the camera 16 has been delayed by an amount equal to the amount the synchronizing pulses have been delayed by passing from the main unit to the portable unit since it is these delayed synchronizing pulses which are controlling the horizontal and vertical deflection in the camera pickup tube.

At the main transmitter unit it is necessary to balance out those undelayed synchronizing pulses which are fed from the output tube 13 to the amplifier tube 26. This is accomplished in the same manner as previously described, synchronizing pulses being fed through the amplifier tube 32 to balance out the undesired synchronizing pulses of opposite polarity appearing in the common plate resistor 33. The result is that picture signals and synchronizing pulses mixed in the proper time relation appear across the plate resistor 33 without any of the synchronizing pulses of the wrong time relation being present.

In this embodiment of the invention, as in the preceding embodiment, the end of the cable 14 at the main transmitter unit preferably is terminated in its surge impedance to avoid reflection.

From the foregoing description it will be apparent that by employing my invention, the

amount of apparatus in the portable pickup unit is substantially less than that required when following the usual remote pickup technique.

I claim as my invention:

1. In a television system, a main transmitter unit, a remote pickup unit, a wire line connecting said units, a synchronizing pulse generator located at said main unit and connected to transmit synchronizing pulses over said line to said pickup unit, means in said pickup unit for transmitting picture signals over said line to said main unit, and means at said main unit for balancing out certain undelayed synchronizing pulses which would otherwise become unavoidably mixed with said picture signal.

2. In a television system, a main transmitter unit, a remote pickup unit, a wire line connecting said units, a synchronizing pulse generator located at said main unit and connected to transmit synchronizing pulses over said line to said pickup unit, a cathode ray pickup unit at said remote unit and connected to transmit picture signals over said line to said main unit, means comprising deflecting circuits for causing the cathode ray of said tube to scan a certain area, a picture separating circuit located between said deflecting circuits and the junction point of said wire line and the output connection of said cathode ray pickup unit, and means at said main unit for balancing out undesired synchronizing pulses whereby the output of said main unit consists only of picture signals and synchronizing pulses occurring in the desired time relation.

3. In a television system, a main transmitter unit, a remote pickup unit, a wire line connecting said units and having a nonreflecting termination at said remote unit, a synchronizing pulse generator located at said main unit and connected to transmit synchronizing pulses over said line to said pickup unit, means in said pickup unit for transmitting picture signals over said line to said main unit, means at said main unit for balancing out certain undelayed synchronizing pulses which would otherwise become unavoidably mixed with said picture signal, and

means at said main unit for mixing delayed synchronized pulses with the delayed picture signal.

4. In a television system, a main transmitter unit, a remote pickup unit, a wire line connecting said units and having a reflecting termination at said remote unit, a synchronizing pulse generator located at said main unit and connected to transmit synchronizing pulses over said line to said pickup unit, a cathode ray pickup unit at said remote unit and connected to transmit picture signals together with reflected synchronizing pulses over said line to said main unit, means comprising deflecting circuits for causing the cathode ray of said tube to scan a certain area, a picture separating circuit connected to prevent picture signals from passing into said deflecting circuits, and means at said main unit for balancing out undesired synchronizing pulses whereby the output of said main unit consists only of picture signals and synchronizing pulses occurring in the desired time relation.

5. In a television system, a main transmitter unit, a remote pickup unit, a wire line connecting said units, a synchronizing pulse generator located at said main unit and connected to transmit synchronizing pulses over said line to said pickup unit, means in said remote pickup unit for transmitting picture signals over said line to said main unit, a picture signal amplifier at said main unit, said amplifier having an input circuit connected to said wire line to receive said picture signals whereby undelayed synchronizing pulses are unavoidably impressed upon said amplifier, and means at said main unit for balancing out said undelayed synchronizing pulses.

6. The invention according to claim 5 wherein said wire line has a nonreflecting termination at said remote pickup unit.

7. The invention according to claim 5 wherein said wire line has a partially reflecting termination at said remote pickup unit.

RAY D. KELL.