

Oct. 10, 1939.

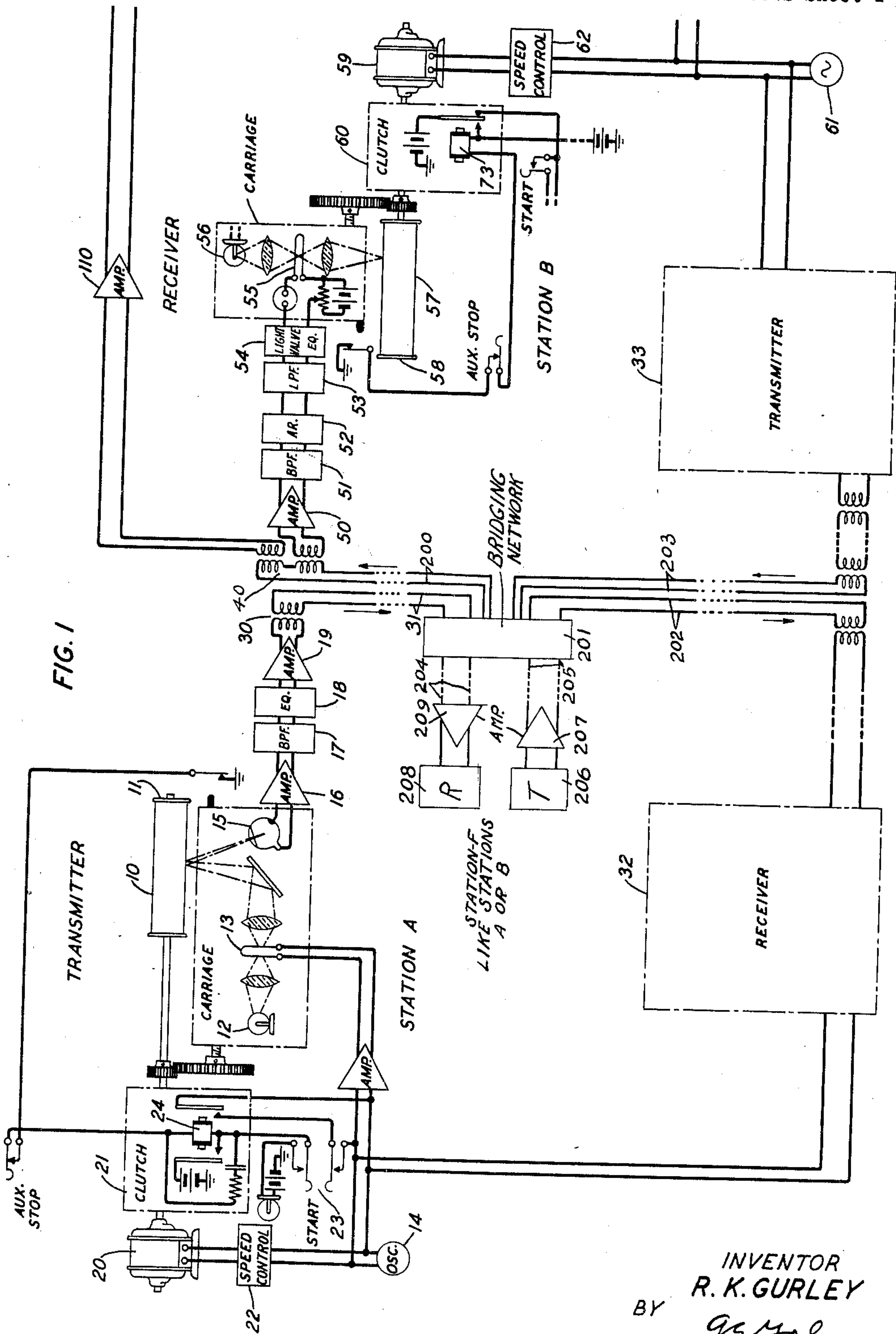
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2,175,388

PICTURE BROADCASTING SYSTEM

Filed Dec. 28, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

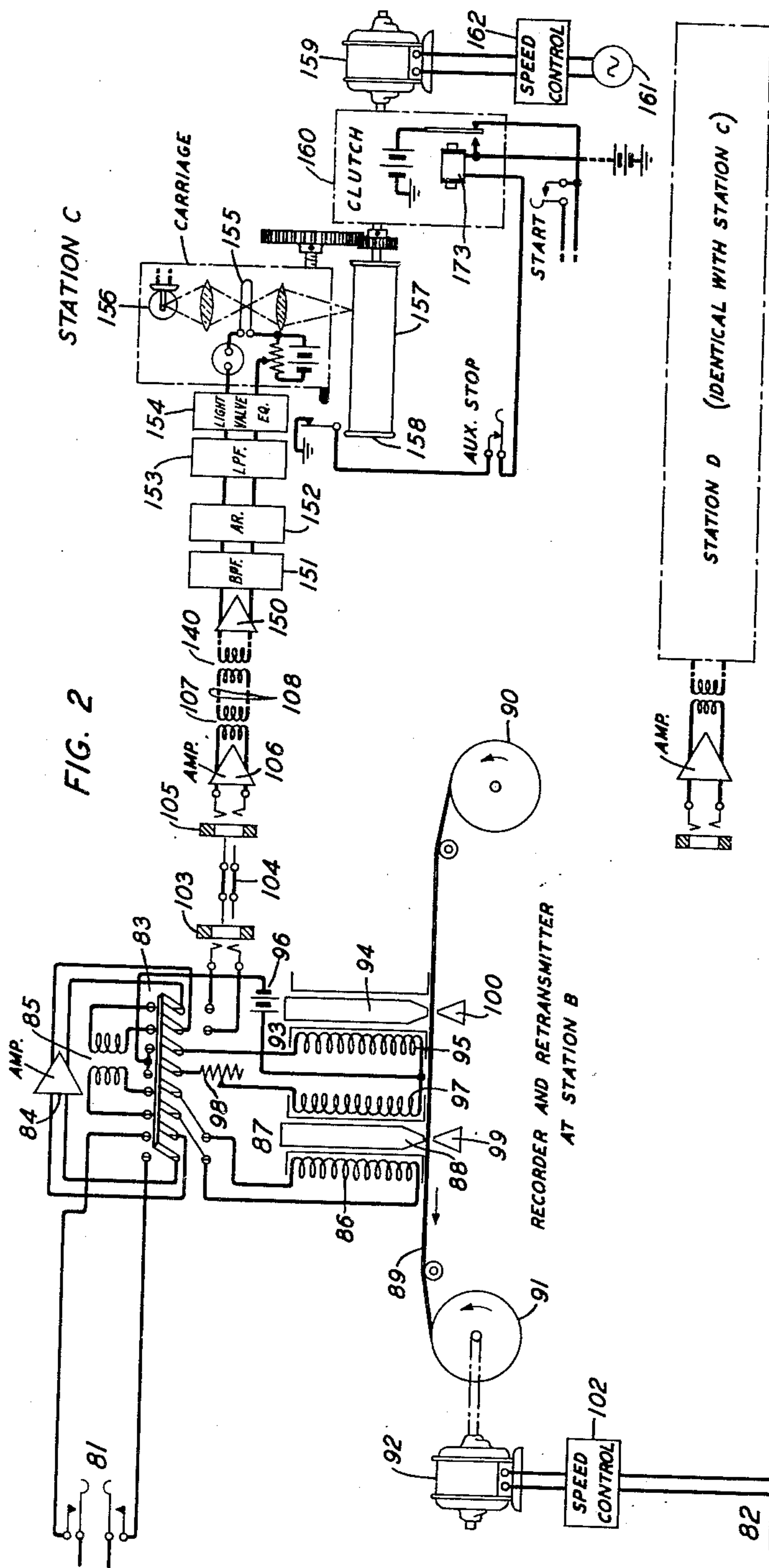


FIG. 2

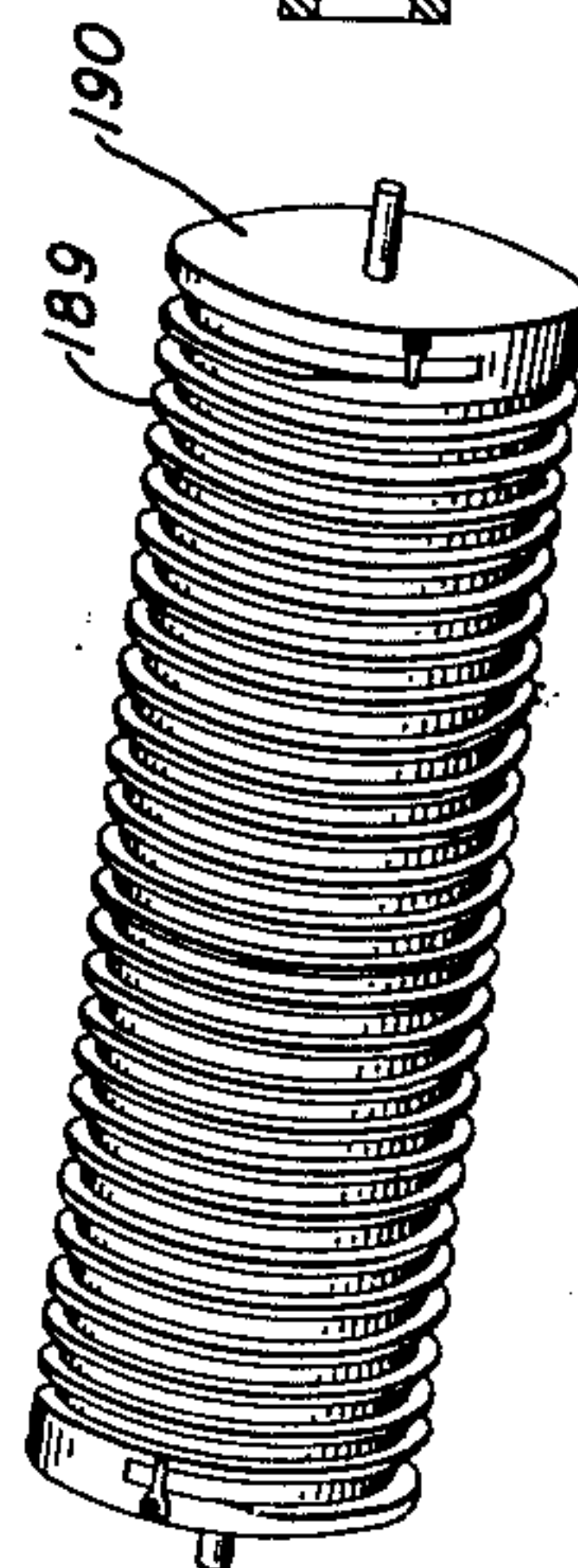
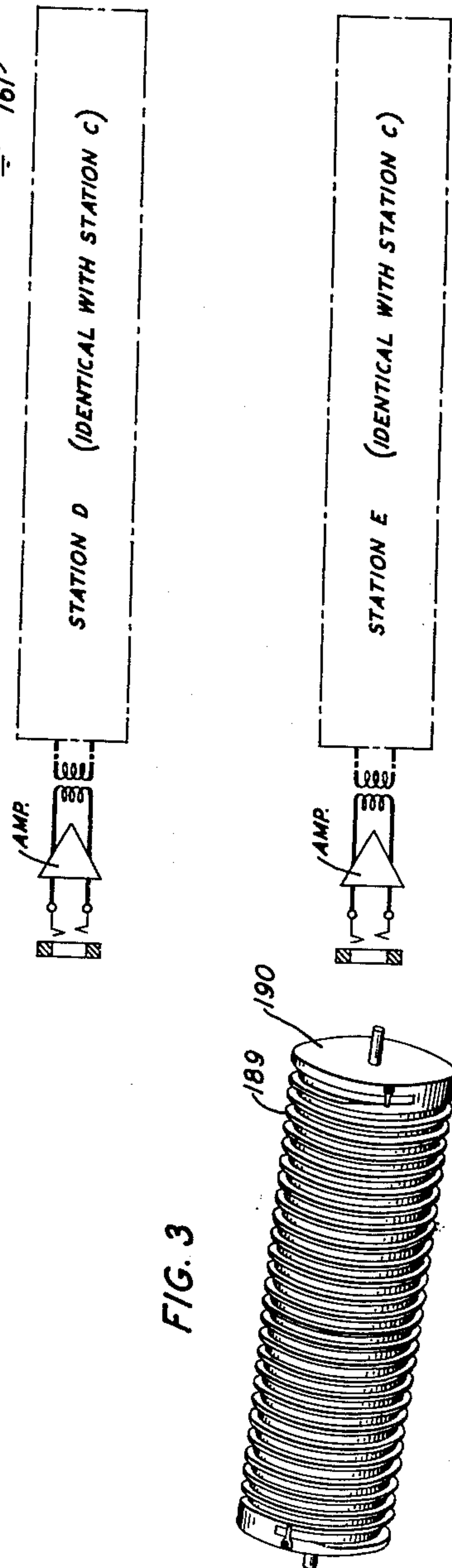


FIG. 3

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PICTURE BROADCASTING SYSTEM

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2 Claims. (Cl. 178—6)

This invention relates to telephotography and particularly to a picture broadcasting system provided with apparatus for simultaneously producing, under control of a transmitted picture current, a picture and a non-pictorial record of the picture from which the picture can be subsequently retransmitted.

In a picture broadcasting system which is disclosed in British Patent No. 453,462, a plurality of terminal stations each provided with picture transmitting and picture receiving apparatus are connected by a transmission network so that a picture current, produced as the result of scanning a picture at one station, is transmitted to the other stations where the current is utilized to control the reproduction of the picture. It has been found desirable to have such a system set up on a permanent basis so that pictures can be sent at any time from a desired station to one or more other stations located at the larger centers of population.

In accordance with the present invention there is provided an arrangement for sending, on a part time basis, certain selected pictures of those transmitted over the permanent system to receiving stations located at smaller centers of population. For this purpose the desired pictures of special interest are recorded, preferably on a magnetic tape, at one of the stations of the permanent system and are subsequently retransmitted from the magnetic tape to one or more stations equipped with picture receiving apparatus and not connected into the permanent system. The transmission lines for the retransmission of pictures to the outlying districts are required for this purpose discontinuously, say one or two hours each day. The cost of the part-time picture service to customers located in the smaller communities will thus be materially less than the cost of the continuous service. Of course, any number of these stations which are connected into the permanent system may be provided with the facilities for recording pictures and retransmitting them to any number of picture receiving stations.

Figures 1 and 2 when placed side by side with Fig. 1 at the left, depict diagrammatically a picture broadcasting system embodying the present invention.

Fig. 3 is a perspective view showing a modification of a portion of the recording apparatus of Fig. 2.

In the drawings are shown diagrammatically three terminal stations A, B and F of a telephotographic system which includes additional

terminal stations and transmission facilities not shown. These transmission facilities are especially conditioned to adapt them for picture transmission and are established as a regular or permanent network such that any sending station of the system can send a picture simultaneously to all the receiving stations at any time that a picture is not being transmitted from some other station. The complete system is described in detail in the British patent supra and the following United States patents.

A. D. Dowd Patent 2,041,822, granted May 26, 1936; C. C. Towne Patent No. 2,105,897, granted Jan. 18, 1938; E. R. Morton Patent 2,050,624, granted Aug. 11, 1936; A. D. Dowd Patent 2,059,564, granted Nov. 3, 1936; G. J. Goetz Patent 2,054,901, granted Sept. 22, 1936; E. N. Staples Patent 2,055,638, granted Sept. 29, 1936; C. W. Green Patent 2,019,603, granted Nov. 5, 1935.

This telephotographic system is also briefly described in the publication "Electrical Engineering" for September 1936, beginning on page 996.

As described in the British Patent 453,462, the picture transmission apparatus located at each of the terminal stations of the permanent telephotographic system, such as station A, includes a picture cylinder 11 upon which is mounted a picture 10 which is to be transmitted. Light from source 12 after being interrupted by light valve 13 energized by current from the alternating current source 14 of 2400 cycles, for example, is directed upon a small spot on the picture 10 and the light reflected from this illuminated spot is received by the photoelectric cell 15. The scanning apparatus, including the light source 12 and the photoelectric cell 15, is mounted on a carriage which is moved in the direction of the axis of the picture cylinder 11 as the cylinder rotates so that the elemental areas of the picture lying along a helical path are scanned in succession. The current set up in the circuit of the photoelectric cell is amplified in the amplifier 16, transmitted through the band pass filter 17 and equalizer 18 and further amplified by the amplifier 19. This portion of the apparatus is disclosed in detail in the Dowd patent No. 2,041,822. The picture cylinder and scanning apparatus may be connected under control of an operator to a driving motor 20 by means of an electromagnetically operated clutch 21 which is described in detail in the Towne patent supra. The motor 20, when started, operates continuously at a speed which is maintained accurately at a constant value under control of

current from the source 14 of constant frequency alternating current and the speed control apparatus 22. The speed control apparatus is disclosed in detail in the Morton patent, supra.

6 The apparatus at station A for operating the clutch magnet to start the picture cylinder 11 and the scanning apparatus and for simultaneously sending out a signal for controlling the starting mechanism at the distant stations is similar to that described in the Dowd Patent No. 2,059,564, supra.

15 A transformer 30 couples the amplifier 19 of the picture transmitting apparatus at station A to a transmission path 31 which connects the transmitter at station A with the other stations of the system including stations B and F. Station A is also provided with picture receiving apparatus 32, like the picture receiver at station B and station B is provided with a picture transmitter 33, like the transmitter at station A.

20 At station B the transmission path 200 is connected through transformer 40 to amplifier 50 which in turn is connected through the band pass filter 51, amplifier-rectifier 52, low pass filter 53 and light valve equalizer 54 to the light valve 55. Light from source 56 is directed through the light valve 55 to a small spot on the light sensitive picture film 57 mounted on picture cylinder 58. The motor 59, when the electromagnetically controlled clutch 60 is operated, drives the picture cylinder 58 to rotate it about its axis, and the carriage which supports the optical apparatus comprising light source 56 and light valve 55 to move it in the direction of the axis of the cylinder so that the tone values of elemental areas of the picture are reproduced in succession along a helical path in synchronism with the scanning of the elemental areas of a picture at a transmitting point, station A, for example. This portion of the picture reproducing apparatus is disclosed in detail in Dowd Patent 2,041,822, the clutch mechanism being disclosed in detail in the Towne application, supra. The motor 59, when started, operates continuously at a speed which is maintained at a constant value under control of current from source 61 of constant frequency alternating current, having the same frequency as source 14 at station A, and the speed control apparatus 62. The speed control apparatus is fully described in the patent to Morton, supra. The apparatus for operating the clutch 60 so as to start the picture receiving apparatus substantially simultaneously with the picture transmitting apparatus under control of a transmitting operator at station A, for example, is disclosed in detail in Dowd Patent 2,059,564.

60 The lines coming from the different stations of the system are interconnected through a bridging network 201. As shown, the lines 31 and 202 from station A, the lines 200 and 203 from station B and the lines 204 and 205 from station F are connected to the bridging network 201. The station F is like station A or station B. It includes a picture transmitter 206 connected to line 205 through apparatus including an amplifier 207 and a picture receiver 208 connected to line 204 through apparatus including an amplifier 209.

70 In operating the system, the operator at station A, for example, desiring to transmit a picture, operates a key to condition the system for picture transmission from station A only to the other stations of the system including station B. The operator at station B, for example, will then operate a key to condition the starting circuit at

station B. The operator at station A then operates start key 23 to energize the clutch magnet 24 to start the picture sending machine at station A and to momentarily interrupt the transmission of carrier current, produced due to the interruption of the light from source 12, to station B. At station B the interruption of the received carrier current causes the operation of clutch magnet 73, thus starting the picture receiving machine. When the operator at station A releases key 23, the carrier current is again transmitted and, due to the operation of the picture transmitting machine, this carrier current is modulated in accordance with the tone values of the successively scanned elemental areas of the picture. At station B the received modulated carrier current, after being amplified and rectified, actuates the light valve 55 to control the exposure of the elemental areas in succession of the light sensitive surface 57 to reproduce the picture thereon after suitable development.

25 In order that certain preselected pictures of those transmitted from some station, such as station A, of the permanent system, to station B may be transmitted to one or more stations, such as stations C, D and E, not connected with the permanent system, during a certain relatively short period of each day, there is provided at station B a picture recording and retransmitting apparatus. This apparatus is preferably one in which a magnetic record is produced such, for example, as disclosed in a copending application of C. N. Hickman Serial No. 65,020, filed February 21, 1936.

35 The currents received at station B from station A, for example, may be recorded by operating keys 81 and 82 and closing switch 83 upwardly as viewed in the drawings. Under these conditions a winding of transformer 40 is connected through amplifiers 110 and 84 and transformer 85 to a winding 86 of a translating magnet 87. The signaling current flowing through winding 86 will set up an alternating flux in the pole piece 88. The recording member 89 of magnetic material is moved from right to left, as indicated by the arrow, it being unwound from reel 90 and wound up on reel 91, the latter being driven by the motor 92. The motor 92 is caused to run at a constant speed under control of current from the constant frequency source 61 and the speed control apparatus 102 like the speed control apparatus 22 and 62. As the recording member 89 passes the polarizing magnet 93 it is highly magnetized to erase any previous recording by steady flux in the pole-piece 94 set up by a steady current from the battery 96 flowing in the winding 95. The depolarizing winding 97 of the translating magnet 87 is connected to the battery 96 through a variable resistor 98 to produce in the pole piece 88 a steady flux in the opposite direction from that produced in the pole piece 94, to bring the recording member 89 to the proper magnetic condition to receive a record. The small backing blocks 99 and 100 of magnetic material disposed opposite the tips of pole pieces 88 and 94, prevent the flux from these pole pieces from spreading along the magnetic tape 89 and cause the flux to pass directly from the pole piece tips through the magnetic tape 89 in a perpendicular direction as viewed in the drawings.

75 When a complete picture transmitted from station A has been recorded upon the magnetic record 89 the operator will open keys 81 and 82 and switch 83. The operator will then uncouple the reel 91 from motor 92 and couple reel 90 to

a suitable motor to cause the recording tape 89 to be wound up on the reel 90. The picture current previously received from station A may then be reproduced by closing the switch 83 to its lower position as viewed in the drawings, by coupling reel 91 to motor 92 and energizing the motor by closing key 82. As a result the recording tape 89 will again be moved in the direction indicated by the arrow. The polarizing windings 95 and 97 respectively, are disconnected from the battery 96 and the winding 86 is connected to the input of amplifier 84, the output of the amplifier being connected to the terminals of jack 103.

If it is desired to retransmit the picture from the magnetic record 89 to station C, for example, a cord 104 terminated in a plug at each end is used to connect jack 103 to the jack 105 the terminals of which are connected to the input of amplifier 106. The output of amplifier 106 is connected through transformer 107 to the transmission line 108 which terminates at station C. In a similar manner a connection may be completed from jacks, not shown, connected in multiple with jack 103, to the stations D and E which are provided with apparatus which is identical with that shown at station C. Station C is provided with picture receiving apparatus identical with that provided at station B and this apparatus, therefore, will not be further described. The parts of the apparatus at station C are numbered the same as the corresponding parts of the apparatus at station B except that numbers supplied to the parts at station C are each raised by 100.

In recording upon the magnetic tape 89 at station B a picture transmitted from some other station of the permanent system such as station A, there will first be produced a magnetic record under control of unmodulated carrier current which is being transmitted from station A. Next there will occur a blank space on the magnetic record due to the interruption in the transmission of the unmodulated carrier current from station A. Subsequently the picture modulated carrier current will be received and a record of the picture will be produced in the magnetic tape under control of these picture modulated currents.

In transmitting from the magnetic tape 89 at station B to the picture reproducing apparatus at station C, unmodulated carrier current will first be transmitted. While this unmodulated carrier current is being transmitted the operator at station C will operate the start key to condition the starting circuit so that the subsequent interruption of the carrier current will cause the clutch 160 to operate and the picture receiving apparatus to be set into motion. This is more fully explained in the patent to Dowd 2,059,564. When the picture modulated carrier current is subsequently received at station C, the successive elemental areas of the light sensitive surface 157 will be exposed in succession in accordance with the tone values of the successively scanned elemental areas of the original picture 10 at station A.

Instead of moving the magnetic recording tape 89 between reels 90 and 91 as shown in Fig. 2, a tape 189 may be wound helically upon a cylinder 190, preferably of thin non-magnetic material as shown in Fig. 3, this cylinder being driven by the motor 92. The recording and retransmission apparatus of Fig. 2 may be used with the apparatus of Fig. 3, the magnetic backing blocks 99 and 100 being positioned within the cylinder

190 and the tips of pole pieces 88 and 94 being positioned outside the cylinder adjacent to the magnetic tape 189.

What is claimed is:

1. A telephotographic system comprising a first station, a second station, a third station, a wire network interconnecting all of said stations, means at each of said stations for scanning a picture or other field of view and for producing a carrier current modulated in accordance with the light tone values of the elemental areas of said field, and for broadcasting said carrier current to each of the others of said stations over said network, means at each of said stations for broadcasting an unmodulated carrier current, means for interrupting the transmission of said unmodulated carrier just prior to the commencement of the picture transmission, and means for subsequently modulating said carrier current in accordance with the tone values of the successively scanned elemental areas of the picture to be broadcast and for broadcasting said modulated carrier current to each of the other of said stations over said network, means at each of said stations for reproducing a picture under control of said broadcast current, a fourth station, means, including said means for broadcasting from either of said first or second stations to the other of said first or second stations and also to said third station, for permitting said broadcast from either of said first or second stations to reach said fourth station after a desired delay, said last-mentioned means including also means at said third station for continuously, linearly recording, simultaneously with the reproduction of the broadcast at said third station, said variations from either of the first or second stations including said unmodulated carrier and the interruption thereof and the subsequently broadcast carrier modulations and for producing at the end of said desired delay period variations from the record thus produced corresponding to all of the recorded variations and for transmitting them to said fourth station, and means at said fourth station including means for reproducing the picture and means for starting the picture reproducing means, both said last-mentioned means being under control of said current variations transmitted thereto.

2. A telephotographic system comprising a first station, a second station, a third station, means at each of said stations for scanning a picture or other field of view and for producing a carrier current signal modulated in accordance with the light tone values of the elemental areas of said field of view, means including scanning means at each of said stations for reproducing a picture under control of said broadcast current, means at each of said stations for generating and transmitting a starting signal and for broadcasting said signal, means at each of said stations for receiving signals broadcast from any of the others of said stations and for reproducing a picture under control of said received signals, said last-mentioned means including scanning means, means for simultaneously initiating the scanning operation at all said stations under control of any one of said stations comprising means at each of said stations for generating and broadcasting a starting signal to start the receiving scanning means at each of the other of said stations, a fourth station, means, including said means for broadcasting from either of said first or second stations to the other of said first or second stations and also to said third station, for

5 permitting said broadcast from either of said
first or second stations to reach said fourth sta-
tion after a desired delay, said last-mentioned
means including means at said third station for
continuously, linearly recording all said signals
received from either of said first or second sta-
tions including said starting signal and signals
representative of the field scanned at the broad-
casting station, the recording of said last-men-
10 tioned signals occurring simultaneously with the
receiving scanning operation of said third sta-

tion, means for producing at the end of said de-
sired delay period current variations from the
record thus produced corresponding to all of the
recorded signals and for transmitting them to
said fourth station, and means at said fourth
station including scanning means for reproduc- 5
ing the picture and means for initiating the
scanning operation, both said last-mentioned
means being under control of said current varia-
tions transmitted to said fourth station. 10

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