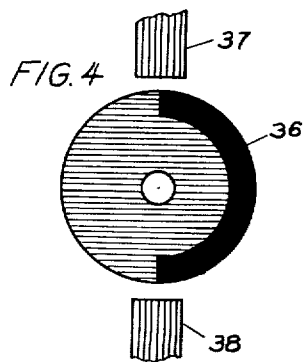
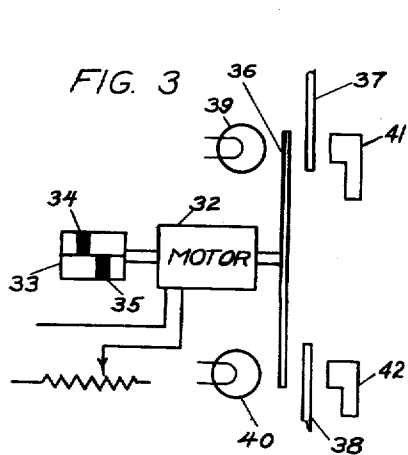
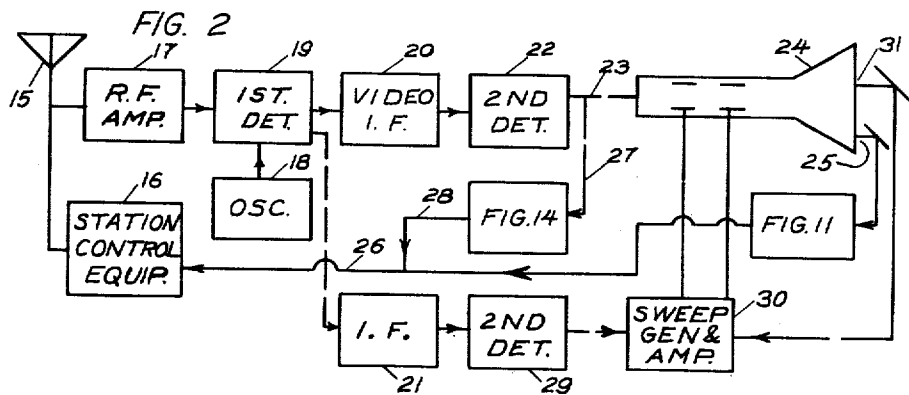
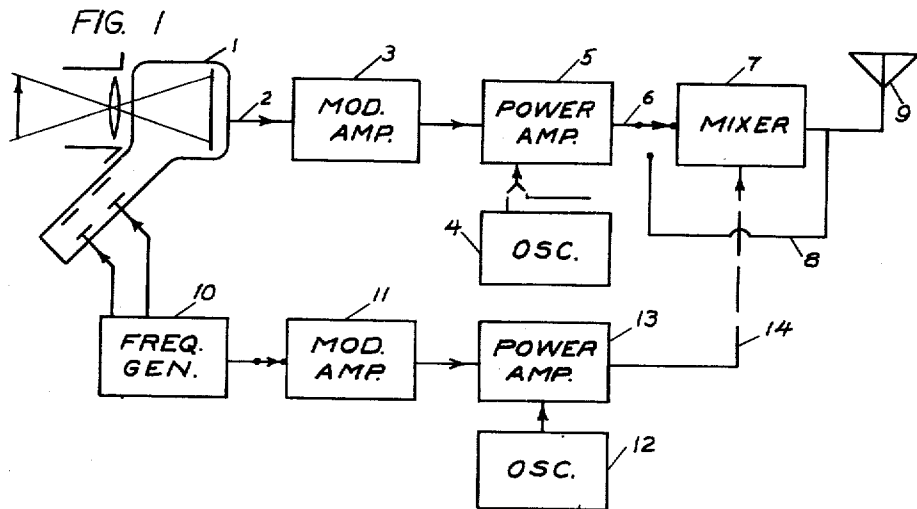


Feb. 20, 1945.

J. H. HOMRIGHOUS
METHOD AND SYSTEM FOR CONTROLLING RADIO AND
TELEVISION RECEIVERS AT A DISTANCE
Filed Aug. 3, 1940

2,369,783

3 Sheets-Sheet 1



INVENTOR.

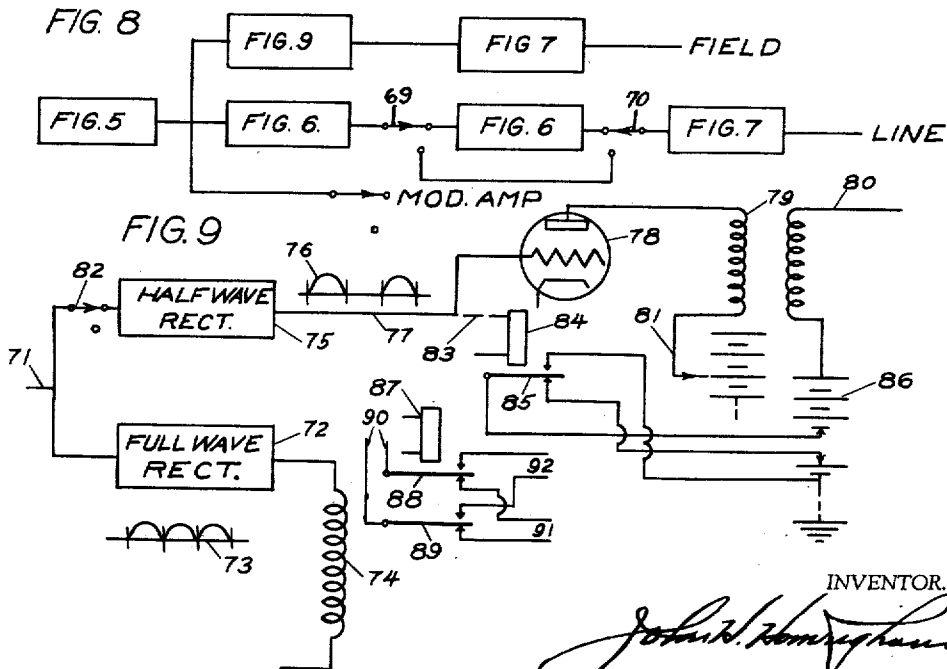
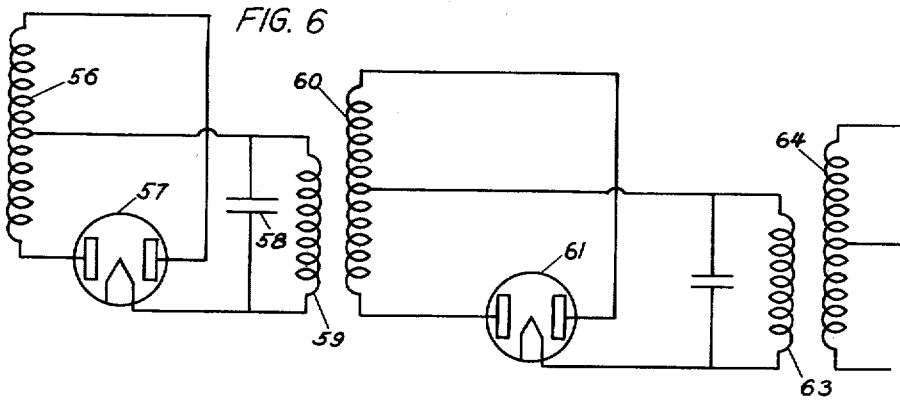
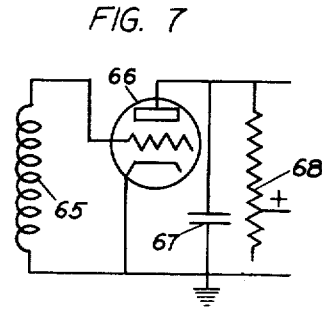
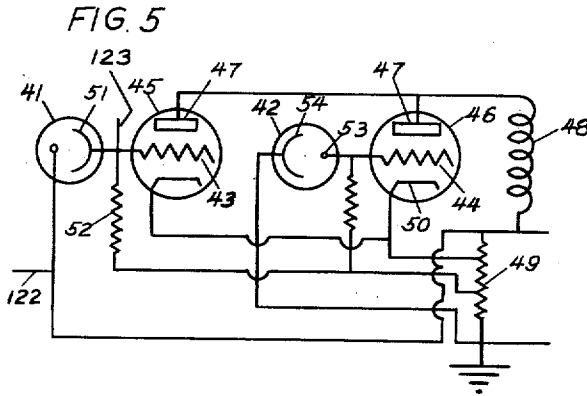
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2,369,783

3 Sheets-Sheet 2



INVENTOR.

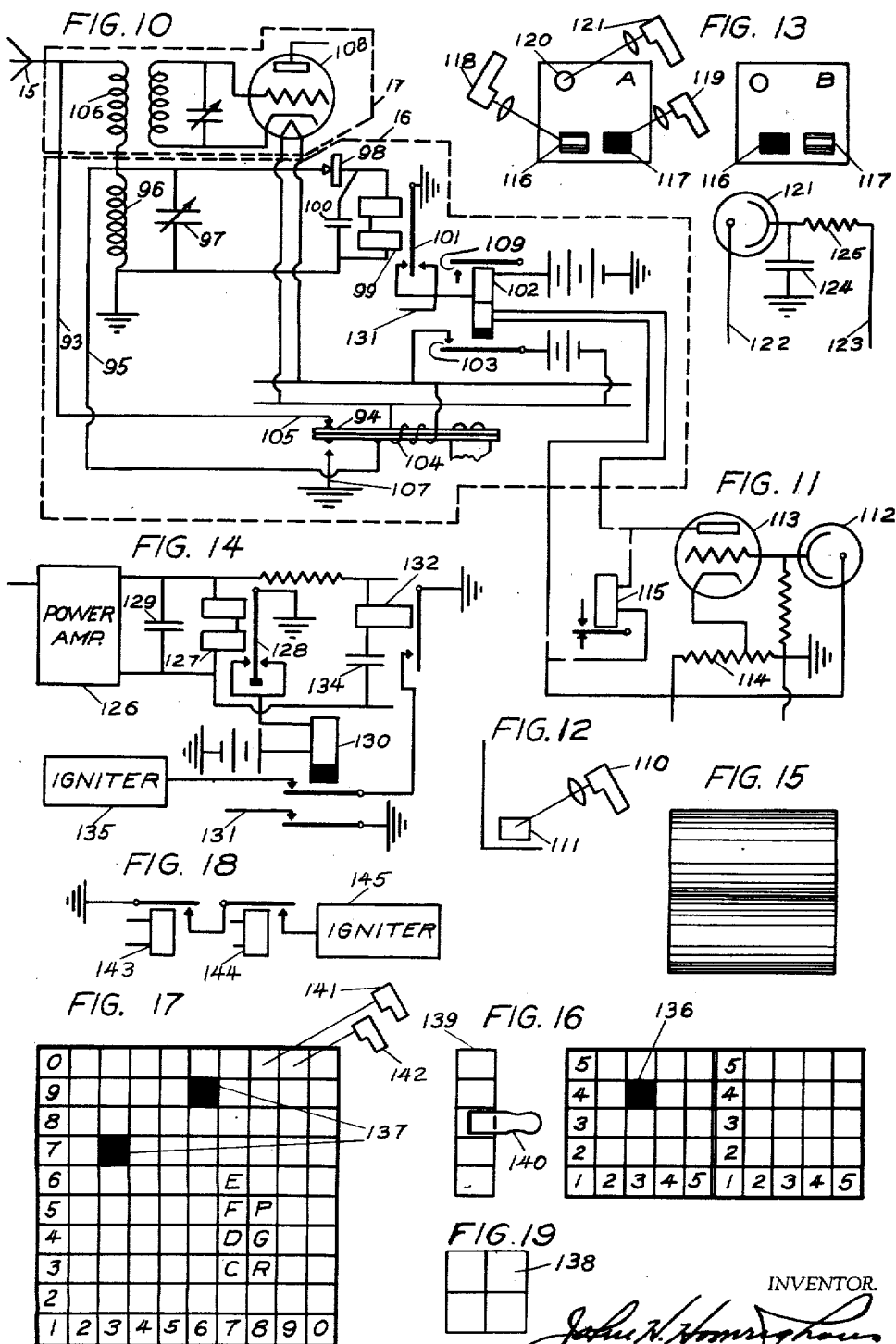
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2,369,783

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,369,783

METHOD AND SYSTEM FOR CONTROLLING
RADIO AND TELEVISION RECEIVERS AT A
DISTANCE

John H. Homrighous, Oak Park, Ill.

Application August 3, 1940, Serial No. 350,758

27 Claims. (Cl. 178-6.8)

My invention relates generally to an improved method and system for controlling radio receivers at a distance.

One object of my invention is the provision of radio and television receiving sets under the control of the operator at the transmitting station whereby power supply may be connected to the receiving set.

Another object of my invention is the provision of receiving stations under the control of the operator at the transmitting station whereby any one or any number of the stations can be operated.

Another object of my invention is the selection for operation of any one or several of a number of controls and to change this selection of controls to any other combination at the will of a distant operator.

The present invention is an improvement on my prior inventions Serial #306,537 filed Nov. 28, 1939, now Patent Number 2,309,393, and Serial #334,864 filed May 13, 1940, now Patent Number 2,320,699. In this application I have not shown a method for transmitting and reproducing sound but it is to be understood that either of the methods shown in above noted applications may be used where desired between certain types of stations.

Other objects, features, and advantages of my invention will appear from the following description taken in connection with the accompanying drawings illustrating an embodiment thereof in which:

Figures 1 and 2 are simplified diagrammatic views of a television transmitting station and a television receiving station, respectively, illustrating the principles applied in this invention.

Figure 3 is a motor device for generating control frequencies.

Figure 4 is an end view of the disk shown in Figure 3.

Figures 5, 6, 7, and 9 are control circuits for scanning and interlace operations.

Figure 8 is a simplified diagram showing circuit figure numbers used in generating the sweep frequencies.

Figure 10 is a tuned station control and circuit.

Figure 11 is a photo-electric tube circuit.

Figures 12 and 13 show picture or video control characters, reproduced at the receiver, and a photo tube circuit.

Figure 14 shows selective devices responsive to certain definite frequencies.

Figure 15 shows picture characters for use at the transmitter to produce definite frequencies.

Figures 16 and 17 show picture characters, or code reproduced at the receiver.

Figure 18 shows circuits arranged for code operation.

Figure 19 shows an arrangement for several separate codes.

In Figure 1 the numeral 1 designates a cathode-ray pick-up tube of the conventional type, and is known as an Iconoscope. It is to be understood that other types of tubes may be used such as the Orthiconoscope developed for perpendicular scanning of all points on the mosaic; or the tube, known as the image dissector may be used instead of the one illustrated.

As shown the tube comprises a mosaic, photo-electric screen on which a light image of the object is projected and an electron gun for generating a ray of electrons directed at the screen, and two sets of deflecting plates for deflecting the electron ray at the line and field frequencies, so that it is caused to scan the screen. It is to be understood that electromagnetic means may be employed for deflecting the electron beam. The picture and certain other control characters are thereby developed and fed by an output connector 2 to a modulating amplifier 3.

A carrier wave is provided by an oscillator 4 in the power amplifier 5. The oscillator 4 may be arranged to supply several different frequencies or different oscillators may be switched in and out of the circuit in order that several carrier waves may be used. The carrier is modulated by the frequency band video or picture signals through the modulation amplifier 3. The signals from the amplifier 5 are supplied by a connection 6 to the mixing circuit 7. Certain control characters for governing the scanning action at the receiving set may be transmitted as video signals, as also covered in my prior application, and when this is done the signals from amplifier 5 are supplied by the connections 6 and 8 direct to the antenna 9.

The numeral 10 designates a generator for producing pulsating voltage waves or waves of sine form for controlling the sweep frequencies at the desired frame frequencies. These sweep and line frequencies are supplied to the deflecting plates of tube 1. The sine form wave may through the medium of amplifier 11 modulate another carrier produced by oscillator 12 in its amplifier stage 13. When it is desired by the operator to transmit a separate synchronizing frequency for controlling the scanning action at the receiver. The

signals from the amplifier 13 are fed to the mixer circuit 7 through the conductor 14.

The two carrier waves, one modulated by a single control sweep frequency; the other, modulated by video signals, are mixed in the mixer circuit 7 and fed to the common antenna 9 for transmission by radio.

The control signals are transmitted in the form of a sine wave which are changed or rectified at the receiving station before they are used to synchronize the scanning action with the transmitter.

The antenna 15, Figure 2, receives the carrier signals from the transmitter antenna 9 to a tuned station control equipment circuit 16. These signals may come in over a single carrier whenever the control voltages are to be generated from the picture signals, or two carriers may be employed when it is desired to have the control for the sweep signals transmitted as a definite frequency on a sub-carrier.

The tuned station control, circuit 16 functions only when a carrier modulated by a particular frequency is received, to switch the incoming signal from the tuned station control circuit to the radio frequency amplifier 17 and to close the battery supply to the receiving set.

An oscillator 18 reacts with these signals in the first stage 19 on the superheterodyne principle to produce in one case a single intermediate frequency signal which is supplied to the video intermediate stage 20 and at stations operating from two carriers, the oscillator 18 reacts with these two signals in the stage 19 to produce two intermediate frequencies which are fed to the two stages 20 and 21.

After suitable amplification, the video signals are detected at 22 and fed by a connection 23 to a reproducing or picture tube 24. The device 24 is represented as being in the form of a cathode ray tube of well known construction, and comprises a fluorescent screen, an electron gun for developing a ray of electrons, directed toward the screen, and two sets of electrostatic plates for deflecting the electron ray at the line and field frequencies to cause it to scan the screen. It is to be understood that electromagnetic means may be employed for deflecting the electron beam. The video signals are applied to a control electrode of the electron gun to change the intensity of the electron ray in accordance with picture or video signals.

Blanking signals may be obtained in accordance with the system shown in my prior applications Serial #334,864.

The picture tube 24 reproduces a certain character at 25 which is picked up by the photo-tube shown in the circuit of Figure 11 which in turn operates over connection 26 to a holding device in the station control circuit 16 whereby the apparatus will continue to be supplied with battery until such time as the transmitter either goes off the air or the image for producing the character at 25 is no longer transmitted.

In certain instances a more economical and different method of interpreting video signals is desirable and I have provided such a device in Figure 14 to be explained more fully later and as shown in Figure 2 it is fed from connection 27 eliminating the picture tube 24 and the necessity for sweep signals. The connection 28 is for holding the station control circuit 16 in operated condition.

Referring to the intermediate frequency stage 21, which in certain instances may receive the control signals and through the action of the sec-

ond detector 29 the output of which is a voltage wave of sine form that is fed to the sweep generator and amplifier circuit 30 where after suitable amplification it is changed or rectified and used to control the vertical scanning and this output voltage wave is also used to produce a higher frequency for synchronizing horizontal line scanning in the amplifier generator device 30 using circuits similar to those used in the transmitter, which will be explained in more detail later.

The picture control characters reproduced at 31 and supplied to suitable photo-tube circuits are for generating the synchronizing frequencies at the receiving station, thereby eliminating the necessity of transmitting control frequencies. This will also narrow the frequency band required.

Referring to Figure 3, the numeral 32 represents a motor which is operated from the local power supply and has a variable speed from approximately 1500 R. P. M. to 1800 R. P. M. or one revolution per frame. The drum 33 has two black bands 34 and 35, each of which extends over one half of the periphery and are located adjacent the opposite edges of the drum 33 which drum is directly connected to the motor shaft so that by rotating it in front of the transmitting tube 1, two short black lines will appear alternately, but separated on the mosaic which will be reproduced at the picture tube in the receiving set as shown in Figure 13 and are used for controlling the sweep frequencies which will be further explained later.

Thus it will be seen that each mark or sign on the mosaic is definitely identified with a field and that it is also definitely related to the speed of the motor which is two fields per revolution.

Connected to the motor shaft, is a disk of light polarizing material 36, revolving past stationary pieces of light polarizing material 37 and 38 and also separate sources of light 39 and 40 respectively.

The revolving and stationary members are better shown in Figure 4. The disk 36 is of polarizing material, having a certain part painted or blocked out so that by rotating it in a clockwise direction past its stationary members of polarizing material 37 and 38 and between its sources of light 39 and 40 and their respective photo-cell 41 and 42 the intensity of the light reaching each photo-cell will uniformly vary from zero value to maximum value and back to zero during one half of a revolution and during the other half of the revolution there will be no light change. The photo-cell 41 and 42 are placed one hundred and eighty degrees apart and changes in intensity of light will alternately effect each photo-cell.

A system for producing the proper sweep frequencies is shown in Figures 5 to 9 inclusive.

Referring to Figure 5 I have shown a circuit for producing an alternating current from the variations of light occurring in the photo-cells 41 and 42 which are the photo-cells shown in Figure 3. These photo-cells control the grid excitation of grids 43 and 44 of amplifier tubes 45 and 46. The anodes 47 are connected in parallel through the primary transformer winding 48 to the positive side of voltage divider 49. The cathodes 50 are connected in parallel to an intermediate point of the voltage divider 49. The cathode 51 of photo-cell 41 is connected to the grid 43 of tube 45 and through resistance 52 to negative potential at the voltage divider, thereby maintaining the grid 43 at a negative potential with respect to cathode 50 and plate 47. The circuit is so arranged therefore, that an increase in the intensity of light on

the photo-cell 41 will increase the output current of tube 45. The photo-cell 42 has its anode 53 connected to the grid 44 of tube 46, and it is maintained at a positive potential with respect to its cathode 54. This causes a decrease in the current of tube 46, upon increasing the intensity of light directed toward the photo-cell 42 other amplifier tubes may be connected in parallel to increase the output.

Therefore since the plate circuits of tubes 45 and 46 are in parallel the rotation of the disk 36 will alternately operate the photo-cells 41 and 42 to produce a continuous rising and falling current in the primary winding 48 of a transformer whereby, alternating voltages are induced in the secondary winding.

When it is desired to control the receivers by a definite frequency from the transmitter these voltage waves generated by Figure 5 are modulated on a sub-carrier as explained in connection with Figure 1, and are transmitted by radio to the receiving set to control the field and line frequencies for controlling the deflection of the electron ray in the receiving tubes. These voltage waves are also used to control the line and field saw tooth wave at the transmitting tube.

In this invention I employ frequency multiplying circuits for the purpose of producing the high frequency required for horizontal line scanning. The field frequency is obtained as described above and from these frequencies the higher line frequencies are produced.

Referring to Figure 6, two stages of frequency multiplication are shown. The secondary 56 is inductively connected to the primary winding 48 in Figure 5 to supply alternating pulses to the tapped secondary and in turn to the full wave rectifier tube 57 which delivers twice the number of pulses or cycles to the tuned filter comprising the condenser 58 and the next transformer primary winding 59. This double cycle signal is supplied by the tapped secondary 60 to the full wave rectifier tube 61, where it is again doubled and fed to the succeeding transformer primary 63. The tapped secondary 64 delivers alternating current to the next stage and so on until the desired high frequency for line scanning is obtained.

In this invention I prefer to use doublers and obtain an even number of lines per field or frame and for interlace scanning each field would have an even and equal number of lines.

From the above it will be seen that by changing the speed of the motor in Figure 3 the number of fields or frames per second would be changed but the number of lines per field would remain the same. This will eliminate interference with local power, and it is one method that can be used that will make it difficult for other than predetermined receiving sets to obtain the information transmitted.

To produce the desired output wave of saw tooth form for field and line scanning, I employ a grid controlled discharge tube circuit shown in Figure 7, where voltages induced into the transformer secondary winding 65 drive the grid of tube 66 positive, discharging the condenser 67 through the tube 66. Thus by alternately charging the condenser 67 through the resistance 68 and discharging it through the tube 66 a saw tooth voltage is generated.

In Figure 8, I have shown, diagrammatically, the circuit figure numbers used to produce the required frame and line frequencies; several circuits of Figure 6 may be used but it is to be un-

derstood that this circuit may represent only one stage.

With further reference to Figure 8, I have provided two switches 69 and 70 for shorting out one or more stages of doublers so that the horizontal lines may be varied at the will of the operator. One of the switches or keys may also change the voltage on the focusing electrode in the CR tubes to thereby change the size of the spot of electron on the screen.

The diagrammatical arrangement of circuit figure numbers shown in Figure 8 will be the same arrangement of circuits employed at the receiver when control frequencies are developed from characters reproduced on the screen of the picture tube. However, when a sine form voltage wave is transmitted to govern the scanning action at the receiver the schematic arrangement will be the same, except Figure 5 should be omitted.

In the present invention in order to produce interlace scanning from a sine form voltage wave it is necessary to identify every other field and in some manner cause the horizontal lines of one field to fall in between the lines produced in the second field or the lines of one field are even numbered and in the second field they are odd numbered.

In order to accomplish the interlace features noted above, I employ the circuit shown in Figure 9. In this circuit voltage waves of sine form are supplied from the circuit of Figure 5 or are transmitted to the receiving set as previously explained in connection with Figure 2, over the conductor 71 to a full wave rectifier 72 of conventional design. The output wave form is shown at 73. These pulses are fed through the primary winding 74 of a transformer to the wave forming circuit Figure 7, to drive the grid of tube 66 positive discharging condenser 67 thereby, producing saw tooth waves for vertical scanning.

These circuits are so arranged that the timing or synchronizing pulses are also the trigger pulses for the discharge tube whereby, the retrace is initiated.

In multiple, with the full wave rectifier 72, is a half wave rectifier 75, having an output wave form as shown at 76. The pulses from the rectifier 75 are supplied by connection 77 to an amplifier 78, the output of which is connected through a transformer winding 79 to battery. These pulses will induce in the secondary a voltage which will alter the potential in conductor 80 from that furnished by the battery 86 for the duration of each pulse. The lead 80 supplies potential to one of the vertical deflecting plates of the cathode ray tube 24, Figure 2 through a variable resistance (not shown) for centering or adjusting the vertical movement of the electron spot. Another lead from the battery 86 would supply potential to the opposite vertical deflecting plate through another resistance. The potential on the plate of amplifier 78 is adjustable at 81, depending upon the space between even or odd lines.

The half wave rectifier 75 and the amplifier 78 will operate during each positive pulse to increase or decrease the potential on one of the vertical deflecting plates without changing the potential on the opposite deflecting plate which will have the effect of raising or lowering the horizontal lines.

From the above description it will be seen that I have provided means for interlace scanning or for shifting the position of the horizontal lines scanned in a cathode ray tube, during alternate

field pulses, eliminating any necessity of transmitting by radio synchronizing pulses, other than one sine form wave of field frequency.

From the above description it will be seen that the line pulses are definitely locked with the field pulses, or in other words, the same pulse that triggers the vertical deflection also, through multiplying circuits, supplies the trigger pulses for line scanning.

Furthermore, from the above description, the control of the field and line deflecting circuits at the receiver from the sine form voltage wave transmitted by radio from the transmitting station will cause the cathode-ray or electron ray in the viewing tube to be in exact synchronization with the cathode-ray in the pick-up tube whenever the receiving station is tuned to the proper carrier wave.

At any time or instant that the receiver is tuned to the same carrier wave of the transmitting station, the deflecting circuits will automatically be in step. Suppose that at a certain instant the cathode-ray or electron ray in the pick-up tube is focused on mid-point of line number 175. Now, since a single frequency or control voltage wave generated at the transmitter station times the deflection of both the field and the horizontal lines at both the transmitting station and receiving station, the cathode-ray at the viewing tube would automatically be focused at the mid-point of line 175 on the screen of the viewing tube, and furthermore, since I have provided through the medium of a half wave rectifier, Figure 9, means for associating the positive pulse in each cycle of the control voltage wave with a certain field, the focused electron ray in each tube would also fall in the proper vertical location in each field. The picture or symbols produced from this system will be approximately as high as they are wide since there is very little need of reserving space at the bottom of the picture for synchronizing pulses.

With further reference to Figure 9, the switch or key 82 is thrown to off position whenever it is desired to send pictures or symbols by progressive scanning, in which case there would be no need for changing the position of the horizontal lines in the fields. The changing from progressive to interlace scanning is another method that would be difficult for uninstructed receiving station operators to figure out.

In some cases it may be desirable to operate the movement of the electron beam at a slow rate and for that purpose I have provided at the receiver an optional feature, or the positive pulses from the connection 77 Figure 9 are fed through connection 83 to a relay 84 instead of going through the tube 78. This relay 84 operates its spring 85 upon receiving a positive pulse to change the potential of battery 86 which battery is supplied to one of the vertical deflecting plates through a variable centering resistance and as previously explained in connection with the tube 78 this potential change causes the lines of one field to fall in between the lines of a second field.

With reference to the relay 84 it may be used for an entirely different purpose and as shown by the reference numeral 87 it operates the springs 88 and 89 to switch the input circuit 90 from one output circuit 91 to a second output circuit 92 which will be explained in more detail later.

From the preceding explanation it will be seen that many combinations may be derived, for instance, at certain predetermined time intervals

during the day messages or pictures may be transmitted by progressive scanning; other time intervals interlace scanning may be used. The field frequency may be changed from slow to fast and vice versa at the option of the operator at the transmitting station; also the number of lines per field may be changed at predetermined intervals.

Referring to Figure 10, I have shown a station control stand-by circuit or, in other words, a circuit that will only operate when the proper carrier wave is received and normally this circuit is without battery drain. The modulated carrier is received from the antenna 15 over conductor 93, spring 94, conductor 95 to the receiving tuned station circuit consisting of the following equipment an antenna coil 96 and condenser 97 which may be adjusted for various carriers and a crystal detector 98 which may be a tube detector provided with a power supply. After detection the signals are supplied to a relay or auxiliary device 99 which operates in the low or audio frequency range and may be similar to the one shown in my prior application Patent Number 1,460,814. The number 100 represents a by-pass condenser.

The carrier at the transmitter is first modulated by a particular frequency for a short interval of time. The method of modulation to be more fully explained later. The duration of this preliminary frequency will actuate the spring 101 and close the circuit to the slow acting relay or circuit closing device 102. The relay 102, in operating its springs 103, closes the battery supply circuit to all the tube filaments in this receiving set, and also to the heating element 104 for controlling the bimetal spring or circuit changing device 94. The relay 102 will remain energized through the action of spring 101 during the interval of the low frequency modulation or until such time as the bimetal spring becomes sufficiently heated from its element 104, to deflect and open the circuit to the antenna coil 96, at follow up spring 105 and to place ground on the antenna coil 106 through the closing of spring 94 and 107.

The operation of the bimetal spring 94 to switch antenna coils from coil 96 to coil 106 is slow in order to allow some time for the filaments of the several receiving tubes (one tube shown at 108) to become sufficiently heated for proper operation. At the time of the switch over the preliminary frequency received over the antenna should be ended and video signals for code operation and other controls should be received from the antenna on the same or a different carrier and developed in the receiving set equipment.

The operation of relay 102 also closes the B battery supply to the anode circuits for the several receiver tubes at springs 109. The relay 102 must remain in an operated position during the transmission of video signals. One method used to accomplish this feature is to provide a photo-cell 110 Figure 12 to pick up a beam of light at a particular spot or location on the screen of the viewing tube and as shown at 111. This spot or point 111 is under the control of the operator at the transmitter and may be produced from one of the marks on the drum 33 Figure 3 or it may be produced in a manner to be described in connection with Figure 15. Referring to Figure 11 I have shown a photo-cell 112 which may be the photo-cell 110 in Figure 12. This cell is responsive to variations of light intensities and will also permit current to flow when exposed to a steady

beam of light of sufficient intensity. Light directed toward the photo-cell will change the grid potential of amplifier tube 113. The anode of tube 113 is connected through the lower winding of relay 102 to the positive terminal of the voltage divider 114. Therefore a steady light on the spot 111 directed toward the photo-cell 112 will cause current to flow in the lower winding of relay 102, thereby maintaining the relay operated as long as the spot 111 remains illuminated to release the receiving set all that is required is to transmit signals to make the spot 111 dark which will release the relay 102 and also render the receiving station inoperative until it is again signaled as previously described.

The anode of tube 113 may be connected through the winding of another relay 115 instead of a winding of relay 102. The spot 111 may be placed at different locations on the tubes of different receiving sets so that any one of a number of receiving sets operating on the same carrier may be released independently of the other receiving sets. By keeping the spot 111 dark for a short or indefinite interval the relay 102 will release opening the battery supply to the various tubes.

With reference to Figure 13 I have shown two fields, A and B, reproduced at the viewing tube showing control character or marks 116 and 117. These marks or characters are produced by rotating the drum 33 Figure 3 in front of the transmitting tube. The marks 116 and 117 will alternate from light to dark and back to dark again, or the mark 116 field A will be light and in field B it will be dark while mark 117 is the reverse from this or at the time of field A mark 117 will be dark while mark 116 will be light.

Light from these characters 116 and 117 is directed through suitable lenses to photo-cells 118 and 119 respectively which may be the photo-cells 41 and 42 shown in the circuit of Figure 5. These photo-cells will operate in the circuit of Figure 5 to alternately increase and decrease the current in the primary winding 48 as previously described whereby, the field and horizontal line scanning frequencies are produced at the receiving stations using the figure numbers as shown in Figure 8.

In my prior application Patent No. 2,309,393 the characters for producing synchronizing frequencies were developed at the rate of picture or frame frequency instead of as shown and described in this application of having the characters developed at the rate of field frequency.

With further reference to Figure 13, some means must be provided for automatically starting the scanning operation, when the sweep frequencies are controlled from characters reproduced at the unattended receiving station. When the battery at the receiver is first switched on the electron beam in the cathode-ray tube will be directed toward the upper left corner of the viewing tube as indicated by the spot 120. The fields A and B in Figure 13 are shown rotated one hundred eighty degrees or like they would appear on the mosaic at the transmitting tube, therefore the scanning would start from the lower right hand corner and progress toward the left and top in Figure 13. The electron ray will rest at this point 120, which may be an adjustable location outside of the normal picture area, since the horizontal and vertical deflecting condensers (like 67 Figure 7) have been charged to maximum capacity which would cause the electron ray to be deflected further than normal. The discharge of these condensers is ac-

complished by modulating test pulses on the carrier by placing test fields or patterns in front of the transmitting tube. The light caused by the impact of the electrons at the spot 120 during the sending of one preliminary test field is directed through suitable lenses to the photo-tube 121 which is in multiple with the photo-tube 41 Figure 5, through conductors 122 and 123.

The sender or test pattern placed in front of the transmitting tube is similar to the reproduced picture or field in Figure 13 except that the top of pattern would be dark gray in color, gradually fading to white in the center and from the center toward the lower edge it would gradually get darker and at the bottom of pattern or chart it would be black, which is the same as upper half of Figure 15. From the above it will be seen that the spot 120 would gradually vary in light intensity which would give the first trigger pulse to the sweep control circuits of Figure 5. The function of by-pass condenser 124 and the resistance 125 is to prevent the operation of the sweep control circuits from high frequency pulses caused by scanning and also by gap or retrace between horizontal lines.

The test pattern after an interval of a few fields would be taken away from transmitting tube but the reproduction of the marks or characters on the drum of Figure 3 would still continue during the sending and receiving of any other information.

With reference to Figure 14, I have shown another method of receiving radio signals originating from a cathode-ray camera tube, and as the picture shown in Figure 15 is placed in front of the camera tube its electron ray will scan an image of the designs or patterns for producing two pulses of current. One pattern occupying the upper half of the picture and the second pattern on the lower half of the picture. Each of these patterns is similar to the test pattern described in connection with Figure 13 and it is to be understood that a picture may contain one or any desired number of patterns.

The test patterns shown in Figure 15 will produce a frequency of 120 cycles per second with 60 fields per second.

From the above description it will be seen that many frequencies may be modulated on the carrier. At the receiving station the cathode-ray tube and associated sweep generator circuits will not be required as shown in Figure 2. The output from the second detector Figure 2 is fed through a power amplifier 126 Figure 14 to a circuit having a tuned or harmonic relay 127 which is well known in the art and as shown it has a weighted or tuned armature 128 which only responds to a certain frequency. The condenser 129 will by-pass extremely high frequencies caused by the gap between lines or retrace interval. The vibration of the relay armature 128 from a suitable frequency caused by a particular pattern at transmitting tube will close the circuit to slow release relay 130. This relay in energizing will place ground on conductor 131 extending back to relay 102 in the station control circuit Figure 10 to hold the station in operative condition as previously explained.

The relay 127 will continue to vibrate its armature as long as the particular frequency is received. However, when placing a picture having more than two patterns in front of the transmitting tube a higher frequency is obtained which will operate the alternating current relay 132 in series with the resistance 133 and condenser 134

which are in resonance for this particular frequency and will not operate on the lower frequency. The relay 132 closes through its spring contacts and the contacts of slow release relay 130 the circuit to the igniter 135 which may be placed in a bomb.

From the above description it will be seen that I have provided a novel system for generating various frequencies at the will of the operator at the transmitting station for controlling devices at a remote distance. Furthermore, as previously stated, the generation of sweep frequencies were not required to operate the apparatus of Figure 14. However, I have provided another method of selecting different circuits by transmitting the field sweep frequency to the receiving station and by employing the circuits of Figure 9 as previously described relay 87 will operate to alternate from one circuit Figure 14 through conductor 91 to another circuit of Figure 14 through conductors 92.

With reference to Figure 16 I have shown a system for producing various combination of numbers or locations reproduced on the screen of a viewing tube, horizontal rows are numbered from bottom up, and vertical columns are numbered left to right, and as shown, the black space, 136, reading up and across would be forty three and so on.

In Figure 16 I have shown two sets of figures of twenty five numbers each. This will further complicate the system. However in Figure 17 I have shown one set of figures but having 100 squares the square 137 indicated black reading up and across would be ninety six, etc. Several of these squares may be used at one time and for various purposes.

These symbols may be used for transmitting various form of information. For instance certain sets of numbers may explode bombs, others may control a robot vehicle, and still others may be used for telegraph or Boudat code symbols. The alphabet may be used similar to that shown where C is number thirty-seven, E is number 67, etc. giving almost an unlimited number of combinations.

Figure 19 shows several separate areas for transmitting simultaneously several codes for different purposes, somewhat similar to Figure 16. For instance the large square 138 may be for the purpose of controlling some selective devices in the receiving station, also the location of the spot or mark 111 in Figure 12 for holding or releasing the receiver may be in this location. The other area may be used for other purposes as desired.

Figures 15, 16, 17, and 21 show the patterns or frames as they are reproduced at the viewing tube. It is to be understood that these will be reversed at the transmitting tube on account of the lens system.

The numeral 139 Figure 16 shows a side view of the frame work for producing the desired images upon mosaic of the camera tube. This structure consists of very thin material placed together forming hollow squares, one hollow square for each two number location; such as the location forty-three is a hollow square represented by the numeral 138, etc. The numeral 140 represents a square peg having a black face. These pegs are placed in the hollow squares when it is desired to transmit some certain square area as black and all others as white.

At the unattended stations using this code system for controlling robots or explosives, I pro-

vide a photo-cell such as 141 and 142 Figure 17 for each location naught eight and naught nine that is to be used for governing the time of the explosion of a bomb or a mine. Either of these photo-cells may be substituted for the photo-cell 112 in the circuit of Figure 11. With reference to Figure 18 I have shown two relays 143 and 144 either of which may be substituted for the relay 116 in a circuit similar to Figure 11. Light directed from location naught eight and naught nine into photo tubes 141 and 142 respectively will operate the springs of relays 143 and 144 to close the circuit to the igniter 145.

I do not intend that the present invention shall be restricted to the arrangement of parts or to the particular form as herein set forth, but contemplate all modification and changes therein within the terms of the appended claims.

Having thus described my invention, I claim:

1. In a radio system, a main receiver including electron tubes, an energizing circuit for the said electron tubes, a control receiver including a signal detector, a signal device, an output circuit for said detector, including said signal device operable from modulated signals, a power supply circuit, a slow acting switching mechanism having a current supply circuit energized by the operation of said signal device for electrically connecting said power supply circuit to the said tubes, and means for impressing upon said control receiver and main receiver modulated carrier waves.

2. The system, in accordance with claim 1, in which there is provided a thermal switch having a winding included in the energizing circuit for the said tubes, whereby the switch may be flexed when the said tubes are energized to thereby render the said control receiver inoperative when the main receiver is receptive to modulated carrier waves.

3. In a radio system, an antenna, a main receiver including a first antenna coil connected to said antenna, an energizing circuit for said main receiver, a stand-by receiver including a second antenna coil connected to said antenna in an operative condition for the reception of modulated carrier signals, control means operated by said stand-by receiver upon the reception of said modulated signals, for energizing said main receiver, said energizing circuit including switching means for by-passing radio frequency energy around said second antenna coil into said first antenna coil to render said main receiver operative to the reception of modulated carrier signals.

4. In a television system, a cathode ray viewing tube provided with a screen, a main receiver network for producing images from received picture signals on said screen, an energizing circuit for said main receiver, a stand-by receiver, control means operated by said stand-by receiver for energizing said main receiver upon the reception of modulated carrier waves, and means for impressing upon said main receiver predetermined carrier waves of another frequency modulated by said picture signals.

5. The system, in accordance with claim 4, in which there is provided a photo electric device, sensitive to light from a certain location in said images, and means regulated by said device for holding said control means energized to maintain said main receiver in an operative condition.

6. The system, in accordance with claim 4, in which said energizing circuit includes switching means for rendering said stand-by receiver in-

operative when the main receiver is receptive to modulated carrier waves.

7. A plurality of television systems, in accordance with claim 4, in which there are provided photo electric devices sensitive to light from different locations in the images on different screens for holding or releasing their associated control means, whereby any one or any number of said main receivers may be maintained in operation while the others are rendered inoperative.

8. A plurality of television systems, in accordance with claim 4, in which there are provided photo electric devices sensitive to light from different locations in the images on different screens for holding or releasing their associated control means the said locations for reflecting light from said images to said photo electric devices are in different sections of said screen for different groups of main receivers and in different locations in said sections for different main receivers in said groups, whereby any one or any number of main receivers in any group or any number of groups may be maintained in operation exclusively.

9. A plurality of television systems, in accordance with claim 4, in which there are provided photo electric devices sensitive to light from different locations in the images on different screens for holding or releasing their associated control means, the said locations for reflecting light from images to said photo electric devices are in different sections of said screen for different groups of main receivers and in different locations in said sections for different main receivers in said groups, whereby means are provided to progressively select groups of main receivers and to make a final selection to pick out one of said main receivers.

10. A plurality of television systems, in accordance with claim 4, in which there are provided groups of main receivers responsive to different carrier frequencies and groups of stand-by receivers responsive to different carrier frequencies, and in which there are also provided photo electric devices sensitive to light from different locations in the images on different screens for holding or releasing their associated control means, the said locations for reflecting light from images to said photo electric devices are in different sections of said screen for different groups of main receivers and in different locations in said sections for different main receivers in said group, whereby means are provided to progressively select groups of main receivers and to make a final selection to pick out one of said main receivers.

11. The system, in accordance with claim 4, wherein there is provided a transmitter and means for producing different light values in successive images at said transmitter.

12. In a radio system, a main receiver, an energizing circuit for said main receiver, a stand-by receiver having a tuned circuit maintained in an operative condition for the reception of sound frequency signals modulated on a carrier, a source of current supply, a circuit closing relay, and relay means in said stand-by receiver responsive to received sound frequency signals for actuating the said circuit closing relay to electrically connect the said source of current supply to the said energizing circuit.

13. In a radio system, a main receiver, an energizing circuit for said main receiver, a stand-by receiver provided with a tuned circuit in an operative condition for the reception of signals modulated on a carrier, a source of current sup-

ply, control means in said stand-by receiver responsive to received signals for electrically connecting the said source of current supply to the said energizing circuit, and a circuit changing device actuated upon the energization of said main receiver to render the tuned circuits in the said stand-by receiver inoperative to the reception of signals modulated on a carrier.

14. In a radio system, a main receiver provided with circuits tuned to a predetermined carrier frequency, an auxiliary receiver provided with circuits tuned to the said predetermined carrier frequency and normally maintained in an operative condition for the reception of signals modulated on a carrier, a circuit changing device, and control means in the said auxiliary receiver responsive to signals received on a carrier of said predetermined frequency for actuating said circuit changing device to change the reception of the signals from the circuits in the said auxiliary receiver to the circuits in the said main receiver.

15. In a radio system, a main receiver provided with tubes, and associated circuits tuned to a predetermined carrier frequency, an energizing circuit for said tubes, an auxiliary receiver provided with a detector, and associated circuits tuned to the same predetermined carrier frequency, said auxiliary receiver normally maintained in an operative condition for the reception of signals modulated on a carrier, a source of current supply, a circuit closing device, a relay in said auxiliary receiver responsive to received signals for controlling the said circuit closing device to electrically connect the said source of current supply to said energizing circuit, and circuit changing mechanism actuated upon the energization of said main receiver for changing the reception of signals from the circuits in the said auxiliary receiver to the circuit in the said main receiver.

16. In a radio system, a main receiver provided with circuits tuned to a carrier frequency, an auxiliary receiver provided with circuits tuned to a different carrier frequency and normally maintained in an operative condition for the reception of signals modulated on a carrier, a circuit changing device, and control means in the said auxiliary receiver responsive to received signals for actuating said circuit changing devices to change the reception of signals from the tuned circuits in the said main receiver, whereby the reception of signals is changed from a carrier of one frequency to a carrier of another frequency.

17. In a television system, a cathode ray viewing tube provided with a screen, a main receiver provided with suitable circuits for producing images on the said screen from received picture signals, an energizing circuit for said main receiver, an auxiliary device operated by received signals, a current supply circuit, control means operated by said device for electrically connecting the said current supply circuit to the said energizing circuit, and means for impressing upon said main receiver a predetermined carrier modulated by said picture signals.

18. In a television system, a cathode ray viewing tube provided with a screen, a main receiver provided with suitable circuits tuned to a predetermined carrier frequency for producing images on said screen from received picture signals, an auxiliary receiver provided with suitable circuits tuned to a predetermined carrier frequency for the reception of signals modulated on a carrier, and control means in the said auxiliary receiver

responsive to received signals for switching the reception of signals from the said auxiliary receiver to the said main receiver.

19. In a television system, a cathode ray viewing tube provided with a screen, a main receiver provided with suitable circuit tuned to a predetermined carrier frequency for producing images on said screen from received picture signals, an auxiliary receiver provided with suitable circuits tuned to a different carrier frequency for the reception of signals modulated on a carrier, and control means in the said auxiliary receiver responsive to received signals for switching the reception of signals from a carrier of one frequency to a carrier of another frequency.

20. The system in accordance with claim 19 in which there is provided a device sensitive to light from a particular location in said images, and means regulated by said device for holding the said control means operated to maintain said main receiver in an operative condition.

21. In a television system, a plurality of cathode ray viewing tubes each provided with an image screen, a main receiver for each of the said tubes, each of the said receivers provided with suitable networks for producing images on its associated screen from received picture signals, means for impressing upon said main receivers a predetermined carrier modulated by picture signals, and means under the control of the images appearing on the said screens for rendering any one or any number of said receivers inoperative to the reception of picture signals.

22. In a television system, a plurality of cathode ray viewing tubes each provided with an image screen, a main receiver for each of the said tubes, each of the said receivers provided with apparatus and suitable circuits for producing images on its associated screen from received picture signals, means for impressing upon said main receivers a predetermined carrier modulated by picture signals, and means in each receiver sensitive to different intensity of light on its associated screen for holding the receiver in an operative condition for the reception of picture signals.

23. In a television system, a plurality of cathode ray viewing tubes each provided with an image screen, a main receiver for each of the said tubes, each of the said receivers provided with apparatus and suitable circuits for producing images on its associated screen from received picture signals, means for impressing upon said main receivers a predetermined carrier modulated by picture signals, and means under the control of the images appearing on the said screens for discontinuing the images on any one or any number of said screens.

24. In a selective communication system, a plurality of cathode ray viewing tubes each provided with an image screen, a receiver for each of the said tubes, each of the said receivers provided with apparatus and suitable circuits for producing images on its associated screen from received picture signals, means for impressing upon said receiver a predetermined carrier modulated by picture signals, a holding and release point in a different location on each one of the said screens for reflecting light, a photo electric device in each of the said receivers sensitive to different intensities of light from the said holding and release point on its associated screen, whereby any one or any number of the said main receivers may be maintained in operation while the others are rendered inoperative.

25. In a selective communication system, a plurality of cathode ray viewing tubes each provided with an image screen, a receiver for each of the said tubes, each of the said receivers provided with apparatus and suitable circuits for producing images on its associated screen from received picture signals, means for impressing upon said receiver a predetermined carrier modulated by picture signals, a holding and release point in different locations on each one of the said screens for reflecting different intensities of light, a device in each of the said receivers sensitive to different degrees of light from the said holding and release point on its associated screen, whereby certain of the said receivers may be maintained in operation for a period of time while the others are rendered inoperative and thereafter any one or any number of the operating receivers may be rendered inoperative.

26. In a selective communication system, a sending station, a plurality of receiving stations, means for transmitting energy therebetween to operate the said receivers including a source of electrical signals, and means under the control of the said sending station for altering the electrical signals to maintain any one or any number of the said receiving stations in operation while the remaining receiving stations are rendered inoperative.

27. In a radio communication system, a transmitting station, a plurality of receiving stations, means for transmitting signals modulated on a carrier therebetween to operate said receiving stations, and means under the control of the transmitting station for changing the said signals to select any one of the said receiving stations exclusive of all other stations to receive the said modulated signals.

JOHN H. HOMRIGHOUS.

CERTIFICATE OF CORRECTION.

Patent No. 2,369,783.

February 20, 1945.

JOHN H. HOMRIGHOUS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, second column, line 52, claim 16, after the word "said" insert --auxiliary receiver to the tuned circuits in the said--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of June, A. D. 1945.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.